UNIVERSIDAD DE GRANADA

Facultad de Psicología

Departamento de Personalidad, Evaluación y Tratamiento Psicológico

Programa de Doctorado en Psicología

ESTRÉS PERINATAL DESDE LA CONCEPCIÓN HASTA EL AÑO DE VIDA

TESIS DOCTORAL INTERNACIONAL-INTERNATIONAL PhD THESIS

Doctorando: Borja Romero González

Directores: Dra. María Isabel Peralta Ramírez y Dr. Rafael A. Caparrós González

Editor: Universidad de Granada. Tesis Doctorales
Autor: Borja Romero González
ISBN: 978-84-1306-461-1
URI: http://hdl.handle.net/10481/60123

A mis padres, por confiar siempre en mí

Agradecimientos

“Ha sido mágico haber llegado aquí sin un solo talismán”

Vetusta Morla

Ha sido mágico sí, aunque este camino ha estado repleto de “talismanes” que merecían, cómo no, tener su página de agradecimientos.

En primer lugar, agradecer a mis dos directores de Tesis: Isabel, gracias por darme la oportunidad de realizar esta Tesis Doctoral en un contexto inigualable, por estar siempre dispuesta a escucharme y por ofrecer siempre una salida a todos los “problemas” que han surgido a lo largo de estos cuatro años. Has conseguido que este viaje haya sido ilusionante y nunca te han faltado palabras de ánimo. Rafa, gracias por tus ideas y apoyo desde el primer día, cuando aún no había empezado este camino, he aprendido mucho de ti.

En segundo lugar, a todos los miembros de mi grupo de investigación, y a su director, Miguel Pérez, por crear un ambiente cálido y agradable de trabajo, y por conseguir que vayamos todos a una, sin importar de dónde vengamos, o con quién trabajemos.

Gracias a todas las mujeres que han formado parte de esta Tesis Doctoral, que me han dejado seguir de cerca algo tan bonito como es su embarazo, y que me han proporcionado la oportunidad de ver crecer a sus hijos. Gracias a las mamás que me han ayudado además con la captación de participantes, María Jesús y Aránzazu, vuestra ayuda ha sido vital.

Gracias al personal sanitario que me ha acompañado en estos años, he aprendido muchísimo de vosotras, Milagros, Emi y Helen.

Gracias a todas las personas que pasaron alguna vez por Gestastress y aportaron su granito de arena en esta Tesis, Juanma, Sara, Carmen, Pilar, Juan Carlos y Jose.

Thank you, Colin Martin, for your help. Thank you, Susan, for hosting me at City University.

Por completar el aspecto ocio-trabajo, gracias a Agar y Alba, comenzamos este viaje juntos y lo acabaremos de la misma forma, escuchándonos y apoyándonos siempre que ha sido necesario. De igual forma, gracias a Juanda y Cristina, que pusieron la nota más divertida al laboratorio y que tanto me han hecho reír. Y gracias a los que han llegado después, Álvaro, Carmen y Sofia, con su energía renovada.

Gracias, además, a todos los que os habéis encontrado conmigo fuera de esta Tesis, proporcionando ocio y tiempo libre:

Gracias a Álvaro y Bea, por cada momento, cena, juego y plan que hemos disfrutado.

Dziękuję̨a Willy, por llevar ahí años y años, y seguir de cerca cada paso que he dado, queriendo saber más y sin perder nunca el interés por mis avances.

Gracias a Manuel, Porcel, Jorge y Silvia, que también han vivido esta Tesis de cerca, y han llenado mi ocio de buenos momentos.

Eskerrik asko Beñat, por estar siempre al loro, proporcionando ideas, compartiendo cafés, ofreciendo ayuda y por no perder nunca la sonrisa.

Gracias Cynthia, por estar siempre ahí desde primero de carrera, sin importar los kilómetros que haya de distancia.

Y para acabar, a los miembros de mi familia que nunca han dejado de apoyarme:

Juanfran, gracias por ilustrar esta Tesis, dando un salto de calidad a lo que ya había, y ayudarme en todo lo que ha estado en tu mano.

Gracias Cristi y Bayo, por prestarme a sus dos pequeñas princesas para esta investigación. Gracias Míster y Ana, por cada noche de juegos de mesa en estos cuatro años.

Gracias Helena, como te dijeron alguna vez, “eres luz”, y durante todos estos años has sido la luz que me ha ayudado a avanzar. Tu apoyo ha sido crucial en este camino, desde que tomé la decisión de empezarlo, hasta que ha llegado el final. Por todos los años que queden por delante, gracias, mil gracias.

Y finalmente, a mis padres y mi hermana, que siempre me han empujado hacia las buenas decisiones, que cuando me he equivocado me han enseñado a corregir mir errores, y que nunca han dejado de confiar en mí. Todo lo conseguido es vuestro, millones de gracias.

Resumen

La presente Tesis Doctoral se estructura en catorce capítulos organizados de la siguiente forma: Introducción (Capítulos I, II, III y IV); justificación y objetivos (capítulo V); bloque de estudios 1: "Adaptación y validación de instrumentos de evaluación psicológicos" (capítulos VI y VII); bloque de estudios 2: "Estrés perinatal y síntomas psicopatológicos de la madre y su efecto en el proceso de embarazo y parto" (capítulos VIII, IX y X); bloque de estudios 3: "Estrés perinatal y consecuencias en la descendencia" (capítulos XI y XII); bloque de estudios 4: "Eficacia de una intervención psicológica de control de estrés en el embarazo" (capítulo XIII); discusión, conclusiones y perspectivas futuras (capítulo XIV).

En primer lugar, los cuatro primeros capítulos forman la base teórica de la presente Tesis Doctoral. En el capítulo I se conceptualiza el estrés, sus formas de medirlo y sus consecuencias en la salud. En el capítulo II, se realiza una aproximación de este estrés al estrés perinatal, diferenciando ambos y presentando el denominado estrés específico del embarazo. Además de la evaluación psicológica, se presenta la evaluación fisiológica del estrés crónico, esto es, la importancia de extraer el cortisol del pelo. Finalmente, el capítulo termina con los principales estudios realizados hasta el momento sobre estrés perinatal y cortisol en pelo en el embarazo. En el capítulo III se abordan las principales consecuencias negativas del estrés perinatal en la salud física y mental de la mujer embarazada, para continuar con su repercusión en el feto y recién nacido. Para terminar este capítulo se describen los mecanismos que subyacen a dichas consecuencias negativas. En el capítulo IV, y último que compone la introducción teórica, se realiza una aproximación a la psicopatología materna, la cual también es motivo de estudio en esta Tesis, y se finaliza con las distintas intervenciones destinadas a reducir los niveles de estrés de la mujer en el embarazo.

En el capítulo V se realiza la justificación de la Tesis Doctoral, presentando los hechos por los que se requiere la investigación en este campo, además de exponerse los objetivos e hipótesis derivadas de los mismos.

Tras esta introducción, se pasa a describir los bloques empíricos que componen esta Tesis Doctoral. Comenzando con el bloque 1 de estudios, titulado "Adaptación y validación de instrumentos de evaluación psicológicos", se presenta en el capítulo VI el *Prenatal Distress Questionnaire Revised* (NuPDQ), un instrumento diseñado para la evaluación del estrés específico del embarazo, y del cual no existe adaptación ni validación a muestra española. En dicho capítulo, se lleva a cabo la traducción, adaptación y validación al español del NuPDQ, además la realización de un análisis factorial. Los resultados indican que se trata de un instrumento adecuado para evaluar estrés específico en muestra española y se recomienda su uso en mujeres embarazadas.

Completando este bloque, el capítulo VII presenta la traducción, adaptación y validación de la *Birth Satisfaction Scale- Revised* (BSS-R), el cual en todas sus versiones muestra unos adecuados índices psicométricos y es usada para evaluar la satisfacción con el parto. Los resultados han mostrado unos índices similares a la versión inglesa original, permitiendo su uso en muestra española.

En el bloque 2, denominado el "Estrés perinatal y síntomas psicopatológicos de la madre y su efecto en el proceso de embarazo y parto", se presentan 3 capítulos. En el capítulo VIII, se explora la relación entre el índice de masa corporal elevado de la mujer antes de quedarse embarazada, y su relación con el estrés perinatal y específico del embarazo, así como síntomas psicopatológicos, en comparación con mujeres con un índice de masa corporal normal. Los resultados mostraron que aquellas mujeres embarazadas con un índice de masa corporal elevado antes del embarazo tenían peores síntomas psicopatológicos durante todo el embarazo, así como mayores niveles de estrés. Ante este hecho, se vuelve necesaria la concienciación de la población hacia tener un estilo de vida saludable cuando deciden tener un bebé.

En el capítulo IX presentamos un estudio comparativo entre mujeres gestantes y no gestantes, en estrés, cortisol en pelo y psicopatología, con el fin de encontrar diferencias en el estado psicológico por el hecho de estar embarazada. Asimismo, los resultados mostraron que existen determinados síntomas psicopatológicos presentes en el embarazo, que pueden estar asociados al momento evolutivo en el que se encuentran las mujeres embarazadas, como son las somatizaciones, psicoticismo e ideación paranoide, entre otros. Además, se elaboró un perfil psicopatológico para detectar el curso que siguen determinados síntomas durante todo el embarazo. Con estos resultados se puede atender al hecho de que posibles desviaciones en determinados síntomas psicopatológicos deben de considerarse como un factor a tener en cuenta durante el embarazo, ya que podrían suponer un riesgo para la salud.

En el capítulo X se estudió la relación entre el estrés psicológico, cortisol en pelo y síntomas psicopatológicos con el proceso de parto. Los resultados fueron determinantes ya que se encontró un mayor número de síntomas psicopatológicos durante el tercer trimestre en aquellas mujeres que finalmente necesitaban de atención quirúrgica durante el parto. Por ello, es necesario cuidar y atender a las mujeres psicológicamente en las últimas etapas del embarazo, con el fin de tener una herramienta más para prevenir complicaciones en el parto.

En el tercer bloque, se presenta la relación entre el estrés materno durante el embarazo y su efecto en la descendencia. En el capítulo XI se replicó un estudio realizado en primates, por primera vez en humanos. En él, se buscó la relación entre el cortisol en pelo materno durante el embarazo y el mismo en el recién nacido. Los resultados mostraron que mayores niveles de cortisol de la madre durante el primer trimestre inhiben la correcta liberación en el recién nacido, lo cual puede tener implicaciones para su salud.

En el capítulo XII se explora la relación entre padecer un embarazo de alto riesgo y el neurodesarrollo infantil. En este capítulo se comparó el neurodesarrollo de bebés nacidos de embarazos de alto y bajo riesgo, encontrando que los nacidos de embarazos de alto riesgo tenían mayores niveles de neurodesarrollo a los 6 meses de edad. En este sentido, se hipotetizó que el uso de fármacos que mejoren la circulación sanguínea, y el mayor número de consultas especializadas durante el embarazo pueden tener un efecto positivo en el desarrollo del bebé.

Finalmente, en el bloque 4 se presenta el capítulo XIII, que a su vez cierra los estudios de la presente Tesis Doctoral. En él, se presenta un ensayo controlado aleatorizado en el que se aplicó una terapia cognitivo conductual de control de estrés en mujeres embarazadas. Los resultados mostraron un descenso en los niveles de estrés psicológico y cortisol en pelo, además de en determinados síntomas psicopatológicos, certificando la eficacia de la terapia.

En el último capítulo de esta Tesis Doctoral, se presenta una discusión conjunta de todos los estudios derivados de la misma con los hallazgos encontrados, así como las principales conclusiones.

Capítulo I. Introducción al estrés

1.1. *Definición de estrés*

A través de los años y de la investigación, muchos autores han intentado aportar una definición de estrés psicológico, convirtiéndose en un concepto ampliamente descrito y estudiado. Una de las primeras definiciones de estrés, con gran aceptación dentro de la comunidad científica, ha sido la proporcionada por Selye (1955), que conceptualizaba el estrés como una respuesta del organismo ante un estímulo, que podía ser interno o externo, real o imaginario. Parte de la base de que este estímulo supone una amenaza para la estabilidad fisiológica del individuo, u homeostasis (Selye, 1955).

Sin embargo, esta definición hace un abordaje puramente fisiológico y por tanto muy reducido para explicar el estrés como proceso, ya que no contempla elementos claves para el ser humano. Tras lo cual, Lazarus y Folkman (1986) abordaron este concepto incluyendo variables de carácter cognitivo y establecían el término como una "*relación entre el individuo y el entorno, que es evaluado por este como amenazante o desbordante de sus recursos, y que pone en peligro su bienestar*" (p.43).

Tras esta definición, el estrés pasó a ser considerado como estrés psicológico, ya que implica la interpretación de la persona que lo experimenta, por lo que adquiere así un componente cognitivo. Además, esta nueva perspectiva donde es clave la interpretación, propuesta por Lazarus y Folkman (1986), detalla dicha interpretación en tres componentes:

1. Evaluación primaria: Es la primera evaluación que se establece, esto es, la manera particular e individual de valorar, apreciar e interpretar los acontecimientos posiblemente estresantes.
2. Evaluación secundaria: se trata de la forma de apreciar e interpretar los propios recursos o habilidades para afrontar el estrés. Cuando el individuo entiende que

sus habilidades no son las necesarias para enfrentarse a la situación, se experimentará estrés, pues se ve incapaz de hacerle frente.

3. Reevaluación: esta etapa tiene lugar tras la evaluación de la situación (primaria) y de las herramientas o recursos disponibles (secundaria) y sería la etapa que produciría un cambio en el individuo (Lazarus y Folkman, 1986).

Actualmente esta conceptualización y modelo del estrés es la que cuenta con mayor apoyo científico en el ámbito de la Psicología. Una vez definido el estrés psicológico, es necesario continuar por categorizar el estresor según sus características principales, de duración, origen e intensidad.

1.2 Tipos de estresores y eventos estresantes

Para continuar en la línea establecida, es importante hablar del término de estresor, el cual es considerado como cualquier organismo, de naturaleza real o imaginaria, y procedencia externa o interna, que altera nuestro organismo (Selye, 1955). A partir de este estresor, se proporciona una visión categorizada del estrés, el cual, en primer lugar, vamos a considerarlo en función de su duración, pudiendo ser agudo y crónico (Latendresse, 2009).

- El **estrés agudo** es aquel que la persona, con sus recursos, es capaz de afrontar y de solventar, desapareciendo las demandas exigidas por la situación estresante, y con ellas el estrés experimentado, en un corto periodo de tiempo.
- El **estrés crónico,** por su parte, posee una mayor duración, ya que el evento estresante suele ser prolongado en el tiempo, y existe una carencia de recursos para poder afrontar la situación, lo que conlleva que, además, el efecto psicológico en el individuo sea más prolongado (Latendresse, 2009).

Para continuar, en relación al modelo propuesto por Labrador (1996), los hechos estresantes se pueden clasificar en función de su naturaleza, pudiendo ser externos o internos.

- Factores estresantes **externos,** son aquellos que proceden del ambiente, y que a su vez pueden ser de naturaleza psicosocial, convirtiéndose en estresantes por la interpretación cognitiva que realizamos de ellos, o biogénica, siendo capaz el estresor de provocar cambios bioquímicos en el organismo.
- Factores estresantes **internos**, los cuales tienen su origen en el propio individuo, y que pueden ser físicos (dolor) o psicológicos/cognitivos (preocupaciones, rumiaciones, autoestima, etc.).

A partir de estos tipos de estrés, caracterizados por la duración y origen, los eventos estresantes, esto es, aquellos que pueden detonar una respuesta de estrés en el individuo, se han dividido en tres categorías, en el intento de englobarlos según la fuente estresora y en función de su intensidad y duración: sucesos vitales intensos y extraordinarios, sucesos diarios estresantes de menor intensidad (estrés cotidiano), y situaciones de tensión crónica mantenida (Kanner, Coyne, Schaefer y Lazarus, 1981). A continuación pasamos a describirlos:

- Los **sucesos vitales intensos y extraordinarios** son aquellos que ocurren de momentos muy específicos y determinados de la vida. Son situaciones que se caracterizan por ser inesperadas y puntuales, por lo que se produce un desborde emocional muy intenso que provoca un gran desajuste en el organismo. Algunos ejemplos de este tipo de estrés son casarse, la muerte de un familiar o un despido laboral.
- Los **sucesos diarios estresantes de menor intensidad** son aquellos pequeños momentos del día que nos provocan estrés, como puede ser un dolor de cabeza repentino, llegar tarde a algún sitio o un atasco en la carretera. Se caracterizan

por una baja intensidad, pero por una alta frecuencia de ocurrencia a lo largo del día. A estas situaciones, al estar presentes diariamente, no les prestamos la suficiente atención ni les damos importancia, pero, a largo plazo, pueden implicar importantes problemas de salud.

- Las **situaciones de tensión crónica mantenida** son las situaciones de estrés muy intensas y muy frecuentes que se encuentran presentes durante un periodo muy largo de tiempo, como son sufrir una enfermedad crónica incapacitante, encontrarse desempleado, sufrir malos tratos, etc.

Como se ha descrito, el estrés puede ser analizado desde diferentes enfoques, pudiendo caracterizarse en función de su origen, intensidad y/o duración. Sin embargo, una característica del estrés, como ya se ha hablado, es la amenaza que supone para la homeostasis fisiológica del individuo, para la cual es clave la respuesta que el mismo genera. Por ello vamos a pasar a describir en qué consiste la respuesta fisiológica del estrés, para poder entender posteriormente las consecuencias que éste supone para la salud.

1.3. Respuesta fisiológica del estrés

La respuesta fisiológica del estrés tiene una base evolutiva, puesto que supone la necesidad de activar distintos ejes glandulares y cerebrales para preparar al individuo para huir o luchar asegurando así su supervivencia (Cannon, 1929). A continuación, vamos a describir los ejes implicados en dicha respuesta.

Cuando se percibe una situación como estresante el primer eje que se activa es el **eje adrenomedular** para que el organismo ofrezca una respuesta de lucha/huida. A través de su activación, suceden una serie de reacciones fisiológicas como son el aumento de la presión arterial, con el fin de permitir que la sangre fluya de forma más rápida; el aumento de sangre que llega al cerebro y la aceleración de la tasa cardíaca. Así mismo, con el objetivo de preparar el cuerpo para la acción se produce una estimulación mayor en los músculos esqueléticos, se aumenta la liberación de los ácidos grasos (triglicéridos y colesterol) los cuales proporcionan energía en el organismo, se liberan opiáceos endónenos (endorfinas y encefalinas, para anular la percepción de dolor), se disminuye el riego sanguíneo en la piel y la secreción de hormonas sexuales. Con el fin de hacer frente a las necesidades energéticas que supone su activación, la adrenalina se encarga de liberar glucosa en el hígado (Peralta-Ramírez, 2019, Sapolsky, 2008).

De esta forma, la respuesta de supervivencia sucede para enfrentarse a un estímulo estresor, pero este eje no es suficiente cuando la amenaza persiste en el tiempo, por lo que entonces se produce la activación del segundo eje implicado, el **eje hipotálamo hipofisario adrenal** (HHA). Este eje comprende estructuras cerebrales como el hipotálamo, la hipófisis y diversas glándulas adrenales, los cuales entran en una cascada de acontecimientos tras aparecer el estímulo estresor. En primer lugar, ante una situación de amenaza, el hipotálamo comienza a producir la hormona liberadora de corticotropina (CRH), esta hormona activa la hipófisis y la segregación de hormona adrenocorticótropa (ACTH). Es en este momento, cuando la ACTH estimula la liberación de cortisol desde las glándulas supra-renales, el cual completa la activación del eje mediante la supresión de liberación de CRH por parte del hipotálamo (Tsigos y Chrousos, 2002).

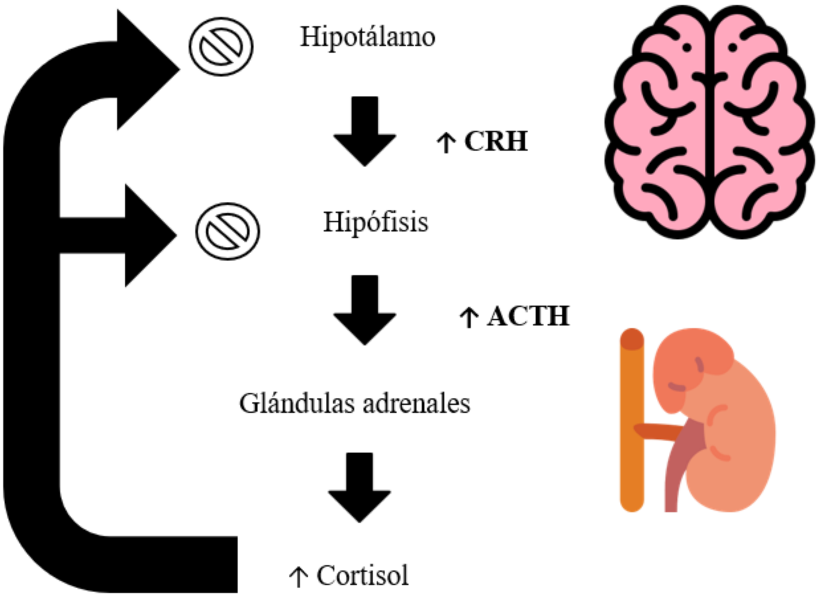

Figura 1. Eje hipotálamo-hipofisario adrenal

Las implicaciones de este hecho van más allá de las fisiológicamente descritas, pues el cortisol es el encargado de controlar la homeostasis corporal y, además, de la respuesta del organismo al estrés. Por esta razón, actúa suprimiendo la activación del hipotálamo y de la hipófisis, minimizando por ello los efectos de la ACTH, que es una hormona que cumplen funciones catabólicas e inmunosupresoras. Por todo ello, la liberación excesiva de cortisol, procedente de experimentar situaciones estresantes de forma crónica, puede producir una desregulación en el eje, lo cual conlleva consecuencias negativas, como producir un desajuste metabólico o la supresión del sistema inmunitario (Frodl y O'Keane, 2013).

Además, la activación de la respuesta de estrés también lleva asociadas hormonas como el glucagón, el cual se produce tras la activación pancreática y contribuye al incremento de la glucosa en sangre, proporcionando de este modo la energía necesaria para afrontar la situación. Otras reacciones provocadas son la secreción de prolactina (la cual inhibe la actividad sexual), la inhibición de estrógenos, progesterona y testosterona, así como de secreción de insulina (Peralta-Ramirez, 2019; Sapolsky, 2008).

En resumen, todo el organismo se pone en marcha cuando se trata de hacer frente a una situación percibida como estresante, lo que implica respuestas fisiológicas y/o hormonales, que muy bien coordinadas, producen cambios en el organismo. Sin embargo, en este caso, es un arma de doble filo, ya que la cadena de reacciones fisiológicas que provoca el estrés se activa cuando el individuo encuentra una situación amenazante, tanto si es real como imaginaria, existiendo momentos en los que, debido a la interpretación errónea de la situación, la persona activa una "descarga" fisiológica sin tener la necesidad evolutiva de lucha o huida (Peralta-Ramirez, 2019). Dicha respuesta activada de forma crónica puede tener unas consecuencias negativas para la salud que serán descritas en el siguiente apartado.

1.4 Consecuencias del estrés

La continua activación de los ejes adrenomedular y HHA, así como la liberación de catecolaminas y cortisol producen desregulaciones hormonales e inmunológicas que afectan a distintos sistemas de nuestro organismo. Al ser tantos los cambios ocasionados en el mismo, los sistemas que se ven comprometidos son bastantes, pasamos a describirlos de forma resumida:

- Sistema digestivo, en el cual se producen aumentos en la secreción de ácido gástrico y moco gastrointestinal lo que conlleva mayores problemas de estómago, se acelera la activación del colon, aumenta la frecuencia de diarreas y problemas gastrointestinales (Mayer, 2000). Además, se considera que un exceso de cortisol está en la base del desarrollo de patologías como el Síndrome de Intestino Irritable y úlcera, así como es responsable del empeoramiento de enfermedades como la enfermedad de

Crohn, dispepsia, etc. (Cranston, 2014; Sgambato, Miranda, Ranaldo, Federico y Romano, 2017).

- Sistema inmune, ya mencionado anteriormente, mediante la supresión del mismo, el cuerpo se encuentra expuesto a factores patógenos que lo puede hacer más vulnerable a desencadenar respuestas de enfermedad (Hass y Schauenstein, 2001; Reiche, Nunes y Marimoto, 2004). El estrés psicológico y su respuesta fisiológica, además, contribuyen a la aparición y empeoramiento de enfermedades autoinmunes sistémicas, como el lupus eritomatoso sistémico, el síndrome de Sjögren, esclerosis sistémica, miopatías inflamatorias, síndrome antifosfolípido y neoplasias (Montero-Lopez, Santos-Ruiz, Garcia-Silva y Delgado, 2019).

- Sistema nervioso, una hiperactivación de los ejes de respuesta al estrés se pueden suceder respuestas habituales de ansiedad, depresión, pérdida de sueño o afección en la memoria (McEwen y Sapolsky, 2006). Estos problemas se deben a los cambios funcionales cerebrales ocasionados por la continua activación de la respuesta al estrés, como puede ser la pérdida de conexiones sinápticas o la reducción del tamaño del hipocampo debido a la excesiva liberación de cortisol (Martin, Vilar y Verdejo-Roman, 2019; McEwen y Sapolsky, 2016). Se produce también una hiperactividad en la amígdala, lo cual se relaciona con trastornos psicológicos como el estrés postraumático o la depresión (Pittenger y Duman, 2008; Stevens y cols., 2017). Asimismo, disminuye la función inhibitoria del hipocampo y la corteza prefrontal, lo que conlleva problemas de memoria, toma de decisiones y control de impulsos (Martin y cols., 2019).

- Sistema cardiovascular, mediante el aumento de la presión sanguínea y las grasas en sangre (colesterol y triglicéridos), el organismo se encuentra más expuesto a sufrir enfermedades cardiacas. Además, el aumento de los niveles de glucosa sanguíneos y el aumento del apetito contribuyen a aumentar el riesgo de sufrir obesidad o diabetes (Dimsdale, 2008). Todo esto puede conllevar al padecimiento de enfermedades coronarias, por la acumulación de depósitos lipídicos en las arterias, provocando el estrechamiento, obstrucción o inflamación de las arterias, dificultando el riego sanguíneo (Blanco, 2011; Reyes y Montoro, 2019). De igual forma, existe una mayor probabilidad de sufrir enfermedades cerebrovasculares, al producirse trombos o rupturas de vasos sanguíneos que irrigan el cerebro, provocando aneurismas o apoplejías (Blanco, 2011; Reyes y Montoro, 2019).

Como se puede apreciar, las consecuencias del estrés en la salud son demasiadas como para no tenerlo en cuenta. El problema que existe en la actualidad es que disparamos la respuesta al estrés ante estímulos que no necesitan la activación de todos los sistemas, ya que no implican un peligro real para nuestra existencia. Además, percibimos como amenazante una gran cantidad de situaciones que realmente no lo son, lo que lleva a disparar de forma continuada la respuesta de estrés, convirtiéndonos en más vulnerables a sufrir enfermedades de este tipo. Sin embargo, todas estas nocivas consecuencias ocurren en la población general, pero ¿qué ocurre con las poblaciones de riesgo? Por ejemplo, el embarazo, en el cual las mujeres además de verse expuestas al estrés anteriormente descrito, así como a los procesos presentados, se encuentran en una situación delicada y vital, en el que tienen que afrontar una serie de cambios trascendentales en su vida. En el próximo capítulo, describiremos el estrés propio del embarazo, así como sus consecuencias, ya que las mujeres embarazadas no están exentas de sufrir estrés psicológico, sino todo lo contrario, son más vulnerables y existe un mayor riesgo para su salud, y la de su futuro hijo.

Capítulo II. El embarazo como suceso vital estresante

En el presente capítulo se pretende extrapolar los conocimientos existentes sobre el estrés psicológico en una población muy vulnerable al mismo, como son las mujeres embarazadas. A través de sus apartados, se conceptualizarán los términos de estrés perinatal y estrés específico del embarazo, cómo se evalúan psicológica y fisiológicamente, y su aplicación para entender el curso del estrés durante el embarazo.

2. 1. Estrés perinatal y estrés específico del embarazo

El Instituto Nacional de Estadística (INE) de España tasó el número de embarazos totales de 2018 en un total de 369.302 embarazos (INE, 2019). Esta estadística contempla únicamente los casos en los que el embarazo fue completo, sin contar aquellos casos en los que existe aborto espontáneo, tasado en 1 de cada 5 mujeres, por lo que las estadísticas reales son muy superiores a esta (Griebel, Halvorsen, Golemon y Day, 2005).

El embarazo, a pesar de tratarse de una etapa muy positiva, e incluso en muchas ocasiones un objetivo vital a ser alcanzado, es una etapa compleja, evolutiva, fisiológica y psicológicamente, por lo que requiere una adaptación en todas las esferas de la mujer que le permita poder hacer frente al embarazo de forma satisfactoria (Christian, 2012; Dunkel y Lobel, 2012).

En este sentido, el estrés perinatal es aquel estrés que una mujer embarazada experimenta desde el principio de la gestación hasta la finalización del mismo, englobando el posparto como periodo perinatal, y que se caracteriza por los eventos estresantes, independientemente de la naturaleza. Estos acontecimientos pueden ser vitales leves o catastróficos, como pueden ser el trauma, las pérdidas de familiares de primer grado, el estrés laboral… (Labrador, 1996).

Sin embargo, el estrés perinatal es el mismo estrés general descrito en el anterior capítulo, pero experimentado durante un periodo muy concreto de la vida. Por ello, diversos investigadores intentaron profundizar un poco más en el conocimiento de éste en busca de algunas características que fueran especificas al embarazo, por lo que surgió el denominado *estrés específico del embarazo*, el cual hace referencia a un conjunto de preocupaciones y pensamientos presentes en la mujer embarazada y que tienen que ver con aspectos concretos del embarazo, como son los síntomas físicos (aumento de peso, dolores, etc.), preocupaciones sobre la habilidad para ser madre, cambios y tensiones en las relaciones sociales y de pareja, ansiedad o miedo al parto y preocupaciones sobre la salud propia y la del bebé (Lobel y cols., 2008).

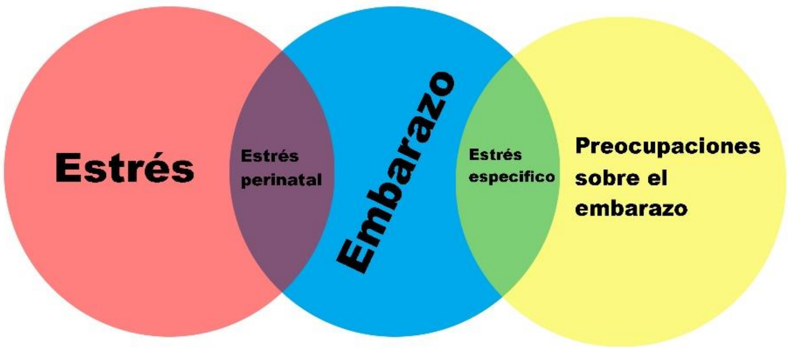

Figura 2. Diagrama sobre el estrés en el embarazo

Una vez conceptualizado el estrés específico del embarazo y el estrés perinatal, se procede a explicar los principales métodos que han sido usados para su evaluación, comenzando con la evaluación psicológica. Es importante destacar que de los instrumentos que serán presentados a continuación, algunos pueden usarse en población general, mientras que otros son específicos del embarazo.

2.2. La evaluación psicológica del estrés materno

Tradicionalmente para comprobar el estrés perinatal y específico del embarazo se solía recurrir a instrumentos de evaluación tales como cuestionarios autoinformados, en los cuales la mujer puede expresar su nivel o grado de malestar.

Uno de los cuestionarios más usados por la comunidad científica ha sido la ***Escala de Estrés Percibido*** (Cohen, Kamarck y Mermelstein, 1994), validado para la población española por Remor (2001), el cual, a través de 14 ítems evalúa el grado en el que persona percibe distintas situaciones como estresantes, algunos ejemplos son: "En el último mes, ¿con qué frecuencia ha podido controlar las dificultades de su vida?" o "En el último mes, ¿con qué frecuencia ha pensado sobre las cosas que le quedan por hacer?" (Remor, 2001). También existen instrumentos relacionados con la vulnerabilidad al mismo como es el Test de Vulnerabilidad al Estrés (Miller y Smith, 1985).

Otros cuestionarios desarrollados para evaluar el estrés psicológico se centran en las estrategias de afrontamiento para combatirlo, un ejemplo de estos es la Escala de afrontamiento de Lazarus (Lazarus y Folkman, 1984).

En la presente Tesis Doctoral se ha usado la Escala de Estrés Percibido (Cohen y cols., 1994; Remor, 2001) con el objetivo de evaluar el estrés general en las mujeres embarazadas.

Por lo que respecta al estrés específico del embarazo, un instrumento aparece como el más utilizado para su objetivo, el ***Prenatal Distress Questionnaire*** (PDQ; Yali y Lobel, 1999). Este instrumento cuenta con su versión revisada (NuPDQ; Lobel, 1996; Yali y Lobel, 2002). El PDQ evalúa el estrés específico del embarazo mediante 12 ítems que se centran en las preocupaciones existentes en el embarazo, mientras que la versión revisada posee 18 ítems y aunque en principio estaba pensado para ser administrado en formato de entrevista, finalmente se ha validado como cuestionario de autoinforme. La peculiaridad de este instrumento revisado es que posee ítems que pueden ser usados para evaluar las preocupaciones más comunes en cada uno de los trimestres, permitiendo obtener una información más concisa (Lobel, 1996, Lobel y cols., 2008). Ambos instrumentos han demostrado tener unas buenas propiedades psicométricas, aunque la investigación sobre el NuPDQ es algo más escasa, y actualmente no contamos con una adaptación española del mismo (Alderdice, Lynn y Lobel, 2012; Ibrahim y Lobel, 2019). Es por ello que, uno de los objetos de estudio de esta Tesis es la traducción, adaptación y validación del instrumento anteriormente descrito, ***Prenatal Distress Questionnaire Revised*** (NuPDQ) para la población española. Sin embargo, su versión previa ha sido utilizada como instrumento para evaluar el estrés específico del embarazo en la población estudiada en la presente Tesis Doctoral.

Durante el periodo de posparto también es frecuente evaluar los niveles de estrés en las mujeres, ya que el parto es un evento que genera una gran variedad de emociones. En este periodo se han usado instrumentos para explorar la propia experiencia del parto, por ello la mayoría se han focalizado en la *satisfacción con el parto*, el cual engloba el estrés experimentado durante el parto, pero además la percepción de control, la participación activa en la toma de decisiones sobre el parto o la calidad de los cuidados recibidos, entre otros (Bryanton, Gagnon, Johnston & Hatem, 2008; Goodman, Mackey & Tavakoli, 2004). Para evaluar este constructo se ha creado la ***Birth Satisfaction Scale-Revised*** (BSS-R; Hollins-Martin y Martin, 2014), adaptada y traducida en múltiples idiomas, y es actualmente considerada como un gran instrumento de evaluación debido a su brevedad (10 ítems) y que cuenta con unos adecuados índices psicométricos.

Esta escala, a pesar de sus interesantes cualidades y su amplia utilización, no estaba validada para la población española por lo que ha sido objeto de estudio en la presente Tesis Doctoral.

Finalmente, en este período de posparto, es común el uso de instrumentos que evalúen problemas psicológicos en la madre a causa del parto, como puede ser la depresión posparto o el estrés postraumático relacionado al parto. En el caso de la depresión posparto, es ampliamente utilizada la ***Escala de Depresión Posparto de Edinburgo*** (EPDS, Cox, Holden y Sagovsky, 1987; versión española de García-Esteve, Ascaso, Ojuel y Navarro, 2003), la cual aporta información acerca del riesgo de depresión posparto a través de 10 ítems de respuesta tipo Likert desde 0 (igual que siempre) hasta 3 (no, en absoluto) con un índice de fiabilidad de $\alpha = 0,79$.

Otro aspecto muy importante a evaluar es el estrés postraumático debido al parto. En lo relativo al mismo, se encuentra la ***CITY Birth Trauma Scale, CITY BiTS*** (Ayers, Thornton y Wright, 2018), la cual contiene 31 ítems desarrollados a partir de los criterios del DSM-5 referidos a Trastorno de Estrés Postraumático (TEP). Evalúa la sintomatología de TEP relativa a experiencias relacionadas con el embarazo, el parto o el postparto inmediato haciendo referencia a los síntomas experimentados en la última semana con una frecuencia desde 0 (nunca) hasta 3 (5 o más veces). Esta escala posee una adecuada fiabilidad ($\alpha = 0,92$). Este instrumento tampoco cuenta con validación para la población española.

Tras haber presentado los principales instrumentos psicológicos de evaluación del estrés y depresión, tanto general como específico del proceso de embarazo y parto, vamos a pasar a la evaluación biológica del estrés, que ha sido usada en esta Tesis Doctoral como medida retrospectiva de estrés crónico en mujeres embarazadas.

2.3 La evaluación biológica del estrés materno: cortisol

Una de las formas más utilizadas para medir la respuesta del estrés ha sido mediante la evaluación del cortisol. Existen diferentes métodos para la obtención de los niveles de cortisol y varían en función del objetivo de dicha evaluación. A continuación, pasamos a describir los métodos más utilizados:

- Cortisol en plasma u orina: se trata de la manera más tradicional de obtener información biológica, mediante muestras de sangre u orina. Al igual que el colesterol o triglicéridos, el cortisol viaja a través de la sangre, por lo que obtener una muestra de plasma sanguíneo aporta información sobre los niveles de cortisol presentes en ese momento (Carr, Parker, Madden, McDonald y Porter, 1981; Jung y cols., 2011). Así mismo, la expulsión de residuos por la orina también nos permite su recolección mediante esta vía (Lindholm y Schultz-Moller, 1973).
- Cortisol en el líquido amniótico: es posible la recogida de cortisol en líquido amniótico durante el embarazo, sin embargo, es necesario realizar una amniocenTesis . Para ello es necesaria insertar una aguja larga en el útero, con el fin de extraer una muestra de este líquido, lo que convierte en un procedimiento muy invasivo y con riesgo para el embarazo (Ghaemmaghami, Dainese, La Marca, Zimmermann y Ehlert, 2014).
- Cortisol en saliva: como alternativa a la sangre, orina o líquido amniótico se encuentra el cortisol salival. Para su recogida únicamente se necesita un tubo y un pequeño algodón para recoger la muestra salival, por lo que es una de las técnicas más usadas en investigación (Obel y cols., 2005).

Sin embargo, todo este tipo de metodologías para la extracción de cortisol presentan una serie de particularidades que limita la información recogida. En primer lugar, todas las muestras descritas anteriormente están sujetas al momento temporal en el que se toman, es decir, la información obtenida son los niveles de cortisol presentes en el momento de la toma, en un momento puntual del día. Por ello, esta metodología, y en especial la extracción en saliva, es muy utilizada en estudios donde se pretende comprobar la fluctuación de cortisol mediante una tarea estresante realizando varias tomas de cortisol (Montero y cols., 2016; Stalder y Kirschbaum, 2012).

En segundo lugar, la extracción, el transporte y el almacenamiento de las muestras de saliva, sangre, líquido amniótico u orina requiere de unas condiciones determinadas de conservación, por lo que no es posible que cualquier persona las maneje y almacene, requiriendo en muchas ocasiones la ayuda de un profesional (Stalder y Kirschbaum, 2012). A esto hay que añadir que, debe de tenerse en cuenta que algunas de las técnicas descritas son invasivas, como las muestras de sangre o líquido amniótico (Ghaemmaghami y cols., 2014).

Ante el reto de usar una nueva técnica que pudiera contrarrestar las desventajas de las técnicas anteriormente descritas, pero que además ofreciera información de carácter retrospectivo, como es el estrés crónico sufrido, surgió el análisis de cortisol en pelo. La principal ventaja de esta técnica es que ofrece información de los niveles de cortisol que se han liberado de forma crónica en los meses previos a su extracción.

- Cortisol en pelo: La evaluación de los niveles de cortisol en pelo han aparecido en los últimos años como un biomarcador de estrés crónico que permite conocer los niveles de cortisol liberados por el organismo en un periodo de tiempo determinado (Stalder y Kirschbaum, 2012). El cortisol, al liberarse en el organismo, viaja a través de la sangre y es depositado en el cuero cabelludo, el cual al ir creciendo mantiene dicha cantidad de cortisol almacenada en él. En este sentido, y al crecer el pelo una media de un centímetro al mes, se considera que el centímetro más próximo a la raíz capilar contiene el cortisol almacenado durante el último mes (Sauvé, Koren, Walsh, Tokmakejian y Van Uum, 2007). Debido a las propiedades que alberga esta nueva técnica, su aplicación al embarazo permite obtener los niveles de cortisol liberados durante un trimestre de embarazo completo (al obtener una muestra de 3 cm de pelo). Además, se han encontrado grandes correlaciones del cortisol en pelo con el cortisol salival y los niveles de estrés percibido durante el embarazo, lo que convierte a esta técnica en una medida fiable de estrés fisiológico (D'Anna-Hernandez, Ross, Nastvig y Laudenslager, 2011; Kalra, Einarson, Karaskov, Van Uum y Koren, 2007).

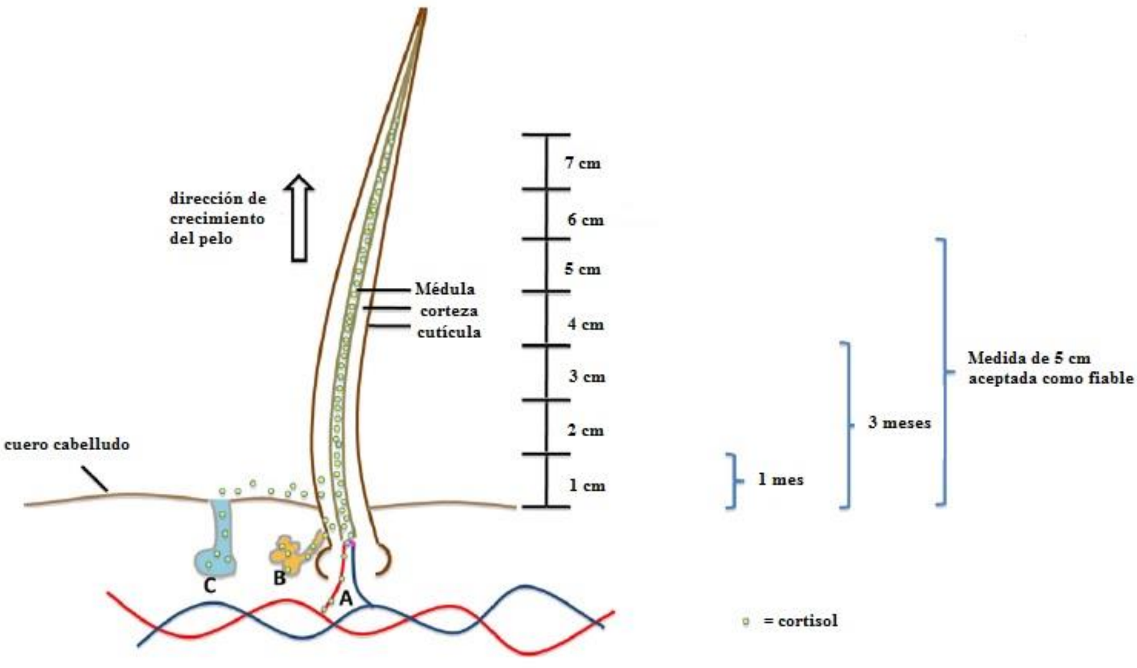

Figura 3. Almacenamiento del cortisol en pelo. A: sangre; B: glándula sebácea; C: sudor. Imagen tomada de Russell, Koren, Rieder y Van Uum, (2012).

Además, la recogida y almacenamiento de la muestra de pelo es más sencilla que el resto de muestras, ya que únicamente precisa de realizar un corte de un mechón de pelo, de la parte posterior del cráneo y lo más próximo al cuero cabelludo posible. Tras ello, se envuelve en papel de aluminio y se conserva en un lugar donde no reciba una exposición directa del sol hasta su análisis (Caparros-Gonzalez y cols., 2017). Una vez en el laboratorio, la extracción del cortisol de pelo se describe en la figura 4.

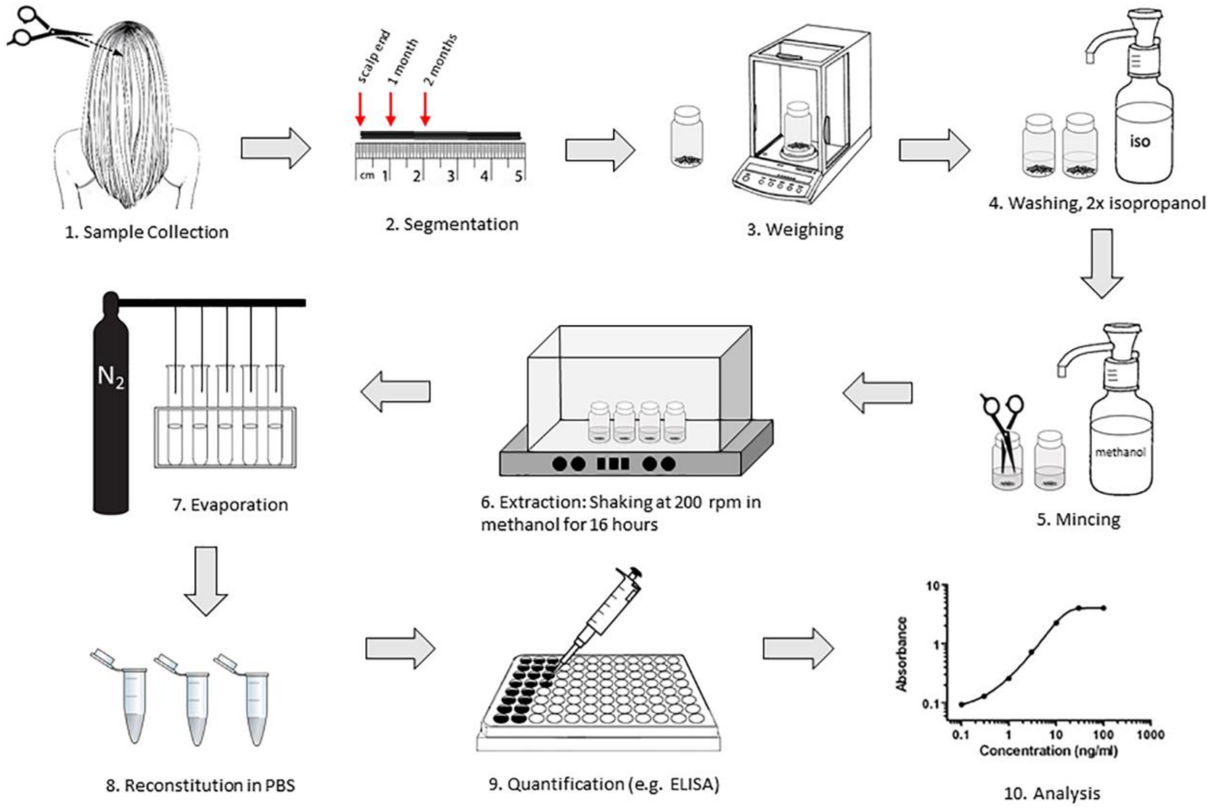

Figura 4. Procedimiento de extracción del cortisol en pelo. Figura tomada de Greff y cols. (2019).

Dadas las amplias ventajas descritas, en esta Tesis Doctoral se han usado los niveles de cortisol en pelo como medida de estrés crónico en la mujer embarazada, complementado con las medidas de estrés psicológico.

Una vez detallados los diferentes métodos de evaluación del estrés en el embarazo, vamos a terminar este capítulo describiendo los principales estudios que han analizado el proceso de estrés a lo largo de la gestación.

2.4 Estrés psicológico y cortisol durante el embarazo

La utilización complementaria de la evaluación psicológica y fisiológica del estrés no es tan común como cabe esperar, ya que la mayoría de los estudios presentan una medida u otra. Incluso aquellos que pretenden usar ambas medidas, no suelen evaluar los niveles de estrés crónico, sino que presentan otro tipo de análisis de cortisol, como se ha visto anteriormente.

Empezando con las preocupaciones presentes durante el embarazo, o estrés específico del embarazo, un estudio realizado con muestra española pretendía analizar las preocupaciones más comunes durante el embarazo, encontrando que las cuestiones de mayor relevancia para la mujer embarazada eran la probabilidad de que algo saliera mal en el embarazo, el parto, la posibilidad de aborto, y en menor medida el desempleo y problemas económicos (Peñacoba-Puente, Carmona y Marín, 2010). Estos resultados manifiestan que el estrés que mayor efecto tiene en las mujeres embarazadas es aquel relacionado con el propio embarazo y sus consecuencias, más que el estrés general que cualquier persona sufre.

Otro objeto de estudio ha sido conocer cómo fluctúa el estrés a lo largo del embarazo, partiendo de la base de que, en función del trimestre, éste puede ser mayor o menor, dadas las características propias del embarazo. En esta línea, en el primer trimestre, el riesgo de aborto espontáneo es más alto, mientras que, en las últimas etapas del embarazo, la ansiedad y miedo al parto puede contribuir al incremento del estrés. Para ello, Rallis, Skouteris, McCabe y Milgrom (2014) analizaron la variación de estrés psicológico en distintos momentos del embarazo. Se encontró que los niveles de estrés eran más altos en el primer y último trimestre, mientras que estos niveles disminuían en el segundo trimestre, considerándose este período como el “psicológicamente más estable” (Rallis y cols., 2014).

Si consideramos que el estrés propio del embarazo es diferente, cabe esperar que la respuesta fisiológica sea diferente a la encontrada por aquellas personas que experimentan únicamente el estrés general. Es por ello por lo que otros investigadores buscaron relación entre el propio estrés psicológico y los niveles de cortisol en pelo, encontrando que, durante el segundo y tercer trimestre de embarazo, el cortisol en pelo aumenta según lo hace el estrés percibido (Scharlau y cols., 2018). Estos resultados ya habían sido encontrados previamente por D'Anna-Hernandez y cols., (2011), cuando demostraban la alta fiabilidad existente en la medida de cortisol en pelo en relación con el estrés experimentado durante el embarazo.

Además, otro de los objetivos que los investigadores se plantearon fue el de mostrar cómo es el curso del cortisol en pelo en las mujeres embarazadas, ya que, al conocer el curso normal, se puede atender a las posibles desviaciones como marcadores de futuras desregulaciones. Con este objetivo, D'Anna-Hernandez y cols., (2011) trazaron el curso que seguían los niveles de cortisol en pelo a lo largo de un embarazo sano, mostrándose un aumento de los mismos según avanzaba el embarazo, para llegar a su pico máximo en el tercer trimestre, y tras el parto, los niveles de cortisol descienden.

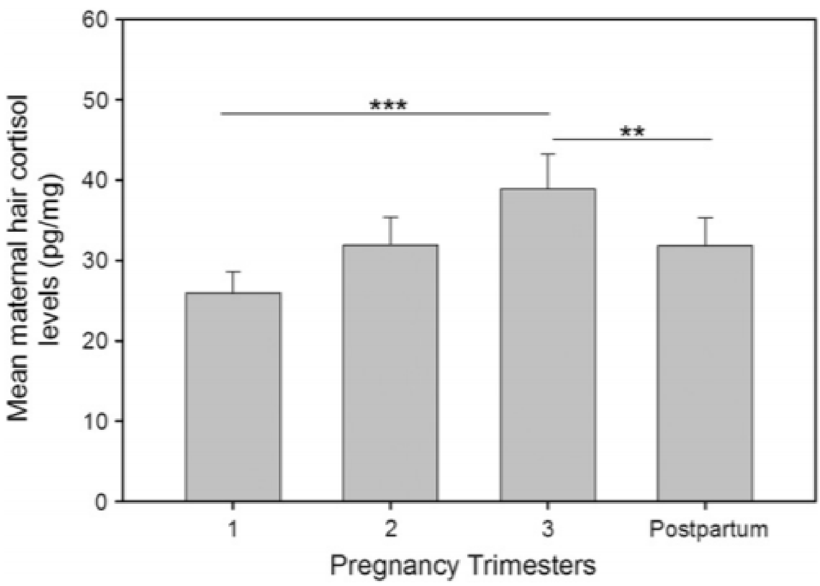

Figura 5. Curso de los niveles de cortisol en pelo a través de los trimestres. Imagen extraída de D'Anna-Hernandez y cols. (2011).

Ante los estudios presentados, se puede concluir que el estrés y la respuesta fisiológica y liberación de cortisol llevan un curso determinado en esta población, que puede ser diferente de la población general. Por todo ello, es tan importante el estudio de esta población usando ambas medidas de estrés, ya que aportan información complementaria que permite aumentar el conocimiento sobre el embarazo.

Finalmente, cabe recalcar que el estrés experimentado durante el embarazo no influye únicamente en la salud de la mujer, sino que repercute además de forma directa en el feto, cuya salud y posterior crecimiento pueden verse alterados por la influencia que el estrés perinatal ejerce. Durante el próximo capítulo, se expondrán las principales consecuencias que el estrés perinatal tiene tanto en la embarazada como en su recién nacido.

Capítulo III. Consecuencias maternas e infantiles del estrés durante el embarazo

Tras haber conceptualizado el estrés psicológico, el estrés perinatal y el estrés específico del embarazo, así como las formas para evaluarlo, en este capítulo se describirán las principales consecuencias del estrés perinatal en la salud materna e infantil. En primer lugar, se verán algunos factores maternos previos al embarazo que pueden condicionar su salud, para continuar con las consecuencias maternas físicas y psicológicas. Finalmente, abordaremos la afección que el estrés perinatal tiene en la salud fetal e infantil y el mecanismo de explicación del mismo.

3.1 Factores maternos previos relacionados con el proceso de embarazo

A pesar de que el embarazo, biológicamente hablando, comienza en el momento en el que el espermatozoide fecunda al óvulo, existen un consenso en el ámbito científico que subraya la importancia del estilo de vida de la mujer en los meses previos a la concepción como determinantes para el futuro devenir del embarazo. Por ejemplo, la suplementación de hierro y ácido fólico, tan necesaria para las mujeres embarazadas, está siendo cada vez más recomendada si se planea un embarazo, desde varios meses previos a la concepción (Stephenson y cols., 2018).

Siguiendo esta línea, se han establecido una serie de factores de riesgo antes de la concepción, que pueden condicionar la salud de la embarazada, como son padecer depresión, diabetes o hipertensión, consumir tabaco, la carencia de ejercicio físico, y el sobrepeso u obesidad (Robbins y cols., 2018). De entre todos ellos, en la presente Tesis Doctoral se abordará el tema del sobrepeso y obesidad, por lo que pasaremos a profundizar en este tema.

El sobrepeso u obesidad de la mujer, previos a quedarse embarazada, han sido factores estudiados por su relación con una gran cantidad de problemas obstétricos y de resultados fetales. En esta línea se han encontrado mayores problemas asociados al sobrepeso pregestacional, como por ejemplo que aquellas mujeres que lo padecen tienen un 50% más de probabilidad de desarrollar diabetes gestacional (Muller y Nirmala, 2018).

También se ha relacionado con el riesgo de eclampsia previa, siendo la probabilidad de sufrirla un 11% más elevada si se padeció sobrepeso u obesidad pregestacional (Bartsch, Medcalf, Park y Ray, 2016). La eclampsia previa, o preeclampsia es un síndrome que ocurre de forma específica durante el embarazo y que se caracteriza por hipertensión arterial alta y una elevada presencia de proteína en la orina (NHS, 2018). Además, también se relacionó con una mayor probabilidad de sufrir hipertensión arterial gestacional (Metsälä, Stach-Lempinen, Gissler, Eriksson y Koivusalo, 2016; Shin y Song, 2015).

En lo que respecta a la repercusión en la salud fetal, se ha encontrado que los bebés nacidos de madres con un peso pregestacional elevado son más grandes en longitud y peso, aumentando su riesgo a sufrir obesidad en el futuro (Liu y cols., 2016a). Resultados más devastadores vienen de la mano de un estudio realizado por Liu y cols (2016b) donde encontraron que también se relaciona con riesgo de muerte fetal, por lo que no debe dejar de prestarse atención a este hecho.

En el aspecto psicológico, algunos autores también han encontrado mayores niveles de estrés durante el embarazo en mujeres con un elevado peso pregestacional (Laraia, Siega-Riz, Dole y London, 2009).

Indudablemente, la repercusión que el peso pregestacional tiene sobre el embarazo es negativa, pero además no se ha de dejar de tener en cuenta que todos los problemas anteriormente descritos, y que vienen a consecuencia del peso pregestacional, llevan asociados más problemática en la salud materna e infantil.

3.2 Consecuencias del estrés psicológico en el proceso de embarazo

Las consecuencias que el estrés tiene en la salud materna durante el embarazo, parto y puerperio engloban desde problemas de salud física, hasta el desarrollo de trastornos mentales. En los siguientes apartados se van a describir de forma pormenorizada dichas consecuencias que serán divididas en consecuencias físicas y obstétricas y consecuencias psicológicas.

3.2.1 Consecuencias físicas y obstétricas

En primer lugar, es importante recalcar que todas las consecuencias que el estrés tiene en el ser humano (descritas en el capítulo 1) también se aplican a la mujer embarazada, poniendo aún más en riesgo su salud. Sin embargo, la peculiaridad de este periodo enfatiza la importancia de que estas consecuencias no solo afectan a la salud física, sino que también tiene una repercusión muy importante en los resultados obstétricos del embarazo.

En términos hormonales, la principal consecuencia que el estrés tiene durante el embarazo es la desregulación del eje HHA, lo cual puede ocasionar problemas inmunitarios durante el embarazo. Se entiende que, subyacente a esta desregulación, pueden venir otros problemas derivados, uno de ellos la ya anteriormente mencionada **preeclampsia**, cuyo riesgo aumenta cuando la mujer se encuentra sometida a elevados niveles de estrés durante el embarazo (Perkins y cols., 1995; Vianna, Bauer, Dornfeld y Chies, 2011). Además, se ha relacionado el estrés perinatal con el desarrollo de **diabetes gestacional**, la cual se caracteriza por elevados niveles de glucosa en sangre, y que se asocia con el riesgo de padecer diabetes tras el embarazo, hipertensión, mayores problemas en el parto e incluso con la muerte fetal (Horsch y cols., 2016).

El estrés psicológico de la embarazada también se ha relacionado con los abortos como demuestra, un meta-análisis llevado a cabo por Qu y cols. (2017) donde se analizó el efecto del estrés en los **abortos espontáneos** durante el embarazo, encontrando que el estrés psicológico era un potente predictor de los abortos, poniendo en riesgo además la salud materna.

En relación con los resultados obstétricos, se ha postulado que la desregulación del eje HHA, ocasionado por el estrés experimentado, es un buen predictor de parto prematuro (Gilles y cols., 2018; Karakash y cols., 2016).

El **parto prematuro** es aquel que ocurre antes de las 38 semanas de gestación, y es considerado como la principal causa de muerte de niños menores de 5 años (Liu y cols., 2016b; OMS, 2018a). Además de la activación del eje HHA, el estrés psicológico se ha relacionado con mayores tasas de parto prematuro. En relación a esto, los eventos catastróficos, considerados como estresantes, se han asociado con una mayor tasa de partos prematuros, como por ejemplo el atentado de las Torres Gemelas el 11 de septiembre de 2001 (Lederman y cols., 2004). Así mismo, también se han encontrado indicios de mayor riesgo de sufrir parto prematuro cuando las mujeres embarazadas sufrían dos o más sucesos estresantes durante el embarazo (Zhu, Tao, Hao, Sun y Jiang, 2010).

Muy asociado con el parto prematuro se encuentra el **bajo peso al nacer**, el cual la Organización Mundial de la Salud (OMS) lo define como el peso inferior a 2500 gramos al nacer (OMS, 2017). El bajo peso al nacer predispone a futuras enfermedades en los niños, como son la diabetes o enfermedades cardiovasculares (Larroque, Bertrais, Czernichow y Leger, 2001; Risnes y cols., 2011). Un meta-análisis realizado por Bussières y cols., (2015) encontró que en términos del bajo peso al nacer, el estrés especifico del embarazo ejercía una influencia mayor, que los eventos diarios estresantes o los sucesos catastróficos, lo cual pone de hecho que ambos tipos de estrés conllevan consecuencias distintas.

Estas consecuencias, a pesar de tener una importante repercusión en el recién nacido, son resultados obstétricos directamente relacionados con el periodo gestacional, por ese motivo se han presentado dentro de las consecuencias maternales.

Finalmente, a pesar de que los factores que más se han relacionado con el proceso de parto han sido la edad materna o el índice de masa corporal (Roos, Sahlin, Ekman-Ordeberg, Kieler y Stephansson, 2010), es importante destacar que el estrés psicológico podría incluso influir en el proceso de parto, ya que se ha demostrado que algunas hormonas asociadas con el estrés, como la epinefrina o prolactina, pueden asociarse con cesáreas (Vogl y cols., 2006). Sin embargo, se desconoce el papel que el estrés psicológico tiene en variables como el inicio del parto, o la necesidad de intervención quirúrgica. Por ello, uno de los objetivos de la presente Tesis Doctoral consiste en comprobar la relación existente entre el estrés psicológico y variables de parto.

3.2.2 Consecuencias psicológicas

Después de describir las principales consecuencias del estrés psicológico en la salud física y obstétrica de la mujer, es importante atender a la esfera psicológica de la misma, así como el efecto del estrés en ella. Es importante destacar que el estrés en el embarazo, es considerado como un antecedente de varios problemas psicológicos que pueden sucederse tras el parto, y que sin duda, contribuyen a la forma en la que la reciente madre va a interactuar con su recién nacido.

