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ORIGINAL ARTICLE

Nutritional status and depression during pregnancy

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ABSTRACT

Objective: During the pregnancy, the mood may be changeable and depression may have negative consequences for pregnant and infants. The aim of this study was to investigate the relationship between nutritional status and depression in all trimesters.

Material and Methods: The study was conducted with 140 women who were in the 1st trimester of pregnancy and admitted to the Pregnancy Unit of Haydarpaşa Numune Training and Research Hospital of Health Sciences University. In this study the Edinburgh Postnatal Depression Scale (EPDS) was administered, and personal information and 24-h food consumption were recorded. This scale and dietary record were repeated in the 2nd and 3rd trimesters.

Results: According to EPDS scores, In the 1st and 2nd trimesters, the weekly consumption frequency of milk, yogurt, red meat, and legumes were significantly different in terms of the risk of depression ($p<0.05$). In all trimesters, the weekly consumption frequency of fish and types of bread were significantly different according to EPDS scores ($p<0.05$). Dietary energy, protein, fat, tryptophan, and iron were found to be correlated with EPDS scores in all trimesters ($p<0.0001$).

Conclusion: Pregnancy depression may affect the woman and the fetus negatively. For example, depression may cause developmental retardation in the fetus. The fact that some foods and regular consumption of meals are associated with depression shows that the risk of depression in pregnant women may be affected by nutrition.

Keywords: Depression, mood, nutrients, pregnancy nutrition.

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INTRODUCTION

Mood changes are common during pregnancy and women will be at risk of depression unless the pregnancy process is managed properly. The prevalence of depression during pregnancy is between 18 and 53 in Türkiye.[1] According to a review of data from 26 countries, the prevalence of depression during pregnancy is 20–47% in France, 12.4% in Portugal, 54% in China, 20.2% in Pakistan, 11% in Brazil, 86.6% in Ireland, and 41.5% in the USA. In the same study, the prevalence of depression was 10.35% in the 1st trimester, 6.58% in the 2nd trimester, and 26.7% in the 3rd trimester.[2]

Depression is associated with negative consequences such as premature birth, low birth weight, stress, poor postpartum adaptation, and the need for intensive care.[3] Pregnancy depression may lead to deterioration of the baby's neuromotor development at 3 months of age, slowing of hippocampal growth at 6 months of age, weakening of immunity, and development of asthma and allergy.[4] In addition, children of depressed pregnant women may have visual and memory disorders, and problems in communication and social skills.[5]

The fact that some nutrients have antioxidant properties, and affect the nervous system and mood by playing a role in neurotransmission and hormone production, suggests that a healthy diet may be an effective approach to reducing the risk of depression.

It has been shown that a healthy diet characterized by a high intake of fruits, vegetables, fish, and whole grains can reduce symptoms of depression during pregnancy.[6,7] Consuming a variety of foods such as cereals, dairy products, fish, vegetables, and fruits is negatively associated with depression in pregnant women.[8] It has been determined that an unhealthy diet including high sweets, high refined grains, low fruits, and low legumes increases depression risk in pregnant women.[9,10]

In light of this information, this study aimed to investigate the relationship between nutritional status and depression during pregnancy.

MATERIAL AND METHODS

Study Design

This descriptive cross-sectional research was conducted on pregnant women who applied to Health Sciences University, Haydarpaşa Numune Training and Research Hospital between March and August 2019 in Türkiye.

The study included 140 volunteer women, aged between 18 and 45 years, in the first trimester of pregnancy, who could understand and respond to scales and questionnaires (power was calculated as 0.9 and α=0.05 and β=0.1 by G*Power 3.1.9.2). Exclusion criteria in the study were being diagnosed with depression before pregnancy, having chronic diseases (heart, liver, kidney, and thyroid), and using antidepressants and narcotic drugs.

Data Collection Form, Edinburgh Postnatal Depression Scale (EPDS), 1-week food frequency questionnaires (FFQs), and 24-h food recall (24 HR) were used to collect data and were repeated in the 1st, 2nd, and 3rd trimesters. EPDS scores of the participants were named EPDS1, EPDS2, and EPDS3 in trimesters, respectively.

Data Collection Form

In this form, there were questions on education status, having a diagnosis of vitamin or mineral deficiency, such as iron deficiency anemia, and whether or not to use nutritional supplements. With this form, the body weight data of the patients in the prepregnancy were collected by declaration. In this form, the body weight of the participants was measured and recorded in the 1st, 2nd and 3rd trimesters (by Charder MS3400).

