



AREL ÜNİVERSİTESİ
SAĞLIK BİLİMLERİ DERGİSİ
JOURNAL OF HEALTH SCIENCES AREL UNIVERSITY



Home page (Web sayfası): <https://dergipark.org.tr/en/pub/arsagbil>

Araştırma Makalesi

Mediterranean Diet Adherence and Health Literacy Levels in Pregnant Women with Gestational Diabetes: A Case-Control Study

Simay Kundakçı^{1*}, Pınar Geyik², Rabia Bağlayıcı³, Şule Aktaç⁴

¹Department of Nutrition and Dietetics Institute of Health Sciences Marmara University, 34865 Maltepe, İstanbul, Türkiye

E-mail: siimayferelii@gmail.com Orcid: 0000-0002-7962-2624

²Zeynep Kamil Women and Children Diseases Training and Research Hospital, 34668 Üsküdar, İstanbul, Türkiye

E-mail: pinargeyikk@gmail.com Orcid: 0000-0003-4579-808X

³Department of Nutrition and Dietetics Institute of Health Sciences Marmara University, 34865 Maltepe, İstanbul, Türkiye

E-mail: rabia.baglayici76@gmail.com Orcid: 0009-0004- 1832-6313

⁴Department of Nutrition and Dietetics Faculty of Health Sciences Marmara University, 42075 Maltepe, İstanbul, Türkiye

E-mail: suleaktac@gmail.com Orcid: 0000-0002-2158-5015

Abstract

This study aims to investigate the relationship between adherence to the Mediterranean diet and health literacy levels of pregnant women with and without gestational diabetes (GDM). Mediterranean diet is thought to be beneficial in the management of GDM and other pregnancy complications. Health literacy enables pregnant women to make decisions about nutrition and health management. This case-control study was conducted in a training-research hospital between October 2023 and April 2024. The study included 100 pregnant women with a gestational week \geq 37, 50 with GDM and 50 non-GDM. Questionnaire forms including socio-demographic characteristics, Mediterranean Diet Adherence Scale (MEDAS) and Maternal Health Literacy Inventory in Pregnancy (MHELIP) were administered to the pregnant women. It was determined that the mean MEDAS score of the pregnant women was 7.46 ± 2.18 and 58% of the pregnant women with GDM showed moderate fit with the Mediterranean diet. The average health literacy score was 81.18, with 46% of women with GDM and 52% of non-GDM classified as having 'sufficient' or 'excellent' health literacy. No significant differences in Mediterranean diet adherence were observed based on demographic factors and pre-pregnancy body mass index (BMI). Among women with GDM, the health literacy scores of employed women and women with lower pre-pregnancy BMI were significantly higher. Linear regression analysis revealed that changes in health literacy scores significantly impacted adherence to the Mediterranean diet in women with GDM. In conclusion, improving health literacy and promoting healthy eating habits are especially important for pregnant women with gestational diabetes.

Keywords: Gestational diabetes mellitus, Mediterranean diet, Health literacy

Gestasyonel Diyabetli Gebelerin Akdeniz Diyetine Uyum ve Sağlık Okuryazarlığı Düzeyleri: Bir Vaka-Kontrol Çalışması

Özet

Çalışmanın amacı, gestasyonel diyabeti (GDM) olan ve olmayan gebelerin Akdeniz diyetine uyumu ile sağlık okuryazarlığı düzeyleri arasındaki ilişkiyi araştırmaktır. Akdeniz diyetinin GDM ve diğer gebelik komplikasyonlarının yönetiminde faydalı olduğu düşünülmektedir. Sağlık okuryazarlığı ise gebelerin beslenme ve sağlık yönetimi hakkında karar vermelerini sağlamaktadır. Vaka-kontrol çalışması Ekim 2023 - Nisan 2024 tarihleri arasında bir eğitim-araştırma hastanesinde yürütülmüştür. Çalışmaya gebelik haftası ≥ 37 olan, 50 GDM'li ve 50 GDM'li olmayan 100 gebe dahil edilmiştir. Gebelere sosyo-demografik özellikleri içeren anket formu, Akdeniz Diyetine Uyum Ölçeği (MEDAS) ve Gebelikte Sağlık Okuryazarlığı Ölçeği (MHELIP) uygulanmıştır. Gebelerin ortalama MEDAS puanının 7.46 ± 2.18 olduğu ve GDM'li gebelerin %58'inin Akdeniz diyetine orta düzeyde uyum gösterdiği belirlenmiştir. Ortalama sağlık okuryazarlığı puanı 81,18 olup GDM'li kadınların %46'sı ve GDM'li olmayan kadınların ise %52'si 'yeterli' veya 'mükemmel' sağlık okuryazarlığına sahip olarak sınıflandırılmıştır. Demografik faktörlere ve gebelik öncesi vücut kütle indeksine (BKİ) bağlı olarak Akdeniz diyetine uyumda farklılık gözlenmemiştir. GDM'li kadınlar arasında, çalışan kadınların ve gebelik öncesi BKİ'si daha düşük olan kadınların sağlık okuryazarlığı puanları anlamlı olarak yüksek olduğu bulunmuştur. Doğrusal regresyon analizi, sağlık okuryazarlığı puanındaki değişimin GDM'li kadınlarda Akdeniz diyetine uyumu etkilediğini ortaya koymuştur. Sonuç olarak, sağlık okuryazarlığının geliştirilmesi ve sağlıklı beslenme alışkanlıklarının teşvik edilmesi özellikle gestasyonel diyabetli hamile kadınlar için önemlidir.