Uno de los mayores trastornos estudiados tras el embarazo ha sido la conocida como **depresión posparto**. La caída de niveles de cortisol y el reajuste hormonal a la que una mujer se tiene que adaptar tras el parto pueden contribuir a una bajada de su estado de ánimo (Akman y cols., 2008). Sin embargo, ese bajo estado de ánimo puede acabar en depresión posparto, el cual es un trastorno mental tan inhabilitante como la depresión grave, y que tiene importantes consecuencias negativas para la madre y el recién nacido (O'Hara y McCabe, 2013; Sockol, Epperson y Barber, 2013). Existen evidencias de que el estrés experimentado en el embarazo, así como mayores niveles de cortisol en pelo a lo largo del mismo han sido predictores del desarrollo de la posterior depresión posparto de la gestante (Caparros-Gonzalez y cols., 2017).

A pesar de que existen otros tipos de trastornos mentales tras el embarazo, como pueden ser el trastorno de estrés postraumático debido al parto, o la ansiedad posparto, no se ha demostrado de forma tan directa que el estrés perinatal pueda jugar un papel importante en su etiología, siendo los propios síntomas de ansiedad o depresión previos los que estarían más relacionados con este tipo de trastornos (Ayers, McKenzie-McHarg y Slade, 2015; Field, 2018).

No obstante, el estrés se ha relacionado con el empeoramiento de los trastornos mentales presentes, por lo que, en aquellos casos en los que existe una psicopatología previa al embarazo, como puede ser esquizofrenia, depresión, trastornos de ansiedad, etc., el estrés perinatal juega un papel importante agravando los síntomas (Farr y Bish, 2013; O´Hara, Wisner, Asher y Asher, 2014). Durante el embarazo además se suelen reducir o eliminar las dosis de medicamentos que la embarazada con trastornos psicopatológicos recibe, por lo que, el empeoramiento de la sintomatología como consecuencia de elevados niveles de estrés, unido a la disminución de dosis de medicamentos, puede producir una exacerbación del trastorno que les lleve a necesitar el aumento de medicación, lo cual además puede ser perjudicial para la propia salud materna y la fetal (Hudson y cols., 2017; Khalifeh, Brauer, Toulmin y Howard, 2015; Leong y cols., 2017).

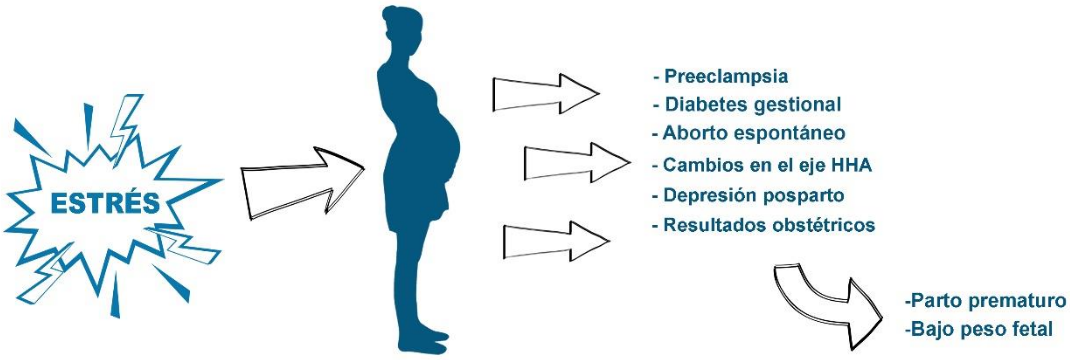

Figura 6. Consecuencias del estrés en el proceso de parto y embarazo.

Como hemos podido comprobar, el estrés psicológico tiene importantes consecuencias en el proceso de parto y embarazo incidiendo también en la salud psicológica de la mujer gestante. Pero dichas consecuencias trascienden a la madre llegando a afectar al propio feto, al recién nacido, e incluso pueden llegar a mantener dicho efecto hasta la edad adulta. En el siguiente apartado vamos a pasar a describirlo de forma más detallada.

3.3 Consecuencias infantiles

El feto depende por completo de su madre, dentro del útero recibe los alimentos necesarios, al igual que se puede ver privados de ellos si la madre lo está. Así mismo, el estrés que la madre padece también repercute en el feto y recién nacido.

Para entender los efectos del estrés en el recién nacido, se debe de prestar atención en primer lugar al concepto de **neurodesarrollo**; este amplio término se define como el desarrollo psicológico y la formación del cerebro del ser humano y que depende en gran medida de la calidad de estimulación temprana, los hábitos de vida prenatales y la calidad del entorno que rodea al recién nacido, a nivel familiar, comunitario y social (OMS, 2018b).

En este sentido, el estrés perinatal ejerce su función influyendo en las vías de desarrollo fetal intrauterino, pudiendo llegar a producir cambios en el metabolismo, aumentando el riesgo a sufrir distintas enfermedades o problemas en el neurodesarrollo, los cuales van a ser descritos a continuación (Reyes y Carrocera, 2015).

Consecuencias del estrés en el neurodesarrollo

Durante el primer año de vida, la existencia de un trastorno psicológico en el recién nacido no es tan evidente como cuando crecen, ya que, un leve retraso en el desarrollo, puede considerarse como un simple aspecto evolutivo que aún debe desarrollarse. Por ello, los investigadores ponen su énfasis en el neurodesarrollo de los bebés, en tres grandes ámbitos: cognitivo, lingüístico y motriz.

En primer lugar, el **neurodesarrollo cognitivo** hace referencia a la capacidad de atención y percepción del recién nacido, siendo capaz de reaccionar ante los estímulos que se presentan novedosos e interactuando con ellos (Portollano, 2007). En relación a este, se encontró un peor desarrollo cognitivo a los 8 meses de edad cuando las madres habían experimentado un elevado estrés alrededor del segundo trimestre de gestación (27 semanas), así como en aquellas que tenían mayores niveles de cortisol en saliva en las últimas semanas de embarazo (Huizink, Robles de Medina, Mulder, Visser y Buitelaar, 2003)

Estos resultados entraron en controversia con un estudio posterior, donde se evaluó el cortisol en saliva y estrés psicológico a lo largo de todo el embarazo, encontrando que mayores niveles de ambos durante el primer trimestre de embarazo predecían un peor desarrollo cognitivo a los 12 meses de edad (Davis y Sandman, 2010). Sin embargo, estos mismos autores encontraron mayores niveles de neurodesarrollo cognitivo cuando el cortisol salival era alto en el segundo y tercer trimestre (Davis y Sandman, 2010). A pesar de que los estudios parecen mostrar una relación, se siguen sucediendo las investigaciones para intentar encontrar el efecto diferencial y la direccionalidad del efecto del estrés psicológico o del cortisol en el neurodesarrollo cognitivo de los bebés. El más reciente de ellos ha encontrado que, los niveles de cortisol en pelo materno presentes tras el parto, conllevan a un aumento del neurodesarrollo cognitivo del bebé a los 6 meses de edad (Caparros-Gonzalez y cols., 2019).

En lo que respecta al **neurodesarrollo lingüístico**, entendido como la capacidad para reconocer sonidos, emitir sonidos, gestos o palabras para comunicarse (Bayley, 2006), la investigación hasta ahora es más escasa e inconclusa. Los principales resultados encontrados han sido en niños a los 2 años de edad cuyas madres estando embarazadas se enfrentaron a un desastre natural en Quebec (Canadá). En el seguimiento posterior encontraron que estos niños mostraban un neurodesarrollo lingüístico peor, en comparación con aquellos niños cuyas madres no fueron expuestas a dicho desastre (Laplante y cols., 2004).

Finalmente, en el abordaje del **neurodesarrollo motriz** que engloba las habilidades en el manejo de las manos y el mantenimiento de la postura corporal (Bayley, 2006), se encontró relación entre el estrés psicológico perinatal y el cortisol en saliva. De este modo los bebés cuyas madres habían experimentado más estrés durante el embarazo, mostraban un peor rendimiento en tareas que requerían de la motricidad fina a los 16 meses de edad (Haselbeck y cols., 2017). Por otro lado, también se ha encontrado que, a los 6 meses de edad se encontraron peores niveles de desarrollo motor en niños de madres que habían experimentado una serie de inundaciones en Queensland (Australia) durante el embarazo. Sin embargo, al seguir a estos niños en el tiempo, hasta los 2 años, estos resultados se invirtieron encontrando mayores niveles de desarrollo motriz (Simcock y cols., 2016). No obstante, estos datos no se han podido ratificar, ya que un estudio posterior al analizar esta relación no encontró ningún efecto entre el estrés perinatal y el posterior desarrollo motriz del bebé, poniendo de manifiesto que es necesario aumentar la investigación en este campo, para intentar esclarecer la influencia del estrés en el neurodesarrollo (Prado y cols., 2017).

Como se puede comprobar, no existe acuerdo entre los resultados encontrados sobre la relación del neurodesarrollo infantil y el estrés experimentado por la madre. Estos varían en gran medida según el método utilizado para evaluar el estrés, el momento del embarazo y la edad del niño. En el sentido de intentar entender la complejidad de estas relaciones, en el siguiente apartado se explicará el mecanismo explicativo de las consecuencias que el estrés perinatal tiene en el recién nacido.

3.4. Mecanismos explicativos de las consecuencias del estrés perinatal

El mecanismo explicativo principal por el cual el estrés perinatal repercute en la salud fetal es el eje HHA. El feto es totalmente dependiente de la madre, y la placenta es el órgano que regula la transmisión tanto de nutrientes como de hormonas y demás elementos de la madre al feto (Baker, Frank, Deangelis, Feingold y Kaminetzky, 1981).

Asimismo, la placenta se postula como la principal protagonista en la transmisión de los niveles de cortisol de la madre al feto. Como describimos en capítulos anteriores, al experimentar estrés se libera CRH, la cual a su vez estimula la segregación de ACTH y por tanto la posterior liberación de cortisol (Tsigos y Chrousos, 2002). Existen varias vías por las cuales el cortisol materno puede condicionar una alteración en el eje HHA del feto. En primer lugar, alrededor de un 40% del cortisol materno es capaz de atravesar la placenta y entrar en la circulación fetal (Beijers, Buitelaar y de Weerth, 2014). La segunda vía consiste en la sínTesis y liberación de CRH placentaria, y es que la placenta al ser estimulada por el cortisol, sintetiza y libera CRH en su interior, lo que a su vez provocaría la liberación de ACTH fetal y la segregación de cortisol, esto es, estimulando el eje HHA fetal (Glover, O´Donnel, O´Connor y Fisher, 2018; Beijers y cols., 2014; Rakers y cols., 2016).

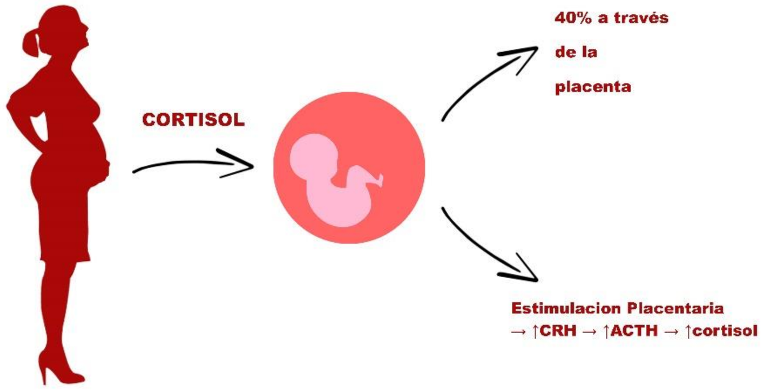

Figura 7. Vías de transmisión del cortisol a través de la placenta

La importancia del cortisol fetal reside en las últimas etapas de la formación del mismo, ya que influye en el desarrollo cerebral y en la formación y maduración de órganos como los pulmones, sin embargo, todo parece indicar que la exposición uterina a altos niveles de cortisol desde etapas tempranas de la gestación puede comprometer el desarrollo cerebral e inmunológico del feto (Beijers y cols., 2014; Entringer y cols., 2008; Howerton y Bale, 2012).

A pesar de la tremenda importancia que tiene el hecho de la transmisión de cortisol materno, tan solo un estudio realizado con primates ha analizado la relación que existe entre el estrés crónico materno y el fetal, medido en niveles de cortisol en pelo (Kapoor, Lubach, Ziegler y Coe, 2016). En dicho estudio, se encontró que, los niveles de cortisol maternos en el primer trimestre correlacionan de manera negativa con los del recién nacido, teniendo en cuenta que, al usar la técnica de cortisol en pelo, la información obtenida se refiere a la exposición a cortisol intrauterina (Kapoor y cols., 2016). Este estudio, realizado con primates, ha sido el único realizado para investigar esta relación, sin embargo, esta relación no ha sido estudiada en humanos. Por ello, siguiendo con la motivación de profundizar en las consecuencias de la secreción de cortisol por parte de la mujer gestante, uno de los objetivos de esta Tesis Doctoral, ha sido estudiar si existe relación entre los niveles de cortisol en pelo maternos con los del recién nacido.

Finalmente, no existe un consenso sobre el momento determinado en el que el estrés ejerce su influencia sobre el desarrollo fetal. Probablemente, el momento de gestación en el que se encuentre la madre cuando sufra el estrés va a marcar de una manera u otra el desarrollo fetal, pues existen distintos períodos evolutivos en el crecimiento del feto. De esta forma, experimentar estrés en el primer, segundo o tercer trimestre de embarazo puede conllevar consecuencias distintas, ya que el desarrollo del cerebro fetal es progresivo, y se encuentra en continuo crecimiento incluso hasta la edad adulta (Gaviria, 2006; Romero-Gonzalez, Caparros-Gonzalez y Peralta-Ramirez, 2019).

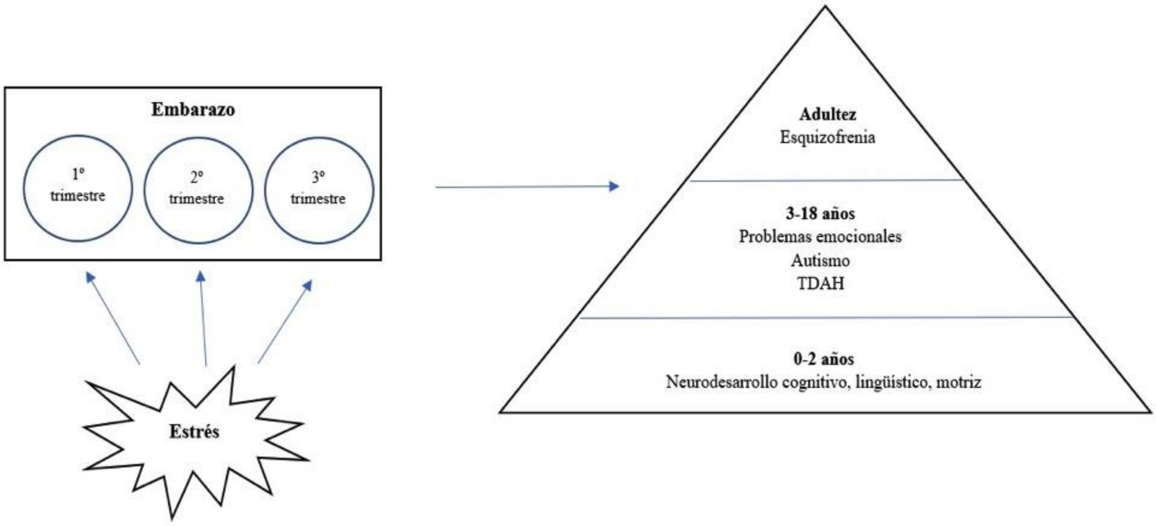

Figura 8. Principales consecuencias del estrés perinatal en la descendencia. Imagen extraída de Romero-González, Caparros-González y Peralta-Ramírez (2019).

3.5. Embarazos de riesgo

Tras describir las posibles consecuencias del estrés en la embarazada y de los mecanismos explicativos del efecto del estrés perinatal, es necesario detenernos en un tipo de embarazo que implica un alto estrés como son los embarazos de riesgo.

Existen una serie de factores maternos previos al embarazo, o que suceden en el mismo, que ponen en riesgo la salud materna y fetal, y que además requieren de un cuidado médico especializado y diferente a un embarazo de bajo riesgo, incluyendo en muchas ocasiones la ingesta de fármacos, pautas de cuidado, etc. (NIH, 2012).

Entre los posibles factores de riesgo que se establecen para considerar un embarazo como embarazo de alto riesgo, han sido la existencia de problemas médicos previos o enfermedades médicas como enfermedades autoinmunes, padecer sobrepeso u obesidad (mencionado anteriormente), el caso de los embarazos múltiples o tener una edad superior a los 35 años (ACOG, 2012; ACOG, 2013; The Society for Maternal-Fetal Medicine, 2012).

Diversos autores han demostrado que esta población de riesgo se ve expuesta a mayores niveles de estrés, depresión y ansiedad, que aquellas mujeres que tienen un embarazo de bajo riesgo (Gourounti, Karpathiotaki y Vaslamatzis, 2015). Además, es más frecuente que estas mujeres soliciten atención psicológica durante el embarazo, ya que no solo tienen que lidiar con los problemas de salud, sino con la incertidumbre y preocupación sobre si sus problemas repercutirán en sus hijos (Kingston y cols., 2015).

Con todo ello, las consecuencias que puede tener el hecho de experimentar un embarazo de alto riesgo sobre la salud infantil, o en el propio neurodesarrollo puede ser diferente al de un embarazo de bajo riesgo. Ante esta premisa, uno de los objetivos de la presente Tesis

Doctoral fue explorar las diferencias existentes en el neurodesarrollo de bebés nacidos de embarazos de alto y bajo riesgo.

Durante todo el capítulo se han presentado las consecuencias que el estrés tiene sobre la salud materna e infantil, viendo que su repercusión tiene una elevada importancia dados los resultados negativos del mismo. Es importante trabajar con la mujer embarazada y prestar atención a sus necesidades psicológicas, con el fin de evitar problemas posteriores. En el siguiente capítulo se van a abordar dos cuestiones, en primer lugar, cómo afecta la psicopatología materna durante el embarazo, y en segundo lugar, qué intervenciones se han destinado a esta población con el fin de reducir los elevados niveles de estrés.

Capítulo IV. Síntomas psicopatológicos en el embarazo e intervenciones para la reducción del estrés en el embarazo

En los primeros capítulos hemos descrito de manera pormenorizada las consecuencias del estrés en el proceso de embarazo-parto. En este último capítulo de la introducción nos gustaría también profundizar en la psicopatología que se produce durante el embarazo, ya que ha sido ampliamente estudiada debido a su prevalencia, y es que las mujeres embarazadas no están exentas de sufrir trastornos de ansiedad, depresión u otra amplia variedad de sintomatología psicopatológica.

En este capítulo se van a abordar la psicopatología estudiada durante el embarazo de forma más prevalente, como es la ansiedad y la depresión, para continuar con otra serie de síntomas psicopatológicos escasamente estudiados.

Para finalizar el capítulo, vamos a describir las intervenciones psicológicas que cuentan con eficacia basada en la evidencia aplicadas al proceso de embarazo-parto, con el objetivo de reducir el estrés de la mujer gestante, así como los resultados obtenidos por estas terapias.

A continuación, vamos a presentar las principales trastornos emocionales y psicopatológicos asociados a embarazo.

4.1 Ansiedad

Cuando las preocupaciones sobre el embarazo comienzan a exacerbarse, aumentar y a convertirse en incontrolables, dan paso a la ansiedad. Además, el hecho de que algunos embarazos puedan ser inesperados incrementa los síntomas de ansiedad (Anniverno, Bramante, Mencacci y Durbano, 2013). Se ha estimado que alrededor de un 25% de mujeres embarazas experimentan síntomas de ansiedad durante el embarazo, aunque estos pasan desapercibidos para los profesionales de la salud, lo que les impide abordarlos correctamente (Britton, 2011; Huizink, Mulder, Robles de Medina, Visser y Buitelaar, 2004).

A la hora de establecer el curso de la sintomatología ansiosa durante el embarazo, se encuentra que ésta permanece de forma estable durante los trimestres, existiendo un descenso tras el parto (Martini y cols., 2015). Ante ello, es importante prestar atención a las posibles desviaciones de esta "norma", ya que se encuentran en la base de posteriores trastornos psicológicos, encontrando que la experiencia de eventos estresantes o adversidades durante el embarazo contribuyen al empeoramiento de la sintomatología ansiosa (Kingsbury, Plotnikova, Clavarino, Mamun y Najman, 2018).

A esto hay que añadir que la ansiedad perinatal se ha relacionado con consecuencias negativas como son el desarrollo de depresión posparto, el riesgo de parto prematuro y bajo peso fetal, además de problemas en el desarrollo de los niños (Davis y Sandman, 2012; Littleton, Breitkopf y Berenson, 2007; O'Donnel y cols., 2012; Skouteris, Wertheim, Rallis, Milgrom y Paxton, 2009). Además, en determinadas ocasiones, la ansiedad precede a otro tipo de trastornos mentales de mayor gravedad, como son los trastornos de pánico, fobias o el trastorno obsesivo-compulsivo, que pueden requerir la necesidad de medicación, suponiendo un riesgo para la salud fetal (Beyondblue, 2011).

Cabe destacar que una de las particularidades de la ansiedad prenatal es su elevada comorbilidad con otro de los trastornos psicológicos más frecuentes, la depresión. Tal es la relación entre ambos, que uno de los factores de riesgo para su desarrollo es la presencia previa de sintomatología ansiosa o depresiva (Heron, O´Connor, Evans, Golding y Glover, 2004). En el siguiente apartado profundizaremos en la depresión perinatal.

4.2 Depresión

Según la Organización Mundial de la Salud, la depresión es uno de los trastornos mentales más inhabilitantes y comunes entre la población, a esto hay que añadir que tiene mayor ocurrencia en mujeres (OMS, 2018c). Durante el embarazo, se ha estimado una prevalencia de entre el 7 y el 12% de sufrir depresión o síntomas depresivos, sin embargo el problema deriva del enorme estigma social que existe en esta población, pues las expectativas de que el embarazo debe ser un periodo alegre y deseado para toda mujer, puede contribuir a que se subestimen los síntomas, y las mujeres no lleguen incluso ni a informarlos (Bennett, Einarson, Taddio, Koren y Einarson, 2004; Marcus, 2009).

Diversos estudios sobre la depresión fueron revisados por Bonari y cols., (2004) y Gentile (2017) para extraer las principales consecuencias de la misma. De estas, destacan mayor riesgo de sufrir preeclampsia, aborto espontaneo, parto prematuro, bajo peso fetal, problemas en el desarrollo fetal, mayores niveles de cortisol en el recién nacido, mayor tasa de muerte fetal, o problemas internalizantes durante la niñez (Bonari y cols., 2004; Gentile, 2017).

Al igual que en el caso de la ansiedad, el curso normal que sigue la sintomatología depresiva durante el embarazo es la estabilidad, con un descenso tras el parto (Martini y cols., 2015). También como factores de riesgo se encuentran episodios ansiosos previos, aunque hay que añadir una amplia lista de factores, como son la posibilidad de que el embarazo no sea deseado, el estatus socioeconómico o la falta de apoyo social o marital (Skipstein, Jason, Kjeldsen, Nilsen y Mathiesen, 2012).

Actualmente, la investigación ha estado especialmente centrada en la ansiedad y depresión, dejando de lado otra serie de trastornos psicológicos o síntomas psicopatológicos que pueden ocurrir durante el embarazo y que serán analizados en el siguiente apartado.

4.3 Otros síntomas psicopatológicos

En primer lugar, las mujeres embarazadas se encuentran en riesgo de sufrir problemas relacionados con **obsesiones y compulsiones**, debido al excesivo cuidado que les pautan durante el embarazo, tanto físico propio como de alimentación e higiénico (Russell, Fawcett y Mazmanian, 2013; Sharma y cols., 2017; Uguz y cols., 2007). A pesar de haberse encontrado una prevalencia alrededor del 2%, la investigación sobre este tipo de sintomatología es muy escasa (House y cols., 2016; Miller, Chu, Gollan y Gossett, 2013). Uno de los problemas principales con este tipo de sintomatología es que suele atribuirse a los cambios neuroendocrinos y hormonales que suceden durante el embarazo, por lo que las mujeres embarazadas, así como los profesionales de la salud, normalizan este tipo de sintomatología minimizando su importancia (Forray, Focseneanu, Pittman, McDougle y Epperson, 2010; Lochner y cols., 2004).

Existe otro tipo de sintomatología que también suele pasar desapercibida debido a las características especiales del embarazo, y son las **somatizaciones.** Es necesario tener en cuenta que el embarazo es un periodo en el que ocurren una serie de cambios corporales y hormonales, cambios en la circulación sanguínea, funciones glandulares, alimentación de los tejidos relacionados con el embarazo, además de frecuentes episodios de insomnio, dolores de cabeza o de espalda, hinchazón de piernas, entre otros (Nayak, Poddar y Jahan, 2015). Todo este tipo de cambios pueden llevar asociados elevados niveles de somatizaciones que pueden ser subestimados, y que suponen, además, elevados niveles de estrés (Nakao, 2017).

En este sentido, los **síntomas psicóticos** se han relacionado con las somatizaciones en las mujeres embarazadas, además de con los elevados niveles de estrés (Andersson y cols., 2003; O'Hara y Wisner, 2014). Los trastornos psicóticos suelen desembocar en psicosis puerperal, altamente incapacitante para la madre, y que se caracteriza por fluctuaciones en el estado de ánimo, comportamiento raro, alucinaciones, e incluso pensamientos suicidas o violentos en contra del recién nacido, pudiendo acabar en la muerte propia o del recién nacido (Howard, Goss, Leese y Thornicroft, 2003; O'Hara y Wisner, 2014).

Finalmente, la sintomatología relacionada con las **fobias** también se puede encontrar en las mujeres embarazadas, adoptando una forma de fobia muy específica, la llamada tocofobia, o miedo al parto (Nilsson y cols., 2018). Este tipo de miedo puede estar presente desde antes del embarazo, provocando que las mujeres decidan postergar el momento para quedarse embarazadas, o incluso no deseándolo por completo (Striebich y cols., 2018). Se estima que alrededor de un 20% de mujeres pueden sufrir este tipo de miedo, siendo un 6% aquellas que describen el miedo como completamente incapacitante (Demšar y cols., 2018; Hofberg y Ward, 2003). Este miedo irracional interfiere con el funcionamiento diario de la mujer embarazada y lleva asociados consecuencias negativas, incrementando el riesgo a nacimiento por cesárea (Handelzalts y cols., 2015).

La delgada línea que existe entre los distintos síntomas psicopatológicos que pueden anteceder a trastornos mentales que generen graves problemas, y los propios síntomas del embarazo hacen realmente complicada la posibilidad de detectar estos problemas, por lo que se requiere una investigación más profunda en este tipo de sintomatología, para comprender de manera psicopatológica este proceso evolutivo en las mujeres (Hudak y Wisner, 2012).

Figura 9. Síntomas psicopatológicos en la mujer embarazada.

Tal y como se ha descrito, existe sintomatología que no ha sido estudiada de forma exhaustiva durante el embarazo, y que además no se le proporciona la importancia que merece. Es por ello que uno de los objetivos de esta Tesis Doctoral ha sido explorar el perfil psicopatológico de la mujer embarazada, con el fin de clarificar las posibles diferencias en síntomas psicopatológicos de las mujeres gestantes en comparación con mujeres no embarazadas.

El abordaje psicopatológico de la embarazada arroja luz sobre la necesidad de una atención e intervención psicológica especializada, por ello es necesario atender a las intervenciones destinadas a reducir los niveles de estrés, y su consecuente psicopatología durante el embarazo, ya que, una vez conocidas las consecuencias, es importante paliarlas.

4.4 Intervenciones para el control del estrés

Dado el malestar psicológico y continuas preocupaciones patentes en la etapa de gestación existe un creciente interés de las mujeres embarazadas por requerir atención psicológica antes que el uso de fármacos, debido al miedo que producen los posibles efectos de estos en malformaciones fetales (Richter y cols., 2012). Sin embargo, no todas las intervenciones psicológicas tienen los mismos resultados ni se centran en los mismos componentes.

4.4.1 Intervenciones alternativas y de tercera generación en el embarazo

El incremento en el uso de la medicina alternativa ha traído una gran cantidad de técnicas e intervenciones que han intentado resolver los problemas de estrés o ansiedad durante el embarazo, con el fin de evitar el uso de fármacos. Sin embargo, la evidencia existente en este tipo de técnicas es escasa e inconclusa, a diferencia de la evidencia mostrada por la Terapia Cognitivo Conductual (TCC) (Hofmann. Asnaani, Vonk, Sawyer y Fang, 2012), de la cual se hablará más adelante.

La biblioteca Cochrane, que busca la evidencia sobre las intervenciones realizadas en distintas poblaciones, publicó una revisión sobre el efecto de las terapias llamadas *Mind-Body,* las cuales se han definido como aquellas intervenciones focalizadas en la interacción entre el cerebro, mente, cuerpo y comportamiento y en la poderosa fuerza que los componentes emocionales, mentales, sociales, espirituales y comportamentales pueden ejercer sobre la salud (National Center for Complementary and Integrative Health, 2018). Ejemplos de estas intervenciones son el yoga, la relajación, la hipnosis, la imaginación, el rezo o el biofeedback (Beddoe y Lee, 2008).

A pesar del creciente interés por estas técnicas, con su revisión, la Biblioteca Cochrane establece que podría existir un beneficio en su aplicación, pero no existe un efecto empírico, ya que los estudios realizados carecen en su mayoría de estándares metodológicos de calidad, como son los ensayos controlados aleatorizados (Marc y cols., 2011).

Por otro lado, están las terapias de tercera generación, entre las que se encuentra el *Mindfulness*, el cual consiste en la observación de los pensamientos, emociones, sensaciones o percepciones del momento presente sin juicios (Kabat-Zinn, 1990). Una reciente revisión sobre el efecto del *Mindfulness* (incluyendo el *Mindfulness* basado en la reducción de estrés) encontró evidencia preliminar sobre los síntomas de ansiedad durante el embarazo, aunque realiza igualmente una dura crítica ante la falta de rigor metodológico de los estudios publicados (Shi y MacBeth, 2017).

Finalmente, se han utilizado técnicas de "*counselling*" ofrecidas por los principales trabajadores de la salud que tienen acceso a las mujeres embarazadas. Este tipo de técnicas consisten en el apoyo, escucha y resolución de dudas, miedo y preocupaciones que pueda presentar la mujer en relación con su embarazo. Es frecuente el uso *counselling* para la reducción de estrés percibido en mujeres que no logran concebir mediante técnicas de reproducción asistida, donde parece encontrarse una reducción del mismo (Hamzehgardeshi y cols., 2019). Sin embargo, a pesar de que algunos autores reportan evidencia sobre la eficacia de este tipo de técnicas, no deben considerarse intervenciones psicológicas *per se*, ya que la mayoría de ellas se centran únicamente en la psicoeducación (Kaboli y cols., 2017).

Tras presentar las principales intervenciones alternativas que se han usado en esta población, pasamos a abordar una que, por sus características, y respaldo científico, es una de las más usadas por los investigadores y clínicos: la Terapia Cognitivo-Conductual.

4.4.2 Terapia Cognitivo-Conductual para el control del estrés en el embarazo

A lo largo de los años, la Terapia Cognitivo-Conductual (TCC) ha recibido el respaldo de numerosos científicos, postulándose como una de las intervenciones psicológicas con mayor eficacia basada en la evidencia para multitud de trastornos psicológicos (Hofmann y cols., 2012). La esencia principal de esta terapia se basa en entender la interacción existente entre la cognición, conducta y emoción, a partir del cual se propone el reconocimiento de las emociones y el cambio cognitivo de los pensamientos irracionales e ideas centrales negativas, por un tipo de cognición más racional, con el fin de conseguir un cambio cognitivo y en consecuencia comportamental y emocional (Dávila, 2014; Westbrook, Kennerly y Kirk, 2011).

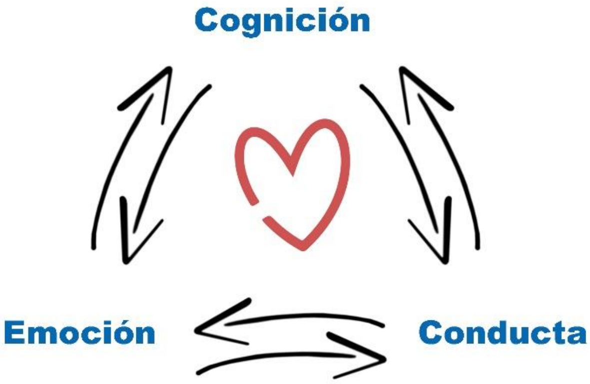

Figura 10. Base de la Terapia Cognitivo-Conductual

Las principales intervenciones destinadas al manejo del estrés con base en la TCC incluyen técnicas de desactivación, como respiración diafragmática, técnicas cognitivas propias de la TCC como puede ser la reestructuración cognitiva, entrenamiento autoinstruccional y técnicas de control de la ira o asertividad (Robles-Ortega y Peralta-Ramirez, 2006).

Este tipo de intervenciones poseen respaldo científico y han sido eficaces en el manejo de estrés, reducción en síntomas psicopatológicos, aumento de habilidades de funciones ejecutivas en población general, pacientes con estrés crónico, pacientes con enfermedad autoinmune, mujeres con cáncer de mama y personas afectadas de *burnout* entre otros (Gardner, Rose, Mason, Tyler y Cushway, 2005; Linares-Ortiz, Robles-Ortega y Peralta-Ramírez, 2014; McGregor y cols., 2004; Navarrete-Navarrete y cols., 2010; Peralta-Ramírez, Robles-Ortega, Navarrete-Navarrete y Jiménez-Alonso, 2009; Santos-Ruiz, Robles-Ortega, Pérez-García y Peralta-Ramírez, 2017; Stagl y cols., 2015).

En lo que respecta a la aplicación de este tipo de intervenciones al embarazo, los estudios que existen van dirigidos a poblaciones clínicas. Por ejemplo, Zaheri, Najar y

Abbaspoor (2017) aplicaron la intervención en mujeres embarazadas que presentaban diabetes gestacional con una duración de 6 sesiones, se centraron en la relación entre el estrés y la diabetes, estilos de afrontamiento, relajación progresiva, resolución de problemas, manejo del tiempo y de la ira y reestructuración cognitiva; encontrando una importante reducción en los niveles de estrés tras las seis sesiones y demostrando así la eficacia de la intervención dirigida a este tipo de población (Zaheri, Najar y Abbaspoor, 2017). Otro estudio que aplicó el mismo tipo de intervención, tuvo como objetivo mujeres embarazadas con preeclampsia, encontrando una reducción en los niveles de ansiedad, depresión y estrés específico del embarazo (Asghari, Faramarzi y Mohammmadi, 2016).

Por otro lado, el objetivo de esta intervención psicológica ha sido también la reducción de la sintomatología depresiva o ansiosa, encontrando que la aplicación de la TCC consigue reducir los niveles de ambos síntomas en mujeres embarazadas con diagnóstico clínico de depresión o ansiedad, e incluso modificando los niveles de cortisol salival (Austin y cols., 2008; Karamoozian y Askarizadeh, 2015; Richter y cols., 2012; Urizar y Muñoz, 2011).

Sin embargo, y a pesar de toda la evidencia descrita, no existen estudios que muestren si es posible reducir los niveles de estrés, preocupaciones, cortisol y síntomas psicopatológicos en un embarazo sano, o, si por el contrario, este tipo de intervenciones solamente son útiles cuando existe una patología de base. Por ello, uno de los objetivos planteados en esta Tesis ha sido comprobar la eficacia de una terapia de carácter cognitivo conductual para el control del estrés en una muestra de mujeres embarazadas sanas.

Ante lo visto, la psicopatología juega un papel importante en la salud de la mujer embarazada, y se han desarrollado diversas intervenciones, con apoyo empírico y sin él, para reducir tanto el estrés como la psicopatología durante el embarazo. De entre todas las intervenciones, la Terapia Cognitivo-Conductual parece reportar los mejores beneficios en embarazos caracterizados por algún tipo de enfermedad, siendo necesaria su investigación en embarazos sanos.

Capítulo V. Justificación y objetivos

5.1 Justificación

Tal y como se ha desarrollado en los apartados anteriores, el estrés tiene una influencia muy importante en la salud, ya que la activación de los ejes adrenomedular y HHA tiene una repercusión en todos los sistemas de nuestro organismo. Este estrés afecta especialmente a las mujeres embarazadas, suponiendo un riesgo para su salud y la de sus bebés. Además del estrés cotidiano, la mujer gestante experimenta lo que se denomina estrés específico del embarazo, que se refiere a todas las preocupaciones que una mujer tiene en lo relativo a su embarazo y lo que lo rodea. Al tratarse de una incidencia en una población tan especifica como es la de las mujeres embarazadas, su estudio y entendimiento se vuelve esencial para un completo abordaje de este proceso.

Uno de los mecanismos explicativos que se han desarrollado para determinar la influencia que tiene el estrés en la salud materna e infantil ha sido la activación del eje HHA, por lo que su evaluación también ha sido de una enorme importancia, por ello ha sido incluida en numerosos estudios, que tienen por objetivo estudiar las consecuencias de este. Tradicionalmente, los estudios han usado medidores de cortisol, como ha sido la saliva o la sangre, los cuales nos informan sobre los niveles de estrés en un momento puntual pero no nos pueden ofrecer información del estrés crónico. Para ello, evaluar los niveles de cortisol en pelo se propone como solución, pudiendo obtener información del estrés crónico al que se ha visto expuesta la madre de forma retrospectiva, así como el del recién nacido.

Por otro lado, se necesitan instrumentos de evaluación psicológica centrados en el estrés específico del embarazo y el estrés tras el parto, que puede ser medido usando escalas de satisfacción con el parto.

En tercer lugar, existe una gran cantidad de síntomas psicopatológicos a los que la mujer embarazada se encuentra expuesta como la ansiedad y la depresión que han sido ampliamente estudiados, pero existen muchos otros que no se han abordado como las somatizaciones, obsesiones y compulsiones, etc. Es por ello por lo que no se conoce el curso de esta sintomatología a lo largo del embarazo. Conocer si existe sintomatología psicopatológica asociada al proceso de embarazo y su curso normal, puede ayudar a atender posibles desviaciones de éste como foco de atención en futuros problemas.

El estrés psicológico y la exposición a estrés crónico puede tener importantes repercusiones tanto en la salud materna, como en el desarrollo del recién nacido. Actualmente no se conoce la influencia que puede tener el estrés crónico experimentado por la mujer gestante a lo largo de todo el embarazo en los propios niveles de cortisol del recién nacido, ya que los únicos estudios realizados hasta ahora han sido en monos.

Siguiendo esta línea, se conoce que el estrés perinatal tiene repercusiones en el desarrollo del niño/a, sin embargo, esto no se ha estudiado en poblaciones con alto estrés asociado al embarazo como es el caso de los embarazos de alto riesgo.

Finalmente, y tras hacer este recorrido por los devastadores efectos del estrés, se hace evidente que es necesario contar con intervenciones psicológicas que ayuden a controlar el estrés durante el embarazo. Sin embargo, los estudios realizados hasta la fecha no han contemplado si es posible reducir los niveles de estrés en el embarazo sano, actuando de esta forma como una intervención de promoción de la salud.

5.2 Objetivos

Por todo ello, el **objetivo principal** de esta investigación fue:

Comprobar las consecuencias que tiene el estrés experimentado por la madre durante todo el embarazo en la salud materna e infantil.

Con el fin de cumplir el objetivo general de esta Tesis Doctoral, se han realizado un total de 8 estudios que se subdividen en 4 bloques.

Bloque 1. Adaptación y validación de instrumentos de evaluación psicológicos

En este bloque se ha realizado la adaptación, validación y traducción de dos instrumentos claves para poder ser usados en la evaluación de muestra española, uno de ellos, durante el embarazo, y el otro, tras el parto.

Los objetivos específicos de este bloque han sido:

Objetivo específico 1. La traducción, adaptación y validación del *Prenatal Distress Questionnaire Revised* (NuPDQ) para su aplicación en mujeres embarazadas españolas.

Este objetivo específico se ha completado con el estudio 1, presente en el capítulo VI de la presente Tesis Doctoral.

El estudio se encuentra en proceso de revisión en la revista *Archives of Women´s Mental Health.*

Romero-Gonzalez, B., Martin, C., Caparros-Gonzalez, R. A., Quesada-Soto, J. M. & Peralta-Ramirez, M. I. (2019). Spanish validation and factor structure of the Prenatal Distress Questionnaire Revised (NuPDQ).

Objetivo específico 2. La traducción, adaptación y validación de la *Birth Satisfaction Scale – Revised* (BSS-R) para su aplicación en mujeres españolas tras el nacimiento de su bebé.

Este subobjetivo se ha completado con el estudio 2, presente en el capítulo VII de la Tesis Doctoral.

Además, el estudio se encuentra publicado en la revista *Midwifery*:

Romero-Gonzalez, B., Peralta-Ramirez, M. I., Caparros-Gonzalez, R. A., Cambil-Ledesma, A., Martin, C. J. H., & Martin, C. R. (2019). Spanish validation and factor structure of the Birth Satisfaction Scale-Revised (BSS-R). *Midwifery*, *70*, 31-37. doi: 10.1016/j.midw.2018.12.009.

Bloque 2. Estrés perinatal y síntomas psicopatológicos de la madre y su efecto en el proceso de embarazo y parto.

Este bloque engloba los capítulos del VIII al X, en los que se han estudiado diferentes aspectos de la salud materna en relación con el estrés, así como la relación entre el estrés y los síntomas psicopatológicos en el proceso de embarazo y parto.

Los objetivos específicos de este bloque son:

Objetivo específico 3. Comprobar la relación entre el sobrepeso y obesidad pregestacional con el estrés perinatal y síntomas psicopatológicos durante los tres trimestres de embarazo.

Este subobjetivo compone el capítulo VIII, publicado en la revista Nutrición Hospitalaria:

Romero-Gonzalez, B., Caparros-Gonzalez, R. A., Strivens-Vilchez, H. y Peralta-Ramirez, M. I. (2018). ¿Puede el índice de masa corporal pre-gestacional relacionarse con el estado psicológico y físico de la madre durante todo el embarazo? *Nutrición Hospitalaria*, *35*(2), 332-339. doi: 10.20960/nh.1192

Objetivo específico 4. Comprobar las diferencias existentes en estrés, cortisol en pelo y síntomas psicopatológicos entre mujeres gestantes y mujeres no gestantes.

Este estudio compone el capítulo IX de la Tesis Doctoral y se encuentra en revisión en la revista *Journal of Affective Disorders.*

Romero-Gonzalez, B., Caparros-Gonzalez, R. A., Gonzalez-Perez, R., Garcia-Leon, M. A., Arco-Garcia, L. & Peralta-Ramirez, M. I. (2019). Psychopathology, psychological stress and hair cortisol levels in pregnant and non- pregnant women.

Objetivo específico 5. Comprobar la repercusión de los altos niveles de estrés y síntomas psicopatológicos durante el embarazo en el tipo e inicio de parto.

Para cumplir este objetivo se desarrolló el capítulo X de la Tesis.

El estudio se encuentra publicado en la revista *Midwifery*:

Romero-Gonzalez, B., Caparros-Gonzalez, R. A., Gonzalez-Perez, R., Coca-Arco, S., & Peralta-Ramirez, M. I. (2019). Hair cortisol levels, psychological stress and psychopathological symptoms prior to instrumental deliveries. *Midwifery, 77*, 45-52. doi: 10.1016/j.midw.2019.06.015

Bloque 3. Estrés perinatal y consecuencias en la descendencia.

Debido a la importancia de estudiar la repercusión del estrés perinatal y su incidencia en el recién nacido, en este bloque se explora, mediante dos capítulos, las consecuencias que elevados niveles de cortisol y estrés psicológico puede tener en el recién nacido (capítulo XI) y en el neurodesarrollo del bebé a los 6 meses de edad (capítulo XII).

Se plantearon dos objetivos específicos:

Objetivo específico 6. Comprobar la relación existente entre el estrés durante el embarazo y los niveles de cortisol en pelo maternos con los niveles de cortisol del recién nacido.

Este articulo compone el capítulo XI de la Tesis y se encuentra publicado en la revista *Plos One*:

Romero-Gonzalez, B., Caparros-Gonzalez, R. A., Gonzalez-Perez, R., Delgado-Puertas, P. y Peralta-Ramirez, M. I. (2018). Newborn infants’ hair cortisol levels reflect chronic maternal stress during pregnancy. *PloS One*, 13(7), e0200279. doi: 10.1371/journal.pone.0200279

Objetivo específico 7. Comprobar el desarrollo infantil a los 6 meses de edad en los bebés nacidos de mujeres embarazadas de alto riesgo versus bebés nacidos tras embarazos de bajo riesgo.

Este artículo se encuentra en el capítulo XII de la Tesis, y se encuentra en revisión en la revista *Midwifery*

Romero-Gonzalez, B., Caparros-Gonzalez, R. A., Cruz-Martinez, M., Gonzalez-Perez, R., & Peralta-Ramirez, M. I. (2019). Neurodevelopment of high and low-risk pregnancy babies at 6 months of age.

Bloque 4. Eficacia de una intervención psicológica de control de estrés en el embarazo

Tras comentar las principales intervenciones destinadas a reducir los niveles de estrés durante el embarazo, y partiendo del apoyo que la medicina basada en la evidencia ofrece a la Terapia Cognitivo Conductual, en este bloque se presenta el capítulo XIII, el cual tiene como objetivo específico:

Objetivo específico 8. Comprobar la eficacia de un tratamiento cognitivo conductual de control de estrés en mujeres embarazadas sanas en la reducción de cortisol, psicopatología y estrés perinatal, así como en el incremento de la resiliencia.

Este artículo se encuentra enviado a *Behaviour research and therapy.*

Romero-Gonzalez, B., Puertas-Gonzalez, J. A., Strivens-Vilchez, H., Gonzalez-Perez, R. & Peralta-Ramirez, M. I. (2019). Effects of the cognitive-behavioural therapy for stress management on stress and hair cortisol levels in pregnant women: a randomised controlled trial

Tras exponer los principales objetivos de esta Tesis Doctoral presentamos el diagrama que muestra los objetivos derivados de cada bloque de la misma (ver figura 11).

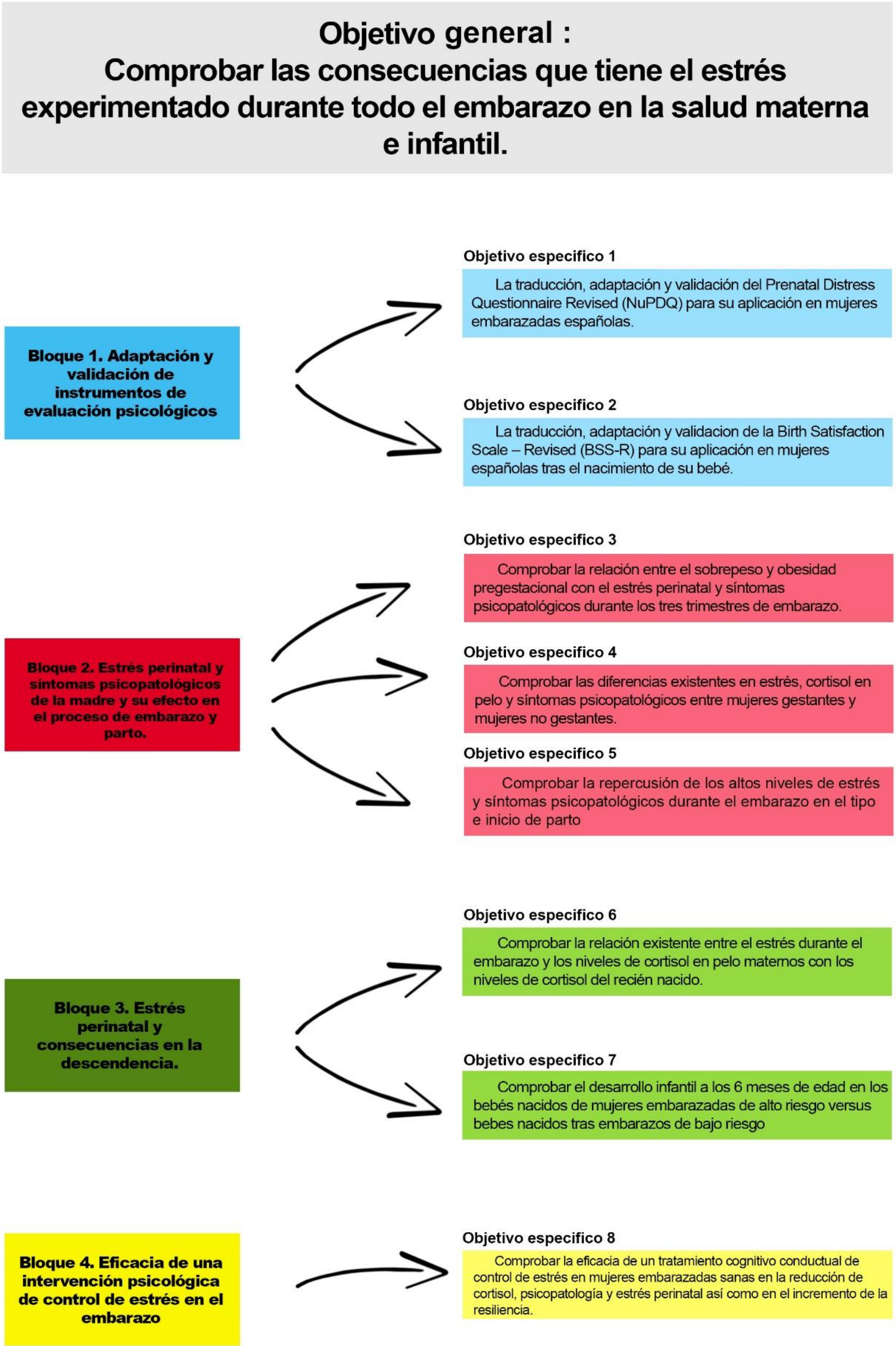

Figura 11. Objetivo general y objetivos específicos de la Tesis Doctoral.

Bloque 1. Adaptación y validación de instrumentos de evaluación psicológicos

CAPÍTULO VI. Spanish validation and factor structure of the Prenatal Distress Questionnaire Revised (NuPDQ).

Romero-Gonzalez, B., Martin, C., Caparros-Gonzalez, R. A., Quesada-Soto, J. M. & Peralta-Ramirez, M. I. (2019). Spanish validation and factor structure of the Prenatal Distress Questionnaire Revised (NuPDQ). Submitted to Archives of Women’s Mental Health.

Introduction

Pregnancy is a stressful event in a woman’s life, the impacts of such stress having implications for the woman themselves or their baby (Duthie & Reynolds 2013). A number of studies have demonstrated that stress during pregnancy is not the same as general population stress, so it has been called as pregnancy-specific stress (Alderdice, Lynn & Lobel, 2012; Lobel et al. 2008).

On one hand, pregnancy-specific stress is comprised of childbirth and medical complications worries, body changes worries, concerns about future baby health or the ability to become a mother (Alderdice et al. 2012). On the other hand, physiological activation and consequences are different from general stress, being related to more potential negative pregnancy outcomes (Alderdice & Lynn 2009; DiPietro et al. 2002; DiPietro, Ghera, Costigan & Hawkins, 2004; Lobel & Dunkel Schetter 2016).

Pregnancy-specific stress has been related to impoverished postpartum maternal mental health, higher postpartum depression risk and the inability to care the newborn (Caparros-Gonzalez et al. 2017; Field 2010; Robertson, Grace, Wallington & Stewart, 2004). Further, there are some newborn negatives outcomes associated to higher pregnancy-specific stress levels, such as premature birth, low weight at birth and a poorer infant neurodevelopment (Graignic-Philippe, Dayan, Chokron, Jacquet & Tordjman, 2014; Lobel et al. 2008; Roesch, Schetter, Woo & Hobel, 2004).

Consequently, it is important to use assessment tools for pregnancy-specific stress, due to general stress assessment tools could not reflect endocrine, psychological and individual characteristics of pregnancy (Nast, Bolten, Meinlschmidt & Hellhammer, 2013).

Two assessment measures have been widely used to evaluate pregnancy-specific stress due to their generally acceptable psychometric characteristics, these being the Prenatal Distress

Questionnaire (PDQ; Yali & Lobel 1999) and its revised version, Prenatal Distress Questionnaire Revised (NuPDQ; Lobel 1996; Yali & Lobel 2002). However, only the PDQ is already validated for its use in Spain (Caparros-Gonzalez et al 2019).

Despite the fact that NuPDQ was firstly thought to be used as an interview, finally it has been used as an auto-informed instrument, reporting a good reliability index in its original version (Coussons-Read et al 2012; Lobel et al 2008; Magriples, Kershaw, Rising, Massey & Ickovics, 2008; Staneva, Morawska, Bogossian & Wittkowsky, 2016). However, it has been used in a wide range of studies, so it is considered as an appropriate instrument due to its reliability and convergent, concurrent, and predictive validity (Ibrahim & Lobel, 2019). To the best of our knowledge, only one study shown the factor structure of the NuPDQ, as a unidimensional instrument (Yuksel, Akin & Durna, 2011).

The aim of this research was the translation, adaptation and validation of NuPDQ in a Spanish sample of pregnant women. Besides, a confirmatory factor analysis of the unidimensional Turkish structure was performed.

Methods

Participants

Three-hundred and eighty-six women were recruited from Health Centres from all around Granada (Albayda de la Cruz, Gran Capitán, Zaidín Sur, Caleta, Realejo, Armilla, Loja, Churriana de la Vega y La Chana) between 1st October 2017 and 13th September 2018.

Inclusion criteria were being pregnant, over 18 years old and being born in Spain. As exclusion criteria were having medication treatment, any medical or psychological condition or being a high-risk pregnancy.

Instruments

Prenatal Distress Questionnaire Revised (NuPDQ; Lobel 1996; Yali & Lobel 2002). Original versión contains 17 items in a Likert scale (0 = not at all; 2 = very much) and another ítem with a dicotomic response (yes or no). Every ítem asked "Are you feeling bothered, upset, or worried at this point in your pregnancy" about pregnancy issues, such as maternal and baby health, body changes, abilities to take care of the baby, etc. Despite being developed to be used in different points of pregnancy (9 items for the entire period, 3 more for the second trimester and 5 more for the third trimester), it has been widely used as an integrated single measure of prenatal distress. In that way, the instrument offers more information than using only the items of each trimester. Besides, it has good psychometric properties (0.82 > α < 0.88) (Alderdice et al. 2012; Lobel et al. 2008; Yali & Lobel 1999; Yali & Lobel 2002).

The following instruments were used to evaluate convergent and discriminant validity:

-**Prenatal Distress Questionnaire** (PDQ; Yali & Lobel 1999; Caparros-Gonzalez et al. 2019) has been used to assess pregnancy-specific stress. It assesses specific worries and concerns that pregnant women experience about labor, medical problems, physical symptoms, childbirth, relationships, body changes, and the baby's health using a 12-item scale scored with a 5-point Likert scale (0 = none at all; 4 = extremely). The Cronbach's alpha reliability coefficient for the Spanish version is α = 0.74.

-**Perceived Stress Scale** (PSS; Cohen, Kamarck & Mermelstein, 1983; Remor 2006) was used to assess general stress during the last month. It has 14 items scored using a 5-point Likert scale from 0 (never) to 4 (very often). The Cronbach's alpha reliability coefficient of the Spanish version is α = 0.81.

-**Connor-Davidson Resilience Scale** (CD-RISC; Connor & Davidson 2003; García-León, Gonzalez-Gomez, Robles-Ortega, Padilla & Peralta-Ramirez, 2019). It has 25 items with a Likert-type response format, punctuated by 0 ("not at all") to 4 ("almost always"). The scale is in the range of 0 to 100, and higher scores indicate a higher level of resilience. The Cronbach's Alpha reliability coefficient of the Spanish version is α = 0.86.

Procedure

The translation of NuPDQ into Spanish was undertaken using the backtranslation method according to international guidelines for cross-cultural adaptations of questionnaires (Epstein, Santo & Guillemin 2015; Martin & Savage-McGlynn 2013). Firstly, the original version was translated into Spanish by two researchers with a proficient level in English. Thereafter, another researcher with proficient levels in both English and Spanish and who was unconnected to the research, translated the scale into English.

One item was identified as problematic within the Spanish context: "Are you feeling bothered, upset, or worried at this point in your pregnancy about paying for your medical care during pregnancy?" The Spanish healthcare system is free of charge, for that reason this item was no sense for Spanish pregnant women.

A pilot study (N=10) was undertaken to obtain feedback about comprehension and interpretation. No further issues were identified and the final version was prepared for data capture.

Participants were informed about the study when attending an antenatal appointment with their midwives. Following enrolment into the study and obtaining informed consent, the questionnaires were administered.

This study met the ethical standards established by the Declaration of Helsinki (revised in Fortaleza, Brazil, 2013) and was reviewed and approved by the Ethics Committee for Human Research at the University of Granada (reference number 881) and the Research Ethics Committee of the public health service in Granada.

Statistical analysis

A conventional route to psychometric evaluation was undertaken using known-groups discriminant validity analysis with pregnancy status (pregnant previously yes/no) as the dichotomous independent variable, internal consistency evaluation using Cronbach's coefficient alpha and convergent and divergent validity determination by evaluation against relevant elements of the measures outlined earlier. The factor structure of the NUPDQ was evaluated using confirmatory factor analysis (CFA) specifying a single-factor (uni-dimensional) model. In the event of poor or inadequate model fit under CFA, a post-hoc exploratory factor analysis (EFA) would be undertaken to determine factor structure using maximum-likelihood estimation and oblimin rotation.

Results

Sample description

From the three-hundred and eighty-six women which were recruited to the study, a total sample of three-hundred and seventy-one had complete NUPDQ data (N=371). Examination of the dataset revealed one multivariate outlier based on NUPDQ data and this case was removed from the dataset thus the final data set was N=370 for analysis. The mean age of participants was 32.36 (SD = 5.10) years. Descriptive information is shown in Table 1.

Table 1. Descriptive information of the sample

		M(SD)	n(%)
Sociodemographic variables			
Age		32.36(5.10)	
Marital status	Single/divorced		15(4.2)
	Married/cohabitant		342(95.8)
Level of education	Primary		12(3.4)
	Secondary		101(28.3)
	University		244(68.3)
Employment situation	Working		271(75.9)
	Unemployed		86(24.1)
Obstetric information			
Trimester of pregnancy	First		70(19.2)
	Second		135(37)
	Third		160(43.8)
Pregnancy method	Spontaneous		309(86.6)
	Fertility treatment		48(13.4)
Nulliparous	Yes		118(33.1)
	No		239(66.9)
Wanted pregnancy	Yes		306(85.7)
	No		51(14.3)
Previous children	0		265(74.2)
	1		75(21)
	≥ 2		17(4.8)
Previous miscarriages	0		261(73.1)
	1		68(19)
	≥ 2		28(7.8)

Note: Sociodemographic and obstetric information missing (n=5 for trimester of pregnancy; n=13 for the rest variables)

Summary of measures

The mean score of the NUPDQ was 13.23 (SD = 6.03) with a minimum score of 0 and a maximum score of 32. Internal consistency of the NUPDQ was 0.82. There was no evidence of significant skew or kurtosis in the NUPDQ total score (0.24, -0.52 respectively). The mean score of the PDQ was 16.53 (SD = 7.10), the mean score of the PSS was 26.43 (SD = 8.15) and the mean score of the CD-RISC was 26.85 (SD = 6.65).

Correlational analysis

Pearson's *r* correlations between the NUPDQ total score and PDQ, PSS and CD-RISC total scores are shown in Table 2. Correlations between the NUPDQ total score and all other measures were all highly statistically significant (*p*<0.001) and in the anticipated direction.

Table 2. Correlation between the NuPDQ total score and PDQ, PSS and CD-RISC total score

Scale	NuPDQ	PDQ	PSS	CD-RISC
NuPDQ		.71	.46	-.29
PDQ			.43	-.32
PSS				-.40
CD-RISC				

Factor analysis

Confirmatory factor analysis of the unidimensional model of the NUPDQ with maximum-likelihoods estimation revealed a poor fit to the data, chi-square = 487.68 (df = 119.00) *p* <0.001, root mean squared error of approximation (RMSEA) = 0.09, comparative fit index (CFI) = 0.72. Adopting the weighted least squares with means and variances (WLSMV) estimation method to accommodate the ordered categorical characteristics of NUPDQ items within the CFS had little impact in improving model fit, chi-square = 518.82 (df = 119.00) *p* <0.001, RMSEA = 0.10, CFI = 0.83.

Post-hoc exploratory factor analysis

Given the poor fit to data of the anticipated single-factor model of the NUPDQ, a post-hoc exploratory factor analysis was undertaken. A parallel analysis suggested the potential of a five-factor solution though only one factor had an eigen value >1 and the screen plot also indicated a single factor solution. Given the previously acknowledged poor-fit of a single-factor solution an alternative five-factor solution based on the parallel analysis was run as a post-hoc EFA under maximum-likelihood estimation with oblique rotation assuming correlated factors. The five-factor solution revealed a good fit to the data, RMSEA = 0.04 and CFI = 0.97 and 39% of the variance explained. The item-factor loading are summarised in Table 3. and reveal clear item-factor differentiation for most items with the exception of items 1. and 17. where these items did not load on any factor and item 10. which was split between factors 1. and 5. These three items were thus removed, and re-examination of model fit statistics revealed excellent fit, RMSEA = 0.04 and CFI = 0.99 with 47% of the variance explained. Internal consistency of the remaining 14-items was 0.81.

