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Developmental Psychology

Maternal–Fetal Attachment Among Pregnant Women in Primary Health Care and Associated Variables

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Abstract: Along with the rapid transition into motherhood, signs of Maternal-Fetal Attachment (MFA) begin to appear. This study aimed to identify the socioeconomic, gestational, social support, and psychological factors associated with MFA among pregnant women receiving primary health care. The sample included 151 pregnant women recruited from the Brazilian Basic Health Units (BHUs) in a city in Rio Grande do Sul, who completed a general questionnaire, the Depression, Anxiety, and Stress Scale, and the short version of the Maternal-Fetal Attachment Scale. The data, analyzed with IBM SPSS Statistics, showed that maternal age over 35, lack of social support, lower gestational age, and stress symptomatology were connected to reduced MFA. Early detection may help promote healthy infant development and improve maternal adjustment in the postnatal period.

Keywords: maternal-fetal attachment, psychological stress, primary health care

Apego Materno-Fetal em Gestantes da Atenção Primária e Variáveis Associadas

Resumo: Simultaneamente à rápida transição da mulher para o papel de mãe, iniciam-se as manifestações do Apego Materno-Fetal (AMF). Objetivou-se avaliar as características socioeconômicas, gestacionais, de apoio social e psicológicas atreladas ao AMF, em gestantes da atenção primária em saúde. A amostra foi composta por 151 gestantes, identificadas através de Unidades Básicas de Saúde de uma cidade do Rio Grande do Sul, as quais responderam um questionário geral, a Escala de Depressão, Ansiedade e Estresse e a versão abreviada da Escala de Apego Materno-Fetal. Os dados, analisados no IBM SPSS Statistics, evidenciaram que a idade acima de 35 anos, falta de apoio social, menor idade gestacional e presença de sintomatologia de estresse estiveram associadas a um menor AMF. A identificação preventiva pode contribuir para o desenvolvimento favorável do bebê e a adaptação positiva da mãe ao período pós-natal.

Palavras-chave: relações materno-fetais, estresse psicológico, atenção primária à saúde

Apego Materno-Fetal en Gestantes en Atención Primaria y Variables Asociadas

Resumen: Simultáneamente a la rápida transición de la mujer al rol de madre, comienzan las manifestaciones de Apego Materno-Fetal (AMF). El objetivo fue evaluar las características socioeconómicas, gestacionales, de apoyo social y psicológicas associadas al AMF en mujeres embarazadas en atención primaria de salud. La muestra estuvo compuesta por 151 mujeres embarazadas, identificadas mediante Unidades Básicas de Salud de uma ciudad del estado de Rio Grande do Sul, quienes responsieron un cuestionario general, la Escala de Depresión, Ansiedad y Estrés, y la versión abreviada de la Escala de Apego Materno-Fetal. Los datos analizados con el IBM SPSS Statistics, evidenciaron que la edad superior a 35 años, la falta de apoyo social, la menor edad gestacional y la presencia de síntomas de estrés estuvieron associados a un menor AMF. La identificación preventiva puede contribuir al desarrollo favorable del bebé y a una adaptación positiva de la madre em el período posnatal.

Palabras clave: relaciones materno-fetales, estrés psicológico, atención primaria de salud

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Pregnancy is a period of great significance in a woman's life, characterized by rapid physical, psychological, and social changes. It is a period marked by the need to adapt to bodily changes and limitations, reorganize new demands and priorities, and restructure roles as the woman prepares for motherhood. This process, defined by anxiety and emotional vulnerability, can be challenging and stressful for pregnant women (McNamara et al., 2019; Santos & Vivian, 2018; Souza et al., 2022).

However, even though there is a qualitative change in the mother-baby dyad relationship immediately after birth, it is during this transitional period that manifestations of care and protection begin, extending into the postpartum period and the early stages of the baby's life (Cranley, 1993). These bonding behaviors are defined by Cranley (1981) as Maternal-Fetal Attachment (MFA) and represent the mother's affiliation and interaction with the fetus, proportional to her involvement with it, while still in the womb.

