Clinical Epidemiology and Global Health 31 (2025) 101904

Contents lists available at ScienceDirect

Clinical Epidemiology and Global Health

journal homepage: www.elsevier.com/locate/cegh

Original article

Does attachment and prenatal depression affect maternal health-promoting lifestyle during pregnancy? A cross-sectional study☆

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ARTICLE INFO

Keywords:
Pregnancy
Prenatal care
Cross-sectional studies
Depression
Life Style

ABSTRACT

Introduction: A healthy lifestyle during pregnancy is crucial for improving maternal and infant outcomes. Maternal-fetal attachment and maternal prenatal depression have been identified as factors influencing maternal lifestyle during pregnancy. This study aimed to investigate the relationship between maternal-fetal attachment, maternal prenatal depression, and a healthy lifestyle among pregnant women.
Methods: A cross-sectional study was conducted among 224 pregnant women in their third trimester, attending an antenatal appointment at a community health center in Surakarta, Indonesia, from July to September 2019.
Results: Bivariate analysis revealed significant associations between education ($p = 0.024$), religion ($p = 0.026$), employment ($p = 0.012$), income ($p = 0.016$), parity ($p = 0.026$), maternal depression ($p < 0.01$), maternal-fetal attachment ($p < 0.001$), and a health-promoting lifestyle. However, factors such as age, living arrangement, gestational age, a planned pregnancy, previous miscarriages, pre-pregnancy diseases, pre-pregnancy complications, and a private health insurance showed no significant associations. Hierarchical multiple linear regression indicated that maternal-fetal attachment ($p < 0.05$) and maternal depression ($p < 0.001$) were the only predictors of pregnant women's health-promoting lifestyles ($R2 = 0.373$, $\Delta R = 0.251$).
Conclusion: Maternal-fetal attachment and maternal prenatal depression are key predictors of adopting a health-promoting lifestyle during pregnancy. These findings highlight the importance of maternal psychological well-being as part of a comprehensive antenatal care.

Problem or Issue	What is Already Known	What this Paper Adds
- Significant concern exists regarding the necessity for raising awareness concerning a healthier lifestyle. - Meanwhile, the	- There is a correlation between maternal attachment and perinatal depression - There is a correlation between maternal	• Maternal-fetal attachment and prenatal depression are significant predictors of maternal health-promoting lifestyle behaviors during

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Problem or Issue	What is Already Known	What this Paper Adds
maternal-fetal attachment is not developed well - Maternal perinatal mental health is not addressed well,	depression and health-promoting lifestyle.	pregnancy. • This study underscores the importance of integrating mental health screening, such as the Edinburgh Postnatal

(*continued on next page*)

☆ This study was a cross sectional study among 224 pregnant women in Indonesia to assess maternal-fetal attachment, maternal prenatal depression, and potential associations with a healthy lifestyle among pregnant women. This study revealed that maternal-fetal attachment and maternal prenatal depression were associated with a health-promoting lifestyle.

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https://doi.org/10.1016/j.cegh.2024.101904
Received 26 May 2024; Received in revised form 11 December 2024; Accepted 22 December 2024
Available online 26 December 2024

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Problem or Issue	What is Already Known	What this Paper Adds
especially in developing countries - To date, there has been a lack of research examining the association between maternal-fetal attachment and depression linked to maternal lifestyle, particularly within the context of Indonesia.		Depression Scale (EPDS), into routine antenatal care to identify and address depressive symptoms early. • The findings highlight the need for antenatal programs to include activities that strengthen maternal-fetal attachment, such as mindfulness exercises, prenatal bonding classes, and structured emotional support. • Community-based and culturally sensitive interventions are essential, particularly for vulnerable groups such as low-income, less-educated, or multiparous women, to overcome barriers to a healthy lifestyle during pregnancy. • The study provides a foundation for developing public health strategies and policies aimed at improving maternal psychological well-being, thereby promoting healthier behaviors during pregnancy and enhancing outcomes for mothers and infants.

