Makara Journal of Health Research

Volume 27
Issue 3 *December*

Article 3

12-30-2023

Age, Body Mass Index, Physical Activity and Quality of Life in Turkish Pregnant Woman with and Without a Diagnosis of Gestational Diabetes Mellitus: A Comparative Study

Yaren Nur Tayyar
Department of Nursing, Institute of Health Sciences, Trakya University, Edirne 22030, Turkey, tayyaryarennur@gmail.com

Hatice Kahyaoglu Sut
Department of Women Health and Disease Nursing, Faculty of Health Sciences, Trakya University, Edirne 22030, Turkey, haticesut@yahoo.com

Recommended Citation

Kahyaoglu Sut H, Nur Tayyar Y. Age, Body Mass Index, Physical Activity and Quality of Life in Turkish Pregnant Woman with and Without a Diagnosis of Gestational Diabetes Mellitus: A Comparative Study. Makara J Health Res. 2023;27.

Makara J Health Res. 2023;27(3):168–176
doi: 10.7454/msk.v27i3.1542

Makara Journal of Health Research

Age, Body Mass Index, Physical Activity and Quality of Life in Turkish Pregnant Woman with and Without a Diagnosis of Gestational Diabetes Mellitus: A Comparative Study

Yaren Nur Tayyar[1], Hatice Kahyaoglu Sut[2*]

[1]Department of Nursing, Institute of Health Sciences, Trakya University, Edirne 22030, Turkey

[2]Department of Women Health and Disease Nursing, Faculty of Health Sciences, Trakya University, Edirne 22030, Turkey

Abstract

Background: This study aimed to examine and compare the age, body mass index (BMI), physical activity (PA), and quality of life (QOL) of third-trimester Turkish pregnant women with and without a diagnosis of gestational diabetes mellitus (GDM).

Methods: A comparative study was conducted in the obstetrics clinic of a university hospital in Turkey, and it included 210 women (GDM women = 105 and non-GDM women = 105). Personal Information Form, International Physical Activity Questionnaire-Short Form (IPAQ), and World Health Organization Quality of Life-Short Form-Turkish (WHOQOL-Bref-TR) were used.

Results: The age and BMI of GDM women were higher than those of non-GDM ($p < 0.05$). The results show that non-GDM women in their third trimester had higher scores on the WHOQOL-Bref-TR domains compared with those with GDM ($p < 0.05$). Among GDM women, a significant positive correlation was observed among WHOQOL-Bref-TR psychological ($r = 0.77$, $p < 0.05$) and environmental ($r = 0.85$, $p < 0.05$) domains and moderate IPAQ scores. A moderate positive correlation was detected among physical, psychological, social relations, environmental domains of WHOQOL-Bref-TR, and walking and total score in IPAQ ($r = 0.39–0.54$, $p < 0.05$).

Conclusions: Local health policies should focus on community education programs, such as regular PA based on BMI and age, for the positive QOL of GDM women.

Keywords: gestational diabetes, physical activity, pregnancy, quality of life

INTRODUCTION

Gestational diabetes mellitus (GDM), which causes abnormal glucose tolerance, is a medical condition that affects pregnant women. GDM screening and diagnosis usually involves the single-step 75 g oral glucose tolerance test at generally 24–28 weeks of pregnancy and in the third trimester.[1] The prevalence of GDM is increasing worldwide, and this condition affects one in every six pregnant women.[2] The global prevalence of GDM is 14%.[3] GDM has been associated with obstetric and neonatal complications.[1] This condition has also been connected to the risks of macrosomia at birth (birth weight ≥ 4 kg), birth trauma, fractures, and birth difficulties, such as shoulder dystocia and neonatal hypoglycemia.[4,5] The main risk factors for GDM development include the following: ≥40 years of age, overweightness or obesity (body mass index (BMI) ≥ 25 kg/m^2) at the beginning of pregnancy,[6,7] and excessive weight gain during pregnancy.[8] The risk of negative health outcomes associated with excessive weight gain during pregnancy can be reduced through routine lifestyle interventions for all women.[9] Women diagnosed with GDM produce 40%–70% less insulin for any degree of insulin resistance.[10] GDM and type 2 diabetes mellitus (T2DM) share pathophysiological similarities,[10,11] and women with GDM have a 70% higher risk of developing T2DM within 28 years after delivery.[12] In some cases, lifestyle modifications can be sufficient to achieve glycemic targets in 70%–85% of women with GDM.[13]

In general, physical activity (PA) and increased exercise are integral to diabetes mellitus management and GDM. Lifestyle changes, such as increased engagement in PA, can help in reducing the risks associated with GDM.[14] Regular engagement in PA is essential to lead a healthy life and can improve the labor and delivery process for pregnant women.[15] As recommended by the American College of Obstetricians and Gynecologists, women with GDM who maintain an active lifestyle should be encouraged to continue with an approved exercise program for pregnancy.[16] Pregnancy complicated by GDM considerably negatively affects women's quality of life (QOL) in the short and long terms.[17] The adverse effects of GDM lead to a decline in the QOL.[18] Moderate-to-vigorous PA during pregnancy provides a number of health benefits, such as the reduced risk of GDM.[19] Thus, studies should investigate in detail the relationship between PA and QOL associated with GDM.[20,21] Evidence on the comparison of age, BMI, PA behaviors, and QOL in the

***Corresponding author:**
Hatice Kahyaoglu Sut
Department of Women Health and Disease Nursing,
Faculty of Health Sciences, Trakya University, Edirne, Turkey
E-mail: haticesut@yahoo.com

third trimester of Turkish pregnant women with GDM and non-GDM is scarce. This research is original in terms of the results obtained. The findings of this study are considered important for the regulation of PA behavior related to age and BMI and the improvement of the local health of GDM women.

