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ORIGINAL ARTICLE

The effect on pregnant women's prenatal attachment of a nursing practice using the first and second Leopold's maneuvers

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Abstract

Objective: This study aimed to determine the effect on pregnant women's prenatal attachment of a nursing practice using the first and second Leopold's maneuvers.

Method: This experimental, randomized and controlled study was conducted in a pregnancy class of a training and research hospital in Kocaeli, Turkey from September 2016 to September 2017. Its sample included 100 pregnant women, 50 in the experimental group and 50 in the control group (https://www. random. org, accessed: 09.20.2016). Data were collected using a personal information form, the Prenatal Attachment Inventory (PAI) and the Fetal Position Awareness Scale (FPAS). The study offered education that included fetal development, the first and second Leopold's maneuvers, and Leopold's maneuvers were administered in the 28th week of the women's pregnancy and re-administered in the 32nd and 36th weeks of pregnancy. No intervention was administered to the control group in these weeks, but the scales were administered.

Results: The sociodemographic, obstetric, social support and baby-related characteristics of the groups were similar ($p > .05$). There were no statically significant differences between their mean PAI and FPAS scores in the 28th week of pregnancy ($p > .05$). The experimental group's mean PAI and the FPAS scores in the 32nd and 36th weeks of pregnancy were significantly higher than those of the control group ($p < .01$).

Conclusion: The study concluded that Leopold's maneuvers affected the pregnant women's prenatal attachment levels.

KEYWORDS

Leopold's maneuvers, nursing, pregnancy, prenatal attachment

1 | INTRODUCTION

Maternal-fetal attachment is a permanent process that starts in pregnancy and continues after birth. The attachment between mothers and babies is defined as the initial and deepest relationship. It affects the health of mothers and babies both biologically and psychologically (Daglar & Nur, 2018; Göbela, Stuhrmanna, Harderb, Schulte-Markworta, & Susanne Mudraa, 2018; HöbekAkarsu, Tuncay, & YüzerAlsaç, 2017; Orta & Sümer, 2016; Tüzün & Sayar, 2006). Studies have shown that a major part of human brain development, especially learning capacity, develops in the prenatal period and at the beginning of life. Safe, nurturing and positive attachment that develops early lays the foundation for healthy development (Glover & Capron, 2017).

The notion of attachment was first addressed in the 1940s, and theorized by Bowlby in the 1950s and then

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brought into the laboratory by Mary Ainsworth. The term, prenatal attachment, has been defined since the 1980s as the bond a pregnant woman develops with her baby. Researchers, including Cranley, have addressed maternal-fetal attachment multi-directionally, and defined it as the whole of mothers' relationships with their babies and behaviors that show their love toward their unborn babies. Condon (1993) defined it as a prenatal emotional bond between parents and their babies. Muller (1993) described prenatal attachment as "a unique and loving bond that develops between a woman and her fetus" (Alan Dikmen & Cankaya, 2018; Busoneraa, Cataudellab, Lampisb, Tommasic, & Zavattinia, 2017; Dereli, 2013; Forte Camarneiro & Rosado de Miranda Justo, 2017; Göbela et al., 2018; Muller, 1993; Orta & Sümer, 2016; Petri et al., 2018; Tüzün & Sayar, 2006; Yılmaz & Beji, 2010).

Understanding the nature of prenatal attachment and the factors that affect it is important for healthcare staff. Previous studies have shown that the factors that negatively affect attachment include: not wishing to get pregnant, not being satisfied with being married, not good relationships between spouses, anxiety, depression, lack of social support from the mother, lower age, lower education, lower employment status and income level, education status of fathers, number of pregnancies, number of births, living children, miscarriage history, maternal obesity, risky pregnancies, painful delivery, neonatal diseases and miscarriage (Alan Dikmen & Cankaya, 2018; Hopkins et al., 2018; Salehi, Kohan, & Taleghani, 2018; Yılmaz & Beji, 2010).

