RESEARCH ARTICLE

Assessment of barriers to the dietary adherence among type 2 diabetic patients in Pakistan: A cross-sectional study

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Abstract

Objective: TTo assess the common barriers responsible for non-adherence to dietary recommendations among type 2 diabetic patients.

Method: The cross-sectional study was conducted from October 4, 2021, to March 6, 2022, at the National Institute of Diabetes and Endocrinology, Dow University of Health Sciences, Karachi, and comprised type 2 diabetes patients of either gender aged 18-80 years who had previously been given recommended dietary advice. Dietary barriers were assessed using a 27-item validated questionnaire, and the subjects were compared in terms of age and diabetes duration. Anthropometric measurements and laboratory parameters were also measured. Data were analysed using Stata 17.

Results: Of the 312 subjects, 234(75%) were females. The overall mean age was 52.2±11.2 years, and mean body mass index was 27.2±5.5kg/m2. The reliability of the questionnaire was established with Cronbach's alpha 0.89. Factor analysis yielded 8 common barriers; lack of knowledge about dietary recommendations (variance: 14.7%), situational barrier (variance: 10.7%), lack of family support (variance: 9.5%), stress-related eating problems (variance: 9.1%), boring and monotonous diet (variance: 8.0%), expensive and ineffective diet recommended (variance: 6.5%), work conditions/don't like food in diet (variance: 5.5%), and feeling hungry and weak (variance: 5.4%). The total variation explained by all the 8 factors was 69.4%.

Conclusion: Lack of knowledge regarding dietary recommendations was reported to be the most common barrier towards recommended dietary adherence.

Keywords: Diabetes mellitus, Type 2 diabetes, Dietary adherence, Barriers, Non-adherence, Dietary advice.

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Introduction

The World Health Organisation (WHO) has reported that 536.6 million people are suffering from diabetes mellitus (DM), and it is predicted that by 2045, this number will rise to 783 million.[1] Globally, the most common form of DM is type 2 DM (T2DM). In 2021, the International Diabetes Federation Diabetes (IDF) Atlas reported T2DM as the most prevalent form of diabetes; similar projections are expected in 2045. Also, T2DM is undiagnosed in around 49.7% of the people.[2] Pakistan is ranked third in the list of top 10 countries, reporting 33 million DM cases aged 20-79 years.[1] The overall prevalence of T2DM is 11.77% in Pakistan, with 11.20% of males and 9.19% of females suffering from DM.[3]

This increasing frequency was preceded by lifestyle changes and urbanisation. Lack of physically demanding work, and sedentary lifestyles led to transition in global nutrition patterns, marked by higher consumption of energy-dense but nutrient-poor foods.[4] T2DM and its complications can be prevented by following WHO recommendations that patients should be physically active, perform at least 30 minutes of moderate-intensity activity on most weekdays, maintain healthy body weight, eat nutrient-dense food rather than energy-dense food by avoiding saturated fat and refined sugar, and by staying away from tobacco use.[5] A healthy diet protects against malnutrition as well as other non-communicable diseases (NCDs), like stroke, heart disease, diabetes and cancer.[6] The American Diabetes Association (ADA) has recommended that secondary prevention of T2DM can be achieved by consuming fibre-containing foods, whole grains, vegetables, fruits and legumes and by minimising the use of sucrose-rich foods.[7]

Failure to implement such approaches will lead to the intensification of pharmacological treatments, or result in sub-optimal hypoglycaemic control. Although dietary modification has been anticipated as the keystone of T2DM management and is usually recommended as the first step, it is considered one of the most challenging aspects of DM management. Collaboration between the healthcare provider and the T2DM patient is required for the regular implementation of recommended dietary practices. Both developing as well as developed countries face the problem of non-adherence to dietary modification by

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people with T2DM.[8,9] Leading factors identified for poor adherence to dietary recommendations include the cost of a healthy diet, lack of communication with healthcare providers, duration of disease, socioeconomic status, and poor DM knowledge.[10-12]

To date, several quantitative studies have examined the knowledge level of patients and self-care practices among people with DM in Pakistan.[13] Cultural and psychological factors are among the barriers often reported to DM self-care in Pakistan.[14] However, there is limited data regarding the barriers to dietary recommendations and the level of adherence in individuals with T2DM in Pakistan. A few studies in Ethiopia and other parts of the world have suggested that adherence to recommendations is generally low.[15] In Pakistan, appropriate dietary practice guidelines are not evident in most primary and secondary healthcare services, and there is a lack of information on the proper dietary practice for people with T2DM. The current study was planned to assess the common barriers to dietary adherence among T2DM patients in Pakistan.

