

Dietary quality and mindful eating among pregnant women with and without gestational diabetes

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Abstract

Objective: The incidence of gestational diabetes mellitus (GDM) is increasing in parallel with maternal obesity. The main components of treatment are monitoring blood glucose levels with medical nutrition therapy and lifestyle modification in order to prevent short- and long-term materno-fetal complications. This study aimed to compare the diet quality and mindful eating among pregnant women with and without GDM.

Methods: This case-control study included 68 pregnant women. Each participant was face-to-face interviewed using a structured questionnaire to obtain socio-demographic information, general health information, nutritional habits, and registered three days of food record. Mindful Eating Questionnaire (MEQ) and Healthy Eating Index (HEI) were applied in order to assess mindful eating and diet quality, respectively.

Results: Mean pre-pregnancy body mass index of women was 27.42 ± 5.44 kg/m², 66.7% of the gestational diabetes group and 29.4% of the control group was obese. Differences in HEI adequacy subgroup scores between the groups were significant. Mean MEQ scores were 2.85 ± 0.34 and 3.13 ± 0.44 in pregnant women with gestational diabetes and control cases, respectively ($r=0.61$, $p=0.003$, $p<0.05$).

Conclusion: Our results showed that pregnant women with gestational diabetes had lower mindful eating and diet quality scores.

Keywords: Gestational diabetes, mindfulness, diet quality.

Introduction

Gestational diabetes mellitus (GDM) is defined as any degree of glucose intolerance with onset or first recognition during pregnancy. It is a common and severe pregnancy complication developing with spontaneous hyperglycemia and is associated with multiple adverse maternal and fetal outcomes.^[1,2] The incidence of GDM is increasing in parallel with maternal obesity. According to the Diabetes Atlas published by the International Diabetes Federation (IDF), 16% of live births had some form of hyperglycemia in pregnancy, and 84% were due to GDM.^[3]

In addition to maternal obesity, certain ethnicities like African, Asian, Hispanic, Native American, and Pacific Island descents, physical inactivity, dyslipidemia, cardiovascular diseases, GDM history in previous pregnancies, advanced maternal age, low socioeconomic or education

level, miscarriages or previous unexplained stillbirths, polycystic ovary syndrome, family history of GDM and severe diabetes are common risk factors for GDM.^[4,5]

The main components of GDM treatment are medical nutrition therapy, lifestyle changes and weight management for achieving target glycemic control. Many women with GDM respond to lifestyle modification like eating behaviors and physical activity which has eminent role in diabetes treatment.^[6–8] Individualized dietary treatment should be planned according to age, body mass index (BMI), and weight gained until that week of gestation for every pregnant woman with GDM. Pharmacological treatment is preferred in women who cannot achieve target plasma glucose levels with lifestyle changes.^[2]

The purpose of mindful eating is to help individuals savor the moment and the food and encourage their full

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presence for the eating experience. When food is consumed, the individual should be aware of what kind of hunger she has and control herself.^[9] Mindful eating reduces food cravings, helps control weight, and thus plays an active role in weight control.^[10] According to a recent study, mindful eating was found to play a role in pregnant women's eating behavior, with the awareness subscale associated with healthy eating and the emotional subscale associated with unhealthy eating.^[11,12]

The effectiveness of diet quality in the prevention and treatment of gestational diabetes is well known.^[7] The Healthy Eating Index (HEI) was first developed in 1995 to evaluate how Americans follow dietary recommendations and diet quality. HEI includes nutritional diversity and makes it easier to determine the diet's appropriateness with healthy and balanced nutrition recommendations.^[13] The HEI is useful in providing a composite measure of dietary intake during pregnancy.^[14]

There are a few studies on eating awareness in pregnancy, but the ones evaluating it in gestational diabetes are missing. Therefore, we aimed to compare the diet quality and mindful eating among women with and without GDM.