MFA is a multidimensional construct that can be expressed through maternal cognitions, affections, and expectations (McNamara et al., 2019). Some examples include the imaginary attribution of physical and personality traits, engaging in indirect contact such as caressing the belly, singing or talking to the baby, and growing fantasies about the baby's arrival (Rollè et al., 2020). It can also be assessed based on protective behaviors and commitment to the fetus, such as identifying and avoiding risk factors and behaviors, practicing restrictions and changes in habits, as well as the desire to carry the pregnancy to term, despite difficulties and challenges (Palma et al., 2020).

Although this is a unidirectional and abstract relationship that develops during pregnancy, multiple experiences and aspects of the mother's previous life can influence the establishment of MFA. In terms of socioeconomic characteristics, studies evaluating pregnant women in private clinics indicate that older maternal age, lower economic status, and not living with a partner are some of the variables that negatively influence MFA (McNamara et al., 2019; McNamara et al., 2022; Palma et al., 2020; Rollè et al., 2020).

On the other hand, MFA is represented by a continuum, increasing as pregnancy progresses, with emphasis on the last months due to fetal movements felt by the pregnant woman, which may be influenced by previous gestational conditions (Palma et al., 2020; Rollè et al., 2020; Rubin et al., 2023). Primiparity, evaluated both in private health contexts and in philanthropic services governed by the *Sistema Único de Saúde* (Brazilian Unified Health System - SUS), is one of the factors contributing to the increase levels of MFA, which, according to the literature, is since multiparous pregnant women are less focused on the fetus because they have already experienced the transition to motherhood in their first pregnancy (Ertmann et al., 2021; Souza et al., 2022). Some other authors, who looked at pregnant women treated at clinics linked to a university system in a city in Nebraska, also say that 3D ultrasound models can be a big deal in helping mothers who have already been through their first pregnancy get better MFA results, with these mothers being positively affected by the new tech (Coté et al., 2020). Moreover, the desire for pregnancy, explained from a gestational acceptability perspective, may further favor these outcomes, which is a factor proportional to the MFA influence (McNamara et al., 2022).

Regarding gestational risk issues, the literature on Maternal–Fetal Attachment (MFA) in the context of high-risk pregnancies is still inconclusive, presenting three strands. The first, conducted in two public hospitals, concerns higher MFA in high-risk pregnancies as maternal prenatal adaptation increases (Çelik & Güneri, 2020; Souza et al., 2022). Meanwhile, a study comparing couples with physiological pregnancies and couples with pregnancies at risk of preterm birth in a hospital in Italy found significantly lower MFA in the latter group (Pisoni et al., 2016). In contrast to previous studies, a private clinic in Chile also found that risk conditions, whether for the mother or the baby, do not appear to significantly affect MFA (Palma et al., 2020).

In the case of relational aspects of the pregnant woman, social support stands out, given the almost unanimous consensus in the literature on its importance for higher mean MFA scores, acting as a protective factor for the pre- and postnatal phases. These findings, assessed in different countries, highlight the importance of a reference figure for the mother, not limited to the baby's father, who can provide support, share experiences, and help her cope with the situation. This, in turn, facilitates maternal planning and imagination regarding the baby, fostering feelings for the child and bringing benefits to both (Cuijlits et al., 2019; Ertmann et al., 2021; McNamara et al., 2019; Rosa et al., 2021; Tichelman et al., 2019; Rubin et al., 2023).

As for the psychological aspects linked to MFA in pregnant women, the literature focuses its results mainly on depressive and anxious characteristics (Cuijlits et al., 2019; Palma et al., 2020; Rollè et al., 2020; Souza et al., 2022). However, regarding other aspects, more specifically stress symptomatology, the results are still scarce and contradictory. Some studies conducted with pregnant women outside Brazil have shown that maternal stress levels were not significantly associated with MFA (Ertmann et al., 2021; Kim et al., 2019; Tichelman et al., 2019). Conversely, other studies reported that higher levels of stress, specifically related to pregnancy, were correlated with stronger MFA, suggesting that pregnant women, faced with the need to reorganize their maternal role and resources for their baby, may be more sensitive to this role and its demands (McNamara et al., 2019). On the other hand, McNamara et al. (2019), in a literature review, observed negative associations between stress and MFA, causing harm both in the pre- and postnatal phases, as did McNamara et al. (2022), who evaluated pregnant women attending outpatient care at a public prenatal clinic in New South Wales, and Lutkiewicz et al. (2020), in a study with mothers in the city of Gdansk.