Subjects and Methods

The cross-sectional study was conducted from October 4, 2021, to March 6, 2022, at the National Institute of Diabetes and Endocrinology (NIDE), Dow University of Health Sciences (DUHS), Karachi. NIDE was selected as a specialised diabetic centre that offers educational and clinical services for diabetes and other endocrine-related disorders.

After approval from the DUHS ethics review committee, the sample size was calculated using OpenEpi calculator. The percentage of one of the barriers for non-compliance to diet, lack of knowledge 79%[9] was used with 5% margin of error and 95% confidence level. The sample was inflated by >20%. The sample was raised using non-probability convenience sampling technique.

Those included were T2DM patients of either gender aged 18-80 years who had already received dietary advice for T2DM from their respective healthcare provider.

Pregnant women or patients with endocrine, thyroid and other severe systemic comorbidity that could limit or restrict their diet, exercise or activity options were excluded. After taking written informed consent from each subject, demographic and anthropometric data was collected using an interview-assisted questionnaire. Dietary obstacles were evaluated using a validated 27-item questionnaire after receiving permission from the corresponding author.[16] Each item graded on a 5-point Likert scale, ranging from 1=strongly disagree to 5=strongly agree.

Pretesting was done on 20 patients who met the inclusion criteria. In the final analysis, pre-test responses were excluded. Data was self-reported on lifestyle and socio-demographic variables, including age, gender, residence, occupation, family history of DM, and DM complications. The patients were taking oral anti-diabetic agents and had previously received dietary recommendations. Anthropometric data including height, weight, body mass index (BMI) and waist circumference (WC), were documented by taking measurements according to standard protocols.

The patients were grouped into categories based on the WHO population cut-offs for the Asian population: BMI <18.5 kg/m^2=underweight, BMI 18.5-22.9 kg/m^2=normal, BMI 23 to 27.4 kg/m^2=overweight, and BMI ≥27.5 kg/m^2= obese.[17] Laboratory parameters, including fasting blood glucose (FBG) and glycated haemoglobin (HbA1C) were also documented. Socio-demographic characteristics were considered independent variables, whereas barriers and compliance to dietary modifications were considered dependent variables.

Data was analysed using Stata 17. Descriptive statistics were presented as mean±standard deviation (SD) for quantitative variables, and as frequencies with percentages for qualitative variables. The internal consistency of the questionnaire was checked using Cronbach's alpha. Factor analysis was carried out using principal component analysis to assess the factors as common barriers to dietary adherence. Items of perceived barriers to dietary adherence were found to be correlated, as checked through poly-choric correlation because the responses were ordinal, with each other enough that could be reduced into some common factors using factor analysis as Bartlett's test of sphericity was significant (p<0.001). A factor was considered if its eigenvalue was >1. Varimax rotation was used and factor loadings >0.45 were considered to find the common barriers to dietary adherence. The method used to determine the factor scores involved taking the mean score of the items linked to each factor. On the 5-point Likert scale of each item (1-5), a higher score indicated strong presence of barrier. P≤0.05 was considered statistically significant.

Results

Of the 312 subjects, 234(75%) were females and 78(25%) were males. The overall mean age was 52.2±11.2 years, and mean BMI was 27.2±5.5kg/m^2. There were 204(65.4%) housewives. The mean duration of T2DM was 8.3±7.2 years. A history of diabetes in first-degree relatives was present in 218(69.9%) patients. Other complications included eye impairment 113(36.2%), foot impairment 69(22.1%) and

Table-1: Socio-demographic characteristics (n=312).