The sense of motherhood gets stronger with early and healthy communication and interaction between mothers and babies. Strong prenatal attachment leads mothers to have positive postpartum ideas about motherhood and enables children to have better cognitive development, motor development and social communication (Güleşen & Yıldız, 2013; Malekpour, 2007; Pisoni et al., 2014). Weak prenatal attachment is associated with problems such as feeling discomfort about the fetus, fetal abuse, negative effects on the organization of the right side of children's brains, poor emotional and mental development, refusing to go to school, aggressive and hostile behaviors in childhood, tendencies toward behavioral disorders in adolescence, drug dependence in adulthood, anxiety, depression, mood disorders and child abuse (Brandon, Pitts, Denton, & Stringer, 2009; Petri et al., 2018; Salehi & Kohan, 2017). Studies reported that mothers with weak attachment used alcohol and nicotine more, had higher levels of anxiety, had higher levels of risk for damaging the fetus, had increased levels of postpartum anxiety and depression (Akarsu and Rathfish, 2017; Göbela et al., 2018). Weak prenatal attachment also leads to problems such as feeding disorders, growth and developmental deficiencies, restlessness, crying and sleep disorders (Hopkins et al., 2018; HöbekAkarsu et al., 2017)

The Prenatal Attachment Inventory (Müller & Mercer, 1993) and the Prenatal Attachment Inventory-Revised (PAI-R, 2014 revised version of the PAI by Pallant et al.) is one of the most commonly used scales (Göbela et al., 2018; Karakulak Aydemir & Alparslan, 2016; Malm, Hildingsson, Rubertsson, Ra destad, & Lindgren, 2016; Pallant, Heins, Hildingsson, Cross, & Rubertsson, 2014; Van den Bergh & Simons, 2009; Kavlak & Sirin, 2009; Taylor, Atkins, Kumar, Adams, & Glover, 2005).

Recent studies have shown that fetuses develop the ability to perceive, acquire and learn what they hear beginning in the 26th week of pregnancy (Lubbe, 2007). Therefore, mothers and families should be informed about the developmental stages, perception and affection levels of the fetus to create prenatal attachment. Interventions that enable pregnant women to take active roles in pregnancy should be administered and taught by nurses since this is important for prenatal attachment.

Nursing practices that improve mothers' fetus awareness and maternal attachment during pregnancy have been described in the literature (Brandon et al., 2009). These studies concern attachment behaviors or skills that can contribute to stronger prenatal attachment. They include palpating fetal parts, counting fetal movements, getting information about childcare, keeping a diary, and singing and talking to fetuses (Cannella, 2005; Marzouk & Nabil, 2015). Fetal movements being perceived by mothers are also an important milestone in prenatal attachment (Malm et al., 2016; Condon & Corkindale, 1997).

A randomized, controlled study conducted by Mikhail et al. (1991) with 213 pregnant women reported that teaching mothers to count fetal movements increased maternal prenatal attachment (Brandon et al., 2009). Malm et al. found that the prenatal attachment scores of mothers who perceived three or more fetal movements within 24 hr in the last trimester of pregnancy were higher (Malm et al., 2016). A study conducted by Deleram et al. in Iran reported that counting of fetal movements by mothers in their 28th through 37th weeks of pregnancy did not affect maternal-fetal attachment; however, they emphasized the need for a randomized controlled and multi-centered study involving a variety of psychological factors (Delaram et al., 2018).

Fetal palpation using Leopold's maneuvers increases prenatal attachment (Nishikawa & Sakakibara, 2013). When a mother gives tactile stimulus to her fetus in the third trimester of pregnancy, the fetus responds with movements (Taşkın, 2016). Nurses and midwives can teach practices that mothers can do independently during pregnancy, and doing so will increase their prenatal attachment levels (Nishikawa & Sakakibara, 2013).

Abdominal examination done by hand using Leopold's maneuvers is practiced by midwives and nurses starting in the 24th week of pregnancy (Yazıcı & Dutucu, 2017). The length of the uterus, position of the fetus, dorsum, extremities, present parts of fetus and fetal movements are determined, and nurses communicate with pregnant women during this medical examination (Nishikawa & Sakakibara, 2013). The findings of Leopold's maneuvers can be explained to pregnant women, and mothers can be taught to touch their babies (Murray & Kinney, 2010; Nishikawa & Sakakibara, 2013). The maneuvers touch the uterus through the abdomen. Fetuses generally perceive this stimulus and respond with movements (Lubbe, 2007; Murray & McKinney, 2010). Leopold's maneuvers can help mothers to perceive and visualize fetuses.

Therefore, this study aimed to determine the effect on pregnant women's prenatal attachment of a nursing practice using the first and second Leopold's maneuvers.

