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The Association of Mindfulness with Nutritional Status of Patients with Type 2 Diabetes Mellitus: A Cross-sectional Study

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Abstract

Background and Objective: Mindfulness has emerged as a promising adjunctive approach in the management of type 2 diabetes mellitus (T2DM), potentially affecting nutritional behaviors, glycemic control, and psychological well-being. This study explores the association of mindfulness with nutritional status among adults with T2DM.

Methods: This cross-sectional study included 151 patients (86.8% female, mean age 60.4 ± 9.4 years) with T2DM who were recruited from healthcare centers in Maragheh, Iran from Oct 2023 to Mar 2024. Anthropometric indices, blood pressure (BP), and fasting blood sugar (FBS) were precisely assessed. We assessed participants' nutritional status using the Mini Nutritional Assessment (MNA), appetite with the Comprehensive Nutritional Assessment Questionnaire (CNAQ), and mindfulness through the Five-Factor Mindfulness Questionnaire (FFMQ). Additionally, we evaluated dietary intake using a Food Frequency Questionnaire (FFQ). Associations between mindfulness and nutritional and clinical parameters were analyzed using appropriate statistical analyses.

Findings: Most participants were overweight (mean of BMI: 29.5 ± 4.6 kg/m²) and had good nutritional status per MNA (80.1% normal, 19.9% at risk, none malnourished). The average FFMQ score was 135.8 ± 11.6, with 93.4% demonstrating good mindfulness. Appetite was sufficient in 58.9% of participants and moderate in 41.1%. Age had a significant reverse association with appetite. Mindfulness had no significant associations with DM duration, appetite, or nutritional status ($P > 0.05$). Similarly, weight, BMI, FBS, and blood pressure did not significantly correlate with mindfulness or appetite scores.

Conclusion: While the majority of T2DM patients exhibited good mindfulness and nutritional status, this study did not find any significant associations between mindfulness and nutritional status, FBS, and BP. Therefore, regarding limited and some inconsistent data in this area, future observational studies or clinical trials are needed to clarify whether mindfulness can exert sustained and clinically relevant effects on nutritional status and metabolic parameters in diabetes.

Keywords: Diabetes, Nutritional Assessment, Appetite, Mindfulness, Body weight

Type 2 Diabetes Mellitus (T2DM) is one of the most prevalent non-communicable diseases around the world (1). It is recognized as the ninth leading cause of mortality worldwide, and its prevalence continues to rise alarmingly. It has been reported that 783 million people will have diabetes by 2045 (2).

Given the multifactorial feature of T2DM and various complications, it is essential to consider complementary therapies, lifestyle and dietary modifications, and behavioral changes along with usual pharmaceutical medications for better management of the disease (3). In this context, mindfulness has been integrated as a novel approach alongside traditional treatments to improve the quality of life and better control of blood glucose levels in diabetic patients (3, 4).

Mindfulness refers to the intentional and non-judgmental awareness of the present moment (5). As a practice rooted in human nature, mindfulness can influence the emotional system, encompassing cognitive processes, bodily sensations, emotions, and impulses. Empirical research has shown that mindfulness training yields positive outcomes in psychological well-being. This contributes to increased levels of agreeableness, openness, and conscientiousness, and coping with life events and stressors. Furthermore, individuals practicing mindfulness exhibit improved skills in recognizing, managing, and resolving daily challenges, demonstrating enhanced emotional regulation and problem-solving abilities (6).

Research indicates that mindfulness may help lower fasting blood sugar (FBS) levels and HbA1c levels in patients with T2DM (7, 8). Considering the psychosomatic nature of various diseases, the importance of mental health in disease management, including diabetes, is crucial. Psychological stress can directly elevate blood glucose levels and indirectly lead to excessive caloric intake. Numerous studies have highlighted the effectiveness of mindfulness in improving glycemic control and optimizing diabetes management (9). Mindfulness practices help to reduce negative emotions such as anxiety, depression, anger, and fear, which can disrupt multiple systems of the body, e.g., glycemic control (10). Moreover, a meta-analysis by Ngan et al. showed that mindfulness may influence brain regions involved in appetite regulation and moderate excessive food intake (8).

Self-care behaviors, such as blood sugar monitoring, dietary management, and insulin therapy, can provoke negative thoughts in diabetic patients (e.g., "I am sick"), which may lead to negative emotional experiences such as depression and anxiety among diabetic patients. Mindfulness enables patients with T2DM to confront these disturbing thoughts (11) and can promote better adherence to medical and dietary advice, better metabolic adjustments, and improved quality of life (12).