Characteristics	Mean±SD	Range
Age in years	52.2±11.2	21-79
BMI in kg/m^2	27.2±5.5	14.2-53.8
Waist circumference in cm	42.1±13.7	19-140
FBS in mg/dl	173.6±65.7	73-426
HbA1c in %	8.8±2.1	5.2-17.5
DM- duration in years	8.3±7.2	0.01-40
		n (%)
Gender		
Female		234 (75.0)
Male		78 (25.0)
Occupation		
Home maker/housewife		204 (65.4)
Full time job		60 (19.2)
Part time job		11 (3.5)
Retired		37 (11.9)
Residence		
Rural		42 (13.5)
Urban		270 (86.5)
BMI categories		
Underweight		5 (1.6)
Normal weight		61 (19.6)
Overweight		122 (39.1)
Obese		124 (39.7)

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nerve impairment 68(21.8%) (Table 1). Responses of the subjects to perceived barriers to dietary adherence questionnaire were noted (Table 2).

Kaiser-Meyer-Olkin's value for sampling adequacy was 0.84. A total of eight factors were extracted using the principal component analysis. The weighted mean of factor loadings for items loaded on each factor was used to determine its score. The 1st, 2nd and 3rd common barrier factors were loaded significantly with 6 (range: 0.89-0.56), 3 (range: 0.87-

Table-1: *Continued from previous column.*

Characteristics	Mean±SD	Range
DM- in first degree relatives		
Yes		218 (69.9)
No		94 (30.1)
Complications*		
Cardiovascular disease		44 (14.1)
Nerve impairment		68 (21.8)
Kidney impairment		22 (7.1)
Eye impairment		113 (36.2)
Skin conditions		31 (9.9)
Foot impairment		69 (22.1)
Hearing impairment		52 (16.7)

BMI: Body mass index, FBS: Fasting blood sugar, HbA1c: Glycated haemoglobin, DM: Diabetes mellitus, *Multiple responses were selected.

Table-2: Patients' responses for perceived barriers to dietary adherence.

Items		Disagree/ Strongly disagree	Neutral	Strongly agree/ Agree
1	I don't feel full with the dietary food recommended.	122 (39.1)	34 (10.9)	156 (50.0)
2	Following the recommended diet, I usually feel hungry and weak.	101 (32.4)	42 (13.5)	169 (54.2)
3	I think recommended diet is expensive.	160 (51.3)	78 (25.0)	74 (23.7)
4	I don't enjoy the diet that is recommended to me.	126 (40.4)	61 (19.6)	125 (40.1)
5	I don't enjoy the diet recommended to me, I find it monotonous and boring.	141 (45.2)	54 (17.3)	117 (37.5)
6	I can't follow the diet when on a trip.	130 (41.7)	42 (13.5)	140 (44.9)
7	At parties, I am not able to fully follow recommended diet.	117 (37.5)	49 (15.7)	146 (46.8)
8	Eating food from outside (restaurant, etc.) makes it impossible for me to follow my recommended diet.	136 (43.6)	48 (15.4)	128 (41.0)
9	Stressful family environment makes it difficult for me to follow the recommended diet.	153 (49.0)	42 (13.5)	117 (37.5)
10	Stress at work makes it difficult for me to follow the recommended diet.	148 (47.4)	39 (12.5)	125 (40.1)
11	The diet recommended to me is very different from my previous diet.	79 (25.3)	44 (14.1)	189 (60.6)
12	When anxious and angry (emotional stress), it is difficult for me to follow the recommended diet.	152 (48.7)	38 (12.2)	122 (39.1)
13	I feel hopeless with the continuation of the recommended diet since I don't see effective results on my disease.	141 (45.2)	49 (15.7)	122 (39.1)
14	I can't eat the recommended foods because of other family members.	204 (65.4)	39 (12.5)	69 (22.1)
15	It is difficult for me to follow diet when I am with other people.	153 (49.0)	37 (11.9)	122 (39.1)
16	I am not supported and encouraged by family and friends to follow my recommended diet.	243 (77.9)	31 (9.9)	38 (12.2)
17	Dietary recommendations are not clear.	165 (52.9)	57 (18.3)	90 (28.8)
18	I can't resist temptation to eat unhealthy food and food that is not recommended to me.	132 (42.3)	44 (14.1)	136 (43.6)
19	Due to work conditions, I can't adhere to the recommended diet.	178 (57.1)	47 (15.1)	87 (27.9)
20	I prefer to enjoy the food I eat than dieting.	160 (51.3)	54 (17.3)	98 (31.4)
21	Because other people cook for me, I can't follow the recommended diet.	233 (74.7)	36 (11.5)	43 (13.8)
22	I can't follow the diet schedule.	165 (52.9)	75 (24.0)	72 (23.1)
23	I can't follow the number and the quantity of the recommended diet.	127 (40.7)	73 (23.4)	112 (35.9)
24	I don't know what other foods I can use instead of the foods recommended in the diet.	143 (45.8)	60 (19.2)	109 (34.9)
25	Generally, I don't know what food to eat.	179 (57.4)	53 (17.0)	80 (25.6)
26	I don't know what quantity of food I should eat.	147 (47.1)	44 (14.1)	121 (38.8)
27	I have not received adequate information from my doctor or nutritionist on the recommended diet.	162 (51.9)	24 (7.7)	126 (40.4)