METHODS

This study received ethical approval after obtaining written consent from the University Scientific Research Ethics Committee (BAEK 2021/335). After receiving ethical approval, written permission was secured from the Chief Physician of the University Hospital. Pregnant women who volunteered to participate were informed about the research, and their verbal consent was obtained.

A comparative study is used to analyze and compare two or more ideas. This comparative research of Turkish pregnant women with GDM and non-GDM diagnosis was conducted between September 2021 and February 2022 in the obstetrics and gynecology clinic of a university hospital in Turkey. For the assessment of the levels of PA and QOL in the third trimester of GDM and non-GDM women, 210 pregnant women, including 105 with GDM and 105 non-GDM, who met the inclusion criteria and applied to the obstetrics and gynecology clinic during a specified period were recruited based on clinical experience and predicted moderate effect size (d = 0.5). Power-analysis sampling method was used to calculate the 5% margin of error and 95% power, and the results confirmed that the sample size was sufficient for the detection of significant differences between the two groups. The GDM pregnant group consisted of pregnant women over 18 years of age, in their third trimester, and diagnosed with GDM. The without-GDM pregnant group consisted of pregnant women over 18 years of age, in their third trimester, and without any chronic health problems, including GDM and risky pregnancy.

Data collection was completed through the administration of Personal Information Form, World Health Organization Quality of Life Short Form, Turkish version (WHOQOL-Bref-TR), and International Physical Activity Questionnaire Short Form, Turkish version (IPAQ-TR). It consists of 10 questions, including five questions on age, gestational week, and BMI and five personal categorical characteristics (education level, family type, working status, income status, and place of residence) of pregnant women.[11–20]

WHOQOL-Bref-TR[22] adaptation was performed by Fidaner *et al*.[23] WHOQOL-Bref-TR consists of 27 questions, including the national environment subdimension. The Turkish version of the scale included the national environment domain (Domain 5) because the 27th question is used only in national studies. The scale consists of five domains: physical (7 items: 3, 4, 10, 15, 16, 17, and 18), psychological (6 items: 5, 6, 7, 11, 19, and 26), social relations (3 items: 20, 21, and 22), environmental (8 items: 8, 9, 12, 13, 14, 23, 24, and 25), and national environmental (1 item: 27) domains. The physical domain assesses an individual's ability to perform daily tasks, dependence, vitality, fatigue, discomfort, sleep, rest, and work. The psychological domain assesses the body's appearance, positive or negative emotions, self-esteem, and personal beliefs. The social relations domain assesses an individual's social environment, communication, interpersonal relationships, emotional, material, spiritual, and, where necessary, cognitive support to the individual. The environmental domain assesses issues related to financial resources, benefits and accessibility in health care, chances to acquire knowledge and skills, leisure time, and physical environment. The national environment domain measures an individual's perception of social pressure. In WHOQOL-Bref-TR Likert-type scoring, each of the 27 questions was scored between 1–5. Questions 3, 4, and 26 were reverse coded. Domain scores can range between 4 and 20 or between 0 and 100. A high domain score indicates a high QOL. The total score of the scale is not calculated.

IPAQ assesses PA in different areas related to leisure time, home, work, and transportation.[24] The Turkish adaptation of the scale was conducted by Sağlam *et al*.[25] The short form comprises seven questions. IPAQ assesses walking, moderate, and vigorous PA performed for at least 10 min every day for seven days. Metabolic equivalent (MET) refers to the energy of PA served and provides a set value of PA energy consumption. This score is presented as MET minutes/week (walking + moderate + vigorous PA). Individual MET scores for walking, moderate, and vigorous PA are calculated separately for each domain and then combined to obtain a total score (formula: Total- MET minutes/week = MET-level x minutes per day x days per week). For the analysis of IPAQ data, walking: 3.3 METs, moderate physical activity: 4.0 METs, and vigorous physical activity: 8.0 METs. The PA level rises with the increase in MET. The PA of the participants were classified as inactive (<600 MET-min/week), moderately active (600-3000 MET-min/week), and highly active (>3000 MET-min/week) based on their levels.[24]

The data were analyzed using SPSS 25. Descriptive statistics, including number, percentage, minimum and maximum values, mean, and standard deviation, were presented. The normal distribution of data was determined using the Shapiro–Wilk test. Normally distributed quantitative data were compared between GDM and non-GDM women using Student's t-test. Mann–Whitney U test was used on data with non-normal distribution. Categorical data were compared using the Chi-square test. The level of statistical significance was set at $p < 0.05$.