EPDS

This scale was developed and validated to investigate the risk of depression.[9] The validity and reliability study of the scale was conducted by Engindeniz.[11] It included 10 items evaluating the emotional status in the past week. EPDS was based on individual responses. When using the scale, a score between 0 and 3 was given for each question and the maximum score was 30. A total of 13 or more scores indicated the risk of depression in the person.

FFQ

This questionnaire was developed by the researchers in the light of similar studies and it grouped the 1-week milk, meat, cereal, vegetable, fruit and fat-containing foods, and beverages consumption frequency of participants.

Food Consumption Recall

All foods, beverages, and meals consumed by the participants were recorded in the past 24 h.

Analysis of Data

Statistical Package Program for Social Sciences 22.0 and Food Information Systems 7.1 (BEBİS) program were used in the study.

Twenty-four HR was analyzed by the BEBİS 7.1 program and the macro and micronutrients were calculated as numerical values. Percentage frequency distribution, median, minimum (min), maximum (max), mean (mean), and standard deviation (SD) values were calculated for descriptive data. When checked with the One-Samplemogorov–Smirnov test, the Mann–Whitney test was used on comparing 2 independent groups, and the Kruskal–Wallis test was used on comparing 3 independent groups since the variables showed nonparametric properties.

Friedman test was used to compare 3 dependent groups. Subgroup analyses were performed using the Wilcoxon test to compare 2 dependent groups and Bonferroni correction was applied. The relationship between the measurable variables was analyzed with the Spearman correlation. $p<0.05$ was accepted for statistical significance. The study was approved by the Health Sciences University Hamidiye Ethics Committee (February 22, 2019, decision no:19/17)

RESULTS

The mean age of the pregnant women was 28.15±5.97 years. The mean body weight was 63.39±13.18 kg before pregnancy, 66.51±13.45 kg in the 1st trimester, 68.48±13.17 kg in the 2nd trimester, and 70.90±12.57 kg in the 3rd trimester, respectively.

Table 1: The relationship of age and body weight with EPDS scores

Variables	EPDS 1		EPDS 2		EPDS 3	
	r[c]	p	r[c]	p	r[c]	p
Age	-0.075	0.375	-0.090	0.290	-0.158	0.062
Weight prepregnancy	0.226**	**0.007**	0.197*	**0.020**	0.127	0.135
Weight during pregnancy	0.171*	**0.044**	0.183*	**0.031**	0.037	0.666

c: Spearman Correlation; *: P<0.05; **: P<0.001; EPDS 1: Edinburgh Postnatal Depression Scale scores in the 1st trimester; EPDS 2: Edinburgh Postnatal Depression Scale scores in the 2nd trimester; EPDS 3: Edinburgh Postnatal Depression Scale scores in the 3rd trimester.

Table 2: Comparisons of pregnants according to meal consumption status and EPDS scores in trimesters

Meal consumption	1st trimester			2nd trimester			3rd trimester		
	n	EPDS	p	n	EPDS	p	n	EPDS	p
Breakfast									
+	138	13.01±9.71	0.909	140	10.12±8.41	–	139	8.56±6.59	0.214
-	2	14±9.78		0	–		1	18±0	
Snack 1									
+	20	7.40±8.75	**0.005**	7	1.71±2.42	**0.002**	12	4.25±6.13	**0.008**
–	120	13.95±9.68		133	10.57±8.39		128	9.04±6.53	
Lunch									
+	97	10.72±10.02	**<0.0001**	105	8.84±8.14	**0.002**	122	8.17±6.57	**0.022**
–	43	18.23±6.92		35	13.91±8.17		18	11.77±6.26	
Snack 2									
+	45	6.73±8.88	**<0.0001**	53	5.81±6.71	**<0.0001**	74	5.47±5.07	**<0.0001**
–	95	13.95±9.68		87	12.75±8.79		66	12.18±6.38	
Dinner									
+	139	12.92±9.74	0.086	139	10.07±8.42	0.514	139	8.56±6.59	0.214
–	1	28±0		1	17±0		1	18±0	
Snack 3									
+	107	11.85±8.75	**0.013**	105	8.37±7.96	**<0.0001**	115	7.63±6.41	**<0.0001**
–	33	16.81±7.65		35	15.4±7.58		25	13.24±5.59	

Mann Whitney U-test, + Consumed, - Skipped, p<0.05; EPDS 1: Edinburgh Postnatal Depression Scale scores in the 1st trimester; EPDS 2: Edinburgh Postnatal Depression Scale scores in the 2nd trimester; EPDS 3: Edinburgh Postnatal Depression Scale scores in the 3rd trimester.