Methods

We conducted a case-control study of women with singleton pregnancies with and without diagnosis of gestational diabetes mellitus who admitted to the obstetric outpatient clinic between February and May 2020. The study was approved by the Institutional Review Board (94603339-604.01.02). Each participant was face-to-face interviewed using a structured questionnaire developed by researchers according to similar studies^[8,14] to obtain socio-demographic information, general health information, nutritional habits, and registered three days of food record. Respondents were 68 pregnant women between age of 19–45 years and were divided into two groups: 21 pregnant women in the GDM group and 47 pregnant women in the control group. To calculate the sample size in this study, at least 60 women should participate in order to detect a moderate difference between the ratios of parameters of interest (diet quality and mindful eating) in women with and without gestational diabetes, with 90% power, 5% Type I error and 1:2 assignment. For this, G*Power 3.1.3 power analysis program (Heinrich-Heine University, Düsseldorf, Germany) was used. The case-control ratio used to determine the sam-

ple was 1:2, thus the number of cases was 20 and number of controls was 40. However, when data collection was carried out, there were 21 pregnant women diagnosed as GDM who came to the hospital for the case group and 47 pregnant women for the control group, hence all of them were included as research subjects. After informing, individuals who wanted to voluntarily participate in the study were included and the 'Informed Voluntary Consent Form' was read and signed.

The participants had the Oral Glucose Tolerance Test (OGTT) between the 24th and 28th weeks of their pregnancy. Women were diagnosed as GDM in accordance with The International Association of Diabetes and Pregnancy Study Group (IADPSG) criteria.^[15] According to OGTT results and general health examination, 21 women diagnosed with GDM and 47 healthy pregnant women with similar demographic characteristics were included as study groups. Adolescents or pregnant women with other chronic diseases (Type 1 or 2 diabetes, cancer, kidney, liver diseases) or twin pregnancies were not included the current study. Each participant was interviewed using a structured questionnaire to obtain socio-demographic information, general health information and nutritional habits. Dietary intakes of these women were ascertained at 26–28 weeks of gestation using 3-day (2 weekdays, 1 weekend) food record. Pre-pregnancy weight, current weight and height of the pregnant women participating in the study were recorded. Pre-pregnancy BMI was calculated by dividing the body weight before pregnancy by the square of the height [body weight (kg) / height² (m)].

Healthy Eating Index (HEI) was developed in the USA to evaluate diet quality. HEI is a method consisting of 10 components in which the intake of five food groups and four nutrients and the number of food varieties are examined. The maximum score for each component of the HEI is 10, and the total score is 100. The diet quality of an individual with a HEI score of 80 and above is classified as "good", between 51–80 as "diet that needs improvement", and 51 and below as "poor".^[13] The structure of the HEI has been revised and updated twice since 2005, and HEI-2015 is the most recent form in terms of compliance with the main recommendations of the Dietary Guidelines.^[16] We used HEI-2015 in the current study in order to evaluate diet quality.

Mindfulness towards eating was assessed with the Mindful Eating Questionnaire (MEQ). MEQ was developed by Framson et al.^[17] in 2009 with associations

Table 1. Demographic characteristics of women with and without GDM.

		GDM group (n=21)		Control group (n=47)		Total (n=68)		p-value
		n	%*	n	%*	n	%*	
Age (years)	19–30	13	61.9	20	42.6	33	48.5	0.15 [†]
	≥31	8	38.1	27	57.4	35	51.5	
Working status	Working	9	42.9	13	27.7	22	32.4	0.26 [†]
	Not working	12	57.1	34	72.3	46	67.6	
Education status	Low	6	28.8	10	21.3	16	23.5	0.80 [†]
	Medium	8	38.1	19	40.4	27	39.7	
	High	7	33.3	18	38.3	25	36.8	
Pre-pregnancy BMI	Normal (<25 kg/m ²)	0	0.0	27	57.4	27	39.7	<0.001 [†]
	Overweight (25–29.9 kg/m ²)	7	33.3	14	29.8	21	30.9	
	Obese (≥30 kg/m ²)	14	66.7	6	12.8	20	29.4	

*Column percentage is taken; [†]Chi-square test. **BMI**: body mass index; **FPG**: fasting plasma glucose; **GDM**: gestational diabetes mellitus. For education status, low means secondary school and below, medium means high school, and high.

