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Original Article

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Trimester-specific and postpartum reference ranges for homocysteine, vitamin B12, and folate levels: a prospective study

İsmail Bağlar[1], Koray Özbay[2], Sahra Sultan Kara[1], Fatma Tufan Altuncu[3], Ceyda Kabadayı Demiray[4], Hazal Aydın Bozcu[1], Esra Keleş[5], Fatih Şanlıkan[5]

[1]Department of Gynecology and Obstetrics, Kartal Lütfi Kırdar City Hospital, İstanbul, Turkiye
[2]Department of Gynecology and Obstetrics, Gebze Private Century Hospital, Kocaeli, Turkiye
[3]Department of Family Medicine, Mahmudiye Family Center, Eskişehir, Turkiye
[4]Department of Family Medicine, Nazife Yaman Family Health Center, İstanbul, Turkiye
[5]Department of Gynecologic Oncology, Kartal Lütfi Kırdar City Hospital, İstanbul, Turkiye

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Corresponding Author: İsmail Bağlar, ismailbg@gmail.com

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ABSTRACT

Aims: Elevated homocysteine levels during pregnancy have been linked to various adverse outcomes, including gestational complications and congenital anomalies. Despite the significance of monitoring homocysteine, reference ranges specific to pregnancy remain poorly defined, particularly within diverse populations. This prospective study aimed to establish trimester-specific reference ranges for serum homocysteine, vitamin B12, and folate levels in a Turkish pregnant population and to evaluate the interrelationships among these biomarkers.

Methods: A total of 220 pregnant women were prospectively assessed across three trimesters and a postpartum period, categorized into four groups: first trimester (n=52), second trimester (n=51), third trimester (n=62), and postpartum (n=55). Serum levels of homocysteine, vitamin B12, and folate were measured, and correlations among these variables were analyzed. Statistical analyses of the collected data were conducted utilizing IBM SPSS Statistics version 25.0.

Results: The determined homocysteine reference ranges were 2.82-6.82, 1.08-7.82, 0.18-8.46, and 0.10-12.13 µmol/L for the first, second, third trimesters, and postpartum period, respectively. Significant negative correlations were observed between homocysteine and both vitamin B12 ($r=-0.180$, $p=0.007$) and folate ($r=-0.374$, $p=0.001$). Notably, age-adjusted homocysteine levels were significantly elevated in the postpartum group compared to all trimesters ($p=0.001$), while vitamin B12 levels were significantly lower in the postpartum period ($p=0.001$).

Conclusion: This study presents the results of a comprehensive investigation into the reference ranges for homocysteine, vitamin B12, and folate levels during pregnancy and postpartum in the Turkish population. The findings of this study underscore the critical importance of regular monitoring of these biomarkers for maternal and fetal health. It is also noted that elevated homocysteine levels are particularly pronounced in the postpartum period. The study concludes with a call for future research to investigate the associations of these biomarkers in more depth in different ethnic groups and geographical regions.

Keywords: Homocysteine, vitamin B12, folate, pregnancy, postpartum, reference intervals

INTRODUCTION

Homocysteine, a sulfur-containing amino acid, is integral to various metabolic pathways, particularly in the remethylation and transsulfuration processes influenced by vitamins B12, B6, and folate.[1] Dysregulation of homocysteine metabolism, which can lead to hyperhomocysteinemia, may result from genetic factors, such as mutations in the MTHFR gene, nutritional deficiencies, and lifestyle factors, including dietary habits and smoking.[2] Elevated serum homocysteine levels have been linked to a range of adverse health outcomes, including cardiovascular diseases and gestational complications, such as pre-eclampsia, recurrent pregnancy loss, and neural tube defects. The implications of homocysteine on maternal and fetal health highlight the necessity of monitoring its levels during pregnancy.[2,3]

Despite the recognized importance of homocysteine in pregnancy, reference ranges for serum levels remain inadequately defined, and current guidelines predominantly focus on the general population.[4] Fluctuations in homocysteine levels throughout gestation may be affected by physiological changes, such as elevated estrogen levels and modified metabolic processes, thereby necessitating trimester-specific reference ranges. Additionally, the interaction between homocysteine, vitamin B12, and folate during pregnancy is critical, as deficiencies in these vitamins can intensify hyperhomocysteinemia and present risks to both maternal and fetal health.[5-8]

To date, there has been a paucity of research focusing on homocysteine reference intervals specific to pregnant populations, particularly within the context of Turkiye. The objective of this study is to establish serum homocysteine reference ranges across the three trimesters of pregnancy and the postpartum period. Additionally, this research seeks to investigate the relationships between homocysteine levels and those of vitamin B12 and folate within this cohort. By providing normative data tailored to our population, this study aims to enhance the accuracy of hyperhomocysteinemia detection during pregnancy and improve its subsequent management.

METHODS

This prospective study was conducted at the Gynecology and Obstetrics Clinic of Ümraniye Training and Research Hospital between April 20, 2025 and May 20, 2025. The Clinical Researches Ethics Committee of Koşuyolu Specialized Training and Research Hospital approved this study (Date: 18.02.2025, Decision No: 2025/04/1039). All procedures were carried out in accordance with the ethical rules and the principles of the Declaration of Helsinki. Written and verbal informed consent was obtained from all patients prior to the commencement of the study. Detailed information regarding the study design and purpose was provided to the participants.

A total of 220 patients were recruited and classified into four groups based on their gestational periods: Group 1 (first trimester, n=52), group 2 (second trimester, n=51), group 3 (third trimester, n=62), and group 4 (postpartum period, n=55). Gestational age was determined using the last menstrual period and was subsequently confirmed through ultrasound measurements conducted during the first trimester. The first trimester was defined as encompassing weeks 1 to 13, the second trimester as weeks 14 to 27, and the third trimester as beginning at week 28 and continuing thereafter.

Exclusion criteria: Patients were excluded from the study if they had a body-mass index (BMI) of less than 18 kg/m^2, exhibited signs of inadequate nutrition, had a history of smoking, presented with known vitamin deficiencies, had personal or familial histories of deep vein thrombosis, were diagnosed with any chronic medical conditions, were in active labor, were experiencing multiple pregnancies, or had hypertension.

Blood samples were collected from all participants under standardized conditions. To minimize the effects of diurnal variation and nutritional status, venipuncture was performed between 8:00 and 10:00 AM after an overnight fast of at least 6 hours. Blood samples were obtained from the antecubital veins of the participants. Subsequent to venipuncture, the fasting blood samples were maintained on ice until processing, which occurred within 60 minutes. The samples were then subjected to centrifugation to isolate plasma, serum, and cellular components, with the serum being stored at -80°C until further analysis.

Biochemical analysis: Plasma homocysteine levels were quantified utilizing the DS30 Total Homocysteine Kit (Drew Scientific Inc., Dallas, TX, USA). Serum concentrations of vitamin B12 and folate were evaluated through chemiluminescence employing the BIODPC kit (Roche Modular E170, Roche Diagnostics Turkey, Istanbul, Turkiye). The reference ranges for these biomarkers were established as follows: 2.2-13.2 μmol/L for homocysteine, 126.5-505 pg/ml for vitamin B12, and 3.1-17.5 ng/ml for folate. The results were interpreted in accordance with these defined reference ranges.

Statistical Analysis

The data analyses of the collected data were conducted utilizing IBM SPSS Statistics version 25.0. To account for age-related variations, an age adjustment was implemented using the formula: age adj.=age-b*(x-agemean). For the comparison of quantitative data among groups, a One-way ANOVA was performed, followed by Bonferroni post hoc tests to identify specific differences. Furthermore, Pearson Correlation Analysis was employed to evaluate the relationships between variables. A significance level of 0.05 was established for all statistical tests.

RESULTS

Table 1 displays the correlation coefficients (r) and corresponding p-values (p) for the relationships among age, homocysteine, folate, and vitamin B12 levels. The analysis indicates a positive correlation between age and homocysteine (r=0.193, p=0.004). Conversely, age demonstrated negative correlations with folate (r=-0.097, p=0.150) and vitamin B12 (r=0.041, p=0.546). Additionally, homocysteine levels were found to be negatively correlated with both folate (r=-0.374, p=0.001) and vitamin B12 (r=-0.180, p=0.007). Furthermore, folate exhibited a positive correlation with vitamin B12 (r=0.177, p=0.009).

Table 1. Relationships between age, homocysteine, folate and vitamin B12

	Homocysteine		Folate		Vitamin B12	
	r	p	r	p	r	p
Age	0.193	0.004	-0.097	0.150	0.041	0.546
Homocysteine			-0.374	0.001	-0.180	0.007
Folate					0.177	0.009

p<0.05 was considered statistically significant

Descriptive statistics for age, homocysteine, folate, and vitamin B12 across various gestational periods are presented in Table 2. The mean age was higher in the third trimester (28.32±5.18 years) compared to the other groups; however, this difference did not reach statistical significance (p=0.063). Homocysteine levels exhibited significantly between the groups, with the postpartum group recording the highest mean (5.73±3.34 μmol/L), while both the second and third trimesters reported the lowest levels (4.41±1.79 μmol/L; p=0.006). Adjusted homocysteine values were also significantly elevated during the postpartum period (p=0.001). Folate levels were found to be lowest in the postpartum period (11.18±4.64 ng/ml), although this difference was not statistically significant (p=0.080). Furthermore, vitamin B12 levels demonstrated a significant decline in both the third trimester (200.88±88.64 pg/ml) and the postpartum period (158.45±41.41 pg/ml) when compared to the first trimester (299.24±119.40 pg/ml; p=0.001).

p<0.05 was considered statistically significant. Post-hoc comparisons: Homocysteine levels were significantly higher in the postpartum group compared with the first, second, and third trimesters (p<0.01). Vitamin B12 levels were significantly lower in the third trimester and postpartum groups compared with the first trimester (p<0.01).

The prevalence of elevated homocysteine levels was notably significant during the third trimester, recorded at 16.1% (p=0.006). In contrast, only one case of elevated levels was observed in the postpartum group, accounting for 1.8%. Folate levels remained within the normal range across all trimesters, with only 1.8% of postpartum patients classified as having low levels. Conversely, vitamin B12 deficiency was notably prevalent in the postpartum group, affecting 25.5% of individuals, as well as in the third trimester, where it was observed in 16.1% of cases (p=0.001).

Table 3 presents the reference ranges for homocysteine levels across all trimesters of pregnancy. The 95th percentile for homocysteine levels rose from 6.82 μmol/L during the first trimester to 12.13 μmol/L in the postpartum period. This trend suggests a gradual increase in reference values as pregnancy advances and persists into the postpartum period.

