ASSOCIATION OF SELF-REPORTED PHYSICAL FITNESS WITH BODILY, LUMBAR AND SCIATIC PAIN DURING EARLY PREGNANCY

FINDINGS FROM THE GESTAFIT PROJECT

Alumna: NURIA MARÍN JIMÉNEZ

Tutora: Virginia A. Aparicio García-Molina

Departamento de Fisiología

MÁSTER DE INVESTIGACIÓN EN ACTIVIDAD FÍSICA Y DEPORTE

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Alumna:

NURIA MARÍN JIMÉNEZ

Con DNI: 77371723E

Firmado:

Tutora:

VIRGINIA A. APARICIO GARCÍA-MOLINA

Con DNI: 53265170E

Firmado:

DECLARACIÓN EXPLÍCITA DE ORIGINALIDAD DEL TRABAJO

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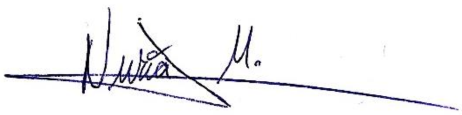

Nuria Marín Jiménez

INDEX

Abstract

Aims: To explore the association of self-reported physical fitness during early pregnancy (16th gestational week) with bodily, lumbar and sciatic pain. **Methods:** The present study sample comprised 124 pregnant women aged 33± 4.7 years old that were recruited within the GESTAtion and FITness (GESTAFIT) project. Self-reported physical fitness was assessed with the *International Fitness Scale (IFIS)*. Bodily pain was assessed with the *36-Item Short Form Health Survey* questionnaire. Lumbar and sciatic pain were measured with a *Visual Analogic Scale*. The *Oswestry Disability Index* questionnaire was employed to assess the disability resulting from pain. **Results:** Pregnant women who reported greater self-reported overall physical fitness showed lower bodily pain (β=0.233, $p<0.05$), and lower lumbar pain (β=-0.207, $p<0.05$). Those pregnant women who reported greater self-reported cardiorespiratory fitness and speed-agility also showed lower bodily pain (both, $p<0.01$). Pregnant women with greater self-reported levels of cardiorespiratory fitness and speed-agility showed lower lumbar pain (both, $p<0.01$). Women with greater self-reported levels of speed-agility showed less sciatic pain (β=-0.251, $p<0.05$). **Conclusion:** Greater self-reported physical fitness is associated with lower bodily, lumbar and sciatic pain during early pregnancy. Greater levels of general fitness, cardiorespiratory fitness and speed-agility were associated with lower bodily and lumbar pain. Besides, a greater speed-agility was also associated with lower sciatic pain. The employment of the IFIS scale in clinical settings may be a quick, cheap and easy tool for monitoring physical fitness and pregnancy-related pain during pregnancy.

Keywords: Physical fitness; back pain; International Fitness Scale; gestation; strength; flexibility; cardiorespiratory fitness; agility.

“Asociación de los niveles auto-reportados de condición física con el dolor general corporal, lumbar y ciático durante la gestación temprana. Hallazgos del proyecto GESTAFIT”

Resumen

Objetivo: Explorar la asociación de la condición física auto-reportada durante el embarazo temprano (semana 16 de embarazo) con el dolor corporal, lumbar y ciático. **Método:** La muestra del presente estudio comprendió a 124 mujeres embarazadas de 33±4,7 años que fueron reclutadas dentro del proyecto GESTAtion and FITness (GESTAFIT). La condición física auto-reportada se evaluó con la escala International Fitness Scale (IFIS). El dolor corporal se evaluó con el cuestionario general de calidad de vida de 36 ítems (SF-36). El dolor lumbar y ciático se midió con una Escala Visual Analógica. El cuestionario del Índice de Discapacidad de Oswestry se empleó para evaluar la discapacidad resultante del dolor. **Resultados:** Las embarazadas que auto reportaron mayor condición física general mostraron menos dolor corporal (β=0,233; *p<0,05*) y dolor lumbar (β=-0,207; *p<0,05*). Aquellas que reportaron una mejor capacidad cardiorrespiratoria y agilidad-velocidad también mostraron menos dolor corporal (ambos, *p<0,01*). Las embarazadas con mayores niveles auto-reportados de capacidad cardiorrespiratoria y agilidad-velocidad presentaron menor dolor lumbar (ambos, *p<0,01*). Por último, las gestantes con mayores niveles auto-reportados de agilidad-velocidad mostraron menos dolor ciático (β=-0,251; *p<0,05*). **Conclusiones:** Mayores niveles auto-reportados de condición física general, de capacidad cardiorrespiratoria y de velocidad-agilidad han demostrado ser indicadores de un menor dolor corporal y lumbar. Además, una mayor agilidad-velocidad auto reportada también se ha mostrado como indicadora de un menor dolor ciático. El empleo de la escala IFIS en entornos clínicos podría ser una herramienta rápida, económica y sencilla para monitorizar los niveles de condición física y el dolor relacionado con el embarazo.

Palabras clave: Condición física; dolor de espalda; International Fitness Scale; gestación; fuerza muscular; flexibilidad; capacidad cardiorrespiratoria; agilidad.