Given the high prevalence of T2DM and its numerous physical and psychological complications, including malnutrition, further investigation in this area is warranted. Only a limited number of studies have examined the association between mindfulness and the nutritional status of patients with diabetes, although existing evidence suggests that mindfulness may have beneficial health effects. Therefore, we hypothesized that higher mindfulness scores would be associated with better nutritional status. The present study aimed to assess nutritional status in patients with DM by evaluating anthropometric indices, appetite, dietary intake, blood pressure (BP), and fasting blood sugar (FBS), and to examine their relationship with mindfulness scores.

Methods

1.1. Study design and subjects

The present cross-sectional study included eligible patients with T2DM who visited healthcare centers in Maragheh, Iran from Oct 2023 to Mar 2024. All participants entered the study voluntarily based on their eligibility and a convenient sampling method was employed to select them. Individuals aged 32 to 75 years who could read and write were eligible to participate in the study. Exclusion criteria included people with type 1 DM, as well as those diagnosed with mental health conditions such as Alzheimer's disease, pregnant or lactating women, and individuals with other chronic medical conditions (such as thyroid diseases, cardiovascular diseases, severe kidney failure, or cancer) who had intensive exercises or special diets. Out of the 460 patients who visited healthcare centers, 151 were eligible to enter the study.

1.2. Data Collection

This study received ethical approval from the Ethics Committee of Maragheh University of Medical Sciences (IR.MARAGHEHPHC.REC.1402.003). All participants were made aware of the content of the study and signed a written consent form at the beginning of the study.

Weight and height were measured using a standard scale (Seca, Hamburg, Germany) with minimal clothing and no shoes. Body mass index (BMI) was calculated by dividing weight (kg) by the square of height (m). The waist circumference (WC) was measured using a tape with a precision of 1 mm at the midpoint between the lower rib and the iliac crest.

Personal information, including age, gender, medications, other comorbidities, duration of diabetes, and family history, was collected through face-to-face interviews. Additionally, nutritional status and anthropometric indicators were assessed using the Mini Nutritional Assessment (MNA) (13)

questionnaire. Dietary intake and appetite were evaluated using the Food Frequency Questionnaire (FFQ) (14) and the Current Nutritional Assessment Questionnaire (CNAQ) (15), respectively. Furthermore, mindfulness levels were assessed using the Mindfulness Questionnaire (FFMQ) (16). The validity and reliability of all questionnaires had already been assessed in previous studies.

Before the completion of the questionnaires, a healthcare provider measured and recorded the participants' blood pressure using a standard digital barometer. FBS was also measured in the same session of assessments using a precise glucometer (MediSense Optimum TM Xceed, Abott Diabetes Care Inc., USA) after 10-12 hours of fasting (17).

1.3. Statistical analysis

Data were analyzed using the SPSS software, version 23.0 (IBM Corp., Armonk, NY, USA). The normal distribution of variables was tested by the Kolmogorov–Smirnov test, complemented by an assessment of the mean and standard deviation (SD). Results of descriptive statistical analysis are reported as mean ± SD or frequency (number).

The results of the Appetite Questionnaire (CNAQ) were interpreted according to the questionnaire guidelines (15), categorizing individuals into two groups: those with good appetite and those with moderate appetite. The Mini Nutritional Assessment (MNA) results were also divided into three categories according to the questionnaire guidelines (13): normal, at risk of malnutrition, and malnutrition. The FFMQ questionnaire is a 39 item self-assessment questionnaire with five-point Likert scale scoring from 1 for “never” to 5 for “often”. The total scores ranged from 39 to 195, with higher scores indicating greater mindfulness levels. The median mindfulness questionnaire score of 117 is usually considered the cutoff point; scores exceeding this threshold indicate good mindfulness while those below it represent low mindfulness (16).

To examine the relationships between variables, Pearson's correlation (for quantitative variables), and Spearman's correlation (for ordinal variables) were conducted. $P < 0.05$ was considered statistically significant.