RESULTS

The GDM and non-GDM women had a mean gestational week of 33.79 ± 4.37 (p = 0.098). The mean age of non-GDM women was 28.15 ± 5.56, and that of GDM women was 30.03 ± 5.98 (p = 0.023). The mean initial weight of non-GDM women was 64.8 ± 14.78, and that of GDM women was 75.05 ± 18.07 (p < 0.001). The mean weight of non-GDM women in the third trimester was 74.62 ± 14.76, and that of GDM women was 84.12 ± 16.41 (p < 0.001). The mean BMI of non-GDM women was 24.38 ± 5.03, and that of GDM women was 28.33 ± 6.19 (p < 0.001). In this study, the age and BMI of GDM women were higher than those of non-GDM women (p < 0.05). Table 1 presents the comparison of age, gestational week, and BMI in the third trimester of GDM and non-GDM women.

More GDM women reported reaching high school and higher education levels (p < 0.05). No significant difference was observed in the family type, working status, income status, and place of residence between the two groups of pregnant women (p > 0.05). Table 2 presents the comparison of personal categorical variables of GDM and non-GDM women in their third trimester.

The scores of the physical domain of the WHOQOL-Bref-TR scale were 14.21 ± 2.60 in non-GDM women and 12.99 ± 3.25 in GDM women. The psychological domain scores were 15.17 ± 2.07 in non-GDM women and 14.17 ± 2.82 in GDM women. The scores in the social relations domain were 15.20 ± 3.01 for non-GDM women and 13.55 ± 4.17 for GDM women. The scores on the environmental domain were 15.28 ± 2.59 in non-GDM women and 14.49 ± 3.34 in GDM women. The scores on the national environment domain reached 16.34 ± 4.19 in non-GDM women and 14.93 ± 4.09 in GDM women. The study revealed a significant difference in the scores of GDM and non-GDM women in the physical, psychological, social relations, national environment domains (p < 0.05). The OQL of non-GDM women in the physical, psychological, social, and national domains were significantly better than those of GDM women. No significant difference was observed in the environmental subdimension scores between the two groups of pregnant women (p > 0.05). Table 3 presents the comparison of the mean scores of WHOQOL-Bref-TR subscales of GDM and non-GDM women in the third trimester.

TABLE 1. Comparison of age, gestational week, and BMI of GDM and non-GDM women in their third trimester (N = 210)

Variable	Non-GDM women (N = 105)	GDM women (N = 105)	Total	*p*
	Mean ± SD	Mean ± SD	Mean ± SD	
Gestational week	34.11 ± 4.65	33.47 ± 4.08	33.79 ± 4.37	0.098
Age	28.15 ± 5.56	30.03 ± 5.98	29.09 ± 5.83	0.023
Initial Weight	64.80 ± 14.78	75.05 ± 18.07	69.92 ± 17.25	<0.001*
Weight in the 3rd trimester	74.62 ± 14.76	84.12 ± 16.41	79.37 ± 16.28	<0.001*
BMI	24.38 ± 5.03	28.33 ± 6.19	26.36 ± 5.97	<0.001*

*p < 0.05, Mann–Whitney U test statistics

TABLE 2. Comparison of personal categorical variables of GDM and non-GDM women in their third trimester (N = 210)

Variable	Non-GDM women (N = 105)		GDM women (N = 105)		Total		*p*
	N	%	N	%	N	%	
Education level							0.043*
Primary education and below	44	41.9	30	28.6	74	35.2	
High school and above	61	58.1	75	71.4	136	64.8	
Family type							0.071
Nuclear family	90	85.7	98	93.3	188	89.5	
Extended family	15	14.3	7	6.7	22	10.5	
Working status							0.662
Working	37	35.2	34	32.4	71	33.8	
Not working	68	64.8	71	67.6	139	66.2	
Income status							0.425
Income is less than expenses	15	14.3	9	8.6	24	11.4	
Income equals expenses	83	79.0	89	84.8	172	81.9	
Income exceeds expenses	7	6.7	7	6.7	14	6.7	
Place of residence							0.413
Village	7	6.7	7	6.7	14	6.7	
Town	41	39.0	32	30.5	73	34.8	
Province	57	54.3	66	62.9	123	58.6	

*p < 0.05, Chi-square analysis

The study revealed that non-GDM women had a mean IPAQ total score of 757.37 ± 662.46, and those with GDM had a mean score of 673.54 ± 787.27 (moderately active). The mean scores for moderate activity were 465.00 ± 398.25 for non-GDM women and 548.57 ± 847.49 for those with GDM (inactive). The mean activity scores for walking were 717.34 ± 662.80 for non-GDM women and 621.65 ± 744.25 for those with GDM (moderately active). No significant difference was observed in the total, moderate, walking activity values (IPAQ) between the groups ($p > 0.05$). In this study, we were unable to calculate and compare the vigorous activity scores of GDM women because none of the women with GDM had vigorous physical activity. Table 4 presents the comparison of IPAQ scale mean scores of pregnant women with and non-GDM in their third trimester.