INTRODUCTION

Major physiological and anatomical changes during pregnancy

Pregnancy is characterized by considerable changes in the physiological, anatomical and biochemical spheres of women's health (Pacheco, Costantine, & Hankins, 2013). Indeed, many of these changes begin already during early pregnancy (Pacheco, Costantine, & Hankins, 2013). Strong scientific evidence supports that increasing physical activity levels, or performing adapted physical exercise during pregnancy, promote benefits for both, the mother and the fetus (Newton & May, 2017). Thus, women with data of self-reported exercise frequency and intensity have shown improved pregnancy outcomes. Appropriate physical activity or exercise levels means less risk of developing some complications or illness associated with pregnancy, such as less gestational weight gains (Muktabhant, Lawrie, Lumbiganon, & Laopaiboon, 2015), fewer cesarean deliveries (Domenjoz, Kayser, & Boulvain, 2014), lower gestational diabetes (Zheng, Wang, & Ren, 2017) and preeclampsia (Aune, Saugstad, Henriksen, & Tonstad, 2014) risk, and less back pain (Liddle & Pennick, 2015). Indeed, specialized Guidelines about physical activity and exercise during pregnancy, such as those launched by the American College of Obstetricians and Gynecologists, ACOG (Obstetricians & Gynecologists, 2015), or by the American College of Sports Medicine, ACSM (Mudd, Owe, Mottola, & Pivarnik, 2013), recommend at least 20 to 30 minutes of moderate-vigorous physical activity most days of the week. Unfortunately, despite the positive effects of physical activity and exercise on maternofetal outcomes, these Guidelines are poorly met by pregnant women, being its fulfillment of around 10% in many countries, including Spain (Amezcua-Prieto et al., 2011; Petersen, Leet, & Brownson, 2005).

Pregnancy-related pain

Most low back pain is non-specific (90%) (Koes, van Tulder, & Thomas, 2006). Since 1900, several terms have been used to define a non-specific back pain, such as “Spinal insufficiency” (Berg, Hammar, Mollernielsen, Linden, & Thorblad, 1988), “Back pain” (Bjorklund, Naessen, Nordstrom, & Bergstrom, 1999; Ostgaard, RoosHansson, & Zetherstrom, 1996) or “Lumbar back pain” (Noren, Ostgaard, Johansson, & Ostgaard, 2002). Low back pain is a common health problem, affecting up to 80% of the population at some point in life (Van Tulder, Koes, & Bombardier, 2002). Moreover, radiating low back pain (also called sciatic pain) is significantly more often in women than in men (Van Tulder et al., 2002).

Wu et al. (2004) proposed that two different types of back pain occur during pregnancy; Pelvic Girdle Pain and Lower Back Pain. However, other researchers, such as Brynhildsen, Hansson, Persson, and Hammar (1998) could not find any difference in long-term prognosis between sacroiliac problems and other kinds of back pain during pregnancy. Indeed, Wu et al. (2002) did not find any significant difference in gait coordination between women with postpartum pelvic girdle pain and those with chronic nonspecific low back pain (Lamoth et al., 2002).

Some recent research have found that low back pain (or lumbar pain) was the most common pain during pregnancy, since between 50-80% of pregnant women suffered from it (Liddle & Pennick, 2015; Ojukwu, Anyanwu, & Nwafor, 2017; Stuge, Jenssen, & Grotle, 2017). Another type of usual pain reported during pregnancy is sciatic pain. Sciatica, generally defined as pain and sensory deficit in the distribution of the sciatic nerve (i.e., radiating to the leg, usually below the knees), has prevalence rates that range from 10 to 25% (Ferreira & McLachlan, 2016; Konstantinou & Dunn, 2008).

Pain can be so unbearable that limits daily activities of women who suffer it, such as standing, walking, sleeping and lifting weight (Elden, Gutke, Kjellby-Wendt, Fagevik-Olsen, & Ostgaard, 2016; Morino et al., 2017; Smith, Marcus, & Wurtz, 2008). Sexual difficulties and unsatisfying sexual life are also common, because of disabling pain (Mogren, 2006). Van Tulder et al. (2002) found that the majority of patients with lumbar pain took some painkiller (64%), being most of them nonsteroidal anti-inflammatory drugs (52%). This drug is contraindicated in the final trimester of pregnancy, and only recommended for use in the first and second trimesters under a physician recommendation.

Importance of an active lifestyle to prevent pregnancy-related pain

General pain (or bodily pain) is known as a major healthcare problem (Goldberg & McGee, 2011) that may affect quality of life by interfering with mental, physical, and social activities (Koskinen, Aho, & Nyholm, 2016; Mystakidou et al., 2007; Ramstad, Jahnsen, Skjeldal, & Diseth, 2012; Schirbel et al., 2010; Simon, 2012). In addition, individuals with pain appear to have an increased risk for developing a range of comorbid health conditions such as depression, obesity (Andersson, 2009) and early mortality (Macfarlane, Crombie, McBeth, & Silman, 2001; McBeth et al., 2008). Thus, bodily pain, has been also studied during pregnancy (Kazemi, Nahidi, & Kariman, 2016; Ursin, Lydersen, Skomsvoll, & Wallenius, 2018), and it has been shown that pain is higher in pregnant women with postpartum depression (Papamarkou et al., 2017).

A poor self-reported fitness (Sjolie, 2002), low self-reported physical activity (Fairbank, Pynsent, Vanpoortvliet, & Phillips, 1984; Salminen, Erkintalo, Laine, & Pentti, 1995) and a great amount of time spent sitting (Balague, Troussier, & Salminen, 1999) were found to be associated with back pain at a young age.