Table-3: Factor loadings for each item of perceived barriers to dietary adherence.

	Items	Factor							
		1	2	3	4	5	6	7	8
24	I don't know what other foods I can use instead of the foods recommended in the diet.	0.89	0.03	0.13	0.09	0.02	0.07	0.04	-0.03
26	I don't know what quantity of food I should eat.	0.88	0.11	0.05	0.13	0.07	-0.02	0.04	0.02
25	Generally, I don't know what food to eat.	0.86	0.04	0.17	-0.04	0.07	0.09	0.11	0.03
27	I have not received adequate information from my doctor or nutritionist on the recommended diet.	0.78	0.04	-0.10	0.02	0.05	0.10	0.06	0.05
17	Dietary recommendations are not clear.	0.62	0.13	0.18	0.04	0.06	-0.12	0.20	0.10
23	I can't follow the number and the quantity of the recommended diet.	0.56	0.21	0.34	0.21	0.25	-0.18	-0.10	0.07
7	At parties, I am not able to fully follow recommended diet.	0.06	0.87	0.09	0.23	0.16	0.01	0.06	-0.06
6	I can't follow the diet when on a trip.	0.07	0.86	0.13	0.09	0.20	0.07	0.00	0.08
8	Eating food from outside (restaurant, etc.) makes it impossible for me to follow my recommended diet.	0.11	0.83	0.22	0.10	0.01	0.06	0.11	0.10
14	I can't eat the recommended foods because of other family members.	0.16	0.29	0.71	0.09	0.18	0.25	-0.09	-0.03
15	It is difficult for me to follow a diet when I am with other people.	0.10	0.37	0.68	0.05	0.22	0.20	0.12	0.15
21	Because other people cook for me, I can't follow the recommended diet.	0.16	0.08	0.61	0.17	0.07	0.09	0.30	0.00
16	I am not supported and encouraged by family and friends to follow my recommended diet.	0.17	0.07	0.61	-0.18	-0.10	-0.22	0.24	0.09
22	I can't follow the diet schedule.	0.24	0.30	0.51	0.23	0.21	-0.19	0.08	0.02
10	Stress at work makes it difficult for me to follow the recommended diet.	0.08	0.16	0.06	0.88	0.11	0.07	0.03	0.04
9	Stressful family environment makes it difficult for me to follow the recommended diet.	0.07	0.18	0.03	0.87	0.08	0.04	-0.06	0.06
12	When anxious and angry (emotional stress), it is difficult for me to follow the recommended diet.	0.06	0.10	0.04	0.64	0.07	0.21	0.19	0.12
4	I don't enjoy the diet that is recommended to me.	0.08	0.11	0.08	0.11	0.92	0.07	0.02	0.05
5	I don't enjoy the diet recommended to me, I find it monotonous and boring.	0.09	0.20	0.11	0.09	0.88	0.14	0.03	0.12
11	The diet recommended to me is very different from my previous diet.	-0.01	0.10	0.02	0.15	0.19	0.72	0.18	0.07
13	I feel hopeless with the continuation of the recommended diet since I don't see effective results on my disease.	0.10	0.11	0.16	0.14	0.22	0.68	0.13	0.17
3	I think recommended diet is expensive.	0.19	-0.01	0.20	0.02	-0.03	0.53	-0.14	0.12
20	I prefer to enjoy the food I eat than dieting.	0.15	0.09	0.09	-0.02	0.00	0.11	0.84	0.00
19	Due to work conditions, I can't adhere to the recommended diet.	0.20	0.14	0.19	0.43	0.19	0.00	0.48	0.06
1	I don't feel full with the dietary food recommended.	-0.00	0.04	0.06	0.05	0.08	0.01	0.10	0.89
2	Following the recommended diet, I usually feel hungry and weak.	0.13	0.09	0.01	0.17	0.19	0.34	-0.16	0.68
18	I can't resist the temptation to eat unhealthy food and food that is not recommended to me.	0.18	0.37	0.27	0.23	0.22	0.16	0.41	0.26
	Eigenvalue	3.97	2.88	2.56	2.46	2.14	1.77	1.50	1.47