Thus, the way pregnant women experience this period will directly impact the development of their motherhood and, consequently, the establishment of MFA. Regulated by her mental health, MFA is a vital component in fulfilling the maternal role and serves as a predictor of postpartum attachment, thereby promoting the child's long-term physical, cognitive, and socioemotional development (Lutkiewicz et al., 2020; Palma et al., 2020; Santos & Vivian, 2018; Tichelman et al., 2019).

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These factors justify and reinforce the importance and need for further research on the subject, especially in the context of Primary Health Care (PHC), which is a reference for ongoing care for many women. The literature still presents inconclusive results regarding Maternal-Fetal Attachment in high-risk pregnancies, and there is a lack of studies on the topic focusing on users of BHUs, along with differential investigation of stress symptomatology concomitant with depression and anxiety (Lima et al., 2024; Rollè et al., 2020; Rubin et al., 2023). Therefore, this study aimed to evaluate the socioeconomic, gestational, social support, and psychological characteristics associated with MFA in pregnant women in PHC. It is believed that older women have lower socioeconomic status, do not live with a partner, are not primiparous, have a high-risk pregnancy, lower gestational age, an unintended pregnancy, or lack social support are likely to exhibit lower average levels of MFA. Similarly, women with depression, anxiety, or stress symptomatology will have lower mean scores.

Method

This quantitative, descriptive, correlational, cross-sectional study was conducted with pregnant women in primary health care in a municipality in Rio Grande do Sul, Brazil.

Participants

The target population consisted of 162 pregnant women, aged 18 years or older, living in the catchment area of BHUs managed by a university in a municipality in Rio Grande do Sul. Of these, 9 refused to participate in the study, and for logistical and care-related reasons, 2 were excluded from the sample because they no longer resided in the city, resulting in a final total of $N = 151$ participants.

Instruments

General questionnaire: designed to collect exposure variables relevant to the general characterization of the sample and data analysis, such as: age (18 to 34 years and 35 years or older); living with a partner (no/yes); first pregnancy (no/yes); gestational trimester (1st trimester up to 13 weeks, 2nd trimester from 14 to 26 weeks, and 3rd trimester from 27 weeks onward); social support (no/yes); intended pregnancy (no/yes); high-risk pregnancy (no/yes) identified at the initial stage of prenatal care.

Brazil Economic Classification Criteria: according to the *Associação Brasileira de Empresas de Pesquisa* (Brazilian Association of Research Companies – ABEP, 2022), it is used for economic classification as an exposure variable in the sample and is based on the quantity of material assets, the structural and sanitary conditions of the residence and the education level of the head of the household, defined as the person who contributes the largest share of household income. The classification is divided into six classes: A, B1, B2, C1, C2, and DE, which for this study are grouped as follows: DE with an average income of R$900.60; B/C with an average income between R$10,361.48 and R$1,965.87; and A with an average income of up to R$21,826.74, considering "DE" to be the lowest economic class and "A" the highest.

Depression, Anxiety, and Stress Scale – Short form (DASS-21): adapted for Brazil in 2014 by Vignola and Tucci, with high adequacy (KMO = 0.949, $\chi^2 = 3542.253$, $p < .01$) and good internal consistency (Cronbach's α of .92 for depression, .90 for stress, and 0.86 for anxiety), the scale was designed to identify symptoms of depression, anxiety, and stress as exposure variables in the sample. It consists of a 21-item self-report scale, composed of three Likert-type subscales, namely stress (questions 1, 6, 8, 11, 12, 14, and 18), anxiety (questions 2, 4, 7, 9, 15, 19, and 20) and depression (questions 3, 5, 10, 13, 16, 17, and 21), with four possible responses ranging from "did not apply at all" with a score of zero to "applied very much, or most of the time" with a score of 3. The result is obtained by adding the item scores of each subscale, which must be multiplied by 2 to calculate the final score and apply the cutoff point. For this study, based on the original cutoff score, the presence of anxiety symptomatology was considered from 10 points, the presence of depressive symptomatology from 14 points, and stress from 19 points.