Anahtar kelimeler: Gestasyonel diyabetes mellitus, Akdeniz diyeti, Sağlık okuryazarlığı

1. INTRODUCTION

Nutrition during pregnancy is a potentially modifiable risk factor that can influence the mother's and newborn's physiological and metabolic health (Xu et al., 2024). Inadequate nutritional status and an unhealthy lifestyle may negatively impact the pregnant woman's body composition, metabolism, and placental nutrient transfer, which, in turn, can negatively affect the baby's development. Nutritional models and improvements during pregnancy have been shown to reduce perinatal health risks, such as gestational diabetes and preterm birth. These factors are also crucial during the first 1000 days of life, a critical window of opportunity for promoting long-term health (Reijnders et al., 2019; Xu et al., 2024). To better understand the relationship between maternal nutritional status and dietary habits during pregnancy and birth outcomes and to develop nutritional interventions that enhance maternal and infant health long-term, the “window of opportunity” provided by pregnancy must be optimized (Patel, 2023). During pregnancy, women may change their dietary habits to consider both their health and that of their babies, adopting behaviors they believe to be healthier (Reijnders et al., 2019).

Gestational diabetes mellitus (GDM) is a disorder of glucose intolerance that is first diagnosed during pregnancy. According to the International Diabetes Federation (IDF), GDM occurs in approximately 14% of pregnancies worldwide, accounting for about 20 million births annually (Wang et al., 2022). Inadequate management of GDM, one of the most common complications during pregnancy, can lead to adverse health outcomes for both the mother and the baby (Kibret et al., 2019). Management of GDM is influenced by factors such as nutrition, physical activity, obesity, and weight gain, and it is primarily managed through dietary and lifestyle changes supported by proper nutrition and physical activity (ADA, 2022). Increased consumption of vegetables, fruits, and whole grains, as well as reduced intake of meals prepared outside the home and simple sugars, has been reported to reduce the risk of GDM (Kibret et al., 2019).

Being considered one of the healthiest dietary patterns and utilized in medical nutrition therapy for many metabolic diseases, including diabetes (Assaf-Balut et al., 2018), the Mediterranean diet (MD) is characterized by limited consumption of dairy products, meat, poultry, and saturated fats; moderate consumption of fish, and high consumption of vegetables, legumes, fruits, nuts, and cereals (Flor-Aleman et al., 2024). Studies have reported that women who adhere to the MD during pregnancy experience reduced weight gain and a lower risk of GDM (Assaf-

Balut, 2018; Amati et al., 2019), while their infants have a reduced risk of premature birth, low birth weight, neural tube defects, asthma, and allergies. Furthermore, adherence to the MD during pregnancy has been shown to reduce health risks such as insulin resistance, hyperglycemia, and abdominal obesity in childhood (Biagi et al., 2019). These studies assessed adherence to the Mediterranean diet using the MedDiet (Assaf-Balut, 2018) and the Mediterranean Diet Adherence Score (Biagi et al., 2019).

Health literacy refers to the knowledge, motivation, and competencies required to access, understand, evaluate, and apply information about health services, disease prevention, and health promotion (Sørensen et al., 2012). Health literacy, which also encompasses food selection and understanding and applying health information (Duarte et al., 2024), is particularly important for vulnerable groups such as pregnant women (Nawabi et al., 2021). Since pregnant women aim to maintain their health and that of their babies during this critical period, they are highly motivated to adopt health improvements. Maternal health literacy involves the cognitive and social skills necessary to acquire, understand, and use information that promotes and protects maternal and child health (Kilfoyle et al., 2016). Studies examining health literacy during pregnancy have reported that low health literacy levels range between 15-44% (Javadzade et al., 2013; Ghanbari et al., 2020). Health literacy, one of the key factors in ensuring a healthy pregnancy and a smooth transition to motherhood, enhances the quality of antenatal services and reduces adverse pregnancy outcomes (Taheri et al., 2021). It has been reported that women with limited health literacy struggle to understand written information provided during antenatal care and are unable to make medical decisions (Kilfoyle et al., 2016). Studies evaluating the health literacy of pregnant women have employed general health literacy tools such as the Rapid Estimate of Adult Literacy in Medicine (REALM), the Short-Test of Functional Health Literacy in Adults (S-TOFHLA), the New Vital Sign (NVS), and the Brief Health Literacy Screening (BHLS), as well as researcher-developed questionnaires (Sørensen et al., 2013). In addition to these tools, the Maternal Health Literacy and Empowerment in Pregnancy (MHELIP) tool, which specifically targets pregnant women, has been used to assess maternal health literacy in research (Taheri et al., 2021; Rahimi et al., 2022).

The number of studies examining the relationship between adherence to the Mediterranean diet and health literacy among pregnant women is limited (Albani et al., 2022; Abreu et al., 2023). In a study, health literacy level affected adherence to the Mediterranean diet (Duarte et al., 2024); in other studies, an adequate level of health literacy did not affect adherence to the Mediterranean diet (Albani et al., 2022; Abreu et al., 2023). It is emphasized that health literacy can enhance adherence to the MD by increasing nutritional knowledge and plays a critical role in improving maternal and child health (Staynova and Yanachkova, 2022; Duarte et al., 2024). However, the literature lacks in studies that specifically explore this relationship in pregnant women, who represent one of the vulnerable groups in society.