DISCUSSION

Our results demonstrated that the age-adjusted serum homocysteine levels postpartum were significantly higher than those recorded during any trimester. The reference ranges established in our study (2.82-6.82 μmol/L for the 1st trimester, 1.08-7.82 μmol/L for the 2nd trimester, 0.18-8.46 μmol/L for the 3rd trimester, and 0.10-12.13 μmol/L postpartum) provide crucial benchmarks that differ markedly from those reported in other studies, such as Yang et al.[1] and Mishra et al.[7] This discrepancy underscores the influence of geographical and dietary factors on homocysteine levels and suggests that local reference ranges are essential for accurate clinical assessment.[9]

Table 3. Homocysteine level reference ranges

Percentages (%)	1st trimester	2nd trimester	3rd trimester	Post-partum
95	6.82	7.82	8.46	12.13
90	6.49	7.27	7.78	11.10
75	5.99	6.43	6.75	9.53
50	4.82	4.45	4.32	5.84
25	3.65	2.47	1.89	2.15
10	3.15	1.63	0.86	0.58
5	2.82	1.08	0.18	0.10

The observed increase in homocysteine levels during the postpartum period is particularly concerning, as it may signify a risk for hyperhomocysteinemia. Previous research has indicated that elevated homocysteine levels are associated with adverse maternal health outcomes, including cardiovascular complications and impaired recovery in the postpartum phase.[10-13] Our findings underscore the necessity for ongoing monitoring of homocysteine levels beyond the perinatal period, especially in light of the concurrent decrease in vitamin B12 levels noted in our cohort. While folate levels remained stable, the negative correlation between folate and homocysteine highlights the essential role of folate in maintaining homocysteine homeostasis.[14-16]

One of the strengths of this study is its diverse population. Conducted at a tertiary referral hospital, which caters to patients from various backgrounds across the Marmara Region, the findings are likely to be generalizable to a broader demographic. This characteristic enhances the external validity of the results, rendering them applicable to a wide range of clinical contexts. Furthermore, the comprehensive design of the study, which assesses homocysteine, vitamin B12, and folate levels throughout all three trimesters and the postpartum period, offers valuable insights into the dynamic changes of these biomarkers during pregnancy. The prospective nature of the study further fortifies its methodology, as it facilitates real-time data collection, thereby minimizing recall bias and enhancing the reliability of the findings. Another notable contribution of this research is the establishment of localized reference ranges for homocysteine, vitamin B12, and folate levels. This development addresses a critical gap in the existing literature, providing a valuable

Table 2. Age, homocysteine, folate and vitamin B12 values according to trimesters and postpartum period

	1st trimester (n=52)	2nd trimester (n=51)	3rd trimester (n=62)	Post-partum (n=55)	p-value
	Mean±SD	Mean±SD	Mean±SD	Mean±SD	
Age (year)	27.96±2.42	27.06±4.88	28.32±5.18	26.27±4.51	0.063
Homocysteine (micromol/L)	4.87±1.02	4.41±1.79	4.41±2.10	5.73±3.34	0.006
Homocysteine* (micromol/L)	4.82±1.06	4.45±1.72	4.32±2.11	5.84±3.21	0.001
Folate (ng/ml)	13.14±3.02	12.07±3.72	12.44±4.23	11.18±4.64	0.080
Vitamin B12 (pg/ml)	299.24±119.40	257.57±105.69	200.88±88.64	158.45±41.41	0.001

SD: Standard deviation, *: Adjusted with age resource for clinicians in the assessment of maternal health and the interpretation of laboratory results within the specific context of the studied population. The observed elevation in homocysteine levels and concurrent decline in vitamin B12 during the postpartum period suggest a potential window of vulnerability for maternal cardiovascular and metabolic health. These findings support the incorporation of postpartum biochemical screening, particularly for homocysteine and vitamin B12, into routine postnatal follow-up, especially in women with additional risk factors such as nutritional deficiencies, previous pregnancy complications, or cardiovascular disease. Targeted nutritional counseling and, where appropriate, supplementation may help optimize maternal recovery and mitigate long-term health risks.

Limitations

Despite its strengths, the study presents several limitations. A significant drawback is the absence of dietary data, which constrains the capacity to comprehensively assess the influence of nutritional intake on homocysteine and vitamin levels. This omission introduces potential confounding factors that may affect the observed outcomes. Another limitation of this study is the potential influence of diurnal rhythm and hydration status on homocysteine measurements. Although all samples were collected after a standardized fasting period and at a fixed time window in the morning to reduce variability, residual biological fluctuations cannot be fully excluded. Future studies could further control for these factors through repeated measurements across different times of day and with standardized hydration protocols. Furthermore, the study's single-center design may limit the diversity of the sample, thereby potentially restricting the generalizability of the findings to other regions or populations with distinct dietary habits and health profiles. Furthermore, the brief follow-up duration postpartum may not adequately capture long-term trends in homocysteine and vitamin levels, which are essential for comprehensively understanding maternal health outcomes. Additionally, although the sample size is adequate, an increased cohort size could enhance the robustness of the data and improve statistical power, thereby facilitating more nuanced analyses.

Several avenues for future research are apparent. Multi-center studies would provide a more diverse sample, improving findings on homocysteine dynamics across populations. Longitudinal follow-up of postpartum patients could also reveal long-term trends in homocysteine and vitamin levels, helping to identify potential health risks associated with these biomarkers. Incorporating dietary assessments into future studies would allow researchers to examine the relationship between nutritional intake and serum levels of homocysteine, vitamin B12, and folate, thereby elucidating the role of diet in maternal health. Interventional studies could also evaluate the impact of dietary or supplemental interventions on these biomarkers during pregnancy and postpartum to improve maternal health outcomes. Expanding the analysis to include additional biomarkers could offer a comprehensive view of the factors influencing pregnancy outcomes, leading to targeted interventions and enhanced clinical practices.

CONCLUSION

This prospective study reveals the dynamics of serum homocysteine levels during pregnancy and postpartum, challenging existing literature. While no significant differences were found across trimesters, postpartum homocysteine levels significantly increased compared to pregnancy. This indicates the need for monitoring beyond the perinatal period, as elevated postpartum levels may affect maternal health. The study provides localized reference ranges for homocysteine, vitamin B12, and folate, helping clinicians interpret lab results and guide nutritional interventions. The negative correlation between folate and homocysteine emphasizes the need for adequate folate intake during pregnancy.

ETHICAL DECLARATIONS

Ethics Committee Approval

The Clinical Researches Ethics Committee of Koşuyolu Specialized Training and Research Hospital approved this study (Date: 18.02.2025, Decision No: 2025/04/1039).

Informed Consent

All patients signed and free and informed consent form.

Referee Evaluation Process

Externally peer-reviewed.

Conflict of Interest Statement

The authors have no conflicts of interest to declare.

Financial Disclosure

The authors declared that this study has received no financial support.

Author Contributions

All of the authors declare that they have all participated in the design, execution, and analysis of the paper, and that they have approved the final version.

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İsmail Bağlar

Dr. Ismail BAĞLAR is a dedicated Obstetrician and Gynecologist with extensive experience providing comprehensive clinical care in the field of women's health. He earned his medical degree from the prestigious Marmara University Faculty of Medicine. Dr. BAĞLAR completed his specialty training in Obstetrics and Gynecology at Ümraniye Training and Research Hospital , which was preceded by foundational residency experience in General Surgery at Taksim Training and Research Hospital. His professional career is distinguished by a steadfast commitment to patient management in various public health institutions. He began his journey as a General Practitioner at Sultanbeyli State Hospital and later served there as a Specialist in Obstetrics and Gynecology for several years. Currently, he continues his practice at Kartal City Hospital. As an active member of key professional bodies, including the Turkish Society of Obstetrics and Gynecology (TJOD) and UJOD, his hands-on experience and broad clinical background have solidified his reputation as a skilled and reliable practitioner.

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Original Article

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The relationship between breastfeeding status, self-efficacy, and postpartum depression in mothers with infants aged 0-6 months

Merve Feride Tan Ceylan[1], Bektaş Murat Yalçın[2]

[1]Department of Family Medicine, Home Health Unit, Yozgat City Hospital, Yozgat, Turkiye
[2]Department of Family Medicine, Faculty of Medicine, Ondokuz Mayıs University, Samsun, Turkiye

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Corresponding Author: Merve Feride Tan Ceylan, merveferide.tc@gmail.com

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ABSTRACT

Aims: To investigate the relationship between breastfeeding self-efficacy, breastfeeding status, and postpartum depression in mothers with infants 0-6 months old.

Methods: This cross-sectional descriptive study was conducted at the Samsun Training and Research Hospital, Obstetrics, Gynecology, and Pediatrics Departments between January and June 2023. The study population consisted of 247 mothers over eighteen who applied to the breastfeeding outpatient clinic and had babies between 0 and 6 months. We compared mothers who exclusively breastfed (study group), mothers who solely fed formula, and mothers who fed formula and breastfed (control group). The questionnaire, including sociodemographic information, the Breastfeeding Self-Efficacy Scale (BSES), and the Edinburgh Postpartum Depression Scale (EPDS), was administered to the participants face-to-face.

Results: The mean age of the participants was 29.4 years. The rate of exclusively breastfeeding mothers was 65.2%. The variables that caused differences between the study and control groups were educational status ($p=0.017$), breastfeeding education ($p=0.026$), breastfeeding distress ($p<0.001$), and targeted-breastfeeding duration ($p<0.001$). While the BSES scores were significantly different in the two groups ($p<0.001$), no relationship was found between the EPDS scores ($p<0.271$). There was a negative correlation between BSES and EPDS scores ($p>0.005$). Educational status, income status, planned pregnancy, difficulty of delivery, birth week, time of the baby's first breastfeeding, experiencing distress during breastfeeding, and target breastfeeding duration affected EPDS ($p<0.005$). While a negative correlation was observed between spousal support and EPDS, the BSES score decreased significantly with the support of someone other than the spouse.

Conclusion: Educational status, income status, number of children, whether the pregnancy is planned, breastfeeding education, difficulty of delivery, gestational week, time of the baby's first breastfeeding, experiencing distress during breastfeeding, starting work after delivery, receiving help from spouse or other person, and target breastfeeding duration were detected variables for breastfeeding.

Keywords: Breastfeeding, breastfeeding self-efficacy, postpartum depression, mothers, infants

INTRODUCTION

Breastfeeding is one of the most effective ways to protect infant health and ensure survival. The World Health Organization (WHO) and UNICEF recommend exclusive breastfeeding for the first six months of life. However, this rate is much lower than expected and is reported as approximately 44% worldwide.[1] In primary care health services, advising and providing the necessary preconceptional education to all pregnant women is essential. Breastfeeding within the first hour strengthens the mother-infant bond in physiological, psychological, and social dimensions and increases maternal milk production.[2] Additionally, it is an essential fact that breastfeeding has been found to contribute to the infant's cognitive development and provide protective effects against certain diseases.[1,2] However, breastfeeding is not always a process that happens spontaneously. It is recommended that breastfeeding continue alongside complementary foods until the age of two.[1] Maternal prenatal education and support can increase breastfeeding success and the mother's confidence. This confidence is referred to as "breastfeeding self-efficacy" and is considered a skill to be developed. Physiological and emotional changes during the postpartum period may lead to postpartum depression in mothers. This condition can negatively affect the mother's breastfeeding success and interaction with the infant. This study investigates the relationship between breastfeeding status, breastfeeding self-efficacy, and postpartum depression in mothers with infants aged 0-6 months.

METHODS

Ethics

Ethical approval for the study was obtained from the Ondokuz Mayıs University Clinical Researches Ethics Committee (Date: 28.12.2022, Decision No: OMÜ KAEK 2022/553). The Scientific Research Evaluation Committee of the Provincial Health Directorate also approved conducting the study at the Samsun Training and Research Hospital's Obstetrics and Pediatrics Department. All procedures were carried out according to the ethical rules and principles of the Declaration of Helsinki.

Type, Location, and Duration of the Study

This cross-sectional study was conducted between January and June 2023 at the breastfeeding clinic of Samsun Training and Research Hospital.

Population and Sample

The study's universe is selected through mothers who had at least one live birth in Samsun last year. Our sample was divided into two groups: mothers exclusively breastfed and those who either formula-fed or did both. The sample size was calculated using the G*power 3.1 program. A significance level of p<0.05 was accepted, and it was determined that each group should consist of 111 individuals. Since there are two groups, the total number was planned to be 222. However, 240 individuals were included in the study to account for possible missing data. The study's inclusion criteria are volunteering, having a 0-6-month-old infant, and completing the survey questions. We excluded subjects who didn't volunteered to participate in the study, individuals with missing data, mothers of premature infants, mothers whose infants were in the intensive care unit after birth, mothers of infants with congenital anomalies, mothers with chronic diseases, mothers of multiple pregnancies (twins, triplets, etc.), and mothers under 18 years of age. Although the target sample size was reached, the distribution between the two groups was not homogeneous. The number of mothers who exclusively breastfed was higher than those who formula-fed or both. This imbalance was noted as a limitation of the study.