Maternal Fetal Attachment Scale (MFAS): used to assess this study's outcome, it was initially developed by Cranley (1981), showed evidence of validity for Brazil by Feijó (1999), and recently received its abbreviated version by Lima et al. (2022), conducted with pregnant women in primary health care, aiming to investigate behaviors developed during pregnancy in preparation for the birth of the baby, with appropriate internal consistency (Cronbach's $\alpha = .878$) and composite reliability (>.70). It consists of a Likert-type instrument containing 15 items divided into 3 domains, namely: "Experiencing expectations" (items 1 to 5), "Imagining and caring for the fetus" (items 6 to 10), and "Interacting with the fetus" (items 11 to 15), with five possible responses: almost always, frequently, sometimes, rarely, and never, with scores ranging from 5 to 1, respectively. The result is obtained by summing the scores of each item on the scale, with 15 points representing the lowest level of Maternal-Fetal Attachment and 75 points the highest. Since there are no cutoff points, higher scores indicate greater maternal-fetal attachment.

Procedures

Data collection. Initially, a pilot study was conducted with four pregnant women who were not affiliated with the healthcare services included in the sample, to verify any necessary modifications related to the applicability and logistics of the study. Subsequently, from April to September 2023, a survey was conducted of pregnant women residing within the coverage area of the BHUs managed by the aforementioned university. Data collection then began through the administration of the questionnaire, which was developed using the Google Forms platform and conducted via telephone calls by the researchers responsible for the study. Subsequently, an active search for pregnant women who had not been contacted was conducted

to minimize possible losses and avoid selection bias, and these women responded to the questionnaire in person.

Data analysis. The data collected resulted in an Excel spreadsheet, which was later analyzed using IBM SPSS Statistics 25.0. The absolute (*N*) and relative (%) frequencies were used to characterize the sample, along with the mean and Standard Deviation (*SD*) to measure participants' age. Bivariate analyses were conducted using Analysis of Variance (ANOVA) and Student's t-test for descriptive purposes. For analytical purposes, considering the non-normality of the MFA variable, equivalent non-parametric tests (Kruskal-Wallis and Mann-Whitney) were performed. As a final step to adjust for confounding factors, all variables were analyzed with multiple linear regression using the Backward method, assuming a 5% significance level ($p < .05$) for interpreting statistically significant associations.

Ethical considerations

The research was approved by the Human Research Ethics Committee of the Universidade Católica de Pelotas under opinion No. 5,993,585 and CAAE No. 67733523.0.0000.5339. During the initial contact with the participants, the information described in the Free and Informed Consent Term (FICT) was verbally communicated. The participants verbally consented to the study, emphasizing the confidentiality of the data obtained and that they could withdraw from the study at any time without prejudice or loss of assistance. Pregnant women identified with depressive, anxious, and/or stress symptomatology were immediately referred to the health service of their own BHU for this purpose. It is noteworthy that the identification of gestational risk occurred at the initial prenatal visit at the BHU and was later confirmed during data collection. Thus, women diagnosed with high-risk pregnancies were referred by the health service itself for follow-up at a specialized outpatient clinic, in accordance with the guidelines of the Health Care Network (HCN).

Results

Table 1 presents the socioeconomic, gestational, social support, and psychological characteristics of pregnant women living in the coverage area of BHUs managed by the university in a municipality of Rio Grande do Sul between April and September 2023, along with the bivariate analysis of these characteristics in relation to the MFA. Regarding socioeconomic characteristics, the average age in the sample was 26.8 years ($SD \pm 5.5$), the majority (55.6%) were classified between economic classes B/C (average income ranging from R$5,755.23 to R$1,965.87), and 70.2% lived with their partner. In terms of gestational characteristics, most were in their second trimester of pregnancy (50.3%) and were not primiparous (66.9%), while 39.1% had a high-risk pregnancy. As for the pregnancy acceptance, 95.4% reported wanting the pregnancy and feeling supported (95.4%). With respect to the mental health of the pregnant participants, as measured by the DASS-21, 10.6% showed depressive symptomatology, 25.2% anxiety symptomatology, and 17.2% stress-related symptomatology (Table 1).