2. SAMPLE AND METHODOLOGY

This study aims to determine adherence to the MD and health literacy levels in pregnant women with and without GDM and to evaluate the relationship between these factors. The hypotheses formulated in line with this aim are as follows: adherence to the MD in pregnant women with GDM is higher than in those without GDM, and health literacy levels of pregnant women with GDM are higher than in those without GDM.

2.1. Study Desing

This case-control study was conducted between October 2023 and April 2024 at a training and research hospital with 100 pregnant women, 50 diagnosed with GDM, and 50 healthy pregnant women; all consented to participate and were at ≥ 37 weeks of gestational age.

The sample size was calculated through power analysis using the G*Power v3.1.9.7 program, with an effect size of 0.25, a type 1 error rate of $\alpha=0.05$, and a test power of $1-\beta=0.90$. This analysis determined that a total of 96 participants would be required, with 48 in each group (GDM and non-GDM) (Taheri et al., 2021). Considering potential inconveniences such as incomplete questionnaires and participants' withdrawal from the study, it was decided to include 50 pregnant women from each group. Pregnant women who regularly attended the pregnancy follow-up outpatient clinic were invited to participate in the research and the study was conducted with those who agreed to participate.

The doctor determined GDM with a single-step (75 g glucose) OGTT (Oral Glucose Tolerance Test) performed on pregnant women at 24-28 gestation weeks. Fasting blood glucose ≥ 92 mg/dL; 1st-hour blood glucose ≥ 180 mg/dL and 2nd-hour blood glucose ≥ 153 mg/dL; presence of any of these criteria was diagnosed as GDM (ADA, 2022). Principles of the Helsinki Declaration were followed, ethics committee approval was obtained from the Clinical Research Ethics Committee (Decision No: 98) and informed consent was obtained from the participants.

2.2. Data Collection and Evaluation

Data were collected using a socio-demographic questionnaire to determine the general characteristics of the pregnant women, the (Mediterranean Diet Adherence Scale) MEDAS to assess adherence to the Mediterranean diet, and the (Maternal Health Literacy Inventory in Pregnancy) MHELIP to evaluate health literacy levels.

2.2.1. Socio-demographic questionnaire

A socio-demographic questionnaire, including questions on the age, educational status, and employment status of the pregnant women, was developed by the researchers based on a review of the relevant literature (Nawabi et al., 2021; Albani et al., 2022; Odabaş et al., 2024). Data were collected through face-to-face interviews conducted by the researchers. After obtaining consent from the participants, their height and body weight were measured. Pregnant women's Body Mass Index (BMI) was classified according to WHO criteria (WHO, 2000).

2.2.2. Mediterranean diet adherence scale (MEDAS)

Mediterranean diet questionnaire with 14 items developed by Martínez-González et al. (2012) in the PREDIMED study, later validated by Schröder et al. (2011) was used. The Turkish validity and reliability study of the questionnaire was conducted by Pehlivanoğlu et al. and the Cronbach's alpha value of the scale was found to be 0.829 (Pehlivanoğlu et al., 2020). The questionnaire assesses various dietary components, including the main type of oil used in meals, the amount of olive oil consumed daily, portions of fruits and vegetables, consumption of margarine/butter and red meat, the amount of wine, legumes, fish, and seafood, nuts, pastries, and tomato sauce with olive oil consumed weekly, as well as whether white meat is preferred over red meat. Each question is scored as 1 or 0, and a total score is calculated. A total score of < 7 indicates poor fit to the MD, 7-8 indicates moderate fit, while a score of 9 and above indicates good fit (León-Muñoz et al., 2012).

2.2.3. Maternal health literacy inventory in pregnancy (MHELIP)

The questionnaire developed by Taheri et al. (2020) to assess maternal health literacy consists of 48 questions graded on a 5-point Likert scale (Taheri et al., 2020). The Turkish validity and reliability study of the scale was conducted by Abay et al. (2023) and the Cronbach's alpha value of the scale is 0.94, indicating excellent internal consistency. The total score ranges from 48 to 240, with higher scores reflecting higher levels of maternal health literacy. The MHELIP score is categorized into four levels: inadequate (0-50), problematic (50.1-66, indicating limited health

literacy), sufficient (66.1-84), and excellent (84.1-100, representing desired health literacy) (Taheri et al., 2020).

2.3. Data Analysis

The data obtained were transferred to a computer environment and analyzed using SPSS v.28. First, the total scores of the scales were calculated, and their normal distribution was assessed using the Kolmogorov-Smirnov test, skewness and kurtosis values, Q-Q plots, and histograms. The relationship between employment status and the scales was analyzed using an Independent Samples t-test. The relationships between education level, income level, pre-pregnancy BMI, and the scales were examined using the Chi-squared test and One-Way ANOVA followed by the Tukey multiple comparison test. Predictive relationships between variables were analyzed using regression analyses. The significance level was accepted as $p < 0.05$ for all analyses.

3. RESULTS

The mean age of the women was 31.2 ± 4.9 years, and their pre-pregnancy body weight was 70.6 ± 16.6 kg. The majority of the pregnant women (43%) had a pre-pregnancy BMI classified as normal, and 93% had not been diagnosed with GDM in previous pregnancies. These findings indicate that the general characteristics of pregnant women with and non-GDM were similar (Table 1).