Table 3. Factor loadings of NuPDQ following exploratory factor analysis with maximum-likelihood estimation and oblique rotation.

Item	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5
1.	0.20	0.20	0.17	0.15	-0.19
2.	0.06	**0.30**	0.01	-0.05	0.25
3.	-0.05	**0.65**	0.03	0.08	0.07
4.	**0.68**	0.02	0.00	0.11	-0.12
5.	0.12	0.21	-0.01	**0.41**	-0.14
6.	0.14	0.21	0.03	0.01	**0.38**
7.	0.04	**0.72**	-0.06	-0.05	-0.02
8.	0.11	0.14	0.03	0.22	**0.41**
9.	-0.08	0.04	0.07	**0.42**	0.16
10.	**0.30**	0.00	0.07	0.10	**0.31**
11.	**0.90**	-0.01	0.01	-0.05	0.06
12.	0.04	**0.38**	0.26	0.04	0.11
13.	0.04	0.14	0.18	**0.39**	-0.03
14.	0.01	-0.04	**0.96**	-0.04	0.00
15.	0.00	0.14	**0.55**	0.20	0.01
16.	0.05	-0.16	-0.06	**0.46**	0.17
17.	0.02	0.13	0.02	-0.09	0.14

Items description and factors name

According to the every item description, every factor has renamed in order to have sense when using it in studies. Items allocated in factor 1 assess worries about delivery and pain, items in factor 2 share worries about maternal health and the ability to be able to take care of family during pregnancy, items in factor 3 describe worries about taking care of the baby. As for items in factor 4, they assess worries about changes resulting from pregnancy. Finally, factor 5 explore worries about unexpected issues of pregnancy (preterm birth) and incontrollable issues (get a good quality of medical care). Items description and factors name are described in Table 4.

Table 4. Items description and factors name.

Item	Item description. **Are you feeling bothered, upset, or worried at this point in your pregnancy:**	Factor	Proposed factor name
4	about pain during labor and delivery?	1	Worries about delivery
11	about what will happen during labor and delivery?		
2	about the effect of ongoing health problems such as high blood pressure or diabetes on your pregnancy?	2	Worries about own health and pregnancy
3	about feeling tired and having low energy during your pregnancy?		
7	about physical symptoms of pregnancy such as vomiting, swollen feet, or backaches?		
12	about working or caring for your family during your pregnancy?		
14	about working at a job after the baby comes?	3	Worries about taking care of the baby
15	about getting day care, babysitters, or other help to watch the baby after it comes?		
5	about changes in your weight and body shape during pregnancy?	4	Worries about physical, social and economic changes
9	about changes in your relationships with other people due to having a baby?		
13	about paying for the baby's clothes, food, or medical care?		
16	about whether the baby might be affected by alcohol, cigarettes, or drugs that you have taken?		
6	about whether the baby might come too early?	5	Worries about unexpected and incontrollable issues of pregnancy
8	about the quality of your medical care during pregnancy?		
Removed			
1	about taking care of a newborn baby?	none	
10	about whether you might have an unhealthy baby?	1 and 5	
17	Are there other things that you are bothered, upset, or worried about that have to do with your pregnancy, the birth, or the baby?	none	

Correlations between sub-scales

The five sub-scales extracted from the EFA comprise three sub-scales comprising two items each (sub-scales 1, 3, 5) and two sub-scales comprising four items each (sub-scales 2, 4). All correlations were positive and highly statistically significant ($p<0.001$). The correlations between these EFA-derived sub-scales is shown in Table 5.

Table 5. Correlations between the EFA-derived fourteen item NuPDQ sub-scales

Sub-scale	1	2	3	4	5	Total
1		.34	.27	.32	.36	.62
2			.36	.40	.47	.79
3				.39	.29	.65
4					.41	.74
5						.69
Total						

Known-group discriminant validity

Comparison between the 14-item EFA-derived NUPDQ total score and EFA-derived sub-scales as a function of previous pregnancy status are shown in Table 6. Significantly higher sub-scale scores were observed for those who had a previous pregnancy on sub-scales 1. and 4. only.

Table 6. Comparison of 14-item EFA-derived NuPDQ total score and EFA-derived sub-scales as a function previous pregnancies status (degrees of freedom = 355)

Scale	No previous pregnancy n=118 M(SD)	Previous pregnancy n=239 M(SD)	*t*	*p*
1	1.18(1.11)	2.28(1.25)	2.96	0.003
2	3.11(1.90)	3.03(2.08)	0.36	0.72
3	1.84(1.46)	1.86(1.37)	0.15	0.88
4	1.75(1.53)	2.33(1.75)	3.04	0.003
5	1.58(1.17)	1.70(1.23)	0.87	0.39
Total	10.17(4.85)	11.21(5.53)	1.74	0.08

Note: discrepancy between group N and total sample size due to small amount of missing data on regarding previous pregnancy status.

Correlations between sub-scales and PDQ, PSS and CD-RISC total scores.

Pearson's *r* correlations between the 14-item EFA-derived NUPDQ total score and EFA-derived sub-scales and PDQ, PSS and CD-RISC total scores are shown in Table 7. All correlations were highly statistically significant ($p<0.001$) and in the anticipated direction with the exception of sub-scale 3 and CD-RISC total score ($p = 0.17$) and sub-scale 5 and CD-RISC total score ($p = 0.01$).

Table 7. Correlations between 14-item EFA-derived NuPDQ total score and EFA-derived sub-scales and PDQ, PSS and CD-RISC.

Sub-scale	PDQ	PSS	CD-RISC
1.	.52	.22	-.31
2.	.50	.44	-.19
3.	.40	.19	-.08
4.	.57	.38	-.25
5.	.45	.31	-.14
Total	.69	.46	-.28

Discussion

Due to the increasing importance of accurate assessment of pregnancy-specific stress, and the inexistence of a Spanish assessment tool as the NuPDQ, the aim of this research was the translation, adaptation and validation of the NuPDQ into Spanish. Moreover, it was intended to analyse the unidimensional factorial structure of the Turkish version (Yuksel et al., 2011) to check if Spanish version was unidimensional too.

Firstly, CFA demonstrated poor model fit against data for the unidimensional model, contrary to the Turkish version proposed by Yuksel et al., (2011). It is important to highlight that between Turkish and Spanish samples there are many cultural differences (Gonzalez-Mesa et al., 2018). This may explain, at least to a degree, the inconsistencies in factor structure between Spanish and Turkish versions of the NuPDQ.

Post-hoc EFA revealed that a five-factor model was the most appropriate fit to data, with accompanying good model fit characteristics. Nevertheless, some items had to be removed from this five-factor model. Specifically, item 1: "Are you feeling bothered, upset, or worried at this point in your pregnancy about taking care of a newborn baby?" which did not fit in any factor. One plausible explanation is that there were more multiparas in our sample, which could influence in the fact that the item could not be allocated into any factor. Besides, this item is too general to fit in any factor, as the words "taking care" could mean a wide range of aspects, which could be economical, psychological or even social support (Gurman & Becker, 2008). Apart from that, item 17 was removed too, the item content itself could explain the reason why it had to be removed, as it was the only dicotomic item in the questionnaire ("Are there other things that you are bothered, upset, or worried about that have to do with your pregnancy, the birth, or the baby?"), being very ambiguous (Lobel 1996; Yali & Lobel 2002). Finally, item 10("Are you feeling bothered, upset, or worried at this point in your pregnancy about whether you might have an unhealthy baby?) could be allocated into factors 1 and 5, so it was removed from the factorial structure. It is again a general item which try to assess concerns about any kind of disease, while all the rest items do specify certain concerns. Moreover, the factorial structure of their Spanish previous version, the PDQ (Caparros-Gonzalez et al., 2019) also revealed that this item did not work properly, as it was related to another similar item, even it was not be removed.

Given that, the questionnaire is composed by 14 items which confirmatory factor analysis revealed good fit to the data and a good reliability index. In this sense, the 14-item NuPDQ has a good psychometric properties to be used in Spanish pregnant women in order to assess pregnancy-specific stress, just as it has been used in another countries (Ibrahim & Lobel, 2019).

Reliability of the NuPDQ is in line with those found by another authors, which have varied from .79 to .88 (Staneva et al., 2016; Rosenthal & Lobel, 2018). In addition to that, NuPDQ reliability index is higher than the previous Spanish version, the PDQ, which has a reliability index of .74 (Caparros-Gonzalez et al., 2019).

The NuPDQ, after those results, it is composed by 14 items allocated into 5 factors or subscales, which are: "worries about delivery (items 4 and 11)"; "worries about own health and pregnancy" (items 2, 3, 7 and 12); "worries about taking care of the baby" (items 14 and 15); "worries about physical, social and economic changes" (items 5, 9, 13 and 16); and "worries about unexpected and incontrollable issues of pregnancy" (items 6 and 8). Using the questionnaire and the subscales it is tried to measure the pregnancy-specific stress, which this encompassed by concerns about the management and significance of physical symptoms, body changes, social changes, concerns about labour and delivery, parenting, the health of their fetus and fear of medical complications (Alderdice et al., 2012; Caparros-Gonzalez et al., 2019; Romero-Gonzalez, Caparros-Gonzalez, Gonzalez-Perez, Puertas-Delgado & Peralta-Ramirez, 2018; Romero-Gonzalez, Caparros-Gonzalez, Gonzalez-Perez, Coca-Arco & Peralta-Ramirez, 2019).

About discriminant validity of NuPDQ, there were differences in subscales of "worries about delivery" and "worries about physical, social and economic changes", having multiparous pregnant women more concerns. Maybe, previous pregnancies could reduce concerns about maternal and fetal health, given more importance to those concerns about changes that could bring the birth of a second (or more) baby, which needs a different psychological and lifestyle adaptation than having the first child (Volling, 2012).

Finally, there is a strong relation between every NuPDQ subscale and the PDQ and perceived stress, which manifests once again the usefulness of the questionnaire. Only with the resilience, the relation was not the expected one with the subscale of “worries about taking care of the baby”. Even when resilience has been proved to be a protective factor during pregnancy, it seems not to be influenced by this kind of concerns (Garcia-Leon, Caparros-Gonzalez, Romero-Gonzalez, Gonzalez-Perez & Peralta-Ramirez, 2019).

The present study has some limitations, as the NuPDQ has been validated in its questionnaire form, so it is not possible to know the psychometric properties of its interview version. Besides, future research should address the pregnancy-specific stress in high-risk pregnancies, as it could be different from low-risk pregnancies (Caparros-Gonzalez et al., 2019).

As a conclusion, the NuPDQ is a questionnaire that could be very useful to assess pregnancy-specific stress, due to its good psychometric properties, which are higher than its previous version, the PDQ. It is essential to assess pregnancy-specific stress, as it could have negatives consequences in maternal and fetal health. By assessing it, it could be possible to detect pregnant women at risk and try to prevent those negatives consequences (Alderdice et al. 2012; Lobel et al. 2008).

CAPÍTULO VII. Spanish validation and factor structure of the Birth Satisfaction Scale-Revised (BSS-R)

Romero-Gonzalez, B., Peralta-Ramirez, M. I., Caparros-Gonzalez, R. A., Cambil-Ledesma, A., Hollins-Martin, C., & Martin, C. (2019). Spanish validation and factor structure of the Birth Satisfaction Scale-Revised (BSS-R). *Midwifery, 70*, 31-37.

Introduction

Childbirth represents an emotionally complex experience that not only represents interrelated physiological and psychological processes, but also the unique experience itself is circumscribed and influenced by the quality of health care received (Bell & Andersson, 2016). Women's experience of labour can have a significant impact on their own lives, and wider social relationships, specifically their partner, previous children, and of course the newborn infant (Conde, Figueiredo, Costa, Pacheco & Pais, 2008; Ford & Ayers, 2009).

Birth satisfaction represents a multidimensional construct, which unsurprisingly, is influenced by such diverse phenomena as discrepancy between childbirth expectations and reality of childbirth (Hollins-Martin & Fleming, 2011); the quality of health care, including emotional support, communication and doctor-patient relationship received (Bryanton, Gagnon, Johnston & Hatem, 2008); active participation in decision-making about labour, control perception and stress experienced during labour and birth (Goodman, Mackey & Tavakoli, 2004).

Satisfaction with medical processes and health systems has grown as contemporary area of interest, particularly in terms of the relationship to actual quality of care (Fowler & Patterson, 2013). Unsurprisingly, appropriate use of available health services improves when the perception and satisfaction with the service is positive (Mpembeni et al., 2007; Srivastava, Avan, Rajbangshi & Bhattacharyya, 2015). Satisfaction with healthcare represents such an important aspect of globalisation, that assessment is central to service evaluation, measurement usually being conducted using validated self-completion questionnaires due to their high reliability and low cost (Blazquez, Ferrandiz, Moya, Caballero & Corchon, 2017; Konerding, 2016; Marin-Morales, Carmona-Monge, Peñacoba-Puente, Olmos-Albacete & Toro-Molina, 2013).

Several questionnaires have been developed as an assessment tool for measuring women's birth satisfaction (Hollins-Martin & Fleming, 2011).

The Birth Satisfaction Scale–Revised (BSS-R) was designed from an extensive psychometric assessment (Hollins-Martin & Martin, 2014) of items derived from a theoretically-informed and thematically-derived long-form version, the Birth Satisfaction Scale (BSS; Hollins-Martin & Fleming, 2011). The BSS-R comprises 10 items and consists of 3 subscales: (1) quality of care provided, (2) personal attributes of women and (3) stress experienced during childbirth.

The growing awareness of the importance of satisfaction with childbirth reflected in clinical outcomes, measured using short, valid, and reliable and theoretically supported measure such as the BSS-R has facilitated international interest, application and endorsement of this questionnaire (Martin et al., 2017; The International Consortium for Health Outcome Measurement, 2016). Thus, the BSS-R has been validated and translated into several versions including Greek, Australian, American and Turkish (Barbosa-Leiker, Fleming, Hollins-Martin & Martin, 2015; Goncu-Serhatlioglu, Karahan, Hollins-Martin & Martin, 2018; Jefford, Hollins-Martin & Martin, 2018; Martin et al., 2017; Vardavaki, Hollins-Martin & Martin, 2015).

Due to the importance and usefulness of the BSS-R and because of the lack of short assessment tools available to measure birth satisfaction within a Spanish population, the purpose of the current investigation was to develop and validate a Spanish version of the BSS-R (S-BSS-R), examining key psychometric parameters of reliability and validity. Specifically, our objectives were to:

1. Demonstrate the replicability of the tri-dimensional measurement model of the BSS-R to the S-BSS-R.

2. Evaluate the divergent validity of the S-BSS-R

3. Evaluate the convergent validity of the S-BSS-R.

4. Evaluate the known-groups discriminant validity of the S-BSS-R.

5. Investigate the potential relationship between the S-BSS-R total and sub-scale scores and pain control during labour.

6. Evaluate the internal consistency of the Quality of Care (QC), Women's Attributes (WA), and Stress Experienced during Child-bearing (SE) sub-scales for the S-BSS-R.

Methods

Design

A cross-sectional survey design utilising purposive sampling. Participants were informed of the study when they gave birth. Those who agreed to participate read and signed the informed consent form. Those who consented but chose not to complete the study questionnaires at the same time took the questionnaires and returned them within one month of delivery. Participants were recruited from Antequera Hospital (Málaga), Poniente Hospital (Almería) and San Cecilio Hospital (Granada).

Ethical approval

Ethical approval for the study was granted by the Ethic Committee of Biomedical Research of the Andalusian Government.

Measures

The BSS-R (Hollins-Martin & Martin, 2014), comprises ten items scored on a five-point Likert type scale with possible responses being: strongly agree, agree, neither agree or disagree, disagree, strongly disagree. A number of items are reverse-scored, with higher scores on the BSS-R total scale and sub-scales indicating comparatively greater birth satisfaction. The items relate to three sub-scales: stress experienced during child-bearing (SE; 4 items); quality of care (QC; 4 items); and women's attributes (WA; 2 items) and combined produce an overall total BSS-R score. The psychometric profile of the BSS-R has been found to be valid and reliable across different versions (Barbosa-Leiker et al., 2015; Burduli, Barbosa-Leiker, Fleming, Hollins-Martin & Martin, 2017; Goncu-Serhatlioglu et al., 2018; Jefford et al., 2018; Martin et al., 2017; Martin et al., 2016; Vardavaki et al., 2015).

The Perceived Stress Scale (PSS; Cohen, Kamarck & Mermelstein, 1983; Remor, 2006) is a fourteen item scale designed to assess the perception of stress during the previous month. Each item scores on a 5-point Likert scale (0 = never, 1 = almost never, 2 = once in a while, 3 = often, 4 = very often). Interpretation consists of adding up each item, higher scores indicative of comparatively greater perceived stress. The Cronbach's alpha reliability coefficient of the Spanish version is $\alpha = 0.8$.

Development of the Spanish version of the BSS-R: Translation process

The translation of BSS-R into Spanish was done by the backtranslation method. In the first step, the UK English-language version of the BSS-R (Hollins-Martin & Martin, 2014) was translated into Spanish by two researchers with a proficient level in English. During the second step, another researcher with proficient levels in both English and Spanish and who was unconnected to the research, translated the scale into English. A pilot study (N = 10) was carried out to obtain feedback about comprehension and interpretation of items prior to agreement of the final version. A draft version of the S-BSS-R were administered to a total of 10 women who gave birth in the previous four weeks. Then, they were asked if every item was clear, understandable and concise, and if the full questionnaire was easy to understand and complete. The full sample of 10 women reported not having encountered any difficulties while completing the S-BSS-R and neither were any of the S-BSS-R items indicated to be ambiguous or requiring clarification of meaning. This version of the S-BSS-R was then used as the final version of the S-BSS-R for psychometric evaluation.

Statistical analysis

Confirmatory factor analysis

Consistent with previous investigations (Barbosa-Leiker et al., 2015; Burduli et al., 2017; Goncu-Serhatlioglu et al., 2018; Hollins-Martin & Martin, 2014; Jefford et al., 2018; Martin et al., 2017; Vardavaki et al., 2015), Objective 1 was addressed using Confirmatory Factor Analysis (CFA; Brown, 2015) to evaluate the tri-dimensional measurement model (Hollins-Martin & Martin, 2014) of the BSS-R. Maximum-likelihood estimation was used to evaluate the CFA model (Brown, 2015; Kline, 2011). The comparative fit index (CFI; Bentler, 1990), the root mean squared error of approximation (RMSEA;(Steiger & Lind, 1980), the square root mean residual (SRMR;(Hu & Bentler, 1999) are the most widely used model fit indices in CFA and were thus selected for the current study.

Divergent validity

Divergent validity was evaluated by correlating S-BSS-R sub-scale scores with participant age. No statistically significant correlation between S-BSS-R sub-scale scores and this parameter is predicted.

Convergent validity

Convergent validity was evaluated by examination of correlations between the S-BSS-R total score and sub-scale scores and the PSS. It was predicted that S-BSS-R total and SE scales would be significantly correlated with the PSS. It was also predicted that the QC sub-scale would be significantly correlated with the PSS, but that the comparative strength of the association would be less than the S-BSS-R total and SE sub-scale score association. Finally, no statistically significant relationship was predicted between the WA sub-scale and the PSS (thus an additional evaluation of divergent validity for this sub-scale).

Known-groups discriminant validity

Consistent with previous BSS-R validation studies (Jefford et al., 2018; Vardavaki et al., 2015) known-groups discriminant validity was evaluated by comparison of BSS-R sub-scale and total scores as a function of delivery type, (i.) unassisted vaginal delivery, vs. (ii.) assisted delivery (instrument, Caesarean section). Statistically significant higher S-BSS-R total, SE and WA sub-scale scores are predicted in women having an unassisted vaginal delivery (UVD). Given that the original BSS-R development study and the Australian validation study demonstrated no significant differences between groups as a function of delivery type on the QC sub-scale, in contrast to a large US study and a Greek translation/validation study, where UVD was associated with significantly higher QC sub-scale scores, no specific prediction is made in terms of directionality for this specific S-BSS-R sub-scale.

Pain control

Known-group discriminant validity was further evaluated by stratifying groups on the basis of whether pain control (epidural/nitrous oxide/massage) was received or no pain control given. It was predicted that a statistically significant difference in S-BSS-R total and sub-scale scores would be observed on the basis of pain control status. The directionality of predicted difference is not apriori specified.

Internal consistency

Cronbach's coefficient alpha (Cronbach, 1951) was used to evaluate the internal consistency of S-BSS-R sub-scales and the total scale with a threshold of 0.70 or greater indicating acceptability (Kline, 2000).

Results

Participants

Two-hundred and eight native Spanish-speaking women who had given birth within the past four weeks consented to take part in the study. Six participants were excluded due to being multivariate outliers on BSS-R item scores as determined by Mahalanobis distances greater than threshold ($\chi^2 > 29.59$). Multivariate normal S-BSS-R data was thus available for analysis for N = 202 participants. Participant mean age was 32.86 (SD 4.75), range = 19-47 years. Pregnancy duration was 39.57 (SD 1.51) weeks and just over half of participants had had their first baby (N=104, % =51%). The mean time of completion of self-report measures was 7 days (SD 8.88) postpartum. S-BSS-R sub-scale and total scores are summarised in Table 1. Comparison with the original UK BSS-R total and sub-scale mean scores using the one-sample *t*-test revealed no statistically significant differences.

Table 1. Mean, standard deviation and distributional characteristics of S-BSS-R sub-scales and total score and comparison with mean (Mu) UK BSS-R scores reported by Hollins-Martin and Martin (2014) using one-sample *t*-test (df=201). se = standard error of kurtosis, CI = Confidence Interval.

Subscale	Mean	SD	Min	Max	Skew	Kurtosis	se	Mu	*t*	*p*	95% CI
Stress	9.36	3.68	0	16	-0.39	-0.41	0.26	9.70	1.83	0.19	8.85 – 9.87
Attributes	4.76	2.01	0	8	-0.32	-0.44	0.14	4.90	1.01	0.32	4.48 – 5.04
Quality	13.94	2.01	7	16	-0.80	0.16	0.14	13.76	1.28	0.20	13.66 – 14.22
Total Score	28.05	6.22	12	40	-0.30	-0.42	0.44	28.36	0.70	0.49	27.19 – 28.92

Descriptive characteristics of each S-BSS-R item are summarised in Table 2 and reveal no evidence of excessive skew or kurtosis based on Kline's (2011) thresholds of 3 (skew) and 10 (kurtosis).

All correlations between the S-BSS-R total score and SE, WA, and QE sub-scales were highly statistically significant, respectively, r = 0.91, p <0.001, r = 0.78, p <0.001 and r = 0.64, p <0.001. Correlations between SE sub-scale and the WA (r = 0.61, p <0.001) and QC (r = 0.39, p <0.001) sub-scales were highly statistically significant, as was the correlation between WA and QC sub-scales (r = 0.29, p <0.001). When compared with the correlations reported in the original UK BSS-R development study (Hollins-Martin & Martin, 2014) using the method of Diedenhofen and Musch (2015), no statistically significant differences between S-BSS-R and UK BSS-R total or sub-scale correlations were observed, with the exception of S-BSS-R total score and SE which was significantly higher in the current study (Table 3).

Table 2. Mean, standard deviation and distributional characteristics of individual S-BSS-R items. se = standard error of kurtosis.

Item	Item content	Domain*	Mean	SD	Min	Max	Skew	Kurtosis	se
BSS-R 1	I came through childbirth virtually unscathed	SE	2.44	1.32	0	4	-0.39	-1.07	0.09
BSS-R 2	I thought my labour was excessively long	SE	2.46	1.36	0	4	-0.50	-0.94	0.10
BSS-R 3	The delivery room staff encouraged me to make decisions about how I wanted my birth to progress	QC	2.99	1.10	0	4	-1.12	0.64	0.08
BSS-R 4	I felt very anxious during my labour and birth	WA	2.04	1.21	0	4	-0.06	-1.12	0.09
BSS-R 5	I felt well supported by staff during my labour and birth	QC	3.68	0.55	1	4	-1.68	2.86	0.04
BSS-R 6	The staff communicated well with me during labour	QC	3.69	0.59	0	4	-2.44	8.72	0.04
BSS-R 7	I found giving birth a distressing experience	SE	2.28	1.21	0	4	-0.20	-0.95	0.08
BSS-R 8	I felt out of control during my birth experience	WA	2.72	1.20	0	4	-0.68	-0.58	0.08
BSS-R 9	I was not distressed at all during labour	SE	2.19	1.19	0	4	0.04	-1.09	0.08
BSS-R 10	The delivery room was clean and hygienic	QC	3.58	0.71	0	4	-2.05	4.91	0.05

*Domain of the S-BSS-R. SE = Stress experienced during child-bearing, WA = Women’s attributes, QC = Quality of Care.

Table 3. Correlations of S-BSS-R sub-scales and total score and comparison with original UK BSS-R (Hollins-Martin & Martin, 2014).

Scale combination	Spanish *r*	UK *r*	Z	95% CI	*p*
Stress-Attributes	0.61	0.57	0.63	(-0.09 – 0.16)	0.53
Stress-Quality	0.39	0.26	1.50	(-0.04 – 0.30)	0.13
Attributes-Quality	0.29	0.35	0.69	(-0.23 – 0.11)	0.49
Total score-Stress	0.91	0.86	2.41	(0.01 – 0.09)	0.02*
Total score-Attributes	0.78	0.80	0.60	(-0.09 – 0.05)	0.55
Totals score-Quality	0.64	0.63	0.19	(-0.09 – 0.12)	0.85

*$p < 0.05$.

Confirmatory factor analysis

The three-factor measurement model of the BSS-R was observed to offer a good fit to the data ($\chi^2_{(df=32)} = 62.55$, $p <0.05$, CFI = 0.94, RMSEA = 0.07, SRMR = 0.06).

Divergent validity

No statistically significant correlations between S-BSS-R total and sub-scale scores and participant age, (S-BSS-R total score r = -0.06, p = 0.36, SE r = -0.06, p = 0.43, WA r = -0.04, p = 0.54, QE r = -0.05, p = 0.46) were observed.

Convergent validity

Statistically significant positive correlations were observed between S-BSS-R total, SE and QC sub-scores, and the PSS, (r = -0.20, p = 0.006, r = -0.20, p = 0.006 and r = 0.14, p = 0.05 respectively). No statistically significant correlation was observed between the WA sub-scale and the PSS (r = 0.11, p = 0.13).

Known-groups discriminant validity

Statistically significant differences were observed on all S-BSS-R sub-scales and the total score with women having an unassisted vaginal delivery having higher S-BSS-R scores compared to those that experienced an intervention (Table 4).

Women who received no pain control were observed to have significantly higher S-BSS-R sub-scale and total scores compared to those who received pain control (Table 5).

Table 4. Comparison of S-BSS-R total and sub-scale scores as a function of birth delivery type. Standard deviations are in parentheses, degrees of freedom = 200, CI = confidence interval. Intervention group comprised, planned Ceasarean section N=12, emergency Ceasarean section N=19, forceps N = 5, vacuum cup N=29, spatula N=3, and breech birth N=1.

BSS-R Scale	Unassisted vaginal delivery (N=133)	Intervention delivery (N=69)	95% CI	*t*	*p*	Hedges g	Hedges g 95% CI	Effect size*
Stress	10.60 (2.99)	6.96 (3.70)	2.69 – 4.60	7.56	<0.001	1.12	0.81 – 1.43	Large
Attributes	5.08 (2.06)	4.15 (1.78)	0.35 – 1.51	3.18	0.002	0.47	0.17 – 0.77	Small
Quality	14.29 (1.83)	13.28 (2.17)	0.44 – 1.58	3.49	<0.001	0.52	0.22 – 0.81	Medium
Total score	29.96 (5.38)	24.38 (6.10)	3.94 – 7.24	6.68	<0.001	0.99	0.68 – 1.30	Large

* Note: Effect size conventions, 0.2 = small, 0.5 = medium, 0.8 = large (Cohen, 1977).

Table 5. Comparison of S-BSS-R total and sub-scale scores as a function of pain control received. Standard deviations are in parentheses, degrees of freedom = 197, CI = confidence interval. Pain control group comprised, epidural N=139, nitrous oxide N=13, massage N = 6. Note: N=3 missing cases due to incomplete pain control data.

BSS-R Scale	No pain control (N=41)	Pain control (N=158)	95% CI	*t*	*p*	Hedges g	Hedges g 95% CI	Effect size
Stress	11.51 (2.84)	8.79 (3.69)	1.51 - 3.95	4.40	<0.001	0.77	0.41 – 1.12	Medium
Attributes	5.42 (2.04)	4.62 (1.98)	0.11 – 1.48	2.27	0.02	0.40	0.04 – 0.75	Small
Quality	13.95 (2.21)	13.94 (1.96)	-0.69 – 0.71	0.02	0.98	0.004	-0.34 – 0.35	Negligible
Total score	30.88 (5.82)	27.35 (6.18)	1.42 – 5.64	3.30	0.001	0.58	0.23 – 0.93	Medium

Internal consistency

Total scale, SE, WA and QC sub-scale Cronbach's alphas are summarised in Table 6. Comparison with Cronbach alpha reported by Hollins-Martin and Martin (2014) revealed the alpha of the QA sub-scale to be significantly lower than that of the original UK version with no other statistically significant differences observed between studies.

Table 6. Cronbach's alpha of S-BSS-R sub-scales and total score and comparison with original UK BSS-R (Hollins-Martin & Martin, 2014). Degrees of freedom = 1.

Subscale	Spanish alpha	UK alpha	χ^2	*p*
Stress	0.70	0.71	0.04	0.85
Attributes	0.57	0.64	0.56	0.46
Quality	0.55	0.74	9.57	0.002*
Total score	0.77	0.79	0.36	0.55

$^*p < 0.005$.

Discussion

The aim of this study was to validate a Spanish-language version of the BSS-R (Hollins-Martin & Martin, 2014) in a Spanish sample of women. Findings from this investigation are generally consistent with the original UK version.

CFA demonstrated good fit to the three-factor measurement model of the original version. These observations are also consistent with other translated non-English language version which show good fit to the BSS-R tri-dimensional measure model (Goncu-Serhatlioglu et al., 2018; Vardavaki et al., 2015), thus offering further compelling evidence of the transferability of the birth satisfaction conceptual model of the BSS-R to another non-English language and thus conferring confidence in the factor structure of the Spanish version.

Also observed was no statistically significant differences between S-BSS-R total and sub-scale mean scores and those reported by Hollins-Martin and Martin (2014) thus revealing a further layer of consistency between Spanish and UK versions, a finding of particular interest given the ICHOM (The International Consortium for Health Outcome Measurement, 2016) recommended use of the BSS-R within the Pregnancy and Childbirth standard set in allowing robust and valid comparisons between countries, associated health economies and health outcomes. Similar findings were observed for the comparison of S-BSS-R correlations between sub-scales/total score and those reported by Hollins-Martin and Martin (2014), with the exception of correlations between the S-BSS-R stress sub-scale and the S-BSS-R total score (0.91) which were significantly higher than those reported in the original BSS-R development study (0.86). However, it should be noted that, in terms of common variance explained, this difference is modest (83% vs. 74%) and viewed within the context of no other statistically significant differences in sub-scale correlations being observed between studies, would again suggest good evidence of equivalence to the original measure.

Adopting the same known-groups discriminant validity testing paradigm of previous BSS-R validation studies, it is noted that our findings are also consistent with previous investigations. Women who had an unassisted vaginal delivery were observed to have significantly higher S-BSS-R total and sub-scale scores compared to those who had an assisted/intervention delivery. Unpacking these observations in comparison to previous BSS-R studies, provides some useful comparative insights into the distinct facets of birth satisfaction as measured by the BSS-R. The finding of the S-BSS-R total score being significantly higher in the unassisted group would appear to be a universal finding in published BSS-R studies (Fleming et al., 2016; Hollins-Martin & Martin, 2014; Jefford et al., 2018) and additional pooled data reported in a meta-analysis of BSS-R studies (Martin & Hollins-Martin, 2018). This finding in isolation, highlights both the need and desirability of women to be adequately and appropriately informed about birth choices and options in relation to delivery type, particularly in relation to health economies that foster a culture of interventionism and medicalisation of the birth experience. We note that, in one large US BSS-R study in which women elected to have their babies in birth centres, essentially counter to the dominant federal interventionist/medical culture of the US, that the largest effect size for comparisons for unassisted vs. assisted delivery were observed in favour of unassisted delivery. Similarly, in relation to the S-BSS-R SE sub-scale women experiencing an unassisted delivery scored significantly higher compared to those receiving an intervention, thus, and again consistent with other studies (Fleming et al., 2016; Hollins-Martin & Martin, 2014; Jefford et al., 2018), indicating that assisted delivery is associated with less satisfaction and more stress. Given the relationship of stress as a fundamental component to distinct perinatal mental health presentations, ranging from postpartum posttraumatic stress disorder (Ali, 2018; Dikmen-Yildiz, Ayers & Phillips, 2017; Shlomi-Polachek, Dulitzky, Margolis-Dorfman & Simchen, 2016), tokophobia (Goutaudier, Bertoli, Séjourné & Chabril, 2018; Striebich, Mattern & Ayerle, 2018) and postnatal depression (Dennis et al., 2018; Pampaka et al., 2018), this finding yields valuable data regarding the potential implications of delivery type on psychological well-being and the development of psychiatric disturbance. Focusing upon the S-BSS-R QC sub-scale we noted that women who had an assisted delivery were significantly less satisfied in terms of quality of care received compared to those who had an unassisted delivery. Reflecting on these findings in relation to previous BSS-R studies again yield some valuable insights that may be of relevance when evaluating and redesigning the system of care provision within Spain. It is noted that in the UK (Hollins-Martin & Martin, 2014) and Australian (Jefford et al., 2018) BSS-R studies no significant differences were observed on the BSS-R QC sub-scale as a function of delivery type. This contrasts with the large US study (Fleming et al., 2016) and the Greek study (Vardavaki et al., 2015) where statistically significant differences were observed on the BSS-R sub-scale in favour of unassisted delivery. The most logical explanation for differences between studies on this single index of birth satisfaction is likely to be the intrinsic characteristics of the healthcare system itself. Therefore, within the context of Spain, the findings are illuminating in relation to actual and real differences that women may encounter as a function of non-intervention/intervention that are individually evaluated in relation to the quality of care received. Comparison with other studies internationally using the same index of birth satisfaction and instrument measurement framework is thus incredibly useful in terms of clarifying the potential differential impact of specific elements of the care package as they influence the women's perceptions and experiences of care.

Extending the established known-groups discriminant validity testing paradigm associated with the BSS-R to novel group comparisons, this is the first validation study to examine group differences in terms of pain control. Statistically significant differences were observed as a function of pain control status on S-BSS-R total and SE and WA sub-scales. On these birth satisfaction measures women experienced greater satisfaction in the no pain control group compared to those receiving pain control, and in the case of the S-BSS-R total and SE sub-scale scores, these differences were highly statistically significant. Pain control within the context of birth represents a complex topic in terms of not only physiological elements but also psychological aspects that may be anticipated to play a role in pain experienced (Christiaens, Verhaeghe & Bracke, 2010; Guszkowska, 2014). A perspective that a positive view of pain and accepting it as a part of the process of childbirth could increase birth satisfaction may be a potential explanation (Whitburn, Jones, Davey & Small, 2014), though as highlighted the topic is complex, the debate rich and dissonances on the topic and possible mechanisms involved common (Van der Gucht & Lewis, 2015).

A surprising finding given the generally acceptable internal consistency of the QC sub-scale in other BSS-R validation studies (Hollins-Martin & Martin, 2014; Jefford et al., 2018) was the sub-optimal Cronbach's alpha observed in the current study. Interestingly, one other validation study of the BSS-R (Vardavaki et al., 2015), found a similar alpha level for the QC sub-scale. Given that alpha is influenced by the number of items within the scale, this, with other mediating factors, for example cultural context, might play a role in the lower than anticipated alpha observation of this sub-scale. It is of note that in the Turkish version of the BSS-R (Goncu-Serhatlioglu et al., 2018), sub-optimal alpha was observed for the SE sub-scale and was acceptable for the QC sub-scale, therefore cultural nuances may possibly influence individual sub-scale internal consistency against a backdrop of otherwise good psychometric properties and consistent factor structure. George and Mallery (2003) note that alpha levels of >0.50 are not unacceptable, however, in terms of future work with the S-BSS-R, further evaluation of the internal consistency properties of this QC sub-scale is desirable in the event future revision of sub-scale items is required.

The current investigation had a number of limitations. These include limits on the amount of socio-demographic data available, thus it was not possible to examine the influence of employment, marital or educational status on S-BSS-R scores. Additionally, all participants in the current study gave birth within the public health system, thus no information was available on the potential impact on birth satisfaction of private health service provision models. Extending the current research focus to address these inherent shortcomings is desirable and achievable through future research endeavours that use the S-BSS-R.

BLOQUE 2. Estrés perinatal y síntomas psicopatológicos de la madre y su efecto en el proceso de embarazo y parto.

CAPÍTÚLO VIII. ¿Puede el índice de masa corporal pre-gestacional relacionarse con el estado psicológico y físico de la madre durante todo el embarazo?

Romero-Gonzalez, B., Caparros-Gonzalez, R. A., Strivens-Vilchez, H. y Peralta-Ramirez, M. I. (2018). ¿Puede el índice de masa corporal pre-gestacional relacionarse con el estado psicológico y físico de la madre durante todo el embarazo? *Nutrición Hospitalaria*, *35*(2), 332-339.doi: 10.20960/nh.1192

Introducción

El sobrepeso y la obesidad son un problema de creciente preocupación entre la población mundial y española, relacionado con enfermedades cardiovasculares, diabetes mellitus, cáncer, y un mayor riesgo de fallecimiento (WHO, 2016a). La prevalencia de mujeres españolas con sobrepeso es del 54,6%, con una media de Índice de Masa Corporal (IMC) de 25,8 kg/m^2 (WHO, 2016b, 2016c). Durante el embarazo, aumenta el riesgo de la mujer a sufrir sobrepeso y obesidad, lo cual conlleva un importante riesgo para la salud materna, fetal e infantil (Camacho-Buenrostro, Perez-Molina, Vasquez-Garibay y Panduro-Baron, 2015; Vahratian, 2009).

Por una parte, la obesidad y el sobrepeso pre-gestacional aumentan el riesgo de sufrir diabetes gestacional, pre-eclampsia, hipertensión, nacimiento por cesárea urgente, mayor peso del bebé al nacer, e incluso aumenta el riesgo de muerte fetal (Athukorala, Rumbold, Willson y Crowther, 2010; Ding y cols., 2014; Kristensen, Vestergaard, Wisborg, Kesmodel y Secher, 2005). Por otro lado, el embarazo es un proceso estresante que conlleva importantes cambios en la mujer (Duhthie y Reynolds, 2013). En este sentido, altos niveles de estrés, así como síntomas de depresión y ansiedad durante el embarazo, se han relacionado con un aumento del riesgo de aborto, nacimiento pre-término y bajo peso fetal; además se relaciona con menor neurodesarrollo motor y cognitivo en bebés a los 8 y 12 meses de edad, respectivamente (Alderdice, Lynn y Lobel, 2012; D'Anna-Hernandez, Ross, Natvig y Laudenslager, 2011; Davis y Sandman, 2010; Huizink, Robles de Medina, Mulder, Visser y Buitelaar, 2003). De esta forma, conocer la salud psicológica de la embarazada durante todo el embarazo, puede favorecer la aplicación de medidas preventivas y mejorar su bienestar (de Wit y cols., 2015; Doyle, Delaney, O'Farrelly, Fitzpatrick y Daly, 2017). Por otro lado, niveles elevados de IMC pre-gestacional se ha relacionado con mayores niveles de estrés, depresión y ansiedad durante el embarazo (Bogaerts y cols., 2013; Laraia, Siega-Riz, Dole y London, 2009; Mehta, Siega-Riz, Herring, Adair y Bentley, 2011), así como con un aumento de probabilidad a desarrollar depresión posparto (LaCoursiere, Baksh, Bloebaym y Varner, 2006). Además, a largo plazo, un IMC superior a 24,9 kg/m^2 antes del embarazo se ha relacionado con un desarrollo cognitivo menor en el bebé, puntuaciones más bajas en inteligencia a la edad de 6 años y un mayor riesgo de desarrollar trastorno por déficit de atención e hiperactividad (Buss y cols., 2012; Casas y cols., 2013; Torres-Espinola y cols., 2015).

Atendiendo a las consecuencias negativas que tiene la obesidad y el sobrepeso pre-gestacional sobre el embarazo, es necesario investigar qué áreas psicológicas se ven afectadas cuando el IMC pre-gestacional es superior a 24,9 kg/m^2 (Bodnar, Wisner, Moses-Kolko, Sit y Hanusa, 2009; Bogaerts y cols., 2013; Mina y cols., 2016). Por todo esto, el objetivo de este estudio fue comprobar si existían diferencias en los niveles de estrés psicológico, síntomas psicopatológicos y variables fisiológicas a lo largo del embarazo, en un grupo de participantes con IMC pre-gestacional normal versus un grupo de gestantes con IMC pre-gestacional superior a la norma.

Métodos

Participantes

Un total de 170 mujeres embarazadas dieron su consentimiento para participar en este estudio. Tres tuvieron un aborto espontáneo y 11 manifestaron su deseo de abandonar su participación en el estudio alegando falta de tiempo. Finalmente, 156 mujeres embarazadas con edades comprendidas entre 21 y 44 años (M = 32,44; DT = 4,95) fueron evaluadas longitudinalmente durante el primer trimestre (M = 11,90 semanas de gestación; DT = 3,65), segundo trimestre (M = 25,16 semanas de gestación; DT = 3,34) y tercer trimestre de embarazo (*M* = 34,87 semanas de gestación; *DT* = 3,34). Las participantes pertenecían al Centro de Salud Góngora del Servicio Andaluz de Salud de Granada.

Los criterios de inclusión fueron ser mayor de 18 años, dominio del idioma castellano (escrito, hablado, comprensión oral y escrita) y llevar un seguimiento del embarazo en la sanidad pública. Como criterio de exclusión se encontraba tener un IMC inferior a 18,5 kg/m^2 antes del embarazo, debido a los objetivos de la investigación.

Las participantes fueron divididas en dos grupos: un grupo con IMC pre-gestacional elevado (superior a 24,9 kg/m^2) y otro grupo con IMC pre-gestacional normal (inferior a 24,9 kg/m^2).

Las embarazadas que estaban interesadas en participar leyeron la hoja de información del estudio y firmaron un documento de consentimiento informado. El estudio estaba acorde a las normas éticas según la Declaración de Helsinki (revisada en Fortaleza, Brasil, 2013) y fue revisado y aprobado por el comité de ética para la investigación humana de la Universidad de Granada (referencia 881) y el comité de ética de investigación del área sanitaria pública de Granada.

Instrumentos

Se recogió información acerca de variables sociodemográficas y obstétricas del Documento de Salud de la Embarazada (Junta de Andalucía, 2010), el cual contiene información acerca del embarazo ofreciendo una valoración del riesgo obstétrico, antecedentes médicos, historia obstétrica, gestación actual, diagnóstico prenatal, visitas tanto concertadas como urgentes, visita puerperal e información fetal mediante diagnóstico ecográfico.

Además, se llevó a cabo una evaluación psicológica, mediante los siguientes instrumentos:

- **Cuestionario de Preocupaciones Prenatales, PDQ** (Caparros-Gonzalez y cols., 2015; Yali y Lobel, 1999). Este instrumento evalúa el estrés específico del embarazo mediante preguntas relacionadas con preocupaciones de la madre en relación a su embarazo, problemas médicos, síntomas físicos, cambios corporales, crianza de los hijos, parto y nacimiento, relaciones interpersonales y salud del bebé. Está compuesto de 12 ítems de respuesta tipo Likert que varían desde 0 (en absoluto) a 4 (en extremo). El coeficiente de fiabilidad alfa de Cronbach de la versión española es de α = ,71 (Caparros-Gonzalez y cols., 2015).

- **Cuestionario de 90 síntomas, SCL-90-R** (Caparros-Caparros, Villar-Hoz, Juan-Ferrer y Viñas-Poch, 2007; Derogatis, 1975). Mediante 90 ítems que se responden en una escala Likert de cinco opciones, donde 1 es nada y 5 es mucho, evalúa el malestar subjetivo percibido por la persona. El cuestionario aporta información de nueve dimensiones primarias (somatizaciones, obsesión compulsión, sensibilidad interpersonal, depresión, ansiedad, hostilidad, ansiedad fóbica, ideación paranoide y psicoticismo). Además, el cuestionario incluye tres índices globales de malestar psicológico: índice global de sintomatología general (IGS), total de síntomas positivos (SP) e índice de malestar positivo (PSDI). Las nueve dimensiones muestran una fiabilidad adecuada, con una consistencia interna en el alfa de Cronbach de entre 0,81 y 0,90 (Caparros-Caparros y cols., 2007).

- **Escala de Estrés Percibido, EEP-14** (Cohen, Kamarck, Mermelstein, 1983; Remor, 2006). Evalúa el grado en que diferentes situaciones de la vida se perciben como estresantes a través de 14 ítems a responder en una escala Likert. Permite cinco opciones de respuesta (0: nunca; 4: muy a menudo) y la puntuación total oscila entre 0 y 56, donde a mayor puntuación, mayor nivel de estrés percibido. La escala ha demostrado una fiabilidad adecuada, con una alta consistencia interna (alfa de Cronbach = 0,81) (Remor, 2006).

- **Tensión arterial**. Se evalúa mediante manguitos de tensión tanto la tensión arterial sistólica como la diastólica.

- **Prueba O'Sullivan.** Prueba de glucosa en sangre que sirve de cribado para la diabetes mellitus gestacional. Se realiza en el segundo trimestre de embarazo.

Procedimiento

Las participantes eran captadas cuando atendían a su primera visita de control de embarazo con su matrona, correspondiente al primer trimestre de su embarazo. En este momento, se les informaba del estudio y se les hacía entrega de la hoja de información. Aquellas que manifestaron su deseo de participar leían, y firmaban el documento de consentimiento informado. Además, ofrecieron información acerca de su peso antes de quedarse embarazadas y de su talla, lo cual se registró en el Documento de Salud de la Embarazada (Junta de Andalucía, 2010) y que sirvió para calcular el IMC pre-gestacional de cada participante. Durante cada visita trimestral, la matrona les hacía entrega de los instrumentos psicológicos (PDQ, SCL-90R, PSS), dicha batería se aplicaba tres veces durante todo el embarazo, coincidiendo con su revisión trimestral. Los datos médicos se registraron igualmente en el Documento de Salud de la Embarazada (Junta de Andalucía, 2010), del cual se tomaron los correspondientes a tensión arterial y niveles de glucosa en sangre para su posterior análisis.

Análisis de datos

Con el objetivo de comprobar si los grupos estaban igualados en las principales variables sociodemográficas y obstétricas se realizó la prueba t de Student para muestras independientes en el caso de variables continuas, y en el caso de variables categóricas se utilizó la prueba Chi cuadrado para muestras independientes. Las variables dependientes fueron las variables sociodemográficas, obstétricas, fisiológicas y las puntuaciones en cada uno de los cuestionarios psicológicos (PDQ; SCL-90-R; PSS) en los tres trimestres de gestación; la variable independiente fue el IMC previo al embarazo, con dos niveles (IMC pre-gestacional normal e IMC pre-gestacional elevado).

Para comprobar si existían diferencias entre los dos grupos (normopeso versus sobrepeso) respecto a las diferentes puntuaciones en los cuestionarios psicológicos utilizados se llevaron a cabo diferentes t de Student.

Finalmente, se realizaron distintas pruebas t de Student para comprobar si existían diferencias entre ambos grupos en algunas variables médicas, como hipertensión o glucosa en sangre.

Todos los análisis estadísticos se realizaron con Statistical Package for Social Sciences versión 20.0 para Mac (SPSS, Armonk, New York).

Resultados

Descripción de la muestra

La muestra incluida en el estudio fue de 156 participantes que se dividieron en dos grupos, uno con IMC pre-gestacional normal (M = 21,22 kg/m^2; *DT* = 2,04), compuesto por 115 participantes y otro grupo con IMC pre-gestacional elevado (M = 26,31 kg/m^2; *DT* = 1,65), formado por 41 participantes. En la Tabla 1 se muestran las puntuaciones de IMC pre-gestacional, primer trimestre, segundo trimestre y tercer trimestre de embarazo, además de los datos sociodemográficos y de historia obstétrica de ambos grupos. Destacar que existían diferencias estadísticamente significativas entre los dos grupos en la puntuación IMC durante todo el embarazo: pre-gestacional (t = -8,64; $p \leq$,01) y en las puntuaciones IMC del primer trimestre (t = -8,81; $p \leq$,01), segundo trimestre (t = -4,08; $p \leq$,01), y tercer trimestre (t = -3,89; $p \leq$,01). Ambos grupos estaban igualados en las principales variables sociodemográficas y obstétricas evaluadas (ver Tabla 1).

Tabla 1. Diferencias en puntuaciones de IMC, variables sociodemográficas e historia obstétrica entre mujeres con IMC pre-gestacional normal e IMC pre-gestacional elevado

		IMC normal *X*(*DT*)/%	IMC elevado *X*(*DT*)/%	Test de contraste*	*p*
Puntuaciones de IMC					
Pre-gestacional		21,22 (2,04)	26,31 (1,65)	-8,64	**,00**
Primer trimestre		22,99 (2,44)	26,85 (1,21)	-8,81	**,00**
Segundo trimestre		23,40 (1,31)	27,40 (0,43)	-4,08	**,00**
Tercer trimestre		24,50 (1,43)	28,79 (1,33)	-3,89	**,00**
Variables sociodemográficas					
Edad		32,31 (4,74)	32,80 (5,54)	-0,54	,58
Nacionalidad	Española	95(75,40%)	31(24,60%)	7,29	,39
	Inmigrante	20(66,70%)	10(33,30%)		
Estado civil	Soltera/separada/viuda	3(50%)	3(50%)	5,40	,14
	Casada/en pareja	112(74,70%)	38(25,30%)		
Situación laboral	Trabajando	88(75,90%)	28(24,10%)	4,52	,34
	Desempleada	27(63,90%)	13(36,10%)		
Nivel educativo	Primario	2(25%)	6(75%)	12,19	,34
	Secundario	30(68,20%)	14(31,80%)		
	Universitario	83(79,80%)	21(20,20%)		
Deporte	Sí	61(77,20%)	18(22,80%)	1,01	,36
	No	54(70,10%)	23(29,90%)		
Tabaco	Sí	8(53,30%)	7(46,70%)	3,55	,07
	No	107(75,90%)	34(24,10%)		
Alcohol	Sí	2(50%)	2(50%)	1,19	,28
	No	113(74,30%)	39(25,70%)		
Historia obstétrica					
Número de hijos	0	76(82,60%)	16(17,40%)	-,92	,58
	1 o más	39(60,90%)	25(39,10%)		
Embarazo deseado	Sí	105(74,30%)	36(25,70%)	0,42	,51
	No	10(66,70%)	5(33,30%)		

Método de embarazo	Natural	103(75,20%)	34(24,80%)	3,12	,21
	Artificial	12(63,20%)	7(36,80%)		
Abortos previos	0	84(77,80%)	24(22,20%)	-1,67	,10
	1 o más	31(64,60%)	17(35,40%)		

Nota: Nivel de significación $p \leq ,01$
* Los estadísticos reflejan t de Student para variables cuantitativas y test Chi cuadrado para variables categóricas

Relación del IMC pre-gestacional con estrés a lo largo del embarazo

Con respecto a las puntuaciones medias en estrés percibido en relación a el IMC pre-gestacional, aunque las puntuaciones en estrés fueron mayores en el grupo con IMC pre-gestacional elevado durante los tres trimestres de embarazo, solo se encontraron diferencias estadísticamente significativas en el tercer trimestre de embarazo (t = -3,83; $p \leq ,01$). Del mismo modo, las puntuaciones obtenidas en el instrumento de estrés específico del embarazo son mayores en el grupo IMC pre-gestacional elevado frente las de IMC pre-gestacional normal a lo largo de todo el embarazo, siendo estadísticamente significativas en primer trimestre (t = -2,33; $p \leq ,05$) y segundo trimestre (t = -2,32; $p \leq ,02$). (Ver Tabla 2).

Tabla 2. Diferencias en estrés percibido y estrés específico del embarazo entre mujeres con IMC pre-gestacional normal e IMC pre-gestacional elevado.

Trimestres	**Cuestionarios**	**IMC normal** ***X*(*DT*)**	**IMC elevado** ***X*(*DT*)**	***t***	***p***
Trimestre 1	EEP	26,93(2,16)	27,56(1,80)	-1,30	,19
	PDQ	14,60(5,72)	18,48(7,64)	-2,33	,02*
Trimestre 2	EEP	26,81(1,61)	27,14(1,62)	-1,06	,19
	PDQ	13,10(5,29)	15,53(6,30)	-2,32	,02*

Trimestre 3	EEP	26,66(1,55)	27,88(2,22)	-3,83	,00**
	PDQ	14,31(5,78)	16,05(5,94)	-1,66	,09

Nota: *Nivel de significación $p \leq ,05$. **$p \leq ,01$
EEP = Escala de Estrés Percibido; PDQ = Cuestionario de Preocupaciones Prenatales.

Relación del IMC pre-gestacional con síntomas psicopatológicos a lo largo del embarazo

En la Figura 1 se representa el perfil psicopatológico en las distintas sub-escalas y escalas generales del SCL-90-R durante los tres trimestres de embarazo. En el primer trimestre, las puntuaciones medias del grupo con IMC pre-gestacional elevado son mayores en todas las sub-escalas y escalas generales, sin embargo solo se encontraron diferencias estadísticamente significativas entre grupos en las sub-escalas de depresión (t = -2,35; $p \leq ,01$), ideación paranoide (t = -2,00; $p \leq ,05$), y la escala general PSDI (t = -2,75; $p \leq ,01$).

En el segundo trimestre, las mujeres con IMC pre-gestacional elevado mostraron mayores puntuaciones medias en todas las sub-escalas y escalas generales del SCL-90-R. De igual forma, se hallaron diferencias estadísticamente significativas entre grupos, en las sub-escalas de somatizaciones (t = -2,30; $p \leq ,01$), obsesión compulsión (t = -2,14; $p \leq ,05$), sensibilidad interpersonal (t = -2,06; $p \leq ,05$), depresión (t = -2,05; $p \leq ,05$), ansiedad (t = -2,02; $p \leq ,05$), ideación paranoide (t = -2,94; $p \leq ,01$), y en las escalas generales IGS (t = -2,38; $p \leq ,01$) y SP (t = -2,37; $p \leq ,01$).

De igual modo, en el tercer trimestre, las puntuaciones medias en las sub-escalas del SCL-90-R son mayores en el grupo con IMC pre-gestacional elevado con respecto al grupo IMC pre-gestacional normal. Estas diferencias son estadísticamente significativas en las sub-escalas de somatizaciones (t = -2,08; $p \leq$,05), ansiedad (t = -2,96; $p \leq$,01) y en la escala general SP (t = -2,00; $p \leq$,05).

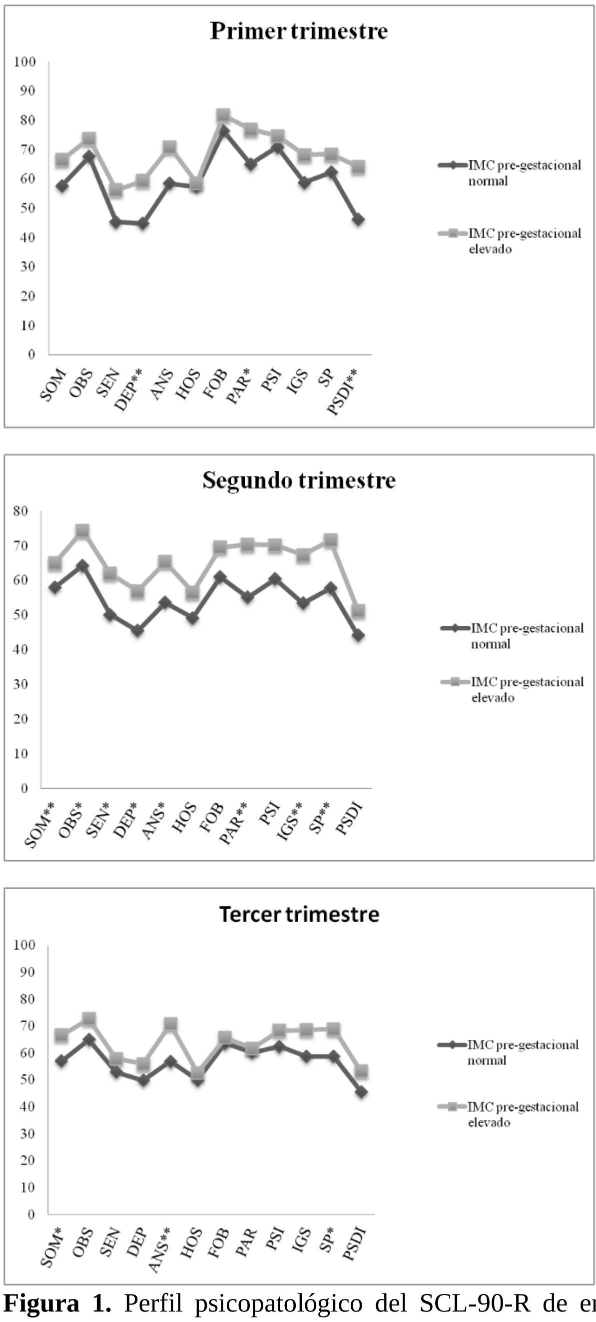

Figura 1. Perfil psicopatológico del SCL-90-R de embarazadas en primer, segundo y tercer trimestre, según IMC pre-gestacional normal o elevado.

Nota: *Nivel de significación $p \leq$,05. ** $p \leq$,01

***SOM = Somatizaciones; OBS = Obsesión Compulsión; SEN = Sensibilidad Interpersonal; DEP = Depresión; ANS = Ansiedad; HOS = Hostilidad; FOB = Ansiedad Fóbica; PAR = Ideación Paranoide; PSI = Psicoticismo; IGS = Índice de Sintomatología General; SP = Índice Total de Síntomas Positivos; PSDI = Índice de Malestar Positivo.

Relación del IMC pre-gestacional con tensión arterial y niveles de glucosa.

Las pruebas realizadas a lo largo del embarazo muestran mayores niveles de tensión arterial sistólica (TAS) y tensión arterial diastólica (TAD) en el grupo de IMC pre-gestacional elevado, siendo estas diferencias estadísticamente significativas en los niveles de TAD en el primer trimestre (t = -2,27; $p \leq$,05), en TAS (t = -2,08; $p \leq$,05) y en TAD (t = -2,43; $p \leq$,01) en el tercer trimestre. No se encontraron diferencias entre ambos grupos en el nivel de glucosa medido en el segundo trimestre. Estos resultados se muestran en la Tabla 3.

Tabla 3. Diferencias en tensión arterial y glucosa entre mujeres con IMC pre-gestacional normal e IMC pre-gestacional elevado.

Trimestres	**Pruebas**	**IMC normal** ***X*(*DT*)**	**IMC elevado** ***X*(*DT*)**	***t***	*****
Trimestre 1	TAS	108,09(11)	112,14(12,02)	-1,40	,16
	TAD	64,62(10,32)	70,29(7,81)	-2,27	,02*
Trimestre 2	TAS	107,15(14,04)	109,56(10,80)	-,62	,53
	TAD	64,38(9,67)	67,19(6,91)	-1,72	,28
	Glucosa	106,98(30,06)	114,31(26,40)	-,79	,43
Trimestre 3	TAS	108,88(10,81)	113,80(12,20)	-2,08	,03*
	TAD	65,63(11,08)	71,34(10,67)	-2,43	,01**

Nota: *Nivel de significación $p \leq$,05. **$p \leq$,01
***TAS = Tensión arterial sistólica; TAD = Tensión arterial diastólica. Glucosa expresada en mg/dL

Discusión

Dada la demostrada importancia del IMC de la embarazada por sus implicaciones en el proceso de embarazo, el objetivo de este estudio fue profundar sobre la relación de éste con variables psicológicas. En concreto, conocer si existen diferencias en los niveles de estrés y síntomas psicopatológicos, entre las mujeres que presentan un IMC pre-gestacional superior y las que tienen un IMC normal antes del embarazo. Los resultados han mostrado que existen diferencias en los niveles de estrés específico del embarazo entre ambos grupos en el primer y segundo trimestre, además de diferencias en los niveles de estrés percibido en el tercer trimestre. En lo que respecta a los síntomas psicopatológicos, ambos grupos muestran diferentes puntuaciones en las sub-escalas a través de todo el embarazo. En concreto encontramos diferencias en depresión, ideación paranoide y escala general PSDI en el primer trimestre aumentando las diferencias entre los dos grupos en el segundo trimestre de embarazo donde encontramos diferencias en somatizaciones, obsesión compulsión, sensibilidad interpersonal, depresión, ansiedad, ideación paranoide y las escalas generales IGS y SP. En el tercer trimestre ambos grupos se igualan más mostrando mayores puntuaciones únicamente en las sub-escalas de somatización, ansiedad y la escala general SP. Añadir, que en lo que respecta a variables fisiológicas se encontraron mayores niveles de tensión arterial diastólica en el primer trimestre, y mayor tensión arterial sistólica y diastólica en el tercer trimestre en el grupo de mayor IMC pre-gestacional.