In the bivariate analysis, the mean MFA Rank among pregnant women in the first trimester was 39.9, 74.1 in the second trimester, and 95.8 in the third trimester, indicating a statistically significant difference between the means ($p < .001$; $H(2) = 27.0$). These data, analyzed using the ANOVA test, also show linearity between them, indicating that the more advanced the gestational trimester, the higher the mean MFA of the pregnant woman ($p < .001$). In turn, the other socioeconomic, gestational, and psychological data presented in Table 1 showed no association with MFA ($p > .05$) in the bivariate analysis.

To deepen the understanding of gestational age data in relation to MFA, Table 2 presents the mean scores according to the three domains of Maternal–Fetal Attachment proposed by the MFA scale. Among these, domain 1 "Experiencing expectations" ($p = .035$; $H(2) = 6.7$), as well as domain 3 "Interacting with the fetus" ($p < .001$; $H(2) = 27.7$), showed a significant increase as pregnancy progressed, with mean ranks of 61.1 and 38.3 in the first trimester, 73.4 and 75.2 in the second trimester, and 86.9 and 94.8 in the third trimester, respectively. Additionally, ANOVA revealed a linear trend in the data, indicating that the more advanced the trimester, the higher the mean scores for these domains ($p < .001$). Only Domain 2, "Imagining and caring for the fetus," showed no significant differences across trimesters ($p > .05$).

In the multivariate linear regression analysis presented in Table 3, pregnant women over the age of 35 had 4.4 points lower MFA scores compared to those aged 18 to 34 ($p = .019$; $\beta = -.2$). Also, for each increase in gestational trimester, MFA scores increased by 5.8 points ($p < .001$; $\beta = .5$). Likewise, women who reported receiving social support during pregnancy had MFA scores 8.3 points higher than those who did not report such support ($p = .005$; $\beta = .2$). Finally, pregnant women presenting stress symptomatology had AMF scores 4.1 points lower than those without such symptomatology ($p = .014$; $\beta = -0.2$). The remaining variables were not associated with Maternal-Fetal Attachment ($p > .05$).

Discussion

This study aimed to evaluate the socioeconomic, gestational, social support, and psychological characteristics associated with MFA in pregnant women in PHC. Regarding socioeconomic characteristics, older maternal age was negatively associated with MFA, reinforcing previous studies (McNamara et al., 2019). The sample analyzed shows that pregnant women over the age of 35 have lower mean attachment scores when compared to younger pregnant women. According to Ertmann et al. (2021), these data, provided they are not considered in isolation as risk factors for the relationship, represent an important predictor of the intensity of Maternal–Fetal Attachment and are associated with more realistic expectations, greater concern about the changes imposed by pregnancy, along with lower performance of roles attributed to motherhood. Branjerdporn et al. (2020) also report in their results that interaction with the fetus is

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Table 1

Socioeconomic, gestational, social support, and psychological characteristics associated with the short version of the Maternal-Fetal Attachment Scale in pregnant women living in the coverage area of Brazilian Basic Health Units administered by the university in a municipality of Rio Grande do Sul. 2023. (N = 151)

	MATERNAL-FETAL ATTACHMENT			
	N (%)	Mean (*SD*)	Mean Rank	*p*-value
Age				.209
18 to 34 years	132 (87.4)	77.7 (8.6)	77.7	
35 years or older	19 (12.6)	64.2 (9.7)	64.2	
ABEP				.108
B/C	84 (55.6)	63.6 (8.5)	70.9	
D/E	67 (44.4)	65.4 (8.9)	82.4	
Living with a partner				.290
No	45 (29.8)	62.9 (10.3)	70.2	
yes	106 (70.2)	65.1 (7.9)	78.4	
Gestational age				<.001*
1st Trimester	24 (15.9)	56.7 (9.6)	39.9	
2nd Trimester	76 (50.3)	64.4 (8.2)	74.1	
3rd Trimester	51 (33.8)	68.1 (6.5)	95.8	
Primiparity				.399
No	101 (66.9)	65.1 (7.8)	78.1	
Yes	50 (33.1)	63.1 (10.3)	71.7	
High-risk pregnancy				.110
No	92 (60.9)	64.1 (8.7)	74.1	
Yes	59 (39.1)	64.9 (8.8)	78.9	
Intended pregnancy				.443
No	7 (4.6)	59.9 (13.9)	63.6	
Yes	144 (95.4)	64.7 (8.4)	76.6	
Social Support				.168
No	7 (4.6)	56.0 (16.0)	53.8	
Yes	144 (95.4)	64.9 (8.1)	77.1	
Depressive Symptomatology				.372
No	135 (89.4)	65.0 (7.7)	77.1	
Yes	16 (10.6)	59.7 (14.5)	66.8	
Anxiety Symptomatology				.961
No	113 (74.8)	64.7 (8.0)	76.1	
Yes	38 (25.2)	63.6 (10.7)	75.7	
Stress Symptomatology				.313
No	125 (82.8)	65.0 (7.8)	77.6	
Yes	26 (17.2)	61.6 (12.0)	68.1	