between eating behavior and mindfulness, and emotional state can be carefully investigated. The items in the original scale are evaluated with a 4-point Likert scale (1=none/rarely, 2=sometimes, 3=frequently, 4=usually/always). The adapted new scale used 5-degree Likert scale (1=none, 2=rarely, 3=sometimes, 4=frequently, 5=always). In total, there are 30 questions and 7 subscales. These subscales are Disinhibition, Emotional Eating, Eating Control, Focusing, Eating Discipline, Mindfulness and Interference. MEQ was adapted into Turkish by Köse et al.^[18] The MEQ's reliability and validity was supported in pregnant women by Apolzan et al.^[19]

Data analysis was conducted using the Statistics Package for Social Sciences (SPSS) version 23.0 (IBM Corp., Armonk, NY, USA). Quantitative data were expressed as mean (\bar{x}) and standard deviation (SD). Qualitative data were stated as number (n) and percentage (%) values. Normality was tested by Kolmogorov-Smirnov test. Difference between groups were tested by

chi-square test. The comparison of means was performed using Student's t-tests. Pearson correlation test was used for correlation analysis. The p-value of <0.05 was considered statistically significant.

Results

The mean age and pre-pregnancy BMI of women were 30.97±5.37 years and 27.42±5.44 kg/m², respectively. Demographic characteristics of women with and without GDM were similar except pre-pregnancy BMI which is higher in GDM group (**Table 1**). OGTT results were not surprisingly higher in GDM group (**Table 2**). Results of diet quality of women according to Healthy Eating Index-2015 results are given in **Table 3**. Diet quality was lower in GDM group than controls (p<0.05). Total fruits, total vegetables, greens and beans, whole grains, dairy, total protein foods, sea food and plant protein, fatty acids and sodium consumptions were higher in controls than GDM (p<0.05). The mean

Table 2. OGTT results of women with and without GDM.

		GDM group (n=21)		Control group (n=47)	
		\bar{x}	SD	\bar{x}	SS
OGTT results	FPG (mg/dL)	113.95	14.67	80.91	10.96
	OGTT 1st hour (mg/dL)	240.71	30.08	120.76	22.84
	OGTT 2nd hour (mg/dL)	173.28	16.65	102.91	23.45
Plasma glucose levels at the breakfast meal in the same week of the OGTT	FPG (mg/dL)	115.76	16.77	-	-
	PPG (mg/dL)	205.64	20.72	-	-

FPG: fasting plasma glucose; GDM: gestational diabetes mellitus; OGTT: oral glucose tolerance test; PPG: postprandial plasma glucose.

Table 3. Classifications of Healthy Eating Index (HEI) of women.

		GDM group (n=21)		Control group (n=47)		Total (n=68)		p-value [†]
		n	%*	n	%	N	%*	
HEI	Poor	11	52.4	10	21.3	21	30.9	0.021
	Needed improvement	10	47.6	37	78.7	45	66.2	
	Good	-	-	-	-	-	-	

*Column percentage is taken; [†]Chi-square test.

mindful eating questionnaire scores of the GDM group was lower than the controls ($p<0.05$, **Table 4**).

Correlations between Healthy Eating Index and Mindful Eating Questionnaire (MEQ) scores of pregnant women are given in **Table 5**. A moderate positive correlation was found between MEQ and HEI in pregnant women with gestational diabetes ($r=0.61$, $p=0.003$, $p<0.05$). A moderate negative correlation and statistical significance were found between BMI and HEI ($r=-0.52$, $p=0.01$, $p<0.05$). A moderate negative correlation and statistical significance were found between BMI and HEI ($r=-0.58$, $p<0.05$) in the control group. Significant positive correlation was found between education and HEI-2015 score in both groups. Energy intake was decreased while MEQ score was increasing only in control group (**Table 5**).

Discussion

GDM is the most common metabolic problem in pregnant women. Several international organizations, including the World Health Organization (WHO), Endocrine Society, American College of Obstetricians and Gynecologists (ACOG) and American Diabetes Association (ADA), recommend universal screening for GDM in all pregnant women.^[1,15] The Hyperglycemia and Adverse Pregnancy Outcome (HAPO) study, a large multinational cohort, clarified the risks of adverse outcomes associated with hyperglycemia. The findings of the study showed that maternal hyperglycemia independently increased the risks of preterm birth, cesarean delivery, babies born large for gestational age, admission to the neonatal intensive care unit, neonatal hypoglycemia and hyperbilirubinemia.^[20]

Table 4. The mean HEI and MEQ scores of women with and without GDM.