2 | METHODS

2.1 | Design and sample

This experimental and randomized controlled study was conducted in a pregnancy class at a training and research hospital in Kocaeli, Turkey from September 2016 to September 2017.

2.2 | Study population and sample

The study population included all the pregnant women who attended the pregnancy class between September 1, 2016 and September 1, 2017. The study was designed after ethics committee consent and institutional approvals were obtained (Kocaeli University Ethics Committee for Non-Interventional Clinical Research, Project number: 21/09/ 2016/230). During the study, 147 pregnant women attended a pregnancy class, and 108 of them met the sample inclusion criteria; however, the study was conducted with 106 voluntary participants since two pregnant women refused to participate. The participants were randomized using an online program (https://www.random.org accessed: 09.20.2016). Of the participants in the experimental group, two did not proceed with the pregnancy class and one gave birth preterm. Three participants in the control group also gave birth preterm, and were not included in the study. The study was finalized with 100 participants (50 in the experimental group, and 50 in the control group). The study design based on the Consolidated Standards of Reporting Trials algorithm is shown in Figure 1.

The sample included literate participants ranging in age from 18 to 40 with spontaneous single pregnancies in their 28th week. They had no communication problems, mental deficiencies, chronic (hypertension, cardiac diseases, obesity, etc.), obstetric or psychiatric diseases and agreed to participate in the study and regularly attend its pregnancy classes.

2.3 | Study instruments

This study used a questionnaire developed by the researchers that included 40 questions about sociodemographic and obstetric characteristics.

It also used the 21-item PAI developed by Müller in 1993 to determine attachment levels during prenatal period. The PAI is a four-point Likert-type scale, and all its items are scored between one and four (1 = never, 2 = sometimes, 3 = often, and 4 = always). Scale scores range between 21 and 84 (Bergh & Simons 2009, Yılmaz, 2013). The Cronbach's alpha co-efficient of the scale was $\alpha = .84$ in the Turkish adaptation carried out by Yılmaz and Beji in 2009. The Cronbach's alpha co-efficient of the scale was $\alpha = .86$ in the Turkish adaptation carried out by Karakoca and Ozkan (2017). This study found the Cronbach's alpha co-efficient of the scale to be $\alpha = .815$, which indicates high reliability. Permission to use the scale, related institutional approvals and ethics committee approvals were obtained before conducting the study.

The Fetal Position Awareness Scale (FPAS) was developed by Nishikawa and Sakakibara (2013) to assess maternal levels of perception of fetal position. It has six five-point Likert-type items that are scored between one and five (1 = never, 2 = rarely, 3 = sometimes, 4 = often, and 5 = always). High scores indicate high levels of fetal position awareness. Permission for use was obtained from the authors of the scale. Its internal consistency was found to be 0.74. This study found its Cronbach's alpha co-efficient to be .693. The questionnaire and the scales were completed by the researcher during face-to-face interviews.

2.4 | Data procedure pilot test

A pilot test was conducted with 10 pregnant women in their 28th week of pregnancy who attended a hospital pregnancy class. The comprehensibility and applicability of the forms and scales were assessed, and these data are not included in this study.

2.5 | Application

The study was conducted from September 1, 2016 to September 1, 2017. The participants, women in their 28th week of pregnancy, were among the pregnant women who would attend a 6-week educational program and were randomly selected online. The educational protocol used in the study is given below.