En primer lugar, en relación con las diferencias encontradas en los niveles de estrés percibido y estrés específico del embarazo, estos datos están en concordancia con los encontrados por Laraia y cols. (2009) en su estudio transversal, donde muestran que los niveles de estrés percibido, medidos antes de la semana 20 de gestación, son mayores en mujeres con un alto IMC previo al embarazo. Sin embargo, este estudio no permite conocer los niveles de estrés percibido de manera longitudinal a lo largo del embarazo, por lo que nuestro estudio da un paso más y nos permite conocer qué trimestre es en el que esta población puede ser especialmente vulnerable. Además, nuestro estudio es el primero que muestra la relación entre el IMC pre-gestacional y el estrés específico del embarazo, encontrando que las mujeres de un alto IMC pre-gestacional muestran mayores niveles de estrés en el primer y segundo trimestre. Sin embargo, hay que destacar que las diferencias que se han encontrado entre ambos instrumentos de estrés no concuerdan. Esto podría deberse al instrumento usado, ya que en el estrés específico del embarazo se evalúan preocupaciones de la madre directamente relacionadas con el embarazo, mientras que en el cuestionario de estrés percibido, el nivel de estrés evaluado es general y no específico de esta población. Es importante destacar que existe aval científico de que el estrés específico del embarazo está relacionado de manera más potente con resultados negativos, como el aumento de riesgo de aborto, nacimiento pre-término y bajo peso fetal, que el propio estrés general (Alderdice y cols., 2012), por lo que cabe esperar que usando este tipo de instrumentos, la información recogida sea más adecuada a la población que se está evaluando. Esto es, usar un instrumento para medir estrés específico del embarazo puede detectar estos niveles de estrés que no serían captados con instrumentos de estrés general.

En lo que respecta a los síntomas psicopatológicos, la tendencia general que se muestra en los tres trimestres es que las embarazadas con un IMC pre-gestacional elevado tienen un estado psicológico más afectado durante su embarazo, pues las puntuaciones son mayores durante todos los trimestres. Además, durante el segundo trimestre se encuentran más diferencias entre ambos grupos. El segundo trimestre es en el que la mujer embarazada se encuentra en el nivel más óptimo de su embarazo, probablemente esta sea la razón por la que se encuentran dichas diferencias, ya que las mujeres que presentan un

IMC pre-gestacional elevado muestran puntuaciones altas en psicopatología en numerosas sub-escalas, mientras que las mujeres con un IMC normal muestran unos síntomas psicopatológicos iguales a la media de la población.

En concordancia con nuestros hallazgos, estudios previos muestran un incremento durante la gestación en los niveles de ansiedad y depresión cuando la mujer tiene un IMC pre-gestacional elevado (Bicudo, Garanhani, Lira, Maria y Turato, 2016; Bogaerts y cols., 2013; Mehta y cols., 2011). Sin embargo, estos estudios son transversales, perdiendo por tanto información sobre la evolución de los síntomas psicopatológicos durante todo el embarazo, como es el caso de nuestra investigación. Nuestros resultados han mostrado una amplia variedad de síntomas psicopatológicos que se ven afectados durante el embarazo cuando el IMC pre-gestacional es elevado, no limitándose exclusivamente a procesos de ansiedad y depresión. Por esto, es imprescindible prestar atención a estos síntomas psicopatológicos durante el embarazo con el fin de prevenir consecuencias negativas.

Respecto a las complicaciones médicas asociadas al IMC pre-gestacional elevado, nuestros resultados concuerdan con los encontrados por Bodnar. Catov, Klebanoff, Ness y Roberts (2007), pues se asocia un mayor IMC pre-gestacional con el aumento de la tensión arterial durante el embarazo. Por su parte, los niveles de glucosa en sangre no muestran diferencias estadísticamente significativas entre ambos grupos, a pesar de que otros autores sí muestren dicha relación (Athukorala y cols., 2010). No obstante, son dos variables que deben ser controladas durante el embarazo para evitar consecuencias negativas.

A pesar de los resultados encontrados y aunque el número de embarazadas incluidas en el estudio es alto, sería interesante haber incluido un número mayor de muestra con el fin de conseguir mayor número de mujeres en el grupo de IMC pre-gestacional elevado. Para futuras investigaciones sería interesante comprobar también cómo se relaciona el IMC de la madre con la evolución del bebe. En concreto, sería interesante realizar un seguimiento en el tiempo para comprobar si los hijos de mujeres con IMC pre-gestacional elevado tienen algunas áreas del desarrollo más pobremente desarrolladas, o si presentan dificultades del aprendizaje e incluso trastornos psicológicos. Además, podrían estudiarse las consecuencias psicológicas de un IMC pre-gestacional inferior a 18,5 kg/m^2.

Es de gran importancia conocer cómo afecta el IMC previo al embarazo a la mujer, pues estos resultados muestran que un IMC superior al normal conlleva en sí mismo un deterioro psicológico, no solo en términos de estrés percibido, ansiedad y depresión, sino también en estrés específico del embarazo y en un amplio rango de síntomas psicopatológicos, así como variables sanitarias. Dicho deterioro psicológico y de la salud puede provocar consecuencias negativas tanto para la mujer como para el feto, e incluso para el bebé a corto y largo plazo (Alderdice y cols., 2012; D'Anna-Hernandez y cols., 2011; Davis y Sandman, 2010; Huizink y cols., 2003). Además, la condición psicológica de la mujer embaraza sana se ve alterada por cambios hormonales debido a que esta etapa es una fuente de estrés y ansiedad (Duthie y Reynolds, 2013). Por esto, en casos en los que está presente un IMC superior al normal, el bienestar psicológico se ve aún más afectado, pudiendo derivar en psicopatologías clínicas.

Los resultados de este estudio tienen importantes repercusiones a nivel clínico, en concreto en el ámbito de la prevención. De este modo, es necesario que la población sea sensible al papel del sobrepeso y su importancia en la evolución del embarazo tanto a nivel físico como a nivel psicológico en la mujer embarazada. Para ello es clave la sensibilización del personal sanitario que proporcione información basada en consejos dietéticos acerca de su peso y sobre su alimentación, incluso, elaborando una dieta personalizada durante su embarazo en los casos en que sea necesario. De esta forma podrían reducirse las consecuencias negativas derivadas de tener un peso superior al normal (Bye y cols., 2016; Ramírez-López y cols., 2015). Es necesario que tanto los profesionales de la salud como las propias mujeres adquieran conciencia de lo importante que es un peso adecuado antes de quedarse embarazadas, controlándolo a lo largo del embarazo.

CAPÍTULO IX. Psychopathology, psychological stress and hair cortisol levels in pregnant and non-pregnant women

Romero-Gonzalez, B., Caparros-Gonzalez, R. A., Gonzalez-Perez, R., Garcia-Leon, M. A., Arco-Garcia, L. & Peralta-Ramirez, M. I. (2020). Psychopathology, psychological stress and hair cortisol levels in pregnant and non-pregnant women. Submitted to *Journal of Affective Disorders.*

Introduction

Pregnancy is a period in a woman's life that involves numerous changes, requiring both hormonal and psychological adaptations (Alhusen, Ayres & Depriest, 2016). During this period, physical and psychological care as well as social support become essential to guarantee the health of the mother and child (Lindgren, 2003).

Therefore, during this period, a series of psychological alterations can occur bringing about a more sensitive and emotional state, as a pregnancy generates unpredictability, uncertainty, and novelty. Added to this is the large number of demands pregnant women have to face (Cetin, Guzel, Kurdoglu & Sahin, 2017).

The psychological disorders that have been studied the most during pregnancy are depression and anxiety. A prevalence between 10% and 16% (Sharma, Singh, Tempe & Malhotra, 2017) has been advanced for depression, and around 8% for anxiety (Gariepy, Lundsberg, Miller, Stanwood & Yonkers, 2016). These states of anxiety and depression have different repercussions on maternal and foetal health including: preterm birth, low birth weight, an increased risk of postpartum depression and the deregulation of the adrenal-pituitary-hypothalamus-axis in newborns (Caparros-Gonzalez et al., 2017; Romero-Gonzalez, Caparros-Gonzalez, Gonzalez-Perez, Puertas-Delgado & Peralta-Ramirez, 2018).

A large number of alterations, however, apart from anxiety and depression, have been poorly addressed in research. For example, the risk of alterations related to obsessions and compulsions is estimated to be twice as high in pregnant women than in the general population, due to the excessive care and concern that women expecting a baby usually show for their health (Russell, Fawcett & Mazmanian, 2013; Sharma et al., 2017; Uguz et al., 2007). Moreover, other psychopathological symptoms have been related to worse obstetric outcomes during childbirth, such as a greater number of somatisations or a higher level of psychoticism (Romero-Gonzalez, Caparros-Gonzalez, Gonzalez-Perez, Coca-Arco & Peralta-Ramirez, 2019).

Furthermore, regarding stress and hair cortisol levels, a recent study published averages and percentiles both in the general population and in pregnant women (Garcia-Leon et al., 2018). At a descriptive level, these authors found higher cortisol levels in pregnant women than in the general population.

Pregnancy is, therefore, a stage of life that is psychologically and physiologically different, making pregnant women a particularly vulnerable population from a psychopathological viewpoint. Despite the fact that psychopathological symptoms and hair cortisol levels have been studied in this population.in detail and comparing with other variables, to the best of our knowledge, no research has been conducted to verify whether there is a higher incidence of psychopathological symptoms in pregnant women with respect to non-pregnant women, covering a wide range of symptoms. In addition, establishing this comparison according to the trimester of pregnancy can provide information with notable clinical implications. Therefore, the general objective of this study was to verify whether there are differences in psychopathological symptoms and hair cortisol levels of pregnant women versus non-pregnant women. Specific objectives were also proposed: to verify whether psychological stress or hair cortisol levels predicted the differences in psychopathological symptoms between both populations.

A final objective of the study was to explore the course of psychopathological symptoms throughout the entire pregnancy. A subsample of pregnant women was thus followed throughout the three trimesters of pregnancy.

Methods

Participants

A total of 762 women participated in this study, of which 171 belonged to the group of non-pregnant women (M = 28.01 years of age; SD = 11.81) and the remaining 591 to that of pregnant women (M = 32, 35 years old; SD = 5.18).

Within the group of pregnant women, participants were recruited during different pregnancy periods, with a total of 124 women (M = 32.25 years of age; SD = 5.50) in their first trimester of pregnancy (M = 10.93 weeks of pregnancy; SD = 3.97), 200 women (M = 32.36 years of age; SD = 4.93) in their second trimester of pregnancy (M = 24.69 weeks of pregnancy; SD = 3.38), and 190 women (M = 32.90 years of age; SD = 5.19) in their third trimester of pregnancy (M = 34.18 weeks of pregnancy; SD = 3.23). These women were assessed at a single point in time (1st, 2nd and 3rd trimester).

A subsample of 77 women assessed longitudinally during the three trimesters of pregnancy (M = 32.64 years of age; SD = 4.44) was also included.

The sample of non-pregnant women was collected through accidental snowball sampling: in this way, women were asked to send information about the study to any interested person they might know. For their part, pregnant women were informed of the study during their prenatal pregnancy consultation, in the health centres of Gongora and Mirasierra (Granada) and Hospital of Poniente (Almeria).

The inclusion criteria consisted of: being over 18 years of age; being a woman; knowing how to read and write; and their informed consent to participate in the study. The exclusion criteria consisted of: being on a corticosteroid treatment; taking oral contraceptives; being diagnosed with a disease; or following a psychiatric treatment.

This study was reviewed and approved by the Ethics Committee for Human Research at the University of Granada (reference number 881) and the Research Ethics Committee of the public health service in Granada and Almeria.

Instruments

All participants underwent a semi-structured interview to obtain the main sociodemographic variables: age, marital status, level of education and employment status. In addition, women belonging to the group of pregnant women provided their Pregnancy Health Document (Andalusian Ministry of Health, 2010) which records their obstetric history.

All participants completed a psychological evaluation consisting of:

Perceived Stress Scale (PSS; Cohen, Kamarck & Mermelstein, 1983; Remor, 2006) is a self-report questionnaire which evaluates the perceived stress level in the previous month. Besides, it assess the degree in which people find their lives unpredictable, uncontrollable or overcharged. It consists of 14 items scoring in a Likert-scale with four response alternatives (0 = never and 4 = very often). The Spanish version of the PSS (14 items) showed a high internal consistency = 0.81.

The Symptom Checklist-90-Revised (SCL-90-R; Caparros-Caparros, Ferrer & Viñas-Poch, 2007; Derogatis, 1994): It is a 90-item self-report inventory and items are scored using a 5-point Likert-type scale (1 = never and 5 = very often). It measures psychopathological symptomatology in nine dimensions (somatization, obsessive-compulsive, interpersonal sensitivity, depression, anxiety, hostility, phobic anxiety, paranoid ideation and psychoticism) and three global indices of psychological distress (global severity index, positive symptom distress index and total positive symptoms). The

Cronbach's alpha reliability coefficients of the Spanish version ranged between $.67 < \alpha < .94$.

Pregnancy Distress Questionnaire (PDQ, Caparros-Gonzalez et al., 2019; Yali & Lobel, 1999): it assess pregnancy-specific stress, which assesses specific worries and concerns that pregnant women experience regarding body changes, medical problems, physical symptoms, childbirth, relationships, labor, and the baby's health. It contains 12-item in a Likert scale scored from 0 (none at all) to 4 (extremely). The Cronbach's alpha reliability coefficient for the Spanish version is $\alpha = 0.71$.

Hair cortisol levels

For the purpose of assessing the activation of the hypothalamic-pituitary-adrenal axis, hair cortisol levels were measured through hair samples were collected by cutting hair carefully with fine scissors as close as possible to the scalp from a posterior vertex position. Each sample were no greater than 3 cm (assuming an average growth rate of 1 cm/month, a 3 cm segment contains cortisol that has been deposited over approximately the last 3 months). The hair samples were wrapped in a piece of aluminum foil to protect them from light and humidity and they were stored in an envelope at room temperature until being sent for analysis to the Faculty of Pharmacy at the University of Granada. The cortisol in the hair sample was measured using the salivary ELISA cortisol kit with the reagent provided following the manufacturer's directions. Using a salivary ELISA cortisol kit is a validated method to assess hair cortisol levels and is highly positive correlated with liquid chromatograph–mass spectrometry (LC–MS/MS) (Russell et al., 2015). The laboratory protocol applied is described in detail in Caparros-Gonzalez et al. (2017), Romero-Gonzalez et al. (2018) and Romero-Gonzalez et al. (2019).

Procedure

First, information about the study was distributed and managed in health centres, employment offices, universities and civic centres. Women wishing to participate in the study were summoned to the Mind, Brain and Behaviour Research Centre at the University of Granada. There, they were explained what the research consisted of and, in accordance with established ethical standards, they received an informed consent form.

Following the principal investigator's explanations, all attendants interested in participating read the information sheet and signed the informed consent form. The research staff then administered the psychological assessment (PSS-14 and SCL-90-R) and cut a strand of hair following the instructions on how to collect this type of sample (Sauvé, Koren, Walsh, Tokmakejian & Van Uum, 2007).

In addition, a subgroup of pregnant women was constituted, to be assessed during the three trimesters of pregnancy. They were informed of the study upon arrival at their first prenatal pregnancy consultation with their health professional. The same questionnaires were administered once they had been explained the study, had read the information sheet and signed the informed consent, including the PDQ, used only for pregnant women. A strand of hair was then collected. This process was repeated twice more over time, coinciding with the pregnancy consultations of the second and third trimesters of pregnancy.

Data analysis

First, a descriptive analysis of both samples was carried out focusing on the main sociodemographic variables. In addition, the nine main scales of the SCL-90-R were categorised to identify which women obtained clinical scores. For this, scores between 5 and 69 were considered as normal scores, and scores above or equal to 70 were categorised as clinical scores. A frequency analysis was performed to check how many women in the sample obtained clinical scores.

Subsequently, to verify whether pregnant women showed higher levels of stress, hair cortisol levels and psychopathology than non-pregnant women, different comparisons of Student t test averages of non-pregnant women with that of pregnant women were performed in the first, second and third trimesters of pregnancy.

Then, in order to verify whether perceived stress, specific pregnancy stress or hair cortisol levels predicted pregnant women's possible psychopathological symptoms, hierarchical linear regression analyses were performed using the enter method. In the first step, the variable of having previous children was included as a confounder variable. In the second step, the following predictor variables were included: specific pregnancy stress scores, perceived stress and hair cortisol levels. The dependent variables were the pregnant women's scores in each SCL-90-R scale that presented statistically significant differences compared to non-pregnant women during the three trimesters.

Finally, to verify the psychopathological profile of the women who were followed up throughout the entire pregnancy, a repeated measures ANOVA was carried out relating to the nine main dimensions of the SCL-90-R and the three trimesters of pregnancy. The Greenhouse-Geisser correction was applied. This subsample of pregnant women was not included in the previous group comparison analyses.

Regarding the statistical analysis of hair cortisol levels, following the recommendations of analysis of these types of samples (Stalder et al., 2012), a log transformation (natural logarithm; ln base e) was performed to adjust to a normal distribution. The analyses were conducted using the Statistical Package for the Social Sciences 20.0 for Windows, version 8.1 (SPSS, Armonk, New York).

Results

Sample description and clinical scores in psychopathology

The total sample was composed of 171 non-pregnant women and 591 pregnant women. The average age of the pregnant women was 32.35 years (SD = 5.18), while the average age of non-pregnant women was 28.01 years (SD = 11.81).

Within the group of non-pregnant women, 30.4% (n = 52) were single, widowed or divorced, while the remaining 69.6% (n = 119) were married or living with their partners. Most of them had a university education (83%; n = 142), only 25 had secondary education (14.7%) and 4 had primary education (2.3%). In addition, 67 of them were university students (39.20%), 64 had a job (37.40%) and the remaining 40 were unemployed (23,40%).

A majority of the women belonging to the group of pregnant women were married or living with their partners (76.50%; n = 452), while the remaining 166 (n = 23.50%) were single or widowed. The majority in this group also had a university education (58.03%; n = 343), a total of 194 had secondary education (32.80%), 27 had primary education (7.95%) and the remaining 6 had no education (1.20%). Regarding obstetric aspects, 292 were pregnant for the first time (49.40%) while for the remaining 299 (50.60%), this pregnancy was at least their second.

Finally, Table 1 shows the frequencies of the clinical scores on the nine main psychopathology subscales of pregnant women versus non-pregnant women for each trimester. The percentage of women with clinical symptoms was higher in the group of pregnant women regarding most scales, except for interpersonal sensitivity, where a higher percentage of non-pregnant women had clinical scores. On the rest of the scales, somatisations, obsessions and compulsions during the first trimester, depression, anxiety in the first and third trimester, hostility in the first trimester, phobic anxiety, paranoid ideation and psychoticism, pregnant women had a higher percentage of clinical symptomatology.

Table 1. Number of participants and percentage of clinical scores (≥ 70) in the SCL-90-R.

	Non pregnant women (n=171) n(%)	First trimester (n= 124) n(%)	Second trimester (n=200) n(%)	Third trimester (n=190) n(%)
Scores ≥ 70				
Somatization	54(32.1)	60(48.4)	87(43.5)	84(44.2)
Obsessive-Compulsive	105(61.4)	93(75)	122(61)	116(61.1)
Interpersonal Sensitivity	84(50.3)	44(35.5)	74(37)	74(38.9)
Depression	56(32.7)	42(33.9)	66(33)	64(33.9)
Anxiety	88(51.5)	75(60.5)	101(50.5)	107(56.3)
Hostility	67(39.2)	57(46)	68(34)	60(31.6)
Phobic anxiety	36(21.1)	80(64.5)	95(47.5)	94(49.5)
Paranoid ideation	62(36.3)	63(50.8)	86(43)	89(46.8)
Psychoticism	77(45)	81(65.3)	107(53.5)	106(55.8)

Differences in psychopathological symptoms, perceived stress, and hair cortisol levels between pregnant women and non-pregnant women

Psychopathological symptoms

Regarding psychopathological symptoms, differences were found on 4 subscales in the three trimesters of pregnancy: somatisations in the first trimester ($t = -3.07$; $p < .001$), second trimester ($t = -2.14$; $p < .05$) and third trimester ($t = -2.60$; $p < .001$);

interpersonal sensitivity in the first trimester (t = -3.09; p <.001), second trimester (t = 2.59; p <.001) and third trimester (t = 2.55; p <.001); phobic anxiety in the first trimester (t = -10.93; p <.001), second trimester (t = -7.31; p <.001) and third trimester (t = -7.41; p <.001) and psychoticism in the first trimester (t = -4.30; p <.001), second trimester (t = -2.98; p <.001) and third trimester (*t* = -2.58; *p* < .001).

There were also differences in paranoid ideation between the first (t = -3.08; p <.001) and third trimester (t = -2.01; p <.05).

As regards the SCL-90-R general scales, the GSI in the first (t = -6.82; p <.001), second (t = -5.98; p <.001) and third trimester (t = -6.80; p <.001), as well as the PSDI scale in the first trimester (t = -2.38; p <.001) were significantly different.

Figure 1 shows the eleven SCL-90-R subscales for each trimester compared that of non-pregnant women.

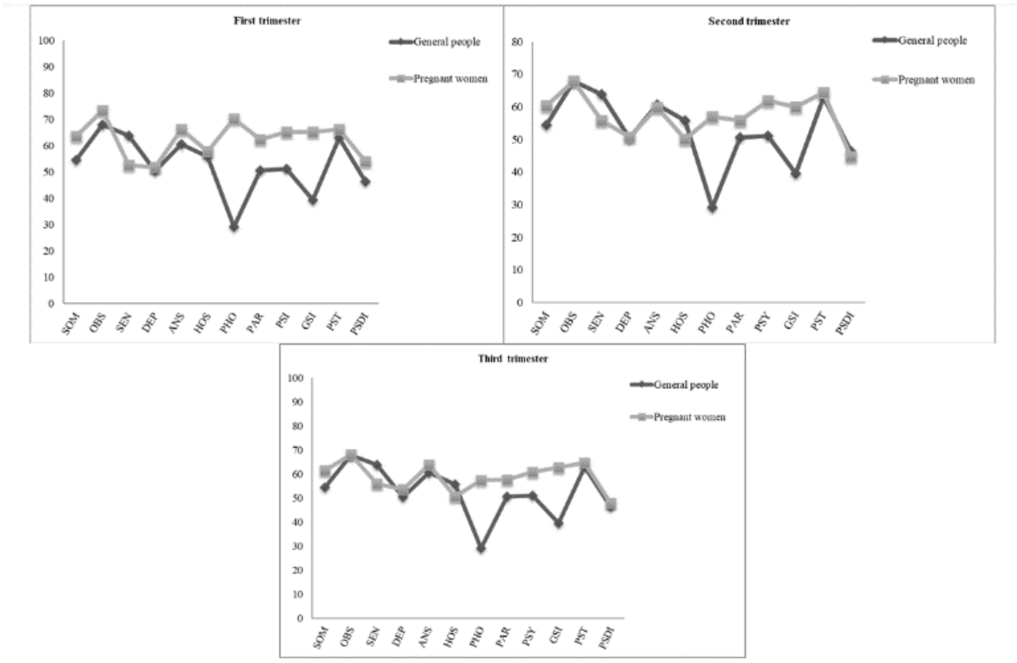

Figure 1. Psychopathological profile of pregnant and non-pregnant women

SOM = Somatization; OBS= Obsessive-Compulsive; SEN= Interpersonal Sensitivity; DEP= Depression; ANS= Anxiety; HOS= Hostility; PHO= Phobic Anxiety; PAR= Paranoid Ideation; PSY= Psychoticism; GSI: Global Severity Index; PST: Positive Symptom Total; PSDI: Positive Symptom Distress Index

Perceived stress

The analysis of the differences in averages between non-pregnant women and pregnant women in the first, second and third trimesters of pregnancy showed statistically significant differences between both groups regarding perceived stress in the first trimester (t = -5.78; p <.001), second trimester (t = -5.82; p <.001) and third trimester (t = -5.82; p < .001) of pregnancy.

Hair cortisol levels

Finally, regarding the analyses of hair cortisol levels, statistically significant differences existed between pregnant and non-pregnant women in the second trimester (t = -5.23; p <.001) and third trimester (t = -5.12; p <.001) of pregnancy, pregnant women obtaining higher scores. No differences were found in the level of hair cortisol in the first trimester of pregnancy. The cortisol averages of both groups per trimester are shown in Table 2.

Table 2. Differences in stress, psychopathological symptomatology and hair cortisol concentrations between non pregnant women and pregnant women

	General people (n=171) M(SD)	**First trimester (n= 124) M(SD)**	**t**	***p***	**Second trimester (n=200) M(SD)**	**t**	***p***	**Third trimester (n=190) M(SD)**	**t**	***p***
Somatization	54.55(25.39)	63.60(24.16)	-3.07	**.001**	60.30(25.83)	-2.14	**.03**	61.48(24.85)	-2.60	**.01**
Obsessive-Compulsive	67.92(27.88)	73.38(25.25)	-1.75	.08	67.93(26.52)	-.00	.99	68.14(26.97)	-.07	.93
Interpersonal Sensitivity	63.87(30.18)	52.51(32.32)	3.09	**.001**	55.78(29.83)	2.59	**.01**	55.92(28.88)	2.55	**.01**
Depression	50.43(30.75)	51.85(28.76)	-.40	.68	50.81(29.33)	-.12	.90	53.53(27.49)	-1.00	.31
Anxiety	60.61(28.19)	66.14(26.39)	-1.70	.08	59.86(29.76)	.24	.80	63.87(27.87)	-1.10	.27
Hostility	55.78(26.85)	57.88(31.06)	-.62	.53	50.07(31.38)	1.88	.06	50.64(29.74)	1.71	.08
Phobic anxiety	29.94(33.43)	70.23(29.54)	-10.93	**.001**	57.00(32.22)	-7.31	**.001**	57.41(36.59)	-7.41	**.001**
Paranoid ideation	50.45(33.59)	62.31(31.06)	-3.08	**.001**	55.77(33.35)	-1.52	.12	57.70(34.49)	-2.01	**.04**
Psychoticism	51.11(36.52)	65.12(29.34)	-4.30	**.001**	61.90(32.48)	-2.98	**.001**	60.81(34.74)	-2.58	**.01**
GSI	39.51(34.96)	65.12(29.34)	-6.82	**.001**	60.00(30.15)	-5.98	**.001**	62.72(29.14)	-6.80	**.001**

PST		62.95(30.44)	66.20(30.07)	-.90	.36	64.43(29.81)	-.46	.63	64.74(28.63)	-.56	-57
PSDI		46.35(26.97)	53.94(27.12)	-2.38	**.01**	44.76(28.86)	.54	.58	47.85(25.21)	-.54	.58
Stress	**PSS**	23.52(8.13)	27.19(4.59)	-5.78	**.001**	26.72(3.37)	-5.82	**.001**	26.76(3.58)	-5.82	**.001**
	HCC	4.55(0.79)	4.71(1.38)	-1.24	.21	4.74(1.17)	-5.23	**.001**	5.01(1.12)	-5.12	**.001**

Note: GSI = Global Severity Index; PST = Positive Symptom Total; PSDI = Positive Symptom Distress Index; PSS = Perceived Stress Scale; HCC = Hair Cortisol Concentrations.

Predictors of psychopathological symptoms in pregnant women: Hierarchical regression.

The results showed that in the first trimester, pregnancy-specific stress levels were the score predictor on the somatisation subscale, with an explained variance (EV) of 28%, and perceived stress was a score predictor on the subscales of interpersonal sensitivity (EV 17%) and psychoticism (EV 20%).

In the second trimester, the predictive models of somatisation (EV 13%), interpersonal sensitivity (EV 16%) and psychoticism (EV 18%) showed that both, perceived stress and pregnancy specific stress were score predictors on these subscales. Finally, perceived stress was the only predictor (EV 8%) in the case of phobic anxiety.

In the third trimester, only the phobic anxiety (EV 13%) predictive model showed a type of stress, i.e. perceived stress, as a predictor. The rest of the models were not significant, although being primiparous was a predictive variable in both the somatisation model and the interpersonal sensitivity model in model 2. Table 3 shows the models for all trimesters.

Table 3. Hierarchichal linear regression analyses in psychopathological symptomatology

		First trimester						Second trimester						Third trimester					
		Model 1			Model 2			Model 1			Model 2			Model 1			Model 2		
		β	SE B	*t*	β	SE B	*t*	β	SE B	*t*	β	SE B	*t*	β	SE B	*t*	β	SE B	*t*
SOM	**Primiparous**	4.87	.10	.74	3.16	.06	.53	1.70	.03	.34	1.25	.02	.26	-11.57	-.22	-2.17^{*}	-10.63	-.20	-2.00^{*}
	PDQ				1.58	.43	3.83^{**}				1.05	.23	2.40^{*}				.83	.18	1.80
	PSS				.94	.17	1.38				1.57	.25	2.62^{**}				.90	.16	1.53
	HCC				-1.64	-.07	-.63				.89	.04	.42				-.95	-.03	-.31
	R^2		.01			.28			.01			.13			.05			.11	
	F for changes in R^2		.54			6.20^{**}			.11			4.98^{**}			4.73^{*}			1.85	
SEN	**Primiparous**	.4.55	-.07	-.53	-6.83	-.11	-.53	-1.31	-0.2	-.22	-2.75	-.04	-.50	-4.37	-.07	-.69	-2.65	-.04	$-.42^{*}$
	PDQ				1.73	.36	-.82				1.83	-34	3.64^{**}				1.18	.23	2.15
	PSS				.75	.11	2.66^{**}				1.41	.19	2.03^{*}				.34	.05	.49
	HCC				-.85	-.03	.43				-1.23	-.04	-.51				-2.07	-.06	-.56
	R^2		.01			.17			.01			.16			.01			.06	
	F for changes in R^2		.28			3.40^{*}			.05			6.60^{**}			.48			1.74	
PHO	**Primiparous**	-6.05	-.11	-.82	-9.03	-.17	-1.24	2.88	.03	.39	4.40	.05	.60	5.46	.06	.62	3.51	.05	.50
	PDQ				1.30	.32	2.26^{*}				-.35	-.05	-.53				.10	.01	.17
	PSS				-.20	-.03	-.24				2.66	-29	2.92^{**}				2.78	.36	3.58^{**}
	HCC				3.01	.12	.93				-4.15	-.13	-1.31				-2.39	-.06	-.58
	R^2		.01			.12			.01			.08			.01			.13	
	F for changes in R^2		.68			2.04			.15			2.97^{*}			.39			4.30^{**}	
PAR	**Primiparous**	2.76	.04	.31	.10	.01	.01							.20	.01	.08	.67	.01	.08
	PDQ				1.59	.33	2.34^{*}										.41	.06	.61
	PSS				.30	.99	.30										.41	.06	.55
	HCC				.52	.01	.13										-.02	-.01	-.01
	R^2		.01			.12									.01			.01	
	F for changes in R^2		.10			2.27									.01			.01	

															.01			.22	
	Primiparous	-6.11	-.09	-.70	-6.51	-.10	-.79	2.69	.04	.43	2.31	.03	.40	-2.36	-.03	-.38	-2.15	-.03	-.27
	PDQ				1.28	.26	1.97				1.37	.24	2.60**				.40	.06	.59
PSY	**PSS**				1.91	.27	2.01*				2.59	.33	3.57**				1.05	.13	1.22
	HCC				-.72	-.02	-.19				-.74	-.02	-.29				.10	.01	.02
	R^2		.01			.20			.01			.18			.01			.02	
	F for changes in R^2		.49			3.93*			.18			7.38**			.09			.62	

Note: Significance level at $^{*}p<.05$ and $^{**}p<.01$.
SOM = Somatization; OBS= Obsessive-Compulsive; SEN= Interpersonal Sensitivity; DEP= Depression; ANS= Anxiety; HOS= Hostility; PHO= Phobic Anxiety; PAR= Paranoid Ideation; PSY= Psychoticism; PDQ= Pregnancy Distress Questionnaire; PSS= Perceived Stress Scale; HCC= Hair Cortisol Concentrations

Psychopathological evolution and psychopathological symptomatology profile in the subsample of pregnant women assessed throughout the pregnancy

The repeated measures analysis showed differences in the hostility subscale [F (2, 1910) = 6.42; p <.01] between the first and second trimesters (p <.01) and the first and third trimesters (p <.01), the scores being higher in the first trimester. Similarly, the phobic anxiety subscale showed differences [F (2, 1910) = 23.20; p <.01] between the first and second trimesters (p <.01) and the first and third trimesters (p <.01), presenting a score decrease in the second and third trimesters with respect to the first. In addition, there were differences in the paranoid ideation scale [F (2, 1910) = 7.27; p <.01] between the first and second trimesters (p <.01) and the first and third trimesters (p <.01), in the psychoticism subscale [F (2, 1910) = 15.71; p <.01] between the first and second trimesters (p <.01) and the first and third trimesters (p <.01). The direction was the same as in the previous cases, showing a decrease in the second and third trimester scores compared to the first.

Table 4 shows the averages for each trimester, while Figure 3 presents the scores in for each trimester.

Table 4. Repeated measures ANOVA during pregnancy

	M(SD)			F		*p*
	T1	**T2**	**T3**			
SOM	56.88(24.49)	53.57(27.64)	53.35(27.27)	.93	T1=T2	.26
					T1=T3	.26
					T2=T3	.92
OBS	64.10(28.15)	60.95(31.81)	59.47(31.70)	1.14	T1=T2	.32
					T1=T3	.17
					T2=T3	.61
SEN	48.35(31.69)	47.36(31.59)	44.31(30.60)	.74	T1=T2	.74
					T1=T3	.27
					T2=T3	.39
DEP	42.12(26.15)	43.79(28.01)	43.56(29.58)	.24	T1=T2	.53
					T1=T3	.60
					T2=T3	.91
ANS	57.58(28.65)	54.94(31.71)	53.73(31.05)	.77	T1=T2	.39
					T1=T3	.28
					T2=T3	.66
HOS	55.81(28.76)	46.81(31.48)	42.65(31.35)	6.42	T1>T2	**.01**
					T1>T3	**.001**
					T2=T3	.23
PHO	72,79(25.16)	54.18(32.93)	47.87(35.34)	23.20	T1>T2	**.001**
					T1>T3	**.001**
					T2=T3	.10
PAR	57.64(30.90)	47.30(32.95)	43.06(35.50)	7.27	T1>T2	**.001**
					T1>T3	**.001**
					T2=T3	.22
PSY	70.86(26.41)	55.77(32.97)	50.92(33.86)	15.71	T1>T2	**.001**
					T1>T3	**.001**
					T2=T3	.19

Note: SOM = Somatization; OBS= Obsessive-Compulsive; SEN= Interpersonal Sensitivity; DEP= Depression; ANS= Anxiety; HOS= Hostility; PHO= Phobic Anxiety; PAR= Paranoid Ideation; PSY= Psychoticism; T1 = First trimester; T2 = Second trimester; T3 = Third trimester

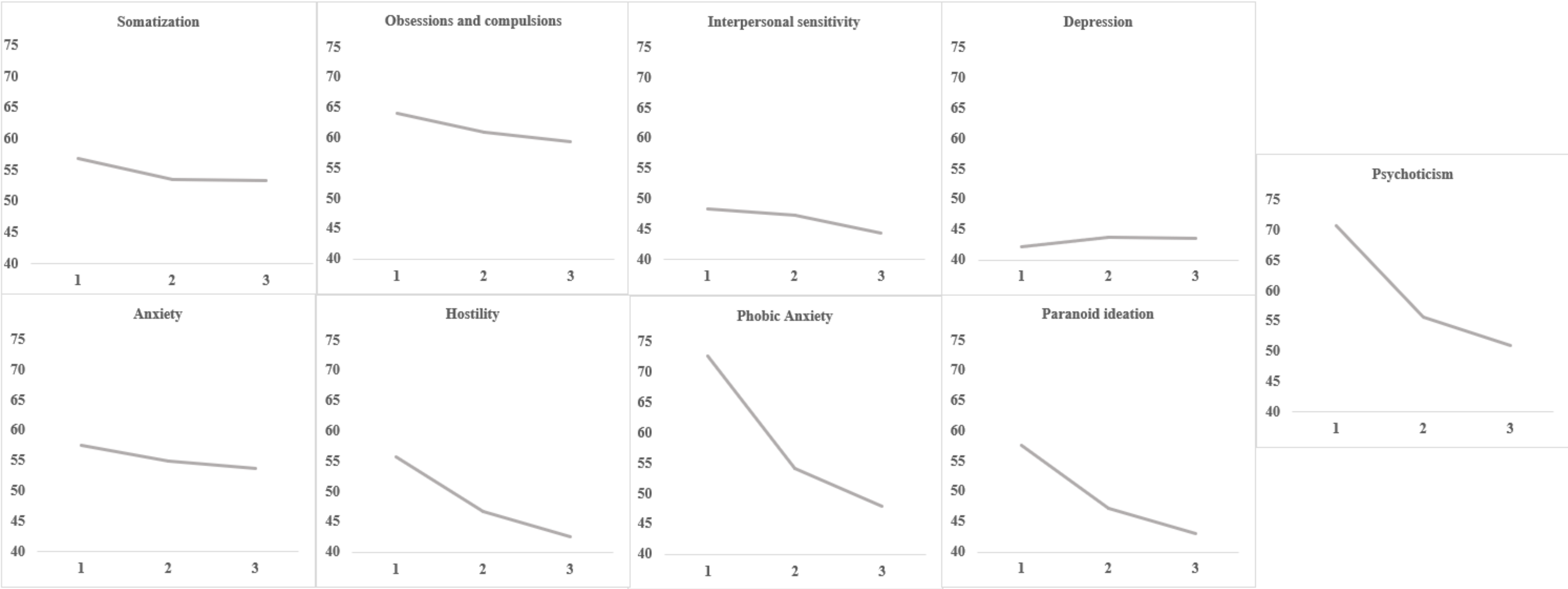

Figure 2. Psychopathological profile of pregnant women throughout pregnancy

Discussion

The objective of this study was, first of all, to verify whether there were differences between psychopathological symptoms, perceived stress and hair cortisol levels of pregnant women with respect to non-pregnant women. In addition, possible predictors of the differences between both groups were found including: specific pregnancy stress, perceived stress or hair cortisol levels. The last objective was to draw up a profile of the possible psychopathological symptoms experienced by pregnant women and their evolution throughout a pregnancy, in order to understand women's psychological state in the case of an intervention.

First, a frequency analysis was performed to verify whether a greater number of pregnant women presented clinical symptoms compared to pregnant women. Various psychopathological sub-scales were found in which the percentage of clinical symptoms was higher in pregnant women, such as somatisation, obsessions, compulsions, depression, anxiety, hostility, phobic anxiety, paranoid ideation and psychoticism in the first trimester, clinical differences in depression and anxiety being maintained in the third trimester. In this way, pregnant women clearly present a greater number and range of psychopathological symptoms, some of which are even clinical in nature, compared to non-pregnant women. It should also be noted that the percentage of clinical symptoms in pregnant women exceeded 50% of the sample in the case of obsessions and compulsions, anxiety and psychoticism in any pregnancy trimester. In addition, over 50% of pregnant women also showed clinical symptoms of phobic anxiety and paranoid ideation in the first trimester.

Based on these findings, we sought to know whether differences in psychopathology existed between pregnant and non-pregnant women. The findings showed that pregnant women had greater psychopathological symptoms on eight of the nine psychopathological subscales, five of them being significantly different. However, they scored below non-pregnant women on interpersonal sensitivity. Pregnant women presented higher levels in both perceived stress and hair cortisol levels, this difference being also significant regarding perceived stress throughout pregnancy and hair cortisol levels in the second and third trimesters.

Analysing each sub-scale in which differences were found individually, the somatisation subscale scores were higher in pregnant women. A large number of bodily and hormonal changes usually occur during a pregnancy, including changes in blood circulation, glandular functions and in the process of feeding pregnancy-related tissues. They entail greater efforts during which a pregnant woman's psychological sphere must adapt to all physical changes (Nayak, Poddar & Jahan, 2015). Different authors have found that both body adaptation and pregnancy-specific stress could explain the presence of such high symptomatology, which is why special attention should be given to avoid the problems deriving from it, both at an obstetric level and for health, generally (Haghparast, Faramazi & Hassanzadeh, 2016; Nakao, 2017; Séjourné, Callahan & Chabrol, 2010).

Another notable psychopathological symptom was interpersonal sensitivity, understood as the ability to perceive the behaviour of others appropriately and adjusted to reality, being able to take part satisfactorily in interpersonal relationships (Hall, Andrzejewsky & Yopchick, 2009). Lower levels were found in pregnant women. On some occasions, pregnant women claimed they had greater difficulties in creating and maintaining a social network that allowed them to interact appropriately, which could explain the lack of interpersonal sensitivity skills (Kingston, Heaman, Fell, Dzakpasu & Chalmers, 2012). A new problem thus arises, since the lack of such an ability in turn leads to a decrease in social support, which in turn is related to higher rates of stress, depression and anxiety during pregnancy (Evans, Heron, Lewis, Araya & Wolke, 2005; Howard et al., 2014; Raine, Boyce & Thorpe, 2019). Another subscale on which pregnant women in our study showed greater psychopathology was phobic anxiety, one of the most studied fears in pregnant women being fear of childbirth (O'Connell, Leahy-Warren, Kenny & Khashan, 2019; Simpson & Catling, 2016; Striebich, Mattern & Ayerle, 2018). Understandably, each pregnancy-related concern can lead to intense fears: these women face multiple medical tests and they are exposed to a large amount of information about foetal health and their own health. The latter may cause fears regarding the responsibility of caring for their baby and of lacking support as mothers (Brockington, Macdonald & Wainscott, 2006). These fears are reflected in pregnancy-specific stress that encompasses all pregnant women's concerns and may precede phobic anxiety (Caparros-Gonzalez et al., 2019; Lobel et al., 2008). These fears have even been related to the experience of childbirth, which is usually more traumatic, as well as longer pregnancies (Rondung, Ekdahl, Hildingsson, Rubertsson & Sundin, 2018; Yuksel, Akin & Durna, 2014). To this we must add the results of a recently published study which found that greater psychopathological symptomatology during the third trimester of pregnancy could predict the need for surgical intervention during childbirth (forceps, vacuum extraction, emergency caesarean section). The latter finding shows how, throughout a pregnancy, a pregnant woman's psychological condition as well as her fears have a powerful impact on birth variables (Romero-Gonzalez et al., 2019).

Other psychopathological variables especially worthy of attention are the highest scores found on the subscales related to paranoid and psychotic symptoms. These symptoms are usually regarded as a whole because paranoid ideation is considered as the stage preceding psychotic problems (Saarinen et al., 2018). In addition, paranoid ideation is defined as feelings of vulnerability in relation to others and fear of criticism (Saarinen et al., 2018). According to this definition, paranoid ideation seems to be related to two other symptoms already appearing in pregnant women: interpersonal sensitivity and phobic anxiety. Lack of sleep, considered one of the most widespread problems during pregnancy, has also been linked to paranoid ideation and psychoticism (Grezellschak, Jansen & Westermann, 2017; Román-Gálvez et al., 2018; Teran-Perez et al., 2012). These types of problems thus arise and are all related, with notable repercussions on maternal health. They can even turn into more serious problems such as cases of psychosis, which may be related to the appearance of puerperal psychosis or the appearance of a maladjusted relationship between mother and baby (Cès, Falissard, Glangeaud-Freudenthal, Sutter-Dallay & Gressier, 2018; Devi, 2015; Taylor, Broadbent, Khondoker, Stewart & Howard, 2018).

With respect to the second objective, differential effects were found between perceived stress and pregnancy-specific stress on most scales and according to the trimester. In the case of somatisations and interpersonal sensitivity, the greatest predictor was perceived stress. Pregnancy-specific stress has been related to worse obstetric outcomes, such as low birth weight or premature delivery (Lobel et al., 2008), but in this case, it seems that general stress was most closely related to the psychopathological symptomatology of pregnant women, as already demonstrated both in the general population and in pregnant women (Nakao, 2017). In the late stages of pregnancy, it was the fact of being or not primiparous that could be related to a worse symptomatology. This fact must be addressed due to the relationship between psychopathology and delivery results (Romero-Gonzalez et al., 2019). Similarly, in the case of phobic anxiety and psychoticism, perceived stress was differentially related to both psychopathologies depending on the trimester, pregnancy-specific stress being the predictor of psychoticism in the second trimester. A possible explanation for the differentiation between perceived stress and pregnancy-specific stress is the moment in time it is experienced, since it has been shown that pregnancy-specific stress increases as from the second trimester, while perceived stress is present even before pregnancy. This can be explained by the fact that pregnancy-specific stress affects psychopathology at a more advanced stage of pregnancy (Caparros-Gonzalez et al., 2019). These results highlight the need to address the pregnant women's psychological sphere, regardless of the type of stress or moment in time.

In order to understand the differences between pregnant and non-pregnant women, attention should be paid to the probable cognitive changes occurring during pregnancy (Anderson & Rutherford, 2012). Several authors, adopting an evolutionary approach, have compared human pregnancy with animal pregnancy, and have found that the survival instinct of the mother and the foetus underlies all cognitive changes, all these changes arising from the necessary adaptation to stay safe (Anderson & Rutherford, 2012). Changes found in women during pregnancy includes different emotional processing and facial recognition: they have been found to be more likely to recognise emotions such as fear or anger, which can lead to interpreting reality as threatening (Pearson, Lightman & Evans, 2009). In addition, pregnant women tend to show greater ethnocentrism during this period, identifying themselves as part of the group of pregnant women, which could also lead to the rejection of other groups, as well as a greater susceptibility to identifying threats outside their group (Anderson & Rutherford, 2011; Navarrete, Fessler & Eng, 2007). It is likely that all these changes occurring during a pregnancy cause the type of psychopathological symptomatology found in this article; fear and rejection of those belonging to a different group, the recognition of negative emotions or a greater likelihood of finding a situation threatening could explain the symptoms of interpersonal sensitivity, phobic anxiety, paranoid ideation or psychoticism

(Anderson & Rutherford, 2011; Anderson & Rutherford, 2012; Navarrete et al., 2007; Pearson et al., 2009).

Finally, the psychopathological evolution was analysed along the pregnancies, using a subgroup of pregnant women. A decrease in hostile psychopathological symptoms, phobic anxiety, paranoid ideation and psychoticism was observed throughout the pregnancies. In this case, the highest scores corresponded to the first trimester, which could reflect the ambivalent period in which they were exposed, since fears and doubts about the future of the pregnancy are very intense in the first weeks (Downe, Finlayson, Tunçalp & Gülmezoglu, 2016).

The present study gives a highly complete description of how pregnant women's psychological aspects function compared to that of non-pregnant women, using hormonal tests of chronic stress such as hair cortisol levels, and a psychological assessment that addressed both perceived stress and pregnancy-specific stress, in addition to the psychopathological symptoms surrounding pregnancy. A possible limitation of this study was the total number of participants in each group, as well as not having explored the desire of the group of non-pregnant women to conceive a child, which could have provided more specific information on these differences. In addition, future research could include women with high-risk pregnancies, to verify whether their psychopathological course differs from that of women with low-risk pregnancies.

Pregnancy is a vital, complex and multidimensional period. This fact makes it more difficult to establish clear and strong relationships, and even more so when addressing the mother's psychological sphere. With regards to psychopathology during pregnancy, this study presented a more in-depth examination of the psychopathological symptoms of pregnant women compared to that of a group of healthy non-pregnant women. This approach turns this work into a pioneering study. To conclude, the psychological difficulties accompanying the very fact of being pregnant were revealed: a psychological approach to pregnant women is thus essential. In this line, it is notable that the most conclusive data indicate that pregnancy is a different evolutionary period. Pregnant women, therefore, represent a more vulnerable population that must be cared for in a personalised way, studying not only their physical evolution but also their psychological state.

CAPÍTULO X. Hair cortisol levels, psychological stress and psychopathological symptoms prior to instrumental deliveries.

Romero-Gonzalez, B., Caparros-Gonzalez, R. A., Gonzalez-Perez, R., Coca-Arco, S., & Peralta-Ramirez, M. I. (2019). Hair cortisol levels, psychological stress and psychopathological symptoms prior to instrumental deliveries. *Midwifery*, *77*, 45-52. doi: 10.1016/j.midw.2019.06.015

Introduction

Pregnancy is a highly stressful period due to the many challenges it presents. These include physical changes, concerns about motherhood, tension in personal relationships, fear of childbirth and worries about the infant's health (Lobel & Dunkel-Schetter, 2016). These all correspond to a particular kind of stress, termed pregnancy-specific stress, which can lead to negative health outcomes for the mother and her newborn infant. Pregnancy-specific stress has been associated with a higher risk of spontaneous abortion, preterm delivery and low birth weight, as well as postpartum depression and even poor cognitive neurodevelopment in the infant (Alderdice, Lynn & Lobel, 2012; Caparros-Gonzalez et al., 2017; Romero-Gonzalez, Caparros-Gonzalez, Gonzalez-Perez, Delgado-Puertas & Peralta-Ramirez, 2018). It has been reported to be a better predictor of negative outcomes than general stress, and together with depression and anxiety, it poses a major problem for mothers (Alderdice et al., 2012; Lobel & Dunkel-Schetter, 2016).

From the biological point of view, cortisol is released as a result of experiencing psychological stress (El-Farhan, Rees & Evans, 2017). Cortisol levels can be measured in hair, saliva or blood, but hair offers the unique advantage of providing retrospective information. In addition, collection is non-invasive and hair is easy to handle and transport (Wright, Hickman & Laudenslager, 2015). However, the most important advantage of hair is that it provides information on chronic stress levels in the months prior to collection, because cortisol is deposited and stored in the capillary root (Wright et al., 2015). High cortisol levels during pregnancy have been associated with preterm delivery, delivery complications, maternal illness, postpartum depression and permanent changes in infant physiology (Caparros-Gonzalez et al., 2017; Hoffman, Mazzoni, Wagner, Laudenslager & Ross, 2016; Littleton, Bye, Buck & Amacker, 2010; Romero-Gonzalez et al., 2018). High saliva cortisol has also been reported to be a predictor of low birth weight (van den Heuvel, van Assen, Glover, Claes & Van den Bergh, 2018).

Psychological stress and cortisol levels both increase towards the end of gestation, and a marked rise in these variables may be related to delivery complications, which in turn are associated with a higher risk for mothers and babies (Mylonas & Friese, 2015; Rallis, Skouteris, McCabe & Milgrom, 2014; Sandman et al., 2006). Labour is a decisive process in a pregnant woman's life, since it has been demonstrated that instrumental deliveries reduce the probability of wanting to have another baby (Elvander, Dahlberg, Andersson & Cnattingius, 2015). Furthermore, instrumental deliveries and caesarean sections both have repercussions for maternal and child health and are associated with worse obstetric outcomes in subsequent pregnancies and children (Black, Bhattacharya, Philip, Norman & McLernon, 2015; Hu et al., 2018; Youssef, Ramalingam, Macleod & Murphy, 2005).

Maternal age, a higher body mass index, previous instrumental deliveries and first pregnancies are among the risk factors that have been related to instrumental deliveries and caesarean sections (Dietz, Lanzarone & Simpson, 2006; Roos, Sahlin, Ekman-Ordeberg, Kieler & Stephansson, 2010). In terms of psychological variables in pregnant woman, some studies have reported that depression and anxiety are related to delivery complications (Alder, Fink, Bitzer, Hösli & Holzgreve, 2007), but this relationship remains inconclusive since other studies have failed to find the same association (Larsson, Sydsjö & Josefsson, 2004). However, these studies were conducted on women with a depressive or anxiety disorder, and no comparisons were performed with the psychological profile of healthy pregnant women. Besides the lack of agreement regarding the relationship between psychopathology and delivery, it should be noted that to the best of our knowledge, there is no evidence of the role of chronic and pregnancy-specific stress in delivery complications.

Consequently, given the possible impact of stress in the final stages of gestation on delivery, the aim of the present study was to determine which psychological (perceived stress, pregnancy-specific stress and psychopathology symptoms), physiological (hair cortisol), sociodemographic and obstetric variables, collected during the third trimester of pregnancy, are associated with important delivery variables (eutocic or instrumental delivery, spontaneous or induced labour).

Methods

Sample size estimation

To the best of our knowledge, there are no research papers published studying the relationship between stress, cortisol or anxiety with the mode of delivery. Nevertheless, there are some studies which aim was to find out the relationship between mode of delivery and personality. Within personality traits, “emotional stability” is very related to stress and anxiety.

Sample size estimation was calculated using this variable and its relation to the mode of delivery in Johston & Brown (2012). G*Power (Faul, Erdfelder, Buchner & Lang, 2009) was used to calculate the sample size to achieve 80% power and contrast the null hypotheses H_0:$\mu 1=\mu 2$ at the 5% alpha level. Comparing two independent means (t-test) using mean scores and deviation standards of Johnston & Brown (2012) of two groups (vaginal delivery vs instrumental delivery), the sample size required were 54 participants, 26 for each group (Cohen’s d =, 71).

Participants

A total of 101 women agreed to participate in the study. Of these, 6 were excluded for failure to complete the psychological evaluation, 3 because insufficient hair was collected for cortisol extraction and 2 for not providing delivery information. Another 2 participants were eliminated from the analysis because they were outliers. Thus, the final sample consisted of 88 pregnant women attending the Gongora and Mirasierra health centres in the province of Granada. Participants were aged between 23 and 43 years old and all were evaluated in the third trimester of pregnancy. A flow diagram can be consulted in Figure 1.

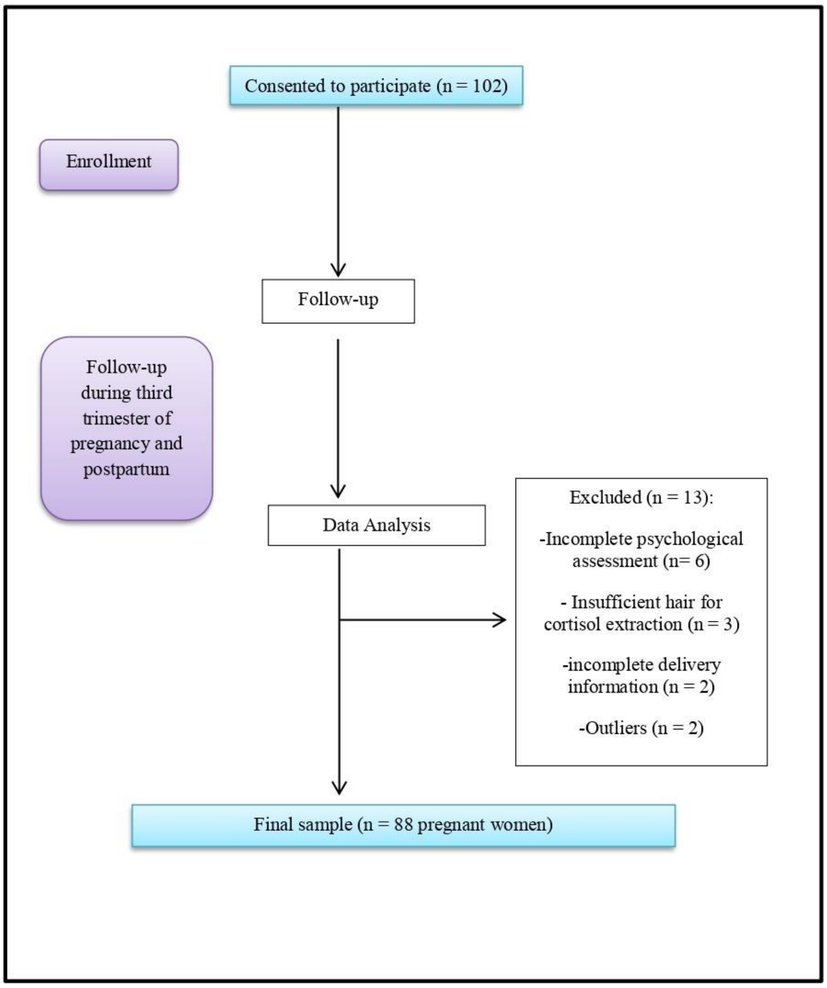

Figure 1. Flow diagram of the participants.

The inclusion criteria were: being over 18 years old, having a command of the Spanish language (writing, speaking and listening and reading comprehension), attending antenatal care in public health centres and being between weeks 28 and 37 of gestation. The exclusion criteria were: previous or present physical or psychological illness, high risk pregnancies or receiving glucocorticoid treatment.

After delivery, participants were divided into groups according to type of delivery (eutocic or instrumental delivery) and onset of labour (spontaneous or induced labour). First, 59 participants were included in the eutocic delivery group (*mean (M)* = 32.56 years; Standard deviation (*SD*) = 3.98), and 29 women were included in the instrumental delivery group (*M* = 32.83 years; *SD* = 3.80). The instrumental delivery group was further sub-divided into those assisted by emergency caesarean section (n = 18), forceps (n = 3) or vacuum (n = 8). Second, participants were divided into two groups according to onset of labour (spontaneous or induced). Fifty-four women (*M* =32.41 years; *SD* = 4.05) were included in the spontaneous onset group and 34 women (*M* = 33.03 years; *SD* = 3.68) in the induced onset group.

The study met the ethical standards established by the Declaration of Helsinki (revised in Fortaleza, Brazil, 2013) and was reviewed and approved by the Human Research Ethics Committee at the University of Granada (reference 881) and the Ethics Committee for public health services in the province of Granada. All participants read the study information sheet and gave their signed informed consent. Besides, this study has a longitudinal design and all data were obtained between September 2017 and October 2018.

Instruments

We collected sociodemographic, obstetric, delivery and newborn somatometric data from the pregnant women's health records (Andalusian Ministry of Health, 2010). The variables included information on obstetric risk, medical history, history of pregnancy, type of pregnancy, number of children, if this was the first pregnancy, number of spontaneous abortions, gestational age at birth, birth weight in grams (g) and length at birth in centimeters (cm).

Psychological evaluation

Psychological evaluation was carried out using the following instruments:

The **Prenatal Distress Questionnaire** (PDQ; Caparros-Gonzalez et al., 2019; Yali & Lobel, 1999): this is a 12-item self-report scale that measures pregnancy-specific stress related to maternal concerns about pregnancy, medical problems, labour and delivery, physical symptoms, bodily changes, parenting, interpersonal relations and the baby's health. Responses are given using a 5-point Likert-type scale where 0 = not at all and 4 = very much. The Cronbach's alpha reliability coefficient is 0.71 (Caparros-Gonzalez et al., 2019).

The **Perceived Stress Scale** (PSS-14; Cohen, Kamarck & Mermelstein, 1983; Remor, 2006): this is a 14-item scale that measures general stress. Responses are given using a 5-point Likert-type scale where 0 = never and 4 = very often. Scores range from 0 to 56, and the higher the score, the greater the perceived stress. This scale has obtained a high Cronbach's alpha (0.81) for internal consistency (Remor, 2006).

The **Symptom Checklist-90-Revised** (SCL-90-R; Caparros-Caparros, Villar-Hoz, Juan-Ferrer & Viñas-Poch, 2007; Derogatis, 1975): this measures the subject's perceived distress in nine primary dimensions (somatisation, obsessive-compulsive, interpersonal sensitivity, depression, anxiety, hostility, phobic anxiety, paranoid ideation and psychoticism) and three global indices of psychological distress (global severity index, positive symptom distress index and total positive symptoms). It is a 90-item self-report inventory and items are scored using a 5-point Likert-type scale, where 1 = never and 5 = very often. The nine dimensions show an acceptable reliability, with a Cronbach's alpha for internal consistency of 0.81 (Caparros-Caparros et al., 2007).

Biological evaluation

The hair samples consisted of locks of approximately 150 strands of hair taken from the posterior vertex, cut as closely to the scalp as possible, with a length no greater than 3 cm (assuming an average growth rate of 1 cm/month, a 3 cm segment contains cortisol that has been deposited over approximately the last 3 months) (Sauvé, Koren, Walsh, Tokmakejian & Van Uum, 2007). Each sample was then wrapped in aluminium foil to protect it from light and humidity, and stored in an envelope at room temperature. Later, the samples were analysed in the Department of Pharmacology at the University of Granada, Spain. The hair samples were weighed and ground to a fine powder to break up the hair's protein matrix and increase the surface area for extraction using a ball mill. Cortisol from the interior of the hair shaft was extracted into HPLC-grade methanol by incubation of the sample for 72 hours at room temperature in the dark with constant inversion using a rotator. After incubation, the supernatant was evaporated until completely dry using a vacuum evaporator and the extract was reconstituted in 150 ul of phosphate buffered saline at a Ph of 8.0 (Meyer, Novak, Hamel & Rosenberg, 2014). The reconstituted sample was immediately frozen at -20 for later analysis (Meyer et al., 2014; Russell et al., 2015). The cortisol in the hair sample was measured using the salivary ELISA cortisol kit with the reagent provided following the manufacturer's directions. Using a salivary ELISA cortisol kit is a validated method to assess hair cortisol levels and is highly positive correlated with liquid chromatograph±mass spectrometry (LC±MS/MS) (Russell et al., 2015).

The sensitivity of the cortisol ELISA kit is 1.0 ng/ml as reported by the manufacturer and the cross reactivity is as follows: Prednisolone 13.6%, Corticosterone 7.6%, Deoxycosticosterone 7.2%, Progesterone 7.2%, Cortisone 6.2%, Deoxycortisol 5.6%, Pednisone 5.6% and Dexamethasone 1.6%. No cross-reaction was detected with DHEAS and Tetrahydrocortisone. The intra- and inter-assay variations were analyzed on internal quality controls used for routine salivary cortisol measurement, measured in duplicate on eight consecutive assays. The intra-assay coefficients of variance (CV) were 2.7% at 10.7 ng/ml and 4.3% at 43.9 ng/ml. The inter-assay CVs were 4.4% and 6.3%, respectively (Caparros-Gonzalez et al., 2017; Romero-Gonzalez et al., 2018).