1. Introduction

Lifestyle during pregnancy appears as a key factor associated with health and disease in pregnant women. To achieve a high level of health during pregnancy, psychosocial and demographic aspects should be considered as key factors.[1] Several studies have found that a healthier behavior during pregnancy was related to several factors such as age, income, religion, parity, and education.[2–4] Alternative variables that were negatively correlated with a healthy nutrition were trait anxiety, marital dissatisfaction ($\beta = -0.305$, $p < 0.001$), social support ($\beta = -0.188$, $p < 0.001$), and depression.[1] (see Table 1) (Table 1)

Depressive and anxiety disorders are the most frequent prenatal psychiatric illnesses, affecting 15–29 % of women; low- and middle-income countries (LMICs) have more prenatal mental problems, poor health practice, and lack of research identifying maternal-fetal attachment than high-income countries.[5] Prenatal depression can harm newborns and families, particularly other children during their early years, can impair parental-infant bonding[6,7] and is associated with low health outcomes during pregnancy.[8]

A number of studies have investigated the link between prenatal depression and maternal-fetal attachment. A comprehensive review spanning 45 papers across America, Europe, Asia, and Australia found a negative association between prenatal attachment and symptoms of prenatal depression.[9] Additional studies have explored how postnatal depressive symptoms can be related with low levels of prenatal attachment.

Maternal attachment plays a vital role in both maternal and infant well-being, involving a pattern of interaction and communication between a mother and her unborn child. Establishing and nurturing this connection before and after childbirth is crucial for cognitive and physical development of both the mother and the infant.[10] This aligns with the importance of adopting healthy lifestyle behaviors throughout the perinatal period, from preconception to postpartum, to promote a successful pregnancy while reducing the risk of gestational illnesses.[11]

Besides, parenting practices should encompass promoting a healthy lifestyle, as evidenced by declining physical activity among pregnant women with obesity in late pregnancy, emphasizing the importance of raising awareness about healthier behaviors.[12] Moreover, improving maternal health during pregnancy has long-term benefits for both mother and child.[13] Despite the known association between maternal-fetal attachment and depression, there is a gap in understanding their potential association with maternal lifestyle, particularly in Indonesia. This study aimed to investigate maternal-fetal attachment, maternal prenatal depression, and their potential links to a healthy lifestyle among pregnant women.

Table 1
Obstetric and health information.

Variables	M ± SD	N	%
Mother Age (years)	28.34 ± 5.24		
Gestation age (weeks)	32.3 ± 3.8		
24-29		74	33.0
30-35		84	37.5
36-40		66	29.5
Parity			
Primigravida		89	39.7
Multigravida		135	60.3
Pregnancy planning			
Planned		169	75.4
Unplanned		55	24.6
Previous miscarriages			
Yes		26	11.6
No		198	88.4
Disease before pregnancy			
Yes		22	9.8
No		202	90.2
Complications in previous pregnancy			
Yes		11	4.9
No		213	95.1
Health Insurance membership			
Yes		194	86.6
No		30	13.4

2. Methods

2.1. Research design and participants

A cross-sectional study involving n = 224 pregnant women attending a prenatal appointment with a midwife at a community health center in Surakarta, Central Java, Indonesia was conducted from July to September 2019. Inclusion criteria were: (i) women during the third trimester of pregnancy aged ≥20 years; (ii) no mental health disease diagnosis. Exclusion criteria included high-risk pregnancies including diabetes, pre-eclampsia, or risk of a premature birth.

Participants provided written informed consent prior to their participation. The sample size was calculated a priori using G*Power statistical software version 3.1, which is recommended for its user-friendly interface and cost-free availability.[14] Using multiple regression with an R2 deviation from zero with alpha set at 0.05, power at 0.8, and nine predictors, the target sample size was calculated to be 114. Assuming a 10 % refusal rate, the minimum sample size was set at 125. After two months of data collection, the final sample size reached n = 224 respondents, which is above the minimum number required by G*Power 3.1.

2.2. Assessment psychological instruments

Prenatal Attachment Inventory (PAI): This measure was developed by Muller & Mercer (1993) to assesses maternal-fetal attachment using a

4-point Likert scale with 21 items and five subscales.[15] The PAI offers information on differentiation of self from the fetus, affection, fantasy, sensitivity, and interaction, with higher scores indicating stronger attachment. The PAI has good psychometric properties with an internal consistency Cronbach's alpha of $\alpha = 0.85$ in the Indonesian version[16] and $\alpha = 0.87$ in the present study.