Data Collection Tools

A questionnaire was developed for the research. It consists of four sections. In the first section, information about the study is provided, and participants are asked whether they want to participate in the survey. The second section inquired about factors affecting the duration and status of breastfeeding.[3-7] Questions included the type of feeding (breastfeeding or formula feeding), maternal age, education level, income status, obstetric history (number of pregnancies, number of living children, planned pregnancy status, history of anxiety disorder diagnosis during pregnancy or after birth, breastfeeding education), delivery and post-delivery information (type of delivery, delivery difficulty, time of first breastfeeding, person assisting with breastfeeding, gestational age at birth, infant birth weight, infant's current age, breastfeeding difficulties, return to work after birth), paternal support in infant care, social support, and target breastfeeding duration. The third section included the Breastfeeding Self-Efficacy Scale (BSES) short form, which has a Cronbach alpha coefficient of 0.72.[8] The final section used the Edinburgh Postnatal Depression Scale, with a Cronbach's alpha coefficient of 0.76.[9,10]

Statistical Analysis

Data were analyzed using the Statistical Package for Social Sciences (SPSS) version 25.0. Descriptive statistics are presented as means, standard deviations, and percentages. The Kolmogorov-Smirnov test was used to assess the distribution of continuous variables. Independent t-tests were used for pairwise comparisons for normally distributed data, and ANOVA was used for comparisons among three or more groups. For non-normally distributed data, the Mann-Whitney U test was used for two groups, and the Kruskal-Wallis test for more than two groups. Paired Samples t-test and Wilcoxon Signed Ranks Test were used for metric measurements. Post-hoc Tukey tests were used to identify the group causing the difference. Relationships between scale scores were assessed using Spearman's rho correlation analysis. A p-value of <0.05 was considered statistically significant. The normality analysis showed that the dependent variables, the total mean scores of the BSES, did not follow a normal distribution. In contrast, the total mean score of the Edinburgh Postnatal Depression Scale (EPDS) did.

RESULTS

A total of 247 mothers with infants aged 0-6 months who visited the breastfeeding clinic in our hospital participated in the study. The average age of the participants was 29.4 years (min=18, max=51). The average number of pregnancies was 2.02, and the average number of living children was 1.72. The mean gestational age of the infants was 38.5 weeks, and their average birth weight was 3186 grams. The degree of delivery difficulty was evaluated between 1 and 5, with an average score of 3.11. The average level of perceived spousal support was 3.7 on a 5-point scale, and the average social support score was 2.13. General sociodemographic and breastfeeding-related information of the participants are shown in **Table 1**.

In our survey, two scales were used, with the average score of the BSES being 56.88 and the average score of the Edinburgh Postpartum Depression Scale (EPDS) being 9.44. The cases participating in the study were divided into two groups: the study group (those who exclusively breastfeed) and the control group (those who breastfeed and supplement with formula, and those who exclusively formula feed). Statistical significance was observed only in the educational status of the mothers between the two groups. It was found that mothers with postgraduate education had a higher rate of exclusive breastfeeding. The sociodemographic and obstetric characteristics of both groups are shown in **Table 2**.

Chi-square analyses conducted to detect differences between the groups revealed statistically significant differences between the groups regarding the following variables: whether the mothers received education about breastfeeding, who provided the education, difficulties experienced during breastfeeding, types of problems encountered while

Table 1. General sociodemographic and breastfeeding-related information of the participants

Variable	Category	n (%)
Infant's feeding method	Exclusive breastfeeding	161 (65.2)
	Mixed feeding (breastfeeding and formula)	65 (26.3)
	Exclusive formula feeding	21 (8.5)
Educational status	Primary education	22 (8.9)
	Secondary education	46 (18.6)
	High school diploma	54 (21.9)
	Undergraduate (Bachelor's degree)	74 (30)
	Postgraduate (Master's/PhD)	51 (20.6)
Income level	Below minimum wage	20 (8.1)
	Minimum wage	77 (31.2)
	Above minimum wage	150 (60.7)
Planned pregnancy (yes/no)	Yes	182 (73.7)
	No	65 (26.3)
Mood disorder during pregnancy or postpartum (yes/no)	Yes	10 (4)
	No	237 (96)
Status of receiving education about breastfeeding	Did not receive	112 (45.30)
	From a primary healthcare facility (family physician)	65 (26.30)
	From a secondary or tertiary healthcare facility	76 (30.80)
	From media sources (newspapers, magazines, television, computer)	23 (9.30)
	From relatives or neighbors	17 (6.90)
Support received while breastfeeding	On my own only	54 (21.90)
	With the help of a healthcare professional	135 (54.70)
	With the help of a birth companion/relative	93 (37.70)
	With the help of my spouse	22 (8.90)

breastfeeding, and the planned duration of breastfeeding for the baby. The most commonly encountered breastfeeding issue in all groups was insufficient milk. The postnatal and breastfeeding characteristics of both groups are shown in **Table 3**.

Table 4 compares the average breastfeeding self-efficacy and postpartum depression scores between the two groups. In the study group, breastfeeding self-efficacy scores were higher compared to the control group, while postpartum depression scores were higher in the control group compared to the study group. A statistically significant difference was found between the groups in terms of breastfeeding self-efficacy scores, whereas no statistically significant difference was detected between the groups regarding postpartum depression scores.

Table 5 compares breastfeeding self-efficacy scores with sociodemographic and obstetric characteristics of the subjects. When examining the distribution of breastfeeding self-efficacy scores according to sociodemographic and obstetric characteristics in the groups, a statistically significant difference was found in the study group regarding education level, income level, number of living children, planned status of the last pregnancy, receipt of breastfeeding education, and the person providing the education. It was found that mothers with a secondary education had higher breastfeeding self-efficacy score averages. Regarding income level, mothers below the minimum wage had higher self-efficacy. It was observed that as the number of children increased, the breastfeeding self-efficacy score also increased. Mothers who received breastfeeding education from relatives and neighbors had the highest self-efficacy scores, followed by those who received education from primary healthcare centers.

Table 2. Comparison of sociodemographic and obstetric characteristics between the two groups

Characteristics		Study group 161 (65.2%)	Control group 86 (34.8%)	p
Age	n/%	161 (65.2%)	86 (34.8%)	0.695
	X/SD	29.31±4.71	29.58±5.92	
Educational status	Primary education	12 (54.5%)	10 (45.5%)	0.017
	Secondery education	25 (54.3%)	21 (45.7%)	
	High school diploma	31 (57.4%)	23 (42.6%)	
	Undergraduate (Bachelor's degree)	51 (68.9%)	23 (31.1%)	
	Postgraduate (Master's/PhD)	42 (82.4%)	9 (17.6%)	
Income level	Below minimum wage	11 (55.0%)	9 (45.0%)	0.588
	Minimum wage	50 (64.9%)	27 (35.1%)	
	Above minimum wage	100 (66.7%)	50 (33.3%)	
Number of living children	1	81 (62.3%)	49 (37.7%)	0.585
	2	52 (73.2%)	19 (26.8%)	
	3	19 (59.4%)	13 (40.6%)	
	4	9 (69.2%)	4 (30.8%)	
	5	0 (0.0%)	1 (100.0%)	
Planned pregnancy status	Planned	122 (67.0%)	60 (33.0%)	0.307
	Unplanned	39 (60.0%)	26 (40.0%)	

SD: Standard deviation

Table 3. Comparison of postnatal and breastfeeding characteristics between the two groups

Characteristics		Study group 161 (65.2%)	Control group 86 (34.8%)	p
Experience of mood disorder during pregnancy or postpartum	Yes	5 (50.0%)	5 (50.0%)	0.304
	No	156 (65.8%)	81 (34.2%)	
Source of support for breastfeeding after birth	On my own only	34 (63.0%)	20 (37.0%)	0.454
	With the help of a healthcare professional	83 (62.4%)	50 (37.6%)	
	With the help of a birth companion/relative	39 (72.2%)	15 (27.8%)	
	With the help of my spouse	5 (83.3%)	1 (16.7%)	
Type of delivery	Normal vaginal delivery	44 (67.7%)	21 (32.3%)	0.621
	Cesarean section (C-section)	117 (64.3%)	65 (35.7%)	
Breastfeeding education and source of education	Did not receive	62 (55.4%)	50 (44.6%)	0.026
	From a primary healthcare facility (family physician)	46 (71.9%)	18 (28.1%)	
	From a secondary or tertiary healthcare facility	44 (72.1%)	17 (27.9%)	
	From media sources (newspapers, magazines, television, computer)	7 (100.0%)	0 (0.0%)	
	From relatives or neighbors	2 (66.7%)	1 (33.3%)	
Return to work after childbirth	Yes	15 (53.6%)	13 (46.4%)	0.171
	No	146 (66.7%)	73 (33.3%)	
Experience of problems during breastfeeding	Yes	76 (49.7%)	77 (50.3%)	
	No	85 (90.4%)	9 (9.6%)	
Types of problems experienced during breast-feeding	No problems	85 (90.4%)	9 (9.6%)	0.001
	Insufficient milk supply	20 (25.3%)	59 (74.7%)	
	Nipple soreness/Nipple cracks	28 (87.5%)	4 (12.5%)	
	Mastitis	2 (66.7%)	1 (33.3%)	
	Breast refusal	11 (57.9%)	8 (42.1%)	
	Forceful letdown/oversupply of milk	12 (92.3%)	1 (7.7%)	
	Family pressure not to breastfeed	0 (0.0%)	2 (100.0%)	
	Small/inverted nipples	2 (66.7%)	1 (33.3%)	
	Improper breastfeeding positioning	1 (100.0%)	0 (0.0%)	
	Medication use	0 (0.0%)	1 (100.0%)	
Time of first breastfeeding after birth	Within the first 15 minutes after birth	41 (71.9%)	16 (28.1%)	0.126
	Between 15–30 minutes after birth	43 (61.4%)	27 (38.6%)	
	Within the first hour after birth	52 (72.2%)	20 (27.8%)	
	Between 1–3 hours after birth	13 (54.2%)	11 (45.8%)	
	More than 3 hours after birth	8 (42.1%)	11 (57.9%)	
	Did not breastfeed	2 (66.7%)	1 (33.3%)	
	Breastfed after 24 hours	2 (100.0%)	0 (0.0%)	
Planned duration of breastfeeding	Between 0–6 months	2 (8.7%)	21 (91.3%)	0.001
	Between 6 months and 1 year	11 (47.8%)	12 (52.2%)	
	Between 1 year and 1.5 years	15 (55.6%)	12 (44.4%)	
	Between 1.5 years and 2 years	64 (80.0%)	16 (20.0%)	
	2 years or more	69 (73.4%)	25 (26.6%)	

Table 4. Comparison of mean breastfeeding self-efficacy and Edinburgh Postpartum Depression Scores between the two groups

Scale	Group	n	%	$\overline{X}$/SD	p
BSESp	Studygroup	161	65.2%	4.27±0.71	0.001
	Control group	86	34.8%	3.68±1.03	
EPDSp	Study group	161	65.2%	0.89±.56	0.271
	Control group	86	34.8%	0.98±.56	

SD: Standard deviation, BSES: Breastfeeding Self-Efficacy Scale, EPDS: Edinburgh Postpartum Depression Scale

Table 6 compares breastfeeding self-efficacy scores with postnatal characteristics and breastfeeding-related features. When examining the distribution of breastfeeding self-efficacy scores according to postnatal and breastfeeding-related characteristics in the groups, in the study group, a statistically significant difference was found in the evaluation of the difficulty of the most recent birth, the week of pregnancy at the time of delivery, the timing of the first breastfeeding after birth, breastfeeding difficulties encountered, whether or

Table 5. Distribution of breastfeeding self-efficacy scores based on sociodemographic and obstetric parameters across groups