Principal component analysis and varimax rotation was used in factor analysis. The cut-off point for significant factor loading was 0.45.

0.83) and 5 (range: 0.71-0.51) items, respectively. The 4th and 6th factors were loaded with 3 items each (range: 0.88-0.64 and 0.72-0.53, respectively). The 5th, 7th and 8th factors were loaded with two items each (range: 0.92-0.88, 0.84-0.48, and 0.89-0.68, respectively). Item number 18 did not load on any of the extracted factors, and was removed from the analysis. Factor analysis was repeated without this item, and found no change in the rest of the results (Table 3).

The reliability of the questionnaire was established with Cronbach's alpha 0.89. Factor analysis yielded 8 common barriers; lack of knowledge about dietary recommendations (variance: 14.7%), situational barrier (variance: 10.7%), lack of family support (variance: 9.5%), stress-related eating problems (variance: 9.1%), boring and monotonous diet (variance: 8.0%), expensive and ineffective diet recommended (variance: 6.5%), work conditions/don't like food in diet (variance: 5.5%), and feeling hungry and weak (variance: 5.4%). The total variation explained by all the 8 factors was 69.4% (Table 4).

Table-4: Extracted factors for perceived barriers to dietary adherence.

	Factors	Mean±SD	% of Variance (Total=69.4)	Cronbach's alpha (Overall=0.89)
1	Lack of knowledge about dietary recommendations	3.2±1.0	14.7	0.88
2	Situational barrier	2.9±1.1	10.7	0.88
3	Lack of family support	3.6±0.8	9.5	0.77
4	Stress-related eating problems	3.1±1.1	9.1	0.82
5	Monotonous and boring diet	3.0±1.2	8.0	0.90
6	Expensive and not effective recommended diet	2.9±0.9	6.5	0.57
7	Work conditions/don't like food in diet	3.3±0.9	5.5	0.48
8	Feeling hungry and weak	2.7±1.1	5.4	0.59

Discussion

Pakistan is facing an immense healthcare burden due to an alarming increase in the incidence of T2DM and its complications.[18] Despite the great significance of dietary modification in the management of T2DM and its complications, like skin, nerve, kidney and eye issues, foot impairment, hearing impairment, and cardiovascular diseases, it is evident that there are various factors acting as barriers for noncompliance with dietary recommendations,[19] making it vital to identify the barriers leading to non-dietary adherence comprehensively. The identification of barriers to dietary recommendations in Pakistan will assist healthcare providers to tailor targeted interventions that address the specific needs of T2DM

patients in Pakistan. This can include culturally appropriate dietary education, counselling and support services to help patients overcome these barriers. This can lead to improved patient outcomes and better management of DM.

In the current study, the most common barrier to dietary adherence was lack of knowledge regarding dietary recommendations, which showed that DM patients had inadequate information about the recommended food, alternative selection in food choices and portion size to be consumed at each meal. Similar findings were reported in earlier studies where insufficient understanding of the prescribed diet plan and uncertainty about the appropriate food choices to include in the daily regime were reported as the most common barrier to dietary adherence leading to disease progression and poor glycaemic control.[11,12] To overcome this barrier, patients must be provided with recommendations that are simple, feasible and flexible with regular follow-ups.[16]

The second most common barrier identified in the current study was the situational barrier. In line with a study in Iran,[16] participants of the current study reported that special occasions and situations, such as holidays, weekends, going to restaurants, parties, visits or trips and gatherings, made it difficult for them to adhere to optimal dietary recommendations.