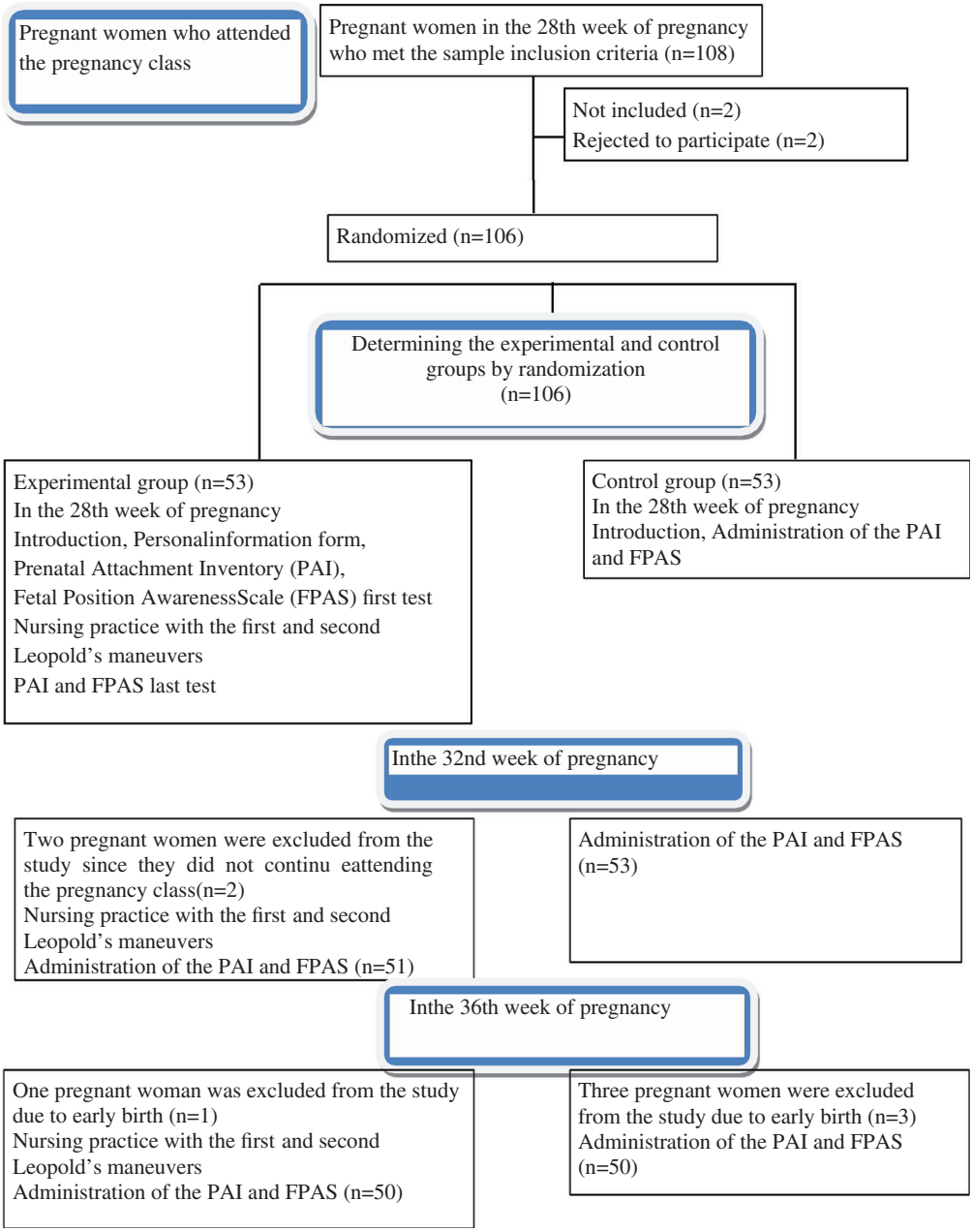

FIGURE 1 Study flow chart

1. Meeting
2. Completing the questionnaire
3. Administration of PAI and FPAS
4. Experimental group: information about embryonal-fetal developmental stages was provided to the group. The pregnant women were given brochures indicating the use of the first and second Leopold's maneuvers. The first and second Leopold's maneuvers were demonstrated and then the women were asked to try these maneuvers on themselves and listen to the fetal heartbeat.

Experimental group: during the 32nd and 36th week of pregnancy, abdominal examination was performed using Leopold's maneuvers and fetal heart sounds were heard using a manual Doppler. The pregnant women completed the PAI and FPAS. The pregnant women's questions and suggestions were addressed. The intervention took 45 to 60 min with a maximum of five participants per session.

Control group: before the meeting, the pregnancy diagnosis form, FPAS, and PAI were administered. The same forms were used again at the 32nd and 36th week of pregnancy. Upon completion of the study, the pregnant women used the Leopold's maneuver and felt the fetus. They heard their fetal heartbeat using manual Doppler. Excluding the last session, data collection was completed in 20 min with a maximum of five people in the control group. Upon completion of the study, the control group was provided with educational brochures and given gifts and the experimental group was given gifts.

All of this study's procedures are shown in Figure 1.