Edinburgh Postpartum Depression Scale (EPDS): This is a widely used 10-item scale to assess maternal depression through a four-point Likert scale ranging from 0 to 3. EPDS offers information on mood, guilt, worthlessness, sleep disturbances, and suicidal ideation during and after pregnancy. The EPDS has shown comparable accuracy in both pregnant and postpartum women,[17] making it a suitable tool to be used with pregnant women. The EPDS demonstrated split-half reliability of $\alpha = 0.88$ and a standardized alpha coefficient of $\alpha = 0.87$,[18] while the Indonesian version showed a Cronbach's alpha of $\alpha = 0.85$.[19] Additionally, the Cronbach's alpha for the EPDS in this study was $\alpha = 0.76$.

The Health-promoting Lifestyle Profile-II (HPLP-II), developed by Walker et al., helps assessing health-related behaviors across six domains and 52 items.[20] These domains include interpersonal relationships, nutrition, stress management, health responsibility, spiritual growth, and physical activity and are scored on a four-point Likert scale. The HPLP-II demonstrated a high internal reliability ($\alpha = 0.94$) and subscale alpha coefficients ranging from 0.79 to 0.87.[20] The Indonesian version showed a Cronbach's alpha of $\alpha = 0.92$,[21] and in this study, the HPLP-II exhibited a Cronbach's alpha of $\alpha = 0.95$.

2.3. Sociodemographic and obstetric data

Sociodemographic and obstetric characteristics were collected, including age, marital status, education level, religion, household income, and employment status. Participants were categorized based on age (24–29, 30–35, 36–40), marital status (married, not married), education level (elementary, junior and senior high school, higher education), religion (Muslim, Protestant, Catholic), household income (below minimum, average, above), and employment status (housewives, employed).

Obstetric information included age, gestation age, parity (primigravida, multigravida), pregnancy planning (planned, unplanned), miscarriage history, disease before pregnancy, complications in previous pregnancies, and health insurance membership, all categorized as yes or no.

2.4. Ethics and data collection

This study received ethical approval from The Institutional Review Board (IRB) from Sebelas Maret University, Surakarta (UNS) (Ref No.257/UN27.06/KEPK/2019). Upon approval, permission was obtained from the Surakarta Health Department to access Community Health Centers for participant screening from July to September 2019 across 17 *health centers*. Midwives at each *health center* assisted in identifying eligible participants based on the inclusion and exclusion criteria. After explaining the study details, participants provided informed consent and completed a set of questionnaires, including a demographic questionnaire, the Prenatal Attachment Inventory (PAI), The Edinburgh Perinatal Depression Scale (EPDS), and Health Promotion Lifestyle Profile-II (HPLP-II). Participation was voluntary, could withdraw at any time, and confidentiality was maintained throughout the study. All questionnaire papers were securely stored in a private location accessible only to authorized researchers.

2.5. Statistical analysis

Statistical analyses were conducted using SPSS version 22.0. Descriptive statistics, including means, standard deviation, frequency, and percentages (95 % CI), were used to summarize variables. The *t*-test and one-way ANOVA assessed differences in demographic and obstetric factors. Hierarchical multiple linear regression identified predictive variables for health-promoting lifestyle among pregnant women. Participants with severe mental health issues were excluded, and only significant variables were included in the regression analysis.

3. Results

3.1. Description of the study sample

The researchers distributed questionnaires to 235 potential participants, with 233 confirming eligibility and completing them. After excluding nine incomplete responses, n = 224 were included

in the study. This community-based cross-sectional study focused on pregnant women (n = 224) in Surakarta, Central Java, Indonesia. Despite being a developed city with diverse characteristics, Surakarta's data can help improve health service quality.