In non-GDM women, a weak positive correlation was observed between the scores on the physical domain of WHOQOL-Bref-TR, walking domain in IPAQ (r = 0.299, p = 0.007), and total IPAQ score (r = 0.297, p = 0.007). A weak positive correlation was also found between the scores on psychological domain and walking (r = 0.242, p = 0.031). In GDM women, a moderate positive correlation was observed between the scores on physical domain of WHOQOL-Bref-TR and walking in IPAQ (r = 0.421, $p < 0.05$). A moderate positive correlation was detected between physical domain of WHOQOL-Bref-TR and IPAQ total score (r = 0.415, $p < 0.05$). A highly significant positive correlation was observed among psychological domain (r = 0.774, $p < 0.05$) and environmental domain (r = 0.855, $p < 0.05$) and moderate IPAQ scores. A moderate positive correlation was noted between psychological domain and IPAQ total (r = 0.544, $p < 0.05$) and walking (r = 0.506, $p < 0.05$) scores, between social relations and IPAQ total (r = 0.437, $p < 0.05$) and walking (r = 0.413, $p < 0.05$) scores, between environmental and IPAQ walking (r = 0.391, p < 0.05) and total (r = 0.416, $p < 0.05$) scores. A weak positive relationship was identified between the national environment and walking IPAQ score (r = 0.268, $p < 0.05$). Table 5 presents the relationship between the scores of GDM and non-GDM women in their third trimester on the WHOQOL-Bref-TR subscales and IPAQ scale.

TABLE 3. Comparison of the mean scores on the WHOQOL-Bref-TR subscales of GDM and non-GDM women in their third trimester

WHOQOL-Bref-TR subscales	Min	Med	Max	Mean	*p*
Physical[a]					0.003*
Non-GDM women	20.00	13.71	8.00	14.21 ± 2.60	
GDM women	20.00	13.14	6.29	12.99 ± 3.25	
Psychological[b]					0.015*
Non-GDM women	19.33	15.33	9.33	15.17 ± 2.07	
GDM women	20.00	14.67	6.67	14.17 ± 2.82	
Social relations[b]					0.005*
Non-GDM women	20.00	16.00	8.00	15.20 ± 3.01	
GDM women	20.00	14.67	4.00	13.55 ± 4.17	
Environmental[b]					0.175
Non-GDM women	20.00	15.50	8.00	15.28 ± 2.59	
GDM women	19.50	15.00	4.00	14.49 ± 3.34	
National environment[b]					0.008*
Non-GDM women	20.00	16.00	4.00	16.34 ± 4.19	
GDM women	20.00	16.00	4.00	14.93 ± 4.09	

[a]: Independent sample t test statistics, [b]: Mann–Whitney U test statistics, *$p < 0.05$

TABLE 4. Comparison of IPAQ scale mean scores of GDM and non-GDM women in their third trimester

IPAQ scale (N)	Min	Med	Max	Mean ± SD	*p*
IPAQ Total					0.176
Non-GDM women (81)	66.00	594.00	2,970.00	757.37 ± 662.46	
GDM women (74)	66.00	420.75	5,544.00	673.54 ± 787.27	
Severe					
Non-GDM women (1)	240.00	240.00	240.00	240.00 ± -	-
GDM women (0)	-	-	-	-	
Moderate					0.382
Non-GDM women (8)	80.00	360.00	1,200.00	465.00 ± 398.25	
GDM women (7)	40.00	240.00	2,400.00	548.57 ± 847.49	
Walking					0.232
Non-GDM women (80)	66.00	594.00	2,970.00	717.34 ± 662.80	
GDM women (74)	66.00	396.00	5,544.00	621.65 ± 744.25	

TABLE 5. Relationship between scores of GDM and non-GDM women in their third trimester on the WHOQOL-Bref-TR subscales and IPAQ scale

WHOQOL-Bref-TR subscales	IPAQ Moderate	IPAQ Walking	IPAQ Total
Non-GDM women (N)	8	80	81
Physical	-0.464	0.299*	0.297*
Psychological	-0.295	0.242*	0.206
Social Relations	-0.510	0.145	0.156
Environmental	-0.531	0.153	0.142
National Environment	0.126	0.101	0.054
GDM women (N)	7	74	74
Physical	0.090	0.421*	0.415*
Psychological	0.774*	0.506*	0.544*
Social Relations	0.275	0.413*	0.437*
Environmental	0.855*	0.391*	0.416*
National Environment	-0.179	0.268*	0.194

*$p < 0.05$, N: number

DISCUSSION

This study aimed to examine and compare the age, BMI, PA behaviors, and QOL of Turkish pregnant women with and without a diagnosis of GDM in the third trimester. The results show that the age and BMI of GDM women were higher than those of non-GDM women in the third trimester. The QOL of GDM women in all domains was lower compared to that of non-GDM women. The PA levels were similar in GDM and non-GDM women. The psychological, environmental, physical and social relations QOL domains were positively related to the increased PA in GDM women. The prominent findings are discussed in light of the literature on similar topics.

The age of a pregnant mother is an important risk factor for pregnancy and the QOL.[26] The risk factors for GDM include being overweight/obese at the beginning of pregnancy and excessive weight gain during pregnancy.[6,8] Significantly overweight pregnant women often have poor diet and mild PA.[27] In this study, age and BMI were higher in GDM women than that of non-GDM women during the third trimester. Abolfathi *et al*. conducted a study on GDM women and observed that most of them were overweight and obese.[28] Ede observed that the mean age of GDM women was higher than that of non-GDM women. Pre-pregnancy BMI was higher in GDM women than in those non-GDM.[29] Muhli *et al*. reported that pre-pregnancy BMI was higher in women with a history of GDM compared with those without a history.[27] Keskin *et al*. found no significant difference in age, weight gain, and BMI between GDM and non-GDM women.[30] In general, GDM women have higher age and BMI than non-GDM women. The risk of GDM in pregnancy increases with the increase in age and BMI. Age is a risk factor that cannot be changed. However, BMI can be changed through a healthy diet and engagement in PA.