TABLE 1 Inter group assessment of sociodemographic characteristics ($N = 100$)

		Groups		Test value
		Experimental ($n = 50$)	**Control ($n = 50$)**	***p***
Age (years)	Min-max (median)	20–38 (28)	20–39 (27)	t: 0.309
	Mean ± SD	27.84 ± 4.28	27.56 ± 4.77	[a].758
Education level	Primary school	1 (2.0)	2 (4.0)	
	Secondary school	6 (12.0)	7 (14.0)	χ^2: 4.540
	High school	5 (10.0)	12 (24.0)	[c]*.204*
Education level of spouse	University	38 (76.0)	29 (58.0)	
	Primary school	2 (4.0)	1 (2.0)	
	Secondary school	4 (8.0)	7 (14.0)	χ^2: 2.390
	High school	18 (36.0)	22 (44.0)	[c]*.534*
Employment status economic status	University	26 (52.0)	20 (40.0)	
	Yes	18 (36.0)	20 (40.0)	χ^2: 0.170
	No	32 (64.0)	30 (60.0)	[b]*.680*
	Less income than expenses	5 (10.0)	7 (14.0)	χ^2: 0.541
	Income equal to expenses	40 (80.0)	37 (74.0)	[b]*.763*
	More income than expenses	5 (10.0)	6 (12.0)	

[a]Student's *t* test.
[b]Pearson's Chi-square test.
[c]Fisher-Freeman-Halton test.

TABLE 2 Intergroup assessment of baby-related features ($N = 100$)

		Groups		Test value
		Experimental ($n = 50$)	**Control ($n = 50$)**	***p***
		***n* (%)**	***n* (%)**	
Time when fetal movements were perceived	16th-18th weeks of pregnancy	26 (52.0)	28 (56.0)	χ^2: 0.407
	19th-21st weeks of pregnancy	17 (34.0)	17 (34.0)	[a].816
	22nd-24th weeks of pregnancy	7 (14.0)	5 (10.0)	
Seeing fetus on ultrasound	Yes	50 (100,0)	49 (98.0)	χ^2: 1.010
	No	0 (0.0)	1 (2.0)	[c]1.000
Sex of the baby	Female	25 (50.0)	24 (48.0)	**χ^2: 0.040***
	Male	25 (50.0)	26 (52.0)	[a].841
Baby matches the preferred gender	Yes	13 (26.0)	18 (36.0)	χ^2: 3.039
	No	2 (4.0)	5 (10.0)	[b].215
	No preference	**35 (70.0)**	**27 (54.0)**	
Talking to the baby	Yes	**47 (94.0)**	**47 (94.0)**	**χ^2: 0.000***
	No	3 (6.0)	3 (6.0)	[c]*1.000*
Listening to music during pregnancy	Yes	**30 (60.0)**	**30 (60.0)**	**χ^2: 0.000***
	No	20 (40.0)	20 (40.0)	[a]*1.000*

[a]Pearson's Chi-square test.
[b]Fisher-Freeman-Halton test.
[c]Fisher's exact test.
*$p < .05$.

TABLE 3 Intergroup distrubition and assessment of the Prenatal Attachment Inventory (PAI)

PAI		Groups		Test value
		Experimental (n = 50)	Control (n = 50)	p
The PAI score in the 28th week of pregnancy	Min-max (median)	41–76 (66)	38–80 (64.5)	t: −0.410
	Mean ± SD	63.58 ± 8.48	64.26 ± 8.11	[a]***.683***
The PAI score in the 32nd week of pregnancy	Min-max (median)	46–84 (71.5)	43–82 (65)	t: 3.367
	Mean ± SD	71.18 ± 7.87	65.66 ± 8.51	[a]***.001****
The PAI score in the 36th week of pregnancy	Min-max (median)	56–84 (76)	47–83 (67)	t: 6.166
	Mean ± SD	76.10 ± 6.76	67.10 ± 7.80	[a]***.001****

[a]Student's t test.
*$p < .01$.