Likewise, a study among Nepali diabetics revealed that festivals and feasts were barriers that made it difficult to adhere to dietary advice. In South Asian traditions, food has pivotal significance, and during festivals, social pressure to eat everything provided on the table makes dietary adherence difficult to be followed.[20] Similar results were reported by another study.[12]

The contribution of friends, family and community members can play both obstructive and supportive roles. An improved support group can not only help in better management of T2DM, but can also mediate in the reduction of DM-related complications.[12,21]

A study in an Ethiopian hospital revealed that the attitudes, beliefs and knowledge of social support groups, like friends and family, were positively correlated with adherence to dietary and other lifestyle interventions. A remarkable impact was observed when the social support groups had prior higher knowledge regarding counselled diet, lifestyle modifications and interventions.[22] A study in Botswana reported similar findings.[23] Likewise, a qualitative evaluation in Nepal also reported that lifestyle changes and dietary modifications were difficult to be followed by the patients due to the people that surrounded them.[24] To overcome this barrier in Pakistan and worldwide, meticulous attention is required to formulate programmes highlighting the importance of family support in the dietary adherence of T2DM patients.

The current study found that stressful families or work environment acted as a barrier to dietary adherence. In Pakistan, people usually have long, physically or mentally stressful work hours with little choice to concentrate on recommended diet at the workplace. Previous studies revealed that negative attitudes, like stress, depression, burnout, anxiety and other psychosocial problems, were factors that poorly affected dietary regimen adherence in T2DM patients.[16] Furthermore, it has been reported that both the aetiology and management of DM are affected negatively by psychological stress.[10] Health professionals should encourage patients to develop calculated eating habits. Providing psychosocial care by improving problem-solving skills related to management of DM needs to be focussed as recommended in the diabetes self-management education and support (DSMES) programme.[25]

Humans by nature cannot intake monotonous food all the time. The current participants did not enjoy their mealtimes due to the lack of food diversity. They found it monotonous and boring. The findings were in line with a previous study which reported a monotonous diet and fewer healthy food choices as barriers to dietary adherence, resulting in aggravated feelings of deprivation.[16] For optimal health management, nutrition therapy in T2DM management should support diversified healthy food choices, especially focussing on appropriate quality and portion size of the dietary pattern.[26]

The current study's participants revealed that the diet recommended to them was quite expensive to follow as well as very much different from what they were previously consuming, which made dietary adherence difficult. Pakistan is a developing country in which most people are striving hard for their livelihood. Thus, patients' needs should be fulfilled with healthy, low-cost food choices and recipes that are socially and culturally acceptable. Similar findings were conveyed in a study conducted in Iran where DM patients considered the high cost of food as the main barrier to dietary adherence, and the annual increase in the cost of healthy food resulted in higher stress levels in patients from lower socioeconomic status.[16] A study reported the cost of a diabetic diet as the main contributing barrier towards noncompliance to dietary recommendations, which resulted in the increased prevalence of diabetic complications as well as the prevalence of T2DM in lower socioeconomic groups.[12] Dieticians and healthcare providers need to address this barrier by formulating cost-effective recipes. The focus

should not only be on managing a diet properly, but also on its sustainability.

The current study had its limitations. The cross-sectional design meant the study could not explore the improvement in barriers to dietary adherence in T2DM patients. Secondly, participants' self-reporting of barriers can be associated with potential bias. The findings cannot be generalised and may not represent the entire country's population as it was a single-centre study, and barriers to dietary adherence may vary in different geographical locations.

Despite the limitations, the findings suggest that dietary adherence can be achieved in Pakistan if dietary recommendations are individualised, based on the patient's psychological, sociocultural and socio-economic conditions, individual's level of understanding and dietary preferences with the inclusion of common food and appropriate alternatives, simplified cooking methods and specified portion sizes. Using techniques, like motivational enhancement therapy (MET), can be beneficial.[27] Different counselling sessions can improve dietary adherence and mitigate any future complications of the disease. Policymakers and healthcare decision-makers in areas where they are not available should design effective and practical dietary guidelines for diabetic patients.

Conclusions

Lack of knowledge regarding dietary recommendations was reported to be the most common barrier towards recommended dietary adherence.

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SS, MA: Conceptualization, design, writing, and review
SM: Statistical analysis and interpretation
R: Data collection and review
H: Conceptual development, research idea, and final approval