The study determined that the QOL levels related to physical, psychological, social relations, national environment domains of the WHOQOL-Bref-TR scale were better in the third trimester of non-GDM women than those of GDM women. Pantzartzis *et al*. reported that in the third trimester of pregnancy, decreases in the total, environmental, physical domains of the QOL were observed in GDM women compared with those with non-GDM women (no difference in the psychological and social relationships).[31] According to Danyliv *et al*., GDM women had lower health-related QOL levels than pregnant women with normal glucose tolerance.[32] Dalfrà *et al*. compared the QOL levels of GDM women, pregnant women with type I diabetes, and healthy pregnant participants. The GDM women exhibited a significantly lower QOL level in terms of general health perception in the third trimester than in the first and second trimesters.[33] Trutnovsky *et al*. reported that after the 20th week of pregnancy, the QOL level of GDM women in terms of physical, psychological, and social aspects and overall decreased substantially.[34] Kim *et al*. noted that GDM women were more likely to report poor physical functioning and health status than healthy pregnant women.[35] Bień *et al*. reported a slightly poorer psychological domain in the QOL of GDM women compared with other domains.[36] Kopec *et al*. revealed the negative impact of GDM on social domain.[37] GDM women in their third trimester showed deterioration in the general QOL and all general QOL domains. Especially after the second half of pregnancy, when GDM is diagnosed, psychologically poor health perception leads to a decrease in the general QOL.

The study revealed that the PA levels of GDM and non-GDM women were similar according to the results on the IPAQ scale (walking: moderately active; moderate: inactive). GDM women stated that they did not perform vigorous PA. Muhli *et al*. reported that the PA level in women with a history of GDM was not different from that of women without a history of GDM. Overweight/obese women were likely to have lower PA levels than average-weight women.[27] Heybet discovered a difference between the PA levels of pregnant women with high and low blood glucose levels. The group with lower blood glucose levels

exhibited higher PA levels.[38] In a meta-analysis, Doi *et al*. revealed that the risk of GDM in pregnant women was considerably reduced with PA.[39] After the diagnosis of GDM, pregnant women may reduce their need for insulin therapy and improve glycemic control in late pregnancy by engaging in an exercise program. Prenatal exercise has a potential role in the reduction of obesity risks for the next generation.[40] Pagel *et al*. reported lower PA levels of pregnant women diagnosed with GDM in early pregnancy than those non-GDM. Engagement in PA in early pregnancy has been associated with the reduced risk of GDM and reversal of excess risk in women with a genetic predisposition.[41] Performing PAs in pregnancy does not increase the risk of adverse outcomes for the fetus. Such activities offer many health benefits, including the reduced risk of gestational diabetes.[42] Previous studies revealed that regular PA, especially in early pregnancy, is essential in reducing the risk of GDM.

The assessment of PA and QOL in GDM women is critical in maternal, fetal, and neonatal health care planning.[28] This study indicated that engaging in moderate level PA (IPAQ) and psychological and environmental domain QOL (WHOQOL-Bref-TR) increased the QOL to a high level in GDM women. Walking activity and general PA moderately improved the physical-psychological-social and environmental QOL domain and slightly boosted the national domain of the QOL. Uria-Minguito *et al*. implemented an online structured and supervised exercise program to prevent and manage gestational diabetes in a randomized controlled trial. Their results confirmed the benefit of PA and an optimal QOL throughout pregnancy.[43] Ghasemi *et al*. provided information on self-care, nutrition, and PA in counseling pregnant women between 24–26 weeks. At the end of counseling, fasting blood glucose levels, self-care, and QOL showed improvement.[44] Andersen *et al*. determined that in pregnant women diagnosed with GDM, postprandial glucose levels can be controlled with 20 min of intermittent walking after a meal.[45] Soylu detected a higher PA level in GDM women with controlled blood glucose monitoring than those with uncontrolled GDM. A high QOL was observed in GDM women with high PA levels.[46] Engberg *et al*. reported the application of cardiovascular fitness and PA programs to overweight/obese (BMI > 29 kg/m^2) women with a history of GDM and planned pregnancy. Women at risk of GDM who performed cardiovascular fitness and PA programs showed a positive association with general health and physical well-being.[47] Woodside *et al*. conducted a systematic review and demonstrated the positive impact of exercise on the presence of glucose transporter type 4, which facilitates the transportation of glucose from the bloodstream into cells.[48] Maintaining a healthy lifestyle and engaging in regular PA before, during, and after pregnancy can help in the prevention of the risk of several complications and improve the QOL.[49,50] In addition, PA during pregnancy can help in the regulation of insulin resistance and blood glucose levels. The literature and findings of this study suggest that the QOL of GDM women is related to their PA level.