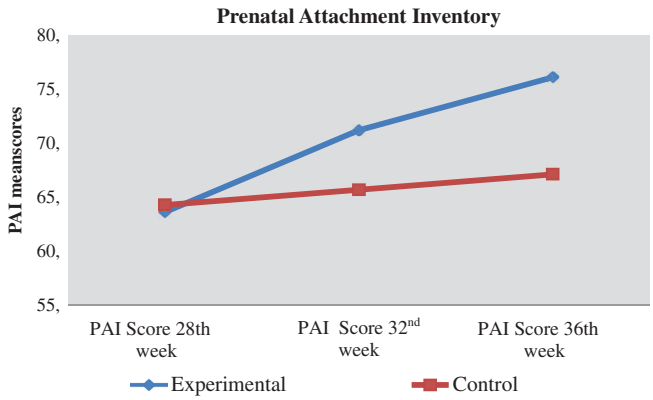

FIGURE 2 Inter group distribution of Prenatal Attachment Inventory (PAI) scores

2.6 | Data analysis

The statistical analysis of the data was conducted using SPSS 20.0 (SPSS Inc., Chicago, IL, USA) software. Descriptive statistics (means, standard deviations, medians, frequencies, ratios, minima and maxima), Student's t test and the Mann-Whitney U-test for the binary comparison of the quantitative data were used to analyze the data. The Kruskal-Wallis test was used to compare three or more groups, the Mann-Whitney U-test with Bonferroni's correction and the paired samples test were used to identify the groups that caused differences. Pearson's and Spearman's correlation analyses were used to assess the relationships between variables. The threshold for significance was $p < .05$.

3 | RESULTS

3.1 | Demographic characteristics

The mean age of the experimental group was 27.84 ± 4.28 years (min: 20, max: 38), and that of the control group was 27.56 ± 4.77 (min: 20, max: 39). There were no statistically significant differences between the groups by age, employment status or education level (Table 1, $p > .05$).

The obstetric characteristics of the pregnant women are shown in Table 1. Of the pregnant women in the experimental group, 82% (n = 41) planned their pregnancy. This was 76% (n = 38) in the control group. Of the experimental group, 99% (n = 49) regularly visited the hospital for checkups.

Of the pregnant women in the experimental group, 52% (n = 26) perceived fetal movements in the 16th and 18th weeks of pregnancy, and the majority of them (94%, n = 47) talked to their babies. Of the pregnant women in the control group, 56% (n = 28) perceived fetal movements in the 16th through 18th weeks of pregnancy (Table 2). Furthermore, most of the pregnant women had an ultrasound scan. They were also observed to whisper to their babies (94.0% n = 47, Table 2).

While there were no differences between the groups' mean PAI scores in the 28th week of pregnancy ($p > .05$), the PAI scores of the experimental group in the 32nd and 36th weeks of pregnancy were significantly higher than those of the control group p (p = .001, $p < .01$, Table 3, Figure 2).

The experimental group's mean PAI score was 63.58 ± 8.48 in the 28th week of pregnancy. The control group's mean score was 64.26 ± 8.11 (Table 2).The experimental group's mean FPAS score was 17.72 ± 4.87. The control group's mean score was 18.20 ± 3.87 (Table 3). There were no statistically significant differences between the groups' PAI and FPAS scores in the 28th week of pregnancy ($p > .05$, Tables 3 and 4, Figure 3).

The PAI scores of the experimental group in the 32nd and 36th weeks of pregnancy were 71.18 ± 7.87 and 76.10 ± 6.76, respectively, and the PAI scores of the control group in the 32nd and 36th weeks of pregnancy were 65.66 ± 8.51 and 67.10 ± 7.80, respectively, with statistically significant differences between the groups s (p = .001, $p < .01$, Table 3).

The FPAS scores of the experimental group in the 32nd and 36th weeks of pregnancy were 24.54 ± 4.40 and

TABLE 4 Intergroup distrubition and assessment of the Fetal Position Awareness Scale (FPAS)

FPAS		Groups		Test value
		Experimental ($n = 50$)	Control ($n = 50$)	p
FPAS score in the 28th week of pregnancy	Min-max (median)	10–30 (17)	9–26 (18)	t: −0.546
	Mean ± SD	17.72 ± 4.87	18.20 ± 3.87	[a]***.586***
FPAS score in the 32nd week of pregnancy	Min-max (median)	11–30 (25)	9–29 (18)	t: 7.426
	Mean ± SD	24.54 ± 4.40	18.34 ± 3.94	[a]***.001****
FPAS score in the 36th week of pregnancy	Min-max (median)	19–30 (28)	9–29 (18)	t: 11.906
	Mean ± SD	27.32 ± 2.92	18.90 ± 4.06	[a]***.001****

[a]Mann Whitney U test.
*$p < .01$.