Results

The baseline characteristics of participants are shown in Table 1. A total of 151 participants were recruited in this study, including 131 (86.8%) women and 20 (13.2%) men. The participants' age ranged from 32 to 90 years old, with a mean age of 60.37±9.40 years. Eighty-six patients (57%) had a family history of DM. According to Table 2, the average weight was 72.94 ± 11.42 kg and the average BMI was 29.50 ± 4.58, indicating that most participants were overweight according to established BMI classifications. The average FBS was 153.59±53.67, and the average systolic and diastolic blood pressures were 119.87 ± 11.25 mm Hg and 72.68 ± 7.60 mm Hg, respectively. Table 3 represents dietary intake assessment of participants. According to Table 4, the findings of the CNAQ questionnaire revealed an average score of 27.60 ± 2.94 among participants. Of these, 89 individuals (58.9%) had sufficient appetite, while the appetite of 62 individuals (41.1%) was at an average level. Data from the MNA questionnaire indicated that 121 participants (80.1%) had a normal nutritional status, 30 people (19.9%) were at risk of malnutrition, and no participants were classified as malnourished in this study. The FFMQ questionnaire scores ranged from 39 to 195, with higher scores indicating greater mindfulness levels (Table 4). Analysis of the collected data revealed that the mean score among participants is 135.77 ± 11.62. Only 10 participants (6.6%) had lower mindfulness, whereas the majority, comprising 141 participants (93.4%), demonstrated good mindfulness levels.

The relationship between age and the average mindfulness score indicated an inverse but non-significant relationship ($P = 0.48$). Moreover, results showed that the appetite decreased significantly with age ($P=0.007$).

There was no significant relationship between the average mindfulness score and the duration of DM ($P=0.415$), the CNAQ appetite scores ($P=0.448$), and the MNA questionnaire scores ($P=0.263$). Furthermore, the relationship of participants' weight and BMI with mindfulness scores did not yield significant results. Moreover, FBS, SBP, DBP, and dietary intake did not demonstrate a significant association with FFMQ scores (Table 5).

Table 1. The demographic information of participants (n = 151)

	Variable	number (percentage)
Sex	female	(86.8%) 131
	man	(13.2%) 20
Age		60.37± 9.40*
Education	University degrees	(9.9%) 15
	Less than Diploma	(59%) 89
	Illiteracy/Primary	(31.1%) 47
Marital status	single	(1.3%) 2
	married	(98.7%) 149
Family history of diabetes (yes)		(57%) 86
Duration of diabetes (y)		8.98± 6.45*

*mean± SD

Table 2. Baseline characteristics of participants (n=151)

Variable		mean± SD
Weight (Kg)		72.94 ± 11.42
Height (cm)		157.7± 38.67
BMI (Kg/m²)		29.4± 50.58
WC (cm)		98.22± 10.13
Blood pressure (mm Hg)	*Systolic*	119.87± 11.25
	Diastolic	72.68± 7.60
FBS (mg/dL)		153.59± 53.67
FFMQ score		135.77±11.62
CNAQ score		27.60±2.94
MNA score		12.03±1.60

BMI, Body mass index; FBS, fasting blood sugar; WC, Waist circumference.

Table 3. Dietary intake assessment of participants (n=151)*

Variable	Mean	± SD
Energy (Kcal)	2476.31±595.89	
Protein (g	82.89±26.40	
Carbohydrate (g)	322.16±117.27	
Fat (g)	101.11±25.73	
Saturated fatty acids (g)	36.42±12.77	
Poly unsaturated fatty acids (g)	32.71±4.78	
Dietary fiber (g)	15.15±3.45	
Sodium (mg)	2524.77±636.65	
Potassium (mg)	2959.65±280.59	

* based on the results of food frequency questionnaire (FFQ)

Table 4. The assessment of appetite, nutritional status, and mindfulness of participants based on CNAQ, MNA, and FFMQ questionnaires, respectively.

Variable		number (percentage)
CNAQ score	good appetite	(58.9%) 89
	Moderate appetite	(41.1%) 62
MNA score	Normal nutritional status	(80.1%) 121
	At risk of malnutrition	(19.9%) 30
FFMQ score	Good mindfulness	(93.4%) 141
	Low mindfulness	(6.6%) 10

CNAQ, Comprehensive Nutritional Assessment Questionnaire; FFMQ, Five-Factor Mindfulness Questionnaire; MNA, Mini Nutritional Assessment

Table 5. The association of mindfulness with different variables of the study

	Correlation (r)*	P-value
Age (y)	-0.58	0.480
Duration of diabetes (y)	0.067	0.415
Weight (kg)	0.005	0.955
BMI	0.016	0.849
FBS (mg/dL)	0.018	0.825
SBP (mm Hg)	-0.095	0.253
DBP (mm Hg)	-0.088	0.287
CNAQ score	-0.062	0.448
Appetite level (categorized CNAQ score)**	0.121	0.137
MNA score	-0.092	0.263
Malnutrition state (categorized MNA score)**	0.066	0.420
Energy intake (calories)	0.117	0.159

* Based on Pearson correlation

** Based on Spearman correlation

BMI, Body mass index; CNAQ, Comprehensive Nutritional Assessment Questionnaire; DBP, Diastolic Blood Pressure; FBS, fasting blood sugar; FFMQ, Five Facet Mindfulness Questionnaire; MNA, Mini Nutritional Assessment; SBP, Systolic Blood Pressure.