Based on the results of this study, walking activity and general PA in non-GDM women slightly positively affected their QOL in terms of the physical and psychological domains (Table 5). PA positively affects the QOL status of healthy pregnant women. Heybet observed that the QOL was high among healthy non-GDM women who engaged in intense PA. Moreover, PA stabilizes blood glucose levels.[38] According to Vieira *et al*., despite the low self-reported exercise participation in the third trimester of pregnancy, it has been associated with improvements in physical and environmental QOL. Women who were in good physical condition and had environmental resources during pregnancy were likely to exercise.[51] Moundary *et al*. revealed the positive association of total and light-intensity PA during pregnancy with the psychological and social domains of the QOL.[52] Göker *et al*. reported that the QOL increased with the increase in PA level among pregnant women. He emphasized the need to plan interventions to help healthy women become physically active during pregnancy.[53] Kara *et al*. reported that an increase in the PA level during pregnancy considerably affects the QOL associated with health improvement.[20] Krzepota *et al*. associated the high levels of vigorous, occupational, and sport/exercise activity during pregnancy with desirable results on several domains of the QOL, including overall QOL, psychological, social, and physical domains.[54] The findings suggest that regular walking and increased intensity of PA during healthy pregnancy positively affect the overall QOL and its domains and contribute to maintaining a healthy state of being.

The limitation of this cross-sectional study is that it is single-center research. Therefore, its generalizability is limited. Its strengths include the use of valid and reliable instruments to assess PA and QOL with comparison between GDM and non-GDM women groups.

CONCLUSIONS

In conclusion, in this study, age and BMI were higher in the third trimester of GDM women and revealed that the QOL was positively related to the PA. Therefore, local health policies should be focused on community education programs, such as lifestyle changes of regular engagement in PA, especially in overweight/obese and higher-age GDM women. Multicenter studies should be conducted in the future.

CONFLICT OF INTEREST

The authors declare no potential conflicts of interest with respect to the authorship and/or publication of this article.

FUNDING

No financial support has been received from any person or organization for this study.