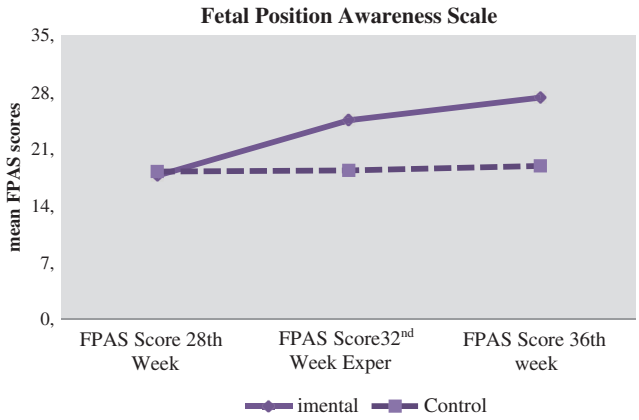

FIGURE 3 Inter group distribution of the Fetal Position Awareness Scale (FPAS) scores

27.32 ± 2.92, respectively, and the FPAS scores of the control group in the 32nd and 36th weeks of pregnancy were 18.34 ± 3.94 and 18.90 ± 4.06, respectively, with significantly high differences between the groups ($p = .001$, $p < .01$, Table 4).

There were no statistically significant differences in the groups' PAI and FPAS scores by age, education level, economic status, parity or planned pregnancy ($p < .01$).

4 | DISCUSSION

This study was conducted to determine the effect of a nursing practice on pregnant women's prenatal attachment using the first and second Leopold's maneuvers. The study found statistically significant differences between the experimental and control groups at the 32nd and 36th weeks of pregnancy. The PAI and FPAS scores of the experimental group to whom education was provided and Leopold's maneuvers administered were higher than those of the control group, indicating that education and Leopold's maneuvers positively affected prenatal attachment. On the other hand, a randomized controlled and experimental study conducted by (Güney & Ucar, 2019) in Turkey provided education to its experimental group about fetal movement counting and found an increase in pregnant women's prenatal attachment levels. As stated in these studies, the maternal-fetal attachment levels can be improved with nursing practices regarding fetal position awareness.

A study conducted in Iran included three control and three experimental groups and prepared an educational program with four sessions (2 hr a week) for the experimental group. The first session of the educational program included subjects such as the benefits of attachment, maternal-fetal attachment, and behaviors that support and develop attachment. These behaviors included counting and recording fetal movements, positive visualization of fetuses, talking to fetuses, imagining breastfeeding and abdominal touching. In other sessions, the women shared information they had recorded. There were no significant differences between the attachment scores of the experimental and control groups at the beginning of the educational program; a statistically significant difference was found afterwards (Abasi et al., 2012). A study by Nishikawa and Sakakibara conducted using the PAI and Leopold's maneuvers reported that their intervention increased prenatal attachment levels (Nishikawa & Sakakibara, 2013). Another study that provided an educational program including the Leopold's maneuvers and counting of fetal movements found an increase in prenatal attachment after the program (Marzouk & Nabil, 2015). A cohort study by Cıldır (2015), conducted to determine the effects of prenatal attachment, pregnancy anxiety and depression on early childhood, found that pregnant women with high prenatal attachment scores during pregnancy did not develop depression or anxiety, and this continued for 2 years postpartum. The emotional and behavioral development of their children was normal. This cohort study also found that mothers of children with developmental insufficiencies had low prenatal attachment scores. Previous studies have shown that preparatory training for delivery supports prenatal attachment. A semi-experimental study conducted by Kartal and Karaman (2018) in Sakarya found PAI scores increased in parallel with educational background.

Education and nursing practices in similar studies increased attachment scores. Educational programs provided by healthcare professional should mention prenatal attachment, strengthen the internal and control focus of pregnant women, and ensure that they are able to take responsibility for their own health and that of their fetuses.

