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Original article

Dietary habits of type 2 Diabetes patients: frequency and diversity of nutrition intake – Kingdom of Saudi Arabia

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Summary. One of the important cornerstones of diabetes care is dietary management which should be based on healthy eating in context of food choices, cultural and social aspects. There is scarcity of literature adressing the dietary habits of type 2 diabetics in the Kingdom of Saudi Arabia (KSA). In Gulf countries, especially KSA there are ineffective dietary habits programs that can prevent and control complications from diet-related non-communicable diseases like diabetes The present study was conducted to examine the dietary habits and food frequencies of type 2 diabetes patients attending the primary healthcare centers in Almajmaah City, KSA. It was an analytical cross-sectional study by design which was conducted from February – April 2017. A self-prepared Food Frequency Questionnaire (FFQ) in English language was used to collect the data from 350 patients. The FFQ comprised of local food items that were distributed in 9 food groups. The selection of patients was done by means of systematic random sampling technique. The median age of the patients was 45 years. When compared with the food guide pyramid, the consumption of lipids and fats, sweets and bakery, drinks and, soups and sauces were more than the recommended intake ($p<0.001$) respectively. Whereas, consumption of proteins, carbohydrates, dairy products, fruits, and vegetables was less than the recommended intake ($p<0.001$) respectively. The dietary habits of type 2 diabetics have been reported to be poor. Individualizing the nutrition interventions and encouraging to change the behavior can help the patients in accomplishing the health goals. The treating doctors should also identify the barriers that are hindering the patients from not following the recommended dietary guidelines. To achieve best results from self-care management, patients, doctors, and dietitians should work together.

Key words: dietary habits; type 2 diabetes mellitus; food frequency questionnaire; Kingdom of Saudi Arabia

Introduction

Diabetics' Dietary Habits (DH) refers to food consumption based on nutrition advice given by the healthcare providers. It emphasizes on the intake of food that contains fish, low-fat products, omega 3 fatty acids, fruits, vegetables, a diet low in sodium and high in fiber (1). The ultimate goal in the management of Diabetes Mellitus (DM) is to have blood glucose levels in an acceptable range to delay or prevent the microvascular and macrovascular diabetes complications, that is highly dependent upon what is consumed by the diabetics (2). It has also been reported that controlling the DH of diabetics can improve HbA1c which can help in delaying the onset of diabetes complications (3).One of the important cornerstones of diabetes care is dietary management which should be based on healthy eating in context of food choices, cultural and

social aspects (4). Healthy DH are considered an integral part of treating and improving metabolic disorders and complications that can arise from Diabetes Mellitus (DM) (5,6). To study the relationship between diet and health, some valid instruments are required to access the dietary intake of the subjects of the selected population. Food Frequency Questionnaire (FFQ) can be used as a successful tool used for such epidemiological studies. It can help us draw out the link between DH and health. In FFQ the study subjects are asked to report about the consumption of various foods over a specified time, the frequency of consumption can be reported as per day, per week or per month (7). A great deal of research work has been reported under the supervision of American Diabetes Association (ADA). ADA has also prepared "food guide pyramids" showing the foods to be used more and those to be used less (8).

In Gulf countries, especially KSA there are ineffective DH programs that can prevent and control complications from diet-related non-communicable diseases like diabetes (9). A study conducted on dietary practices of type 2 diabetics in KSA reported an overall inadequate result (10). There is scarcity of literature about the DH of type 2 diabetics in KSA that have been conducted using the local food items. Therefore, the purpose of this study is to identify the types of local foods that are being consumed by the type 2 diabetics along with their frequency and to compare the consumption of proteins, carbohydrates, dairy products, lipids and fats, sweets and bakery, drinks, fruits, vegetables and soups and sauces with the food guide pyramid. This can help the healthcare providers in devising strategies for better patient care.

Materials and Methods

Participants

It was an analytical cross-sectional study which was conducted among type 2 diabetics visiting the primary healthcare centres in Almajmaah City. The study was conducted from February to April 2017. Systematic random sampling technique was used to collect the data from 350 diabetics using direct investigation method. Level of precision formula for used to calculate the sample size, keeping in view the prevalence of DM (23.7%) in KSA (11). However, it was increased to 350 keeping in-view the number of factors. Inclusion criteria were; known type 2 diabetics; aged between 35-55 years and either gender. Written informed consent was taken from the patients prior to data collection and anonymity was maintained. As dietary habits vary from region to region, therefore, we tried to develop a tailored questionnaire by rigorously reviewing the literature with special emphasis on the local food items that can help in studying the DH of type 2 diabetics in KSA in the last 3 months. In case the patient(s) face any difficulty in understanding the questions, the DH questionnaire was translated into Arabic language as well by an expert using the backward translation technique. The psychometric analysis (including face and content validity) of the FFQ used in this research showed good – excellent reliability. The authors have discussed it in detail in another article (12).

Food frequency questionnaire

The FFQ comprised of 9 food groups which are proteins (13 items), carbohydrates (9 items), dairy products (12 items), lipids and fats (12 items), sweets and bakery (12 items), drinks (9 items), fruits (15 items), vegetables (15 items) and soups and sauces (7 items). Responses were recorded as "0 (not consumed), 1 (1-3 times per month), 2 (once a week), 3 (2-4 times per week), 4 (5-6 times per week), 5 (once a day), 6 (2-3 times per day), 7 (4-5 times per day) and 8 (6 or more times per day)". Frequency, total score and median score for each food group was calculated. The score calculation criteria was < 10 (not consumed), 10-19 (1-3 times per month), 20-29 (once a week), 30-39 (2-4 times per week), 40-49 (5-6 times per week), 50-59 (once a day), 60-69 (2-3 times per day), 70-79 (4-5 times per day), > 80 (6 or more times per day) (13). This research was approved by the ethical review committee of Majmaah University, KSA vides reference no: MURECApril.02/COM-2016.