Note. *Statistically significant association.

Table 2

Gestational age associated with domains of the shortened version of the Maternal-Fetal Attachment Scale in pregnant women living in the coverage area of Brazilian Basic Health Units administered by the university in a municipality of Rio Grande do Sul. 2023. (N=151)

	EXPERIENCING EXPECTATIONS			INTERACTING WITH THE FETUS		
	Mean (*SD*)	Mean Rank	*p*-value	Mean (*SD*)	Mean Rank	*p*-value
Gestational age			.035*			<.001*
1st Trimester	21.2 (4.5)	61.1		14.1 (6.2)	38.3	
2nd Trimester	22.7 (2.7)	73.4		19.4 (5.4)	75.2	
3rd Trimester	23.5 (1.9)	86.9		22.0 (3.0)	94.8	

Note. *Statistically significant association.

Table 3

Multiple linear regression analysis of socioeconomic, gestational, social support, and psychological variables as predictors of Maternal-Fetal Attachment in pregnant women living in the coverage area of Brazilian Basic Health Units administered by the university in a municipality of Rio Grande do Sul. 2023. (N=151)

	MATERNAL-FETAL ATTACHMENT			
	β	B	95% *CI*	*p*-value
Age	-0.2	-4.4	(-8.1;-0.7)	.019*
ABEP	0.1	1.8	(-1.0;4.6)	.216
Living with a partner	0.0	0.5	(-2.6;3.5)	.750
Gestational age	0.5	5.8	(4.1;7.6)	<.001*
Primiparity	-0.1	-1.9	(-4.5;0.7)	.154
High-risk pregnancy	0.0	0.8	(-1.8;3.4)	.557
Intended pregnancy	0.1	3.3	(-2.6;9.1)	.269
Social Support	0.2	8.3	(2.5;14.1)	.005*
Depressive Symptomatology	0.0	-0.0	(-5.2;5.1)	.989
Anxiety Symptomatology	0.0	0.4	(-2.9;3.6)	.832
Stress Symptomatology	-0.2	-4.1	(-7.4;-0.9)	.014*

Note. *Statistically significant association.

negatively correlated with maternal age, with younger women experiencing greater pleasure in this interaction. Moreover, the authors state that older maternal age is associated with an increase in depressive symptomatology, which, under certain circumstances, contributes to a reduction in MFA.

Regarding gestational age, the study result showed significantly higher mean MFA scores in pregnant women in the third trimester when compared to those in the first and second trimesters. These data show not only an abrupt increase, but also a continuous and linear increase in these means, thus indicating a higher MFA score as pregnancy progresses. McNamara et al. (2019) report that 6 out of 10 studies analyzed found that pregnant women in later stages of pregnancy reported stronger MFA. Similarly, Tichelman et al. (2019) report that pregnant women assessed in a later stage of pregnancy exhibited better quality of Maternal–Fetal Attachment compared to those in the early stages.

Rosa et al. (2021), in a study on parental bond perception and its association with MFA among pregnant women in the city of Pelotas, Rio Grande do Sul, state that the positive association between advancing pregnancy and higher MFA is mainly due to the growth and onset of fetal movements perceived by the pregnant women. The authors argue that these bodily manifestations allow a more tangible and realistic connection with the fetus, which until then was only imagined, enabling greater interactions between the mother–baby dyad. Recent experimental studies with pregnant women also indicate that the technique of counting fetal movements, used to assess fetal health, may represent a protective factor for increased MFA. It is important to note that not only the counting of movements itself, but also the mother's involvement with them is important, in this case, a period of the day when the focal point is her baby. At this moment, the pregnant woman engages in behaviors such as caressing her belly, talking to her, and especially bringing the image of her baby to consciousness, thereby increasing fetal sensitivity and triggering better quality and stronger attachment (Cuijlits et al., 2019).