Prenatal attachment is not directly related to age, maternal education levels, the match of a baby's sex to the mother's preference or number of pregnancies (Cannella, 2005). Age, ethnicity, income and education levels affect prenatal attachment at a low level, and social support during pregnancy is important for prenatal attachment (Yarcheski, 2009). A study conducted by Yılmaz and Beji (2010) with 210 pregnant women found low PAI mean scores for women who became pregnant at 35 or older, had low levels of education, did not work, had unplanned pregnancies or were multiparous (Yılmaz & Beji, 2010). This study found no statistically significant difference in PAI scores by maternal age. Yılmaz and Beji (2010) found that the mean PAI scores of pregnant women who were 35 or older were lower than others. A study conducted by Üstünsöz et al. (2010) in Turkey found that, as the ages of pregnant women and their spouses increased, the women's PAI scores fell. A study by Cannella (2005), which included a literature review, reported that maternal age did not affect prenatal attachment. This study's findings are similar to those of some previous studies.

The relationship between the educational levels and prenatal attachment levels of pregnant women was found to be significant in some studies. A study conducted by Metin and Pasinlioğlu (2016) in Turkey found that the PAI mean scores of pregnant women with high education levels were higher than those of pregnant women with less education. There were no significant differences by education level in the experimental group's PAI scores in this study ($p > .05$). While there were no statistically significant differences by education level in FPAS scores in the 28th and 32nd weeks of pregnancy ($p = .051$, $p > .05$), university graduates' FPAS scores in the 32nd week of pregnancy were higher those of their 28th week, which was not significant, but interestingly high. Cannella (2005) found that the education levels of pregnant women did not affect prenatal attachment. This study's findings are similar to those of some previous studies since the education levels of its participants were high.

This study found no statistically significant relationship between PAI and FPAS scores and the perceived economic levels of the pregnant women ($p > .05$). Elkin (2015) found that the PAI scores of pregnant women with more income than expenses were higher than those of pregnant women with other income levels. A study by Yarcheski (2009) which included a literature review reported that economic levels slightly affect prenatal attachment. This study found that economic levels did not affect prenatal attachment.

There were no statistically significant differences in the groups' PAI and FPAS scores by planned pregnancy ($p > .05$). Abbasoğlu et al. (2015) reported that planned pregnancy is not related to maternal attachment. Yılmaz and Beji (2010) found that the PAI scores of the pregnant women with unplanned pregnancies were low. This study's result is similar to that of Abbasoğlu et al. In summary, the study results showed that prenatal attachment was not directly related to maternal age, maternal education level, economic levels and planned pregnancy.

This study was conducted as a randomized controlled study and the participants had high motivation, being the strongest and most important aspect of the study. Limitations of the study included, two pregnant women not attending class, one giving premature birth in the control group and three women not being included in the study due to social or medical reasons like premature birth and the pregnant women who did not attend prenatal classes were not included.

LIMITATIONS

This study cannot be generalized for all pregnant women since it was conducted in one pregnancy center, and it should be conducted again in the pregnancy monitoring polyclinic with pregnant women who did not get education.

CONCLUSION AND RECOMMENDATIONS

Prenatal attachment process positively affects the physical, social and mental health of babies and mothers throughout the prenatal, natal, postnatal and other life periods. This study showed that nursing practices and Leopold's maneuvers increased mothers' awareness on fetal position and maternal-fetal attachment. Thus, it is recommended that all healthcare professionals teach fetal touching, counting fetal movements, and Leopold's maneuvers to all mothers during pregnancy. Also, it is recommended that nurses support pregnant women with education and guidance about the benefits of such interventions. Nurses and other healthcare professionals should announce and distribute visual, audio and written materials about attachment through media and social media. Culturally specific studies should be conducted, and nursing curricula should be updated to include maternal attachment. Bowlby said that prenatal attachment is "a permanent psychological bond between humans." Thus, midwives, nurses and other healthcare professional have important responsibilities to help develop this attachment. In addition, we suggest that studies about the effects of prenatal attachment along with cohort studies be investigated during

the postpartum period and randomized controlled studies and meta-analysis studies be conducted on pregnant women with different characteristics, particularly risky ones.

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CONFLICT OF INTEREST

No potential conflicts of interest were reported by the authors.

AUTHOR CONTRIBUTIONS

This authorship statement confirms that the listed authors meet the authorship criteria and that all authors agree with the content of the manuscript. M. C., and A. E. designed the study. M. C. collected the data. A. E., and M. C. analyzed the data. A.E. drafted and wrote the article. All authors approved the final version for submission.

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