Component	Maximum points	GDM group (n=21)	Control group (n=47)	T	p-value*
		Mean±SD	Mean±SD		
Total HEI score	100	52.61±9.03	59.04±9.87	-2.543	0.013
Adequacy					
Total fruits	5	3.14±0.57	3.57±0.61	-2.723	0.008
Whole fruits	5	3.52±0.74	3.59±0.68	-.390	0.698
Total vegetables	5	3.09±0.62	3.51±0.58	-2.649	0.010
Greens and beans	5	3.19±0.74	3.61±0.67	-2.321	0.023
Whole grains	10	6.66±1.74	7.55±1.33	-2.300	0.025
Dairy	10	5.76±1.44	7.10±1.43	-3.565	0.001
Total protein foods	5	3.09±0.88	3.63±0.96	-2.195	0.032
Sea food/plant protein	5	1.47±0.81	2.17±1.14	-2.499	0.015
Fatty acids	10	5.01±1.81	6.70±1.62	-3.844	0.001
Moderation					
Refined grains	10	4.85±1.42	4.68±1.50	.453	0.652
Sodium	10	3.52±1.12	4.40±1.37	-2.569	0.008
Added sugars	10	4.61±1.16	4.12±1.66	1.225	0.225
Saturated fats	10	4.61±1.24	4.36±1.67	.630	0.531
MEQ		2.85±0.34	3.13±0.44	-2.295	0.010

*Independent sample t-test. **GDM:** gestational diabetes mellitus; **HEI:** Healthy Eating Index; **MEQ:** Mindful Eating Questionnaire.

Table 5. The correlations between some sociodemographic and nutritional factors of both HEI-2015 and MEQ scores of pregnant women.

	GDM group (n=47) HEI		Control group (n=21) HEI		GDM group (n=47) MEQ		Control group (n=21) MEQ	
	r	p*	r	p*	r	p*	r	p*
MEQ	0.61	0.00 [†]	0.13	0.37	-	-	-	-
HEI-2015	-	-	-	-	0.61	0.00 [†]	0.13	0.37
Energy (kcal)	-0.34	0.13	-0.09	0.54	-0.05	0.82	-0.36	0.01 [†]
Pre-pregnancy BMI (kg/m ²)	-0.61	0.01 [†]	-0.50	0.00 [†]	-0.32	0.15	-0.22	0.13
Actual BMI (kg/m ²)	-0.52	0.01 [†]	-0.58	0.00 [†]	-0.41	0.06	-0.33	0.02 [†]
Weight gained during pregnancy (kg)	0.28	0.20	0.15	0.28	0.37	0.09	0.22	0.12
Age (years)	-0.16	0.48	-0.01	0.93	-0.03	0.88	-0.42	0.00 [†]
First gestational age (years)	0.36	0.10	0.28	0.05	0.27	0.22	0.27	0.05
Education (years)	0.65	0.01 [†]	0.40	0.00 [†]	0.29	0.19	0.27	0.06

*Pearson correlation analysis; [†]p<0.05. **GDM:** gestational diabetes mellitus; **HEI:** Healthy Eating Index; **MEQ:** Mindful Eating Questionnaire.

Healthy Eating Index-2015 is the most up-to-date version of the HEI in compliance with the basic recommendations of the Nutrition Guidelines. HEI uses a scoring system to evaluate a range of foods.^[16] Obese pregnant women got lower diet quality index scores than pregnant women with underweight and normal BMI.^[21] Similar to our study, in a cohort conducted with 787 women in Spain, the mean HEI score was 54.3.^[22] In our study, we found the mean HEI score was 52.6 for GDM group and 59.0 for control group (p<0.05). It is well known that the education is substantial in diabetes management; however, nutritional knowledge is discussed for the past few years.^[23] We found significant positive correlation between years of education and HEI-2015 score in both GDM and control groups.

Becoming pregnant as obese/overweight and excessive gestational weight gain above the IOM recommendations increase GDM risk.^[24] Women receive information from a range of sources and make a number of dietary adaptations during pregnancy. However, especially obese pregnant women with gestational diabetes generally are reluctant to follow a healthy diet.^[2,11,23] Shin et al.^[25] reported that the women with obese pre-pregnancy BMI demonstrated significantly lower HEI-2010 compared to those who were underweight or normal, respectively. In the current study, we associated higher BMI with lower HEI total score both for GDM and control groups (p<0.05), which suggest that dietary quality can play an important role in gestational weight gain.