Procedure

All participants were informed of the study by their midwife at the health centre when attending their third trimester check-up. Those who agreed to participate read and signed the informed consent document, which explained the study procedure, anonymity of their personal information and their freedom to abandon the study at any time. After signing the consent form, participants completed the questionnaires (PDQ, PSS and SCL90-R), and then a hair sample was collected for subsequent cortisol extraction. After delivery, data on all labour, delivery and newborn somatometric variables were collected during the postpartum appointment with the midwife.

Data analysis

First, we calculated the means and percentages for the main sociodemographic and obstetric variables in the study sample. Then, in order to determine differences in the main sociodemographic, obstetric and newborn somatometric variables between eutocic versus instrumental delivery or spontaneous versus induced onset of labour, we conducted various Student's *t* -tests (quantitative variables) and Chi-squared tests (qualitative variables).

Lastly, in order to determine differences in the scores obtained for stress, psychopathology and hair cortisol between eutocic versus instrumental delivery or spontaneous versus induced onset of labour, we conducted various Student's *t*-tests where the independent variables were type of delivery and onset of labour and the dependent variables were scores obtained for the PSS, PDQ, cortisol and the various subscales of the SCL-90R. Gestational age at birth was included as a covariable in the analyses.

For hair cortisol, we performed a log transformation (natural log; ln base e) in order to obtain a normal distribution. Analyses were performed using the Statistical Package for the Social Sciences 20.0 for Windows, version 8.1 (SPSS, Armonk, New York).

Results

Description of the sample

The final study sample consisted of 88 pregnant women in their third trimester of gestation (M = 34.33 week of gestation; *SD* = 2.70), with a mean age of 32.65 years (*SD* = 3.90). Table 1 gives the main sociodemographic, anthropometric, lifestyle and obstetric history variables. For 53.4% of participants, this was their first pregnancy, while for the remaining 46.6%, it was at least their second pregnancy. Some 19.3% had conceived using assisted reproductive technology, while 80.7% had conceived spontaneously.

Sociodemographic and obstetric differences according to type of delivery and onset of labour

First, participants were divided into two groups according to type of delivery (eutocic vs instrumental delivery). Table 1 gives the main sociodemographic, obstetric and newborn somatometric variables. Our results revealed statistically significant differences in gestational age at birth (t = 2.23; p < 0.02), whereby women in the eutocic delivery group presented a longer pregnancy than women in the instrumental delivery group. We found no significant differences between the two groups for the remaining sociodemographic or obstetric history variables (Table 1).

Table 1. Differences in sociodemographic variables, obstetric information and newborn somatometric data in terms of type of delivery and onset of labour.

		Total sample (n=88) M(SD)/n(%)	Eutocic delivery (n= 59) M(SD)/n(%)	Instrumental delivery (n=29) M(SD)/n(%)	t/chi*	*p*	Spontaneous labour (n=54) M(SD)/n(%)	Induced labour (n=34) M(SD)/n(%)	t/chi*	*p*
Sociodemographic variables										
Age		32.65 (3.90)	32.56 (3.98)	32.83 (3.80)	-0.30	0.76	32.41 (4.05)	33.03 (3.68)	-0.72	0.47
Nationality	Spanish	66(75%)	46(78%)	29(69%)	0.84	0.25	39(72.2%)	27(79.4%)	0.57	0.31
	Immigrant	22(25%)	13(22%)	9(31%)			15(27.8%)	7(20.6%)		
Marital status	Single/divorced/widow	1(1.1%)	-	1(3.4%)	2.05	0.33	-	1(2.9%)	1.60	0.38
	Married/cohabitant	87(98.9%)	59(100%)	28(9.6%)			54(100%)	33(97.1%)		
Education	Primary school	1(1.1%)	1(1.7%)	-	1,03	0,79	1(1.9%)	-	1.31	0.72
	Secondary school	21(23.9%)	15(25.4%)	6 (20.7%)			13(24.1%)	8(23.5%)		
	University	65(73.9%)	42(71.2%)	23 (79.3%)			39(72.2%)	26(76.5%)		

	No education	1(1.1%)	1(1.7%)	-			1(1.9%)	-		
Employment situation	Employed	69(78.4%)	46(78%)	23(79.3%)	0.02	0.55	43(79.6%)	26(79.6%)	0.12	0.46
	Unemployed	19(21.6%)	13(22%)	6(20.7%)			11(20.4%)	8(23.5%)		
Height		1.64(0.05)	1.65(0.05)	1.64(0.05)	0.47	0.64	1.65(0.56)	1.64(0.51)	1.13	0.26
BMI		22.30	21.79	23.27	-1.37	0.17	21.87	22.99	-1.05	0.29
		(4.58)	(4.90)	(3.77)			(5.01)	(3.74)		
Smoker	No	83(94.3%)	55(93.2%)	28(96.6%)	0.40	0.46	51(94.4%)	32(94.1%)	0.00	0.55
	Yes	5(5.7%)	4(6.8%)	1(3.4%)			3(5.6%)	2(5.9%)		
Alcohol	No	82(93.2%)	56(100%)	26(89.7%)	0.84	0.30	51(94.4%)	31(91.8%)	0.35	0.42
	Yes	6(6.8%)	3(5.1%)	3(10.3%)			3(5.6%)	3(8.8%)		
Hair	Dyed	49(55.70%)	30(50.8%)	19(65.5%)	1.69	0.14	31(57.4%)	18(52.9%)	0.16	0.42
	Natural	39(44.3%)	29(49.2%)	10(34.5%)			23(42.6%)	16(47.1%)		
Obstetric information										
Pregnancy method	Spontaneous	71(80.7%)	50(84.7%)	21(72.4%)	1.89	0.13	44(81.5%)	27(79.4%)	0.05	0.51
	Fertility treatment	17(19.3%)	9(15.3%)	8(27.6%)			10(18.5%)	7(20.6%)		
Previous children	0	52(59.1%)	32(54.2%)	20(69%)	3.79	0.15	31(57.4%)	21(61.8%)	2.07	0.35

	1	27(30.7%)	22(37.3%)	5(17.2%)			19(35.2%)	8(23.5%)		
	≥ 2	9(10.2%)	5(8.5%)	4(13.8%)			4(7.4%)	5(14.7%)		
Primiparous	No	41(46.6%)	31(52.5%)	10 (34.5%)	2.54	0.08	25(46.3%)	16(47.1%)	0.00	0.55
	Yes	47(53.4%)	28(47.5%)	19 (65.5%)			29(53.7%)	18(52.9%)		
Previous miscarriages	0	65(73.9%)	42(71.2%)	23(79.3%)	0.98	0.61	40(74.1%)	25(73.5%)	0.67	0.71
	≥ 1	23(26.1%)	17(28.8%)	6(20.7%)			14(25.9%)	9(26.5%)		
Gestational age		39.53	39.78	39.07	2.23	**0.02**	39.52	39.56	-0.13	0.89
		(1.39)	(1.24)	(1.60)			(1.39)	(1.41)		
Newborn anthropometric measures										
Birthweight (gr)		3263(434.96)	3284.05(382.55)	3220.17(530.92)	0.64	0.52	3314.07(380.83)	3181.88(504.78)	1.39	0.16
Length (cm)		50.24	50.31	50.10	0.20	0.84	50.87	49.21	1.67	0.09
		(4.52)	(5.07)	(3.20)			(2.01)	(6.81)		

Note: * Student's t-test used for quantitative variables and Chi-square test for categorical variables. BMI: Body Mass Index.

Second, participants were divided into two groups according to onset of labour (spontaneous vs induced onset). Again, Table 1 gives the main sociodemographic, obstetric history and newborn somatometric variables. As can be seen, we found no differences between the two groups for sociodemographic, obstetric history or newborn variables.

Psychological and hormonal status of the mother in the third trimester, and relationship with type of delivery and onset of labour

As regards type of delivery and onset of labour in relation to the main variables of stress, hair cortisol and psychopathology symptoms in the third trimester, our results indicated statistically significant differences between type of delivery (eutocic vs instrumental delivery) and the scores obtained in the third trimester for the SCL-90-R subscales somatization ($t = 6.98$; $p = 0.01$), anxiety ($t = 3.42$; $p < 0.05$), depression ($t = 5.20$; $p < 0.02$) and psychoticism ($t = 5.28$; $p < 0.01$), and for two of the SCL-90-R global indices; the global severity index ($t = 5.57$; $p < 0.05$) and total positive symptoms *(T* = 5.21; $p < 0.01$). We also found borderline statistically significant differences in interpersonal sensitivity, obsessive-compulsive and the positive symptom distress index, which presented a statistical significance below 0.07. As can be seen in Figure 2, the mean scores for these psychopathology variables in the third trimester of pregnancy were higher in the instrumental than the eutocic delivery group.

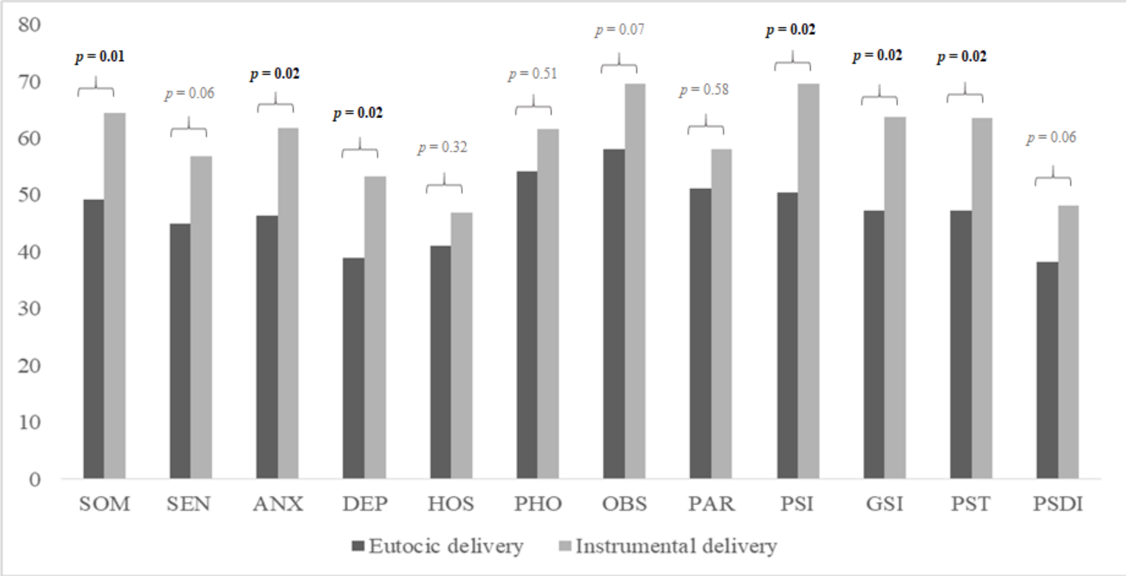

Figure 2. Difference between eutocic delivery and instrumental delivery in SCL-90-R scores.

Note: SOM = Somatizations; SEN = Interpersonal sensibility; ANX = Anxiety; DEP = Depression; HOS = Hostility; PHO = Phobic anxiety; OBS = Obsession and compulsion; PAR = Paranoid ideation; PSI = Psychoticism; GSI = Global Severity Index; PST = Positive Symptoms Total; PSDI = Positive Symptoms Distress Index

We did not observe any statistically significant differences between type of delivery and stress variables. Neither did we find any differences between the spontaneous vs induced onset of labour groups as regards stress variables, psychopathology or hair cortisol in the third trimester.

Discussion

Our main finding was that the mother's psychological status in the third trimester was associated with type of delivery. Women who scored higher for psychopathology in the third trimester were more likely to have an instrumental delivery than women who scored lower. The psychopathology variables that obtained the highest scores were somatization, anxiety, depression and psychoticism, as well as the global severity and positive symptom indices. In addition, we found that variables such as obsessive-compulsive, interpersonal sensitivity and total positive symptoms might also exert an effect, albeit with borderline significance. However, stress in the third trimester (measured by self-report and cortisol) was not associated with having a eutocic or instrumental delivery or a spontaneous or induced onset of labour.

Our results indicate higher rates of psychopathology symptoms in the third trimester in women who subsequently had an instrumental delivery, which is consistent with studies reporting that high levels of anxiety and depression are associated with a higher incidence of obstetric complications (Alder et al., 2007). In addition, the wide variety of psychopathology symptoms studied extended the number of psychopathologies associated with delivery beyond those previously analysed, such as anxiety and depression. At this level, we observed higher scores for somatization and psychoticism during pregnancy prior to instrumental delivery.

The psychological preparation or status of the mother before birth may play a decisive role in this process. It has been suggested that pregnant women who present a greater fear of childbirth may experience a longer duration of labour (Adams, Eberhard-Gran, Sandvik, Eskild, 2012). Our results coincide with those reported in other studies (Handelzalts et al., 2015), which found that a poor psychological status, defined as a low self-esteem, lack of social skills, neuroticism, low extraversion and vulnerability, was associated with a greater fear of childbirth and a higher number of obstetric complications and instrumental deliveries (Handelzalts et al., 2015). The authors concluded that high levels of fear of childbirth may interfere with coping skills during labour and thus give rise to the need to use surgical instruments for delivery (Handelzalts et al., 2015). There are multiple causes of fear of childbirth, including a pregnant woman's psychological characteristics, personality and previous experiences. Thus, in order to reduce the fear of childbirth, psychological characteristics should be addressed on an individual basis (Handelzalts et al., 2015).

These findings have important clinical implications because instrumental deliveries involve higher risks for mothers and infants alike (Mylonas & Friese, 2015). Pregnant women have now begun to choose and request instrumental deliveries as a result of fear, depression and anxiety; hence, it is vital to treat these symptoms in order to ensure maternal and infant well-being and reduce the demand for an instrumental delivery (Akintayo et al., 2014; Stützer et al., 2017).

Although we obtained clear results with respect to psychopathology, it is interesting to note that we found no differences between the eutocic vs instrumental delivery groups as regards psychological or pregnancy-specific stress or hair cortisol levels. These results are inconsistent with those reported in other studies (Braig et al., 2015), which found that women who had an instrumental delivery previously presented lower hair cortisol levels than women who had a eutocic delivery (Braig et al., 2015). Although we did not detect any significant differences, our data suggested a similar albeit non-significant trend whereby women in the instrumental delivery group presented lower mean hair cortisol levels. These two findings are consistent with the role of stress, because in a process such as childbirth, it is probably beneficial for the individual to experience an appropriate response to stress, activating the alarm system and preparing the body to fight, whereas an insufficient response to stress during childbirth might increase the individual's need for assistance, which could be associated with an instrumental delivery.

As regards spontaneous or induced onset of labour, we did not observe any relationship whatsoever with the psychological variables studied or with hair cortisol levels. This may be because a multitude of factors could trigger or delay the onset of labour, and therefore this might bear more relation to individual biological factors (Denison, Price, Graham, Wild & Liston, 2008; Mozurkewich, Chilimigras, Koepke, Keeton & King, 2009; Prosser, Barnett & Miller, 2018).

This study presents a series of limitations, one of which was sample loss. In prospective studies that involve follow-up after a life event as stressful as childbirth, it is especially hard to maintain the sample. In addition, hair cortisol assessment nearly always involves the appearance of outliers, with the consequent elimination of participants from the analysis. Another limitation concerned the low incidence of caesarean sections, obliging us to include them as instrumental deliveries; despite the fact that all the caesarean sections included in the sample were emergency caesarean sections, which imply a surgical treatment, as instrumental deliveries, it should be noted that women who have elective caesarean sections may present a different stress profile during pregnancy. Besides, there reasons for planned or elective caesarean sections that can vary widely from instrumental deliveries, and may not be related to maternal stress, such as breech presentations prior to labor. For that reason, future researches could have an interest in studying if there is any difference in psychological symptoms in instrumental deliveries and planned or elective caesarean sections.

Nevertheless, our study also presents various strengths, including a prospective design measuring hormonal and psychological parameters, as well as specific measures of pregnancy. Previous studies on pregnancy using the same type of sample have measured cortisol in blood or saliva, limiting the information obtained (Russell, Koren, Rieder & Van Uum, 2012). Using hair cortisol levels give us information about chronic stress, that perhaps need to be study among the whole pregnancy in order to find strong associations. For that reason, it is very important to test hair cortisol levels as the predictive measure of several aspects of pregnancy, such as its relationship with postpartum depression or neonatal hair cortisol levels (Caparros-Gonzalez et al., 2017; Romero-Gonzalez et al., 2018). Our study also enabled us to investigate the relationship between maternal psychological and sociodemographic variables, and biological measures, onset of labour, type of delivery and newborn somatometric variables.

Conclusions

The psychological characteristics of pregnant women in the weeks leading up to childbirth may determine the type of delivery, which in turn can affect maternal and infant health. Thus, an analysis of psychological and hormonal aspects in relation to labour, delivery and newborn variables could help inform future health education and prevention interventions (Gilles et al., 2018). In addition, the psychological assessment and treatment of pregnant women could play a key role in enhancing maternal mental health and preventing the processes and outcomes associated with poor psychological status. For example, evidence-based psychological therapies are highly effective in helping to cope with stress, fear of childbirth, depression, anxiety, somatisation, phobias and all the other psychological challenges involved in such a major life event as having a child.

BLOQUE 3. Estrés perinatal y consecuencias en la descendencia.

CAPÍTULO XI. Newborn infants' hair cortisol levels reflect chronic maternal stress during pregnancy.

Romero-Gonzalez, B., Caparros-Gonzalez, R. A., Gonzalez-Perez, R., Delgado-Puertas, P. y Peralta-Ramirez, M. I. (2018). Newborn infants' hair cortisol levels reflect chronic maternal stress during pregnancy. *PloS One, 13*(7), e0200279. doi: 10.1371/journal.pone.0200279

Introduction

High levels of prenatal stress can have negative consequences for maternal, fetal, and infant health (Cardwell, 2013; Entringer, Buss & Wadhwa, 2015; Ruiz & Avant, 2005). The various methods used to assess stress during pregnancy and postpartum (Caparros-Gonzalez et al., 2017; Perez-Ramirez, Garcia-Garcia, Caparros-Gonzalez & Peralta-Ramirez, 2016) include the administration of psychological questionnaires and the measurement of hair cortisol, which is a non-invasive biological method for obtaining retrospective information on chronic stress (Grass et al., 2015; Stalder & Kirschbaum, 212; Witalison, Thompson & Hofseth, 2016). The relationship between psychological stress and cortisol levels in pregnant women is inconsistent, as it seems to depend on the matrix of the cortisol sample (Voegtline et al., 2013). For example, there seems to be a relationship between salivary cortisol and anxiety and depression (Evans, Myers & Monk, 2008). However, several authors have proved that there is no association between hair cortisol levels and self-reported symptoms of prenatal distress or perceived stress (Mustonen et al., 2018; Stalder et al., 2017).

High hair cortisol levels during pregnancy have been associated with an increased risk of miscarriage, premature birth, and low weight at birth (D'Anna-Hernandez, Ross, Natvig, Laudenslager, 2011; Karlen et al., 2015); however, no conclusive results have been reported concerning the relationship between maternal cortisol and neonatal cortisol at birth. Primate studies have found higher maternal hair cortisol levels in the latter stages of pregnancy, and a negative relationship between this and birth weight (Dettmer et al., 2015; Dettmer et al., 2017). They have also reported lower hair cortisol levels in infant monkeys born to mothers exposed to stress during pregnancy (Kapoor, Lubach, Ziegler & Coe, 2016).

In humans, only a few studies have analyzed maternal stress levels in relation to those of their newborn infants (Flom, John, Meyer & Tarullo, 2017: Hoffman, D;Anna-Hernandez, Benitez, Ross & Laudenslager, 2017; Liu, Fink, Brentani & Brentani, 2017), and a positive relationship has been found between maternal and infant hair cortisol at 6, 9, and 12 months after birth (Flon et al., 2017; Hoffman et al., 2017; Liu et al., 2017). These studies were carried out by taking hair cortisol samples after birth, without taking into account the pregnancy (Liu et al., 2017). Only one study has compared hair cortisol levels in mothers and premature babies immediately after birth, but no relationship was found (Hoffman et al., 2017). However, no study on humans has taken the entire pregnancy into consideration.

Therefore, the objective of the present study was to analyze the relationship between maternal psychological stress and hair cortisol levels throughout the three trimesters of pregnancy and postpartum, and neonatal hair cortisol levels.

Methods

Participants

A total of 154 pregnant women from the Góngora Health Center (Granada), Roquetas de Mar Health Center (Almeria), and the Poniente Hospital in El Ejido (Almeria) signed an informed consent form. Seven had a miscarriage and 46 were excluded from the study for failure to complete all assessments. A further 21 were excluded because their newborn infants did not have sufficient hair for cortisol extraction. Hence, the final study sample comprised 80 pregnant women and 80 newborn infants (Figure 1). The women were longitudinally assessed in the first trimester of pregnancy (*M* = 11.48 weeks of gestation, *SD* = 3.72), the second trimester (*M* = 24.19 weeks of gestation, *SD* = 3.75), and the third trimester (*M* = 34.49 weeks of gestation, *SD* = 2.46).

In addition, hair samples were collected from mothers and infants after birth (*M* = 15.79 days postpartum, *SD* = 9.78). Data were collected from April 2016 to July 2017.

As inclusion criteria, participants were over 18 years of age, had a good level of spoken and written Spanish, and their pregnancy was being monitored in the public health system. In addition, their infants had to have a minimum amount of 10 mg hair on their heads in order to take and analyze hair samples (Meyer, Novak, Hamel & Rosernberg, 2014).

The exclusion criteria were having been administered corticosteroids during pregnancy, high risk pregnancies, or being diagnosed with any psychiatric condition or physical disease.

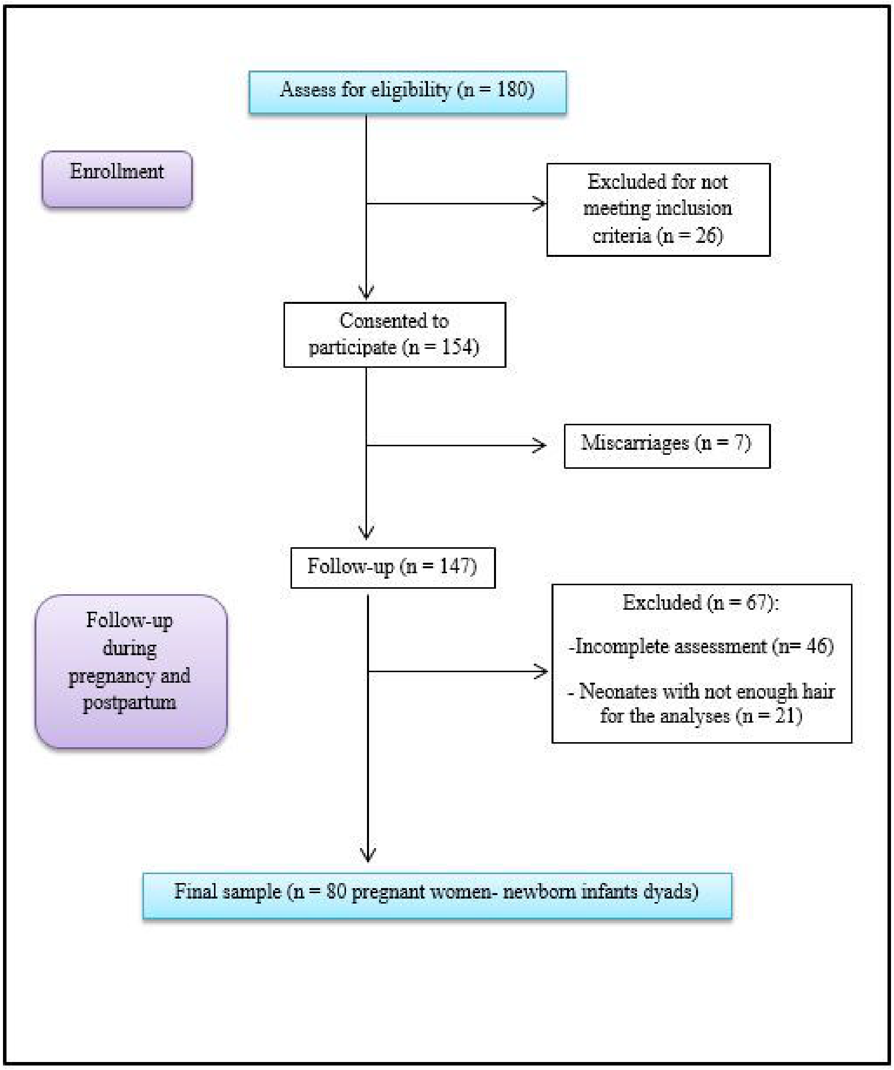

Figure 1. Participant follow-up flow diagram.

The protocol study "Influence of the hypothalamic-pituitary-adrenal axis on maternal and fetal health during pregnancy, childbirth, and the puerperium period" met the ethical standards established by the Declaration of Helsinki (revised in Fortaleza, Brazil, 2013) and was reviewed and approved by the Ethics Committee for Human Research at the University of Granada (reference number 881) and the Research Ethics Committee of the public health service in Granada and Almeria. As part of the protocol, the present study entitled "Newborn infants' hair cortisol levels reflect chronic maternal stress during pregnancy" was also reviewed and approved by the abovementioned institutional review boards.

Measures

Hair cortisol levels

Activation of the hypothalamic-pituitary-adrenal (HPA) axis was assessed by taking approximately 150 strands of hair from the posterior vertex of the head, close to the scalp (Sauvé, Koren, Walsh, Tokmakejian & Van Uum, 2007). Harvesting samples from this region of the head ensured less intra-assay variance in cortisol levels (Steudte et al., 2011). In addition, the maximum length of each sample was defined as 3 cm, in order to reflect cortisol levels over the previous 3 months independently of race, sex, or age variability in hair growth rates (Massey et al., 2016; Stalder & Kirschbaum, 2012; Wennig, 2000). Assuming an average growth rate of 1 cm/month, a 3 cm segment would contain cortisol that had been deposited over approximately the previous 3 months (Kirschbaum, Tietze, Skoluda & Dettenborn, 2009). The hair samples were wrapped in a piece of aluminum foil to protect them from light and humidity, and were then stored in an envelope at room temperature until being sent to the Faculty of Pharmacy at the University of Granada for analysis.

Prior to analysis, each hair sample was washed twice in isopropanol, weighed, and then ground to a fine powder using a ball mill (Bullet Blender Storm, Swedesboro NJ) in order to break up the hair protein matrix and increase the surface area for extraction. Cortisol was extracted in HPLC-grade methanol by incubating the sample for 72 hours at room temperature in the dark with constant inversion using a rotator. After incubation, a vacuum evaporator (Centrivac, Heraeus, Hanau, Germany) was used to evaporate the supernatant until completely dry. Then, the extract was reconstituted in 150 ul of phosphate buffered saline at a pH of 8.0. After that, the sample was frozen at -20ºC until subsequent analysis (Chen et al., 2013; Kirschbaum et al., 2009; Meyer et al., 2014).

The cortisol was measured using the Salivary ELISA Cortisol kit with the reagent provided following the manufacturer's instructions (Alpco Diagnostics, Windham, NH). The Salivary ELISA Cortisol kit is a validated method to assess hair cortisol levels, is highly positively correlated with liquid chromatograph–mass spectrometry (LC–MS/MS) (Russell et al., 2015), and has been successfully used during pregnancy (Caparros-Gonzalez et al., 2017). The sensitivity of the ELISA Cortisol kit is 1.0 ng/ml as reported by the manufacturer, and its cross-reactivity is as follows: Prednisolone 13.6%, corticosterone 7.6%, deoxycorticosterone 7.2%, progesterone 7.2%, cortisone 6.2%, deoxycortisol 5.6%, prednisone 5.6%, and dexamethasone 1.6%. No cross-reactions were detected with DHEAS or tetrahydrocortisone.

The intra- and inter-assay variations were analyzed on internal quality controls used for routine salivary cortisol measurement, measured in duplicate in eight consecutive assays. The intra-assay coefficients of variance (CV) were 2.7% at 10.7 ng/ml and 4.3% at 43.9 ng/ml. The inter-assay CVs were 4.4% and 6.3%, respectively.

Psychological assessment

Demographic information was collected from the Pregnancy Health Document (Andalusian Ministry of Health, 2010), which is the official health record for pregnant women and their newborns.

For psychological assessment, psychological stress was evaluated using the Spanish version of the *Perceived Stress Scale* (PSS) (Cohen, Kamarck & Mermelstein, 1983; Remor, 2006), which is a 14-item scale to evaluate the perception of general stress during the preceding month. Each of the 14 items is scored using a 5-point Likert scale (0 = never, 1 = almost never, 2 = once in a while, 3 = often, 4 = very often). The Cronbach's alpha reliability coefficient for the Spanish version is $\alpha = 0.81$ (Remor, 2006).

In addition, the Spanish version of the *Prenatal Distress Questionnaire* (PDQ) (Caparros-Gonzalez et al., 2015; Yali & Lobel, 1999) was used to assess pregnancy-specific stress. This instrument assesses specific worries and concerns that pregnant women experience regarding medical problems, physical symptoms, body changes, childbirth, relationships, labor, and the baby's health using a 12-item scale scored with a 5-point Likert scale from 0 (none at all) to 4 (extremely). The Cronbach's alpha reliability coefficient for the Spanish version is $\alpha = 0.71$ (Caparros-Gonzalez et al., 2015).

Psychopathological symptoms were assessed using the Spanish version of the *Symptom Checklist 90 Revised* (SCL-90-R) (Caparros-Caparros, Villar-Hoz, Juan-Ferrer & Viñas-Poch, 2007; Derogatis, 1975). In order to facilitate participant assessment and due to the relation between cortisol levels and anxiety/depression, only the depression and anxiety sub-scales were used (depression sub-scale, Cronbach's $\alpha = 0.88$; anxiety sub-scale, Cronbach's $\alpha = 0.83$) (Caparros-Caparros et al., 2007).

Procedures

When the women attended their first antenatal appointment at 12 weeks' gestation, the midwife informed them about the study. Those who agreed to participate were given an information sheet to read and signed an informed consent form. At this point, each participant was assigned an identification code to ensure anonymity throughout the study. Subsequently, the midwife distributed psychological questionnaires in paper format (PDQ, PSS, SCL-90-R), which the participants completed at home and submitted at their next appointment. At the same time, the midwife took hair samples in accordance with the established protocol (Sauvé et al., 2007). This sequence was repeated in the second and third trimesters of pregnancy.

After birth, the midwife administered the psychological questionnaires to the mothers (PSS and SCL-90-R) and took a hair sample from each of them and their newborn infants. This evaluation was performed during the first postpartum appointment with the midwife.

Statistical analyses

First, we checked differences between included and excluded participants as regards sociodemographic and obstetric variables and stress levels. To this end, we performed Student's t-tests for age and PDQ and PSS mean scores (quantitative variables) and Chi-square tests for the remaining variables, which were all categorical.

Second, given the main determinants of hair cortisol levels in adults and children (Gray et al., 2018; Stalder et al., 2017), variables such as maternal age, gestational age at birth, and birth weight were correlated with the outcome variable to determine potential confounding variables. In addition, two Student's t-tests were performed to check differences between hair cortisol levels and maternal hair treatment (dyed or natural) and sex of the fetus (male or female).

A multicollinearity diagnosis was then performed in order to examine the associations between predictors, predicted variables, and covariates. A tolerance statistic higher than 0.3 and a variance inflation factor (VIF) $\leq$ 10 indicate a lack of multicollinearity (Field, 2013).

To determine the relationship between maternal hair cortisol levels during the three trimesters of pregnancy and postpartum, and neonatal hair cortisol levels, we next conducted hierarchical linear regression analyses by the enter method. The dependent variable was newborn infants' hair cortisol levels. In the first step, a potential confounding variable was included (maternal hair treatment). Then, maternal hair cortisol levels during pregnancy were included in step two of the model.

Similarly, in order to determine whether the maternal stress variables were related to neonatal cortisol levels, we performed a hierarchical linear regression analysis with neonatal hair cortisol levels as the dependent variable, and PDQ and PSS scores as independent variables. Maternal hair treatment was included in the model as a covariate.

Finally, a hierarchical linear regression analysis was conducted with neonatal hair cortisol levels as the dependent variable and maternal anxiety and depression scores during pregnancy as independent variables. Maternal hair treatment was included in the model as a covariate.

In line with recommendations for statistical analysis of hair cortisol level data, we conducted a natural logarithmic transformation (natural log; *ln* base e). All statistical analyses were performed using the Statistical Package for the Social Sciences 20.0 for Windows, version 8.1 (SPSS, Armonk, New York).

Results

Description of the sample

The sample consisted of 80 pregnant women aged between 23 and 44 years old (M = 32.17 years, SD = 4.06), and 80 newborn infants (56 boys and 24 girls). Table 1 shows the included and excluded participants' main sociodemographic and obstetric variables. Forty-one out of 46 excluded participants provided sufficient information to be included in the analyses. There were no differences between groups.

Table 1. Sociodemographic and obstetric variables of the sample.

		Participants n = 80 M(SD)/n(%)	Excluded n = 41 M(SD)/n(%)	Test[a]	*p*
Sociodemographic variables					
Age		32.17(4.06)	32.80(5.00)	0.75	0.45
Nationality	Spanish	62(77%)	36(88%)	1.87	0.13
	Immigrant	18(23%)	5(12%)		
Marital status	Married/cohabitant	77(96%)	41(100%)	1.57	0.28
	Single/divorced/widow	3(4%)	-		
Level of education	Primary school	1(1%)	-		
	Secondary school	16(20%)	12(29%)	1.74	0.41
	University	63(79%)	29(71%)		
Employment status	Unemployed	12(15%)	9(22%)	1.74	0.41
	Working	68(85%)	32(78%)		
Hair	Natural	43(54%)	-	-	-
	Dyed	37(46%)	-		
Smoker	Yes	7(9%)	5(12%)	0.36	0.38
	No	73(91%)	36(88%)		
Alcohol	Yes	1(1%)	3(7%)	3.12	0.11
	No	79(99%)	38(93%)		
Obstetric information					
Primiparous	Yes	48(60%)	19(46%)	2.04	0.10
	No	32(40%)	22(54%)		
Wanted pregnancy	Yes	72(90%)	37(90%)	0.00	0.61
	No	8(10%)	4(10%)		
	Spontaneous	73(91%)	37(90%)	1.72	0.42

Pregnancy method	Fertility treatment	7(9%)	4(10%)		
Previous miscarriages	0	67(84%)	32(78%)	0.59	0.74
	1	10(12%)	7(17%)		
	≥ 2	3(4%)	2(5%)		
Previous children	0	50(63%)	23(56%)	1.34	0.71
	1	25(31%)	13(32%)		
	≥ 2	5(6%)	5(12%)		
Sex of the fetus	Male	56(70%)	-	-	-
	Female	24(30%)	-		

Note: [a] Student's t-test used for quantitative variables and Chi-square test for categorical variables.

Regarding stress levels, 34 out of 46 participants obtained scores for PDQ and PSS. There were no differences between groups for PDQ scores in the first trimester (t = 0.61; p = 0.54) or second trimester (t = 1.63; p = 0.11), or for PSS scores in the first trimester (t = -0.54; p = 0.58) or second trimester (t = -0.20; p = 0.83).

Cortisol and potential confounding variables

No statistically significant correlations were observed between neonatal cortisol levels and maternal age (r = -0.09; p = 0.39), birth weight (r = -0.06; p = 0.59), or gestational age at birth (r = 0.04; p = 0.67). Neither were any statistically significant differences in neonatal cortisol levels detected according to sex of the fetus (t = -0.45; p = 0.65).

With regard to potential maternal confounders, the Student's t-test only showed differences between groups in hair cortisol levels and maternal hair treatment (natural or dyed) in the first trimester (t = -2.30; $p \leq 0.05$). Maternal age was not correlated with maternal hair cortisol levels (S1 Table). Consequently, maternal hair treatment was included in the analyses as a potential confounder.

Hierarchical linear regression analyses for neonatal hair cortisol levels

We conducted a hierarchical linear regression by the enter method. The dependent variable was neonatal hair cortisol levels while the independent variables were maternal hair cortisol levels during pregnancy. In addition, a confounding variable was identified (maternal hair treatment) and this was included in the model (step 1).

Model 1, with only the confounding variable, explained less than 1% of the variance (F = 0.43; R^2= 0.00; p > 0.05), whereas model 2, which included confounding variables and maternal hair cortisol levels, explained 14% of the variance (F = 2.50; R^2= 0.14; $p \leq 0.05$).

Maternal hair cortisol levels during the first trimester were the strongest predictor of hair cortisol levels in newborn infants (β = -0.24; t = -2.45; $p \leq 0.05$) (Table 2).

Table 2. Hierarchical regression between maternal hair cortisol levels and newborn infants' cortisol levels

			Model 1			**Model 2**		
	***M* (SD)**	***M* (SD)^a**	**β**	**SE B**	***t***	**β**	**SE B**	***t***
Maternal hair treatment			-0.13	0.21	-0.66	-0.06	0.21	-0.31
Cortisol T1	529,80(653,74)	5.78(1.04)				-0.24	0.10	-2.45*
Cortisol T2	422,23(510,99)	5.76(0.70)				-0.11	0.15	-0.74
Cortisol T3	448,25(681,63)	5.76(0.77)				-0.24	0.13	-1.78
Cortisol T4	735,81(1300,86)	6.00(0.97)				0.16	0.10	1.51
R^2				0.00			0.14	
F for changes in R^2				0.43			3.01*	

Note= *Significant at $p \leq 0.05$; ^{a}Mean and standard deviation of logarithmic transformation of cortisol levels
Dependent variable: Hair cortisol levels in newborn infants
T1= trimester 1; T2 = trimester 2; T3 = trimester 3; T4 = Postpartum period.

Diagnosis of multicollinearity showed adequate tolerance (confounding variables > 0.60; independent variables > 0.80) and VIF < 10.

Hierarchical linear regression analyses for psychological stress and newborn infants' hair cortisol levels

We conducted a hierarchical linear regression by the enter method with newborn hair cortisol levels as the dependent variable and PDQ and PSS scores as the independent variables. In addition, maternal hair treatment was included in the model (step 1) as a confounding variable.

Model 1, which included maternal hair treatment, explained less than 1% of the variance (F = 0.43; R^2= 0.00; p > 0.05), whereas model 2 explained 22% of the variance (F = 2.54; R^2= 0.22; p < 0.05). The second model showed two variables that predicted newborn infants' cortisol levels: PDQ scores in the third trimester (β = 0.08; t = 2.88; p < 0.01) and PSS scores in the same trimester (β = -0.28; t = -3.13; p < 0.01). The results are shown in Table 3.

Table 3. Multiple linear regression using psychological stress to predict neonatal hair cortisol levels
Note= **Significant at $p \leq 0.01$

	M (SD)	**Model 1**			**Model 2**		
		β	**SE B**	***t***	**β**	**SE B**	***t***
Maternal hair treatment		-0.13	0.21	-0.66	-0.20	0.20	-1.02
PDQ T1	14.23(3.84)				-0.01	0.02	-0.41
PDQ T2	12.88(3.49)				-0.04	0.03	-1.33
PDQ T3	13.10(3.90)				0.08	0.02	2.88^{**}
PSS T1	26.88(1.10)				-0.10	0.09	-1.12
PSS T2	26.83(1.15)				0.00	0.09	0.00
PSS T3	27.08(1.20)				-0.28	0.09	-3.13^{**}
PSS T4	26.90(1.20)				0.06	0.08	0.71
R^2			0.00			0.22	
F for changes in R^2			0.43			2.84^{*}	

Dependent variable: Hair cortisol levels in newborn infants

PDQ = Prenatal Distress Questionnaire; PSS= Perceived Stress Scale; T1= trimester 1; T2 = trimester 2; T3 = trimester 3; T4 = Postpartum period.

The tolerance statistic for variables was higher than 0.70, and VIF was also satisfactory (VIF < 10).

With respect to anxiety and depression, the scores did not predict neonatal hair cortisol levels. Pearson's correlation between maternal and neonatal cortisol levels and psychological stress, anxiety, and depression are shown in S2 Table.

Discussion

The objective of this study was to analyze the relationship between psychological stress and hair cortisol levels in mothers during pregnancy and postpartum, and neonatal hair cortisol levels, based on a longitudinal assessment. The results showed that higher maternal hair cortisol levels in the first trimester of pregnancy predicted lower neonatal hair cortisol. In addition, pregnancy-specific stress and perceived stress were also predictors of neonatal hair cortisol.

First, we found that high hair cortisol levels in the first trimester predicted lower hair cortisol levels in newborn infants. This negative relationship is in agreement with the only other study conducted with a similar objective, on rhesus monkeys, which found lower hair cortisol levels in infants of mothers who were highly stressed during the first trimester of pregnancy (Kapoor et al., 2016). It is known that high levels of stress during the third trimester affect the long-term development of the newborn infant (Van den Bergh et al., 2017); however, our results seem to indicate that maternal cortisol affects fetal cortisol from the first trimester. The effect of timing and type of prenatal stress exposure has been related to different outcomes in the offspring (Kapoor, Dunn, Kostaki, Andrews & Matthews, 2006; Van den Bergh et al., 2017); in this respect, our study shows an important time-specific relation between biological measures of stress, such as cortisol, and fetal programming. A possible explanation could be that during pregnancy, maternal cortisol crosses the placenta to the fetus, since the latter cannot produce it independently until later stages of gestation (Rakers et al., 2016). Maternal cortisol stimulates secretion of the corticotrophin release hormone (CRH) in the fetus, and in turn, CRH secretion stimulates cortisol synthesis (Beijers, Buitelaar & de Weerth, 2014; Merlot, Couret & Otten, 2008). Hence, excessively high levels of cortisol crossing the placenta in the early stages of fetal formation probably alter fetal programming of the HPA axis, preventing correct cortisol production in the fetus (Glover, Bergman, Sarkar & O'Connor, 2009).

Special attention should be paid to this phenomenon due to its implications for development, since low cortisol levels at birth require the administration of glucocorticoids to ensure the extrauterine life of the infant (Busada & Cidlowski, 2017). Furthermore, it is well known that the effect of prenatal stress on child development and infant stress regulation is explained by fetal programming of the HPA (Beijers et al., 2014, Davis, Glynn, Waffarn & Sandman, 2011). Therefore, ensuring high neonatal cortisol levels could help promote good lung function and thus prevent the development of later diseases (Bernhard, 2016; Chung, 2014; Roberts, Brown, Medley & Dalziel, 2017).

Similarly, the scores for perceived stress in the third trimester of pregnancy were negatively associated with neonatal cortisol levels, whereas pregnancy-specific stress in the third trimester was positively associated with neonatal cortisol levels. Although the relationship between these measures remains unknown, similar results have been reported when cortisol was measured in the umbilical cord of newborn infants, whereby those whose mothers had experienced more stress during pregnancy showed lower cortisol levels (Gow, Thomson, Rieder, Van Uum & Koren, 2010). As our data indicate, there was no association between perceived and pregnancy-specific stress in our sample, and the trends in correlations with maternal and neonatal hair cortisol differed according to time and type of stress. It is important to note that perceived stress and pregnancy-specific stress are not the same measures of stress: Hence, the effects each could exert on infants are different (Alderdice, Lynn & Lobel, 2012). Our results show that the effects of pregnancy-specific stress are different to those of perceived stress, as other authors have previously reported (Caparros-Gonzalez et al., 2017; Lobel & Dunkel-Schetter, 2016).

As study limitations, a high number of participants were lost due to the longitudinal design and inclusion and exclusion criteria of the study. Another limitation is generalizability of the sample, since almost the entire sample lived with an intimate partner and there were no multiple pregnancies, which is not representative of the general population. Thus, future research should strive to include single mothers and those who have multiple pregnancies.

Nonetheless, the longitudinal design of this study and the simultaneous assessment of hair cortisol levels and psychological status have shed valuable light on relationships that have not previously been studied in humans, revealing a negative association between maternal hair cortisol in the first trimester and neonatal hair cortisol levels. Future research could include long-term follow-up of newborn infants in order to elucidate the implications of cortisol levels for subsequent neurodevelopment.

It is important to determine the effect of maternal stress on the fetus and identify critical periods such as the first trimester, as has been demonstrated in the present study. Since stress during pregnancy has negative consequences for the fetus and newborn infant, the main challenge is to ensure early identification and prevention of high stress levels (Bastani, Hidarnia, Kazemnejad, Vafaei & Kashanian, 2005; Laurent, Duncan, Lightcap & Khan, 2017; Su et al., 2015). Although there is evidence that postnatal care can help neonates at risk (Caparros-Gonzalez, de la Torre-Luque, Diaz-Piedra, Vico &

Buela-Casal, 2017; Talavera et al., 2016), prenatal assessment of stress levels and maintenance of optimal levels remain important. Collecting data on cortisol levels and psychological well-being may help early detection of problems that could affect the intrauterine relationship between mother and fetus, which is fundamental for the future health of both.

Conclusions

This is the first study to analyze the relationship between maternal hair cortisol during pregnancy and neonatal hair cortisol. The analysis was complemented by psychological assessment of the mother throughout pregnancy.

This enabled us to determine that maternal hair cortisol in the first trimester exerts a negative influence on neonatal hair cortisol levels. These findings have important clinical implications, since the detection of vulnerable trimesters during pregnancy could contribute to minimize the adverse effects of psychological and physiological stress during pregnancy for the newborn infant and subsequent child.

Supplementary information

S1 Table. Pearson correlation and Student's t-tests between potential confounding variables for neonatal and maternal cortisol levels

			X(DT)	t/*r*	*p*
Neonatal cortisol levels					
Sex		Male	7.52(0.93)	-0.45	0.65
		Female	7.62(0.94)		
Maternal age				-0.09	0.39
Birth weight				-0.06	0.59
Gestational age at birth				0.04	0.67
Maternal cortisol levels					
Trimester 1	Maternal hair treatment	Natural	6.02(1.02)	-2.30	**0.02***
		Dyed	5.50(1.00)		
	Maternal age			-0.14	0.21
Trimester 2	Maternal hair treatment	Natural	5.73(0.75)	0.36	0.71
		Dyed	5.79(0.65)		
	Maternal age			0.07	0.53
Trimester 3	Maternal hair treatment	Natural	5.77(0.91)	-0.12	0.89
		Dyed	5.74(0.59)		
	Maternal age			0.01	0.92
Postpartum	Maternal hair treatment	Natural	6.15(1.02)	-1.51	0.13
		Dyed	5.82(0.90)		
	Maternal age			-0.02	0.82

Note: *Significant at $p \leq 0.05$

S2 Table. Pearson correlation between psychological and biological measures.

	Cortisol T1	Cortisol T2	Cortisol T3	Cortisol T4	Cortisol NB
PDQ T1	-0.10	-0.08	0.00	-0.17	0.05
PDQ T2	0.14	-0.19	0.04	**-0.24***	-0.12
PDQ T3	0.04	0.05	0.08	0.08	0.17
PSS T1	-0.02	0.11	-0.00	0.05	-0.14
PSS T2	0.08	-0.01	0.03	**-0.24***	-0.07
PSS T3	-0.24	-0.09	0.11	-0.06	**-0.32****
PSS T4	0.14	-0.07	-0.04	-0.13	-0.02
ANX T1	-0.01	0.02	0.02	**-0.23***	-0.02
ANX T2	0.08	0.01	0.09	-0.17	-0.08
ANX T3	0.05	0.03	0.21	0.06	-0.04
ANX T4	0.03	-0.10	0.02	-0.03	-0.02
DEP T1	-0.05	0.08	0.10	-0.14	-0.14
DEP T2	0.11	0.06	0.07	-0.09	-0.06
DEP T3	0.15	0.06	0.14	0.00	-0.06
DEP T4	-0.03	-0.02	0.05	0.04	-0.04

Note: Significant at $^{*}p \leq .05$ and $^{**}p \leq .01$

T1 = Trimester 1; T2 = Trimester 2; T3= Trimester 3; T4 = Postpartum; NB = Newborn infants; PDQ = Prenatal Distress Questionnaire; PSS = Perceived Stress Scale; ANX = Anxiety sub-scale SCL-90-R; DEP = Depression sub-scale SCL-90-R

CAPÍTULO XII. Neurodevelopment of high and low-risk pregnancy babies at 6 months of age.

Romero-Gonzalez, B., Caparros-Gonzalez, R. A., Cruz-Martinez, M., Gonzalez-Perez, R., Gallego-Burgos, J. C., & Peralta-Ramirez, M. I. (2020). Neurodevelopment of high and low-risk pregnancy babies at 6 months of age. Under review in *Midwifery*.

Introduction

Pregnancy is an evolutionary stage during which mothers usually experience increased stress. This high prenatal stress can be associated with an increased risk of miscarriage, premature birth, and low birth weight (Chiarello et al., 2018). In addition, it is also a major risk factor in babies' neurodevelopment leading to behavioural problems, memory and learning deficits, poor cerebral cortex development and it can affect their mental health (Cardwell, 2013; Karlen et al., 2015; Van den Bergh et al., 2017).

The "Foetal Programming Hypothesis" (Seckl & Holmes, 2007) and the "Development Programming Hypothesis" (Barker, 2004; Langley-Evans, 2015) have tried to explain how sensitive periods during pregnancy may affect babies' development, as the mother's exposure to environmental changes such as diet alterations, infections and, above all, the experience of stressful situations, affect the formation of babies' important biological systems (Bock, Rether, Gröger, Xie, & Braun, 2014; Van den Bergh et al., 2017). These systems include the Central Nervous System and the Autonomous Nervous System (Stroud et al., 2016), where formation problems may cause alterations to the baby's subsequent neurodevelopment, which may affect different cognitive and language skills, as well as increase the probability of acquiring autistic traits (Bronson & Bale, 2015; Laplante, Brunet, Schmitz, Ciampi, & King, 2008; Walder et al., 2014). In addition, alterations in the Hypothalamic-Pituitary-Adrenal (HPA) axis after birth are more likely, and this may affect the functioning of different organs (Romero-Gonzalez, Caparros-Gonzalez, Gonzalez-Perez, Delgado-Puertas, Peralta-Ramirez et al., 2018).

As opposed to low-risk pregnancies (hereon LRPs), high-risk pregnancies (hereon HRPs) pose threats to the health or life of the mother and/or foetus and during these pregnancies, prenatal stress plays as important role in the baby's neurodevelopment (NIH, 2012). The most studied risk factors in these types of pregnancies include: existing health problems, being overweight or obese, multiple pregnancy and age, being too young or aged over 35 years (ACOG, 2012; ACOG, 2013; SMFM, 2012). These factors coupled with the mother's generated stress, significantly increase the likelihood of a series of problems during pregnancy: hypertension and pre-eclampsia, gestational diabetes or increased risk of preterm birth, which can in turn negatively influence babies' appropriate neurodevelopment, generating cognitive problems as well as problems of communication and interaction with the environment (Sweeting et al., 2015; Veerbeek et al., 2015). When childhood neurodevelopment is affected, more serious disorders may appear, the most prevalent being autism spectrum disorders as well as attention deficit and hyperactivity disorders (Avenevoli et al., 2013; Bhutta, Cleves, Casey, Cradock, & Anand, 2013).

Moreover, the experienced stress leads to an increase in HPA axis activation and the subsequent release of the cortisol hormone; this increase can affect a new-born's brain development and even major organs such as lungs (Diaz & Barba, 2016; Romero-Gonzalez et al., 2018). Measuring cortisol is thus a good way to obtain objective and retrospective information about chronic stress during pregnancy (Diaz & Barba, 2016; Garcia, Marti, Valles, Dal-Zotto & Armario, 2000; Meltzer-Brody, 2011; Workman, Barha & Galea, 2012).

Based on the above and in accordance with the "Foetal Programming Hypothesis", the objective of this study was to verify cortisol level differences among LRP and HRP women, and whether the stress differential entailed by the risk factor had an impact on the neurodevelopment of babies aged 6 months, in terms of cognitive, linguistic and motor development.

Method

Participants

The total sample was made up of 91 pregnant women aged between 22 and 44 years (*M* =33,74; *SD*= 4,23) and their 91 babies (45 boys and 46 girls) evaluated at 6 months of age (*M*= 6,09; *SD*= ,54). These women were divided into two groups depending on the type of pregnancy: an LRP group, made up of 49 women (*M*= 6,09; *SD*= ,54) and another HRP group, composed of the remaining 42 *(M=35,33 years; SD= 4,35)*. Participants were informed of the study by a midwife at the Góngora and Mirasierra Health Centres of Granada's Andalusian Health Service as they came to the prenatal pregnancy health care practice. HRP women were directed to a specific risk pregnancy service specialising in autoimmune, systemic or clotting pathologies of the San Cecilio University Hospital in Granada.

The inclusion criteria were being aged over 18 years, being pregnant and mastering both oral and written Spanish. The exclusion criteria included taking corticosteroids or suffering from some psychological illness.

Pregnant women who participated in the study read the Fact Sheet and signed an informed consent document. The latter document ensured that the collected data would remain anonymous, and that the participants were free to leave the study whenever they wished.

The study was approved by the Ethics Committee for Human Research of the University of Granada (reference 881) and the Committee on Research Ethics of Granada's public health area.

Instruments

Evaluation of the chronic stress biomarker: Cortisol in hair.

The cortisol evaluation consisted in taking a lock of hair containing approximately 150 strands from the rear corner of the skull, as close as possible to the scalp (Sauvé, Koren, Walsh, Tokmakejian & Van Uum, 2007). A maximum length of 3cm was set for each sample to reflect cortisol levels during the preceding 3 months (Stalder & Kirschbaum, 2012). The samples were wrapped in aluminium foil to be adequately protected from light and humidity and were kept at room temperature until further analysis by the Department of Pharmacology of the Faculty of Pharmacy of the University of Granada. The analysis protocol was published in Caparros-Gonzalez et al. (2017) and Romero-Gonzalez et al. (2018).

Evaluation of baby neurodevelopment: Bayley-III.

The evaluation of the baby's neurodevelopment was performed using the Bayley-III instrument (Bayley scales of Infant Development-III) (Bayley, 2006). The instrument is standardised and individually administered. It measures the level of development of children aged between 16 days and 42 months and 15 days.

The main objective of Bayley-III is to identify any development problems in the evaluated subjects and to provide useful data to plan interventions.

The abilities it evaluates are: the cognitive scale (attention, memory, reasoning, planning or coordination), auditory acuity and the ability to understand and respond to verbal stimuli (receptive communication and the individual's ability to vocalise, name images and objects, communicate with others through the expressive communication subscale), and the motor scale (fine motor and gross motor skills).

Procedure

Once the pregnant women were informed about the study, those who agreed to participate read the information sheet and consented to participate in it. A hair sample was then cut with scissors and immediately inserted into an envelope made of aluminium foil, which was stored at room temperature to protect the sample from light and humidity. This procedure was repeated during with the second pregnancy trimester (12^{th} to 27^{th} week of pregnancy) and the third pregnancy trimester of (28^{th} to 38^{th} week of pregnancy). The samples were analysed at the Faculty of Pharmacy of the University of Granada.

Finally, Bayley-III was administered to each baby 6 months after birth, and during the evaluation, a hair sample was collected once more, both from the mother and the baby.

Data analysis

Two groups were differentiated in this study: HRP women versus LRP women. First, the average values and percentages of both groups corresponding to the major sociodemographic, obstetric, medical and somatometric variables of their new-borns are presented. To check whether there were differences between both groups, various Student *t* tests (quantitative variables) and Chi-square tests (qualitative variables) were performed.

Subsequently, we analysed the differences between the neurodevelopment of babies born from LRPs with respect to that of babies born from HRPs based on cortisol levels in hair and the scores of the different Bayley-III subscales. To do this, various ANCOVAS were performed, the independent variable being the pregnancy type with two levels (HRP pregnancy versus LRP pregnancy) and the dependent variables being cortisol levels in the mother's and baby's hair as well as the total, scalar, composite and percentile scores of the Bayley-III scales. The age variable was included as the analyses' covariate.

To finish, a linear regression was performed to verify which variables predicted the neurodevelopment of babies in HRP women. The independent variable consisted in the administration or non-administration of anticoagulants and/or anti-aggregants during pregnancy (low molecular weight heparin (hereon LMWH) or salicylic acid (hereon SA)), and the dependent variables were the scores on the Bayley-III scale subscale where significant differences were found between the two groups.

For cortisol in hair, a logarithmic transformation (natural logarithm; ln to the base e) was performed to adjust to a normal distribution. As we wished to obtain a global measurement, the cortisol scores were obtained from the cortisol average of every pregnancy trimester. The analyses were performed using the Statistical Package for the Social Sciences 20.0 for Windows, version 8.1 (SPSS, Armonk, New York).

Results

Description of participants

The 91 pregnant women who participated in this study were divided into two groups depending on their type of pregnancy (HRP versus LRP). A first group of 49 women with an LRP pregnancy (*M*= 32,39 years; *SD*= 3,65) and a second group of 42 women with a risky pregnancy (*M*=35,33 years; *SD*= 4,35).

Table 1 lists the main sociodemographic, obstetric and health variables, as well as the analysis of differences between the two groups. As can be observed, both groups matched each other regarding the main variables, as only age differences were found (t = -3,52; p < .01): HRP women were found to be older than LRP women. No differences were found among the two groups concerning the remaining sociodemographic or obstetric history variables. Table 1 also describes the diseases presented by HRP women and the medical treatment they followed. The results show that more than 50% of this sample had a disease that affected clotting and that LMWH was the most widespread treatment.

Table 1. Differences in sociodemogrpahic variables, obstetric information and labor variables between high-risk pregnant women and low-risk pregnant women. Descriptive information about diseases and medical treatment in high-risk pregnant women.

		LRP (n = 49) X(SD)/n(%)	HRP (n=42) X(SD)/n(%)	Test*	*p*
Sociodemographic variables					
Age		32,39(3,64)	35,33(4,35)	-3,52	**,001****
Marital status	Single/divorced/widow	2(4,3)	-	1,74	,19
	Married/Cohabitant	47(95,7)	42(100)		
Nationality	Spanish	45(91,8)	42(100)	2,9	,24
	Inmigrant	4(8,2)	-		
Level of education	Primary school	-	1(2,30)	5,26	,07
	Secondary school	8(16,4)	18(33,3)		
	University	41(83,6)	27(64,2)		
Employment situation	Unemployed	14(28,6)	12(28,6)	0,15	,69
	Working	35(71,4)	30(71,4)		
Smoking	Yes	3(6,2)	3(7,2)	0,24	,62
	No	46(93,8)	39(92,8)		
Hair	Dyed	18(38,8)	21(50)	4,43	,11
	Natural	30(61,2)	21(50)		
Alcohol	Yes	-	1(2,4)	1,49	,22
	No	49(100)	41(97,6)		
Obstetric information					
Primioparous	Yes	20(40,9)	14(33,3)	0,57	,45
	No	29(59,1)	28(66,7)		
Previous children	0	24(49)	15(35,8)	1,23	,27
	≥ 1	25(51)	27(64,2)		
Wanted pregnancy	No	3(7,2)	7(10,7)	0,84	,36
	Yes	39(92,8)	35(89,3)		
Pregnancy method	Spontaneous	39(79,5)	29(69)	2,99	,08

	Fertility treatment	10(20,5)	13(31)		
Sex of the fetus	Male	22(44,9)	23(54,8)	0,88	,34
	Female	27(55,1)	19(45,2)		
Labour information					
Gestational age		39,43(1,33)	39,44(1,25)	-0,03	,98
Birthweight (g)		3155,23(438,34)	3316,41(445,82)	-1,63	,11
Length (cm)		50,17(2,20)	50,76(2,07)	-1,21	,23
Disease					
Other thrombofilias			21(50)		
Factor XII mutation			3(7,15)		
Antiphospholipid syndrome			12(28,50)		
Ulcerative colitis			2(4,75)		
Severe atopic dermatitis			1(2,45)		
Autoimune hepatitis			1(2,45)		
Thyroid disease			2(4,75)		
Medical treatment					
	LMWH		19(45,20)		
	SA		12(28,60)		
	Others		7(16,70)		
	Vitamins		4(9,5)		

Note: Significance level at $^{**}p \leq ,01$
*Student t-test used for quantitatives variables and Chi-squared test for categorical variables

Differences in neurodevelopment and cortisol levels in hair of babies born from HRP versus those born from LRP

No differences were found between pregnant women's cortisol levels throughout the pregnancy or 6 months after delivery. No differences in babies' cortisol levels were found 6 months after birth.

With regard to child neurodevelopment at 6 months of age, the results showed that statistically significant differences existed according to pregnancy type (LRP vs HRP) and in all cognitive scale scores: total score (F = 9,38; $p \leq$,01), scalar (F = 13,91; $p \leq$,01), composite (F = 13,92; $p \leq$,01) and percentile (F = 15,24; $p \leq$,01). In addition, differences were found between the following language scale scores: scalar score of receptive communication (F = 5,07; $p \leq$,05), composite scores (F = 4,34; $p \leq$,05) and percentile (F = 4,80 $p \leq$,05) of the total language scale.

Finally, with regard to the motor scale, differences were found in the scalar score of fine motor skills (F = 9,19; $p \leq$,01), the scalar score of gross motor skills (F = 6,67; $p \leq$,01), and the scores: scalar (F = 11,73; $p \leq$,01), composite (F = 11,95 $p \leq$,01) and percentile (F = 13,57; $p \leq$,01) of the general motor skills scale. The means of the variables are included in Table 2. In addition, percentile scores on the three general scales are shown in Figure 1. No statistically significant differences were found between the type of pregnancy and the other variables.