Respondents' demographics: average age was M = 28 years old, all married (100 %), >70 % with junior or senior high school education, and a majority of Muslims. More than half had household incomes at or above the regional minimum salary, and 71.42 % were housewives. Obstetric data showed over one-third were in the 30–35 weeks gestation period, about two-thirds were not in their first pregnancy, most pregnancies were planned, and a few had a previous miscarriage. Only 9.8 % had pre-pregnancy diseases, 4.9 % had previous pregnancy complications, and 86.6 % had a private health insurance.

3.2. Bivariate analysis on factors associated with health-promoting lifestyle

The study found significant associations between several sociodemographic and obstetric factors and health-promoting lifestyles among pregnant women. The study on healthy lifestyles among pregnant women in Surakarta showed an average score of M = 135.77 (SD = 21.40), with a range from 66 to 202. Women with higher education levels demonstrated better health-promoting lifestyles compared to those with lower levels of education ($p = 0.024$). Employment also positively influenced lifestyle, with employed women reporting healthier behaviors compared to housewives ($p = 0.012$). Similarly, household income played a role, with women from average or above-average income households showing better health-promoting behaviors than those from lower-income households ($p = 0.016$).

Religious affiliation was associated with health-promoting lifestyles, where Catholic women scored higher than Muslim and Protestant women ($p = 0.026$). Parity also showed significance, with primigravida women exhibiting healthier behaviors compared to multigravida women ($p = 0.026$).

Among psychological factors, maternal-fetal attachment had the strongest positive association with health-promoting lifestyles ($p < 0.001$), while maternal depression showed a negative correlation ($p < 0.01$).

No significant associations were found for factors such as age, living arrangement, gestational age, pregnancy planning, miscarriage history, pre-pregnancy diseases, previous pregnancy complications, or health insurance membership ($p > 0.05$) (see Table 2).

3.3. Multivariate analysis

A hierarchical multiple linear regression examined how well significant variables from bivariate analysis predict healthy lifestyles (Table 3). The predictors, including demographic characteristics, obstetric factors, maternal depression, and maternal-fetal attachment (MFA), were chosen due to their significant correlations with a healthy lifestyle. Initially, demographic and obstetric factors did not significantly predict a health-promoting lifestyle (adjusted R2 = 0.089). Adding maternal depression in the second regression increased R2 to 0.122 (Δ R2 = 0.032), making it a significant predictor ($p < 0.05$). The

Table 2
Bivariate analysis on factors associated with health-promoting lifestyle (N = 224).