Furthermore, these results may be supported by the significant advancements in ultrasound technology, which now allow for anatomical reconstructions that closely resemble the actual appearance of the fetus. In a study on the use of 3D-printed facial models in healthy pregnancies, Coté et al. (2020) report that such models contribute to a significant increase in MFA, showing comparable outcomes in terms of maternal attachment quality and the amount of time mothers spend thinking about the fetus. All these findings reinforce the results observed in this study regarding the significant association in the overall score and in two domains of the MFAS, which assess more cognitive behaviors related to early expectations about the fetus and altruistic behaviors, such as protection, interaction, and preparation for the baby's arrival. These, in turn, represent the early consolidation of the Maternal–Fetal Attachment.

With respect to the pregnant woman's perception of social support, the results confirm the hypothesis that women lacking a social support network show a lower mean MFA score compared to those who feel supported during pregnancy. These findings are consistent with previous studies demonstrating positive associations between these two variables and beneficial outcomes for both the prenatal and postnatal periods (Cuijlits et al., 2019; Ertmann et al., 2021; McNamara et al., 2019; Rosa et al., 2021; Tichelman et al., 2019). Therefore, social support functions as a protective factor during the perinatal period, facilitating a smoother transition and adaptation to motherhood. It also influences the development of the maternal role, helping to prevent isolation, supporting the planning and imagination of the baby, as well as representing a potential stress mitigator (Ertmann et al., 2021; McNamara et al., 2019; Rosa et al., 2021).

Concerning the psychological aspects and mental health of pregnant women, the study's results are consistent with previous findings (McNamara et al., 2019; McNamara et al., 2022; Lutkiewicz et al., 2020), confirming the hypothesis that pregnant women with stress symptomatology have lower mean MFA scores when compared to pregnant women without this symptomatology. When associated with ambivalent or negative feelings about pregnancy, stress represents a risk factor for prenatal bonding, suggesting that these pregnant women may have greater difficulty forming positive mental representations about the fetus and engaging in behaviors of desire and interaction with it (McNamara et al., 2019; McNamara et al., 2022). Lutkiewicz et al. (2020), from the perspective of early postnatal attachment, state that the maternal mental state, specifically the presence of stress symptomatology, may be negatively related to the ongoing process of mother–infant bonding during this period. They further emphasize that future research should analyze the trajectory of this bond to

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support the development of interventions for mothers, aiming to prevent potential negative outcomes.

However, some limitations must be considered. Since this is a cross-sectional study, it is not possible to infer causality. Similarly, due to the use of a non-probabilistic sample, the results of this study cannot be generalized. Furthermore, given the greater vulnerability of self-reports, a bias can be identified in the collection of the gestational risk variable. Nevertheless, the importance and necessary attention to the collected data is reinforced, considering the lack of studies focused on the mental health of pregnant women in primary health care, as well as current evidence pointing to various impairments that may be associated with poor MFA conditions, including reduced fetal growth, disruptions in the formation of the mother–infant bond, and subsequent adverse outcomes in the child's future development (Kim et al., 2019; Lutkiewicz et al., 2020).

Therefore, since this is an appropriate extension of the MFA, attention should be directed toward pregnant women of advanced maternal age, maternal susceptibility to stress, as well as the importance of an adequate social support network starting in the prenatal period. The clarification and identification of these factors enable preventive planning, improved guidance for pregnant women receiving primary health care services, and the prioritization of women's health initiatives that promote significant reductions in maternal mortality rates over the years (Brazilian Ministry of Health, 2022). This, in turn, contributes to better results related to MFA and to the ongoing professional development of healthcare providers in these settings. Given their presence within the same territorial area as the pregnant women, these professionals often establish strong bonds with them, thereby facilitating the dissemination of information. Based on this analysis, a future perspective emerges to evaluate stress symptomatology during the postpartum period, examining its association with the mother's attachment developed during this stage.

Data Availability

The dataset supporting the results of this study is not publicly available.

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