BSESp		Study group				Control group			
		n	%	$\overline{X}$/SD	p	n	%	$\overline{X}$/SD	p
Educational status	Primary education	12	54.5%	4.19±0.99	0.001	10	45.5%	3.49±1.49	0.096
	Secondary education	25	54.3%	4.67±0.38		21	45.7%	4.09±0.68	
	High school diploma	31	57.4%	4.58±0.47		23	42.6%	3.81±0.93	
	Undergraduate (Bachelor's degree)	51	68.9%	4.18±0.69		23	31.1%	3.46±1.14	
	Postgraduate (Master's/PhD)	42	82.4%	3.94±0.78		9	17.6%	3.14±0.75	
Income level	Below minimum wage	11	55.0%	4.58±0.40	0.001	9	45.0%	3.90±0.99	0.475
	Minimum wage	50	64.9%	4.54±0.65		27	35.1%	3.73±1.17	
	Above minimum wage	100	66.7%	4.10±0.72		50	33.3%	3.61±0.96	
Number of living children	1	81	50.3%	4.17±0.69	0.027	49	57.0%	3.55±1.03	0.218
	2	52	32.3%	4.34±0.74		19	22.1%	3.85±0.71	
	3	19	11.8%	4.64±0.36		13	15.1%	4.15±0.92	
	4	9	5.6%	4.03±1.08		4	4.7%	2.82±2.02	
	5	-	-	-		1	1.2%	3.64±.	
Planned pregnancy status	Planned	122	75.8%	4.36±0.67	0.003	60	33.0%	3.60±1.12	0.498
	Unplanned	39	24.2%	3.98±0.77		26	40.0%	3.86±0.77	
Diagnosis of depression or anxiety disorder during pregnancy or postpartum	Yes	5	50.0%	4.24±1.10	0.564	5	50.0%	4.23±0.44	0.248
	No	156	65.8%	4.27±0.70		81	34.2%	3.64±1.04	
Status of receiving education about breastfeeding	Did not receive	62	55.4%	4.34±0.65	0.009	50	44.6%	3.88±0.86	0.144
	From a primary healthcare facility (family physician	46	71.9%	4.46±0.67		18	28.1%	3.28±1.39	
	From a secondary or tertiary healthcare facility	44	72.1%	3.98±0.80		17	27.9%	3.61±0.84	
	From media sources (newspapers, magazines, television, computer)	7	100.0%	4.11±0.52		0	0.0%	-	
	From relatives or neighbors	2	66.7%	4.54±0.15		1	33.3%	1.64±.	

SD: Standard deviation, BSES: Breastfeeding Self-Efficacy Scale

not the mother started working after delivery, whether or not help was received from someone other than the spouse with household chores, and the planned breastfeeding duration. In the control group, a statistically significant difference was found between breastfeeding self-efficacy scores and the mode of delivery, evaluation of the difficulty of the most recent birth, the week of pregnancy at delivery, and the planned breastfeeding duration.

When the distribution of postpartum depression scores by sociodemographic and obstetric parameters was examined across groups, a statistically significant difference was found in the study group about educational level, income status, and whether the most recent pregnancy was planned. In the control group, postpartum depression scores were significantly associated with whether the last pregnancy was planned and whether the participant had been diagnosed with depression or anxiety disorder during pregnancy or after childbirth. The comparison of postpartum depression scores with sociodemographic and obstetric characteristics is presented in Table 7.

In the comparison of participants' postpartum characteristics and breastfeeding-related variables with postpartum depression scores, statistically significant differences were observed in the intervention group based on the person assisting with breastfeeding after birth, perceived difficulty of the most recent delivery, gestational week at birth, timing of the first breastfeeding session, problems encountered during breastfeeding, types of breastfeeding-related issues, the age of the infant when the mother returned to work, and intended breastfeeding duration. In the control group, significant associations were found with perceived delivery difficulty, gestational week at birth, and the age at which the mother resumed work. Table 8 presents the comparison of postpartum depression scores according to postnatal and breastfeeding-related variables by group.

In the study group, there is a relationship between breastfeeding self-efficacy and the number of pregnancies, the difficulty of delivery (inversely), and the planned duration of breastfeeding. Regarding postpartum depression scores, there was an association with the difficulty of delivery, the baby's birth weight, the current age of the baby, partner support (inversely), and the planned duration of breastfeeding (inversely). Additionally, an inverse relationship was found between postpartum depression scores and self-efficacy scores.

Table 6. Association between breastfeeding self-efficacy scores and postnatal as well as breastfeeding-related characteristics

BSESp		Study group				Control group			
		n	%	$\overline{X}$/SD	p	n	%	$\overline{X}$/SD	p
Source of support for breastfeeding after birth	On my own only	34	21.10%	4.40±0.60	0.157	20	23.30%	3.94±0.70	0.262
	With the help of a healthcare professional	83	51.60%	4.30±0.63		50	58.10%	3.48±1.11	
	With the help of a birth companion/ relative	39	24.20%	4.16±0.94		15	17.40%	3.97±1.03	
	With the help of my spouse	5	3.10%	3.73±0.48		1	1.20%	4.14±.	
Type of delivery	Normal vaginal delivery	44	67.70%	4.24±0.75	0.958	21	32.30%	3.67±1.07	0.017
	Cesarean section (C-section)	117	64.30%	4.28±0.70		65	35.70%	3.68±1.02	
Self-rated difficulty of labor	1	16	9.90%	4.65±0.39	0.001	23	26.70%	4.09±0.70	0.013
	2	27	16.80%	4.38±0.65		12	14.00%	3.17±1.10	
	3	64	39.80%	4.24±0.66		16	18.60%	3.60±1.02	
	4	27	16.80%	4.03±0.93		6	7	3.60±1.36	
	5	27	16.80%	4.24±0.73		29	33.70%	3.61±1.09	
Gestational week at birth	36. week	9	5.60%	4.59±0.79	0.001	3	3.50%	3.24±1.65	0.001
	37. week	23	14.30%	4.01±0.85		7	8.10%	4.13±0.67	
	38. week	49	30.40%	4.25±0.81		32	37.20%	3.60±1.13	
	39. week	43	26.70%	4.27±0.59		27	31.40%	3.73±1.03	
	40. week	26	16.10%	4.35±0.64		15	17.40%	3.60±0.90	
	41. week	10	6.20%	4.40±0.33		2	2.30%	3.93±0.61	
	42. week	1	0.60%	5.00±.		-	-	-	
Time of first breastfeeding after birth	Within the first 15 minutes after birth	41	25.50%	4.54±0.53	0.008	16	18.60%	3.60±1.04	0.369
	Between 15–30 minutes after birth	43	26.70%	4.33±0.62		27	31.40%	4.05±0.75	
	Within the first hour after birth	52	32.30%	4.18±0.68		20	23.30%	3.51±0.89	
	Between 1–3 hours after birth	13	8.10%	4.03±0.80		11	12.80%	3.60±1.36	
	More than 3 hours after birth	8	5.00%	3.74±1.31		11	12.80%	3.25±1.36	
	Did not breastfeed	2	1.20%	4.75±0.16		1	1.20%	3.79±.	
	Breastfed after 24 hours	2	1.20%	2.97±0.56		-	-	-	
Presence of breastfeeding difficulties	Yes	76	47.20%	4.05±0.72	0.001	77	89.50%	3.60±1.05	0.064
	No	85	52.80%	4.47±0.65		9	10.50%	4.31±0.45	
Breastfeeding-related problems	Insufficient milk supply	20	12.40%	3.94±0.68	0.232	59	68.60%	3.60±1.12	0.894
	Nipple cracks	28	17.40%	4.10±0.79		4	4.70%	3.57±0.44	
	Mastitis	2	1.20%	4.79±0.30		1	1.20%	2.71±.	
	Breast refusal	11	6.80%	3.95±0.69		8	9.30%	3.78±0.95	
	Oversupply	12	7.50%	4.10±0.57		1	1.20%	4.00±.	
	Flat or small nipples	2	1.20%	4.61±0.15		1	1.20%	4.43±.	
	Incorrect latch/positioning	1	0.60%	2.57±.		2	2.30%	(Family pressure against breastfeeding) 3.35±1.11	
	Medication use	-	-	-		1	1.20%	2.43	
Return to work after childbirth	Yes	15	53.60%	3.86±0.82	0.02	13	46.40%	3.44±0.90	0.212
	No	146	66.70%	4.31±0.69		73	33.30%	3.72±1.05	
Non-spousal support	Yes	91	56.50%	4.15±0.75	0.013	42	48.80%	3.53±1.06	0.182
	No	70	43.50%	4.42±0.64		44	51.20%	3.82±0.98	
Planned breastfeeding duration	0–6 months	2	8.70%	3.61±0.45	0.001	21	91.30%	2.76±1.07	0.001
	6–12 months	11	47.80%	4.13±0.46		12	52.20%	3.83±0.92	
	12–18 months	15	55.60%	3.94±0.84		12	44.40%	3.73±1.18	
	18-24 months	64	80.00%	4.09±0.83		16	20.00%	3.89±0.83	
	24 months or more	69	73.40%	4.55±0.49		25	26.60%	4.21±0.49	

SD: Standard deviation, BSES: Breastfeeding Self-Efficacy Scale

Table 7. Postpartum depression scores by sociodemographic and obstetric characteristics

EPDSp		Study group				Control group			
		n	%	EPDSP (X/SD)	p	n	%	EPDSP (X/SD)	p
Educational status	Primary education	12	54.5%	0.99±0.55	0.032	10	45.5%	0.76±0.50	0.189
	Secondery education	25	54.3%	0.68±0.60		21	45.7%	0.83±0.46	
	High school diploma	31	57.4%	0.76±0.53		23	42.6%	1.16±0.60	
	Undergraduate (Bachelor's degree)	51	68.9%	0.93±0.54		23	31.1%	0.99±0.61	
	Postgraduate (Master's/PhD)	42	82.4%	1.05±0.54		9	17.6%	1.04±0.51	
Income level	Below minimum wage	11	55.0%	0.90±0.66	0.005	9	45.0%	0.84±0.51	0.217
	Minimum wage	50	64.9%	0.68±0.49		27	35.1%	0.88±0.53	
	Above minimum wage	100	66.7%	1.00±0.56		50	33.3%	1.05±0.58	
Number of living children	1	81	50.3%	0.97±0.54	0.123	49	57.0%	0.98±0.54	0.509
	2	52	32.3%	0.84±0.60		19	22.1%	1.06±0.63	
	3	19	11.8%	0.66±0.45		13	15.1%	0.82±0.50	
	4	9	5.6%	1.02±0.60		4	4.7%	1.21±0.55	
	5	-	-	-		1	1.2%	0.36±.	
Panned pregnancy status	Planned	122	75.8%	0.82±0.57	0.004	60	33.0%	0.88±0.52	0.013
	Unplanned	39	24.2%	1.12±0.47		26	40.0%	1.20±0.58	
Diasgnosis of depression or anxiety disorder during pregnancy or postpartum	Yes	5	50.0%	1.31±0.86	0.091	5	50.0%	1.53±0.60	0.021
	No	156	65.8%	0.88±0.55		81	34.2%	0.94±0.54	
Status of receiving education abouth breastfeeding	Did not receive	62	55.4%	0.97±0.53	0.242	50	44.6%	1.01±0.59	0.894
	From a primary healthcare facility (family physician)	46	71.9%	0.66±0.60		18	28.1%	0.91±0.57	
	From a secondary or tertiaryhealthcare facility	44	72.1%	0.99±0.55		17	27.9%	0.94±0.47	
	Frpm media sources (newspapers, magazines, television, computer)	7	100.0%	1.03±0.24		0	0.0%	-	
	From relatives or neighbors	2	66.7%	1.00±0.51		1	33.3%	0.82±.	