Among adults, the lack of appropriate physical fitness level is a risk factor commonly linked with nonspecific low back pain (Payne, Gledhill, Katzmarzyk, & Jamnik, 2000). Furthermore, low levels of muscular fitness have been suggested as a risk factor for low back pain although, until now, the evidence is weak and results are sometimes contradictory (Adams, Mannion, & Dolan, 1999; Bieringsorensen, 1984; Hamberg-van Reenen et al., 2006; Takala & Viikari-Juntura, 2000).

Some authors suggested that higher levels of physical fitness, especially muscular and cardiorespiratory fitness, were strongly associated with a decreased functional limiting low back pain complaints (Heneweer, Picavet, Staes, Kiers, & Vanhees, 2012; Smeets, van Geel, & Verbunt, 2009). In addition, Heneweer et al. (2012) found that these effects were more pronounced in women than in men.

Notwithstanding, the predictive value on back pain of other physical fitness components like flexibility have not been explored enough until now. Jackson et al. (1998) did not find an association between flexibility and low back pain in adults. Morino et al. (2017) investigated activities related to low back pain during pregnancy, however, they did not evaluate muscular strength, or physical flexibility in pregnant women.

Pregnancy-related lower back pain has been attributed to several factors, including, hormonal-mediated joint laxity, vascular changes, postural changes resulting from the increasing growth of the fetus (Rungee, 1993) and muscular dysfunctions (Gutke, Ostgaard, & Oberg, 2008), among others.

Some studies have found a direct association between low back pain and disability, reduced quality of life, higher prevalence of sick leave during pregnancy and risk of postpartum depression (Close, Sinclair, Liddle, Mc Cullough, & Hughes, 2016; Dorheim, Bjorvatn, & Eberhard-Gran, 2013; Gutke et al., 2008; Olsson & Nilsson-Wikmar, 2004).

Indeed, oobservational studies have demonstrated the protective effects of physical activity before pregnancy on the prevention of low back pain (Mogren & Pohjanen, 2006; Ostgaard, Zetherstrom, Rooshansson, & Svanberg, 1994). However, as mentioned above, pregnant women tend to reduce their physical activity levels, and those with low back pain are less likely to exercise regularly (Chang, Yang, Jensen, Lee, & Lai, 2011; Owe, Nystad, & Bo, 2009). Physical inactivity leads to deconditioning, and there is a strong association between reduced muscle function and the development of low back pain in pregnancy (Gutke et al., 2008). On the other hand, exercise can reduce the intensity of pain, improve physical function and reduce disability (Gutke, Betten, Degerskar, Pousette, & Olsen, 2015; Pennick & Liddle, 2013).

Consequently, recently, it has been recommended that primary care providers should assess physical fitness as part of a regular screening and promote the engagement in exercise programs to positively influence their physical fitness and promote health (Petrella, Koval, Cunningham, & Paterson, 2003; Wilder et al., 2006). In this context, the IFIS scale could be a simple, quick and inexpensive tool to measure self-reported physical fitness among pregnant women.

HYPOTHESIS

We hypothesize that those pregnant women with greater levels of self-reported physical fitness may present lower bodily, lumbar and sciatic pain during early pregnancy.

OBJECTIVES

Overall objective

To study the association of self-reported physical fitness during early pregnancy (16th gestational week) with bodily, lumbar and sciatic pain.

Specific objectives

1) To describe and valorize the reported bodily, lumbar and sciatic pain scores of in a population of 124 pregnant women from Granada (Spain).
2) To analyze the potential association between self-reported overall physical fitness and its components with general bodily pain during early pregnancy.
3) To analyze the potential association between self-reported overall physical fitness and its components with lumbar pain during early pregnancy.
4) To analyze the potential association between self-reported overall physical fitness and its components with sciatic pain during early pregnancy.

METHODS

Study design and participants

This cross-sectional study takes part on the supervised Randomized Controlled Trial "Effects of supervised aerobic and strength training in overweight and grade I obese pregnant women on maternal and fetal health markers: the GESTAFIT randomized controlled trial"(Aparicio et al., 2016). Clinical Trail (www.clinicaltrials.org) registration code: NCT02582567.

A total of 124 white Spanish pregnant women (32.9±4.7 years) enrolled in this study. The participants were recruited by interviewers from the research team after the first gynecologist checkup at "San Cecilio" University Hospital (Granada, southeaster Spain), which usually takes place between gestational weeks 11-13th. This day, potential participants were individually informed about the study objectives, evaluation protocol and procedures. If the pregnant woman agreed to participate in the GESTAFIT project and met the inclusion criteria as described below (Table 1), the researcher team provided detailed information about each of the phases of the study and the participant was asked to read and sign written informed consent (See Annex 1). Subsequently (on the same day), weight and height were assessed. After that, all subject data were coded to maintain confidentiality.