Discussion

The present study aimed to clarify the relationship between mindfulness and nutritional status in adults with T2DM. It builds on the growing body of research regarding the psychosomatic aspects of diabetes care. Our findings indicate that while most patients reported high levels of mindfulness and sound nutritional status, no significant associations emerged between mindfulness levels and BMI, nutritional status, appetite, or glycemic control.

Consistent with previous studies, our cohort demonstrated high rates of overweight and obesity, underscoring nutritional management as a key aspect of diabetes care. Appetite is one of the key factors in nutritional management of DM and glycemic control (18). According to our results, age had a significant reverse association with appetite. Similar to our finding, Aphramor et al. (19) found reduced appetite among elderly patients with diabetes.

It has been reported that mindfulness causes better self-management behaviors related to diet and exercise, and it is associated with healthier eating behaviors and improved dietary choices in diabetic patients (20, 21). In the present study, based on the results of the MNA questionnaire, none of the participants were classified as malnourished. Therefore, our results showed that there was no significant association between mindfulness and level of appetite, energy intake, or anthropometric indices. In contrast, Alberts et al. (22) reported that their intervention to increase mindfulness significantly decreased food cravings, thinking in absolutes, body image concerns, emotional eating, and eating out of habit in patients compared to the control group. Mindfulness can control appetite by reducing stress and cortisol levels, and helps to avoid overeating as well as anorexia (23, 24).

According to the present study, over 90% of participants had good mindfulness, and no significant correlations were observed between mindfulness scores and FBS level or blood pressure (BP). Similarly, Guyot et al.(25) found no significant associations between mindfulness and FBS, BMI or BP in depressive patients. However, some other studies have shown a positive effect on T2DM health outcomes. Salari et al. (26), for example, discovered that combining mindfulness with medical and pharmaceutical treatments may help diabetic patients recover more effectively. Other studies showed that higher levels of mindful eating are linked to lower HbA1c and BMI levels (27, 28). Fanning et al.(29) identified a negative relationship between mindfulness and HbA1c levels.

The discrepancies in findings may arise from differences in study settings, sample sizes, geographic locations, and the health status of participants. It should be mentioned that the present study has some limitations and our findings should be interpreted cautiously in light of the study's limitations. First, the sample size was relatively small and all the participants were recruited from healthcare centers in one city. This may limit the generalizability of our findings to other populations. Second, since questionnaires are subjective tools, there is the

likelihood of reporting bias. Third, we adjusted for key variables in our analysis. However, other factors such as socioeconomic status or medication adherence may have still influenced the results. Finally, the FBS measurement was done using a standard glucometer in health care center by a trained study partner instead of blood sampling. However, this method may have some variability compared to standard laboratory test by spectrophotometry. Given the limited number of studies in this area and inconsistent results, our findings may be an incentive for future studies.

Conclusion

The majority of T2DM patients in the present study exhibited good mindfulness and nutritional status, and mindfulness did not have any significant association with nutritional status, FBS, or BP. However, given the limited and some inconsistent data in this area, future observational studies or clinical trials are needed to clarify whether mindfulness can exert sustained and clinically relevant effects on nutritional status and metabolic parameters in diabetes.

Footnotes

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Authors' Contribution: The authors' responsibilities were as follows: FA, AT and SBS helped in data collection and laboratory assessments; SBS and VEA wrote the original paper; HS and VEA did statistical analysis; VEA contributed to the conception of the article as well as to the final revision of the manuscript. All authors read and approved the final version of the manuscript.

Conflict of Interests Statement: The authors declare that they have no competing interests.

Data availability: The datasets used and/or analyzed during the current study are available on a reasonable request from the corresponding author.

Ethical Approval: The study was approved by the Ethical Committee of Maragheh University of Medical Sciences (code: IR.MARAGHEHPHC.REC.1402.003).

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