EPDS: Edinburgh Postpartum Depression Scale, SD: Standard deviation

DISCUSSON

Recent studies over the past five years indicate that exclusive breastfeeding rates remain below global and national targets. In a study conducted in Turkiye in 2018, this rate was reported as 41%, while globally it was approximately 58%.[1,2] In our study, the rate was found to be 65.2%. This relatively high rate may be attributed to the study conducted in a structured setting such as a breastfeeding support clinic. In contrast, studies reporting lower rates often include preterm infants or are conducted in non-baby-friendly hospital environments.[11,12] Breastfeeding self-efficacy is defined as a significant predictor of breastfeeding success. Many recent studies have demonstrated a positive relationship between self-efficacy and exclusive breastfeeding.[3,13,14] Similarly, our findings revealed a statistically significant association between these two variables. The relationship between postpartum depression and breastfeeding remains a controversial topic in the literature. Researchers such as Van der Zee-van den Berg[15] and Kossakowska[16] have suggested that delayed initiation or early cessation of breastfeeding may be associated with maternal depression. In our study, mothers with a history of depression or anxiety had higher EPDS scores; however, no statistically significant relationship was found between exclusive breastfeeding and postpartum depression. Although some studies suggest that younger mothers are more inclined to breastfeed,[17] our study found no significant relationship between maternal age and feeding preference. This indicates that the effect of age on breastfeeding behavior may depend on contextual factors. Various studies have explored the impact of educational level on breastfeeding duration and self-efficacy. A general trend indicates that higher educational levels are associated with longer breastfeeding duration and greater self-efficacy.[18,19] However, in our study, mothers with a secondary education had the highest BSES-SF scores, whereas postgraduate mothers had lower scores. Additionally, a significant relationship was observed between educational level and EPDS scores, with higher-educated mothers showing higher depression scores, consistent with some findings in the literature.[20] The effect of income level on breastfeeding behavior is complex. Although many studies have reported lower breastfeeding success and self-efficacy among low-income groups,[20-22] our study did not identify a direct association between income level and exclusive breastfeeding. However, higher BSES-SF scores were found in the low-income group, possibly due to limited access to alternatives such as formula. Furthermore, the highest-income group had elevated EPDS scores, a finding that contradicts some previous studies.[23,24]

Studies examining the relationship between multiparity and breastfeeding self-efficacy generally report higher self-efficacy among multiparous mothers.[25,26] Our study observed a significant relationship between parity and self-efficacy only in the study group, suggesting that prior breastfeeding experiences may enhance maternal confidence. Pregnancy

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Table 8. Comparison of postpartum depression scores and postnatal and breastfeeding-related characteristics by groups

EPDSp		Study group				Control group			
		n	%	($\overline{X}$/SD)	p	n	%	($\overline{X}$/SD)	p
Source of support for breastfeeding after birth Source of support for breastfeeding after birth	On my own only	34	21.1%	0.95±0.55	0.010	20	23.3%	1.06±0.65	
	With the help of a healthcare professional	83	51.6%	0.77±0.56		50	58.1%	0.95±0.48	
	With the help of a birth companion/ relative	39	24.2%	1.03±0.51		15	17.4%	1.00±0.67	
	With the help of my spouse	5	3.1%	1.44±0.44		1	1.2%	0.27±.	
	On my own only	117	64.3%	0.93±0.59		65	35.7%	0.96±0.57	
Self-rated difficulty of labor	1	16	9.9%	0.77±0.42	0.001	23	26.7%	0.84±0.45	0.001
	2	27	16.8%	0.66±0.57		12	14.0%	1.02±0.58	
	3	64	39.8%	0.90±0.51		16	18.6%	0.97±0.56	
	4	27	16.8%	1.01±0.64		6	7.0	0.80±0.42	
	5	27	16.8%	1.07±0.58		29	33.7%	1.11±0.64	
Gestational week at birth	36. week	9	5.6%	0.66±0.55	0.001	3	3.5%	1.09±0.31	0.001
	37. week	23	14.3%	0.90±0.63		7	8.1%	0.80±0.35	
	38. week	49	30.4%	0.85±0.51		32	37.2%	1.08±0.63	
	39. week	43	26.7%	0.91±0.56		27	31.4%	0.89±0.59	
	40. week	26	16.1%	0.91±0.58		15	17.4%	0.93±0.47	
	41. week	10	6.2%	1.19±0.58		2	2.3%	1.23±0.32	
	42. week	1	0.6%	0.82±.		-	-	-	
Time of first breastfeeding after birth	Within the first 15 minutes after birth	41	25.5%	0.75±0.61	0.021	16	18.6%	1.00±0.54	0.958
	Between 15–30 minutes after birth	43	26.7%	0.82±0.46		27	31.4%	1.04±0.61	
	Within the first hour after birth	52	32.3%	0.93±0.53		20	23.3%	0.98±0.50	
	Between 1–3 hours after birth	13	8.1%	1.30±0.64		11	12.8%	0.89±0.62	
	More than 3 hours after birth	8	5.0%	1.17±0.51		11	12.8%		
	Did not breastfeed	2	1.2%	0.55±0.39		1	1.2%	0.88±0.57	
	Breastfed after 24 hours	2	1.2%	1.32±0.33		-	-	0.73±.	
Presence of breastfeeding difficulties	Yes	76	47.2%	1.05±0.52	0.001	77	89.5%	1.00±.0.57	0.196
	No	85	52.8%	0.75±0.56		9	10.5%	0.75±.0.42	
Breastfeeding-related problems	Insufficient milk supply	20	12.4%	1.22±0.56	0.021	59	68.6%	1.00±0.58	0.532
	Nipple cracks	28	17.4%	0.99±0.54		4	4.7%	1.09±0.50	
	Mastitis	2	1.2%	0.96±0.45		1	1.2%	1.09±.	
	Breast refusal	11	6.8%	0.91±0.47		8	9.3%	0.76±0.33	
	Oversupply	12	7.5%	0.97±0.43		1	1.2%	1.91±.	
	Flat or small nipples	2	1.2%	1.37±0.64		1	1.2%	1.45±.	
	Incorrect latch/positioning	1	0.6%	1.55±.		2	2.3%	1.23±1.35	
	Medication use	-	-	-		1	1.2%	0.73±.	
Return to work after childbirth	Yes	15	53.6%	1.11±0.43	0.116	13	46.4%	1.09±0.55	0.424
	No	146	66.7%	0.87±0.57		73	33.3%	0.96±0.56	
Age of the baby (in months) when the mother returned to work	0.00	147	91.3%	0.87±0.57	0.001	73	84.9%	0.96±0.56	0.005
	2.00	-	-	-		4	4.7%	0.84±0.53	
	3.00	3	1.9%	0.97±0.14		2	2.3%	0.96±0.06	
	4.00	6	3.7%	1.23±0.48		5	5.8%	1.13±0.56	
	5.00	5	3.1%	1.02±0.56		-	-	-	
	6.00	-	-	-		2	2.3%	1.64±0.77	
	I am not working	70	43.5%	0.82±0.53		44	51.2%	0.95±0.57	
Planned breastfeeding duration	0–6 months	2	8.7%	0.87±0.45	0.030	21	91.3%	1.05±0.56	0.842
	6–12 months	11	47.8%	1.23±0.64		12	52.2%	0.96±0.53	
	12–18 months	15	55.6%	1.11±0.51		12	44.4%	0.82±0.55	
	18-24 months	64	80.0%	0.93±0.51		16	20.0%	1.02±0.62	
	24 months or more	69	73.4%	0.76±0.57		25	26.6%	0.97±0.55	

EPDS: Edinburgh Postpartum Depression Scale, SD: Standard deviation planning can influence both psychological well-being and breastfeeding behavior. Planned pregnancies have been associated with greater breastfeeding success and a lower risk of postpartum depression.[27,28] Consistent with these findings, our study found that planned pregnancies were associated with higher BSES-SF scores and lower EPDS scores. While some studies emphasize the potential adverse effects of cesarean delivery on breastfeeding,[13,26] our study found that mothers who had cesarean births in the control group had higher self-efficacy scores. This implies that the mode of delivery may influence self-efficacy indirectly. The difficulty of childbirth may significantly affect both maternal mental health and breastfeeding behaviors. Mothers who experienced a difficult birth had higher EPDS scores and lower BSES-SF scores, indicating that complicated deliveries may be a risk factor for both depression and lower breastfeeding success,[29] Breastfeeding education is a critical intervention that enhances maternal self-efficacy. Studies have shown that education provided in primary healthcare settings is particularly effective.[5] Similarly, in our study, mothers who received breastfeeding education before or after delivery had higher self-efficacy scores. In our study, mothers who returned to work after childbirth had lower BSES-SF scores. However, returning to work was not found to affect EPDS scores significantly. This aligns with findings from similar studies.[30] Initiating breastfeeding within the first hour after birth is a key practice that improves breastfeeding outcomes. Early skin-to-skin contact has increased breastfeeding self-efficacy in the literature.[31] Our findings support the positive impact of early initiation on self-efficacy, although no significant association was found with postpartum depression levels. Finally, difficulties encountered during breastfeeding, particularly the perception of insufficient milk supply, negatively influence self-efficacy. This underscores the necessity of breastfeeding support programs and accurate education. Sandhi et al.[32] reported that the perception of inadequate milk supply results from low self-efficacy.

Limitations

Our study is a cross-sectional study. During face-to-face interviews, mothers were asked about their current situation. It is not known whether the babies received only breast milk during the first six months. Since the survey was conducted face-to-face, biased responses may have been given to the breastfeeding self-efficacy questionnaire and the EPDS. In addition, the distribution between the groups was not homogeneous; the number of mothers who exclusively breastfed was higher than those who formula-fed or both. This imbalance may have affected the comparability between groups and was acknowledged as a limitation of the study.

CONCLUSION

A holistic assessment of mothers in primary care can help identify those at risk for postpartum difficulties. Supporting maternal self-efficacy and breastfeeding practices may improve both maternal mental health and infant access to breast milk, an easily accessible and cost-effective nutrient.

ETHICAL DECLARATIONS

Ethics Committee Approval

Ethical approval for the study was obtained from the Ondokuz Mayıs University Clinical Researches Ethics Committee (Date: 28.12.2022, Decision No: OMÜ KAEK 2022/553).

Informed Consent

Informed consent was obtained from all mothers participating in the study.

Referee Evaluation Process

Externally peer-reviewed.

Conflict of Interest Statement

The authors have no conflicts of interest to declare.

Financial Disclosure

The authors declared that this study has received no financial support.

Author Contributions

All of the authors declare that they participated in the design, execution, and analysis of the paper and that they have approved the final version.

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Merve Feride Tan Ceylan

I was born on 6.12.1990 in Sivas. I studied at Sivas Cumhuriyet University. I completed my specialty education at 19 Mayıs University Faculty of Medicine, Department of Family Medicine. Now I am working as a Family Medicine Specialist in the Home Health Unit at Yozgat City Hospital.

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Review

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The effect of aromatherapy applications on postpartum depression and postpartum blues: a meta-analysis*

Şerife İrem Döner[1], Sümeyra Damsarsan[2], İlknur Sirkeci[3], Sevil Albayrak[4]

[1]Department of Midwifery, Faculty of Health Sciences, Ankara Medipol University, Ankara, Turkiye
[2]Department of Midwifery, Gülhane Faculty of Health Sciences, University of Health Sciences, Ankara, Turkiye
[3]Department of Education Coordination Office, Ankara Etlik City Hospital, Ankara, Turkiye
[4]Department of Nursing, Faculty of Health Sciences, Cyprus Science University, Ozanköy, Cyprus

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Corresponding Author: Şerife İrem Döner, serifeiremdoner@gmail.com

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ABSTRACT

The study aimed to collect empirical information on the effects of aromatherapy practices on postpartum depression and blues and assess the influence of these practices on postpartum depression and blues. The current study synthesized findings to determine the effect of aromatherapy applications on postpartum depression and postpartum blues using a meta-analytic approach. Studies published between January 1, 2012, and December 1, 2022, in the databases "PubMed," "Cochrane," "Scopus," and "Web of Science" were searched. Keywords were "postpartum depression", "postpartum blues" and "aromatherapy". After removing duplicate records, 358 records were reached. After title evaluation, full-text evaluation was performed, and the findings of five articles (n=407 women) that met the inclusion criteria were analyzed. A funnel plot was used to assess the risk of publication bias. This meta-analysis was performed according to preferred reporting items for systematic reviews and meta-analyses (PRISMA) guidelines. This meta-analysis, aromatherapy is effective in reducing the postpartum depression and postpartum blues (Hedge's g=-0.346, 95% CI: -0.161 to -0.141; p=0.001). This meta-analysis, aromatherapy is effective in reducing the postpartum depression and postpartum blues. The articles reported no evidence of any adverse effects of aromatherapy. Aromatherapy can be used as a non-pharmacological therapeutic option for women suffering from postpartum depression and postpartum blues, but further study is needed to improve the level of evidence. However, due to the limited number of included studies, the generalizability of the results should be interpreted with caution.