Table 1. General characteristics of pregnant women

	Total	With GDM (n=50)	Non-GDM (n=50)	<i>p</i>
	Mean \pm SD	Mean \pm SD	Mean \pm SD	
Age (years)	31.2 ± 4.9	31.7 ± 5.3	30.8 ± 4.6	0.250*
Pre-pregnancy body weight (kg)	70.6 ± 16.6	72.6 ± 16.9	68.6 ± 16.2	0.658*
Weight gain during pregnancy (kg)	10.3 ± 4.6	10.5 ± 4.6	10.2 ± 4.5	0.828*
Height (cm)	162.3 ± 5.9	161.8 ± 6.3	162.7 ± 5.4	0.213*
Number of pregnancy	1.8 ± 0.94	1.7 ± 0.83	1.9 ± 1.05	0.078*
	n (%)	n (%)	n (%)	
Pre-pregnancy BMI (kg/m²)				
Underweight	2 (2.0)	-	2 (4.0)	
Normal	43 (43.0)	18 (36.0)	26 (52.0)	
Overweight	29 (29.0)	18 (36.0)	11 (22.0)	
Class I Obesity	18 (18.0)	10 (20.0)	9 (18.0)	0.206**
Class II Obesity	2 (2.0)	2 (4.0)	-	
Class III Obesity	4 (4.0)	2 (4.0)	2 (4.0)	

Employment status				
Yes	37 (37.0)	18 (36.0)	19 (38.0)	0.51**
No	63 (63.0)	32 (64.0)	31 (62.0)	
Education level				
Primary school	11 (11.0)	8 (16.0)	3 (6.0)	0.175**
Middle school	13 (13.0)	7 (14.0)	6 (12.0)	
High school	33 (33.0)	15 (30.0)	18 (36.0)	
Bachelor's degree and above	43 (43.0)	20 (40.0)	23 (46.0)	
GDM in previous pregnancies				
Yes	7 (7.0)	6 (12.0)	1 (2.0)	0.056**
No	93 (93.0)	44 (88.0)	49 (98.0)	
Diabetes history in the family				
Yes	45 (45.0)	25 (50.0)	20 (40.0)	0.211**
No	55 (55.0)	25 (50.0)	30 (60.0)	

*Independent Samples T-Test; **Chi-Square Tests

The mean MEDAS score of the pregnant women was 7.46 ± 2.18 . It was found that 58% of pregnant women with GDM and 48% of those non-GDM exhibited moderate fit with the MD. The mean health literacy score was 81.18 ± 11.67 , with 46% of pregnant women with GDM and 52% of those non-GDM classified as having "sufficient" or "excellent" health literacy. Both groups had similar Mediterranean diet adherence and health literacy levels (Table 2).

Table 2. Comparison of adherence to the Mediterranean diet and health literacy of pregnant women

	Total	With GDM (n=50)	Non - GDM (n=50)	p
	Mean \pm SD	Mean \pm SD	Mean \pm SD	
MEDAS score	7.5 \pm 2.2	7.9 \pm 2.3	7.0 \pm 2.1	0.927*
	n (%)	n (%)	n (%)	
MEDAS categories				
Poor fit	31 (31.0)	11 (22.0)	20 (40.0)	0.053**
Moderate fit	53 (53.0)	29 (58.0)	24 (48.0)	
Good fit	16 (16.0)	10 (20.0)	6 (12.0)	

	Mean ± SD	Mean ± SD	Mean ± SD	
MHELIP score	81.2 ± 11.7	79.4 ± 13.5	83.0 ± 9.1	0.111*
MHELIP categories	n (%)	n (%)	n (%)	
Inadequate	2 (2.0)	2 (4.0)	-	
Problematic	6 (6.0)	4 (16.0)	2 (4.0)	
Sufficient	45 (45.0)	23 (46.0)	22 (44.0)	0.112**
Excellent	47 (47.0)	21 (42.0)	26 (52.0)	

MEDAS: Mediterranean Diet Adherence Scale; MHELIP: Maternal Health Literacy in Pregnancy Scale; *Independent Samples T-Test; **Chi-Square Tests

Demographic data of pregnant women and their adherence to the MD were evaluated with MEDAS and no significant differences were found in educational status, employment status, pre-pregnancy BMI, weight gain, and age in relation to adherence to the MD ($p > 0.05$) (Table 3).

Table 3. Comparison of general characteristics of pregnant women according to MEDAS

		With GDM (n=50)			Non-GDM (n=50)				
		Poor fit (n=11)	Moderate fit (n=29)	Good fit (n=10)	<i>p</i>	Poor fit (n=20)	Moderate fit (n=24)	Good fit (n=6)	<i>p</i>
		n (%)	n (%)	n (%)		n (%)	n (%)	n (%)	
Education level	Primary school	1 (9.1)	5 (17.2)	2 (20.0)	0.27*	1 (5.0)	2 (8.3)	-	0.98*
	Middle school	2 (18.2)	5 (17.2)	-		2 (10.0)	3 (12.5)	1 (16.7)	
	High school	3 (27.3)	11 (37.9)	1 (10.0)		8 (40.0)	8 (33.3)	2 (33.3)	
	Bachelor's degree and above	5 (45.5)	8 (27.5)	7 (70.0)		9 (45.0)	11 (45.9)	3 (50.0)	
Employment status	Yes	5 (45.5)	9 (31.0)	4 (40.0)	0.67*	6 (30.0)	12 (50.0)	1 (16.7)	0.20*
	No	6 (54.5)	20 (69.0)	6 (60.0)		14 (70.0)	12 (50.0)	5 (83.3)	
Pre-pregnancy BMI (kg/m²)	Underweight	-	-	-	0.79*	1 (5.0)	1 (4.2)	-	0.39*
	Normal	5 (45.5)	9 (31.0)	4 (40.0)		12 (60.0)	11 (45.8)	3 (50.0)	
	Overweight	3 (27.3)	13 (44.8)	2 (20.0)		3 (15.0)	6 (25.0)	2 (33.3)	
	Class I Obesity	2 (18.2)	5 (17.2)	3 (30.0)		3 (15.0)	5 (20.8)	1 (16.7)	
	Class II Obesity	1 (9.1)	1 (3.4)	-		-	-	-	