Educational status of the participants as 48.6% high school, 6.4% primary school, 22.9% secondary school, 19.3% university, 1.4% graduate, and 1.4% literate. The median EPDS scores were 13 (0–29) in the 1st trimester and 9 (0–29) in the other trimesters, respectively. EPDS scores showed significant differences during pregnancy in all trimesters (p<0.0001).

When data on age and body weight were analyzed for all trimesters; the body weight was found to be correlated with depression scores (Table 1). It was determined that breakfast and dinner were consumed by the participants to a large extent; snack 1 and snack 2 were not consumed during pregnancy (Table 2). It was found that the consumption of food groups of the participants was generally higher in the first trimester than in the other trimesters (Table 3).

In the 1st trimester, the mean EPDS scores of the subjects who consumed milk and yogurt every day were 10.34±9.04 and 22.92±6.48 for the subjects who never consumed (p<0.0001). When the food consumption frequency of the participants in the 1st

Table 3: Food group consumptions and nutrient intakes of pregnants in trimesters

Food items	1st trimester Mean±SD	2nd trimester Mean±SD	3rd trimester Mean±SD
Dairy (mL)	336±232	300±140	298±146
Protein foods (g)	108.90±31.20	103.20±31.50	82.81±21
Grains (g)	140±35.75	128±28.50	134.75±20.75
Vegetables (g)	187±104	163±76	148±54
Fruits (g)	200±111	179±70	170±90
Oils (g)	21±5.50	18.50±5	17.85±4.50
Energy (kcal)	1530.70±429.70	1492.05±371.51	1614.60±302.15
Carbs (g)	156.44±47.36	135.80±35.70	143.71±33.82
Carbs (%)	42.68±8.50	37.79±6.97	36.20±7.70
Protein (g)	48.20±16.30	50.50±16.30	53.25±16.71
Tryptophan (μg)	563.56±193.45	591.70±187.46	631.13±193.38
Protein (%)	13.26±4.64	13.77±2.65	13.38±3.01
Fat (g)	77.61±28.32	81.67±25.46	90.87±20.52
Oil (%)	45.05±8.55	48.42±6.83	50.44±7.22
Water (mL)	2857.49±778.91	3007.78±690.20	2375.71±497.16
Glucose (g)	10.17±5.94	7.51±4.41	7.34±4.10
Sucrose (g)	20.59±17.39	13.94±12.33	18.74±6.53
Fiber (g)	21.54±8.89	16.17±6.97	18.74±6.53
Saturated fat (g)	26.20±10.41	29.8±10.50	33.13±8.27
Monounsaturated fat (g)	27.79±11.20	29.15±9.54	31.31±7
Short chain FA (g)	1.49±0.83	2.01±0.90	2.24±0.73
Medium chain FA (g)	1.12±0.55	1.41±0.62	1.57±0.49
Long chain FA (g)	69.58±25.56	72. 92±22.97	81.08±18.7
Polyunsaturated fat (g)	18.41±10.70	17.42±8.98	20.67±9.14
Omega-3 (g)	1.78±1.36	1.85±1.17	18.69±8.44
Omega-6 (g)	16.48±9.88	15.55±8.54	18.70±8.41
EPA (g)	0.20±0.19	0.25±0.18	0.28±0.15
DHA (g)	0.0001±0.01	0.001±0.02	0.0001±0.01
Cholesterol (mg)	273.65±149	277.68±136.40	287.38±145.73
Vitamin A (μg)	900.91±568.48	871.03±331.32	1039.25±516.52
Vitamin B1 (mg)	0.67±0.22	0.57±0.22	0.64±0.23
Vitamin B2 (mg)	1.10±0.36	1.11±0.34	1.20±0.35
Niacin (mg)	6.87±3.71	6.78±3.75	7.32±0.35
Folic acid (μg)	269.11±87.30	221.01±66.45	248.69±63.08
Vitamin B12 (μg)	2.72±2.01	3.05±1.08	3.14±1.87
Vitamin C (mg)	99.19±60.22	61.61±41.66	74.84±50.5
Vitamin D (μg)	1.58±3.12	1.35±2.69	1.09±0.97
Iron (mg)	9.73±3.71	8.17±3.24	8.88±2.91
Calcium (mg)	721.90±235.91	749.09±232.62	846.28±224.79
Magnesium (mg)	243±91.08	221.41±90.23	254.37±83.06
Zinc (mg)	9.04±3.04	9.63±3.09	10.64±3.13
Iodine (μg)	172.45±64.93	167.34±55.74	199.95±56.83
Sodium (mg)	3871.10±1330.35	3642.51±1267.50	4190.92±1111.40
Caffeine (mg)	41.26±6.89	22.62±33.14	33.27±33.02