Keywords: Aromatherapy, postpartum period, postpartum blues, postpartum depression

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INTRODUCTION

In the postpartum period, changes in family roles and care demands cause the mother to experience mental health problems.[1] Postpartum blues, postpartum depression and postpartum psychosis are mental health problems that occur after birth.[2]

Postpartum blues, one of the postpartum mental disorders, is a process that typically happens between the second and fourth postpartum days and can last from a few hours to two weeks.[3] Postpartum blues is a temporary physiological and psychological disease characterized by symptoms such as possible depression, crying, grieving, an unstable mood, insomnia, anxiety, and bewilderment.[4] The prevalence of maternal blues was determined to be 39% in a meta-analysis of 26 studies.[5]

Postpartum depression, another mental disorder that can arise after birth, is defined by the DSM-5 as the occurrence of a per-partum severe depressive episode during pregnancy or up to four weeks after birth. Emotional instability, tearfulness, uncontrollable crying, changes in appetite, weight, activity, and sleep level, fatigue, loss of interest in external factors, finding life meaningless, hopelessness, worthlessness, guilt, anger, and feeling overwhelmed, fear of injury, serious concern about the baby, loss of energy and motivation, difficulty focusing, recurrent death, and suicidal thoughts may occur in the mother.[5] The prevalence of postpartum depression is reported to be between 15.8% and 51.3% in Turkiye[6-9] and 11.5% in the USA. Postpartum depression is thought to affect 20% of women worldwide.[10]

Healthy generations are needed for the development of healthy civilizations. Babies of mothers with postpartum depression may have delayed growth, fine motor development and language development.[11] Postpartum depression and postpartum blues should be treated due to their harmful impact on both the mother and the baby. Postpartum depression treatment is adapted from major depression treatment, and there is little particular approved treatment for postpartum.[12] Although psychosocial therapy and antidepressant medicines are suggested as first-line treatments, there is minimal evidence for their use during breastfeeding.[13] Antidepressant medications can enter the body via breast milk and have some harmful effects on the newborn.[14] Aromatherapies, which are non-pharmacological therapy approaches, have recently gained popularity in addition to pharmacological treatments.[13] Aromatherapy, a therapeutic method, involves the use of essential oils to improve physical or emotional well-being. Essential oils can pass the blood-brain barrier. As a result, they have the potential to affect emotions, mood, blood pressure, heart rate, muscle tension, and body temperature.[15]

Essential oils can show therapeutic effects even in small amounts due to their high concentration. In the postpartum period, the concentration of pure essential oil should be 1-2%.[16] The National Association for Holistic Aromatherapy (NAHA) list of evidence-based essential oils that can be used in the postpartum period includes fennel (*Foeniculum vulgare*), jasmine (*Jasminum grandiflorum* and *Jasminum sambac*), lavender (*Lavandula angustifolia*), neroli (*Citrus aurantium var amara*), rose (*Rosa damescena* and *Rosa centifolia*), sweet orange (*Citrus sinensis*), ylang ylang (*Cananga odorata*), and yuzu (*Citrus junos*).[16]

Aromatherapy was hypothesized in this study to significantly reduce symptoms of postpartum depression and sadness, given the limited and conflicting evidence on non-pharmacological treatments for postpartum mood disorders. The aim of this meta-analysis was to evaluate whether aromatherapy as a cost-effective and accessible intervention can be considered as a supportive therapy for postpartum women.

METHODS

Focused Question

The focused question addressed was the following: Are aromatherapy applications effective for postpartum depression and postpartum blues?

Protocol and Registration

This review was performed in accordance with the preferred reporting items for systematic reviews and meta-analyses (PRISMA) statement[17] and the updated guideline for reporting systematic reviews[18] and registered at the PROSPERO database (CRD42023416062).

Search Strategy

"PubMed," "Cochrane," "Scopus," and "Web of Science" electronic databases were used for the literature search. The literature search was performed in the English. The MeSH (Medical Subject Heading) index was used to identify keywords and the words "postpartum depression", "postpartum blues" and "aromatherapy" were searched using the "AND" Boolean operator (**Table 1**). Research results were combined using the EndNote 20 program, and duplicate articles were identified and deleted. The findings of the studies on aromatherapy for postpartum depression and postpartum blues between January 1, 2012, and December 1, 2022 were examined. The literature review was conducted between April 12, 2023 and May 10, 2023 (**Table 1**).

Table 1. Search strategies used in PubMed, Scopus, Cochrane, and the Web of Science

Database	Search strategy
PubMed	Postpartum depression AND aromatherapy, postpartum blue AND aromatherapy
Scopus	Postpartum depression AND aromatherapy, postpartum blue AND aromatherapy
Cochrane	Postpartum depression AND aromatherapy, postpartum blue AND aromatherapy
Web of Science	Postpartum depression AND aromatherapy, postpartum blue AND aromatherapy

Study Selection and Eligibility Criteria

Three researchers, who were independent and blind to avoid bias in the selection of articles, conducted the evaluation initially with relevant titles, abstracts, and full texts. The inconsistencies were analyzed by consensus among the reviewers, with the participation of a fourth reviewer when necessary. The final version of the papers considered qualified was shared among the researchers for critical analysis.

Inclusion criteria: Studies investigating the effect of aromatherapy treatments on postpartum depression and postpartum blues, randomized controlled trials or non-randomized controlled experimental studies that directly discuss the results of the studies, and original studies with full text available in English

Exclusion criteria: Letters to the editor, case reports, case series, systematic reviews, meta-analyses, studies not written in English and without full text.

Data Extraction and Risk of Bias Assessment

Three researchers developed a data table prior to the study. The studies' general descriptive information, including authors, year and country of publication, study design, research objectives, participant information, interventions, and outcomes, was provided (**Table 2**). The methodological quality of the studies was assessed using the Cochrane collaboration tool[19] to assess the risk of bias in randomized controlled trials and assess possible sources of errors that compromise the relevance of trials. The inconsistencies observed during the review of the articles were discussed among the reviewers and a consensus was reached (**Table 2**).

Meta-Analysis

Studies with sample n, mean, standard deviation or standard error of treatment, control/placebo group before and after

Table 2. Characteristics of included studies

Author, year of the study, and country	Participants, interventions, control, and/or placebo	Study design	Interventions	Scales	Summary of results
Conrad & Adams, 2012, USA	13/13	Non-randomized controlled trial	-Essential oil blend of rose otto and Lavandula angustifolia @ 2% dilution -The treatment consisted of 15-minute sessions twice a week for four weeks. - In addition to the inhalation group or the aromatherapy Hand M 'technique of aromatherapy, all participants received psychological treatment and support.	-Edinburgh Postnatal Depression Scale (EPDS) -Generalized Anxiety Disorder Scale (GAD-7)	-As a result of the intervention, it was determined that there was a decrease in EPDS and GAD-7 scores.
Kianpour et al., 2016, Iran	70/70	Clinical trial	- 3 drops of lavender essential oil were used in each session. - Aromatherapy was applied by inhalation every 8 hours for 4 weeks.	-The Edinburgh stress, anxiety, and depression scale - The depression, anxiety, and stress scale	Stress, anxiety, and depression levels all decreased thanks to the intervention.
Mirghafourvand et al., 2017, Iran	48/-/48	Randomized controlled trial	-Participants were given a glass of water containing orange peel essential oil (10 drops). - It was applied after each meal (1 to 3 times a day) for 8 weeks.	-Edinburg postnatal depression scale -Spielberger state-trait anxiety inventory (STAI)	-Orange peel essential oil did not affect postpartum depression or anxiety.
Kianpour et al., 2018, Iran	35/35/35	Clinical trial	- 7 drops of lavender essential oil and 1 cc of rose water were dripped onto a cloth. -It was sniffed with 10 deep breaths before going to sleep and then put under the pillows.	-Edinburgh postnatal depression scale (EPDS)	-The mean depression score in the intervention group was significantly reduced compared to the placebo and control groups.
Malahayati & Nainggolan, 2020, Indonesia	20/20	Non-randomized quasi-experimental controlled trial	- 7 drops of lavender essential oil for one group and 7 drops of bergamot essential oil for the other were dripped onto a handkerchief. -It was sniffed with 10 deep breaths before going to sleep and then put under the pillow for 14 days.	-Edinburgh postnatal depression scale (EPDS)	- There was a decrease in EPDS scores after the intervention.

the intervention, same depression and postpartum Blues scale were selected and analyzed. For the meta-analysis the comprehensive meta-analysis (CMA) program was used for the analyses.

Data were analyzed using CMA V3.2.1. For publication bias, funnel plot, Kendall's tau and Egger regression analysis were used. Heterogeneity was analyzed with Q test and I^2 values. Random model results were interpreted due to the heterogeneous structure. Hedge's effect size was used to calculate the effect size. The significance level is $p<0.05$.

RESULTS

Study Selection and Study Characteristics

As a result of searching the electronic databases, 386 studies were accessed, and 358 studies remained after eliminating 28 duplicate studies. 340 of these studies were not included in the study based on their titles and abstracts. The remaining 18 studies were analyzed in full text, and five studies were included in the analysis (**Figure 1**).

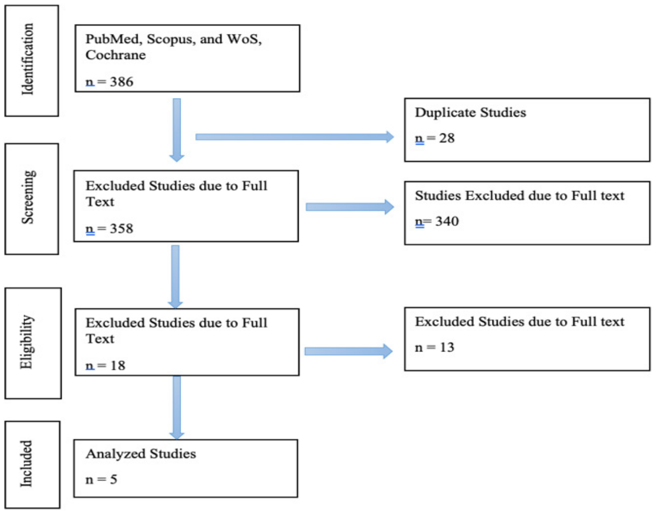

Figure 1. Flowchart of studies that met inclusion/exclusion criteria for qualitative and quantitative analyses (PRISMA)

Methodological Quality/Risk of Bias

The risk of bias analysis of the studies is presented in **Figure 2**. The risk of bias was generally low in the studies. However, Malahayati and Nainggolan's (2020) study was found to have a high risk of bias. The study by Mirghafourvand et al. (2017) is the one with the lowest bias (**Figure 2**).

The studies considered to have the highest methodological quality were randomized controlled trials. Random sequence generation, allocation concealment, and blinding of participants and personnel (n=3, 60%). Selective reporting (n=4, 80%). Others (n=5, 100%) (**Figure 3**).