Table 1. Inclusion and exclusion criteria in the GESTAFIT project
Inclusion criteria
Pregnant woman aged 19–45 years old with a normal pregnancy course
Gestational stadium between 11-13th week
Answer “no” to all questions on the PARmed-X for pregnancy*
To be able to ambulance without assistance
To be able to read and writing enough
To be capable and willing to provide consent
Exclusion criteria
Acute or terminal illness
Malnutrition
Inability to conduct tests for assessing physical fitness or exercise during pregnancy
Underweight, normal-weight or grade II-III obesity
Pregnancy risk factors (such as *hypertension, type 2 diabetes, etc*.)
Multiple pregnancies
Chromosomopathy or foetal malformations
Uterine growth restriction
Foetal death
Upper or lower extremity fracture in the past 3 months
Presence of neuromuscular disease or drugs affecting neuromuscular function

*PARmed-X for pregnancy: Physical Activity Readiness Medical Examination (Kanagasabai, Thakkar, Kuk, Churilla, & Ardern, 2015)

Ethical aspects

This study was approved by the Clinical Research Ethics Committee of Granada, Government of Andalusia, Spain (code: GESFIT-0448-N-15). The study was also conducted following the ethical guidelines of the Declaration of Helsinki, last modified in 2013 (included as Annex 2).

Procedures

After being contacted from the research team in their first gynecologist visit to the Hospital, participants were invited to participate in the study at "Instituto Mixto Universitario Deporte y Salud (IMUDS)" from the University of Granada. In gestational week 16th, a first measurement was carried out. In this evaluation, an initial survey (anamnesis) was performed in order to compile information on the sociodemographic characteristics (such as educational level or marital status), reproductive history, and precedents of diseases (hypertension, diabetes, obesity, etc.). This information was gathered by means of an auto administered questionnaires, which also included personal questions about smoking or alcohol habit and indicators of the socioeconomic status. Moreover, the participants filled questionnaires assessing their quality of live and pain, among others.

Measurements

Sociodemographic and clinical data

The most relevant sociodemographic characteristics were taken from the initial survey by using a self-reported questionnaire including age, number of children, marital status and educational level. All relevant clinical characteristics such as illness diagnosis, drug intake and smoking status were also registered for been analyzed in the present study.

Patients reported the consumption of drugs, such analgesics (yes or no) and medication for pain during the previous 2 weeks. Illness diagnosis (yes or no) related to pain were also reported, including chronic cervical backache, chronic lumbar pain and migraine diagnosis or frequent headache.

Anthropometry and body composition

The maternal weight (kg) and total body fat (%) were measured. Body mass index (BMI) was calculated as weight (kg) divided by height (m) squared.

Pain scores

Pain scores were collected through different self-reported methods. First, through the "bodily pain dimension" of the *36-Item Short Form Health Survey (SF-36)* questionnaire, where women were asked two questions about general bodily pain. This dimension (i.e. bodily pain) is standardized in a scale from 0 (*totally painful*) to 100 (*not painful at all*) (Alonso, Prieto, & Anto, 1995; Ware Jr, 2000), with greater scores indicating less pain

Lumbar and sciatic pain were assessed with a *Visual Analogic Scale (VAS)* (Huskisson, 1974)*,* asking the participants to cross out with a mark (perpendicular line) in a 10 cm scale without references. Later, the research team measured the scale with a ruler from zero mm (*not painful at all)* to 100 mm *(the highest pain)*.

The participants also fulfilled the *Oswestry Disability Index (ODI)* questionnaire (Fairbank & Pynsent, 2000), where is asked about pain intensity during daily situations, such as lifting, walking, sitting, standing, sleeping and socializing. For each section (10 in total) of six statements, the total score is 5; if the first statement is marked, the score is 0 whereas if the last score is marked, the score is 5.

Self-reported physical fitness

Self-reported physical fitness was assessed with the *International Fitness Scale,* which is composed of five Likert-scale questions (1= very poor, 5= very good) asking about the perceived participants' overall fitness, cardiorespiratory fitness, muscular strength, speed-agility and flexibility in comparison with their friends. The participants rate their physical fitness levels as "very poor", "poor", "average", "good" and "very good" (Ortega et al., 2011). Then, the greater score the greater self-reported physical fitness the participant experiences.

Statistical analyses

All analyses were performed using the Statistical Package for Social Sciences (IBM SPSS Statistics for Windows, version 22.0, Armonk, NY) and the level of significance was set at $p<0.05$. Descriptive statistics (mean (standard deviation) for quantitative variables and number of women (%) for categorical variables) were employed to describe baseline characteristics of the participants. Multiple linear regression analyses were performed with self-reported physical fitness measures as independent variables (predictors) and pain (i.e. bodily, lumbar and sciatic pain) as dependent variables (outcomes). Partial correlations after adjustment for maternal age and BMI (Albert, Godskesen, Korsholm, & Westergaard, 2006; Engberg et al., 2018; Juhl, Andersen, Olsen, & Andersen, 2005; Larsen et al., 1999; Mogren & Pohjanen, 2006) (as both of them have been associated with greater pain) were employed to assess the association between all components of self-reported physical fitness with the different pain scores explored (i.e. lumbar and sciatic pain, bodily pain). Linear regression analyses were performed to further explore the association of self-reported fitness with bodily, lumbar and sciatic pain. These analyses were also adjusted for maternal age and BMI.

RESULTS

The final sample size comprised 124 Spanish pregnant women from Granada. Nonetheless, some women did not return all the questionnaires duly completed, which means a loss of data in those questionnaires and, therefore, a smaller sample size in those outcomes.