SD: Standard deviation; EPA: Eicosapentaenoic acid; DHA: Docosahexaenoic acid; FA: Fatty acid.

and 2nd trimesters was compared in terms of depression scores; EPDS scores of women who consumed red meat 1–2 times a week (respectively; 13.04±17.65; 10.19±8.28) were found to be lower than those (17.65±9.19; 18±8.08) who never consumed it (respectively: p=0.04; p=0.005). Depression scores of participants who consumed legumes 1–2 times a week (respectively; 13.46±9.52; 8.51±8.14) were lower than those (respectively: 23.62±5.37; 11.53±8.45) who did not consume (respectively; p=0.002; p=0.025). In the 3rd trimester, it was determined that EPDS scores of the subjects who consumed chocolate sweets 1–2 times a week were 9.10±5.96, and those who never consumed it were 6.94±6.65, respectively (p=0.028).

In addition, when the frequency of consumption was analyzed according to EPDS scores in all trimesters, it was found that those who consumed fish 1–2 times a week (respectively 10.54±9.09; 3.88±5.58; 3.14±3.95) had lower depression scores than those (respectively 16.52±9.41; 13.31±7.83; 9.94±6.46) who did not consume at all (all: p<0.0001). It was determined that the EPDS scores were lower in those who consumed cereal bread every day (respectively 4.91±8.27; 2.65±3.31; 2.03±2.29) than those (respectively 15.82±8.71; 13.09±7.91; 11.03±6.33) who did not consume it at all (all: p<0.0001). Participants who consumed white bread every day (respectively;15.73±8.72; 12.90±8.89; 10.01±6.59), had a higher EPDS scores than those (respectively; 4.27±7.24; 2.64±3.71; 3.20±3.72) who did not consume it at all (all: p<0.0001). EPDS scores in all trimesters were lower in those who consumed nuts every day (respectively 7±8.80; 1.72±2.93; 3.54±4.26) than those who did not consume (respectively: 20.17±7.65; 4.22±7.88; 11.32±6.35) them at all (all: p<0.0001).

Except for caffeine, other nutrients showed a negative correlation with depression scores in all trimesters (Table 4).

Comparing the mean EPDS scores, it was found that the pregnant women using vitamin D supplements (12.6±9.69) had lower values than the pregnant women who did not use any supplement (17.74±8.77, p>0.05). The status of having anemia diagnosed by the doctors of the participants was asked and it was found that 23.5% (n=33) of them were anemic. The anemic and non-anemic groups were separated according to their diagnosis, and when the EPDS scores of the groups were compared, it was found that the risk of depression was significantly different in the anemic group in the 2nd trimester (p=0.033).

DISCUSSION

Nutrition may affect the emotional status of pregnant women.[6,7] The results of this study show the risk of depression associated with nutritional status which is affected by consuming meals, foods, and frequency of food consumption.

Overweight and obesity may be associated with depression. In our study, the participants had a median of normal body weight and the weight gains were within the recommended values during pregnancy.[12] Body weight was positively correlated with depression scores in all trimesters. Possible relationships between overweight, obesity, and depression might be that obesity may cause poor self-esteem and increase inflammation in the body.[13]

Poor eating habits like skipping meals may negatively affect the nutrition quality. In a study, significant relationships were found between nutrition quality, eating habits, and mental health indicators, and it was determined that there were positive relationships between skipping meals, stress, and depression.[14] In our study, the depression scores of the pregnant women who had lunch and all snacks were lower than those who skipped these meals in all trimesters. These results suggest that regular meals may decrease the risk of depression and play an important role in the nutrition of pregnant women.