Lifestyle changes including dietary, physical activity, or a combination of dietary and physical activity interventions to standard antenatal care should be offered to

all women with GDM. A meta-analysis study reported that multiple lifestyle changes, rather than alone, were more effective in the control of GDM. In addition to following a well-structured and balanced diet, individuals with GDM should be encouraged to lead a more physically active life.^[26] A recent study conducted by qualified dietitians, and individually tailored for obese pregnant women, associated significant improvements with diet quality among intervention participants. The authors stated that their success was due to the individualized, target orientated, culturally sensitive, supportive, non-judgmental and non-stigmatizing approaches, which are likely to have been essential components for achieving optimal outcomes.^[27] However, in obese women, dietary interventions do not result in success.^[28] In our study, women with GDM have higher pre-pregnancy BMI thus the difference in HEI-2015 scores may be related to obesogenic diet pattern. In order to explain these relationships, results in women with GDM must be confirmed with a large sample.

Maternal eating behaviors have the potential to influence the metabolic milieu in pregnancies, with implications for the fetal programming of offspring. The evidence suggests that mindfulness during eating may influence metabolic health in non-pregnant populations, but its effects in the context of pregnancy is less well understood. Mindful eating can be described as nonjudgmental awareness of emotional and physical sensations associated with eating. Thus, it may be helpful for weight maintenance or loss.^[29] Wansink et al.^[30] hypothesized that “mindful eating” is the answer for the long-term weight loss success. In this manner, we thought that mindful eating can be an effective strategy to comply

within the appropriate weight gain goals recommended for obese pregnant women. In our study, mindful eating summary score of the GDM group was lower than the control group ($p < 0.05$). Overall mindfulness as evaluated by the summary score was positively associated with HEI ($r = 0.61$, $p < 0.05$) only in GDM group. It is thought that it would be beneficial to plan mindfulness trainings by dietitians and psychologists to promote awareness towards eating behaviors in pregnant women in addition to healthy nutrition training.

Hutchinson et al.^[11] observed no significant relationship between perceived social norms related to diet during pregnancy and dietary behavior reported by the individual. However, women who were more likely to eat in response to negative emotions such as stress and sadness were found to eat nutrient-dense foods with higher energy. Bijlholt et al.^[31] evaluate the relationships between eating behavior (i.e., restricted eating, eating out, emotional eating, food cravings, inhibition, uncontrolled eating, intuitive eating and mindful eating) and weight changes among pregnant women or postpartum period. Their systematic review showed that higher gestational weight gain was associated with lower intuitive eating and higher restrained eating, external eating, emotional eating, food cravings and disinhibition. However, there was no relationship between postpartum weight and mindful eating, food cravings and disinhibition.^[31]

We conducted an observational study and measured mindful eating and diet quality in 21 cases with GDM and 47 healthy pregnant women. Dietary quality was associated with less awareness towards eating in our small sample sized study. In a similar study evaluated eating behavior and diet quality in 56 women with obesity, diet quality was found to be poor for 71% of women with a mean HEI score of 46.7 ± 1.3 , and mindful eating score was 2.93 ± 0.04 .^[32]

The strengths of this study are that the 3-day food records were verified by a dietician and the pre-pregnancy weight status of women was questioned. Index and scale used in the study were previously validated for pregnant women. Eating behaviors were assessed by questionnaires and being prone to self-reporting bias is one of the weaknesses. The low sample size and therefore non-generalizability of the results are the second weakness of our study. It is thought that developing scales that show the nutritional status and diet quality of pregnant women with GDM in a more practical way will be effective in managing GDM.

Conclusion

Women with GDM should manage their blood glucose closer to target levels in order to reduce the risk of adverse materno-fetal outcomes with the support of healthcare providers. This study provides early evidence to suggest that mindful eating has potential to improve metabolic health outcomes in pregnant women, although further researches are required to generalize the effects of diet quality, and mindful eating of pregnant women with GDM.

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