	Class III Obesity	-	1 (3.4)	1 (10.0)		1 (5.0)	1 (4.2)	-	
	Mean ± SD	Mean ± SD	Mean ± SD	p	Mean ± SD	Mean ± SD	Mean ± SD	p	
Total weight gain	12.1±6.3	9.8±3.9	10.4±4.6	0.38**	10.2±4.3	10.4±4.7	9.7±5.5	0.94**	
Age (years)	30.5±5.6	32.3±5.8	31.0±3.4	0.59**	31.9±4.8	29.7±4.6	30.3±3.9	0.28**	

*Chi-squared test, ** One Way ANOVA

Although not statistically significant, health literacy scores in both groups increased as educational status improved. The health literacy scores of pregnant women with GDM who were employed were higher than those of unemployed pregnant women ($p < 0.04$). Additionally, pre-pregnancy BMI significantly affected health literacy scores ($p < 0.001$) in GDM group. A Tukey test was performed to determine which BMI categories differed, revealing that among pregnant women with GDM, those in the 2nd-degree obese category had significantly lower MHELIP scores compared to those in other categories ($p < 0.05$) (Table 4).

Table 4. Comparison of general characteristics and health literacy of pregnant women

	With GDM		Non-GDM	
	MHELIP score	p	MHELIP score	p
Education level	Primary school	69.9±20.4	76.3±7.5	
	Middle school	75.6±8.6	82.0±10.2	
	High school	81.3±11.6	82.5±9.2	0.13*
	Bachelor's degree and above	83.1±11.5	86.3±8.7	
Employment status	Yes	84.1±11.2	86.3±7.5	0.11**
	No	76.7±14.1	82.3±9.8	
Pre-pregnancy BMI (kg/m²)	Underweight	-	65.5±3.5	
	Normal	75.9±14.0 ^b	84.7±7.2	
	Overweight	80.7±9.3 ^{b,c}	84.8±11.6	0.06*
	Class I Obesity	84.0±8.0 ^{b,c}	84.5±8.3	
	Class II Obesity	51.5±3.5 ^a	-	
	Class III Obesity	102.5±20.5 ^c	87.5±9.2	

*One Way ANOVA; **Independent Samples t Test. a-c: There is a statistical difference between the data that do not have a common letter as a superscript.

In Table 5, the MHELIP and MEDAS scores of pregnant women with and without GDM were evaluated using linear regression analysis. The results indicated that the change in health literacy scores of GDM patients significantly affected their adherence to the MD ($\beta=3.351$; $R^2= 0,117$; $p < 0.015$).

Tablo 5. Linear regression analysis of pregnant women's adherence to the Mediterranean diet and health literacy

Variable	With GDM					Non-GDM				
	B	Standard Error	β	t	p	B	Standard Error	β	t	p
Adherence to MD	3.351	1.819		1.842	0.072	6.683	2.733		2.446	0.018
MHELIP score	0.057	0.023	0.342	2.525	0.015	0.004	0.032	0.019	0.132	0.896
R = 0.342; R ² = 0.117; F = 6.378; p = 0.015*					R = 0.019; R ² = 0.000; F = 0.017; p = 0.896					

4. DISCUSSION

This study is one of the first to investigate adherence to the MD, health literacy levels, and influencing factors in pregnant women with and without GDM. It was determined that more than half of the pregnant women demonstrated a moderate adherence to the MD, with their health literacy levels categorized as 'sufficient' and 'excellent.' The adherence to the MD and health literacy levels of pregnant women with and without GDM were similar. Furthermore, adherence to the MD was not influenced by age, weight gain, education, and employment status, or pre-pregnancy BMI. However, it was found that pre-pregnancy BMI affected health literacy, and the health literacy levels of employed pregnant women with GDM were higher. Furthermore, the results showed that the change in health literacy scores of GDM patients significantly affected their adherence to MD.