Table 2. Differences in neurodevelopment and hair cortisol levels between HRP and LRP.

		LRP X(SD)	**HRP X(SD)**	**F**	***p***
Cortisol	*Mean*	5,11(1,2)	4,77(0,96)	1,47	,15
	6 month infant	6,44(1,08)	5,98(1,29)	1,51	,14
	6 month mother	5,16(1,37)	4,44(1,6)	1,81	,07
Cognitive	*Total*	30,69(3,22)	32,38(2,95)	9,38	**,00**
	Scaled	11,61(2,92)	13,45(1,78)	13,91	**,00**
	Composite	109,08(12,82)	117,02(8,77)	13,92	**,00**
	Percentile	68,14(24,97)	83,98(13,99)	15,24	**,00**

Lenguage	**Receptive communication**	*Total*	10,84(1,87)	11,33 (1,50)	2,12	,15
		Scaled	11,14(3,01)	12,52(2,16)	5,07	**,03**
	Expresive communication	*Total*	9,27(2,70)	9,05(2,40)	0,00	,95
		Scaled	11,20(3,24)	11,21(3,03)	0,15	,70
	Scaled		21,88(4,90)	23,55(4,14),	3,60	,06
	Composite		105,69(14,38)	111,10(12,51)	4,34	**,04**
	Percentile		60,47(28,69)	71,88(24,43)	4,80	**,03**
Motor	**Fine motor**	*Total*	20,47(2,64)	21,14(2,43)	2,39	,13
		Scaled	10,33(2,86)	11,98(2,25)	9,19	**,00**
	Gross motor	*Total*	23,90(3,19)	24,98(3,30)	2,51	,12
		Scaled	8,80(2,34)	10,21(2,41)	6,67	**,01**
	Scaled		19,20(4,25)	22,21(3,68)	11,73	**,00**
	Composite		97,63(12,87)	106,74(11,04)	11,95	**,00**
	Percentile		44,59(27,06)	64,43(23,45)	13,57	**,00**

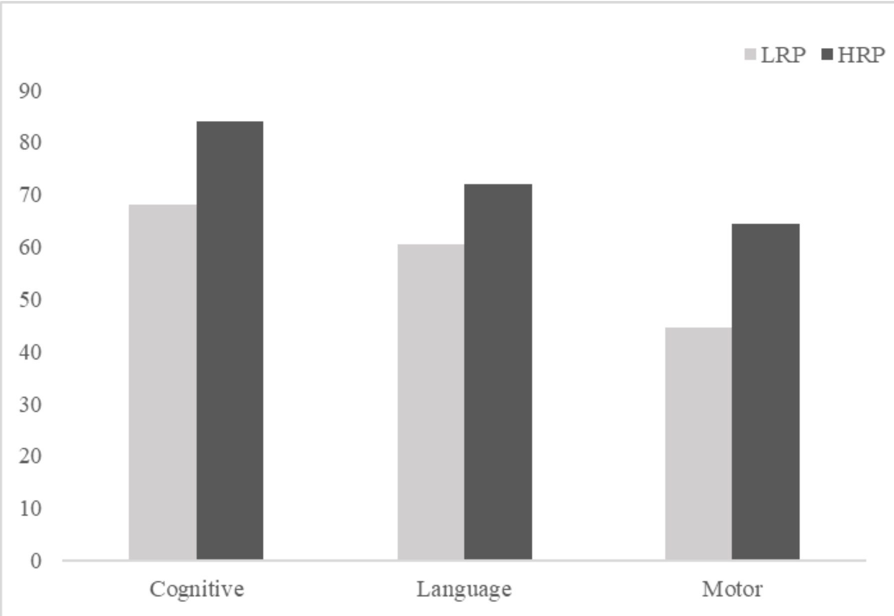

Figure 1. Percentile scores in cognitive, language and motor scales in infants born from a LRP and HRP.

Predictor variables of the neurodevelopment of babies born from high-risk pregnancies.

Linear regression analyses were performed to check whether the administration of LMWH or SA predicted babies' neurodevelopment variables. They found that they predicted, with statistical significance, the cognitive scale: total score (t = 2,06; p < .05), scalar (t = 2,59; p < .01), composite (t = 5,79; p < .01) and percentile (t = 6,26; p < .01); and the motor scales: scalar score in fine motor skills (t = 3,09; p < .01), scalar in gross motor skills (t= 2.29;p < .05), scalar motor (t= 3,23;p < .01), composite motor (t= 3,30;p < .01), and percentile (t=3.16; p < .01) (Table 3).

Table 3. Linear regression between neurodevelopment and the use of medication.

			Medication			
			R^2	**β**	**SE B**	***t***
Cognitive	**Total**		.04	1.43	.21	**2.06***
	Scaled		.07	1.45	.56	**2.59****
	Composite		.06	6.10	2.53	**2.40****
	Percentile		.06	11.84	4.73	**2.50****
Language	**RC**	**Scaled**	.02	.92	.59	1.53
	Composite		.01	3.63	3.03	1.19
	Percentile		.01	6.56	6.02	1.09
Motor	**FM**	**Scaled**	.09	1.77	.57	**3.09****
	GM	**Scaled**	.05	1.22	.53	**2.29***
	Scaled		.11	2.96	.89	**3.23****
	Composite		.10	8.91	2.69	**3,30****
	Percentile		.10	18,14	5,73	**3,16****

Note: *Significance level at p < .05; **p < .01

RC = Receptive communication; FM = Fine motor; GM = Gross motor

Discussion

High prenatal stress is closely linked to various pathologies that can occur during pregnancy such as hypertension, pre-eclampsia or gestational diabetes: the latter constitute risk factors that can affect babies' neurodevelopment (Van den Bergh et al., 2017). For this reason, the aim of this study was to verify whether stress and all the factors involved in an HRP pregnancy affected the neurodevelopment of six-month-old infants born from HRPs, compared to babies born from LRPs. To do this, a prenatal stress assessment was performed by collecting cortisol in the mother's hair throughout the pregnancy, as well as different obstetric and health variables. After delivery, the evaluation of the baby's neurodevelopment was performed at 6 months of age using the Bayley-III instrument as well as the mother and baby cortisol levels. Sociodemographic and obstetric results showed only age differences among the two groups of women, the women in the HRP group being elder. These results are consistent as a major pregnancy risk factor is age (more specifically, being aged 35 years and over) (ACOG, 2012; ACOG, 2013, SMFM, 2012).

Similarly, no significant differences in cortisol levels taken from the mothers' hair were found either in both groups. Cortisol levels in hair did thus *not* represent a decisive factor regarding babies' neurodevelopment differences (which are discussed below). One possible explanation may be that considering the pregnancy as an HRP from the beginning may lead to reducing the psychological impact on mothers compared to that of mothers who receive the news at a more advanced stage of pregnancy. In addition, these women generally face more stressful situations because of their illness, which could affect their own levels of resilience over time and act as a protective factor (García-León et al., 2019).

Moreover, higher scores were found regarding the cognitive, linguistic and motor neurodevelopment of babies born from HRPs. These results differ from those found in other studies that showed greater deficits in the neurodevelopment of babies from HRPs, relating them to stress experienced during pregnancy (King & Laplante, 2005; McDonald, Kehler, Bayrampour, Fraser-Lee & Tough, 2016). However, the results obtained in these studies must be interpreted with caution: they were not compared with that of LRP groups and the participants were not undergoing any special treatment or care. Our study differs in that regard: a control group was included and the drugs given to pregnant women, corresponding to personalised treatments prescribed via specialised consultations, were taken into account.

A possible explanation could be the close follow-up that HRP pathologies require. In most cases, the care and treatment greatly favour the mothers' health and possibly babies' improved development (Amorim, Souza, Moura, Queiroz & Salimena, 2017). Specifically, women experiencing pregnancy complications perceive their risks as more worrying than women with LRPs; they tend to develop a greater sense of internal control, are better at appropriate information search and adopt behavioural changes that translate into improved health. That is, during the pregnancy itself, they take great care in minimising the impact of risk factors that potentially influence the baby's subsequent development (Harris, Granck, Green & Michie, 2014). We must add that they have easier access to a more specialised clinical control system offering more continuous care, personalised education, vigilance, advice and guidance on how to properly manage the pregnancy (Brooten et al., 2007; Morrison et al., 2004). This also favours a bond of trust between professionals and pregnant women that increases pregnant women's safety and significantly reduces pregnancy stress (Mu, 2004).

Furthermore, the administration of LMWH or SA was linked to higher levels of neurodevelopment. Drug treatment is more common in HRP women or women who are likely to develop an HRP (though not exclusive to them) (Scheres, Marijnen & Midderdorp, 2017). The management of LMWH or SA may have predictive power regarding the results found. Due to a high incidence of hypertension problems and placenta-related complications, among others, LMWH or SA treatments are the most widespread among high-risk pregnancies (Mone, Mulcahy, McParland & McAuliffe, 2017; Skeith, 2018). These drugs may lead to good uteroplacental vascular development and prevent problems in subsequent development (Gomez-Alarcón, 2016; Lees, et al., 2015). In the case of LMWH, in addition to an anticoagulant effect, the drug acts at the cellular level as it reduces the number of cells destroyed during pregnancy and increases proteases (D´lppolito, Ortiz, Veglia, Tersigni & Di Simone, 2011; Greer, Brenner & Gris, 2014). It also has an anti-inflammatory effect and is preferred to other anticoagulants because it does not cross the placenta (Gomez-Alarcón, 2016; Drewlo, 2011). For its part, the SA causes the blood vessels to dilate and the number of platelets in the blood (involved in blood clotting) is also reduced, preventing pre-eclampsia (ACOG, 2013; Mone, 2017).

Despite its significant results, this study also had limitations. On the one hand, the sample size was small and did not allow us to perform a detailed analysis of the different HRP group pathologies, making it difficult to interpret the possible causes of the findings.

However, the results obtained are novel and could have major implications. Therefore, it would be relevant to constitute a larger sample of both groups of pregnant women to achieve more generalisable results. This would allow establishing whether the differences obtained are due to the relationship of trust with the healthcare professional, which would be a decisive factor in preventing stress from increasing, or to the antiaggregant and/or anticoagulant treatments used. In addition, being aware of mothers' psychological stress levels and the risk factors they can cause facilitates prevention and helps to carry out special pharmacological treatments and care that improve mothers' health and allow babies to develop properly (Langley-Evans, 2015; Seckl & Holmes, 2007; Van den Bergh et al., 2017). In this sense, this study has also served to corroborate the functioning of these prevention and treatment tools.

To conclude, this study has important research and clinical implications: babies from HRPs were found to have better general cognitive skills, as well as some better specific language and motor skills at six months of age. These results are novel. They highlight the key role of pregnancy care and treatments in improving how the pregnancy unfolds and in ensuring babies' proper neurodevelopment (Amorim, 2017).

Bloque 4. Eficacia de una intervención psicológica de control de estrés en el embarazo

CAPÍTULO XIII. Effects of the cognitive-behavioural therapy for stress management on stress and hair cortisol levels in pregnant women: a randomised controlled trial

Romero-Gonzalez, B., Puertas-Gonzalez, J. A., Strivens-Vilchez, H., Gonzalez-Perez, R., & Peralta-Ramirez, M. I. (2020). Effects of the cognitive-behavioural therapy for stress management on stress and hair cortisol levels in pregnant women: a randomised controlled trial. Submitted to *Behaviour research and therapy*.

Introduction

Despite being regarded as a positive stage, pregnancy is a stressful process that involves numerous changes affecting pregnant women's psychological, physiological and social spheres (Christian, 2012; Dunkel & Lobel, 2012). Pregnancy-specific stress, evaluated and considered differently from general stress, is characterised by particular concerns proper to the pregnancy, such as physical symptoms, stress in intimate relationships, family responsibilities and concern for foetal health (Dunkel & Lobel, 2012; Lobel et al., 2008). It is estimated that around 6% of the pregnant population experiences high levels of prenatal stress, which are related to problems such as pregnancy depression and postpartum depression, increased risk of pre-eclampsia and hypertension, higher risk of miscarriage, low foetal weight and premature birth (Caparros-Gonzalez et al., 2017; Christian, 2012; Kaboli et al., 2017; Woods, Melville, Guo, Fan & Gavin, 2010). To this we must add the effect of the mother's psychological state in the final stages of pregnancy and the likelihood that childbirth will require instrumented or surgical attention. In this line, a recent study presented surprising results according to which mothers with high levels of stress or psychopathological symptoms during pregnancy were more likely to need instrumented delivery (forceps, vacuum, emergency c-sections) (Romero-Gonzalez, Caparros-Gonzalez, Gonzalez-Perez, Coca-Arco & Peralta-Ramirez, 2019).

Similarly, the effects of stress on pregnant women has an impact on their babies. In this line, maternal stress levels are responsible for the deregulation of the pituitary adrenal hypothalamus axis in the newborn, thus babies had lower cortisol levels at birth when maternal cortisol levels during pregnancy were high (Romero-Gonzalez, Caparros-Gonzalez, Gonzalez-Perez, Puertas-Delgado & Peralta-Ramirez, 2018).

In this way, prenatal stress plays a major role in maternal and foetal health, but it also has a major impact on the baby's health and subsequent neurodevelopment. Maternal stress and cortisol levels in hair have been found to be linked to worse motor and cognitive neurodevelopment at 6 months of age (Caparros-Gonzalez et al., 2019; Huizink, Robles de Medina, Mulder, Visser & Buitelaar, 2003).

To these studies we should add the impact of the mother's stress during pregnancy, since it has also been linked to the appearance and development of childhood psychological disorders, such as autism and attention deficit disorder and hyperactivity (Grizenko et al., 2012; Grizenko, Fortier, Gaudreau-Simard, Jolicoeur & Joober, 2015; Kinney, Miller, Crowley, Huang & Gerber, 2008; Walder et al., 2014).

Given the implications of suffering stress, many interventions and therapies have emerged with the aim of reducing or alleviating stress. In recent years, guidance and training of health workers (nurses and midwives) have played a substantial role in preventing stress during pregnancy and childbirth (Kaboli et al., 2017). Other alternatives such as third-generation therapies (e.g. mindfulness) (Dunn, Hanieh, Roberts & Powrie, 2012; Shi & MacBeth, 2017; Tomfohr-Madsen et al., 2016), sports such as yoga (Chen et al., 2017; Kusaka, Matsuzaki, Shiraishi & Haruna, 2016) or relaxation training (Bastani, Hidarnia, Kazcemnejad, Vafaei & Kashanian, 2005) have also been used to reduce stress levels and improve pregnant women's quality of life.

However, within evidence-based medicine, Cognitive-Behavioural Therapy (CBT) stands out for the treatment of many disorders (Butler, Chapman, Forman & Beck, 2006). Particularly worthy of note is the favourable data regarding its efficacy to treat anxiety and depression in gestational women (Austin et al., 2008; Karamoozian & Askarizadeh, 2015; Lane, Roufeil, Williams & Tweedie, 2002; Nakano, Akechi, Furukawa & Sugiura-Ogasawara, 2013). CBT during pregnancy has also been followed by women with pre-eclampsia, showing reductions in stress levels, anxiety and depression after the end of the treatment (Asghari, Faramarzi & Mohammmadi, 2016).

In addition to psychological stress, chronic and physiological stress–evaluated by extracting cortisol in hair–has gained further weight due to its negative impact on the pregnancy and the baby's neurodevelopment (Caparros-Gonzalez et al., 2017; Romero-Gonzalez et al., 2018). It is crucial to measure physiological stress to check the effectiveness of therapies and interventions in reducing it, because stress plays a key role in maternal and foetal health. To the best of our knowledge, there is no evidence regarding the effect that CBT can have on reducing cortisol levels in hair in pregnant women, as most studies are based only on self-informed stress measures (Asghari et al., 2016; Richter et al., 2012; Urizar & Muñoz, 2011; Zaheri, Najar & Abbaspoor, 2017). Including chronic stress physiological measures such as cortisol in hair would thus generate information hitherto unknown as to the effectiveness of a therapy. Therefore, the main objective of this study was to check the effectiveness of a cognitive-behavioural therapy for stress management in reducing psychological stress, cortisol levels in hair, and psychopathological symptomatology in healthy pregnant women.

Methods

Participants

Participants were recruited at the Góngora and Mirasierra Health Centres in the province of Granada over the 2017-2019 period. A total of 108 pregnant women were interested in participating in the study. Of these, 93 met the inclusion criteria, the remaining 15 were thus discarded from the study. Participants were randomly divided into two groups: a control group (n = 47) and an experimental group (n = 46). Within the experimental group, a total of 7 women were excluded from the total sample because they did not complete the therapy. In addition, another 8 women were excluded from the control group for the reasons described in the flowchart (Figure 1). Finally, 78 pregnant women (M = 23.94 weeks of gestation; SD = 4.40) with an average age of 33.07 years (SD = 4.63) participated in the study. These women were divided into two groups: a therapy group with an average age of 34 years (SD = 4.99) and a control group with an average age of 32.03 years (*DT* = 4.01). Figure 1 shows the flowchart corresponding to the sample.

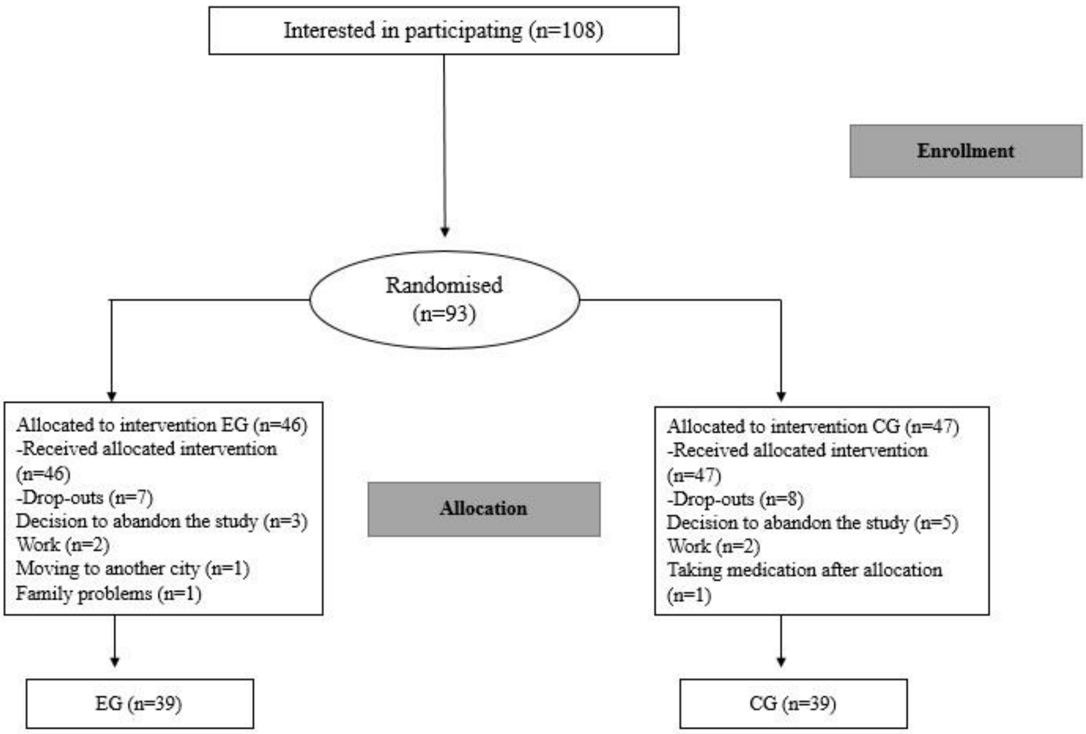

Figure 1. Flow diagram of participants.

Note: EG= experimental group; CG= Control group.

The inclusion criteria consisted of: pregnant women, between weeks 12 and 28 of gestation, with a good command of the Spanish language (oral and written understanding). Exclusion criteria included suffering from a medical or psychological illness or following a corticosteroid treatment.

Participation was voluntary and an informed written consent document was read and signed by every participant. This study was approved by the Human Ethics Research Committee of the University of Granada (reference 881), the Biomedical Ethics Research Committee and the Ethics Research Committee of the Health Centers, and the hospital where this study was implemented. Moreover, this study followed the guidelines of the Helsinki Declaration (AMM, 2008) and the Good Clinical Practice Directive (Directive 2005/28/EC) of the European Union. The study was registered as a Randomised Controlled Trial with the code NCT03404141.

Instruments

Psychological assessment

Perceived Stress Scale (PSS; Cohen, Kamarck & Mermelstein, 1983; Remor, 2001). The PSS provides information on the perception of general stress during the preceding month. It consists of 14 items scores on a 5-point Likert scale (0 = never, 1 = almost never, 2 = once in a while, 3 = often, 4 = very often). Scores range from 0-56 (higher scores represent higher levels of stress). Spanish reliability alpha's Cronbach coefficient is 0,81.

Pregnancy Distress Questionnaire (PDQ; Caparros-Gonzalez et al., 2019; Yali & Lobel, 1999): this is a 12-item scale that measures pregnancy-specific stress related to maternal concerns about pregnancy, such as medical problems, labour and delivery, physical symptoms, bodily changes and the baby's health. Responses are given using a 5-point Likert-type scale where 0 = not at all and 4 = very much. The Cronbach's alpha reliability coefficient is 0.71.

The Symptom Checklist-90-Revised (SCL-90-R; Caparrós-Caparrós. Villar, Ferrer & Poch, 2007; Derogatis, 1994): This is a 90-item scale scored using a 5-point

Likert scale from 0 (never) to 4 (extremely). This instrument is used to assess 9 dimensions: Somatization, Obsession-compulsion, Interpersonal sensitivity, Depression, Anxiety, Hostility, Phobic anxiety, Paranoid ideation, and Psychoticism. The scale also has 7 extra items distributed among 3 global indexes of distress: the GSI, which measures overall psychological distress; the PSDI, which is used to measure the intensity of symptoms; and Positive Symptom Total, used to measure the number of self-reported symptoms. Using the author´s instructions, the scores are transformed to percentiles (0-100). Percentiles ≥ 70 represent clinical symptoms in any of the subscale of this instrument. The nine dimensions show an acceptable reliability, with a Cronbach's alpha for internal consistency of 0.81.

Connor Davidson Resilience Scale (CD-RISC; Connor & Davidson, 2003 Garcia-Leon, Gonzalez-Gomez, Robles-Ortega, Padilla & Peralta-Ramirez, 2019). It reflects the capacity to tolerate experiences such as change, personal problems, illness, pressure, failure, and feelings of pain. The CD-RISC-10 consists of 10 items Likert scale with 5 response options ranging from 0 ("almost never") to 4 ("almost always"). It has a Cronbach's alpha reliability coefficient of 0.86.

Hair cortisol assessment

The cortisol evaluation consisted in taking a lock of hair containing approximately 150 strands from the rear corner of the skull, as close as possible to the scalp (Sauve, Koren, Walsh, Tokmakejian & Van Uum, 2007). A maximum length of 3cm was set for each sample to reflect cortisol levels during the preceding 3 months (Stalder & Kirschbaum, 2012). The samples were wrapped in aluminium foil to be adequately protected from light and humidity and were kept at room temperature until further analysis by the Department of Pharmacology of the Faculty of Pharmacy of the University of Granada. The analysis protocol was published in Caparros-Gonzalez et al. (2017) and Romero-Gonzalez et al. (2018).

Procedure

Participants were recruited by their midwife at their health centre as they attended their quarterly pregnancy visit. At this time, they were informed of the study and provided with a phone number to call if they wished to participate. Subsequently, interested participants were provided with the study information sheet and the informed consent document was signed.

Participants were randomly divided into two groups, a control group (CG) and a therapy group (TG). The randomisation was carried out using SPSS. Random allocation sequences, participants' registration and intervention assignments were carried out by a research assistant who was unaware of the participants' data. Patients assigned to the CG received standard care during their pregnancy. Patients assigned to the therapy group attended 8 weekly CT sessions of 1.5 to 2 hours with two trained psychologists. Each group was composed of 4 to 5 participants and 8 groups were thus formed.

The evaluation instruments described in the previous paragraph were delivered to both the TG and CG members at the same time. In addition, a hair sample was taken for the retrospective removal of cortisol. Those assigned to the TG were informed of the starting date and time of their therapy.

The intervention was adapted from a pre-existing treatment programme (Robles-Ortega & Peralta-Ramírez, 2006) and was taught in the Multipurpose Room of the Zaidin Sur Health Centre. It consisted of a cognitive behavioural programme that had demonstrated to be highly effective in stress management. Its main objective was to provide participants with psychological tools that gave them greater control over the different stressful situations they confront throughout their pregnancy. The programme teaches them strategies to face stress in an optimal way (Linares-Ortiz, Robles-Ortega & Peralta-Ramirez, 2014; Navarrete-Navarrete et al., 2010; Peralta-Ramirez, Robles-Ortega, Navarrete-Navarrete & Jiménez-Alonso, 2009; Santos-Ruiz, Robles-Ortega, Pérez-García & Peralta-Ramirez, 2017). The sessions were composed as follows: (1) psychoeducation: what stress is, characteristics, identification of stressors, responses and consequences; (2) deactivation techniques (thematic imagination along with diaphragmatic breathing); (3) cognitive restructuring: cognitive distortions; (4) cognitive restructuring: irrational beliefs; (5) Alternative thought control strategies - self-instructional training and time organisation; (6) training in social skills: assertiveness, basic assertive rights, saying no and asking for a change of behaviour; (7) Relationship between anger and stress: emotional self-regulation; (8) optimism and good humour – recapitulation.

At the end of the therapy, the assessment tools described above were re-administered to participants in both groups. During this second extraction of hair, only the two centimetres closest to the root were used to avoid overlap between pre and post-treatment samples. At that moment, participants of the CG were offered to take part in the therapy whenever they wished.

Data analysis

First, to check whether both groups (the control group and experimental group) were equal regarding the main sociodemographic and obstetric variables, different student t-tests (quantitative variables) and Chi-square tests (qualitative variables) were performed.

According to the analysis of treatment intent, and following the recommendations established by other researchers (Garcia-Silva et al., 2018; Montori & Guyatt, 2001), using the last observation carry forward method, missing values were imputed and all participants initially randomised were included in a mixed repeated measures ANOVA 2*2 the variable between groups having two levels (CG and TG), and the intrasubject variable two temporary moments (pre and post).

Next, to check the effectiveness of cognitive behavioural therapy, a mixed repeated measures ANOVA 2*2 was performed, the variable between groups having two levels (CG and TG), and the intrasubject variable having two temporal times (pre and post). The Greenhouse-Geisser correction was applied in these ANOVAs. The dependent variables were scores in PSS, PDQ, CD-RISC, the SCL-90-R subscales and cortisol levels in hair. Subsequently, post-hoc multiple-comparison analyses were performed on the variables presenting interaction, applying Bonferroni correction to check whether there were differences between the pre and post scores in both the control group and the experimental group (intra-subject analysis). A comparison of means using the student's t-test was also performed, the group being the independent variable (control vs experimental) and the dependent variables being the scores in the PSS, PDQ, CD-RISC, the SCL-90R subscales and cortisol in hair (inter-group analysis).

Finally, to check the size of the within-subject effects of the differences, Cohen's d was calculated, based on the recommendations of taking a d = 0.20 as the effect's low size, d = 0.50 as the average size, and d = 0.80 as a large effect size (Cohen, 1988).

For hair cortisol, we performed a log transformation (natural log; ln base e) in order to obtain a normal distribution. Analyses were performed using the Statistical

Package for the Social Sciences 20.0 for Windows, version 8.1 (SPSS, Armonk, New York).

Results

Sample description

Of the 78 women participating in the study, 39 belonged to the CG, with an average age of 32.03 years (*SD* = 4.01), while 39 were part of the TG with an average age of 34 years (*SD* = 4.99). As shown in Table 1, both groups had matching major sociodemographic and obstetric history variables.

Table 1. Differences between groups in sociodemographic variables and obstetric information.

		Control group (n = 39) M(SD)/n(%)	**Therapy group (n = 39) M(SD)/n(%)**	**test**	***p***
Sociodemographic variables					
Age		32.03(4.01)	34(4.99)	-1.87	.06
Nationality	Spanish	36(92.3%)	37(94.9%)	.24	.62
	Inmigrant	3(7.7%)	2(5.1%)		
Marital status	Married/cohabitant	39(100%)	39(100%)		
Employment situation	Employed	8(13.9%)	10(25.6%)	.58	.44
	Unemployed	31(86.1%)	29(74.4%)		
Education	Primary school	1(2.6%)	-	1.13	.56
	High school	11(28.2%)	10(25.6%)		
	University	27(69.2%)	29(74.4%)		
Sport	Yes	20(51.3%)	22(56.4%)	1.19	.27
	No	19(48.7%)	17(46.6%)		
Smoking	Yes	3(7.7%)	-	3.48	.06
	No	36(92.3%)	39(100%)		

Alcohol	Yes	-	-		
	No	39(100%)	39(100%)	-	-
Hair	Natural	18(46.2%)	17(46.6%)	.03	.84
	Dyed	21(53.8%)	22(54.4%)		
Hair	Straight	23(59%)	22(56.4%)	4.43	.21
	Curly	16(41%)	17(43.6%)		
Obstetric information					
Weeks of gestation	T_0	23.85(3.20)	24.03(5.37)	-.16	.86
	T_1	33.34(2.27)	31.58(5.59)	1.59	.09
Wanted pregnancy	Yes	36(92.3%)	31(79.5%)	3.96	.08
	No	3(7.7%)	8(20.5%)		
Type of pregnancy	Spontaneous	33(84.6%)	34(87.2%)	.02	.96
	Fertility treatment	6(15.4%)	5(12.8%)		
Previous miscarriages	0	26(67%)	19(48.7%)	3.07	.07
	≥1	13(33%)	20(51.3%)		
Primiparous	Yes	20(51.3%)	17(43.6%)	1.35	.24
	No	19(48.7%)	22(56.4%)		

Note: T-Student test used to quantitaive variables (age and week of gestation), Chi-squared test to categorical variables.

Intervention-to-trait analysis

The analysis performed with the initially randomised group showed that there were statistically significant interaction*group effects in PDQ scores ($F_{1,91,} = 9.18$; $p < 0,01$), EEP scores ($F_{1,91,} = 13.44$; $p < 0.01$), cortisol levels in hair ($F_{1,91,} = 1.48$; $p < 0.05$) and the general scales of the GSI SCL-90-R ($F_{1,91,} = 4.51$; $p < 0,05$) and PSDI ($F_{1,91,} = 8.31$; $p < 0.05$). These results show that not completing the intervention did not imply a bias for this study.

Efficacy of cognitive behavioural therapy in controlling stress during pregnancy: pregnancy-specific stress, perceived stress, cortisol in hair, resilience and psychopathological symptoms.

With regard to the repeated measures ANOVA analysis, group*time interaction effects were found between the therapy group and the control group and the PDQ scores ($F_{1,74,}$ = 11.00; $p < 0.01$), EEP scores ($F_{1,74}$ = 4.04; $p < 0.05$), cortisol levels in hair ($F_{1,74}$ = 14.05; $p < 0.01$) as well as the GSI SCL-90-R general scales ($F_{1.74}$ = 4.86; $p < 0.05$) and PSDI ($F_{1.74}$ = 8.90; $p < 0.01$).

The average scores of the variables showing interaction in both groups in the pre and post are shown in Table 2. Subsequent between-group analyses revealed differences between CG and TG before and after stress therapy.

In addition to the TG, within-subject differences were found in the PDQ scores (t = 4.54; $p < 0.01$), EEP (t = 3.75; $p < 0.01$), cortisol in hair (t = 1.95; $p < .05$), and on the overall scales of the GSI SCL-90-R (t = 2.47; $p < 0.01$) and PSDI (t = 3.27; $p < 0.01$). The mean scores of the therapy group in these variables being higher before the therapy than after. Figure 2 shows the evolution of pre and post intervention scores in both groups in the main stress measures.

The analysis of the size of the sample effect revealed that on most scales where interaction was found, the size of the TG effect presented scores entailing an effect that went from moderate to high (Table 2).

Table 2. Differences between pre-intervention and post-intervention scores in group and experimental group.

		Group	T_0	test	*p*	T_1	test	*p*	d
Stress	PDQ	CG	13.04(4.68)	-4.67	.001	12.93(5.24)	-.71	.47	0.05
		EG	18.18(5.38)			13.82(5.75)ᵀ			0.75
	PSS	CG	26.12(2.78)	-.47	.63	26.43(1.34)	3.70	.001	0.16
		EG	26.72(7.41)			21.87(7.56)ᵀ			0.64
	HCC	CG	5.50(.91)	3.38	.001	5.62(.86)	5.59	.005	0.13

		EG	4.78(.97)			4.47(.94)[T]			0.32
SCL-90-R	GSI	CG	49.37(28.58)	-3.70	.001	50.10(29.30)	-1.53	.12	0.02
		EG	71.33(25.56)			60.05(28.97)[T]			0.81
	PSDI	CG	39.35(24.32)	-3.49	.001	41.88(22.91)	-.30	.76	0.12
		EG	57.95(26.56)			43.59(27.26)[T]			0.55

Note: [T] Significance level at p<0,05 for intrasubject differences
PDQ = Pregnancy Distress Questionnaire; PSS = Perceived Stress Scale; HCC = Hair Cortisol Concentrations; GSI = Global Severity Index; PSDI = Positive Symptom Distress Index; T_0 = Pre-intervention; T_1 = Post-intervention

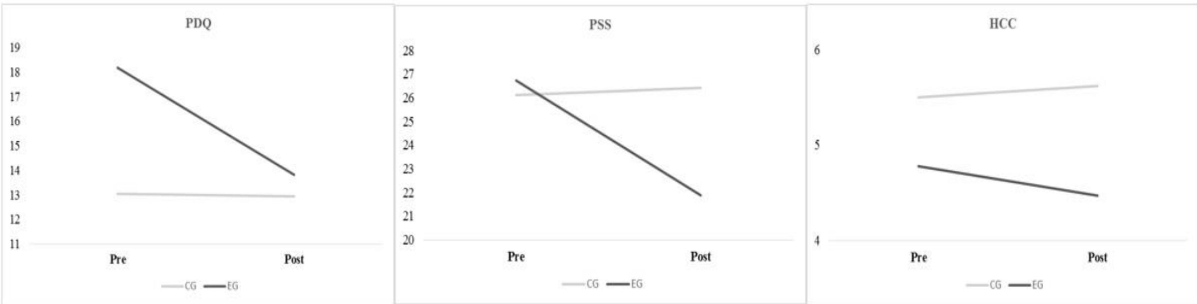

Figure 2. Pre and post-intervention scores in both groups in main stress measures.
Note: PDQ= Pregnancy Distress Questionnaire; PSS= Perceived Stress Scale; HCC= Hair Cortisol Concentrations; CG= Control Group; EG= Experimental Group.

Discussion

The objective of this study was to test the effectiveness of a cognitive-behavioural therapy for stress management in healthy pregnant women. Among the variables to be modified were the pregnancy-specific stress, perceived stress, cortisol levels in hair, psychopathological symptomatology and resilience. To this end, two groups of pregnant women were compared, a group that participated in stress management therapy (TG) and another group that received standard medical care (CG). The results showed that the therapy used was effective, as reductions in specific pregnancy stress levels, perceived stress, cortisol in hair, and in positive indices of discomfort and overall severity were found.

It is first worth noting that the result of the reduction of perceived stress levels in women who participated in the therapy is compatible with that of a previous study that found a decrease in perceived stress levels in pregnant women with gestational diabetes (Zaheri et al., 2017). Perceived stress is a type of stress that is present in both pregnant women and the general population, as it involves aspects such as work, daily tasks, etc. (Remor, 2001). In this sense, the intervention we performed on healthy pregnant women succeeded in alleviating this type of general stress. However, the most exciting result we obtained was the decrease in pregnancy-specific stress. Pregnancy-specific stress is a powerful predictor of negative outcomes in maternal and child health (Lobel et al., 2008), even ahead of perceived stress. In this line, other authors have found it to have been reduced following interventions based on counselling and diseases such as pre-eclampsia Asghari et al., 2016; Kaboli et al., 2017). However, our study is the first to find a reduction during healthy pregnancy, working on the concerns experienced by pregnant women. The results showed that it is possible to diminish the concerns that pregnant women try to normalise, but that can have negative consequences for them. Overall, the decrease in perceived stress and pregnancy-specific stress in a population of healthy pregnant women may be a step towards implementing this therapy as a health-promoting measure.

Second, with regard to the chronic stress biomarker used, cortisol in hair, a reduction in levels was found after intervention, resulting in less activation of the HPA axis, with the positive health consequences that this generates. Some authors have stated the need and utility to include the evaluation of cortisol in hair to check the efficacy of therapies, also finding lower levels after the intervention (Iglesias et al., 2015; Tsoli et al., 2018). A recent study showed the relationship between maternal and child cortisol, as women with high stress levels had newborns with lower levels, posing a risk to their health (Romero-Gonzalez et al., 2018). It is important to address this fact, in accordance with the "hypothesis of foetal programming", which posits the possibility that the intrauterine environment, dependent on the mother and her living habits, significantly conditions child and adult health (Barker et al., 1993). Lowering maternal cortisol levels through therapy may lead to further prevention of diseases in adulthood caused by prenatal stress. That is, the intervention’s effectiveness goes beyond managing psychological stress, it also allows the physiological reduction of cortisol in healthy pregnant women with implications for themselves and for their babies.

In relation to psychopathological symptomatology during pregnancy, lower levels were found after intervention on the general discomfort scales, indicating the average degree of severity of symptoms, and on the positive discomfort scale, which reflects a pregnant woman’s tendency to exacerbate psychopathological symptoms. Some authors had found a reduction in a wide range of psychopathological symptoms by conducting the intervention in different domains (Bradbury et al., 2008; Linares-Ortiz et al., 2014; Santos-Ruiz et al., 2017). Our results indicate that general psychopathological symptoms decreased in this population following the therapy implying that the tendency to exacerbate symptoms and the very perception of the severity of symptoms decrease after therapy. These results are significant in a pregnant population as gestation involves a psychological and hormonal adaptation that does not apply to the general population (Alhusen, Ayres & Depriest, 2016). In addition, during pregnancy, many changes take place in the body, changes in blood circulation, glandular functions and in the process of feeding gestation-related tissues, which can lead to pain and even psychological maladjustment (Nayak, Poddar & Jahan, 2015). Furthermore, it is worth noting the significant role that cognitions play in this programme: a major objective is that participants manage to identify the maladjusted cognitive processes underlying their thoughts and to learn new ways of perceiving and thinking about what they are going through. These aspects can be key to reducing their own symptoms, which are indicators of psychological well-being, by leading the pregnant woman to avoid regarding her symptoms as more serious than they truly are and to focus less on their severity (Hofmann, Asnaani, Vonk, Sawyer & Fang, 2012).

The implications of these results are of great significance: they reflect the effectiveness of a stress management therapy directed towards healthy pregnant women, that succeeded in reducing levels of psychological, physiological stress and certain psychopathological symptoms. Since the population is healthy and has no medical or psychological pathology, this model of therapy is based on promoting mental health in pregnant women: its effectiveness lies in lowering the probability of suffering a large number of stress-associated psychological and obstetric problems (Caparros-Gonzalez y cols., 2017; Romero-Gonzalez y cols., 2018; Romero-Gonzalez y cols., 2019).

Nevertheless, there were some limitations to the present study. The experimental group started with higher levels of stress and a worse psychological state. The latter, however, does not overshadow the fact that notable reductions were found after the intervention in all the variables under study. Indeed, the effect sizes revealed a substantial change in the women having taken part in the therapy, that were not found in the control group. Therefore, despite the groups not having been equal, the therapy effect was visible in the group. Another possible limitation was the measurement of variables at only two moments in time: a follow-up could have provided relevant data regarding the maintenance of the effect of the therapy on the long-term, after birth.

To conclude, these findings have major implications for the field of research and at the clinical level, as a number of stress-related psychological/psychopathological variables shown in pregnant women could be reduced through psychological intervention.

Evaluating these variables can provide relevant data to health professionals on the problems affecting women during the gestation period and the consequent dispensing of treatments adapted to this population. It is essential to raise the awareness of health workers and beneficiaries both about the role of psychological health and its impact on pregnant women and their children (Alderdice et al., 2013; Caparrós-González et al., 2017), as well as the need for interventions aimed at improving it during such a vital stage of life, pregnancy.

Capítulo XIV. Discusión general, conclusiones y perspectivas futuras

14.1 Discusión general

El objetivo general de esta Tesis Doctoral fue comprobar las consecuencias que tiene el estrés experimentado durante todo el embarazo en la salud materna e infantil. Para ello se han llevado a cabo ocho estudios que se engloban dentro de cuatro bloques.

En el primer bloque, titulado Adaptación y validación de instrumentos de evaluación psicológicos, se planteaba la necesidad de contar con instrumentos para poder evaluar el estrés específico del embarazo, y la satisfacción con el parto, ambos muy relacionados con el estrés perinatal.

En primer lugar, y en relación al estrés específico del embarazo, el objetivo fue la traducción, adaptación y validación del *Prenatal Distress Questionnaire Revised* (NuPDQ) para su aplicación en mujeres embarazadas españolas. Este cuestionario se diferencia de su predecesor, el *Prenatal Distress Questionnaire* (Caparros-Gonzalez y cols., 2019; Yali y Lobel, 1999) en su extensión, abarcando más preocupaciones y pudiendo ser administrado de forma específica en cada uno de los trimestres. Tras los resultados encontrados, contamos con un instrumento validado en muestra española que tiene unos adecuados índices psicométricos en su versión de 14 ítems, con una estructura factorial formada por cinco factores, tal y como demostró el análisis factorial exploratorio y confirmatorio. Estos cinco factores permiten evaluar de forma precisa las preocupaciones del embarazo que se subdividen en: "preocupaciones por el parto", "preocupaciones por la salud propia y el embarazo", "preocupaciones sobre el cuidado del bebé", "preocupaciones sobre los cambios físicos, económicos y sociales" y "preocupaciones sobre aspectos inesperados e incontrolables del embarazo".

Mediante el uso de este cuestionario se evalúan las preocupaciones que definen al estrés específico del embarazo, como son preocupaciones sobre los cambios y síntomas físicos, cambios sociales, preocupaciones sobre el parto, la habilidad para ser madre, la salud propia y del feto o preocupaciones sobre posibles complicaciones médicas (Alderdice y cols., 2012; Caparros-Gonzalez y cols., 2019; Romero-Gonzalez y cols., 2018; Romero-Gonzalez y cols., 2019).

Esta versión revisada tiene una elevada fiabilidad, incluso por encima de su versión anterior, con un alfa de *Cronbach* de 0.81 frente al 0.74 del PDQ (Caparros-Gonzalez y cols, 2019). Por todo ello, este instrumento se vuelve imprescindible para su uso durante el embarazo, lo que puede permitir detectar mujeres que se encuentren en riesgo, y prevenir posibles consecuencias negativas (Alderdice y cols., 2012; Lobel y cols., 2008).

Otro instrumento clave para el estudio del proceso de parto es la *Birth Satisfaction Scale Revised* (Hollins-Martin y Martin, 2014). Este instrumento tiene como objetivo estudiar la satisfacción con el parto tras el mismo, y actualmente no contamos con un instrumento parecido en muestra española. La versión original del instrumento, así como sus validaciones en otros idiomas, indicaban adecuados índices psicométricos (Göncü-Serhatlıoğlu y cols., 2018; Hollins-Martin y Martin, 2014; Vardavaki y cols., 2015). Se encontró una estructura de tres factores, siendo estos: estrés experienciado en el parto, calidad de los cuidados y atributos personales. Esta estructura trifactorial encontrada también aparece en todas las versiones validadas de la BSS-R, así como en la versión original (Göncü-Serhatlıoğlu y cols., 2018; Hollins-Martin y Martin, 2014; Vardavaki y cols., 2015). En términos psicométricos, la versión española de la BSS-R posee una validez discriminante entre aquellas mujeres que tienen un parto vaginal o instrumentado, encontrando mayores niveles de satisfacción para las que no necesitan asistencia en el parto, lo cual parece ser universal a través de los estudios realizados con la BSS-R (Fleming y cols., 2016; Hollins-Martin y Martin, 2014; Jefford y cols., 2018). Este hecho resalta la necesidad de que una mujer controle y pueda tomar decisiones sobre su proceso de parto, con el fin de minimizar su estrés y aumentar su satisfacción, pudiendo evitar de esta forma la aparición de trastornos por estrés postraumático, tocofobia, miedo al parto o incluso depresión posparto (Ali, 2018; Dikmen-Yildiz, Ayers y Phillips, 2017; Goutaudier, Bertoli, Séjourné y Chabril, 2018; Pampaka y cols., 2019).

Por todo ello, el instrumento BSS-R, con tan solo 10 ítems, cuenta con unas propiedades psicométricas adecuadas para su uso en muestra española. A esto hay que añadir que no contamos con ningún instrumento parecido y la información que ofrece puede ayudar a mejorar el cuidado ofrecido a las mujeres, y a entender desde el "Sistema Sanitario Español" las necesidades de las mismas.

Continuando con el segundo bloque de estudios presentados en esta Tesis, cuyo objetivo fue comprobar la relación del estrés perinatal con los síntomas psicopatológicos de la madre y su efecto en el proceso de embarazo y parto se realizaron tres estudios. El objetivo del primero de ellos fue comprobar la relación entre el sobrepeso y obesidad pregestacional con el estrés perinatal y síntomas psicopatológicos durante los tres trimestres de embarazo. Los resultados mostraron diferencias entre el grupo de mujeres con un índice de masa corporal (IMC) elevado antes del embarazo y mujeres embarazadas con un IMC normal. Las principales diferencias radican en el estrés específico del embarazo, que era mayor en el primer y segundo trimestre en embarazadas con IMC elevado, mientras que el estrés percibido era más alto en el tercer trimestre. Además, la sintomatología psicopatológica era más elevada durante el segundo trimestre en embarazadas con IMC elevado, algo que se sale de la "norma" en este tipo de población, donde el segundo trimestre suele ser el más estable emocionalmente (Martini y cols., 2015). Encontrar estas diferencias en el estado psicológico entre ambos grupos de mujeres pone en evidencia la importancia que tienen los factores previos al embarazo en el curso del mismo, ya que a partir de una condición poco saludable conlleva un peor estado psicológico, el cual a su vez puede relacionarse con peores resultados obstétricos, y problemas en la salud materna e infantil a largo plazo (Alderdice y cols., 2012; D'Anna-Hernandez y cols., 2011; Davis y Sandman, 2010; Huizink y cols., 2003). De esta forma, es indispensable la concienciación de la comunidad sanitaria a la hora de planificar un embarazo, pues se debe ofrecer información sobre la importancia de mantener unos hábitos de vida saludable para evitar consecuencias negativas durante el embarazo (Bye y cols., 2016; Ramírez-López y cols., 2015).

El segundo objetivo de este bloque fue comprobar las diferencias existentes en estrés, cortisol en pelo y síntomas psicopatológicos entre mujeres gestantes y mujeres no gestantes. La investigación centrada en la psicopatología de la mujer embarazada se ha focalizado tradicionalmente en ansiedad y depresión, dejando de lado otros síntomas psicopatológicos, por lo que es necesario clarificar qué síntomas diferencian a las mujeres embarazadas de las no gestantes, y comprobar el curso de esta sintomatología en un embarazo normal, con el fin de prestar atención a posibles desviaciones como factores de riesgo de consecuencias negativas. Los principales resultados de este estudio mostraron una clara diferencia entre mujeres gestantes y no gestantes en varios síntomas psicopatológicos, como son las somatizaciones, ansiedad fóbica, ideación paranoide y psicoticismo, siendo mayores en las mujeres gestantes. En el caso de sensibilidad interpersonal, las mujeres embarazadas se encontraban por debajo de las no gestantes, lo cual implica la habilidad de percibir los comportamientos de los demás como ajustado a la realidad y tomar parte en relaciones interpersonales satisfactorias (Hall, Andrzejewsky y Yopchick, 2009). Estas diferencias pueden estar generadas por razones evolutivas, ya que el embarazo conlleva cambios cognitivos y comportamentales que favorecen el instinto de supervivencia (Anderson y Rutherford, 2012), mostrando un diferente procesamiento emocional y de reconocimiento facial, lo que las hace más susceptibles a reconocer emociones como miedo o ira. Esto puede conllevar una interpretación de la realidad como amenazante (Pearson, Lightman y Evan, 2009), además de mostrar un mayor nivel de etnocentrismo, lo que lleva a la identificación de la mujer embarazada como parte de un grupo y rechazar aquello ajeno a su grupo (Anderson y Rutherford, 2011; Navarrete, Fessler y Eng, 2007). En lo referente al curso psicopatológico a lo largo de todo el embarazo, se encontraron descensos en la sintomatología psicopatológica según avanzaban los trimestres, siendo el primer trimestre el más elevado, lo cual coincide con la ambivalencia en el que las mujeres embarazadas se encuentran y la incertidumbre a la que deben hacer frente al principio del embarazo (Downe, Finlayson, Tunçalp y Metin Gülmezoglu, 2016; Petersen y Jahn, 2008). De esta forma, mediante este estudio es posible la identificación de mujeres en riesgo al atender a posibles desviaciones en el curso psicopatológico descendente durante el embarazo. Asimismo, nos permite obtener un amplio conocimiento sobre qué diferencia a las mujeres gestantes de las no gestantes, pudiendo entender el estado psicológico de esta población y las necesidades que requieren.

Por último, y para completar este bloque dedicado a profundizar en los conocimientos sobre las consecuencias maternales, el tercer objetivo específico fue comprobar la repercusión de los altos niveles de estrés, cortisol en pelo y síntomas psicopatológicos de la mujer embarazada en el tipo de parto, instrumentado o vaginal, e inicio del mismo, espontáneo o inducido.

En este caso, se encontró que, durante el tercer trimestre de embarazo, aquellas mujeres embarazadas que presentaban niveles más altos en síntomas psicopatológicos, como somatizaciones, ansiedad, depresión y psicoticismo, tenían más probabilidad de tener un parto instrumentado. Estos resultados deben entenderse de forma conjunta con el anterior estudio, en el que se trazó un perfil psicopatológico descendente durante el embarazo, ya que, en este caso, las alteraciones psicopatológicas del tercer trimestre de embarazo conllevan consecuencias negativas obstétricas. Esta relación no es nada desdeñable, ya que las implicaciones que tiene en la salud materna e infantil el parto instrumental son elevadas, siendo más recomendable el parto vaginal, que se relaciona con una mayor calidad de vida de la mujer y la salud del recién nacido (Lumbiganon y cols., 2010; Mylonas y Friese, 2015; Torkan, Parsay, Lamyian, Kazemnejad y Montazeri, 2009). Por todo lo descrito se hace imprescindible la identificación de síntomas psicopatológicos de la mujer gestante a lo largo de su embarazo ya que pueden implicar importantes resultados obstétricos.

A pesar de que el cortisol en pelo no ha mostrado relación entre estrés crónico y los resultados del parto, si encontramos una fuerte relación en los resultados derivados del tercer bloque de esta Tesis Doctoral, titulado "Estrés perinatal y consecuencias en la descendencia".

En este caso, el primero de los estudios de este bloque tenía como objetivo comprobar la relación existente entre el estrés durante el embarazo y los niveles de cortisol en pelo maternos con los niveles de cortisol del recién nacido, partiendo del estudio de Kapoor y cols., (2016) realizado con monos, el cual era el único hasta el momento que había demostrado una relación entre el cortisol en pelo materno y el del recién nacido.

En este caso, nuestros resultados coinciden con aquellos mencionados por Kapoor y cols., (2016), y es que los elevados niveles de cortisol en pelo maternos del primer trimestre se relacionan con una disminución en el cortisol en pelo del recién nacido. Las implicaciones de este hecho radican en la importancia que tiene esta hormona en la maduración pulmonar del feto, la cual requiere unos adecuados niveles para completar su formación y permitir al recién nacido respirar sin dificultad, por lo que una alteración de los mismos puede poner en riesgo su salud (Bernhard, 2016; Busada y Cidlowski, 2017; Chung, 2014; Roberts, Brown, Medley y Dalziel, 2017). Tal y como se presentó anteriormente, parte del cortisol materno es capaz de atravesar la placenta, por lo que este excedente que llega al feto hipotetizamos que podría ser el responsable de la desregulación en su eje HHA, lo que impediría la correcta producción de cortisol por si mismo, dando lugar a menores niveles del mismo (Beijers, Buitelaar y de Weerth, 2014; Rakers y cols., 2016).

Además del cortisol, el estrés percibido por la madre también estaba relacionado con los niveles de cortisol en pelo del recién nacido, y es que aquellas preocupaciones acerca del embarazo se relacionaban de manera positiva con el cortisol del recién nacido, mientras que mayores niveles de estrés percibido en el tercer trimestre podían contribuir a la disminución del cortisol en el recién nacido. Este hecho diferencial remarca de nuevo la particularidad de usar medidas diferentes de estrés, ya que las consecuencias de uno y otro son diferentes (Alderdice y cols., 2012).

Estos resultados subrayan que la identificación de estrés, cortisol y psicopatología en el primer trimestre de embarazo son cruciales para el posterior desarrollo fisiológico fetal, ya que puede permitir elaborar intervenciones destinadas a la disminución del estrés desde los primeros momentos del embarazo.

Antes de continuar al siguiente objetivo, es importante recalcar que, hasta ahora, todos los resultados presentados tienen importantes implicaciones clínicas, ya que nos hacen conscientes de la necesidad de realizar un seguimiento psicológico de la mujer embarazada durante todo el período de gestación, aunando medidas de estrés psicológico, psicopatología y cortisol en pelo, con el fin de detectar de forma precoz y prevenir, lo más pronto posible, las consecuencias negativas derivadas.

Ahora sí, y para completar este bloque relacionado con el estrés perinatal y las consecuencias en la descendencia, se realizó un estudio con el objetivo de comprobar si existían diferencias en el desarrollo infantil a los 6 meses de edad entre los bebés nacidos de mujeres embarazadas de alto riesgo versus bebés nacidos tras embarazos de bajo riesgo.

Tal y como fue descrito en la introducción, el embarazo de riesgo, por sus características, podría llevar asociado un incremento en los niveles de estrés, que a su vez podrían tener repercusión en el neurodesarrollo del recién nacido. Sin embargo, los resultados mostraron que no había diferencias en los niveles de cortisol en pelo entre ambas muestras, por lo que parece no ser un factor determinante en los embarazos de alto riesgo. En lo relativo al neurodesarrollo, los resultados encontrados en este estudio son contrarios a nuestra hipótesis previa, ya que se encontraron mayores niveles de neurodesarrollo cognitivo, lingüístico y motriz en aquellos bebés que nacieron de un embarazo de alto riesgo. Este hecho nos llevó a analizar la posible causa de este sorprendente hecho, encontrando un potente efecto de los medicamentos administrados a la población de embarazo de riesgo de nuestra muestra, los cuales en su mayoría eran anticoagulantes como la heparina o la aspirina. Una posible explicación a estos resultados podría derivarse de que estos anticoagulantes podrían facilitar el flujo sanguíneo uteroplacentario, provocando un mejor riego sanguíneo cerebral en el feto (Gomez-Alarcón y cols., 2016; Lees y cols., 2015). De forma complementaria, el hecho de los cuidados recibidos por las mujeres que experimentan un embarazo de riesgo también puede ser un factor determinante. En este grupo, las revisiones no son trimestrales como en embarazos de bajo riesgo, sino que se realiza un seguimiento casi mensual, por lo que el recibir una atención personalizada puede ayudar a aumentar los hábitos de vida saludables y el cuidado propio en la mujer embarazada (Amorim y cols., 2017; Harris y cols., 2014; Mu, 2004). Estos resultados, además de novedosos y sorprendentes, evidencian la necesidad de cuidar de forma personalizada a las mujeres durante el embarazo, ofreciendo información sobre la importancia de cuidar su salud para prevenir problemas y realizando seguimientos más asiduos que los tres meramente rutinarios.

Para finalizar esta Tesis Doctoral realizamos un último artículo situado en el bloque de “Eficacia de una intervención psicológica de control de estrés en el embarazo”. La necesidad de este estudio surge tras demostrar los efectos del estrés en el embarazo, pues es importante comprobar la eficacia de un tratamiento de control de estrés que poder implementar como medida de promoción de la salud en embarazo. Por ello, el objetivo específico de este bloque fue comprobar la eficacia de un tratamiento cognitivo conductual de control de estrés en mujeres embarazadas sanas en la reducción de cortisol, psicopatología y estrés perinatal, así como en el incremento de la resiliencia.

Los resultados principales mostraron un descenso en los niveles de cortisol en pelo, así como en estrés específico del embarazo, estrés percibido y en algunos índices generales de sintomatología psicopatológica. Estos resultados habían sido encontrados en mujeres gestantes con enfermedades en el embarazo como diabetes o preeclampsia (Asghari y cols., 2016; Kaboli y cols., 2017; Zaheri y cols., 2017). Sin embargo, nuestro estudio ha sido el primero en reducir los niveles de estrés en mujeres embarazadas sanas, por lo que su posible implementación podría funcionar como terapia de promoción de la salud. De igual forma, el cortisol en pelo también disminuye tras la intervención, siendo el primer estudio en encontrar esta reducción fisiológica en embarazo, usando medidas de estrés crónico.

A través de toda la Tesis Doctoral se ha demostrado la importancia del estrés psicológico, así como el cortisol en pelo, en relación con la salud materna e infantil, por lo que su reducción durante el embarazo es el culmen de la Tesis. Mediante 8 sesiones de Terapia Cognitivo-Conductual es posible reducir el estrés en las mujeres gestantes, por lo que es probable que se contribuya a paliar las consecuencias negativas que tiene.

La importancia de esta Tesis Doctoral ha residido en la complementación de medidas de estrés psicológico, estrés fisiológico y psicopatología, de una forma longitudinal durante todo el embarazo, y en algunos casos hasta los 6 meses de vida del recién nacido. De esta forma exhaustiva, se han encontrado los resultados descritos anteriormente, que ayudan a dar sentido y aumentar el conocimiento sobre un período vital en la mujer.

Como posibles limitaciones en esta Tesis se encuentra la generalización de resultados a mujeres que han seguido su embarazo en la sanidad pública, ya que no se han tenido en cuenta aquellas mujeres embarazadas que acuden a la sanidad privada. Además, la mayoría de ellas eran reclutadas durante la semana 10-12 de embarazo, lo que deja un período de 10 semanas que podría ser muy interesante estudiar para conocer el estrés psicológico de esos primeros momentos de embarazo, ya que también pueden condicionar el devenir del mismo.

Con todo ello, a continuación, se presentan las principales conclusiones derivadas de esta Tesis Doctoral, y que, en su conjunto, dan el sentido completo a todos los estudios elaborados.

14.2 Conclusiones

Como resultado de los estudios de esta Tesis Doctoral, se pueden extraer las siguientes conclusiones:

- El instrumento *Prenatal Distress Questionnaire Revised* (NuPDQ) queda compuesto por 14 items, repartidos en 5 factores que evaluan el estrés específico del embarazo de forma válida y fiable, y posee además unas adecuadas propiedades psicométricas. Por ello, se recomienda su uso para evaluar el estrés específico del embarazo en mujeres embarazadas españolas.

- La validación de la La *Birth Satisfaction Scale Revised* (BSS-R) para la población española cuenta con unas propiedades psicométricas y estructura factorial similares a la original, por lo que se recomienda su uso para evaluar satisfacción con el parto en muestra española.

- El índice de masa corporal pregestacional correspondiente a sobrepeso u obesidad lleva asociado mayores niveles de estrés psicológico durante el embarazo, lo cual además puede conllevar problemas de salud en la mujer embarazada o en su descendencia.

- Las mujeres embarazadas muestran mayores niveles de síntomas psicopatológicos que las mujeres no gestantes, entre ellos destacan: somatizaciones, ansiedad fóbica, ideación paranoide y psicoticismo. Este hecho puede responder a razones evolutivas, por el cual la mujer embarazada se encuentra más susceptible a fin de proteger a su futuro bebé de amenazas externas. Además, durante un embarazo normal, los síntomas psicopatológicos suelen descender según avanza el embarazo.

- Alteraciones en el curso de la sintomatología psicopatológica durante el embarazo, concretamente en somatizaciones, ansiedad, depresión y psicoticismo durante el tercer trimestre, se relaciona con un incremento en la probabilidad de necesitar un parto instrumentado, frente a un parto vaginal. Este hecho puede repercutir en la salud materna y en el recién nacido, además de condicionar a la mujer frente a futuros embarazos.

- Niveles elevados de cortisol en pelo maternos durante el primer trimestre de embarazo pueden provocar una desregulación en el eje HHA del feto, presentando menores niveles de cortisol al nacer. Esto puede provocar retrasos en la maduración de los pulmones y demás órganos en el recién nacido.

- Los bebés nacidos de embarazos de alto riesgo tienen mayores puntuaciones en neurodesarrollo cognitivo, lingüístico y motor, frente a bebés nacidos de embarazos de bajo riesgo. La medicación que las mujeres embarazadas de alto riesgo toman, así como la mayor cantidad de revisiones médicas y concienciación de esta población pueden explicar estas diferencias.

- Una terapia cognitivo-conductual de control de estrés, aplicada durante el embarazo a mujeres gestantes sanas, contribuye a la disminución de estrés psicológico y fisiológico. De esta forma, su implantación podría formar un modelo de promoción de la salud de la mujer embarazada, ayudando a disminuir la probabilidad de sufrir consecuencias negativas derivadas de altos niveles de estrés.