Variables	n (%)	M ± SD	Score	*p-value*	*95 % CI*
Age					
20-27	117 (52.23 %)	136.33 ± 22.99	0.492	0.612[a]	(132.12)–(140.54)
28-35	80 (35.71 %)	134.06 ± 15.17			(130.68)–(137.44)
36-42	27 (12.05 %)	138.37 ± 29.22			(126.81)–(149.93)
Education					
Elementary school	6 (2.67 %)	133.83 ± 23.404	3.793	0.024[a,d]	(109.27)–(158.39)
Junior and Senior High School	171 (76.33 %)	133.74 ± 20.69			(130.63)–(136.89)
Higher Education	47 (20.98 %)	143.32 ± 22.425			(136.73)–(149.90)
Religion					
Muslim	207 (92.41 %)	134.78 ± 21.393	3.697	0.026[a,d]	(131.86)–(137.73)
Prothestan	12 (5.35 %)	143.33 ± 13.152			(134.98)–(151.69)
Catholic	5 (2.23 %)	157.80 ± 25.528			(126.10)–(189.50)
Employment					
Housewives	160 (71.42 %)	133.51 ± 22.135	2.523	0.012[b,d]	(-14.060) - (−1.728)
Employed	64 (28.57 %)	141.36 ± 18.425			(-13.619) - (−2.169)
Income					
Below	106 (47.32 %)	132.16 ± 23.007	2.416	0.016[b,d]	(-12.434) - (−1.262)
Average and above	118 (52.67 %)	139.01 ± 19.394			(-12.487) - (−1.209)
Living arrangement					
Live alone	7 (3.12 %)	133.57 ± 18.183	0.718	0.489[a]	(116.76)–(150.39)
Live with husband	101 (45.09 %)	133.99 ± 21.285			(129.81)–(138.23)
Live with husband and extended family	116 (51.78 %)	137.42 ± 21.698			(133.43)–(141.41)
Gestation Age					
24–29 week	74 (33.03 %)	131.51 ± 20.75	2.268	0.106[a]	(126.71)–(136.32)
30–35 week	84 (37.5 %)	138.40 ± 22.33			(133.56)–(143.25)
36–40 week	66 (29.46 %)	137.18 ± 20.49			(132.14)–(142.22)
Parity					
Primigravida	89 (39.73 %)	139.67 ± 21.619	2.237	0.026[b,d]	(0.772)–(12.191)
Multigravida	135 (60.26 %)	133.17 ± 20.93			(0.729)–(12.235)
Pregnancy Planning					
Planned	169 (75.44 %)	135.33 ± 21.82	0.520	0.604[b]	(-8.290) - (4.831)
Unplanned	55 (24.55 %)	137.07 ± 20.209			(-8.081) - (4.622)
Miscarriage history					
Yes	26 (11.60 %)	135.04 ± 25.696	0.184	0.854[b]	(-9.645) - (7.994)
No	198 (88.39)	135.86 ± 20.855			(-11.561) - (9.910)
Disease before pregnancy					
Yes	22 (9.82 %)	135.73 ± 24.178	0.009	0.993[b]	(-9.538) - (9.910)
No	202 (90.17 %)	135.77 ± 21.140			(-11.104) - (11.014)
Complications in previous pregnancy					
Yes	11 (4.91 %)	142.45 ± 23.628	1.063	0.289[b]	(-6.009) - (20.073)
No.	213 (95.08 %)	135.42 ± 21.291			(-8.999) - (23.063)
Health Insurance membership					
Yes	194 (86.61 %)	136.18 ± 21.538	0.760	0.448[b]	(-5.089) - (11.481)
No	30 (13.39 %)	133.00 ± 20.603			(-5.028) - (11.420)
Maternal Depression		8.12 ± 3.97	−0.224	<0.01[c]	
Maternal-Fetal Attachment		63.23 ± 9.35	0.566	<0.001[c]	

[a] One-way ANOVA.
[b] T-Test
[c] Pearson's correlation.
[d] $p < 0.05$.

Table 3
Hierarchical multiple linear regression of health-promoting lifestyle (N = 224).

Variables	B	Step 1	B	B	Step 2	β	B	Step 3	β
		SE			SE			SE	
(Constant)	141.161	9.056		149.729	9.419		72.608	11.538	
Maternal depression				−0.983	0.349	−0.182**	−0.679	0.298	0.126[d]
Maternal-fetal attachment (MFA)							1.199	0.130	0.524***
Multigravida vs. primigravida	−4.767	2.886	−0.109	−5.023	2.842	−0.115	−2.349	2.425	−0.054
Junior and senior high school vs. elementary school	−2.509	8.759	−0.050	−3.790	8.634	−0.075	−7.762	7.326	−0.154
Above high school vs. elementary school	2.667	9.428	0.051	1.940	9.284	0.037	−0.952	7.871	−0.018
Protestant vs. Muslim	7.935	6.241	0.084	7.823	6.143	0.082	3.397	5.226	0.036
Catholic vs. Muslim	17.922	9.547	0.124	19.091	9.407	0.132	7.248	8.070	0.050
Above and average income vs below income	3.047	3.057	0.071	2.667	3.012	0.062	1.786	2.553	0.042
Employed vs. housewives	−5.033	3.250	−0.106	−3.799	3.229	−0.080	−1.201	2.750	−0.025
$_R2$			0.089			0.122			0.373
Δ R^2	0.089			0.032			0.251		

*** = $p < 0.001$ (2-tailed), ** = $p < 0.01$ level (2-tailed), * = < 0.05 level (2-tailed).

final regression, including MFA, showed maternal depression ($p < 0.05$) and MFA ($p < 0.001$) as significant predictors ($R2 = 0.373$, $\Delta R = 0.251$), indicating these were the key predictors of a health-promoting lifestyle among pregnant women.