The participant´s sociodemographic characteristics are shown in **Table 2.**

Table 2. Sociodemographic characteristics of the participants (*n=124)*

Variable	Mean (SD)	n (%)
Age (years)	32.9 (4.7)	
Parity (having more children, yes)		49 (39.5)
Marital Status		
Married		71 (57.3)
Single		52 (41.9)
Divorced/separated/widow		1 (0.8)
Educational Status		
Primary school		13 (10.5)
Professional training		23 (18.5)
Secondary school		18 (14.5)
University medium degree		27 (21.8)
University higher degree		43 (34.7)

SD, standard deviation

The mean age of the sample was 33 years and most of the participants had University studies (56.5%) and were married (57.3% married). The percentage of women with one or more children was 39.5%.

Anthropometric and clinical characteristics of the sample are shown in **Table 3.**

Table 3. Anthropometry and clinical characteristics of the participants (*n=124*)

Variable	Mean (SD)	n (%)
Body composition		
Weight (Kg)	66.6 (11.6)	
Height (cm)	163.7 (6.6)	
Body mass index (Kg/m^2)	24.8 (4.0)	
Illness diagnosis *(yes)*		
Chronic cervical backache		5 (4.0)
Chronic lumbar backache		4 (3.2)
Fibromyalgia		0 (0.0)
Migraine diagnosis or frequent headache		7 (5.6)
Medication for pain in the last 2 weeks		34 (27.4)
Drug Intake *(yes)*		
Ibuprofen		3 (2.4)
Paracetamol		29 (23.4)
Diazepam		1 (0.8)
Smoking Status (current smoker)		10 (8.1)

SD, standard deviation

Pregnant women in the present study showed a weight status close to overweight. A total of 13% of these women suffer any diagnosed pain, and 27% of them took medication for treating pain. The most consumed analgesic drug was Paracetamol (23%). Finally, 8% of the sample were active smokers during early pregnancy.

Bodily, lumbar and sciatic pain of the study sample is shown in Table 4.

Table 4. Bodily, lumbar and sciatic pain reported by the study sample *(n=124)*

Variable	**Mean (SD)**
SF-36-Bodily pain* (0-100)	63.8 (24.6)
Visual Analogic Scale (VAS); (0-100)	
Lumbar pain for the last 4 weeks	26.7 (25.5)
Sciatica (lower member) pain for the last 4 weeks	13.7 (22.7)
Oswestry Disability Index (ODI); (0-5)	
Intensity of the pain	1.2 (1.1)
Pain when you are standing	1.4 (1.1)
Pain when you carry out self-care activities	0.9 (0.7)
Pain when you are sleeping	0.9 (1.0)
Pain when you lift weight	1.4 (1.0)
Pain when you have sexual activities	0.9 (0.6)
Pain while walking	0.8 (0.5)
Limitations of the social life due to pain	0.1 (0.7)
Pain when you are seated	1.3 (1.0)
Pain when you are travelling	1.1 (0.7)

SD, standard deviation; SF-36, 36-Item Short Form Survey; *greater scores indicate lower pain.

The mean score in the bodily pain component from the SF-36 questionnaire was 64 (maximum score = 100). The mean of both, lumbar and sciatica pain, measured by VAS was 40 mm (4 cm). The mean score for each question of the ODI questionnaire was low, without any activity over 50% of pain disability.

Partial correlations after adjustment for age and BMI between self-reported physical fitness and sciatic and lumbar pain (measured by VAS), the dimensions of ODI questionnaire, and SF-36 bodily pain dimension are shown in Table 5.

Table 5. Association of general self-reported physical fitness and its components with lumbar and sciatic pain, as measured through VAS and ODI scales and SF-36 bodily pain dimension.

	General fitness	**Cardiorespiratory fitness**	**Muscular strength**	**Speed-agility**	**Flexibility**
VAS					
Lumbar pain	-0.201*	-0.274**	-0.177	-0.247**	-0.185
Sciatic pain	-0.106	-0.73	0.012	-0.234*	0.034
ODI					
Intensity of the pain	-0.098	-0.214*	-0.101	-0.094	-0.028
Pain while standing	-0.272**	-0.367**	-0.081	-0.268**	-0.100
Pain while carrying out self-care activities	-0.136	-0.261**	-0.092	-0.070	0.019
Pain while sleeping	-0.138	-0.246*	-0.127	-0.060	-0.083
Pain while lifting weight	-0.277**	-0.328**	-0.169	-0.187	-0.105
Pain having sexual activities	-0.151	-0.134	-0.205*	-0.119	-0.007
Pain while walking	-0.265**	-0.287**	-0.117	-0.158	-0.078
Limitations of the social life due to pain	-0.298**	-0.195	-0.182	-0.108	-0.075
Pain while seated	-0.235*	-0.220*	-0.154	-0.076	-0.002
Pain while travelling	-0.296**	-0.266**	-0.274**	-0.119	-0.098
SF-36 bodily pain	0.214*	0.340**	0.152	0.291**	0.148

Model adjusted for age and body mass index. VAS, visual analogue scale; ODI, Oswestry Disability Index; SF-36, 36-Item Short Form Health Survey; *p<0.05; **p<0.01

General fitness was associated with a greater SF-36 bodily pain score (less pain), less lumbar pain and less pain while seated (all, $p<0.05$). General fitness was also associated with less pain while standing, while lifting weight, while walking, while travelling, and limitations of the social life due to pain (all, $p<0.01$). Cardiorespiratory fitness was associated with lower intensity of pain, less pain while sleeping and pain when seated (all, $p<0.05$). Cardiorespiratory fitness was also associated with a greater SF-36 bodily pain score (less pain), less lumbar pain, pain while standing, pain while carrying out self-care activities, pain while lifting weight, pain while walking and pain while travelling (all $p<0.01$). Muscular strength was associated with less pain having sexual activities ($p<0.05$). Speed-agility was associated with lower sciatic pain ($p<0.05$) and a greater SF-36 bodily pain score (less pain), less lumbar pain and pain while standing (all $p<0.01$). Flexibility was not associated with any studied variable ($p>0.05$).