Received: October 9, 2023 | Accepted: November 19, 2023

REFERENCES

1. Balaji B, Ram U, Mohan V. Screening, diagnosis and management of gestational diabetes mellitus. *J Indian Inst Sci*. 2023;103:371–9.
2. International Diabetes Federation. *Diabetes Atlas*. Brussels: International Diabetes Federation, 2021.
3. Wang H, Li N, Chivese T, Werfalli M, Sun H, Yuen L, *et al*. 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 Res Clin Pract*. 2022;183:109050.
4. Committee on Practice Bulletins—Obstetrics. ACOG Practice Bulletin No. 190: Gestational Diabetes Mellitus. *Obstet Gynecol*. 2018;131:e49–64.
5. McIntyre HD, Catalano P, Zhang C, Desoye G, Mathiesen ER, Damm P. Gestational diabetes mellitus. *Nat Rev Dis Primers*. 2019;5:47.
6. Canadian Diabetes Association Clinical Practice Guidelines Expert Committee. Canadian Diabetes Association 2008 clinical practice guidelines for the prevention and management of diabetes in Canada. *Can J Diabetes*. 2008;32:S1–201.
7. Herring SJ, Oken E, Rifas-Shiman SL, Rich-Edwards JW, Stuebe AM, Kleinman KP, *et al*. Weight gain in pregnancy and risk of maternal hyperglycemia. *Am J Obstet Gynecol*. 2009;201:61.e1–7.
8. Bennett CJ, Walker RE, Blumfield ML, Gwini SM, Ma J, Wang F, *et al*. Interventions designed to reduce excessive gestational weight gain can reduce the incidence of gestational diabetes mellitus: A systematic review and meta-analysis of randomised controlled trials. *Diabetes Res Clin Pract*. 2018;141:69–79.
9. Lloyd M, Morton J, Teede H, Marquina C, Abushanab D, Magliano DJ, *et al*. Long-term cost-effectiveness of implementing a lifestyle intervention during pregnancy to reduce the incidence of gestational diabetes and type 2 diabetes. *Diabetologia*. 2023;66:1223–34.
10. Hopkins SA, Artal R. The role of exercise in reducing the risks of gestational diabetes mellitus. *Womens Health (Lond)*. 2013;9:569–81.
11. Madievsky R, Vu A, Cheng F, Chon J, Turk N, Krueger A, *et al*. A randomized controlled trial of a shared decision making intervention for diabetes prevention for women with a history of gestational diabetes mellitus: The Gestational diabetes Risk Attenuation for New Diabetes (GRAND study). *Contemp Clin Trials*. 2023;124:107007.
12. Kim C, Newton KM, Knopp RH. Gestational diabetes and the incidence of type 2 diabetes: A systematic review. *Diabetes Care*. 2002;25:1862–8.
13. Mayo K, Melamed N, Vandenberghe H, Berger H. The impact of adoption of the international association of diabetes in pregnancy study group criteria for the screening and diagnosis of gestational diabetes. *Am J Obstet Gynecol*. 2015;212:224.e1–9.
14. Martis R, Crowther CA, Shepherd E, Alsweiler J, Downie MR, Brown J. Treatments for women with gestational diabetes mellitus: An overview of Cochrane systematic reviews. *Cochrane Database Syst Rev*. 2018;8:CD012327.
15. Shlomo I. Physical activity during pregnancy – Effects on fetal and newborn health and future maternal well being. *Med Res Arch*. 2023;11:3574.
16. ACOG Committee Obstetric Practice. ACOG Committee opinion. Number 267, January 2002: Exercise during pregnancy and the postpartum period. *Obstet Gynecol*. 2002;99:171–3.
17. Marchetti D, Carrozzino D, Fraticelli F, Fulcheri M, Vitacolonna E. Quality of life in women with gestational diabetes mellitus: A systematic review. *J Diabetes Res*. 2017;2017:7058082.
18. Shama EES, Ibrahiem NM, Ahmed AR, El-Berdan A, El-Sherbeny E. Clinical association between gestational diabetes mellitus and quality of life among women. *Malays J Nurs*. 2020;12:10–21.
19. Davenport MH, Meah VL, Ruchat SM, Davies GA, Skow RJ, Barrowman N, *et al*. Impact of prenatal exercise on neonatal and childhood outcomes: A systematic review and meta-analysis. Br J Sports Med. 2018;52:1386–96.
20. Whitaker KM, Jones MA, Wallace MK, Catov J, Barone Gibbs B. Associations of objectively measured physical activity and sedentary time with pregnancy-specific health-related quality of life. *Midwifery*. 2022;104:103202.
21. 2018 Physical Activity Guidelines Advisory Committee. *2018 Physical Activity Guidelines Advisory Committee Scientific Report*. Washington, DC: U.S. Department of Health and Human Services, 2018.
22. The Whoqol Group. The World Health Organization Quality of Life Assessment (WHOQOL): Development and general psychometric properties. *Soc Sci Med*. 1998;46:1569–85.
23. Fidaner H, Elbi H, Fidaner C, Eser SY, Eser E, Göker E. WHOQOL-100 ve WHOQOL-BREF'in psikometrik özellikleri [Psychometric properties of WHOQOL-100 and WHOQOL-BREF]. *Psikiyatri Psikoloji Psikofarmakoloji (3P) Dergisi*. 1999;7:23–41. Turkish.
24. Craig CL, Marshall AL, Sjöström M, Bauman AE, Booth ML, Ainsworth BE, *et al*. International physical activity questionnaire: 12-country reliability and validity. *Med Sci Sports Exerc*. 2003;35:1381–95.
25. Saglam M, Arikan H, Savci S, Inal-Ince D, Bosnak-Guclu M, Karabulut E, *et al*. International physical activity questionnaire: Reliability and validity of the Turkish version. *Percept Mot Skills*. 2010;111:278–84.
26. Yılmaz E, Tokgöz B, Soysal C, Aker SŞ, Küçüközkan T. Nausea and vomiting in pregnant adolescents: Impact on health-related quality of life. *Eur Res J*. 2018;4:390–8.
27. Muhli E, Koivuniemi E, Laitinen K. Living with overweight, rather than a history of gestational diabetes, influences dietary quality and physical activity during pregnancy. *Nutrients*. 2022;14:651.
28. Abolfathi M, Ashtarian H, Eskandari S, Irandoost SF, NeJhaddadgar N, Mirzaei N. Evaluation of quality of life in diabetic pregnant women. *Prim Care Diabetes*. 2022;16:84–8.