Meta-Analysis

Five studies with 407 postpartum women were included in the meta-analysis. In these studies, rose otto, lavandula angustifolia, orange peel, bergamot, and lavender essential oils were used. The aromatherapy application methods varied across the studies. Three studies used inhalation techniques by applying essential oils onto cloth or handkerchiefs, followed by deep breathing and overnight exposure under the pillow.[20-22] One study used hand massage/ inhalation[23]

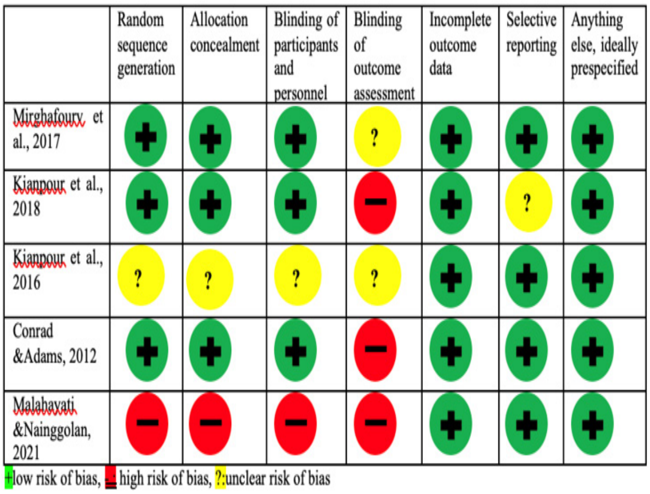

Figure 2. Presentation of risk of bias assessments for studies

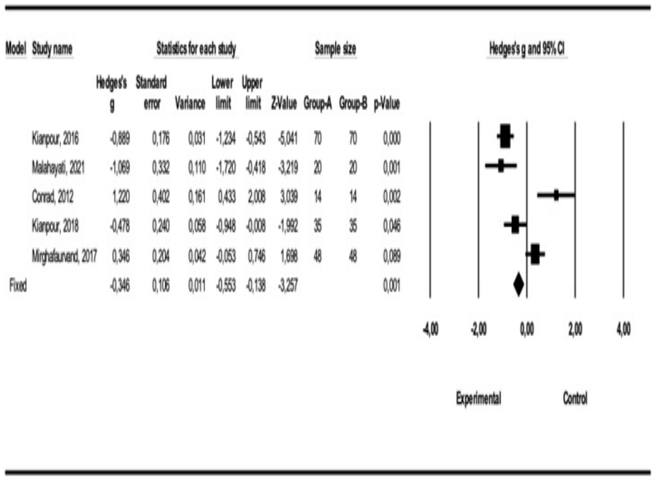

Figure 4. Forest plot for the effect of aromatherapy on postpartum depression and postpartum blues

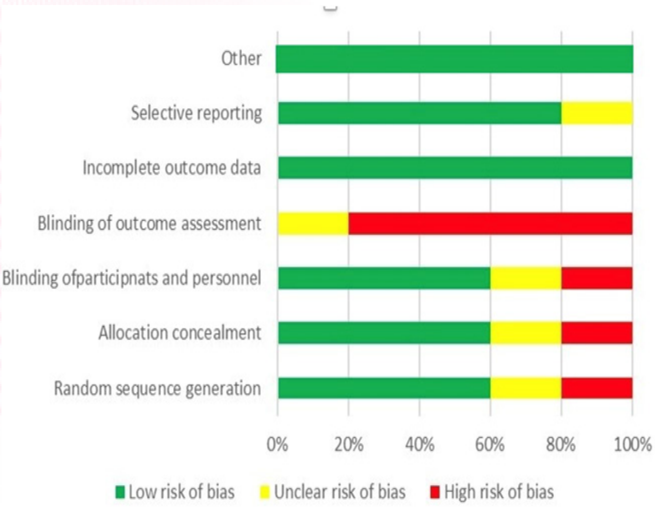

Figure 3. Methodological quality of studies included

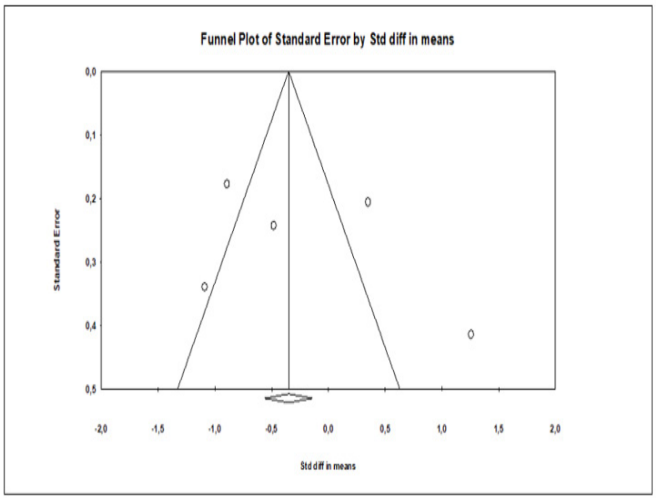

Figure 5. Funnel plot of publication bias

and another administered orange peel essential oil diluted in water orally.[24] The duration of the interventions ranged from 2 to 8 weeks, with most repeated daily or multiple times per day. The variation in both the application method and duration is likely to influence the observed outcomes.

Aromatherapy was found to be useful in treating postpartum depression, with a statistically significant reduction in postpartum depression and postpartum blues (Hedge's g=-0,346, 95% CI: -0.161, -0.141; p=0.001). This shows a large impact size by Cohen's norms, and heterogeneity was high (I 2=90.278)[21-25] (**Figure 4**). The Begg and Mazumdar test using Kendall's tau with continuity correction found tau=0.400, Z=0.979 and p=0.327, and Egger's test revealed no significant publication bias (t=0.690 and p=0.539).

A funnel plot was used to examine the risk of publication bias. The symmetric funnel plot shows that the meta-analysis was free of bias. The funnel plot was not completely symmetrical for the analysis; however, publication bias could not be detected due to the small sample size and heterogeneity of the studies. Diagonal lines represent 95% confidence limits. As exact 95% confidence limits are not reported, these are referred to as "pseudo 95% confidence limits (**Figure 5**).[25]

DISCUSSION

During the postnatal period, often known as the postpartum period, women undergo a variety of hormonal, physiological, physical, and social changes.[26] Women who are unable to cope with these changes may experience a range of problems, from mild psychiatric symptoms to severe psychiatric problems requiring hospitalization.[27] The most common psychiatric disorders observed in women in the postpartum period are maternity blues and postpartum depression. In the literature, it has been reported that the prevalence of maternal sadness ranges from 50 to 80%, while the prevalence of postpartum depression ranges from 5 to 20%.[4,28,29] Maternity blues and postpartum depression are characterized by crying, anxiety, irritability, stress, decreased concentration, restlessness, and fragility.[29] Since it is widely accepted that symptoms of maternal sadness and postpartum depression can improve without treatment, treatment is often inadequate.[30] In addition to this perspective, mothers' reluctance to seek pharmacologic treatment due to breastfeeding in the postpartum period, avoidance of psychological support or inability to allocate time for psychological support have led them to search for different treatment options. Evidence shows that aromatherapy can help with maternal blues and postpartum depression as well as reduce depressive symptoms.[13,24] Lavender, bergamot, rose, jasmine, ylang-ylang, and sandalwood essential oils are commonly used for depression.[31] Most of these essential oils have muscle relaxant and sedative properties.[32] Lavender, rose, orange peel, and bergamot essential oils were used in the studies on the effect of aromatherapy on maternity blues and postpartum depression. These essential oils have been found to have comparable effects on depression. The sedative effect of lavender essential oil is beneficial in the treatment of depression.[13] study on the effect of lavender essential oil on stress, anxiety and prevention of postpartum depression in postpartum women concluded that inhaling lavender essential oil for 4 weeks can prevent postpartum depression, anxiety and stress.[21] Rose has two anti-anxiolytic substances (sytrinol and 2-phenyl ethyl alcohol), and these compounds, which also have antidepressant effects, induce sedative effect. It is thought that the sedative effect of rose essential oil, similar to lavender essential oil, has beneficial impacts on maternal blues and postpartum depression.[32,33] Orange peel essential oil is obtained by water distillation of freshly harvested orange tree flowers.[34] Citrus essential oil has been reported to improve mood, lower blood pressure and reduce pain by stimulating the central nervous system.[35] Thanks to these effects, it is thought to be an option for maternity blues and postpartum depression. Aromatherapy using bergamot essential oil has been reported to be an excellent way to improve both mental health and individual well-being and is even employed in the waiting rooms of mental health centers.[36] Lavender and bergamot essential oils are also recommended for relaxation, depression, and sedation.[37,38] A combination of lavender and bergamot essential oils is argued to be effective in relieving pain, depression, anxiety, and stress.[38] Although studies show that all these oils are used in postpartum depression with similar and positive results, more randomized controlled trials are needed.

In this meta-analysis study, data from five studies were evaluated. The heterogeneity among the included studies was notably high (I^2=90.278). This may be attributed to variations in the type of essential oils used (e.g., lavender, rose, bergamot), the method of application (e.g., inhalation vs. massage), different intervention durations, and the use of various outcome measurement tools. These discrepancies highlight the need for more standardized protocols in future studies. Although the bias of one of the studies included in the research was quite high, it was shown that the aromatherapy applications used in the studies had effects on postpartum depression and postpartum blues. In a previous systematic review and meta-analysis study that determined the effects of aromatherapy applications used only in postpartum depression, similar results were found with this study.[39]

An important limitation of this meta-analysis is the small number of studies included, which limits the generalizability and robustness of the results. This may have affected both the statistical power and external validity of the results.

CONCLUSION

Aromatherapy can be applied in different areas of women's health. Despite the insufficient quality of evidence, the use of aromatherapy, which is non-pharmacological and has minimal side effects, as an adjunct to medical treatment is increasing. One of the studies included in the meta-analysis had a high bias rate. There have also some uncertainties in another study. However, after the analysis, it is determined that aromatherapy treatment is effective in reducing postpartum depression and postpartum blues. It can be used as a non-pharmacological treatment option for women suffering from postpartum depression and postpartum blues, but more randomized controlled trials are needed.

Limitations

Aromatherapy applications has just started to be used in alternative medicine. For this reason, studies are few. According to this meta-analysis study, the number of studies that meet the criteria is low. In addition, some of the information in one of the studies with a high bias rate is unclear. However, it is thought that this research will contribute to healthcare professionals, especially midwives and nurses, in terms of providing evidence. Additionally, this meta-analysis included studies published up to December 2022; therefore, more recent evidence published in 2023 and beyond may have been missed.

ETHICAL DECLARATIONS

Referee Evaluation Process

Externally peer-reviewed.

Conflict of Interest Statement

The authors have no conflicts of interest to declare.

Financial Disclosure

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Author Contributions

All of the authors declare that they have all participated in the design, execution, and analysis of the paper, and that they have approved the final version.

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Şerife İrem Döner

Research Assistant Şerife İrem DÖNER completed master's degree at the University of Health Sciences, Gülhane Institute of Health Sciences, Department of Midwifery in 2022 and completed master's degree as the first graduate. She continues her doctorate education at the same university. Since 2023, she has been working as a research assistant at Ankara Medipol University, Faculty of Health Sciences, Department of Midwifery. The author has many national and international publications and book chapters in areas such as aromatherapy, pregnancy, traumatic birth, alternative therapies during labour, breastfeeding, menopause and social media. The author has many international papers.