Linear regression model assessing the association between self-reported physical fitness and SF-36 bodily pain is shown in Table 6.

Table 6. Linear regression coefficients assessing the association of self-reported physical fitness with SF-36 bodily pain dimension ($n=109$)

International Fitness Scale	β	b	Standard error	*p*
General fitness	0.233	7.30	3.263	0.027
Cardiorespiratory fitness	0.348	9.40	2.518	0.000
Muscular strength	0.149	4.84	3.067	0.118
Speed-agility	0.305	9.46	3.032	0.002
Flexibility	0.149	3.50	2.301	0.131

β, standardized regression coefficient; b, non-standardized regression coefficient. Model adjusted for maternal age and body mass index.

Pregnant women who reported greater overall physical fitness presented a greater SF-36 bodily pain score (b= 7.30, β= 0.233, $p<0.05$). SF-36 bodily pain score was also greater in those with greater self-reported cardiorespiratory fitness and speed-agility (both $p<0.01$).

Linear regression model assessing the association between self-reported physical fitness and lumbar pain is shown in Table 7.

Table 7. Linear regression coefficients assessing the association of self-reported physical fitness with lumbar pain (VAS) (*n=113*)

Lumbar pain (VAS)	**β**	**b**	**Standard error**	***p***
General fitness	-0.207	-6.80	3.223	0.037
Cardiorespiratory fitness	-0.273	-7.67	2.531	0.003
Muscular strength	-0.177	-6.01	3.029	0.050
Speed-agility	-0.262	-8.28	2.968	0.006
Flexibility	-0.179	-4.31	2.215	0.054

VAS, visual analogue scale; β, standardized regression coefficient; b, non-standardized regression coefficient. Model adjusted for maternal age and body mass index.

Pregnant women who reported greater overall physical fitness presented lower lumbar pain (b= -6.80, β= -0.207, $p<0.05$). Lumbar pain was also lower in women with greater self-reported levels of cardiorespiratory fitness and speed-agility (both, $p<0.01$), and slightly lower among those pregnant women with greater self-reported muscle strength and flexibility (both $p=0.05$).

Linear regression model assessing the association between self-reported physical fitness and sciatic pain is shown in Table 8.

Table 8. Linear regression coefficients assessing the association of self-reported physical fitness with sciatic pain (VAS) (*n=113*)

Sciatic pain (VAS)	**β**	**b**	**Standard error**	***p***
General fitness	-0.115	-3.46	3.113	0.268
Cardiorespiratory fitness	-0.074	-1.91	2.503	0.448
Muscular strength	0.007	0.22	2.936	0.939
Speed-agility	-0.251	-7.27	2.842	0.012
Flexibility	0.034	0.76	2.174	0.728

VAS, visual analogue scale; β, standardized regression coefficient; b, non-standardized regression coefficient. Model adjusted for maternal age and body mass index.

Women with greater self-reported levels of speed-agility showed less sciatic pain (b= -7.27, β= -0.251, $p<0.05$), whereas no significant association was found for the overall self-reported fitness nor the rest of self-reported physical fitness components (all $p>0.05$).

DISCUSSION

Pregnant women usually report increased bodily pain, especially regarding back-pain (lumbar and sciatic), which may decrease their quality of life during gestation. The findings of the present study suggest that pregnant women with greater self-reported physical fitness suffer lower bodily, lumbar and sciatic pain during early pregnancy. More specifically, greater self-reported overall physical fitness was associated with a better SF-36 bodily pain score and lower lumbar pain. Greater self-reported cardiorespiratory fitness and speed-agility also was associated with better SF-36 bodily pain score. Greater self-reported levels of cardiorespiratory fitness and speed-agility were associated with lower lumbar pain. Finally, greater self-reported levels of speed-agility were associated with less sciatic pain.

The pathogenesis and etiology of low back pain are still unclear, and is probably multifactorial (Albert, Korsholm, & Westergaard, 2006; Kovacs et al., 2012). Several determinants have been identified: altered posture during pregnancy, ligamentous laxity, and fluid retention within connective tissues (MacEvilly & Buggy, 1996; Vermani, Mittal, & Weeks, 2010). Several lumbar structures are plausible sources of pain (e.g., the intervertebral disc, the facet joints), but clinical tests do not reliably attribute the pain to those structures (Hancock et al., 2007). For example, lumbar lordosis becomes increasingly exaggerated as pregnancy progresses. In some pregnant women, these changes can significantly increase the pain (Talbot & Maclennan, 2016). Morino et al. (2017), found that pain also begins in early pregnancy (12^{th} week), with a 60% of the total prevalence, continuing to almost 75% in week 36^{th} (late pregnancy).