14.3 Perspectivas futuras

Derivadas de esta Tesis, surgen algunas preguntas que pueden responderse mediante perspectivas futuras:

- El estudio de la pareja como elemento importante en el curso del desarrollo fetal. Conocer también el estrés psicológico así como los niveles de cortisol que pueden estar experimentado las parejas. Asimismo, es importante la evaluación del apoyo social que reciben las mujeres embarazadas.

- Contar con información sobre el periodo de preconcepción, con el fin de conocer los niveles de estrés y elaborar un perfil psicopatológico desde antes del embarazo hasta el final.

- Realizar un seguimiento de los bebés, pudiendo relacionar el estrés psicológico y el cortisol en pelo de la madre con el porterior neurodesarrollo en la niñez.

- Realizar un seguimiento tras la terapia cognitivo conductual realizada con las mujeres gestantes, pues de esta forma se podrá conocer el efecto que tiene la intervención en la programación fetal del posterior neurodesarrollo de sus bebés, o en la propia salud materna tras el parto.

14.4 Implicaciones clínicas

Para finalizar, se presentan algunas implicaciones clínicas derivadas del trabajo de la Tesis:

- Contar con dos instrumentos de evaluación psicológica para la mujer embarazada, uno de ellos centrado en el estrés específico del embarazo y el otro tras el proceso de parto.

- Es vital el uso de varias medidas de estrés, tanto psicológico como fisiológico, para poder atender a posibles desviaciones e identificar a las mujeres en riesgo.

- Es importante evaluar síntomas psicopatológicos como somatizaciones, hostilidad, psicoticismo, etc. además de depresión y ansiedad, en la mujer embarazada ya que, de esta forma, se puede igualmente identificar a mujeres en riesgo y se le puede ofrecer ayuda.

- Siempre que sea posible, concienciar a la población de la importancia de mantener unos hábitos de vida saludables incluso antes de la concepción.
- Ofrecer a las mujeres embarazadas, desde el primer momento, la posibilidad de recibir terapia psicológica destinada a disminuir los niveles de estrés, pues los beneficios son elevados.
- Aumentar el número de revisiones médicas durante el embarazo, e incluso si es posible, que estas se realicen por el mismo profesional sanitario, con el fin de crear una relación de confianza.

International PhD

Summary

The present Doctoral Thesis is structured in fourteen chapters organized as follows: Introduction (Chapters I, II, III and IV); justification and objectives (Chapter V); study block 1: "Adaptation and validation of psychological evaluation instruments" (Chapters VI and VII); study block 2: "Perinatal stress and psychopathological symptoms of the mother and its effect on the pregnancy and birth process" (Chapters VIII, IX and X); study block 3: "Perinatal stress and its effect on the offspring" (chapters XI and XII); study block 4: "Effectiveness of a psychological stress management intervention in pregnancy" (chapter XIII); discussion, conclusions and future perspectives (chapter XIV).

Firstly, the first four chapters form the theoretical basis of this Doctoral Thesis. Chapter I conceptualizes stress, its ways of measuring it and its consequences on health. In chapter II, an approximation of this stress to perinatal stress is made, differentiating both and presenting the so-called pregnancy-specific stress. In addition to the psychological assessment, the physiological assessment of chronic stress is presented, that is, the importance of extracting cortisol from the hair. Finally, the chapter ends with the main studies carried out so far on perinatal stress and hair cortisol in pregnancy. Chapter III addresses the main negative consequences of perinatal stress on the physical and mental health of pregnant women, to continue with its impact on the fetus and newborn. This chapter concludes with a description of the mechanisms underlying these negative consequences. Chapter IV, the last chapter in the theoretical introduction, provides an approach to maternal psychopathology, which is also studied in this thesis, and ends with the different interventions aimed at reducing women's stress levels in pregnancy.

In chapter V the justification of the doctoral thesis is made, presenting the facts that require research in this field, as well as exposing the objectives and hypotheses derived from them.

After this introduction, the empirical blocks that make up this doctoral thesis are described. Beginning with block 1 of the studies, entitled "Adaptation and validation of psychological assessment instruments", chapter VI presents the Prenatal Distress Questionnaire Revised (NuPDQ), an instrument designed for the assessment of stress specific to pregnancy, and of which there is no adaptation or validation for a Spanish sample. In the aforementioned chapter, the translation, adaptation and validation of the NuPDQ into Spanish is carried out, in addition to a factorial analysis. The results indicate that it is an adequate instrument to evaluate pregnancy-specific stress in a Spanish sample and its use is recommended for pregnant women.

Completing this block, chapter VII presents the translation, adaptation and validation of the Birth Satisfaction Scale-Revised (BSS-R), which in all its versions shows adequate psychometric indices and is used to assess satisfaction with childbirth. The results have shown similar indices to the original English version, allowing its use in a Spanish sample.

In block 2, called "Perinatal stress and psychopathological symptoms of the mother and its effect on the process of pregnancy and childbirth", 3 chapters are presented. In chapter VIII, the relationship between a high pregestational body mass index and its relation to perinatal and pregnancy-specific stress and psychopathological symptoms is explored in comparison to women with a normal body mass index. The results showed that those pregnant women with a high body mass index before pregnancy had worse psychopathological symptoms throughout pregnancy, as well as higher levels of stress. In view of this fact, it becomes necessary to raise the population's awareness to have a healthy lifestyle when they are thinking about having a baby.

In chapter IX we present a comparative study between pregnant and non-pregnant women, in stress, hair cortisol and psychopathology, in order to find differences in psychological status due to being pregnant. Likewise, the results showed that there are certain psychopathological symptoms present in pregnancy, which may be associated to the evolutionary moment in which pregnant women find themselves, such as somatization, psychoticism and paranoid ideation, among others. In addition, a psychopathological profile was elaborated to detect the course that certain symptoms follow during the whole pregnancy. With these results we can take into account the fact that possible deviations in certain psychopathological symptoms should be considered as a factor to be taken into account during pregnancy, since they could pose a risk to health.

In chapter X we studied the relationship between psychological stress, hair cortisol and psychopathological symptoms with the labour. The results were determinant since a greater number of psychopathological symptoms were found during the third trimester in those women who finally needed surgical care during delivery. Therefore, it is necessary to take care of women psychologically in the last stages of pregnancy, in order to have one more tool to prevent the delivery from becoming complicated.

In the third block, the relationship between maternal stress during pregnancy and its effect on offspring is presented. Chapter XI replicated a study conducted in primates, for the first time in humans. In it, the relationship between maternal hair cortisol levels during pregnancy and the same in the newborn was sought. The results showed that higher maternal cortisol levels during the first trimester inhibit the correct release of cortisol in the newborn, which may have implications for their health.

Chapter XII explores the relationship between having a high-risk pregnancy and infant neurodevelopment. This chapter compared the neurodevelopment of babies born from high-risk and low-risk pregnancies, finding that those born from high-risk pregnancies had higher levels of neurodevelopment at 6 months of age. In this regard, it was hypothesized that the use of drugs that improve blood circulation, and the increased number of specialized visits during pregnancy may have a positive effect on the baby's development.

Finally, in block 4, chapter XIII is presented, which in turn closes the studies of the present Doctoral Thesis. In it, a randomized controlled trial is presented in which a cognitive behavioral therapy was applied to control stress in pregnant women. The results showed a decrease in the levels of psychological stress and cortisol in hair, as well as in certain psychopathological symptoms, certifying the effectiveness of the therapy.

In the last chapter of this Doctoral Thesis, a joint discussion of all the studies derived from it is presented with the findings found, as well as the main conclusions.

Conclusions

As a result of each study presented in this Doctoral Thesis, the following conclusions can be drawn:

- The Prenatal Distress Questionnaire Revised (NuPDQ) in its Spanish version contains 14 items, divided in 5 factors that assess pregnancy-specific stress with a high reliability index and good psychometric properties. For that reason, it is recommended to use the NuPDQ to assess pregnancy-specific stress in Spanish pregnant women.

- The validation of the Birth Satisfaction Scale Revised (BSS-R) for the Spanish population has similar psychometric properties and factor structure to the original, so its use is recommended to evaluate birth satisfaction in Spanish sample.

- The pre-pregnancy body mass index corresponding to overweight or obesity is associated with higher levels of psychological stress during pregnancy, which can also lead to health problems in pregnant women or their offspring.

- Pregnant women show higher levels of psychopathological symptoms than non-pregnant women, including somatization, phobic anxiety, paranoid ideation and psychoticism. This may be due to evolutionary reasons, whereby the pregnant woman is more susceptible to protect her future baby from external threats. In addition, during a normal pregnancy, psychopathological symptoms usually decrease as the pregnancy progresses.

- Alterations in the course of psychopathological symptoms during pregnancy, specifically in somatization, anxiety, depression and psychoticism during the third trimester, is related to an increase in the probability of needing an instrumental delivery, as opposed to a vaginal delivery. This fact can have an impact on maternal and newborn health, as well as condition women for future pregnancies.

- High maternal hair cortisol levels during the first trimester of pregnancy can cause a deregulation in the HPA axis of the fetus, resulting in lower cortisol levels at birth. This can cause delays in the lung's maturation and other organs in the newborn.

- Babies born from high-risk pregnancies have higher scores on cognitive, linguistic and motor neurodevelopment compared to babies born from low-risk pregnancies. The medication that pregnant women take, as well as the increased medical screening and awareness of this population may explain these differences.
- A cognitive-behavioural therapy for stress management, applied during pregnancy to healthy pregnant women, contributes to the reduction of psychological and physiological stress. In this way, its implementation could form a model for promoting the health of pregnant women, helping to reduce the probability of suffering negative consequences derived from high levels of stress.

Future perspectives

Derived from this thesis, some questions arise that can be answered by future perspectives:

- The study of the couple as an important element in the course of fetal development. Knowing also the psychological stress as well as the cortisol levels that couples may be experiencing. It is also important to evaluate the social support that pregnant women receive.
- To have information about the pre-conception period, in order to know the stress levels and to elaborate a psychopathological profile from before the pregnancy until the end.
- To follow the babies, being able to relate the psychological stress and maternal hair cortisol levels cortisol with the later neurodevelopment in the childhood.
- To carry out a follow-up after the cognitive-behavioural therapy applied to pregnant women, since in this way it will be possible to know the effect

that the intervention has on the fetal programming of the subsequent neurodevelopment of their babies, or on the maternal health itself after the delivery.

Referencias

Adams, S. S., Eberhard-Gran, M., Sandvik, Å. R. y Eskild, A. (2012). Mode of delivery and postpartum emotional distress: a cohort study of 55 814 women. *BJOG: An International Journal of Obstetrics & Gynaecology, 119*(3), 298-305. doi: 10.1111/j.1471-0528.2011.03188.x

Akintayo, A. A., Ade-Ojo, I. P., Olagbuji, B. N., Akin-Akintayo, O. O., Ogundare, O. R. y Olofinbiyi, B. A. (2014). Cesarean section on maternal request: the viewpoint of expectant women. *Archives of gynecology and obstetrics*, *289*(4), 781-785. doi: 10.1007/s00404-013-3063-x

Akman, I., Kuscu, M. K., Yurdakul, Z., Özdemir, N., Solakoğlu, M., Orhon, L., … y Özek, E. (2008). Breastfeeding duration and postpartum psychological adjustment: Role of maternal attachment styles. *Journal of Paediatrics and Child Health, 44*(6), 369–373. doi: 10.1111/j.1440-1754.2008.01336.x

Alder, J., Fink, N., Bitzer, J., Hösli, I. y Holzgreve, W. (2007). Depression and anxiety during pregnancy: a risk factor for obstetric, fetal and neonatal outcome? A critical review of the literature. *The Journal of Maternal-Fetal & Neonatal Medicine, 20*(3), 189-209. doi: 10.1080/14767050701209560

Alderdice, F. y Lynn, F. (2009). Stress in pregnancy: identifying and supporting women. *British Journal of Midwifery*, *17*(9), 552-559. doi: 10.12968/bjom.2009.17.9.43787

Alderdice, F., Lynn, F. y Lobel, M. (2012). A review and psychometric evaluation of pregnancy-specific stress measures. *Journal of Psychosomatic Obstetrics & Gynecology, 33*(2), 62-77. doi: 10.3109/0167482X.2012.673040

Alderdice, F., Savage-McGlynn, E., Martin, C., McAuliffe, F., Hunter, A., Unterscheider, J., … y Malone, F. (2013). The Prenatal Distress Questionnaire: An investigation of factor structure in a high risk population. *Journal of Reproductive and Infant Psychology, 31*(5), 456–464. doi: 10.1080/02646838.2013.830210

Ali, E. (2018). Women's experiences with postpartum anxiety disorders: A narrative literature review. *International journal of women's health, 10*, 237-249. doi: 10.2147/IJWH.S158621

Alhusen, J. L., Ayres, L. y Depriest, K. (2016). Effects of Maternal Mental Health on Engagement in Favorable Health Practices During Pregnancy. *Journal of Midwifery and Women's Health, 61*(2), 210–216. doi: 10.1111/jmwh.12407

American College of Obstetricians and Gynecologists. (2013). Hypertension in pregnancy. Report of the American College of Obstetricians and Gynecologists' task force on hypertension in pregnancy. *Obstetrics and Gynecology, 122*(5), 1122-1131. doi: 10.1097/01.AOG.0000437382.03963.88

American College of Obstetricians and Gynecologists (ACOG). (2012). FAQs: HIV and pregnancy. Retrieved from: https://www.acog.org/Patients/FAQs/HIV-and-Pregnancy?IsMobileSet=false

American College of Obstetricians and Gynecologists (ACOG). (2013). Committee Opinion: Obesity in Pregnancy, *121*(1),213-217. doi: 10.1097/01.AOG.0000425667.10377.60

Amorim, T. V., de Oliveira Souza, Í. E., Moura, M. A. V., Queiroz, A. B. A. y Salimena, A. M. O. (2017). Perspectivas do cuidado de enfermagem na gestação de alto risco: revisão integrativa. *Enfermería Global, 16*(2), 500-543. doi: 10.6018/eglobal.16.2.238861

Andalusian Ministry of Health. (2010). Pregnancy Health Document. Retrieved from: http://www.juntadeandalucia.es/salud/sites/csalud/galerias/documentos/c_3_c_1_vi da_sana/embarazo_y_salud/lactancia_materna/cartilla_embarazo.pdf

Anderson, M. V. y Rutherford, M. D. (2011). Recognition of novel faces after single exposure is enhanced during pregnancy. *Evolutionary Psychology, 9*, 47–60. doi: 10.1177/147470491100900107

Anderson, M. V. y Rutherford, M. D. (2012). Cognitive reorganization during pregnancy and the postpartum period: An evolutionary perspective. *Evolutionary Psychology, 10*, 659–687. doi: 10.1177/147470491201000402

Andersson, L., Sundström-Poromaa, I., Bixo, M., Wulff, M., Bondestam, K. y Åström, M. (2003). Point prevalence of psychiatric disorders during the second trimester of pregnancy: A population-based study. American Journal of Obstetrics and Gynecology, 189(1), 148–154. doi:10.1067/mob.2003.336

Anniverno, R., Bramante, A., Mencacci, C. y Durbano, F. (2013). Anxiety and mood disorders in pregnancy and the postpartum period. *New Insights into Anxiety Disorders*, 136–162. doi: 10.1017/CBO9780511543647.010

Asghari, E., Faramarzi, M. y Mohammmadi, A. K. (2016). The effect of cognitive behavioural therapy on anxiety, depression and stress in women with preeclampsia. *Journal of Clinical and Diagnostic Research, 10*(11), QC04–QC07. doi: 10.7860/JCDR/2016/21245.8879

Athukorala, C., Rumbold, A. R., Willson, K. J. y Crowther, C. A. (2010). The risk of adverse pregnancy outcomes in women who are overweight or obese. *BMC Pregnancy and Childbirth, 10*(1), 56-64. doi:10.1186/1471-2393-10-5

Austin, M. P., Frilingos, M., Lumley, J., Hadzi-Pavlovic, D., Roncolato, W., Acland, S., …y Parker, G. (2008). Brief antenatal cognitive behaviour therapy group intervention for the prevention of postnatal depression and anxiety: A randomised controlled trial. *Journal of Affective Disorders, 105*(1–3), 35–44. doi: 10.1016/j.jad.2007.04.001

Avenevoli, S., Baio, J., Bitsko, R. H., Blumberg, S. J., Brody, D. J., Crosby, A., … y Huang, L. N. (2013). Mental health surveillance among children--United States, 2005-2011. Morbidity and Mortality Weekly Report, *62*(2),1-35.

Ayers, S., McKenzie-McHarg, K. y Slade, P. (2015). Post-traumatic stress disorder after birth. *Journal of Reproductive and Infant Psychology*, *33*(3), 215–218. doi: 10.1080/02646838.2015.1030250

Ayers, S., Wright, D. B. y Thornton, A. (2018). Development of a measure of postpartum PTSD: the City Birth Trauma Scale. *Frontiers in psychiatry*, *9*, 409. doi: 10.3389/fpsyt.2018.00409

Baker, H., Frank, O., Deangelis, B., Feingold, S. y Kaminetzky, H. A. (1981). Role of placenta in maternal-fetal vitamin transfer in humans. *American Journal of Obstetrics and Gynecology*, *141*(7), 792–796. doi: 10.1016/0002-9378(81)90706-7

Barbosa-Leiker, C., Fleming, S., Hollins-Martin, C.J. y Martin, C.R. (2015). Psychometric properties of the Birth Satisfaction Scale-Revised (BSS-R) for US mothers. *Journal of reproductive and infant psychology*, *33*(5), 504–511. doi: 10.1080/02646838.2015.1024211

Barker, D. J. P., Hales, C. N., Fall, C. H. D., Smond, C. O., Phipps, K. y Clark, P. M. S. (1993). Type 2 (non-insulin-dependent) diabetes mellitus, hypertension and hyperlipidaemia (syndrome X): relation to reduced fetal growth. *Diabetologia, 36*, 62–67. doi: 10.1007/BF00399095

Barker, D. J. (2004). The developmental origins of chronic adult disease. *Acta Paediatrica, 93*, 26-33. doi: 10.1080/08035320410022730

Bartsch, E., Medcalf, K. E., Park, A. L., Ray, J. G., Al-Rubaie, Z. T. A., Askie, L. M., … y Van Wagner, V. (2016). Clinical risk factors for pre-eclampsia determined in early pregnancy: Systematic review and meta-analysis of large cohort studies. *The BMJ, 353*. doi: 10.1136/bmj.i1753

Bastani, F., Hidarnia, A., Kazemnejad, A., Vafaei, M. y Kashanian, M. (2005). A randomized controlled trial of the effects of applied relaxation training on reducing anxiety and perceived stress in pregnant women. *Journal of midwifery & women's health, 50*(4), e36-e40. doi: 10.1016/j.jmwh.2004.11.008

Bayley, N. (2006). *Bayley scales of infant and toddler development.* PsychCorp, Pearson.

Beddoe, A. E. y Lee, K. A. (2008). Mind-Body interventions during pregnancy. *JOGNN - Journal of Obstetric, Gynecologic, and Neonatal Nursing*, *37*(2), 165–175. doi: 10.1111/j.1552-6909.2008.00218.x

Beijers, R., Buitelaar, J. K. y de Weerth, C. (2014). Mechanisms underlying the effects of prenatal psychosocial stress on child outcomes: beyond the HPA axis. *European child & adolescent psychiatry*, *23*(10), 943-956. doi: 10.1007/s00787-014-0566-3

Bell, A. F. y Andersson, E. (2016). The birth experience and women's postnatal depression: A systematic review. *Midwifery 39*, 112–123. doi: 10.1016/j.midw.2016.04.014

Bennett, H. A., Einarson, A., Taddio, A., Koren, G. y Einarson, T. R. (2004). Prevalence of depression during pregnancy: systematic review. *Obstet Gynecol*, *103*(4), 698–709. doi: 10.1097/01.AOG.0000116689.75396.5f

Bentler, P. M. (1990). Comparative fit indexes in structural models. *Psychological bulletin*, *107*(2), 238–246. doi: 10.1037/0033-2909.107.2.238

Bernhard, W. (2016). Lung surfactant: Function and composition in the context of development and respiratory physiology. *Annals of Anatomy-Anatomischer Anzeiger, 208*, 146-150. doi: 10.1016/j.aanat.2016.08.003

Beyondblue. (2011). Clinical practice guidelines for depression and related disorders–anxiety, bipolar disorder and puerperal psychosis–in the perinatal period. A guideline for primary care health professionals. *A guideline for primary care health professionals*. Recuperado de: https://www.bspg.com.au/dam/bsg/product?client=BEYONDBLUE&prodid=BL/0891&type=file

Bhutta, A. T., Cleves, M. A., Casey, P. H., Cradock, M. M. y Anand, K. J. S. (2002). Cognitive and behavioral outcomes of school-aged children who were born preterm: a meta-analysis. *Jama, 288*(6), 728-737. doi: 10.1001/jama.288.6.728

Bicudo, F. D., Garanhani, S. F., Lira, N. S., Maria, C. y Turato, E. (2016). Psychological issues facing obese pregnant women: a systematic review. *The Journal of Maternal-Fetal and Neonatal Medicine*, 30*(1)*, 88-95. doi:10.3109/14767058.2016.1163543

Black, M., Bhattacharya, S., Philip, S., Norman, J. E. y McLernon, D. J. (2015). Planned cesarean delivery at term and adverse outcomes in childhood health. *Jama*, *314*(21), 2271-2279.doi: 10.1001/jama.2015.16176

Blanco, J. (2011). *Emociones "positivas" y salud cardiovascular*. En: Y. Cañoto, G. Peña y G. Yaber (Eds.), Tópicos en Psicología de la Salud. Caracas: Universidad Católica Andrés Bello.

Blazquez, R. A., Ferrandiz, E. F., Moya, S. P., Caballero, V. G. y Corchon, S. (2018). Translation, adaptation and psychometric validation of the preterm birth experience and satisfaction scale (P-BESS) into Spanish. *Midwifery, 66*, 148-154. doi: 10.1016/j.midw.2018.08.007

Bock, J., Rether, K., Gröger, N., Xie, L. y Braun, K. (2014). Perinatal programming of emotional brain circuits: an integrative view from systems to molecules. *Frontiers in neuroscience*, *8*, 11. doi: 10.3389/fnins.2014.00011

Bodnar, L. M., Catov, J. M., Klebanoff, M., Ness, R. B y Roberts, J. M. (2007). Prepregnancy body mass index and the occurrence of severe hypertensive disorders of pregnancy. *Epidemiology*, *8*(2):234-239. doi:10.1097/01.ede.0000254119.99660.e7.

Bodnar, L. M., Wisner, K. L., Moses-Kolko, E., Sit, D. K. y Hanusa, B. H. (2009). Prepregnancy body mass index, gestational weight gain and the likelihood of major depression during pregnancy. *The Journal of Clinical Psychiatry, 70*(9), 1290-1296. doi:10.4088/JCP.08m04651

Bogaerts, A. F., Devlieger, R., Nuyts, E., Witters, I., Gyselaers, W., Guelinckx, I. y Van den Bergh, B. R. (2013). Anxiety and depressed mood in obese pregnant women: a prospective controlled cohort study. *Obesity facts*, *6*(2), 152-164. doi:10.1159/000346315

Bonari, L., Pinto, N., Ahn, E., Einarson, A., Steiner, M. y Koren, G. (2004). Perinatal risks of untreated depression during pregnancy. *The Canadian Journal of Psychiatry*, *49*(11), 726-735. doi:10.1177/070674370404901103

Bradbury, C. L., Christensen, B. K., Lau, M. A., Ruttan, L. A., Arundine, A. L. y Green, R. E. (2008). The Efficacy of Cognitive Behavior Therapy in the Treatment of

Emotional Distress After Acquired Brain Injury. *Archives of Physical Medicine and Rehabilitation, 89*(12), S61–S68. doi: 10.1016/j.apmr.2008.08.210

Braig, S., Grabher, F., Ntomchukwu, C., Reister, F., Stalder, T., Kirschbaum, C., ... y Rothenbacher, D. (2015). Determinants of maternal hair cortisol concentrations at delivery reflecting the last trimester of pregnancy. *Psychoneuroendocrinology, 52*, 289-296.doi: 10.1016/j.psyneuen.2014.12.006

Britton, J. R. (2011). Infant temperament and maternal anxiety and depressed mood in the early postpartum period. *Women and Health*, *51*(1), 55–71. doi: 10.1080/03630242.2011.540741

Brockington, I. F., Macdonald, E. y Wainscott, G. (2006). Anxiety, obsessions and morbid preoccupations in pregnancy and the puerperium. *Archives of Womens Mental Health*, *9*, 253–263. doi: 10.1007/s00737-006-0134-z

Brooten, D., Youngblut, J. M., Donahue, D., Hamilton, M., Hannan, J. y Neff, D. F. (2007). Women With High-Risk Pregnancies, Problems, and APN Interventions. *Journal of Nursing Scholarship, 39*(4), 349-357. doi: 10.1111/j.1547-5069.2007.00192.x

Bronson, S. L. y Bale, T. L. (2016). The placenta as a mediator of stress effects on neurodevelopmental reprogramming. *Neuropsychopharmacology, 41*(1), 207-218. doi: 10.1038/npp.2015.231

Brown, T. (2015). *Confirmatory Factor Analysis for Applied Research, 2nd ed.* New York : Guilford Press.

Bryanton, J., Gagnon, A. J., Johnston, C. y Hatem, M. (2008). Predictors of women's perceptions of the childbirth experience. *Journal of Obstetric, Gynecologic &*

Neonatal Nursing, 37(1), 24-34. doi: 10.1111/j.1552-6909.2007.00203.x

Burduli, E., Barbosa-Leiker, C., Fleming, S., Hollins Martin, C. J. y Martin, C. R. (2017). Cross-cultural invariance of the Birth Satisfaction Scale-Revised (BSS-R): comparing UK and US samples. *Journal of reproductive and infant psychology, 35*(3), 248-260. doi: 10.1080/02646838.2017.1310374

Busada, J. T. y Cidlowski, J. A. (2017). Mechanisms of glucocorticoid action during development. *Current Topics in Developmental Biology, 125*, 147–170. doi: 10.1016/bs.ctdb.2016.12.004

Buss, C., Entringer, S., Davis, E. P., Hobel, C. J., Swanson, J. M., Wadhwa, P. D. y Sandman, C. A. (2012). Impaired executive function mediates the association between maternal pre-pregnancy body mass index and child ADHD symptoms. *PloS one, 7*(6), e37758. doi:10.1371/journal.pone.0037758.

Bussières, E. L., Tarabulsy, G. M., Pearson, J., Tessier, R., Forest, J. C. y Giguère, Y. (2015). Maternal prenatal stress and infant birth weight and gestational age: A meta-analysis of prospective studies. *Developmental Review*, *36*, 179–199. doi: 10.1016/j.dr.2015.04.001

Butler, A. C., Chapman, J. E., Forman, E. M. y Beck, A. T. (2006). The empirical status of cognitive-behavioral therapy: A review of meta-analyses. *Clinical Psychology Review*, *26*(1), 17–31. doi: 10.1016/j.cpr.2005.07.003

Bye, A., Shawe, J., Stephenson, J., Bick, D., Brima, N. y Micali, N. (2016). Differences in pre-conception and pregnancy healthy lifestyle advice by maternal BMI: Findings from a cross sectional survey. *Midwifery*, *42*, 38-45. doi:10.1016/j.midw.2016.09.013

Camacho-Buenrostro, D., Perez-Molina, J. J., Vasquez-Garibay, E. M. y Panduro-Baron, J. G. (2015). The Association between Pre-Pregnancy Obesity and Weight Gain in Pregnancy, with Growth Deviations in Newborns. *Nutricion Hospitalaria, 32*(1), 124-129. doi:10.3305/nh.2015.32.1.8870.

Cannon, W. B. (1929). *Bodily changes in pain, fear, hunger and rage*. Nueva York: Appleton.

Casas, M., Chatzi, L., Carsin, A. E., Amiano, P., Guxens, M., Kogevinas, M., ... y Riaño, I. (2013). Maternal pre-pregnancy overweight and obesity, and child neuropsychological development: two Southern European birth cohort studies. *International journal of epidemiology, 42*(2), 506-517. doi:10.1093/ije/dyt002

Caparros-Caparros, B., Villar-Hoz, E., Juan-Ferrer, J. y Viñas-Poch, F. (2007). Symptom Check-List-90-R: Fiabilidad, datos normativos y estructura factorial en estudiantes universitarios. *International Journal of Clinical and Health Psychog*y, *7*(3), 781–794.

Caparros-Gonzalez, R. A., Strivens-Vilchez, H., Marinas-Lirola, J. C., Garcia-Garcia, I., Alderdice, F., Lynn, F. y Peralta-Ramírez, M. I. (2015). Internal consistency and convergent validity of the Spanish version of the Prenatal Distress Questionnaire. *Journal of Reproductive and Infant Psycholy, 33*(3), E36. doi:10.1080/02646838.2015.1115265.

Caparros-Gonzalez, R. A., Romero-Gonzalez, B., Strivens-Vilchez, H., Gonzalez-Perez, R., Martinez-Augustin, O. y Peralta-Ramirez, M. I. (2017). Hair cortisol levels, psychological stress and psychopathological symptoms as predictors of postpartum depression. *PloS one, 12*(8), e0182817. doi: 10.1371/journal.pone.0182817

Caparros-Gonzalez, R. A., de la Torre-Luque, A., Diaz-Piedra, C., Vico, F. J., Buela-Casal, G., Dowling, D. y Thibeau, S. (2018). Listening to Relaxing Music Improves Physiological Responses in Premature Infants. *Advances in Neonatal Care, 18*(1), 58-69. doi: 10.1097/ANC.0000000000000448

Caparros-Gonzalez, R. A., Perra, O., Alderdice, F., Lynn, F., Lobel, M., García-García, I. y Peralta-Ramírez, M. I. (2019). Psychometric validation of the Prenatal Distress Questionnaire (PDQ) in pregnant women in Spain. *Women & health*, 1-16. doi: 10.1080/03630242.2019.1584143

Caparros-Gonzalez, R. A., Romero-Gonzalez, B., Gonzalez-Perez, R., Lucena-Prieto, L., Perez-Garcia, M., Cruz-Quintana, F. y Peralta-Ramirez, M. I. (2019). Maternal and Neonatal Hair Cortisol Levels Are Associated with Infant Neurodevelopment at Six Months of Age. *Journal of Clinical Medicine*, *8*(11), 1-14. doi: 10.3390/jcm8112015

Cardwell, M. S. (2013). Stress: Pregnancy considerations. *Obstetrical & gynecological survey*, *68*(2), 119–129. doi: 10.1097/OGX.0b013e31827f2481

Carr, B. R., Parker, C. R., Madden, J. D., MacDonald, P. C. y Porter, J. C. (1981). Maternal plasma adrenocorticotropin and cortisol relationships throughout human pregnancy. *American Journal of Obstetrics and Gynecology*, *139*(4), 416–422. doi: 10.1016/0002-9378(81)90318-5

Chen, P. J., Yang, L., Chou, C. C., Li, C. C., Chang, Y. C. y Liaw, J. J. (2017). Effects of prenatal yoga on women's stress and immune function across pregnancy: A randomized controlled trial. *Complementary Therapies in Medicine, 31*, 109–117. doi: 10.1016/j.ctim.2017.03.003

Chen, Z., Li, J., Zhang, J., Xing, X., Gao, W., Lu, Z. y Deng, H. (2013). Simultaneous determination of hair cortisol, cortisone and DHEAS with liquid chromatography–electrospray ionization-tandem mass spectrometry in negative mode. *Journal of Chromatography B, 929*, 187-194. doi: 10.1016/j.jchromb.2013.04.026

Chiarello, D. I., Abad, C., Rojas, D., Toledo, F., Vázquez, C. M., Mate, A., ... y Marín, R. (2018). Oxidative stress: normal pregnancy versus preeclampsia. *Biochimica et Biophysica Acta (BBA)-Molecular Basis of Disease.* doi: 10.1016/j.bbadis.2018.12.005.

Christiaens, W., Verhaeghe, M. y Bracke, P. (2010). Pain acceptance and personal control in pain relief in two maternity care models: a cross-national comparison of Belgium and the Netherlands. *BMC health services research, 10*(1), 268 doi: 10.1186/1472-6963-10-268

Christian, L. M. (2012). Physiological reactivity to psychological stress in human pregnancy: Current knowledge and future directions. *Progress in Neurobiology, 99*(2), 106–116. doi: 10.1016/j.pneurobio.2012.07.003

Chung, H. R. (2014). Adrenal and thyroid function in the fetus and preterm infant. *Korean journal of pediatrics, 57*(10), 431–439. doi: 10.3345/kjp.2014.57.10.431

Cohen, J. (1977). *Statistical Power Analysis for the Behavioral Sciences*. New York.: Academic Press.

Cohen, S., Kamarck, T. y Mermelstein, R. (1983). A global measure of perceived stress. *Journal of Health and Social Behavior, 24*(4), 385-396. doi:10.2307/2136404.

Cohen, J. (1988). The effect size index: d. *Statistical power analysis for the behavioral sciences, 2*, 284-288.

Conde, A. A., Figueiredo, B., Costa, R., Pacheco, A. y Pais, Á. (2008). Perception of the childbirth experience: continuity and changes over the postpartum period. *Journal of Reproductive and Infant Psychology, 26*(2), 139-154. doi: 10.1080/02646830801918414

Connor, K. M. y Davidson, J. R. (2003). Development of a new resilience scale: The Connor-Davidson resilience scale (CD-RISC). *Depression and anxiety*, *18*(2), 76-82. doi: 10.1002/da.10113

Coussons-Read, M. E., Lobel, M., Carey, J. C., Kreither, M. O., D'Anna, K., Argys, L., ... y Cole, S. (2012). The occurrence of preterm delivery is linked to pregnancy-specific distress and elevated inflammatory markers across gestation. *Brain, behavior, and immunity, 26*(4), 650-659. doi: 10.1016/j.bbi.2012.02.009

Cranston, C. C. (2014). A Review of the Effects of Prolonged Exposure to Cortisol on the Regulation of the HPA Axis: Implications for the Development and Maintenance of Posttraumatic Stress Disorder. *New School Psychology Bulletin*, *11*(1), 1-13.

Cox, J. L., Holden, J. M. y Sagovsky, R. (1987). Detection of postnatal depression: development of the 10-item Edinburgh Postnatal Depression Scale. *The British journal of psychiatry*, *150*(6), 782-786. doi: 10.1192/bjp.150.6.782

D'Anna-Hernandez, K. L., Ross, R. G., Natvig, C. L. y Laudenslager, M. L. (2011). Hair cortisol levels as a retrospective marker of hypothalamic-pituitary axis activity throughout pregnancy: Comparison to salivary cortisol. *Physioly and Behavior, 104*(2), 348-353. doi:10.1016/j.physbeh.2011.02.041

Dávila, W. (2014). Terapia cognitivo-conductual en el trastorno obsesivo-compulsivo. *Norte de Salud mental, 12*(49), 6.

Davis, E. P. y Sandman, C. A. (2010). The timing of prenatal exposure to maternal cortisol and psychosocial stress is associated with human infant cognitive development. *Child development, 81*(1), 131-148. doi:10.1111/j.1467-8624.2009.01385.x.

Davis, E. P., Glynn, L. M., Waffarn, F. y Sandman, C. A. (2011). Prenatal maternal stress programs infant stress regulation. *Journal of Child Psychology and Psychiatry, 52*(2), 119-129. doi: 10.1111/j.1469-7610.2010.02314.x

Demšar, K., Svetina, M., Verdenik, I., Tul, N., Blickstein, I. y Velikonja, V. G. (2018). Tokophobia (fear of childbirth): Prevalence and risk factors. *Journal of Perinatal Medicine, 46*(2), 151–154. doi: 10.1515/jpm-2016-0282

Denison, F. C., Price, J., Graham, C., Wild, S. y Liston, W. A. (2008). Maternal obesity, length of gestation, risk of postdates pregnancy and spontaneous onset of labour at term. BJOG: An International Journal of Obstetrics & Gynaecology, 115(6), 720-725. doi: 10.1111/j.1471-0528.2008.01694.x

Dennis, C. L., Brown, H. K., Wanigaratne, S., Vigod, S. N., Grigoriadis, S., Fung, K., ... y Brennenstuhl, S. (2018). Determinants of comorbid depression and anxiety postnatally: a longitudinal cohort study of Chinese-Canadian women. *Journal of affective disorders, 227*, 24-30. doi: 10.1016/j.jad.2017.09.033

Derogatis, L. R. (1994). *Symptom Checklist-90-R (SCL-90-R): Administration, scoring, and procedures manual (3rd ed.).* Minneapolis, MN: NCS Pearson.

Dettmer, A. M., Rosenberg, K. L., Suomi, S. J., Meyer, J. S. y Novak, M. A. (2015). Associations between parity, hair hormone profiles during pregnancy and lactation, and infant development in rhesus monkeys (Macaca mulatta). *PloS one, 10*(7), e0131692.. doi: 10.1371/journal.pone.0131692

Dettmer, A. M., Rosenberg, K., Menard, M. T., El-Mallah, S. N., Woodward, R. A., Suomi, S. J. y Meyer, J. S. (2017). Differential relationships between chronic hormone profiles in pregnancy and maternal investment in rhesus monkey mothers with hair loss in the neonatal period. *American journal of primatology, 79*(1), e22489. doi: 10.1002/ajp.22489

Devi, A. M. (2019). Psychiatry During Pregnancy. *Journal of Nursing Science & Practice*, *5*(1), 53-57.

De Wit, L., Jelsma, J. G., van Poppel, M. N., Bogaerts, A., Simmons, D., Desoye, G., ... y Devlieger, R. (2015). Physical activity, depressed mood and pregnancy worries in European obese pregnant women: results from the DALI study. *BMC pregnancy and childbirth, 15*(1), 158. doi:10.1186/s12884-015-0595-z.

Díaz, R. y Barba, F. (2016). Estrés prenatal y sus efectos sobre el neurodesarrollo. *Revista Médica Clínica Las Condes*, *27*(4), 441-446. doi: 10.1016/j.rmclc.2016.07.005

Diedenhofen, B. y Musch, J. (2015). cocor: A comprehensive solution for the statistical comparison of correlations. *PloS one, 10*(4), e0121945. doi: 10.1371/journal.pone.0121945

Dietz, H. P., Lanzarone, V. y Simpson, J. M. (2006). Predicting operative delivery. Ultrasound in Obstetrics and Gynecology: *The Official Journal of the International Society of Ultrasound in Obstetrics and Gynecology, 27*(4), 409-415. doi: 10.1002/uog.2731

Dikmen-Yildiz, P., Ayers, S. y Phillips, L. (2017). Depression, anxiety, PTSD and comorbidity in perinatal women in Turkey: A longitudinal population-based study.

Midwifery, 55, 29–37. doi: 10.1016/j.midw.2017.09.001

Dimsdale, J. E. (2008). Psychological Stress and Cardiovascular Disease. *Journal of the American College of Cardiology, 51*(13), 1237–1246. doi: 10.1016/j.jacc.2007.12.024

D'Ippolito, S., Ortiz, A. S., Veglia, M., Tersigni, C. y Di Simone, N. (2011). Low molecular weight heparin in obstetric care: a review of the literature. *Reproductive sciences, 18*(7), 602-613. doi: 10.1177/1933719111404612.

DiPietro, J. A., Ghera, M. M., Costigan, K. y Hawkins, M. (2004). Measuring the ups and downs of pregnancy stress. *Journal of Psychosomatic Obstetrics & Gynecology, 25*(3-4), 189-201. doi: 10.1080/01674820400017830

DiPietro, J. A., Hilton, S. C., Hawkins, M., Costigan, K. A. y Pressman, E. K. (2002). Maternal stress and affect influence fetal neurobehavioral development. *Developmental psychology, 38*(5), 659–668. doi: 10.1037/0012-1649.38.5.659

Downe, S., Finlayson, K., Tunçalp y Metin Gülmezoglu, A. (2016). What matters to women: A systematic scoping review to identify the processes and outcomes of antenatal care provision that are important to healthy pregnant women. *BJOG: An International Journal of Obstetrics and Gynaecology, 123*(4), 529–539. doi: 10.1111/1471-0528.13819

Doyle, O., Delaney, L., O'Farrelly, C., Fitzpatrick, N. y Daly, M. (2017). Can Early Intervention Improve Maternal Well-Being? Evidence from a Randomized Controlled Trial. *PLoS One, 12*(1):e0169829. doi:10.1371/journal.pone.0169829.

Drewlo, S. (2011). Is heparin a placental anticoagulant in high-risk pregnancies?. *Blood, 118*(18), 4780-4788. doi: 10.1182/blood-2011-07-319749

Duthie, L. y Reynolds, R. M. (2013). Changes in the maternal hypothalamic-pituitary-adrenal axis in pregnancy and postpartum: influences on maternal and fetal outcomes. *Neuroendocrinology*, *98*(2), 106-115. doi: 10.1159/000354702

Dunkel Schetter, C. y Lobel, M. (2012). Pregnancy and birth outcomes: A multilevel analysis of prenatal maternal stress and birth weight. In A. Baum, T. A. Revenson y J. Singer (Eds.), *Handbook of health psychology* (p. 431–463). Psychology Press.

Dunn, C., Hanieh, E., Roberts, R. y Powrie, R. (2012). Mindful pregnancy and childbirth: Effects of a mindfulness-based intervention on women's psychological distress and well-being in the perinatal period. *Archives of Women's Mental Health, 15*(2), 139–143. doi: 10.1007/s00737-012-0264-4

El-Farhan, N., Rees, D. A. y Evans, C. (2017). Measuring cortisol in serum, urine and saliva–are our assays good enough?. *Annals of clinical biochemistry, 54*(3), 308-322. doi: 10.1177/0004563216687335

Elvander, C., Dahlberg, J., Andersson, G. y Cnattingius, S. (2015). Mode of delivery and the probability of subsequent childbearing: a population-based register study. *BJOG: An International Journal of Obstetrics & Gynaecology, 122*(12), 1593-1600. doi: 10.1111/1471-0528.13021

Entringer, S., Buss, C. y Wadhwa, P.D. (2015). Prenatal stress, development, health and disease risk: A psychobiological perspective. *Psychoneuroendocrinology, 62*, 366–375. doi: 10.1016/j.psyneuen.2015.08.019

Epstein, J., Santo, R. M. y Guillemin, F. (2015). A review of guidelines for cross-cultural adaptation of questionnaires could not bring out a consensus. *Journal of clinical epidemiology*, *68*(4), 435-441. doi: 10.1016/j.jclinepi.2014.11.021

Evans, J., Heron, J., Lewis, G., Araya, R. y Wolke, D. (2005). Negative self-schemas and the onset of depression in women: Longitudinal study. *British Journal of Psychiatry, 186*, 302-307. doi: 10.1192/bjp.186.4.302

Evans, L. M., Myers, M. M. y Monk, C. (2008). Pregnant women's cortisol is elevated with anxiety and depression—but only when comorbid. *Archives of women's mental health, 11*(3), 239-248. doi: 10.1007/s00737-008-0019-4

Faul, F., Erdfelder, E., Buchner, A. y Lang, A. G. (2009). Statistical power analyses using G* Power 3.1: Tests for correlation and regression analyses. *Behavior research methods, 41*(4), 1149-1160. doi: 10.3758/BRM.41.4.1149

Farr, S. L. y Bish, C. L. (2013). Preconception health among women with frequent mental distress: A population-based study. *Journal of Women's Health*, *22*(2), 153–158. doi: 10.1089/jwh.2012.3722

Field, A. (2013). *Discovering Statistics Using SPSS: and sex and drugs and rock "n" roll*. SAGE Publications.

Field, T. (2010). Postpartum depression effects on early interactions, parenting, and safety practices: a review. *Infant Behavior and Development*, *33*(1), 1-6. doi: 10.1016/j.infbeh.2009.10.005

Field, T. (2018). Postnatal anxiety prevalence, predictors and effects on development: A narrative review. *Infant Behavior and Development*, *51*(October 2017), 24–32. doi: 10.1016/j.infbeh.2018.02.005

Fleming, S. E., Donovan-Batson, C., Burduli, E., Barbosa-Leiker, C., Martin, C. J. H. y Martin, C. R. (2016). Birth Satisfaction Scale/Birth Satisfaction Scale-Revised (BSS/BSS-R): A large scale United States planned home birth and birth centre survey. *Midwifery, 41*, 9-15. doi: 10.1016/j.midw.2016.07.008

Flom, M., John, A. M., Meyer, J. S. y Tarullo, A. R. (2017). Infant hair cortisol: associations with salivary cortisol and environmental context. *Developmental psychobiology, 59*(1), 26-38. doi: 10.1002/dev.21449

Ford, E. y Ayers, S. (2009). Stressful events and support during birth: the effect on anxiety, mood and perceived control. *Journal of Anxiety Disorders, 23*(2), 260-268. doi: 10.1016/j.janxdis.2008.07.009

Forray, A., Focseneanu, M., Pittman, B., McDougle, C. J. y Epperson, C. N. (2010). Onset and exacerbation of obsessive-compulsive disorder in pregnancy and the postpartum period. *Journal of Clinical Psychiatry*, *71*(8), 1061–1068. doi: 10.4088/JCP.09m05381blu

Fowler, G. y Patterson, D. (2013). Use of maternity surveys in improving the care experience–a review of the evidence. *British Journal of Midwifery, 21*(6), 410-415. doi: 10.12968/bjom.2013.21.6.410

Frodl, T. y O'Keane, V. (2013). How does the brain deal with cumulative stress? A review with focus on developmental stress, HPA axis function and hippocampal structure in humans. *Neurobiology of Disease*, *52*, 24–37. doi: 10.1016/j.nbd.2012.03.012

García, A., Martí, O., Vallès, A., Dal-Zotto, S. y Armario, A. (2000). Recovery of the hypothalamic-pituitary-adrenal response to stress. *Neuroendocrinology*, *72*(2), 114-125. doi: 10.1159/000054578

Garcia-Esteve, L., Ascaso, C., Ojuel, J. y Navarro, P. (2003). Validation of the Edinburgh Postnatal Depression Scale (EPDS) in Spanish mothers. *Journal of Affective Disorders, 75*(1), 71–76. doi: 10.1016/S0165-0327(02)00020-4

García-León, M. Á., Caparrós-González, R. A., Romero-González, B., González-Perez, R. y Peralta-Ramírez, I. (2019). Resilience as a protective factor in pregnancy and puerperium: Its relationship with the psychological state, and with Hair Cortisol Concentrations. *Midwifery*, *75*, 138-145. doi: 10.1016/j.midw.2019.05.006

García-León, M. Á., González-Gómez, A., Robles-Ortega, H., Padilla, J. L. y Peralta-Ramírez, M. I. (2019). Psychometric properties of the Connor-Davidson Resilience Scale (CD-RISC) in the Spanish population. *Anales de psicología*, *35*(1), 33-40. doi: 10.6018/analesps.35.1.314111

Garcia-Leon, M. A., Peralta-Ramirez, M. I., Arco-Garcia, L., Romero-Gonzalez, B., Caparros-Gonzalez, R. A., Saez-Sanz, N., …y Gonzalez-Perez, R. (2018). Hair cortisol concentrations in a Spanish sample of healthy adults. *Plos One, 13*(9), e0204807. doi: 10.1371/journal.pone.0204807

Garcia-Silva, J., N. Navarrete, N., Peralta-Ramírez, M. I., García-Sánchez, A., Ferrer-González, M. Á. y Caballo, V. E. (2018). Efficacy of Cognitive Behavioral Therapy in Adherence to the Mediterranean Diet in Metabolic Syndrome Patients: A Randomized Controlled Trial. *Journal of Nutrition Education and Behavior, 50*(9), 896–904. doi: 10.1016/j.jneb.2018.06.003

Gardner, B., Rose, J., Mason, O., Tyler, P. y Cushway, D. (2005). Cognitive therapy and behavioural coping in the management of work-related stress: An intervention study. *Work and Stress*, *19*(2), 137–152. doi: 10.1080/02678370500157346

Gariepy, A. M., Lundsberg, L. S., Miller, D., Stanwood, N. L. y Yonkers, K. A. (2016). Are pregnancy planning and pregnancy timing associated with maternal psychiatric illness, psychological distress and support during pregnancy? *Journal of Affective Disorders, 205,* 87–94. doi: 10.1016/j.jad.2016.06.058

Gaviria, S. (2006). Estrés prenatal, neurodesarrollo y psicopatología. *Revista Colombiana de Psiquiatria*, *35*(3), 281–326.

Gentile, S. (2017). Untreated depression during pregnancy: Short- and long-term effects in offspring. A systematic review. *Neuroscience*, *342*, 154–166. doi: 10.1016/j.neuroscience.2015.09.001

George, D. y Mallery, P. (2003). *SPSS for Windows step by step: a simple guide and reference.* Boston: Allyn, Bacon.

Ghaemmaghami, P., Dainese, S. M., La Marca, R., Zimmermann, R. y Ehlert, U. (2014). The association between the acute psychobiological stress response in second trimester pregnant women, amniotic fluid glucocorticoids, and neonatal birth outcome. *Developmental Psychobiology*, *56*(4), 734–747. doi: 10.1002/dev.21142

Gilles, M., Otto, H., Wolf, I. A., Scharnholz, B., Peus, V., Schredl, M., ... y Deuschle, M. (2018). Maternal hypothalamus-pituitary-adrenal (HPA) system activity and stress during pregnancy: Effects on gestational age and infant's anthropometric measures at birth. *Psychoneuroendocrinology, 94*, 152-161. doi: 10.1016/j.psyneuen.2018.04.022

Glover, V., Bergman, K., Sarkar, P. y O'Connor, T. G. (2009). Association between maternal and amniotic fluid cortisol is moderated by maternal anxiety. *Psychoneuroendocrinology, 34*(3), 430-435.doi: 10.1016/j.psyneuen.2008.10.005

Glover, V., O'Donnell, K. J., O'Connor, T. G. y Fisher, J. (2018). Prenatal maternal stress, fetal programming, and mechanisms underlying later psychopathology - A global perspective. *Development and Psychopathology, 30*(3), 843–854. doi: 10.1017/S095457941800038X

Gómez-Alarcón, A., González-Marisol, E., Arenas-Gómez, B., López-Grande, J., Gómez-García, M. T. y Merlo, G. D. (2017). Heparin treatment “can it improve perinatal outcomes?”. *Ginecología y Obstetricia de México, 84*(11), 717-729.

Göncü-Serhatlıoğlu, S., Karahan, N., Hollins-Martin, C. J. y Martin, C. R. (2018). Construct and content validity of the Turkish Birth Satisfaction Scale–Revised (T-BSS-R). *Journal of reproductive and infant psychology, 36*(3), 235-245. doi: 10.1080/02646838.2018.1443322

González-Mesa, E., Kabukcuoglu, K., Körükcü, O., Blasco, M., Ibrahim, N. y Kavas, T. (2018). Cultural factors influencing antenatal depression: A cross-sectional study in a cohort of Turkish and Spanish women at the beginning of the pregnancy. *Journal of affective disorders*, *238*, 256-260. doi: 10.1016/j.jad.2018.06.003

Goodman, P., Mackey, M. C. y Tavakoli, A. S. (2004). Factors related to childbirth satisfaction. *Journal of advanced nursing, 46*(2), 212-219. doi: 10.1111/j.1365-2648.2003.02981.x

Gourounti, C., Karpathiotaki, N. y Vaslamatzis, G. (2015). Psychosocial stress in high risk pregnancy. *International Archives of Medicine*, 1–9. doi: 10.3823/1694

Goutaudier, N., Bertoli, C., Séjourné, N. y Chabrol, H. (2019). Childbirth as a forthcoming traumatic event: pretraumatic stress disorder during pregnancy and its psychological correlates. *Journal of reproductive and infant psychology*, *37*(1), 44-55. doi: 10.1080/02646838.2018.1504284

Gow, R., Thomson, S., Rieder, M., Van Uum, S. y Koren, G. (2010). An assessment of cortisol analysis in hair and its clinical applications. *Forensic science international, 196*(1-3), 32-37. doi: 10.1016/j.forsciint.2009.12.040

Graignic-Philippe, R., Dayan, J., Chokron, S., Jacquet, A. Y. y Tordjman, S. (2014). Effects of prenatal stress on fetal and child development: a critical literature review. *Neuroscience & biobehavioral reviews*, *43*, 137-162. doi: 10.1016/j.neubiorev.2014.03.022

Grass, J., Kirschbaum, C., Miller, R., Gao, W., Steudte-Schmiedgen, S. y Stalder, T. (2015). Sweat-inducing physiological challenges do not result in acute changes in hair cortisol concentrations. *Psychoneuroendocrinology, 53*,108–116. doi: 10.1016/j.psyneuen.2014.12.023

Gray, N. A., Dhana, A., Van Der Vyver, L., Van Wyk, J., Khumalo, N. P. y Stein, D. J. (2018). Determinants of hair cortisol concentration in children: A systematic review. *Psychoneuroendocrinology, 87*, 204-214. doi: 10.1016/j.psyneuen.2017.10.022

Greer, I. A., Brenner, B. y Gris, J. C. (2014). Antithrombotic treatment for pregnancy complications: which path for the journey to precision medicine?. *British journal of haematology, 165*(5), 585-599. doi: 10.1111/bjh.12813

Greff, M. J. E., Levine, J. M., Abuzgaia, A. M., Elzagallaai, A. A., Rieder, M. J. y van Uum, S. H. M. (2019). Hair cortisol analysis: An update on methodological considerations and clinical applications. *Clinical Biochemistry*, *63*, 1–9. doi: 10.1016/j.clinbiochem.2018.09.010

Grezellschak, S., Jansen, A. y Westermann, S. (2017). Emotion regulation in patients with psychosis: A link between insomnia and paranoid ideation? *Journal of Behavior Therapy and Experimental Psychiatry, 56*, 27–32. doi: 10.1016/j.jbtep.2016.08.001

Griebel, C. P., Halvorsen, J., Golemon, T. B. y Day, A. A. (2005). Management of spontaneous abortion. *American Family Physician*, *72*(7), 1243–1250.

Grizenko, N., Fortier, M. E, Gaudreau-Simard, M., Jolicoeur, C. y Joober, R. (2015). The effect of maternal stress during pregnancy on IQ and ADHD symptomatology. *Journal of the Canadian Academy of Child and Adolescent Psychiatry, 24*(2), 92–99.

Grizenko, N., Fortier, M. E., Zadorozny, C., Thakur, G., Schmitz, N., Duval, R. y Joober, R. (2012). Maternal stress during pregnancy, ADHD symptomatology in children and genotype: Gene-environment interaction. *Journal of the Canadian Academy of Child and Adolescent Psychiatry, 21*(1), 9–15.

Gurman, T. A. y Becker, D. (2008). Factors affecting Latina immigrants' perceptions of maternal health care: findings from a qualitative study. *Health Care for Women International*, *29*(5), 507-526. doi: 10.1080/07399330801949608

Guszkowska, M. (2014). The effect of exercise and childbirth classes on fear of childbirth and locus of labor pain control. *Anxiety, Stress & Coping, 27*(2), 176-189. doi: 10.1080/10615806.2013.830107

Haghparast, E., Faramarzi, M. y Hassanzadeh, R. (2016). Psychiatric symptoms and pregnancy distress in subsequent pregnancy after spontaneous abortion history. *Pakistan Journal of Medical Sciences, 32*(5), 1097–1101. doi: 10.12669/pjms.325.10909

Hall, J. A., Andrzejewski, S. A. y Yopchick, J. E. (2009). Psychosocial correlates of interpersonal sensitivity: A meta-analysis. *Journal of Nonverbal Behavior, 33*(3), 149-180. doi: 10.1007/s10919-009-0070-5

Hamzehgardeshi, Z., Yazdani, F., Elyasi, F., Moosazadeh, M., Peyvandi, S., Gelehkolaee, K. S. y Shahidi, M. (2019). The efficacy of group counselling on perceived stress among infertile women undergoing in vitro fertilization treatment: An RCT. *International Journal of Reproductive BioMedicine, 17*(1), 57–66. doi: 10.18502/ijrm.v17i1.3821

Handelzalts, J. E., Becker, G., Ahren, M. P., Lurie, S., Raz, N., Tamir, Z. y Sadan, O. (2015). Personality, fear of childbirth and birth outcomes in nulliparous women. *Archives of gynecology and obstetrics, 291*(5), 1055-1062. doi: 10.1007/s00404-014-3532-x

Harris, J. M., Franck, L., Green, B. y Michie, S. (2014). The psychological impact of providing women with risk information for pre-eclampsia: a qualitative study. *Midwifery, 30*(12), 1187-1195. doi: 10.1016/j.midw.2014.04.006

Haselbeck, C., Niederberger, U., Kulle, A., Wache, K., Brauner, E., Gutermuth, M., … y Siniatchkin, M. (2017). Prenatal maternal distress seems to be associated with the infant's temperament and motor development: an explorative study. *Journal of Neural Transmission*, *124*(7), 881–890. doi: 10.1007/s00702-017-1712-0

Haas, H. S. y Schauenstein, K. (2001). Immunity, hormones, and the brain. *Allergy*, *56*(6), 470-477. doi: 10.1034/j.1398-9995.2001.056006470.x

Heron, J., O'Connor, T. G., Evans, J., Golding, J. y Glover, V. (2004). The course of anxiety and depression through pregnancy and the postpartum in a community sample. *Journal of Affective Disorders*, *80*(1), 65–73. doi: 10.1016/j.jad.2003.08.004

Hofberg, K. y Ward, M. R. (2003). Fear of pregnancy and childbirth. *Postgraduate Medical Journal*, *79*(935), 505–510. doi: 10.1136/pmj.79.935.505

Hoffman, M. C., D'Anna-Hernandez, K., Benitez, P., Ross, R. G. y Laudenslager, M. L. (2017). Cortisol during human fetal life: Characterization of a method for processing small quantities of newborn hair from 26 to 42 weeks gestation. *Developmental psychobiology, 59*(1), 123-127.doi: 10.1002/dev.21433

Hoffman, M. C., Mazzoni, S. E., Wagner, B. D. y Laudenslager, M. L. (2016). Measures of maternal stress and mood in relation to preterm birth. *Obstetrics and gynecology, 127*(3), 545-552. doi: 10.1097/AOG.0000000000001287

Hofmann, S. G., Asnaani, A., Vonk, I. J. J., Sawyer, A. T. y Fang, A. (2012). The efficacy of cognitive behavioral therapy: A review of meta-analyses. *Cognitive Therapy and Research*, *36*(5), 427–440. doi: 10.1007/s10608-012-9476-1

Hollins-Martin, C. y Fleming, V. (2011). The birth satisfaction scale. *International journal of health care quality assurance, 24*(2), 124-135. doi: 10.1108/09526861111105086

Hollins-Martin, C. y Martin, C. (2014). Development and psychometric properties of the Birth Satisfaction Scale-Revised (BSS-R). *Midwifery, 30*(6), 610-619. doi: 10.1016/j.midw.2013.10.006

Horsch, A., Kang, J. S., Vial, Y., Ehlert, U., Borghini, A., Marques-Vidal, P., … y Puder, J. J. (2016). Stress exposure and psychological stress responses are related to glucose concentrations during pregnancy. *British Journal of Health Psychology*, *21*(3), 712–729. doi: 10.1111/bjhp.12197

House, S. J., Tripathi, S. P., Knight, B. T., Morris, N., Newport, D. J. y Stowe, Z. N. (2016). Obsessive-compulsive disorder in pregnancy and the postpartum period: course of illness and obstetrical outcome. *Archives of Women's Mental Health*, *19*(1), 3–10. doi: 10.1007/s00737-015-0542-z

Howard, L. M., Goss, C., Leese, M. y Thornicroft, G. (2003). Medical outcome of pregnancy in women with psychotic disorders and their infants in the first year after birth. *British Journal of Psychiatry*, *182*(JAN.), 63–67. doi: 10.1192/bjp.182.1.63

Howard, L. M., Molyneaux, E., Dennis, C. L., Rochat, T., Stein, A. y Milgrom, J. (2014). Non-psychotic mental disorders in the perinatal period. *The Lancet, 384*, 15-21. doi: 10.1016/S0140-6736(14)61276-9

Howerton, C. L. y Bale, T. L. (2012). Prenatal programing: At the intersection of maternal stress and immune activation. *Hormones and Behavior*, *62*(3), 237–242. doi: 10.1016/j.yhbeh.2012.03.007

Hu, L. T. y Bentler, P. M. (1999). Cutoff criteria for fit indexes in covariance structure analysis: Conventional criteria versus new alternatives. *Structural equation modeling: a multidisciplinary journal, 6*(1), 1-55. doi: 10.1080/10705519909540118

Hu, H. T., Xu, J. J., Lin, J., Li, C., Wu, Y. T., Sheng, J. Z., ... y Huang, H. F. (2018). Association between first caesarean delivery and adverse outcomes in subsequent pregnancy: a retrospective cohort study. *BMC pregnancy and childbirth*, *18*(1), 273-285. doi: 10.1186/s12884-018-1895-x

Hudak, R. y Wisner, K. L. (2012). Diagnosis and treatment of postpartum obsessions and compulsions that involve infant harm. *American Journal of Psychiatry*, *169*(4), 360–363. doi: 10.1176/appi.ajp.2011.11050667

Hudson, C., Spry, E., Borschmann, R., Becker, D., Moran, P., Olsson, C., … y Patton, G. C. (2017). Preconception personality disorder and antenatal maternal mental health: A population-based cohort study. *Journal of Affective Disorders, 209*(September 2016), 169–176. doi: 10.1016/j.jad.2016.11.022

Huizink, A. C., Robles de Medina, P. G., Mulder, E. J., Visser, G. H. y Buitelaar, J. K. (2003). Stress during pregnancy is associated with developmental outcome in infancy. *Journal of Child Psychology and Psychiatry, 44*(6), 810-818. doi:10.1111/1469-7610.00166

Ibrahim, S. M. y Lobel, M. (2019). Conceptualization, measurement, and effects of pregnancy-specific stress: review of research using the original and revised Prenatal Distress Questionnaire. *Journal of Behavioral Medicine*. doi: 10.1007/s10865-019-00068-7

Iglesias, S., Jacobsen, D., Gonzalez, D., Azzara, S., Repetto, E. M., Jamardo, J., … y Fabre, B. (2015). Hair cortisol: A new tool for evaluating stress in programs of stress management. *Life Sciences*, *141*, 188–192. doi: 10.1016/j.lfs.2015.10.006

Jefford, E., Hollins Martin, C. J. y Martin, C. R. (2018). Development and validation of the Australian version of the Birth Satisfaction Scale-Revised (BSS-R). *Journal of reproductive and infant psychology, 36*(1), 42-58. doi: 10.1080/02646838.2017.1396302

Johnston, R. G. y Brown, A. E. (2013). Maternal trait personality and childbirth: the role of extraversion and neuroticism. *Midwifery, 29*(11), 1244-1250. doi: 10.1016/j.midw.2012.08.005

Jung, C., Ho, J. T., Torpy, D. J., Rogers, A., Doogue, M., Lewis, J. G., … y Inder, W. J. (2011). A longitudinal study of plasma and urinary cortisol in pregnancy and postpartum. *Journal of Clinical Endocrinology and Metabolism*, *96*(5), 1533–1540. doi: 10.1210/jc.2010-2395

Kabat-Zinn, J. (1990). *Full catastrophe living: The program of the stress reduction clinic at the University of Massachusetts Medical Center*. Nueva York: Dell.