4. Discussion

This study examined the association between maternal-fetal attachment, maternal prenatal depression, and a healthy lifestyle among pregnant women. The findings revealed that education, religion, employment, income, parity, maternal depression, and maternal-fetal attachment (MFA) were linked to adopting a health-promoting lifestyle. In Surakarta, pregnant women showed varied health-promoting lifestyle scores. Surakarta, an urban area in Java, has numerous health facilities accessible to pregnant women, ensuring they meet the government-recommended minimum of four prenatal visits. Despite this, studies indicate that Indonesian pregnant women often have nutrient intakes below the recommended levels, highlighting the need for promoting healthier behaviors through well-trained healthcare providers.

Some characteristics of the study group differed from the overall population of Indonesia. For instance, most participants were housewives, while many Indonesian women work outside the home. Additionally, the women in this study had at least a high school education. Education is crucial for developing a health-promoting lifestyle. This study aligns with previous research in the Netherlands, showing that higher education levels correlate with better health literacy, which reduces risky behaviors and promotes healthier choices.[22] Therefore, encouraging higher education for women remains essential.

Bivariate analysis in this study also showed that religious affiliation significantly influenced health-promoting behavior. Muslim women had lower health-promoting lifestyle scores compared to women of other religions. Given that most Indonesians are Muslim, it is important for health professionals, educators, religious leaders, and the government to promote a healthy lifestyle within the Muslim community, emphasizing that caring for one's health is a duty in Islam.[23]

In terms of employment, results showed that employed women had higher health behavior scores compared to housewives. Previous study said that staying at home has been linked to worse physical and mental health due to fewer financial and social resources.[24] Income and employment status affect health-seeking behavior, particularly for pregnant adolescents.[25] Thus, more effort is needed to educate and encourage housewives and low-income women to empower themselves to have such a healthy lifestyle, especially during pregnancy. Moreover, government income subsidies for low-income women could improve overall health status.[26] Regarding parity, primiparas exhibited healthier practices than multiparas, possibly due to stronger family support. Both groups need support, but multiparas face additional responsibilities and less societal support. Therefore, education and support from family and healthcare providers are crucial for multiparas.

This study found that most women were not depressed, although their mean score was higher compared to some countries. However, depression screening in Indonesia, primarily in Community Health Centers, where most pregnant women receive prenatal check-ups, is not widespread. Routine screening for psychological problems in early pregnancy is necessary to address this gap.

Regarding maternal-fetal attachment (MFA), the study revealed a relatively high mean score among women. Previous systematic review shows that prenatal depressive symptoms were found to be negatively associated with prenatal attachment.[9] Furthermore, lower levels of prenatal attachment were related to higher postnatal depressive symptoms. Maternal-fetal attachment has been linked to a lower risk of postpartum depression.[27] However, compared to women in other Asian countries,[28] the MFA score among women in Surakarta, Indonesia, was lower. Improving MFA scores could decrease depression rates, promote healthy lifestyles, and enhance the well-being of both mothers and infants.

Hierarchical multiple linear regression analysis revealed that maternal-fetal attachment and maternal depression significantly predicted the health-promoting lifestyle of pregnant women. Depression negatively impacted health behavior, while attachment positively influenced it. This aligns with previous findings suggesting that emotional disturbances like depression hinder self-care and health behavior adoption.[1] Consequently, pregnant women experiencing depression may face challenges in adopting healthier behaviors.

Moreover, maternal-fetal attachment was found to positively influence health practices in previous research.[29] The bond with the fetus may drive mothers to prioritize health responsibility, leading them to seek information from healthcare providers and attend pregnancy classes. This study observed a correlation between health responsibility and maternal fetal-attachment, suggesting that pregnant women may demonstrate attachment by actively seeking health information and assuming responsibility for their own and their baby's well-being.