Healthy nutrition is based on consuming various and different colored foods in sufficient amounts and supplying the necessary nutrients to the body. In this study, the food consumption of pregnant women was compared to recommendations of the Turkish Dietary Guidelines.[15] Accordingly, it was determined that the dietary intakes of energy, protein, water, eicosapentaenoic acid (EPA), docosahexaenoic acid (DHA), vitamin B1, niacin, folic acid, iron and vitamin D were less than the recommended ones in the 1st and 3rd trimesters. Besides, magnesium and vitamin C were found to be less than the daily recommended values in the 2nd trimester.[15] When the trimesters were compared, it was found that the nutrient intakes of the pregnant women in the 3rd trimester were higher than in the 1st and 2nd trimesters generally.

It has been shown that nutritional quality and some foods may affect the risk of depression during pregnancy and that healthy nutrition including a high intake of fruits, vegetables, fish, and whole grains can reduce the symptoms of depression.[6,7] The consumption of various foods such as cereals, dairy products, fish, vegetables, and fruits was found to be negatively associated with pregnancy depression.[8] In support of these, an unhealthy diet including increased consumption of sweets, refined grains, high-energy drinks, and fast foods was found to increase depressive symptoms in the 3rd trimester.[9] It has been determined that depression is more common in pregnant women whose consumption of fruits and legumes is low, and whose sweets and sugar consumption is high.[10] In our study, in support of this, depression scores in the subjects frequently taking vegetables, fruits, whole grains, nuts, milk, yogurt, meat, and fish were significantly different. These results show that these nutrients, which are included in a healthy diet, may be important for the mood as well as providing benefits for the pregnant and the baby.

Suppressing negative moods with foods may cause more energy intake than needed in depressed individuals.[16] A study conducted on adolescent pregnant women showed that high energy intake was found to be associated with depressive symptoms.[17] Contrarily, the energy intake of the participants was below the daily recommendations, and their energy intake was negatively correlated with their depression scores in our study. The quality of the sources from which energy is gained, rather than its quantity, may be more effective in the risk of depression.

Foods containing high amounts of carbohydrates may have an effect on depression.[17] In our study, the percentage of carbohydrates in the diet showed a positive relationship with EPDS scores. In one study that supports this result, high depressive

Table 4: The relationship between food consumption of pregnants in trimester and EPDS scores