Kaboli, K. S., Mahmoodi, Z., Tourzani, Z., Tehranizadeh, M., Kabir, K. y Dolatian, M. (2017). The effect of group counseling based on cognitive-behavioral approach on pregnancy-specific stress and anxiety. *Shiraz E Medical Journal*, *18*(5), e13183. doi: 10.5812/semj.45231

Kalra, S., Einarson, A., Karaskov, T., Van Uum, S. y Koren, G. (2007). The relationship between stress and hair cortisol in healthy pregnant women. *Clinical and Investigative Medicine, 30*(2), 103–107.

Kanner, A. D., Coyne, J. C., Schaefer, C. y Lazarus, R. S. (1981). Comparison of two modes of stress measurement: Daily hassles and uplifts versus major life events. *Journal of behavioral medicine*, *4*(1), 1-39. doi: 10.1007/BF00844845

Kapoor, A., Dunn, E., Kostaki, A., Andrews, M. H. y Matthews, S. G. (2006). Fetal programming of hypothalamo-pituitary-adrenal function: prenatal stress and glucocorticoids. *The Journal of physiology, 572*(1), 31-44. doi: 10.1113/jphysiol.2006.105254

Kapoor, A., Lubach, G. R., Ziegler, T. E. y Coe, C. L. (2016). Hormone levels in neonatal hair reflect prior maternal stress exposure during pregnancy. *Psychoneuroendocrinology, 66*, 111-117.doi: 10.1016/j.psyneuen.2016.01.010

Karakash, S. D., Tschankoshvili, N., Weedon, J., Schwartz, R. M., Kirschbaum, C. y Minkoff, H. (2016). Hypocortisolism and preterm birth. Journal of Neonatal-Perinatal Medicine, 9(4), 333–339. doi:10.3233/NPM-161640

Karamoozian, M. y Askarizadeh, G. (2015). Impact of prenatal cognitive-behavioral stress management intervention on maternal anxiety and depression and newborns' Apgar scores. *Iranian Journal of Neonatology, 6*(2), 14–23. doi: 10.22038/ijn.2015.4485

Karlén, J., Ludvigsson, J., Hedmark, M., Faresjö, Å., Theodorsson, E. y Faresjö, T. (2015). Early psychosocial exposures, hair cortisol levels, and disease risk. *Pediatrics, 135*(6), e1450-e1457. doi: 10.1542/peds.2014-2561

Khalifeh, H., Brauer, R., Toulmin, H. y Howard, L. M. (2015). Perinatal mental health: What every neonatologist should know. *Early Human Development*, *91*(11), 649–653. doi: 10.1016/j.earlhumdev.2015.08.010

King, S. y Laplante, D. P. (2005). The effects of prenatal maternal stress on children's cognitive development: Project Ice Storm. *Stress, 8*(1), 35-45. doi: 10.1080/10253890500108391

Kingsbury, A. M., Plotnikova, M., Clavarino, A., Mamun, A. y Najman, J. M. (2018). Social adversity in pregnancy and trajectories of women's depressive symptoms: A longitudinal study. *Women and Birth*, *31*(1), 52–58. doi: 10.1016/j.wombi.2017.06.016

Kingston, D., Heaman, M., Fell, D., Dzakpasu, S. y Chalmers, B. (2012). Factors associated with perceived stress and stressful life events in pregnant women: findings from the Canadian Maternity Experiences Survey. *Maternal and child health journal*, *16*(1), 158-168. doi: 10.1007/s10995-010-0732-2

Kingston, D., Janes-Kelley, S., Tyrrell, J., Clark, L., Hamza, D., Holmes, P., … y Austin, M. P. (2015). An Integrated Web-Based Mental Health Intervention of Assessment-Referral-Care to Reduce Stress, Anxiety, and Depression in Hospitalized Pregnant Women With Medically High-Risk Pregnancies: A Feasibility Study Protocol of Hospital-Based Implementation. *JMIR Research Protocols*, *4*(1), e9. doi: 10.2196/resprot.4037

Kinney, D. K., Miller, A. M., Crowley, D. J., Huang, E. y Gerber, E. (2008). Autism prevalence following prenatal exposure to hurricanes and tropical storms in Louisiana. *Journal of Autism and Developmental Disorders, 38*(3), 481–488. doi: 10.1007/s10803-007-0414-0

Kirschbaum, C., Tietze, A., Skoluda, N. y Dettenborn, L. (2009). Hair as a retrospective calendar of cortisol production—increased cortisol incorporation into hair in the third trimester of pregnancy. *Psychoneuroendocrinology, 34*(1), 32-37.. doi: 10.1016/j.psyneuen.2008.08.024

Kline, P. (2000). *A Psychometrics Primer.* London: Free Association Books.

Kline, R.B. (2011). *Principles and Practice of Structural Equation Modeling, 3rd ed.* London: Guilford Press.

Konerding, U. (2016). Which kind of psychometrics is adequate for patient satisfaction questionnaires?. *Patient preference and adherence, 10,* 2083–2090. doi: 10.2147/PPA.S112398

Kristensen, J., Vestergaard, M., Wisborg, K., Kesmodel, U. y Secher, N. J. (2005). Pre pregnancy weight and the risk of stillbirth and neonatal death. *BJOG An International Journal of Obstetrics and Gynaecoy,* 112, 403-408. doi: 10.1111/j.1471-0528.2005.00437.x

Kusaka, M., Matsuzaki, M., Shiraishi, M. y Haruna, M. (2016). Immediate stress reduction effects of yoga during pregnancy: One group pre–post test. *Women and Birth, 29*(5), e82–e88. doi: 10.1016/j.wombi.2016.04.003

Labrador, F. J. (1996) *El estrés. Nuevas técnicas para su control*. Madrid: Temas de Hoy.

LaCoursiere, D. Y., Baksh, L., Bloebaum, L. y Varner, M. W. (2006). Maternal body mass index and self-reported postpartum depressive symptoms. *Maternal and child health journal, 10*(4), 385-390. doi:10.1007/s10995-006-0075-1.

Lane, B., Ruofeil, L., Williams, S. y Tweedie, R. (2002). It's Just Different in the Country: Postnatal Depression and Group Therapy in a Rural Setting. *Social Work in Health Care, 34*(3–4), 333–348. doi: 10.1300/J010v34n03_06

Langley-Evans, S. C. (2015). Nutrition in early life and the programming of adult disease: a review. *Journal of Human Nutrition and Dietetics, 28*, 1-14. doi: 10.1111/jhn.12212

Laplante, D. P., Barr, R. G., Brunet, A., Du Fort, G. G., Meaney, M. L., Saucier, J. F., … y King, S. (2004). Stress during pregnancy affects general intellectual and language functioning in human toddlers. *Pediatric Research*, *56*(3), 400–410. doi: 10.1203/01.PDR.0000136281.34035.44

Laplante, D. P., Brunet, A., Schmitz, N., Ciampi, A. y King, S. (2008). Project Ice Storm: Prenatal maternal stress affects cognitive and linguistic functioning in 5½-year-old children. *Journal of the American Academy of Child & Adolescent Psychiatry, 47*(9), 1063-1072. doi: 10.1097/CHI.0b013e31817eec80

Laraia, B. A., Siega-Riz, A. M., Dole, N., y London, E. (2009). Pregravid weight is associated with prior dietary restraint and psychosocial factors during pregnancy. *Obesity, 17*(3), 550-558. doi:10.1038/oby.2008.585

Larroque, B., Bertrais, S., Czernichow, P. y Léger, J. (2001). School difficulties in 20-year-olds who were born small for gestational age at term in a regional cohort study. *Pediatrics*, *108*(1), 111–115. doi: 10.1542/peds.108.1.111

Larsson, C., Sydsjö, G. y Josefsson, A. (2004). Health, sociodemographic data, and pregnancy outcome in women with antepartum depressive symptoms. *Obstetrics & Gynecology, 104*(3), 459-466. doi: 10.1097/01.AOG.0000136087.46864.e4

Latendresse, G. (2009). The Interaction Between Chronic Stress and Pregnancy: Preterm Birth from A Biobehavioral Perspective. *Journal of Midwifery and Women's Health*, *54*(1), 8–17. doi: 10.1016/j.jmwh.2008.08.001

Laurent, H. K., Duncan, L. G., Lightcap, A. y Khan, F. (2017). Mindful parenting predicts mothers' and infants' hypothalamic-pituitary-adrenal activity during a dyadic stressor. *Developmental psychology, 53*(3), 417-424. doi: 10.1037/dev0000258

Lazarus, R. S. y Folkman, S. (1984). *Stress, appraisal, and coping*. Nueva York: Springer publishing company.

Lazarus, R. S. y Folkman, S. (1986). *Estrés y procesos cognitivos*. Barcelona: Martínez Roca.

Lederman, S. A., Rauh, V., Weiss, L., Stein, J. L., Hoepner, L. A., Becker, M. y Perera, F. P. (2004). The effects of the World Trade Center event on birth outcomes among term deliveries at three lower Manhattan hospitals. *Environmental Health Perspectives*, *112*(17), 1772–1778. doi: 10.1289/ehp.7348

Lees, C. C., Marlow, N., van Wassenaer-Leemhuis, A., Arabin, B., Bilardo, C. M., Brezinka, C., ... y Ferrazzi, E. (2015). 2 year neurodevelopmental and intermediate perinatal outcomes in infants with very preterm fetal growth restriction (TRUFFLE): a randomised trial. *The Lancet*, *385*(9983), 2162-2172. doi: 10.1016/S0140-6736(14)62049-3

Leong, C., Raymond, C., Château, D., Dahl, M., Alessi-Severini, S., Falk, J., … y Katz, A. (2017). Psychotropic Drug Use before, during, and after Pregnancy: A Population-Based Study in a Canadian Cohort (2001-2013). *Canadian Journal of*

Psychiatry, 62(8), 543–550. doi: 10.1177/0706743717711168

Linares-Ortiz, J., Robles-Ortega, H. y Peralta-Ramírez, M. I. (2014). Modificación De La Personalidad Mediante Una Terapia Cognitivo-Conductual De Frontamiento Al Estrés. *Anales de Psicologia, 30*(1), 114–122. doi: 10.6018/analesps.30.1.136281

Lindgren, K. (2003). A comparison of pregnancy health practices of women in inner-city and small urban communities. *Journal of Obstetric, Gynecologic, and Neonatal Nursing, 32*(3), 313–321. doi: 10.1177/0884217503253442

Lindholm, J. (1973). Plasma and urinary cortisol in pregnancy and during estrogen-gestagen treatment. *Scandinavian Journal of Clinical and Laboratory Investigation, 31*(1), 119–122. doi: 10.3109/00365517309082426

Littleton, H. L., Breitkopf, C. R. y Berenson, A. B. (2007). Correlates of anxiety symptoms during pregnancy and association with perinatal outcomes: a meta-analysis. *American Journal of Obstetrics and Gynecology*, *196*(5), 424–432. doi: 10.1016/j.ajog.2007.03.042

Littleton, H. L., Bye, K., Buck, K. y Amacker, A. (2010). Psychosocial stress during pregnancy and perinatal outcomes: a meta-analytic review. *Journal of Psychosomatic Obstetrics & Gynecology, 31*(4), 219-228. doi: 10.3109/0167482X.2010.518776

Littleton, H. L., Breitkopf, C. R. y Berenson, A. B. (2007). Correlates of anxiety symptoms during pregnancy and association with perinatal outcomes: a meta-analysis. *American Journal of Obstetrics and Gynecology, 196*(5), 424–432. doi: 10.1016/j.ajog.2007.03.042

Liu, L., Oza, S., Hogan, D., Chu, Y., Perin, J., Zhu, J., … y Black, R. E. (2016a). Global, regional, and national causes of under-5 mortality in 2000–15: an updated systematic analysis with implications for the Sustainable Development Goals. *The Lancet, 388*(10063), 3027–3035. doi: 10.1016/S0140-6736(16)31593-8

Liu, P., Xu, L., Wang, Y., Zhang, Y., Du, Y., Sun, Y. y Wang, Z. (2016b). Association between perinatal outcomes and maternal pre-pregnancy body mass index. *Obesity Reviews, 17*(11), 1091–1102. doi: 10.1111/obr.12455

Liu, C. H., Fink, G., Brentani, H. y Brentani, A. (2017). An assessment of hair cortisol among postpartum Brazilian mothers and infants from a high-risk community in São Paulo: Intra-individual stability and association in mother–infant dyads. *Developmental psychobiology, 59*(7), 916-926. doi: 10.1002/dev.21557

Lobel, M. (1996). *The revised pregnancy distress questionnaire (NUPDQ).* Stony Brook (NY): State University of New York at Stony Brook.

Lobel, M., Cannella, D. L., Graham, J. E., DeVincent, C., Schneider, J. y Meyer, B. A. (2008). Pregnancy-specific stress, prenatal health behaviors, and birth outcomes. *Health Psychology*, *27*(5), 604. doi: 10.1037/a0013242

Lobel, M. y Dunkel-Schetter, C. (2016). Pregnancy and Prenatal Stress. *Encyclopedia of Mental Health,* 318–329. doi: 10.1016/B978-0-12-397045-9.00164-6

Lochner, C., Hemmings, S. M. J., Kinnear, C. J., Moolman-Smook, J. C., Corfield, V. A., Knowles, J. A., … y Stein, D. J. (2004). Corrigendum to "gender in obsessive-compulsive disorder: clinical and genetic findings" [Eur. Neuropsychopharmacol. 14 (2004) 105-113]. *European Neuropsychopharmacology : The Journal of the European College of Neuropsychopharmacology*, *14*(5), 437–445. doi: 10.1016/j.euroneuro.2004.05.002

Lumbiganon, P., Laopaiboon, M., Gülmezoglu, A. M., Souza, J. P., Taneepanichskul, S., Ruyan, P., … y Villar, J. (2010). Method of delivery and pregnancy outcomes in

Asia: the WHO global survey on maternal and perinatal health 2007-08. *The Lancet, 375*(9713), 490–499. doi: 10.1016/S0140-6736(09)61870-5

Magriples, U., Kershaw, T. S., Rising, S. S., Massey, Z. y Ickovics, J. R. (2008). Prenatal health care beyond the obstetrics service: utilization and predictors of unscheduled care. *American journal of obstetrics and gynecology, 198*(1), 75-e1. doi: 10.1016/j.ajog.2007.05.040

Marc, I., Toureche, N., Ernst, E., Hodnett, E. D., Blanchet, C., Dodin, S. y Njoya, M. M. (2011). Mind-body interventions during pregnancy for preventing or treating women's anxiety. *Cochrane Database of Systematic Reviews*, 7, CD007559. doi: 10.1002/14651858.CD007559.pub2

Marcus, S. M. (2009). Depression during pregnancy: Rates, risks and consequences. *Canadian Journal of Clinical Pharmacology, 16*(1), 15–22.

Maria, E., Reiche, V., Odebrecht, S., Nunes, V. y Morimoto, H. K. (2004). Review Stress , depression , the immune system , and cancer, *5*(October), 617–625.

Marín-Morales, D., Carmona-Monge, F.J., Peñacoba-Puente, C., Olmos-Albacete, R. y Toro-Molina, S. (2013). Factor structure, validity, and reliability of the Spanish version of the Women's Views of Birth Labour Satisfaction Questionnaire. *Midwifery, 29*(12), 1339-1345. doi: 10.1016/j.midw.2012.12.015

Martin, C. y Hollins-Martin, C. (2018). Sensitivity of the Birth Satisfaction Scale-Revised (BSS-R) to delivery type: A meta-analysis. J*ournal of Reproductive and Infant Psychology, 37*(3), e12. doi: 10.1080/02646838.2019.1632544

Martin, C., Hollins-Martin, C., Burduli, E., Barbosa-Leiker, C., Donovan-Batson, C. y Fleming, S. E. (2017). Measurement and structural invariance of the US version of the Birth Satisfaction Scale-Revised (BSS-R) in a large sample. *Women and Birth, 30*(4), e172-e178. doi: 10.1016/j.wombi.2016.11.006

Martin, C. R. y Savage-McGlynn, E. (2013). A 'good practice'guide for the reporting of design and analysis for psychometric evaluation. *Journal of Reproductive and Infant Psychology, 31*(5), 449-455. doi: 10.1080/02646838.2013.835036

Martin, C. R., Vardavaki, Z. y Hollins Martin, C. (2016). Measurement equivalence of the Birth Satisfaction Scale-Revised (BSS-R): further evidence of construct validity. *Journal of Reproductive and Infant Psychology, 34*(4), 394-402. doi: 10.1080/02646838.2016.1184747

Martin, C., Vilar, R. y Verdejo-Roman, J. (2019). ¿Cómo le afecta el estrés a nuestro cerebro? La parte oculta del iceberg. En M. I. Peralta-Ramirez (Ed.), *Un villano llamado estrés* (pp. 51-73). Madrid: Pirámide.

Martini, J., Petzoldt, J., Einsle, F., Beesdo-Baum, K., Höfler, M. y Wittchen, H. U. (2015). Risk factors and course patterns of anxiety and depressive disorders during pregnancy and after delivery: A prospective-longitudinal study. *Journal of Affective Disorders*, *175*, 385–395. doi: 10.1016/j.jad.2015.01.012

Massey, A. J., Campbell, B. K., Raine-Fenning, N., Pincott-Allen, C., Perry, J. y Vedhara, K. (2016). Relationship between hair and salivary cortisol and pregnancy in women undergoing IVF. *Psychoneuroendocrinology, 74*, 397-405. doi: 10.1016/j.psyneuen.2016.08.027

Mayer, E. A. (2000). The neurobiology of stress and gastrointestinal disease. *Gut*, *47*(7), 861–869. http://dx.doi.org/10.1136/gut.47.6.861

McDonald, S., Kehler, H., Bayrampour, H., Fraser-Lee, N. y Tough, S. (2016). Risk and protective factors in early child development: Results from the All Our Babies (AOB) pregnancy cohort. *Research in developmental disabilities, 58*, 20-30. doi: 10.1016/j.ridd.2016.08.010

McEwen, B. y Sapolsky, R. (2006). El estrés y su salud. *The Journal of Clinical Endocrinology & Metabolism*, *91*(2), 0–0. doi: 10.1210/jcem.91.2.9993

McGregor, B. A., Antoni, M. H., Boyers, A., Alferi, S. M., Blomberg, B. B. y Carver, C. S. (2004). Cognitive-behavioral stress management increases benefit finding and immune function among women with early-stage breast cancer. *Journal of Psychosomatic Research*, *56*(1), 1–8. doi: 10.1016/S0022-3999(03)00036-9

Mehta, U. J., Siega-Riz, A. M., Herring, A. H., Adair, L. S. y Bentley, M. E. (2011). Maternal obesity, psychological factors, and breastfeeding initiation. *Breastfeeding Medicine*, *6*(6), 369-376. doi:http://dx.doi.org/10.1089/bfm.2010.0052

Meltzer-Brody, S. (2011). New insights into perinatal depression: pathogenesis and treatment during pregnancy and postpartum. *Dialogues in clinical neuroscience, 13*(1), 89-100.

Merlot E, Couret D, Otten W. Merlot, E., Couret, D. y Otten, W. (2008). Prenatal stress, fetal imprinting and immunity. *Brain, behavior, and immunity, 22*(1), 42-51. doi: 10.1016/j.bbi.2007.05.007

Metsälä, J., Stach-Lempinen, B., Gissler, M., Eriksson, J. G. y Koivusalo, S. (2016). Risk of Pregnancy Complications in Relation to Maternal Prepregnancy Body Mass Index: Population-Based Study from Finland 2006-10. *Paediatric and Perinatal Epidemiology*, *30*(1), 28–37. doi: 10.1111/ppe.12248

Meyer, J., Novak, M., Hamel, A. y Rosenberg, K. (2014). Extraction and analysis of cortisol from human and monkey hair. *JoVE (Journal of Visualized Experiments), 83,* e50882. doi: 10.3791/50882

Miller, E. S., Chu, C., Gollan, J. y Gossett, D. R. (2013). Obsessive-compulsive symptoms during the postpartum period: A prospective cohort. *Journal of Reproductive Medicine*, *58*(3–4), 115–122.

Miller, L. y Smith, A. D. (1985). Stress Vulnerability Scale. University of California, Berkeley Wellness Letter.

Mina, T. H., Lahti, M., Drake, A. J., Räikkönen, K., Minnis, H., Denison, F. C., ... y Reynolds, R. M. (2017). Prenatal exposure to very severe maternal obesity is associated with adverse neuropsychiatric outcomes in children. *Psychological medicine, 47*(2), 353-362. doi:10.1017/S0033291716002452

Mone, F., Mulcahy, C., McParland, P. y McAuliffe, F. M. (2017). Should we recommend universal aspirin for all pregnant women?. *American journal of obstetrics and gynecology*, *216*(2), 141-e1. doi: 10.1016/j.ajog.2016.09.086

Montero-López, E., Santos-Ruiz, A., García-Ríos, M. C., Rodríguez-Blázquez, R., Pérez-García, M. y Peralta-Ramírez, M. I. (2016). A virtual reality approach to the Trier Social Stress Test: Contrasting two distinct protocols. *Behavior Research Methods*, *48*(1), 223–232. doi: 10.3758/s13428-015-0565-4

Montero-Lopez, E., Santos-Ruiz, A., Garcia-Silva, J. y Delgado-Rico, E. (2019). Estrés y autoinmunidad: cuando tu cuerpo te ataca. En M. I. Peralta-Ramirez (Ed.), *Un villano llamado estrés* (pp. 149-168). Madrid: Pirámide.

Montori, V. M. y Guyatt, G. H. (2001). Intention-to-treat principle. *Cmaj*, *165*(10), 1339–1341.

Morrison, J. C., Roberts, W. E., Jones, J. S., Istwan, N., Rhea, D. y Stanziano, G. (2004). Frequency of nursing, physician and hospital interventions in women at risk for preterm delivery. *The Journal of Maternal-Fetal & Neonatal Medicine*, *16*(2), 102-105. doi: 10.1080/14767050400005731

Mozurkewich, E., Chilimigras, J., Koepke, E., Keeton, K. y King, V. J. (2009). Indications for induction of labour: a best-evidence review. *BJOG: An International Journal of Obstetrics & Gynaecology, 116*(5), 626-636. doi: 10.1111/j.1471-0528.2008.02065.x

Mpembeni, R. N., Killewo, J. Z., Leshabari, M. T., Massawe, S. N., Jahn, A., Mushi, D. y Mwakipa, H. (2007). Use pattern of maternal health services and determinants of skilled care during delivery in Southern Tanzania: implications for achievement of MDG-5 targets. *BMC pregnancy and childbirth*, *7*(1), 29. doi: 10.1186/1471-2393-7-29

Mu, P. F. (2004). Maternal role transition experiences of women hospitalized with PROM: a phenomenological study. *International journal of nursing studies, 41*(8), 825-832. doi: 10.1016/j.ijnurstu.2004.03.008

Mustonen, P., Karlsson, L., Scheinin, N. M., Kortesluoma, S., Coimbra, B., Rodrigues, A. J. y Karlsson, H. (2018). Hair cortisol concentration (HCC) as a measure for prenatal psychological distress—A systematic review. *Psychoneuroendocrinology, 92*, 21-28. doi: 10.1016/j.psyneuen.2016.12.017

Mylonas, I. y Friese, K. (2015). Indications for and risks of elective cesarean section. *Deutsches Ärzteblatt International, 112*(29-30), 489. doi: 10.3238/arztebl.2015.0489

Nakano, Y., Akechi, T., Furukawa, T. A. y Sugiura-Ogasawara, M. (2013). Cognitive behavior therapy for psychological distress in patients with recurrent miscarriage. *Psychology Research and Behavior Management, 6,* 37–43. doi: 10.2147/PRBM.S44327

Nakao, M. (2017). Somatic manifestation of distress: clinical medicine, psychological, and public health perspectives. *BioPsychoSocial Medicine, 11*(1), 11–12. doi: 10.1186/s13030-017-0119-3

Nast, I., Bolten, M., Meinlschmidt, G. y Hellhammer, D. H. (2013). How to measure prenatal stress? A systematic review of psychometric instruments to assess psychosocial stress during pregnancy. *Paediatric and perinatal epidemiology*, *27*(4), 313-322. doi: 10.1111/ppe.12051

National Center for Complementary and Integrative Health (2018). Complementary, Alternative, or Integrative Health: What's in a name?. Recuperado de: https://nccih.nih.gov/health/integrative-health#hed4

National Health Service (2018). *Pre-eclampsia*. Recuperado de: https://www.nhs.uk/conditions/pre-eclampsia/

Navarrete, C. D., Fessler, D. M. T. y Eng, S. J. (2007). Elevated ethnocentrism in the first trimester of pregnancy. *Evolution and Human Behavior, 28*(1), 60–65. doi: 10.1016/j.evolhumbehav.2006.06.002

Navarrete-Navarrete, N., Peralta-Ramirez, M. I., Sabio-Sanchez, J. M., Coin, M. A., Robles-Ortega, H., Hidalgo-Tenorio, C., … y Jimenez-Alonso, J. (2010). Efficacy of cognitive behavioural therapy for the treatment of chronic stress in patients with lupus erythematosus: A randomized controlled trial. *Psychotherapy and Psychosomatics*, *79*(2), 107–115. doi: 10.1159/000276370

Nayak, S. K., Poddar, R. y Jahan, M. (2015). Psychological Problems during Advance Stage of Pregnancy. *The International Journal of Indian Psychology, 2*(2), 103–113.

NIH. (2012). Risk of newborn heart defects increases with maternal obesity [news release]. Retrieved from: https://www.nih.gov/news-events/news-releases/risk-newborn-heart-defects-increases-maternal-obesity

Nilsson, C., Hessman, E., Sjöblom, H., Dencker, A., Jangsten, E., Mollberg, M., … y Begley, C. (2018). Definitions, measurements and prevalence of fear of childbirth: A systematic review. *BMC Pregnancy and Childbirth*, *18*(1), 1–15. doi: 10.1186/s12884-018-1659-7

O'Connell, M. A., Leahy-Warren, P., Kenny, L. C. y Khashan, A. S. (2019). Pregnancy outcomes in women with severe fear of childbirth. *Journal of Psychosomatic Research, 120*, 105–109. doi: 10.1016/j.jpsychores.2019.03.013

O'Donnell, K. J., Bugge Jensen, A., Freeman, L., Khalife, N., O'Connor, T. G. y Glover, V. (2012). Maternal prenatal anxiety and downregulation of placental 11β-HSD2. *Psychoneuroendocrinology*, *37*(6), 818–826. doi: 10.1016/j.psyneuen.2011.09.014

O'Hara, M. W. y McCabe, J. E. (2013). Postpartum depression: current status and future directions. *Annual Review of Clinical Psychology*, *9*, 379–407. doi: 10.1146/annurev-clinpsy-050212-185612

O'Hara, M. W. y Wisner, K. L. (2014). Perinatal mental illness: Definition, description and aetiology. *Best Practice and Research: Clinical Obstetrics and Gynaecology*, *28*(1), 3–12. doi: 10.1016/j.bpobgyn.2013.09.002

Obel, C., Hedegaard, M., Henriksen, T. B., Secher, N. J., Olsen, J. y Levine, S. (2005). Stress and salivary cortisol during pregnancy. *Psychoneuroendocrinology*, *30*(7), 647–656. doi: 10.1016/j.psyneuen.2004.11.006

Organización Mundial de la Salud (2016a). Obesidad y sobrepeso. Recuperado de: http://www.who.int/mediacentre/factsheets/fs311/es/

Organización Mundial de la Salud (2016b). Global database on body mass index. Recuperado de: http://apps.who.int/gho/data/node.main.A897A?lang=en

Organización Mundial de la Salud (2016c). Global database on body mass index. Recuperado de: http://apps.who.int/gho/data/node.main.A904?lang=en

Organización Mundial de la Salud (2017). *Metas mundiales de nutrición 2025: Documento normativo sobre bajo peso al nacer.* Recuperado de: https://www.who.int/nutrition/publications/globaltargets2025_policybrief_lbw/es/

Organización Mundial de la Salud (2018a). *Nacimientos prematuros*. Recuperado de: https://www.who.int/es/news-room/fact-sheets/detail/preterm-birth

Organización Mundial de la Salud (2018b). *Diez datos acerca del desarrollo en la primera infancia como determinante social de la salud.* Recuperado de: http://www.who.int/maternal_child_adolescent/topics/child/development/10facts/es/

Organización Mundial de la Salud (2018c). *Depresión.* Recuperado de: https://www.who.int/es/news-room/fact-sheets/detail/depression

Pampaka, D., Papatheodorou, S. I., AlSeaidan, M., Al Wotayan, R., Wright, R. J., Buring, J. E., ... y Christophi, C. A. (2019). Postnatal depressive symptoms in women with and without antenatal depressive symptoms: results from a prospective cohort study. *Archives of women's mental health*, *22*(1), 93-103.doi: 10.1007/s00737-018-0880-8

Pearson, R. M., Lightman, S. L. y Evans, J. (2009). Emotional sensitivity for motherhood: Late pregnancy is associated with enhanced accuracy to encode emotional faces.

Hormones and Behavior, 56(5), 557–563. doi: 10.1016/j.yhbeh.2009.09.013

Peñacoba-Puente, C., Monge, F. J. C. y Morales, D. M. (2011). Pregnancy worries: A longitudinal study of Spanish women. *Acta Obstetricia et Gynecologica Scandinavica*, *90*(9), 1030–1035. doi: 10.1111/j.1600-0412.2011.01208.x

Peralta-Ramírez, M. I., Robles-Ortega, H., Navarrete-Navarrete, N. y Jiménez-Alonso, J. (2009). Aplicación de la terapia de afrontamiento del estrés en dos poblaciones con alto estrés: Pacientes crónicos y personas sanas. *Salud Mental, 32*(3), 251–258.

Peralta-Ramirez, M. I. (2019). El estrés: de héroe a villano. En M. I. Peralta-Ramirez (Ed*.), Un villano llamado estrés* (pp. 25-50). Madrid: Pirámide.

Pérez-Ramírez, F., García-García, I., Caparros-Gonzalez, R. A. y Peralta-Ramírez, M. I. (2016). Psychological assessment among immigrant and Spanish women during the postpartum period in Spain. *Journal of reproductive and infant psychology, 35*(2), 159–171. doi: 10.1080/02646838.2016.1246709

Perkins, A. V., Linton, E. A., Eben, F., Simpson, J., Wolfe, C. D. A. y Redman, C. W. G. (1995). Corticotrophin-releasing hormone and corticotrophin- releasing hormone binding protein in normal and pre-eclamptic human pregnancies. *BJOG: An International Journal of Obstetrics & Gynaecology*, *102*(2), 118–122. doi: 10.1111/j.1471-0528.1995.tb09063.x

Petersen, J. y Jahn, A. (2008). Suspicious findings in antenatal care and their implications from the mothers' perspective: A prospective study in Germany. *Birth, 35*(1), 41-49. doi: 10.1111/j.1523-536X.2007.00210.x

Pittenger, C. y Duman, R. S. (2007). Stress, Depression and Neuroplasticity: A Convergence of Mechanisms. *Neuropsychopharmacology, 33*(1), 88–109. doi:

10.1038/sj.npp.1301574

Portollano, J. A. (2017). *Neuropsicología infantil.* Madrid: Editorial SínTesis .

Prado, E. L., Abbeddou, S., Adu-Afarwuah, S., Arimond, M., Ashorn, P., Ashorn, U., … y Dewey, K. G. (2017). Predictors and pathways of language and motor development in four prospective cohorts of young children in Ghana, Malawi, and Burkina Faso. *Journal of Child Psychology and Psychiatry and Allied Disciplines*, *58*(11), 1264–1275. doi: 10.1111/jcpp.12751

Prosser, S. J., Barnett, A. G. y Miller, Y. D. (2018). Factors promoting or inhibiting normal birth. *BMC pregnancy and childbirth*, *18*(1), 241-252. doi: 10.1186/s12884-018-1871-5

Qu, F., Wu, Y., Zhu, Y. H., Barry, J., Ding, T., Baio, G., … y Hardiman, P. J. (2017). The association between psychological stress and miscarriage: A systematic review and meta-analysis. *Scientific Reports*, *7*(1), 1–8. doi: 10.1038/s41598-017-01792-3

Raine, K. H., Boyce, P. y Thorpe, K. (2019). Antenatal interpersonal sensitivity as an early predictor of vulnerable mother – infant relationship quality. *Clinical Child Psycholy and Psychiatry, 24*, 860-875. doi: 10.1177/1359104519857217

Rakers, F., Rupprecht, S., Dreiling, M., Bergmeier, C., Witte, O. W. y Schwab, M. (2017). Transfer of maternal psychosocial stress to the fetus. *Neuroscience & Biobehavioral Reviews.* doi: 10.1016/j.neubiorev.2017.02.019

Rallis, S., Skouteris, H., McCabe, M. y Milgrom, J. (2014). A prospective examination of depression, anxiety and stress throughout pregnancy. *Women and Birth*, *27*(4), e36-e42. doi: 10.1016/j.wombi.2014.08.002

Ramírez-López, M. T., Vázquez, M., Arco, R., Blanco, R. N., del Olmo, J., Suárez, J., ...

y Gómez, R. (2015). El papel de la dieta materna en la programación metabólica y conductual: Revisión de los mecanismos biológicos implicados. *Nutrición hospitalaria, 32*(6), 2433-2445. doi:10.3305/nh.2015.32.6.9716.

Remor, E. (2006). Psychometric properties of a European Spanish version of the Perceived Stress Scale (PSS). *The Spanish journal of psychology*, *9*(1), 86-93. doi: 10.1017/S1138741600006004

Reyes, G. A. y Montoro, C. I. (2019). Estrés y trastornos cardiovasculares: los factores psicosociales en el corazón y la circulación. En M. I. Peralta-Ramirez (Ed.), *Un villano llamado estrés* (pp. 79-109). Madrid: Pirámide.

Reyes, R. B. y Carrocera, L. F. (2015). Programación metabólica fetal. *Perinatología y Reproducción Humana*, *29*(3), 99–105. doi: 10.1016/j.rprh.2015.12.003

Richter, J., Bittner, A., Petrowski, K., Junge-Hoffmeister, J., Bergmann, S., Joraschky, P. y Weidner, K. (2012). Effects of an early intervention on perceived stress and diurnal cortisol in pregnant women with elevated stress, anxiety, and depressive symptomatology. *Journal of Psychosomatic Obstetrics and Gynecology, 33*(4), 162–170. doi: 10.3109/0167482X.2012.729111

Risnes, K. R., Vatten, L. J., Baker, J. L., Jameson, K., Sovio, U., Kajantie, E., … y Bracken, M. B. (2011). Birthweight and mortality in adulthood: A systematic review and meta-analysis. *International Journal of Epidemiology*, *40*(3), 647–661. doi: 10.1093/ije/dyq267

Robbins, C. L., D'angelo, D., Zapata, L., Boulet, S. L., Sharma, A. J., Adamski, A., ... y Kroelinger, C. (2018). Preconception health indicators for public health surveillance. *Journal of Women's Health*, *27*(4), 430-443. doi: 10.1089/jwh.2017.6531

Roberts, D., Brown, J., Medley, N. y Dalziel, S. R. (2017). Antenatal corticosteroids for accelerating fetal lung maturation for women at risk of preterm birth. *Cochrane database of systematic reviews, 3*, 1–145. doi: 10.1002/14651858.CD004454

Robertson, E., Grace, S., Wallington, T. y Stewart, D. E. (2004). Antenatal risk factors for postpartum depression: a synthesis of recent literature. *General hospital psychiatry*, *26*(4), 289-295. doi: 10.1016/j.genhosppsych.2004.02.006

Robles-Ortega, H. y Peralta-Ramírez, M. I. (2006). *Programa para el control del estrés*. Madrid: Pirámide.

Roesch, S. C., Schetter, C. D., Woo, G. y Hobel, C. J. (2004). Modeling the types and timing of stress in pregnancy. *Anxiety, Stress & Coping*, *17*(1), 87-102. doi: 10.1080/1061580031000123667

Roos, N., Sahlin, L., Ekman-Ordeberg, R., Kieler, H. y Stephansson, O. (2010). Maternal risk factors for postterm pregnancy and cesarean delivery following labor induction. *Acta obstetricia et gynecologica Scandinavica*, *89*(8), 1003-1010. doi: 10.3109/00016349.2010.500009

Román-Gálvez, R. M., Amezcua-Prieto, C., Salcedo-Bellido, I., Martínez-Galiano, J. M., Khan, K. S. y Bueno-Cavanillas, A. (2018). Factors associated with insomnia in pregnancy: A prospective Cohort Study. *European Journal of Obstetrics and Gynecology and Reproductive Biology*, *221*, 70-75. doi: 10.1016/j.ejogrb.2017.12.007

Romero-Gonzalez, B., Caparros-Gonzalez, R. A., Gonzalez-Perez, R., Delgado-Puertas, P. y Peralta-Ramirez, M. I. (2018). Newborn infants' hair cortisol levels reflect chronic maternal stress during pregnancy. *PloS one*, *13*(7), e0200279. doi: 10.1371/journal.pone.0200279

Romero-Gonzalez, B., Caparros-Gonzalez, R. A., Gonzalez-Perez, R., Coca-Arco, S. y Peralta-Ramirez, M. I. (2019). Hair cortisol levels, psychological stress and psychopathological symptoms prior to instrumental deliveries. *Midwifery, 77,* 45–52. doi: 10.1016/j.midw.2019.06.015

Rondung, E., Ekdahl, J., Hildingsson, I., Rubertsson, C. y Sundin, Ö. (2018). Heterogeneity in childbirth related fear or anxiety. *Scandinavian Journal of Psychology, 59*(6), 634–643. doi: 10.1111/sjop.12481

Rosenthal, L. y Lobel, M. (2018). Gendered racism and the sexual and reproductive health of Black and Latina Women. *Ethnicity & health*, 1-26. doi: 10.1080/13557858.2018.1439896

Ruiz, R. J. y Avant, K. C. (2005). Effects of maternal prenatal stress on infant outcomes: a synthesis of the literature. *Advances in nursing science, 28*(4), 345–355.

Russell, E. J., Fawcett, J. M. y Mazmanian, D. (2013). Risk of obsessive-compulsive disorder in pregnant and postpartum women: A meta-analysis. *Journal of Clinical Psychiatry*, *74*, 377-385. doi: 10.4088/JCP.12r07917

Russell, E., Kirschbaum, C., Laudenslager, M. L., Stalder, T., de Rijke, Y., van Rossum, E. F. C., … y Koren, G. (2015). Toward standardization of hair cortisol measurement: Results of the first international inter-laboratory round robin. *Therapeutic Drug Monitoring, 37*(1), 71–75. doi: 10.1097/FTD.0000000000000148

Russell, E., Koren, G., Rieder, M. y Van Uum, S. (2012). Hair cortisol as a biological marker of chronic stress: current status, future directions and unanswered questions. *Psychoneuroendocrinology, 37*(5), 589-601. doi: 10.1016/j.psyneuen.2011.09.009

Saarinen, A., Rosenström, T., Hintsanen, M., Hakulinen, C., Pulkki-Råback, L., Lehtimäki, T., … y Keltikangas-Järvinen, L. (2018). Longitudinal associations of temperament and character with paranoid ideation: A population-based study. *Psychiatry Research, 261*, 137–142. doi: 10.1016/j.psychres.2017.12.044

Sandman, C. A., Glynn, L., Schetter, C. D., Wadhwa, P., Garite, T., Chicz-DeMet, A. y Hobel, C. (2006). Elevated maternal cortisol early in pregnancy predicts third trimester levels of placental corticotropin releasing hormone (CRH): priming the placental clock. *Peptides, 27*(6), 1457-1463. doi: 10.1016/j.peptides.2005.10.002

Santos-Ruiz, A., Robles-Ortega, H., Pérez-García, M. y Peralta-Ramírez, M. I. (2017). Effects of the Cognitive-Behavioral Therapy for Stress Management on Executive Function Components. *Spanish Journal of Psychology, 20,* E11. doi: 10.1017/sjp.2017.10

Sapolsky, R.M. (2008). *¿Por qué las cebras no tienen úlcera? La guía del estrés*. Madrid: Alianza Editorial.

Sauvé, B., Koren, G., Walsh, G., Tokmakejian, S. y Van Uum, S. H. M. (2007). Measurement of cortisol in human hair as a biomarker of systemic exposure. *Clinical and Investigative Medicine, 30*(5), 183–191.

Scharlau, F., Pietzner, D., Vogel, M., Gaudl, A., Ceglarek, U., Thiery, J., … y Kiess, W. (2018). Evaluation of hair cortisol and cortisone change during pregnancy and the association with self-reported depression, somatization, and stress symptoms. *Stress*, *21*(1), 43–50. doi: 10.1080/10253890.2017.1392507

Scheres, L. J., Marijnen, M. C. y Middeldorp, S. (2017). Aspirin or heparin or both for improving pregnancy outcomes in women with persistent antiphospholipid antibodies and recurrent pregnancy loss. *Cochrane Database of Systematic Reviews*, (11). doi: 10.1002/14651858.CD012852

Seckl, J. R. y Holmes, M. C. (2007). Mechanisms of disease: glucocorticoids, their placental metabolism and fetal'programming'of adult pathophysiology. *Nature Reviews Endocrinology*, *3*(6), 479-488. doi: 10.1038/ncpendmet0515

Séjourné, N., Callahan, S. y Chabrol, H. (2010). Support following miscarriage: What women want. *Journal of Reproductive and Infant Psychology*, *28*(4), 403–411. doi: 10.1080/02646830903487375

Selye, H. (1955). Stress and disease. *Science*, *122*(3171), 625-631.

Sgambato, D., Miranda, A., Ranaldo, R., Federico, A. y Romano, M. (2017). The Role of Stress in Inflammatory Bowel Diseases. *Current Pharmaceutical Design*, *23*(27), 3997–4002. doi: 10.2174/1381612823666170228123357

Sharma, P., Singh, N., Tempe, A. y Malhotra, M. (2017). Psychiatric disorders during pregnancy and postpartum. *Journal of Pregnancy and Child Health, 4*, 2. doi: 10.4172/2376-127X.1000317

Shi, Z. y MacBeth, A. (2017). The Effectiveness of Mindfulness-Based Interventions on Maternal Perinatal Mental Health Outcomes: a Systematic Review. *Mindfulness*, *8*(4), 823–847. doi: 10.1007/s12671-016-0673-y

Shin, D. y Song, W. O. (2015). Prepregnancy body mass index is an independent risk factor for gestational hypertension, gestational diabetes, preterm labor, and small- and large-for-gestational-age infants. *Journal of Maternal-Fetal and Neonatal Medicine*, *28*(14), 1679–1686. doi: 10.3109/14767058.2014.964675

Shirley Muller, P. y Nirmala, M. (2018). Effects of pre-pregnancy maternal body mass index on gestational diabetes mellitus. *International Journal of Engineering & Technology*, *7*(1.9), 279. doi: 10.14419/ijet.v7i1.9.10013

Shlomi-Polachek, I. S., Dulitzky, M., Margolis-Dorfman, L. y Simchen, M. J. (2016). A simple model for prediction postpartum PTSD in high-risk pregnancies. *Archives of women's mental health, 19*(3), 483-490. doi: 10.1007/s00737-015-0582-4

Simcock, G., Kildea, S., Elgbeili, G., Laplante, D. P., Stapleton, H., Cobham, V. y King, S. (2016). Age-related changes in the effects of stress in pregnancy on infant motor development by maternal report: The Queensland Flood Study. *Developmental Psychobiology*, *58*(5), 640–659. doi: 10.1002/dev.21407

Simpson, M. y Catling, C. (2016). Understanding psychological traumatic birth experiences: A literature review. *Women and Birth, 29*(3), 203–207. doi: 10.1016/j.wombi.2015.10.009

Skeith, L. (2018). Low-molecular-weight heparin for the prevention and treatment of placenta-mediated pregnancy complications: The tides have shifted. *Thrombosis research, 170*, 207-208. doi: 10.1016/j.thromres.2018.09.045

Skipstein, A., Janson, H., Kjeldsen, A., Nilsen, W. y Mathiesen, K. S. (2012). Trajectories of maternal symptoms of depression and anxiety over 13 years: The influence of stress, social support, and maternal temperament. *BMC Public Health*, *12*(1). doi: 10.1186/1471-2458-12-1120

Skouteris, H., Wertheim, E. H., Rallis, S., Milgrom, J. y Paxton, S. J. (2009). Depression and anxiety through pregnancy and the early postpartum: An examination of prospective relationships. *Journal of Affective Disorders*, *113*(3), 303–308. doi: 10.1016/j.jad.2008.06.002

Sockol, L. E., Epperson, C. N. y Barber, J. P. (2013). Preventing postpartum depression: A meta-analytic review. *Clinical Psychology Review*, *33*(8), 1205–1217. doi: 10.1016/j.cpr.2013.10.004

Srivastava, A., Avan, B. I., Rajbangshi, P. y Bhattacharyya, S. (2015). Determinants of women's satisfaction with maternal health care: a review of literature from developing countries. *BMC pregnancy and childbirth, 15*(1), 97.. doi: 10.1186/s12884-015-0525-0

Stagl, J. M., Bouchard, L. C., Lechner, S. C., Blomberg, B. B., Gudenkauf, L. M., Jutagir, D. R., … y Antoni, M. H. (2015). Long-term psychological benefits of cognitive-behavioral stress management for women with breast cancer: 11-year follow-up of a randomized controlled trial. *Cancer*, *121*(11), 1873–1881. doi: 10.1002/cncr.29076

Stalder, T. y Kirschbaum, C. (2012). Analysis of cortisol in hair - State of the art and future directions. *Brain, behavior and immunity*, *26*(7),1019–1029. doi: 10.1016/j.bbi.2012.02.002

Stalder, T., Steudte, S., Miller, R., Skoluda, N., Dettenborn, L. y Kirschbaum, C. (2012). Intraindividual stability of hair cortisol concentrations. *Psychoneuroendocrinology, 37*(5), 602–610. doi: 10.1016/j.psyneuen.2011.08.007

Staneva, A., Morawska, A., Bogossian, F. y Wittkowski, A. (2016). Pregnancy-specific distress: the role of maternal sense of coherence and antenatal mothering orientations. *Journal of Mental Health*, *25*(5), 387-394. doi: 10.3109/09638237.2015.1101425

Steiger, J. H. (1980). Statistically based tests for the number of common factors. In *the annual meeting of the Psychometric Society*. Iowa City, IA. 1980.

Stephenson, J., Heslehurst, N., Hall, J., Schoenaker, D. A. J. M., Hutchinson, J., Cade, J. E., … y Mishra, G. D. (2018). Before the beginning: nutrition and lifestyle in the preconception period and its importance for future health. *The Lancet*, *391*(10132), 1830–1841. doi: 10.1016/S0140-6736(18)30311-8

Steudte, S., Kolassa, I. T., Stalder, T., Pfeiffer, A., Kirschbaum, C. y Elbert, T. (2011). Increased cortisol concentrations in hair of severely traumatized Ugandan individuals with PTSD. *Psychoneuroendocrinology*, *36*(8), 1193-1200.doi: 10.1016/j.psyneuen.2011.02.012

Stevens, J. S., Kim, Y. J., Galatzer-Levy, I. R., Reddy, R., Ely, T. D., Nemeroff, C. B., … y Ressler, K. J. (2017). Amygdala Reactivity and Anterior Cingulate Habituation Predict Posttraumatic Stress Disorder Symptom Maintenance After Acute Civilian Trauma. *Biological Psychiatry, 81*(12), 1023–1029. doi: 10.1016/j.biopsych.2016.11.015

Striebich, S., Mattern, E. y Ayerle, G. M. (2018). Support for pregnant women identified with fear of childbirth (FOC)/tokophobia–A systematic review of approaches and interventions. *Midwifery, 61*, 97-115. doi: 10.1016/j.midw.2018.02.013

Stroud, L. R., Papandonatos, G. D., Salisbury, A. L., Phipps, M. G., Huestis, M. A., Niaura, R., ... y Lester, B. M. (2016). Epigenetic regulation of placental NR3C1: mechanism underlying prenatal programming of infant neurobehavior by maternal smoking?. *Child development*, *87*(1), 49-60. doi: 10.1111/cdev.12482.

Stützer, P. P., Berlit, S., Lis, S., Schmahl, C., Sütterlin, M. y Tuschy, B. (2017). Elective caesarean section on maternal request in Germany: factors affecting decision making concerning mode of delivery. *Archives of gynecology and obstetrics, 295*(5), 1151-1156. doi: 10.1007/s00404-017-4349-1

Su, Q., Zhang, H., Zhang, Y., Zhang, H., Ding, D., Zeng, J., ... y Li, H. (2015). Maternal stress in gestation: birth outcomes and stress-related hormone response of the neonates. *Pediatrics & Neonatology,* *56*(6), 376-381. doi:

10.1016/j.pedneo.2015.02.002

Sweeting, A. N., Ross, G. P., Hyett, J., Molyneaux, L., Constantino, M., Harding, A. J. y Wong, J. (2016). Gestational diabetes mellitus in early pregnancy: evidence for poor pregnancy outcomes despite treatment. *Diabetes Care*, *39*(1), 75-81. doi: 10.2337/dc15-0433

Talavera, M. M., Bixler, G., Cozzi, C., Dail, J., Miller, R. R., McClead, R. y Reber, K. (2016). Quality improvement initiative to reduce the necrotizing enterocolitis rate in premature infants. *Pediatrics, 137*(5), e20151119. doi: 10.1542/peds.2015-1119

Taylor, C. L., Broadbent, M., Khondoker, M., Stewart, R. J. y Howard, L. M. (2018). Predictors of severe relapse in pregnant women with psychotic or bipolar disorders. *Journal of Psychiatric Research, 104*, 100–107. doi: 10.1016/j.jpsychires.2018.06.019

Teran-Perez, G., Arana-Lechuga, Y., Esqueda-Leon, E., Santana-Miranda, R., Rojas-Zamorano, J. A. y Velazquez Moctezuma, J. (2012). Steroid Hormones and Sleep Regulation. *Mini-Reviews in Medicinal Chemistry*, *12*, 1040-1048. doi: 10.2174/138955712802762167

The International Consortium for Health Outcome Measurement (2016). *Pregnancy and Childbirth Standard Set and Reference Guide.*

The Society for Maternal-Fetal Medicine (SMFM). (2012). High-risk pregnancy care, research, and education for over 35 years. Retrieved from: http://www.mfmnyc.com/wp-content/uploads/2015/10/SMFMMonograph3.1.pdf

Tomfohr-Madsen, L. M., Campbell, T. S., Giesbrecht, G. F., Letourneau, N. L., Carlson, L. E., Madsen, J. W. y Dimidjian, S. (2016). Mindfulness-based cognitive therapy for psychological distress in pregnancy: Study protocol for a randomized controlled trial. *Trials, 17*(1), 1–12. doi: 10.1186/s13063-016-1601-0

Torkan, B., Parsay, S., Lamyian, M. y Kazemnejad, A. (2009). Postnatal quality of life in women after normal vaginal delivery and caesarean section. *BMC Pregnancy and Childbirth, 9*, 1–7. doi: 10.1186/1471-2393-9-4

Torres-Espinola, F. J., Berglund, S. K., García-Valdés, L. M., Segura, M. T., Jerez, A., Campos, D., ... y Campoy, C. (2015). Maternal obesity, overweight and gestational diabetes affect the offspring neurodevelopment at 6 and 18 months of age–a follow up from the PREOBE cohort. *PloS one, 10*(7), e0133010. doi:10.1371/journal.pone.0133010

Tsigos, C. y Chrousos, G. P. (2002). Hypothalamic-pituitary-adrenal axis, neuroendocrine factors and stress. *Journal of Psychosomatic Research*, *53*(4), 865–871. doi: 10.1016/S0022-3999(02)00429-4

Tsoli, S., Vasdekis, S., Tigani, X., Artemiadis, A., Chrousos, G. y Darviri, C. (2018). A novel cognitive behavioral treatment for patients with chronic insomnia: A pilot experimental study. *Complementary Therapies in Medicine, 37*, 61–63. doi: 10.1016/j.ctim.2018.01.015

Uguz, F., Gezginc, K., Zeytinci, I. E., Karatayli, S., Askin, R., Guler, O., … y Gecici, O. (2007). Obsessive-compulsive disorder in pregnant women during the third trimester of pregnancy. *Comprehensive Psychiatry, 48*, 441-445. doi: 10.1016/j.comppsych.2007.05.001

Urizar, G. G. y Muñoz, R. F. (2011). Impact of a prenatal cognitive-behavioral stress management intervention on salivary cortisol levels in low-income mothers and their infants. *Psychoneuroendocrinology*, *36*(10), 1480–1494. doi:

10.1016/j.psyneuen.2011.04.002

Vahratian, A. (2009). Prevalence of overweight and obesity among women of childbearing age: Results from the 2002 national survey of family growth. *Maternal and Child Health Journal, 13*(2), 268-273. doi:10.1007/s10995-008-0340-6

Van den Bergh, B. R., van den Heuvel, M. I., Lahti, M., Braeken, M., de Rooij, S. R., Entringer, S., ... y Schwab, M. (2017). Prenatal developmental origins of behavior and mental health: The influence of maternal stress in pregnancy. *Neuroscience & Biobehavioral Reviews.* doi: 10.1016/j.neubiorev.2017.07.003

Van den Heuvel, M. I., van Assen, M. A., Glover, V., Claes, S. y Van den Bergh, B. R. (2018). Associations between maternal psychological distress and salivary cortisol during pregnancy: a mixed-models approach. *Psychoneuroendocrinology, 96*, 52-60. doi: 10.1016/j.psyneuen.2018.06.005

Van der Gucht, N. y Lewis, K. (2015). Women′ s experiences of coping with pain during childbirth: a critical review of qualitative research. *Midwifery, 31*(3), 349-358. doi: 10.1016/j.midw.2014.12.005

Vardavaki, Z., Hollins-Martin, C. y Martin, C. (2015). Construct and content validity of the Greek version of the Birth Satisfaction Scale (G-BSS). *Journal of Reproductive and Infant Psychology, 33*(5), 488-503.doi: 10.1080/02646838.2015.1035235

Veerbeek, J. H., Hermes, W., Breimer, A. Y., van Rijn, B. B., Koenen, S. V., Mol, B. W., ... y Koster, M. P. (2015). Cardiovascular disease risk factors after early-onset preeclampsia, late-onset preeclampsia, and pregnancy-induced hypertension. *Hypertension, 65*(3), 600-606. doi: 10.1161/HYPERTENSIONAHA.114.04850

Vianna, P., Bauer, M. E., Dornfeld, D. y Chies, J. A. B. (2011). Distress conditions during pregnancy may lead to pre-eclampsia by increasing cortisol levels and altering lymphocyte sensitivity to glucocorticoids. *Medical Hypotheses*, *77*(2), 188–191. doi: 10.1016/j.mehy.2011.04.007

Voegtline, K. M., Costigan, K. A., Kivlighan, K. T., Laudenslager, M. L., Henderson, J. L. y DiPietro, J. A. (2013). Concurrent levels of maternal salivary cortisol are unrelated to self-reported psychological measures in low-risk pregnant women. *Archives of women's mental health, 16*(2), 101-108.. doi: 10.1007/s00737-012-0321-z.Concurrent

Vogl, S. E., Worda, C., Egarter, C., Bieglmayer, C., Szekeres, T., Huber, J. y Husslein, P. (2006). Mode of delivery is associated with maternal and fetal endocrine stress response. *BJOG: An International Journal of Obstetrics and Gynaecology*, *113*(4), 441–445. doi: 10.1111/j.1471-0528.2006.00865.x

Volling, B. L. (2012). Family transitions following the birth of a sibling: An empirical review of changes in the firstborn's adjustment. *Psychological bulletin*, *138*(3), 497. doi: 10.1037/a0026921

Walder, D. J., Laplante, D. P., Sousa-Pires, A., Veru, F., Brunet, A. y King, S. (2014). Prenatal maternal stress predicts autism traits in 6½ year-old children: Project Ice Storm. *Psychiatry research, 219(*2), 353-360. doi: 10.1016/j.psychres.2014.04.034

Wennig, R. (2000). Potential problems with the interpretation of hair analysis results. *Forensic science international*, *107*(1-3), 5-12. doi: 10.1016/S0379-0738(99)00146-2

Westbrook, D., Kennerly, H. y Kirk, J. (2011). An introduction to Cognitive behaviour therapy: Skills and applications. London: SAGE publications.

Whitburn, L. Y., Jones, L. E., Davey, M. A. y Small, R. (2014). Women′ s experiences of labour pain and the role of the mind: an exploratory study. *Midwifery*, *30*(9), 1029-

1035. doi: 10.1016/j.midw.2014.04.005

Witalison, E., Thompson, P. y Hofseth, L. (2015). Protein arginine deiminases and associated citrullination: physiological functions and diseases associated with dysregulation. *Current drug targets, 16*(7), 700-710. doi: 10.1016/j.bbamem.2015.02.010.Cationic

Woods, S. M., Melville, J. L., Guo, Y., Fan, M. Y. y Gavin, A. (2010). Psychosocial stress during pregnancy. *American Journal of Obstetrics and Gynecology, 202*(1), 61.e1-61.e7. doi: 10.1016/j.ajog.2009.07.041

Workman, J. L., Barha, C. K. y Galea, L. A. (2012). Endocrine substrates of cognitive and affective changes during pregnancy and postpartum. *Behavioral neuroscience, 126*(1), 54-72. doi: 10.1037/a0025538

Wright, K. D., Hickman, R. y Laudenslager, M. L. (2015). Hair cortisol analysis: A promising biomarker of HPA activation in older adults. *The Gerontologist, 55*, S140-S145. doi: 10.1093/geront/gnu174

Yali, A. M. y Lobel, M. (1999). Coping and distress in pregnancy: an investigation of medically high risk women. *Journal of Psychosomatic Obstetrics & Gynecology, 20*(1), 39-52. doi: 10.3109/01674829909075575

Yali, A. M. y Lobel, M. (2002). Stress-resistance resources and coping in pregnancy. *Anxiety, Stress & Coping, 15*(3), 289-309. doi: 10.1080/1061580021000020743

Yüksel, F., Akın, S. y Durna, Z. (2011). "Prenatal Distres Ölçeği" nin Türkçe'ye Uyarlanması ve Faktör Analizi. *Koç Üniversitesi Hemşirelikte Eğitim ve Araştırma Dergisi (HEAD), 8*(3), 43-51.

Yuksel, F., Akin, S. y Durna, Z. (2014). Prenatal distress in Turkish pregnant women and factors associated with maternal prenatal distress. *Journal of Clinical Nursing, 23*(1–2), 54–64. doi: 10.1111/j.1365-2702.2012.04283.x

Youssef, R., Ramalingam, U., Macleod, M. y Murphy, D. J. (2005). Cohort study of maternal and neonatal morbidity in relation to use of episiotomy at instrumental vaginal delivery. *BJOG: An International Journal of Obstetrics & Gynaecology, 112*(7), 941-945. doi: 10.1111/j.1471-0528.2005.00564.x

Zaheri, H., Najar, S. y Abbaspoor, Z. (2017). Effectiveness of cognitive-behavioral stress management on psychological stress and glycemic control in gestational diabetes: a randomized controlled trial. *The Journal of Maternal-Fetal & Neonatal Medicine, 30*(11), 1378–1382. doi: 10.1080/14767058.2016.1214699

Zhu, P., Tao, F., Hao, J., Sun, Y. y Jiang, X. (2010). Prenatal life events stress: implications for preterm birth and infant birthweight. *American Journal of Obstetrics and Gynecology*, *203*(1), 34.e1-34.e8. doi: 10.1016/j.ajog.2010.02.023