Morino et al. (2017) found that the three motions where the majority of pregnant women felt low back pain were sitting up, standing up from chair, and tossing and turning while supine. Moreover, special tasks such as lifting heavy objects and running were identified as additional risk factors for low back pain during pregnancy (Wang et al., 2004). In fact, Close et al. (2016) observed that some pregnant women reported not being able to sit for long periods of time because of the intensity of pain. These movements/activities associated with pain are stated in some questions from the ODI scale, where we have observed that levels of self-reported general fitness, cardiorespiratory fitness and muscular strength were associated with less lumbar pain. Further research, focused on the impact of different activities on pain during these activities along pregnancy is warranted.

Despite there are several studies focused on the mother's quality of life, as assessed with the SF-36 questionnaire, some of them have not deeply taken into account the results regarding bodily pain dimension, although very low scores have been obtained. For instance, the pregnant women involved in the study by Tosun et al. (2015), showed a mean score in SF36-bodily pain of 43, when the minimum desired score is 70-75 (Alonso et al., 1995; Hopman et al., 2000). Similar results were found in pregnant women with a diagnostic of pelvic pain (Grotle, Garratt, Jenssen, & Stuge, 2012; Robinson, Vollestad, & Veierod, 2014), or even without any clinical diagnostic of pain (Tasdemir, Balci, & Gunay, 2010). These results are slightly consistent with those found in our study, since the mean score of SF-36 bodily pain showed by our participants was 64 (better than those reported in the above mentioned studied but lower than those recommended). The importance of these findings is also relevant due to the fact that some authors reported that bodily pain was associated with depression during pregnancy and postpartum depression (Sadat, Abedzadeh-Kalahroudi, Atrian, Karimian, & Sooki, 2014; Setse et al., 2009). This is relevant as both, pain and depression during pregnancy may increase the release of cortisol hormone (Anderson, Maes, & Berk, 2012; Penninx, Milaneschi, Lamers, & Vogelzangs, 2013), which has a clear adverse effect on fetal development (Rahman, Iqbal, Bunn, Lovel, & Harrington, 2004). Moreover, bodily pain is lower in active pregnant women, with independence of weight status (Claesson, Klein, Sydsjo, & Josefsson, 2014). Additionally, Gartland, Brown, Donath, and Perlen (2010) investigated women's general health and well-being in early pregnancy and they found a high prevalence of women with back pain and lower scores of bodily pain.

It is well stablished in the literature that regular exercise increases cardiovascular fitness, muscular strength and flexibility, and that women who exercise are less likely to be overweight or obese (Ferraro, Gruslin, & Adamo, 2013; Ladabaum, Mannalithara, Myer, & Singh, 2014). Moreover, aerobic exercise leads to endorphins production which may reduce sensitivity to pain and produce feelings of relaxation (Rasmussen & Farr, 2009), and this is related to our findings that the better cardiorespiratory fitness the lower lumbar and bodily pain. In this line, in 2016, a review concluded that exercise alone, or in combination with education, is effective for preventing low back pain in the general population (Steffens et al., 2016). Furthermore, in a combination of primary and posterior prevention of low back pain during pregnancy, Liddle and Pennick (2015) and Kinser et al. (2017) found that exercise may also be effective in the secondary prevention of low back pain, reducing its intensity and associated disability and sick leave. In fact, we have confirmed that a greater general fitness is associated with less disability and lower intensity of lumbar and sciatic pain, assessed by the ODI questionnaire. In addition, exercise might improve muscle strength and endurance, and seems to be more effective in the prevention of new episodes of low back pain when this is habitual (Nilsen, Holtermann, & Mork, 2011). Accordingly to these findings, a recent meta-analysis suggested that exercise has a protective effect against low back pain in pregnancy (Shiri, Coggon, & Falah-Hassani, 2018), what concurs with the relationships that we found in the present study.

In addition to improved physical fitness, there are some studies that have drawn attention to a range of issues related to the use of painkillers during pregnancy, which included using contraindicated drugs, the self-prescription of painkillers and taking more than the recommended dose for pregnancy (Sinclair, Hughes, & Liddle, 2014; Wellock & Crichton, 2007). In this sense, a physical exercise program, focused on increasing physical fitness, could contribute to beat the pain without the use of painkillers, or by decreasing the dose, which could minimize the risk of these drugs on the fetus.

Finally, some authors have stated that the use of a validated self-reported physical fitness questionnaire can provide valuable information to practicing clinicians, and ought to be considered to be included in primary care monitoring of pregnant women (Holtermann et al., 2015). In fact, as our study suggests that the employment of the *International Fitness Scale* could be found by practitioners as an easy, quick and inexpensive tool to measure physical fitness at the same time that could serve to identify pregnant women at higher risk of suffering pain during pregnancy. Moreover, this questionnaire may be particularly easy to administer by mail, telephone, and Internet-based surveys.

Limitations and strengths

Some Limitations of the present study should be acknowledged. First, since our results are derived from a cross-sectional study, the associations found cannot be explained via a causal pathway: while physical fitness might decrease pain, it is possible that individuals with impaired pain affection were less likely to be involved in physical activity or exercise, therefore, showing lower levels of physical fitness. Second, due to the absence of well validated physical fitness tests batteries for pregnant women, we assessed physical fitness through a self-reported questionnaire. On the other hand, to the best of our knowledge, this is the first study documenting a strong association between the IFIS scale and pregnancy-related pain. Also constitutes a strength of the present study the relatively large sample size employed.