In studies conducted with different populations in Turkey, individuals were found to show “moderate” compliance with the MD (Gümüş, 2023; Yassıbaş, 2023). Consistent with these studies, our study also found adherence to the MD at a moderate fit. Randomized controlled and prospective studies have determined that adherence to the MD from early pregnancy reduces the risk of GDM by 17-41% (Mohtashaminia et al., 2023; Odabaş et al., 2024). Women with GDM were found to have significantly lower adherence to the MD compared to healthy pregnant women (Odabaş et al., 2024). In contrast, Torre et al. (2019) compared pregnant women diagnosed with GDM who received nutrition counseling to those who received standard care, finding that adherence to the MD was higher in the GDM group at 36-38 weeks of gestation (Torre et al., 2019). In our study, however, adherence to the MD was similar among pregnant women with and without GDM. Factors such as small sample size, participants' level of knowledge and awareness, not receiving counseling services, cultural and social influences, and access to health services may have contributed to these results differing from those in the literature. Adherence to the MD is influenced by various demographic and sociocultural factors, including age, gender, education level, and income, as well as by factors such as disease, physical activity, and food accessibility (Sam-Yellowe, 2024). However, in our study, GDM diagnosis, education, employment status, and pre-pregnancy BMI did not significantly affect adherence to the MD. The reasons for this include differences in nutrient accessibility, economic factors, lifestyle variations, and a lack of knowledge about the health benefits of the MD. Based on our findings, it is believed that increasing adherence to the MD—independent of these factors—may be beneficial for maternal and infant health, particularly in cases of GDM that require medical nutrition therapy.

Pregnant women diagnosed with GDM should possess a high level of health literacy to effectively learn about their condition, understand health recommendations, and manage aspects such as diet, insulin use, blood glucose monitoring, and physical activity (Staynova and Yanachkova, 2022). A study utilizing the MHELIP found that the health literacy scores of healthy pregnant women were higher than those of pregnant women with diabetes (Rahimi et al., 2022). However, in our study, the health literacy score did not significantly differ based on GDM status.

Enhancing health literacy levels among pregnant women with GDM is crucial for protecting maternal and infant health and improving overall public health.

Studies indicate that pregnant women with higher educational status and those employed have elevated levels of health literacy (Filiz and Bodur, 2022; Sabetghadam et al., 2023). In a study conducted by Taheri et al., a weak positive correlation was found between the MHELIP scores and both age and educational status (Taheri et al., 2021). In our study, although no significant differences were observed among the academic levels, it was noted that health literacy scores increased with higher educational attainment. Thus, our findings are partially consistent with previous research (Filiz and Bodur, 2022; Sabetghadam et al., 2023).

As health literacy increases, individuals' health behaviors and food choices are positively influenced, leading to better weight management and maintaining BMI within healthy ranges (Staynova and Yanachkova, 2022). Our study found that health literacy levels varied according to pre-pregnancy BMI. Specifically, the health literacy of pregnant women with GDM who were classified as grade 2 obese, as well as that of pregnant women without GDM in the underweight BMI category, was significantly lower. This indicates a lack of alignment between BMI categories and health literacy scores.

Studies examining the relationship between health literacy and adherence to the Mediterranean diet have different results (Albani et al., 2022; Abreu et al., 2023; Duarte et al., 2024). A positive relationship was found between health literacy levels and adopting the Mediterranean diet in socially disadvantaged adults (Albani et al., 2022). On the other hand, a study conducted with adult individuals (Duarte et al., 2024) and university students did not find a significant relationship between health literacy level and adherence to the Mediterranean diet (Abreu et al., 2023). According to our findings, health literacy significantly influenced adherence to the MD in women with GDM. Potential reasons for this may include that pregnant women with GDM may be more motivated, require more information, and need to regulate their dietary habits more strictly. In contrast, health literacy may have a lesser impact on dietary adherence among non-GDM pregnant women, as they may approach their diet more flexibly without strict medical requirements.

The strengths of this study include its contribution to the literature by investigating the critical relationship between health literacy and adherence to the Mediterranean diet in pregnant women with GDM. Additionally, using a health literacy scale specifically designed for pregnant women as a data collection tool enhances the reliability of the findings. The small sample size has limited the generalizability of the study results.

6. CONCLUSIONS

This study contributes to the literature on understanding the relationship between adherence to the MD and health literacy. The results indicate that more than half of the pregnant women adhered to the MD at moderate compliance. GDM diagnosis, age, education, employment status, or pre-pregnancy BMI did not affect MD adherence. In contrast, health literacy varied according to pre-pregnancy BMI and employment status. Furthermore, changes in the health literacy scores of women with GDM were found to influence their adherence to the MD significantly. These findings suggest that improving health literacy is crucial for managing GDM and enhancing healthy dietary habits during pregnancy. Mediterranean diet principles should be included in primary health care services for pregnant women because of their health protective effects. Health policies developed for pregnant women, especially with GDM receiving medical nutrition therapy, should include strategies for health literacy and acquiring healthy eating habits that improve maternal and infant health. Prospective studies should focus on strategies and practices to improve adherence to the MD and enhance health literacy, particularly in managing high-risk groups like those with GDM.

Author's Contributions

SK: Study design, Literature research, Data collection, Data interpretation, Statistical analysis, Manuscript preparation; **PG:** Literature research, Data collection, Data interpretation; **RB:** Literature research, Data collection, Data interpretation; **ŞA:** Study design, Literature research, Data interpretation, Statistical analysis

Ethics Committee Declaration

Ethics committee approval (No. 98, dated 21.06.2023) was obtained from the Clinical Research Ethics Committee of Zeynep Kamil Women's and Children's Diseases Training and Research Hospital. After providing information about the study, pregnant women who voluntarily agreed to participate signed the "Informed Consent Form."

Conflict of Interest

The authors declare that they have no conflict of interest.