Variables	EPDS 1		EPDS 2		EPDS 3	
	r[c]	p	r[c]	p	r[c]	p
Dairy (mL)	-0.155	0.067	-0.581**	**<0.0001**	-0.572**	**<0.0001**
Protein foods (g)	-0.354**	**<0.0001**	-0.460**	**<0.0001**	-0.341**	**<0.0001**
Grains (g)	0.065	0.447	-0.398**	**<0.0001**	-0.219**	**0.009**
Vegetables (g)	-0.235**	**0.005**	-0.331**	**<0.0001**	-0.244**	**0.004**
Fruits (g)	-0.055	0.520	-0.342**	**<0.0001**	-0.215*	**0.011**
Oils (g)	-0.196*	**0.020**	-0.549**	**<0.0001**	-0.457**	**<0.0001**
Energy (kcal)	-0.312**	**<0.0001**	-0.444**	**<0.0001**	-0.389**	**<0.0001**
Carbs (g)	-0.033	0.695	-0.232**	**0.006**	-0.029	0.731
Carbs (%)	0.494**	**<0.0001**	0.237**	**0.005**	0.371**	**<0.0001**
Protein (g)	-0.550**	**<0.0001**	-0.604**	**<0.0001**	-0.454**	**<0.0001**
Tryptophan (μg)	-0.578**	**<0.0001**	-0.605**	**<0.0001**	-0.454**	**<0.0001**
Protein (%)	-0.430**	**<0.0001**	-0.468**	**<0.0001**	-0.369**	**<0.0001**
Fat (g)	-0.401**	**<0.0001**	-0.400**	**<0.0001**	-0.421**	**<0.0001**
Oil (%)	-0.392**	**<0.0001**	-0.072	0.4	-0.239**	**0.005**
Water (mL)	-0.408**	**<0.0001**	-0.511**	**<0.0001**	-0.401**	**<0.0001**
Glucose (g)	-0.353**	**<0.0001**	-0.399**	**<0.0001**	-0.301**	**<0.0001**
Sucrose (g)	-0.101	0.237	-0.142	0.095	0.052	0.538
Fiber (g)	-0.466**	**<0.0001**	-0.532**	**<0.0001**	-0.472**	**<0.0001**
Saturated fat (g)	-0.387**	**<0.0001**	-0.249**	**0.003**	-0.461**	**<0.0001**
Monounsaturated fat (g)	-0.463**	**<0.0001**	-0.391**	**<0.0001**	-0.345**	**<0.0001**
Short chain FA (g)	-0.398**	**<0.0001**	-0.146	0.086	-0.152	0.074
Medium chain FA (g)	-0.349**	**<0.0001**	-0.114	0.182	-0.14	0.1
Long chain FA (g)	-0.394**	**<0.0001**	-0.408**	**<0.0001**	-0.431**	**<0.0001**
Polyunsaturated fat (g)	-0.256**	**0.002**	-0.320**	**<0.0001**	-0.453**	**<0.0001**
Omega-3 (g)	-0.409**	**<0.0001**	-0.483**	**<0.0001**	-0.452**	**<0.0001**
Omega-6 (g)	-0.241**	**0.004**	-0.280**	**0.001**	-0.444**	**<0.0001**
EPA (g)	-0.280**	**0.001**	-0.308	**<0.0001**	-0.231**	**0.006**
Cholesterol (mg)	-0.548**	**<0.0001**	-0.434**	**<0.0001**	-0.367**	**<0.0001**
Vitamin A (μg)	-0.422**	**<0.0001**	-0.323**	**<0.0001**	-0.418*	**<0.0001**
Vitamin B1 (mg)	-0.436	**<0.0001**	-0.640**	**<0.0001**	-0.560**	**<0.0001**
Vitamin B2 (mg)	-0.596**	**<0.0001**	-0.647**	**<0.0001**	-0.561**	**<0.0001**
Niacin (mg)	-0.416**	**<0.0001**	-0.507**	**<0.0001**	-0.416**	**<0.0001**
Folic acid (μg)	-0.439**	**<0.0001**	-0.480**	**<0.0001**	-0.368**	**<0.0001**
Vitamin B12 (μg)	-0.611**	**<0.0001**	-0.574**	**<0.0001**	-0.490**	**<0.0001**
Vitamin C (mg)	-0.327**	**<0.0001**	-0.309**	**<0.0001**	-0.231**	**0.006**
Vitamin D (μg)	-0.405**	**<0.0001**	-0.373**	**<0.0001**	-0.297**	**<0.0001**
Iron (mg)	-0.517**	**<0.0001**	-0.664**	**<0.0001**	-0.545**	**<0.0001**
Calcium (mg)	-0.569**	**<0.0001**	-0.545**	**<0.0001**	-0.520**	**<0.0001**
Magnesium (mg)	-0.508**	**<0.0001**	-0.659**	**<0.0001**	-0.589**	**<0.0001**
Zinc (mg)	-0.646**	**<0.0001**	-0.685**	**<0.0001**	-0.590**	**<0.0001**
Iodine (μg)	-0.412**	**<0.0001**	-0.372**	**<0.0001**	-0.318**	**<0.0001**
Sodium (mg)	-0.369**	**<0.0001**	-0.245	**0.003**	-0.205*	**0.015**
Caffeine (mg)	0.211*	**0.013**	0.227**	**0.007**	0.410	**<0.0001**

C: Spearman correlation; *: P<0.05; **: P<0.001; EPDS 1: Edinburgh Postnatal Depression Scale scores in the 1st trimester; EPDS 2: Edinburgh Postnatal Depression Scale scores in the 2nd trimester; EPDS 3: Edinburgh Postnatal Depression Scale scores in the 3rd trimester; EPA: Eicosapentaenoic acid; DHA: Docosahexaenoic acid; FA: Fatty acid.

symptoms were found to be associated with higher carbohydrate intake.[17] These relationships may be due to the fact that carbohydrates are the brain's primary energy source and a delicate balance between insulin. It has been reported that there is a relationship between the serum insulin level and the production of serotonin, one of the hormones effective in depression.[18]

In a study investigating the relationship between the consumption of dairy products and the frequency of depressive symptoms, a negative relationship was shown between dietary calcium intake and the prevalence of depression during pregnancy.[19] Likewise, in our study, the amount of calcium in the diet and depression scores showed a negative relationship in all trimesters. Possible effects of calcium with depression; It activates tryptophan hydroxylase, which is responsible for serotonin synthesis, increases the dopamine synthesis of the calcium/calmodulin-dependent system in the brain, and changes in the extracellular calcium level affect the excitability of neuromuscular tissues that play a role in regulating emotions.[20] Dietary calcium during pregnancy may be important for bone health as well as decreasing the risk of depression.