Clinical implications

These findings can provide practitioners with valuable information for the evaluation and prevention of bodily, lumbar and sciatic pain during pregnancy. Likewise, the employment of the IFIS scale can help to prescribe increased physical activity, or supervised exercise programs, during pregnancy among those pregnant women with low levels of physical fitness.

Future perspectives

Future studies are needed to contrast if increasing physical fitness levels or the development of exercise programs among pregnant women with pain before or during early pregnancy could decrease the pain-related symptomatology along the pregnancy. It is also necessary to validate the IFIS scale among pregnant women, and to check if the employment of the IFIS scale is well accepted by clinicians, that may provide valuable information about the mother and fetus health state and thus, could be useful in the primary prevention of pregnancy-related alterations.

CONCLUSION

Pregnancy-related pain is very common during pregnancy. Indeed, disability while performing daily activities such as standing, carrying out self-activities, lifting weight or walking, for instance, may be mediated by pain. Pain could also negatively affect quality of life during pregnancy, which may impair fetal development. This study showed that greater self-reported physical fitness is associated with lower bodily, lumbar and sciatic pain during early pregnancy. Specifically, greater levels of self-reported general fitness, cardiorespiratory fitness and speed-agility were associated with lower bodily and lumbar pain. Besides, greater self-reported speed-agility was also associated with lower sciatic pain. Consequently, the employment of the IFIS scale in clinical settings may be a quick, cheap and easy tool to monitoring physical fitness and pregnancy-related pain.

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Annex

Annex 1: *Informed consent*

CONSENTIMIENTO INFORMADO – CONSENTIMIENTO POR ESCRITO DEL PARTICIPANTE

"INFLUENCIA DE LOS NIVELES DE ACTIVIDAD FÍSICA, CONDICIÓN FÍSICA Y HÁBITOS NUTRICIONALES DE LA GESTANTE SOBRE DIVERSOS MARCADORES DE SALUD MATERNA Y FETAL". GESTAFIT PROJECT

Yo (Nombre y Apellidos):..

- He leído el documento informativo que acompaña a este consentimiento (Información al Paciente)
- He podido hacer preguntas sobre el estudio "*Influencia de los niveles de actividad física, condición física y de los hábitos nutricionales de la gestante sobre marcadores de salud materna y fetal*".
- He recibido suficiente información sobre el estudio *"Influencia de los niveles de actividad física, condición física y de los hábitos nutricionales de la gestante sobre marcadores de salud materna y fetal"*

- He hablado con el profesional sanitario informador: ……………………………

- Comprendo que mi participación es voluntaria y soy libre de participar o no en el estudio.

- Se me ha informado que todos los datos obtenidos en este estudio serán confidenciales y se tratarán conforme establece la Ley Orgánica de Protección de Datos de Carácter Personal 15/99.

- Se me ha informado de que la donación/información obtenida sólo se utilizará para los fines específicos del estudio.

- **Deseo** ser informado/a de mis datos genéticos y otros de carácter personal que se obtengan en el curso de la investigación, incluidos los descubrimientos inesperados que se puedan producir, siempre que esta información sea necesaria para evitar un grave perjuicio para mi salud o la de mis familiares biológicos.

Sí No

Comprendo que puedo retirarme del estudio:

- Cuando quiera
- Sin tener que dar explicaciones
- Sin que esto repercuta en mis cuidados médicos

Presto libremente mi conformidad para participar en el proyecto titulado *"Influencia de los niveles de actividad física, condición física y de los hábitos nutricionales de la gestante sobre marcadores de salud materna y fetal*"

Firma del participante	Firma del profesional
(o representante legal en su defecto)	sanitario informador
Nombre y apellidos:……………….	Nombre y apellidos: ………..
Fecha: ………………………………	Fecha: ……………………….

Annex 2: *Approval of the Ethics Committee*

Servicio Andaluz de Salud
CONSEJERÍA DE SALUD

DON MIGUEL ÁNGEL CALLEJA HERNÁNDEZ, EN CALIDAD DE SECRETARIO DEL COMITÉ DE ÉTICA DE LA INVESTIGACIÓN DE LA PROVINCIA DE GRANADA,

CERTIFICA

Que este Comité ha evaluado favorablemente, en su reunión celebrada el día 25 de mayo de 2015, el proyecto titulado: "Influencia de los niveles de actividad física, condición física y hábitos nutricionales de la gestante sobre diversos marcadores de salud materna y fetal". Código GESFIT .I.P. Dª. Virgina Arianna Aparicio Garcia-Molina-UGR y Dra. Carmen Padilla Vinuesa- CHUG

Y considera que:

Se cumplen los requisitos necesarios de idoneidad del protocolo en relación con los objetivos del estudio y están justificados los riesgos y molestias previsibles para el sujeto.

La capacidad del investigador y los medios disponibles son apropiados para llevar a cabo el mencionado estudio.

Es adecuado el procedimiento para obtener el consentimiento informado.

Y que este Comité acepta que dicho proyecto sea realizado en los Centros propuestos.

Lo que firmo en Granada, a veintiocho de mayo de dos mil quince.

HOSPITAL UNIVERSITARIO "San Cecilio"
Avda. Dr. Oloriz, 16. 18012 - GRANADA
Tfno.: 958 02 30 00