REFERENCES

- Abay, H., Alagöz, F. and Tekin, Ö.M. (2023). The Turkish validity and reliability of the maternal health literacy inventory in pregnancy. *Midwifery*, 25, 103774. DOI: 10.1016/j.midw.2023.103774
- Abreu, F., Hernando, A., Goulão, L. F., Pinto, A. M., Branco, A., Cerqueira, A. and Sousa, J. (2023). Mediterranean diet adherence and nutritional literacy: an observational cross-sectional study of the reality of university students in a COVID-19 pandemic context. *BMJ Nutrition, Prevention and Health*, 6(2), 221. DOI: 10.1136/bmjnp-2023-000659
- Albani, E.N., Togas, C., Kanelli, Z., Fradelos, E.C., Mantzouranis, G., Saridi, M. and Tzenalis, A. (2022). Is there an association between health literacy and adherence to the Mediterranean diet? A cross-sectional study in Greece. *Wiadomosci lekarskie*, 9(2), 2181-2188. DOI: 10.36740/WLek202209201
- Amati, F., Hassounah, S. and Swaka, A. (2019). The impact of Mediterranean dietary patterns during pregnancy on maternal and offspring health. *Nutrients*, 11(5), 1098. DOI: 10.3390/nu11051098
- American Diabetes Association (2022). American Diabetes Association (ADA). Standards of medical care in diabetes. Classification and diagnosis of diabetes. *Diabetes Care*, 45(1), 17-38.
- Assaf-Balut, C., Torre, N.G., Durán, A., Fuentes, M., Bordiú, E., Del Valle, L. and Calle-Pascual, A.L. (2018). Medical nutrition therapy for gestational diabetes mellitus based on Mediterranean Diet principles: A subanalysis of the St Carlos GDM Prevention Study. *BMJ Open Diabetes Research and Care*, 6(1), e000550. DOI: 10.1136/bmjdr-2018-00055
- Biagi, C., Di Nunzio, M., Bordoni, A., Gori, D. and Lanari, M. (2019). Effect of adherence to Mediterranean diet during pregnancy on children's health: a systematic review. *Nutrients*, 11(5), 997. DOI: 10.3390/nu11050997
- Duarte, A., Martins, J., Lopes, C., Silva, M.J., Augusto, C., Martins, S.P. and Rosário, R. (2024). Health literacy and its association with the adoption of the Mediterranean diet: A cross-sectional study. *Nutrients*, 16(14), 2176. DOI: 10.3390/nu16142176
- Filiz, E. and Bodur, S. (2022). Evaluation of the relationship between health literacy and health perception in pregnant women. *Selcuk Health Journal*, 3(1), 17-33.
- Flor-Aleman, M., Sandborg, J., Migueles, J.H., Söderström, E., Henström, M., Marín-Jiménez, N. and Löf, M. (2024). Mediterranean Diet adherence and health-related quality of life during pregnancy: Is the Mediterranean diet beneficial in non-Mediterranean countries? *Nutrients*, 16(5), 718. DOI: 10.3390/nu16050718
- Torre, N.G., Assaf-Balut, C., Jiménez Varas, I., Del Valle, L., Durán, A., Fuentes, M., and Calle-Pascual, A. L. (2019). Effectiveness of following Mediterranean diet recommendations in the real world in the incidence of gestational diabetes mellitus (GDM) and adverse maternal-foetal outcomes: a prospective, universal, interventional study with a single group. The St Carlos Study. *Nutrients*, 11(6), 1210. DOI: 10.3390/nu11061210
- Ghanbari, S., Majlessi, F., Ghaffari, M. and Mahmoodi Majdabadi, M. (2020). Evaluation of health literacy of pregnant women in urban health centers of Shahid Beheshti Medical University. *Daneshvar Medicine*, 19(6), 1-12.
- Gumus, D., Topal, G. G., Sevim, S. and Kizil, M. (2023). Adherence to Mediterranean diet and dietary changes according to the fear of COVID-19 during the pandemic: a cross-sectional study. *Journal of Nutritional Science*, 12, e56. DOI: 10.1017/jns.2023.40