Journal of
Controversies in Obstetrics & Gynecology and Pediatrics

Case Report

DOI: 10.51271/JCOGP-0057

Secondary hypertension associated with nutcracker syndrome: a case report

Yaşar Kandur[1], Emre Demir[2], Aydanur Yılmaz[3], Adnan Özdemir[2], Ayşegül Alpcan[3]

[1]Division of Pediatric Nephrology, Department of Pediatrics, Faculty of Medicine, Kırıkkale University, Kırıkkale Turkiye
[2]Department of Radiology, Faculty of Medicine, Kırıkkale University, Kırıkkale, Turkiye
[3]Department of Pediatrics, Faculty of Medicine, Kırıkkale University, Kırıkkale, Turkiye

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Corresponding Author: Yaşar Kandur, yaskan30@yahoo.com

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ABSTRACT

Nutcracker syndrome (NCS) is defined as the compression of the left renal vein (LRV) between the aorta and the superior mesenteric artery, accompanied by clinical findings. Here, we present an adolescent patient diagnosed with NCS during the investigation of secondary causes of arterial hypertension. A 13-year-old female patient presented to our outpatient clinic with complaints of headache and a home-measured blood pressure of 160/100 mmHg. In the clinic, her blood pressure was measured at 150/100 mmHg in the right arm and 160/100 mmHg in the left arm. CT Imaging revealed compression of the LRV between the superior mesenteric artery and the aorta. The angle between the superior mesenteric artery and the abdominal aorta was measured as 18.3 degrees. In conclusion, blood pressure should be routinely monitored in patients with NCS, as hypertension may develop during follow-up.

Keywords: Nutcracker syndrome, child, hypertension

INTRODUCTION

Nutcracker syndrome (NCS) refers to a condition in which the left renal vein (LRV) is compressed between the aorta and the superior mesenteric artery (SMA), leading to various clinical symptoms. Individuals with NCS may experience symptoms such as hematuria, proteinuria, pain in the left flank or abdomen, varicocele on the left side in males, and pelvic congestion syndrome in females.[1,2] There are only a handful of reported pediatric cases in the literature describing the coexistence of NCS and arterial hypertension.[3,4] Here, we present an adolescent patient diagnosed with NCS during the investigation of secondary causes of arterial hypertension. This case aims to demonstrate the association between NCS and secondary hypertension.

CASE

A 13-year-old female patient presented to our outpatient clinic with complaints of headache and a home-measured blood pressure of 160/100 mmHg. In the clinic, her blood pressure was measured at 150/100 mmHg in the right arm and 160/100 mmHg in the left arm. Although not obese, the patient was considered overweight (BMI=28.5 kg/m^2). Blood chemistry results were as follows: blood urea 30 mg/dl, creatinine 0.8 mg/dl, triglyceride 124mg/dl, cholesterol 132mg/dl. Free T4 and TSH were in the normal range. Urinalysis revealed 3–4 red blood cells per microliter, consistent with borderline microscopic hematuria. Plasma renin and aldosterone levels could not be assessed due to the initiation of pharmacological treatment. She was admitted for further evaluation. Despite 12 hours of monotherapy with an antihypertensive agent (Amlodipine), her blood pressure remained between 140/90 and 150/100 mmHg. Therefore, a thoracoabdominal CT angiography was performed. Imaging revealed compression of the LRV between the SMA and the aorta. The angle between the SMA and the abdominal aorta was measured as 18.3 degrees (**Figure**) which is smaller than the normal range (38–65°).[5] Based on these findings, the patient was diagnosed with NCS. A second antihypertensive agent (Enalapril) was added to her treatment regimen. Following this adjustment, her blood pressure stabilized between 110/70 and 120/80 mmHg. The patient was consulted for cardiovascular surgery, and surgical intervention was deemed unnecessary.

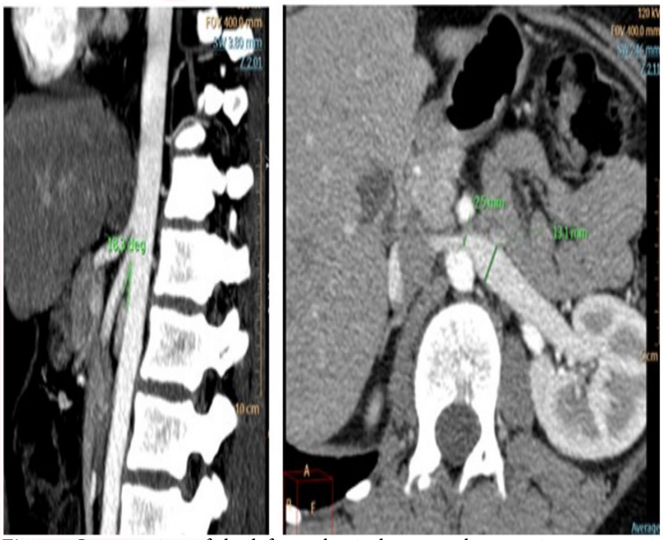

Figure. Compression of the left renal vein between the superior mesenteric artery and the aorta. The angle between the SMA and the abdominal aorta was measured as 18.3 degrees
SMA: Superior mesenteric artery

DISCUSSION

There are very few studies demonstrating an association between NCS and arterial hypertension. In one report, a 17-year-old girl presented with intermittent hypertension, loin pain, and hematuria, and imaging revealed compression of the LRV consistent with NCS.[3] In another adolescent male case, transient high blood pressure was incidentally associated with a nutcracker phenomenon, with normal renin/aldosterone levels and resolution of hypertension after weight gain and conservative management.[4] In our case, which was evaluated for secondary hypertension, no other pathology was identified to explain the elevated blood pressure. Hypertension in NCS is thought to result from venous stasis within the left kidney, leading to renal venous hypertension and consequent activation of the renin–angiotensin–aldosterone system (RAAS). Compression of the LRV impairs venous outflow, increasing intrarenal venous pressure and reducing effective renal perfusion. This decrease in perfusion stimulates renin release from juxtaglomerular cells, which promotes systemic vasoconstriction and sodium retention through RAAS activation. These processes ultimately lead to elevated arterial blood pressure.[6] Among the surgical treatment options for NCS are open surgery, open or laparoscopic extravascular stent placement, and endovascular stenting.[7]

CONCLUSION

As a result, blood pressure should be routinely monitored in patients with NCS, as hypertension may develop during follow-up.

ETHICAL DECLARATIONS

Informed Consent

The patient's family signed the free and informed consent form.

Referee Evaluation Process

Externally peer-reviewed.

Conflict of Interest Statement

The authors have no conflicts of interest to declare.

Financial Disclosure

The authors declared that this study has received no financial support.

Author Contributions

All of the authors declare that they have all participated in the design, execution, and analysis of the paper, and that they have approved the final version.

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Yaşar Kandur

Dr. Yaşar Kandur, born in 1973, is a pediatric nephrologist. After graduating from Hacettepe University Faculty of Medicine in 1998, he completed his pediatrics residency at Hacettepe University Faculty of Medicine in 2003. Between 2003 and 2009, he worked as a pediatrician in various private hospitals. He completed his pediatric nephrology specialization, which he started in 2009, in 2013. From 2013 to 2018, he served his mandatory service. Since 2019, he has continued his academic career at Kırıkkale University Faculty of Medicine. He is fluent in three languages: German, English, and French.

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Letter to the Editor

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Hyperthermic intraperitoneal chemotherapy in gynecologic oncology: current evidence and national perspectives from Turkiye

İlyas Turan
Department of Gynecologic Oncology, Batman Training and Research Hospital, Batman, Turkiye

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Corresponding Author: İlyas Turan, ilyasturan04@gmail.com

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Keywords: Hyperthermic chemotherapy, gynecologic oncology, ovarian cancer

Dear Editor,

I am writing this letter because I have observed that publications on hyperthermic intraperitoneal chemotherapy (HIPEC) in gynecologic oncology in our country are insufficient.[1-3] The article in question is particularly important as it thoroughly addresses HIPEC, a method that is gaining increasing importance in the surgical treatment of gynecologic malignancies.

The purpose of my letter is to open a discussion on several points regarding the role of HIPEC in gynecologic oncology under the conditions of our country, inspired also by the most recent international publications. In gynecologic malignancies, particularly advanced ovarian, tubal, and peritoneal cancers, HIPEC administered after optimal cytoreductive surgery has been shown, in randomized controlled trials such as OVHIPEC-1 and CHIPOR, to significantly improve progression-free and overall survival.[4,5] These data provide a promising strategy for selected patients following interval debulking surgery and in recurrent disease.

However, there are several country-specific challenges for integrating this technique into routine clinical practice. Chief among them are the standardization of HIPEC application, high patient volume, and the requirement for an experienced multidisciplinary team, including gynecologic oncologists, surgical oncologists, medical oncologists, and anesthesiologists. This team must work in a coordinated manner not only during surgery but also before and after the procedure. Critical parameters such as the choice and dosage of chemotherapeutic agent, perfusion duration, liver and kidney function tests, patient performance status, HIPEC-related complications, and their management must be carefully planned and managed.

Although randomized data support the oncologic benefit of HIPEC in selected settings, its implementation must be done with careful consideration of procedure-related morbidity. Complications may arise both from extensive cytoreductive surgery and from the intraperitoneal administration of heated cytotoxic agents. Reported adverse events include anastomotic leakage, ileus, intra-abdominal abscess, and fistula formation; as well as hematologic toxicity (neutropenia, thrombocytopenia), renal impairment—particularly with cisplatin-based regimens—hepatotoxicity, electrolyte imbalance, and perioperative hemodynamic instability. Nevertheless, in large phase III trials such as OVHIPEC-1 and CHIPOR, the incidence of grade 3–4 complications did not differ significantly between the HIPEC and control arms, supporting the feasibility and safety of the procedure when performed in high-volume centers with standardized perioperative protocols.[4,5]

Risk factors that increase HIPEC-related morbidity include poor performance status (ECOG ≥2), hypoalbuminemic malnutrition, prolonged or multi-anastomotic cytoreductive procedures, pre-existing renal impairment, high intraoperative transfusion requirements, and extensive peritoneal stripping in high tumor burden disease.

Prevention strategies focus on meticulous perioperative optimization; these include aggressive hydration with diuresis and magnesium supplementation when cisplatin is used, adherence to standardized HIPEC protocols (typically single-agent cisplatin for 60–90 minutes), ERAS-based perioperative management, structured prehabilitation and nutritional optimization, and predefined complication-management algorithms. Above all, strict patient selection remains the most effective determinant of safety.

Considering all these details, the application of HIPEC by experienced centers and teams will yield more beneficial outcomes. Moreover, patients should be thoroughly informed about the procedures to be performed and potential complications as part of the center's multidisciplinary team.

At this point, another important need in our country is the conduct of national, multicenter clinical studies. The existing literature largely relies on data from international centers. Establishing national databases that include the characteristics of our patient population, morbidity-mortality rates, and long-term survival outcomes, and developing national guidelines based on these data, will facilitate the safe and effective application of this technique with proper patient selection.

Additionally, together with Prof. Dr. Evrim Erdemoğlu, we have data on nearly 50 patients treated with optimal cytoreduction followed by HIPEC protocols, and our results are consistent with international literature. Our study is ongoing, and we believe that its scientific outcomes will contribute to both the literature and our country.

In conclusion, HIPEC is a method that provides a valuable contribution to surgery in gynecologic cancers, particularly ovarian cancer, in selected patients. Promoting the widespread adoption and standardization of this technique in Turkiye should prioritize inter-center collaboration and the development of national protocols and guidelines. I believe that further discussion of this topic in prestigious journals such as Journal of Controversies in Obstetrics & Gynecology and Pediatrics will accelerate these efforts.

Thank you for your time and consideration. I wish you continued success in your work.

Sincerely,

ETHICAL DECLARATIONS

Referee Evaluation Process

Externally peer-reviewed.

Conflict of Interest Statement

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İlyas Turan

I obtained my medical degree from Trakya University Faculty of Medicine in 2009. I completed my obstetrics and gynecology specialization at Pamukkale University Hospital in 2016. I practiced as an obstetrician and gynecologist in various eastern provinces of Turkey until 2018. I finished my gynecologic oncology surgery subspecialty training in Süleyman Demirel University Training and Research Hospital from 2019 to 2022. I am presently employed as a subspecialty expert at Batman Training and Research Hospital, Gynecologic Oncology Surgery Clinic.