29. Ede G. *Sağlıklı ve gestasyonel diyabetli gebe kadınların serum D vitamini düzeyleri ile beslenme durumlarının karşılaştırılması* [Comparison of serum vitamin D levels and nutritional status of healthy and pregnant women with gestational diabetes] [Master's thesis]. Ankara, Turkey: Hacettepe University; 2015. Turkish.
30. Keskin A, Dorman E. Gestasyonel Diyabetik ve Nondiyabetik Gebelerin Glukoz, Lipid, Krom Seviyelerinin Sağlıklı Gruplara Göre Değişimlerinin İncelenmesi [Investigation of glucose, lipid, chromium level changes in gestational diabetic and nondiabetic pregnants compared with healthy groups]. *Celal Bayar Üniversitesi Sağlık Bilimleri Enstitüsü Dergisi*. 2020;7:489–94. Turkish.
31. Pantzartzis KA, Manolopoulos PP, Paschou SA, Kazakos K, Kotsa K, Goulis DG. Gestational diabetes mellitus and quality of life during the third trimester of pregnancy. *Qual Life Res*. 2019;28:1349–54.
32. Danyliv A, Gillespie P, O'Neill C, Noctor E, O'Dea A, Tierney M, *et al*. Health related quality of life two to five years after gestational diabetes mellitus: Cross-sectional comparative study in the ATLANTIC DIP cohort. *BMC Pregnancy Childbirth*. 2015;15:274.
33. Dalfrà MG, Nicolucci A, Bisson T, Bonsembiante B, Lapolla A; QLISG (Quality of Life Italian Study Group). Quality of life in pregnancy and post-partum: A study in diabetic patients. *Qual Life Res*. 2012;21:291–8.
34. Trutnovsky G, Panzitt T, Magnet E, Stern C, Lang U, Dorfer M. Gestational diabetes: Women's concerns, mood state, quality of life and treatment satisfaction. *J Matern Fetal Neonatal Med*. 2012;25:2464–6.
35. Kim C, Brawarsky P, Jackson RA, Fuentes-Afflick E, Haas JS. Changes in health status experienced by women with gestational diabetes and pregnancy-induced hypertensive disorders. *J Womens Health (Larchmt)*. 2005;14:729–36.
36. Bień A, Rzońca E, Kańczugowska A, Iwanowicz-Palus G. Factors affecting the quality of life and the illness acceptance of pregnant women with diabetes. *Int J Environ Res Public Health*. 2015;13:ijerph13010068.
37. Kopec JA, Ogonowski J, Rahman MM, Miazgowski T. Patient-reported outcomes in women with gestational diabetes: A longitudinal study. *Int J Behav Med*. 2015;22:206–13.
38. Heybet F. *Gebelerde fiziksel aktivitenin gestasyonel diyabet üzerine etkisi* [The effect of physical activity on gestational diabetes in the pregnancy] [Master's thesis]. Istanbul, Turkey: Istanbul Medipol University; 2019. Turkish.
39. Doi SAR, Furuya-Kanamori L, Toft E, Musa OAH, Mohamed AM, Clark J, *et al*. Physical activity in pregnancy prevents gestational diabetes: A meta-analysis. *Diabetes Res Clin Pract*. 2020;168:108371.
40. Dipla K, Zafeiridis A, Mintziori G, Boutou AK, Goulis DG, Hackney AC. Exercise as a therapeutic intervention in gestational diabetes mellitus. *Endocrines*. 2021;2:65–78.
41. Pagel KA, Chu H, Ramola R, Guerrero RF, Chung JH, Parry S, *et al*. Association of genetic predisposition and physical activity with risk of gestational diabetes in nulliparous women. *JAMA Netw Open*. 2022;5:e2229158.
42. Davenport MH, Ruchat SM, Poitras VJ, Jaramillo Garcia A, Gray CE, Barrowman N, *et al*. Prenatal exercise for the prevention of gestational diabetes mellitus and hypertensive disorders of pregnancy: A systematic review and meta-analysis. *Br J Sports Med*. 2018;52:1367–75.
43. Uria-Minguito A, Silva-José C, Sánchez-Polán M, Díaz-Blanco Á, García-Benasach F, Carrero Martínez V, *et al*. The effect of online supervised exercise throughout pregnancy on the prevention of gestational diabetes in healthy pregnant women during COVID-19 pandemic: A randomized clinical trial. *Int J Environ Res Public Health*. 2022;19:14104.
44. Ghasemi F, Vakilian K, Khalajinia Z. Comparing the effect of individual counseling with counseling on social application on self-care and quality of life of women with gestational diabetes. *Prim Care Diabetes*. 2021;15:842–7.
45. Andersen MB, Fuglsang J, Ostenfeld EB, Poulsen CW, Daugaard M, Ovesen PG. Postprandial interval walking-effect on blood glucose in pregnant women with gestational diabetes. *Am J Obstet Gynecol MFM*. 2021;3:100440.
46. Soylu Y. *Gestasyonel diyabetli kadınlarda beslenme durumları ve yaşam kalitesi arasındaki ilişkinin değerlendirilmesi* [The evaluation of relationship between nutritional situations and quality of life in women with gestational diabetes (Master's thesis)]. Istanbul, Turkey: Istanbul Medipol University; 2019. Turkish.
47. Engberg E, Tikkanen HO, Koponen A, Hägglund H, Kukkonen-Harjula K, Tiitinen A, *et al*. Cardiorespiratory fitness and health-related quality of life in women at risk for gestational diabetes. *Scand J Med Sci Sports*. 2018;28:203–11.
48. Woodside A, Bradford H. Exercise and the prevention of gestational diabetes mellitus. *Nurs Womens Health*. 2021;25:304–11.
49. Walker RE, Choi TST, Quong S, Hodges R, Truby H, Kumar A. It's not easy - A qualitative study of lifestyle change during pregnancy. *Women Birth*. 2020;33:e363–70.
50. Fajriyah N, Andriani D. Effect of non-pharmacological interventions on glycemic control for gestational diabetes mellitus: A systematic review. *J Sci Health*. 2022;1:251–60.
51. Souza Leite Vieira A, Nascimento SL, Souza Silva L, Mendes Pedroso Chainça T, Costa Machado H, Surita FG. Self-reported exercise or physical activity level: What matters to a better quality of life in the third trimester of pregnancy? *Women Health*. 2022;62:799–808.
52. Mourady D, Richa S, Karam R, Papazian T, Hajj Moussa F, El Osta N, *et al*. Associations between quality of life, physical activity, worry, depression and insomnia: A cross-sectional designed study in healthy pregnant women. *PLoS One*. 2017;12:e0178181.
53. Göker A, Yanıkkerem E, Topsakal Ö. Gebelerin fiziksel aktivite düzeyleri ve yaşam kalitelerinin incelenmesi [Determination of the physical activity and quality of life

in pregnant women]. *Celal Bayar Üniversitesi Sağlık Bilimleri Enstitüsü Dergisi*. 2021;8:315–22. Turkish.

54. Krzepota J, Sadowska D, Biernat E. Relationships between physical activity and quality of life in pregnant women in the second and third trimester. *Int J Environ Res Public Health*. 2018;15:2745.