It has been shown that depression is a result of the insufficient activity of serotonin and norepinephrine neurotransmitters, and the susceptibility to depression may increase in case of deficiency of their amino acid precursors.[21] In our study, the amount of dietary tryptophan and EPDS scores were negatively correlated. A diet rich in tryptophan may be beneficial for the risk of depression during pregnancy.

Omega-3 fatty acids may play a role in reducing the risk of depression, as they are involved in the production of serotonin and one of the main components of the nervous system cell membrane, and have an anti-inflammatory effect.[22] According to the Turkish Dietary Guidelines, a total daily dietary EPA and DHA intake of 250 mg is recommended for an adequate omega-3 level.[15] In one study, EPDS and FFQ were applied at the 32nd week of pregnancy, and low dietary omega-3 intake was associated with an increase in depressive symptoms. Pregnant women who took more than 1.5 g of omega-3 from seafood in a week had lower EPDS scores at the 32nd week of pregnancy compared to those who did not take any.[23] In our study, the amount of omega-3 taken in the diet was negatively correlated with depression EPDS scores.

Vitamin D is important for bone mineralization and calcium deposition during pregnancy, but its main source is sunlight, so its deficiency may occur when dietary intake is low in winter.[24] It was found that vitamin D deficiency increased EPDS scores.[25] It has been determined that vitamin D supplementation provides a decrease in depression scores in the 3rd trimester and postpartum period.[26] Supporting this, in our study, the mean EPDS scores of pregnant women who received vitamin D supplements were lower than those who did not receive any supplement. These results showed the essentiality of supplementation during pregnancy when dietary vitamin D is not adequately taken.

Twenty percent of women are affected by iron deficiency anemia during pregnancy.[27] In one study where the prevalence of anemia was found to be 33.3% in pregnant women, EPDS scores were found to be higher in anemic patients than in others.[28] In our study, the prevalence of anemia was 23.5%, EPDS scores were higher in pregnant women with anemia than others, and the amount of dietary iron intake was associated with depression scores. This relationship is thought to be due to iron playing a role in the production of hormones such as neurotransmission, dopamine, norepinephrine and serotonin, and the development of the central nervous system through the white matter myelination step.[28]

The recommended daily dietary caffeine intake maximum 200 mg during pregnancy.[29] It has been shown that excessive caffeine intake increases the risk of hyperactivity, inattention, and depression. Moreover, it has been reported that the fetal brain is more sensitive to caffeine exposure.[30] In our study, dietary caffeine intake and depression scores showed a positive correlation in all trimesters. The negative effect of caffeine intake over the recommended limit on mood was supported by these results.

Limitations

The fact that the biochemical data of the individuals could not be examined to determine the nutritional status and the serum levels of the nutrients could not be controlled, the results were based on the individual responses.

CONCLUSION

In this study, the relationship between dietary intake of some nutrients along with a healthy diet and depression scores was determined. The nutrients, vitamins, and minerals contained in foods may affect the risk of depression as they play a role in the reduction of oxidative stress, neurotransmission, and the production of hormones such as serotonin. These relationships show the importance of a healthy diet and dietitian follow-up to meet the metabolic needs of the pregnant woman and the fetus, as well as to reduce the risk of depression and progress the pregnancy in healthy conditions. This study is one of the limited studies in this field in our country. To shed light on these relationships, more studies are needed that will include more centers and relate them to the biochemical data of the participants.

Statement

Ethics Committee Approval: The Health Sciences University Hamidiye Research Ethics Committee granted approval for this study (date: 22.02.2019, number: 19/17).

Informed Consent: Written informed consent was obtained from patients who participated in this study.

Peer-review: Externally peer-reviewed.

Author Contributions: Concept – PG; Design – PG, EYA; Supervision – PG; Resource – PG; Materials – PG; Data Collection and/or Processing – PG; Analysis and/or Interpretation – PG; Literature Search – PG; Writing – PG, EYA; Critical Reviews – EYA.

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