Understanding pregnant women's beliefs about healthy lifestyles during pregnancy, their prioritization of fetal health, and their maternal-fetal attachment is crucial. Strong maternal attachment prompts women to adopt healthier behaviors to safeguard their baby's well-being. These findings call for several recommendations. Firstly, depression undermines health behavior, underscoring the importance of addressing depression among pregnant women. Yet, stigma surrounding mental health treatment in Indonesia poses a challenge.[30] Thus, raising awareness about mental health during pregnancy can destigmatize seeking help, enabling depressed individuals to access support and improve their lifestyle. Secondly, enhancing maternal-fetal attachment is vital. Midwives can play a key role by providing high-quality antenatal care, offering prenatal classes that foster attachment, emotional support, and activities like gentle yoga.[31] Integrating healthy lifestyle programs with educational initiatives can further engage mothers' support groups.[32] Thirdly, midwives must pay special attention to vulnerable groups, such as pregnant women with low education and income or multiple children. Enhancing midwives' skills to educate and support pregnant women and their families is imperative for promoting healthier behaviors across all socioeconomic backgrounds.

This study provides evidence that maternal depression and maternal-fetal attachment directly affect health behaviours of pregnant women. It provides a point of comparison for researchers working with different populations to verify this effect. Moreover, this data can be used to develop strategies to improve maternal mental health of pregnant women to prevent severe mental health problems, for example, by using the EPDS to screen for maternal depression during antenatal checks-up.

4.1. Study limitations

This study has limitations, as participants were primarily Javanese, making the findings less generalizable to Indonesia's multicultural population. Different ethnicities may have varying cultural traditions affecting pregnancy health behaviors. However, this study provides new insights, supporting previous research and encouraging further studies on depression, maternal-fetal attachment, and health-promoting lifestyle behavior.

4.2. Clinical and research implications

Understanding the factors influencing health-promoting behaviors among pregnant women provides valuable insights for clinical practice and public health initiatives. The findings of this study highlight the significant roles of maternal-fetal attachment and maternal depression in shaping a healthy maternal lifestyle.

Clinically, routine screening for maternal depression should be integrated into antenatal care using tools such as the Edinburgh Postnatal Depression Scale (EPDS). Early detection and management of depressive symptoms not only improve maternal well-being but also facilitate the

adoption of healthier behaviors during pregnancy. Midwives and healthcare providers should be equipped with skills to assess and address psychological challenges, fostering better outcomes for mothers and their babies.

The promotion of maternal-fetal attachment through prenatal classes and structured interventions, such as mindfulness exercises, yoga, or guided bonding activities, can enhance maternal health responsibility. Such initiatives can be included in antenatal care programs to strengthen emotional connections between mothers and their unborn children.

5. Conclusion

The findings highlight the role of maternal depression and maternal-fetal attachment in promoting a healthy behavior among pregnant women. Certain groups, especially low-income women, unemployed, less educated, and those with previous children are at a high risk of unhealthy lifestyles. Interventions should address these demographic challenges, ensuring antenatal care materials are accessible and affordable to everybody. Healthcare providers and families must recognize the impact of depression during pregnancy and support healthier behaviors.

CRediT authorship contribution statement

Rufidah Maulina: Conceptualization, Data curation, Formal analysis, Funding acquisition, Investigation, Methodology, Project administration, Resources, Software, Visualization, Roles, Writing – original draft. **Su-Chen Kuo:** Conceptualization, Methodology, Supervision, Validation, Roles, Writing – original draft. **Chieh-Yu Liu:** Conceptualization, Methodology, Supervision, Validation, Roles, Writing – original draft. **Yu Ying Lu:** Conceptualization, Methodology, Supervision, Validation, Roles, Writing – original draft. **Siti Khuzaiyah:** Validation, Visualization, Roles, Writing – original draft. **Rafael A. Caparros-Gonzalez:** Writing – review & editing, All authors approved the manuscript to be submitted.

Ethic statement

The ethics of this study was approved by The Institutional Review Board (IRB) from Sebelas Maret University, Surakarta (UNS) (Ref No.257/UN27.06/KEPK/2019).

Funding declaration

This study received no funding from any University.

Declaration of interest

The authors declare there is no conflict interest in this manuscript. All authors agree with the content of this manuscript.

Acknowledgment

We express our gratitude to the participants in this study, including midwives and other healthcare professionals, who granted us the opportunity to conduct this research in primary healthcare settings. We would also like to extend our appreciation to Stefani Pfeiffer for her English editing and proofreading services.

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