- Javadzade, S.H., Sharifirad, G., Reisi, M., Tavassoli, E. and Rajati, F. (2013). Health literacy among adults in Isfahan, Iran. *Journal of Health System Research*, 9(5), 540-549.
- Kibret, K.T., Chojenta, C., Gresham, E., Tegegne, T.K. and Loxton, D. (2019). Maternal dietary patterns and risk of adverse pregnancy (hypertensive disorders of pregnancy and gestational diabetes mellitus) and birth (preterm birth and low birth weight) outcomes: a systematic review and meta-analysis. *Public Health Nutrition*, 22(3), 506-520. DOI: 10.1017/S1368980018002616
- Kilfoyle, K.A., Vitko, M., O'Connor, R. and Bailey, S.C. (2016). Health literacy and women's reproductive health: a systematic review. *Journal of Women's Health*, 25(12), 1237-1255. DOI: 10.1089/jwh.2016.581
- Martínez-González, M.A., García-Arellano, A., Toledo, E., Salas-Salvado, J., BuilCosiales, P., Corella, D. and Fiol, M. (2012). A 14-item Mediterranean diet assessment tool and obesity indexes among high-risk subjects: the PREDIMED trial. *PLoS One*, 7(8), e43134. DOI: 10.1371/journal.pone.0043134
- Mohtashamina, F., Hosseini, F., Jayedi, A., Mirmohammadhani, M., Emadi, A., Takfallah, L. and Shab-Bidar, S. (2023). Adherence to the Mediterranean diet and risk of gestational diabetes: A prospective cohort study. *BMC Pregnancy and Childbirth*, 23(1), 647. DOI: 10.1186/s12884-023-05960-4
- Nawabi, F., Krebs, F., Vennedey, V., Shukri, A., Lorenz, L. and Stock, S. (2021). Health literacy in pregnant women: A systematic review. *International Journal of Environmental Research and Public Health*, 18(7), 3847. DOI: 10.3390/ijerph18073847
- Odabaş, T., Odabaş, O., and Meseri, R. (2024). Impact of Mediterranean diet in lowering risk of gestational diabetes mellitus: A cross-sectional study. *Medicina Clínica (English Edition)*, 162(7), 321-327. DOI: 10.1016/j.medcle.2023.11.009
- Patel, V.B. and Preedy, V.R. (2023). *Eating disorders*. Springer Nature, Cham.
- Pehlivanoglu, E.F.Ö., Balcioğlu, H., Ünlüoğlu, İ. (2020). Akdeniz diyeti bağlılık ölçeği'nin türkçe'ye uyarlanması geçerlilik ve güvenilirliği. *Osmangazi Tıp Dergisi*, 42(2), 160-164. DOI: 10.20515/otd.504188
- Rahimi, M., Arghavanian, E.F., Khadvizadeh, T. and Mazloom, S.R. (2022). Assessment of the relationship between health literacy and self-care in Afghan pregnant mothers with chronic diseases. *Journal of Health Literacy*, 6(4), 59-68. DOI: 10.22038/jhl.2021.61007.1226
- Reijnders, I.F., Mulders, A.G., van der Windt, M., Steegers, E.A. and Steegers-Theunissen, R.P. (2019). The impact of periconceptual maternal lifestyle on clinical features and biomarkers of placental development and function: a systematic review. *Human Reproduction Update*, 25(1), 72-94. DOI: 10.1093/humupd/dmy037
- Sabetghadam, S., Keramat, A., Goli, S., Malary, M. and Chamani, R.S. (2023). Maternal health literacy, health information-seeking behavior and pregnancy outcomes among Iranian pregnant women: A cross-sectional study. *Community Health Equity Research and Policy*, 44(1), 77-87. DOI: 10.1177/0272684X2210956
- Sam-Yellowe, T.Y. (2024). Nutritional barriers to the adherence to the Mediterranean diet in non-Mediterranean populations. *Foods*, 13(11), 1750. DOI: 10.3390/foods13111750
- Schröder, H., Fitó, M., Estruch, R., Martínez-González, M.A., Corella, D., Salas-Salvadó, J. and Covas, M.I. (2011). A short screener is valid for assessing Mediterranean diet adherence among older Spanish men and women. *The Journal of Nutrition*, 141(6), 1140-1145. DOI: 10.3945/jn.110.135566
- Sørensen, K., Van den Broucke, S., Fullam, J., Doyle, G., Pelikan, J. and Slonska, Z. (2012). Health literacy and public health: a systematic review and integration of definitions and models. *BMC Public Health*, 12, 1-13. DOI: 10.1186/1471-2458-12-80
- Sørensen, K., Van den Broucke, S., Pelikan, J.M., Fullam, J., Doyle, G., Slonska, Z. and Brand, H. (2013). Measuring health literacy in populations: illuminating the design and development process of the European Health Literacy Survey Questionnaire (HLS-EU-Q). *BMC Public Health*, 13, 1-10. DOI: 10.1186/1471-2458-13-948
- Staynova, R. and Yanachkova, V. (2022). Improving gestational diabetes management through patient education. In: Radenkovic, M. *Gestational Diabetes Mellitus: New Developments*. IntechOpen Limited, London, pp.59-68.
- Taheri, S., Tavousi, M., Momenimovahed, Z., Direkvand-Moghadam, A., Tiznobaik, A., Suhrabi, Z., and Taghizadeh, Z. (2020). Development and psychometric properties of maternal health literacy inventory in pregnancy. *PLoS one*, 15(6), e0234305. DOI: 10.1371/journal.pone.0234305

- Taheri, S., Tavousi, M., Momenimovahed, Z., Direkvand-Moghadam, A., Rezaei, N., Sharifi, N. and Taghizadeh, Z. (2021). Determining health literacy level and its related factors among pregnant women referred to medical and health centers of Tehran in 2019: a cross-sectional study. *Shiraz E-Medical Journal*, 22(10), e109592. DOI: 10.5812/semj.109592
- Wang, H., Li, N., Chivese, T., Werfalli, M., Sun, H., Yuen, L. and Yang, X. (2022). IDF diabetes atlas: Estimation of global and regional gestational diabetes mellitus prevalence for 2021 by International Association of Diabetes in Pregnancy Study Group's Criteria. *Diabetes Research And Clinical Practice*, 183, 109050. DOI: 10.1016/j.diabres.2021.109050
- Xu, J., Wang, H., Bian, J., Xu, M., Jiang, N., Luo, W. and Zhu, P. (2024). Association between the maternal Mediterranean diet and perinatal outcomes: A systematic review and meta-analysis. *Advances in Nutrition*, 15(2), 100159. DOI: 10.1016/j.advnut.2023.100159
- Yassıbaş, E. and Bölükbaşı, H. (2023). Evaluation of adherence to the Mediterranean diet with sustainable nutrition knowledge and environmentally responsible food choices. *Frontiers in Nutrition*, 10, 1158155. DOI: 10.3389/fnut.2023.1158155