Statistical Analysis

IBM SPSS version 25 (IBM Corp., Armonk, N.Y., USA) was used to analyze the data. One-Sample Kolmogorov Smirnov (K-S) test was applied to check the normality of quantitative variables. Detection of

outliers was done through Z-Scores univariate method. The variable gender is reported as frequency and percentage, whereas, non-normally distributed metric variables are expressed as medians and quartiles ($25^{th} – 75^{th}$). Composite scores were calculated for each food group respectively. One-Sample Wilcoxon Signed Rank test was used to compare the median consumption of foods with the hypothesized median. The hypothesized median values were taken from food guide pyramid based on the recommended consumption of foods. Mid-points were calculated for each interval and rounded for analysis (14). A p-value of less than 0.05 was considered as statistically significant.

Results

Demographic characteristics

The median age of the patients was 45 (40 – 51) years. Majority of the patients were males (n=202; 57.7%) as compared to females (n=148; 42.3%). Outlier detection analysis showed that all the z – score values were less than the absolute value of 4. Therefore, no outliers' problem was detected.

Comparison of dietary habits of the diabetics with the recommended intake

Results presented in Table 2 shows that a significant difference was observed when type 2 diabetics median consumption of proteins, carbohydrates, dairy products, lipids and fats, sweets and bakery products, drinks, fruits, vegetables and soup and sauces were compared with the recommended intake of these foods as per food guide pyramid. Consumption of lipids and fats, sweets and bakery, drinks and, soups and sauces were more than the recommended intake ($p<0.001$) respectively. Whereas, consumption of proteins, carbohydrates, dairy products, fruits, and vegetables was less than the recommended intake ($p<0.001$) respectively. Detail consumption of foods in each category is mentioned below.

Consumption of Protein and Carbohydrates

The median protein consumption of type 2 diabetics in last 3 months was 39 (39-50) or (2-4 times per week). Whereas, according to food guide pyramid, the recommended consumption of protein is 2-3 times daily. Patients were consuming Beef (roast, burger, steak, minced stew, etc.), chicken burger, lamb (roast, chops or stew), fish (curry / fried / canned) and beans "once a day." Consumption of camel meat (roast, steak, minced or grilled) was "5-6 times per week". Whereas, consumption of sausages, Chicken (broast / tikka), organ meat (kidney, liver or brain), eggs and lentils were "once a week." Type 2 diabetics' median carbohydrate consumption in last 3 months was 44 (28-60) or (5-6 times per week). Whereas, according to food guide pyramid, the recommended consumption of carbohydrates is 6-11 times daily. Patients were consuming whole wheat bread, chapati / khubus, cornflakes and rice "once a day," whereas, consumption of white bread, brown bread, porridge (oats, etc.) and paratha was "5-6 times per week" Table 1.

Consumption of Dairy Products and Soups & Sauces

The median dairy products consumption of type 2 diabetics in last 3 months was 31 (24-44) or (2-4 times per week). Whereas, according to food guide pyramid, the recommended consumption of dairy products is 2-3 times per day. Patients were consuming sour / rich cream, whole milk, low-fat milk, dairy desserts and flavoured milk "once a day." Low-fat Laban was being consumed "2-4 times per week". Dairy products like

Table 1. Consumption of Foods in Relation to Intake as per Food Guide Pyramid.

Food Group	Recommended consumption in terms of times as per Food Guide Pyramid	Consumption in terms of times as per Food Frequency Questionnaire
Proteins	2-3 times per day	2-4 times per week
Carbohydrates	6-11 times per day	5-6 times per week
Dairy Products	2-3 times per day	2-4 times per week
Lipids and Fats	Use sparingly or once a week	5-6 times per week
Sweets and Bakery	Use sparingly or once a week	5-6 times per week
Drinks	Use sparingly or once a week	2-4 times per week
Fruits	2-4 times per day	5-6 times per week
Vegetables	3-5 times per day	5-6 times per week
Soup and Sauces	Use sparingly or once a week	5-6 times per week

skimmed milk, full-fat yogurt, low-fat yogurt and full-fat Laban were being consumed "once a week." Labneh was the most used dairy product as it was consumed "daily".The median consumption of soups and sauces by type 2 diabetics in last 3 months was 49 (30-67) or (5-6 times per week). Whereas, according to food guide pyramid, the recommended consumption of soup and sauces is to use sparingly or once a week. Patients were consuming vegetable soup, meat soups and sauces (white sauce, cheese sauce, gravy, etc.) "once a day." Whereas, tomato ketchup was being consumed "once a week." Moreover, pickles were being consumed "2-4 times per week"Table 1.

Consumption of Lipids and Fats, Sweets and Bakery and Drinks

Type 2 diabetics' median lipid and fats consumption in last 3 months was 47 (35-61) or (5-6 times per week). Whereas, according to food guide pyramid, the recommended consumption of lipids and fats is to use sparingly or once a week. Margarine, olive oil, French and other dressings, chocolate spread, honey, jam / marmalade, salad cream, and mayonnaise were being consumed "once a day." Whereas, butter, peanut butter and cheese (cheddar or cottage) were being consumed "once a week.". The median sweets and bakery products consumption of type 2 diabetics in last 3 months was 40 (31-51) or (5-6 times per week). Whereas, according to food guide pyramid, the recommended consumption of sweets and bakery is to use sparingly or once a week. Biscuits, cakes, sugar added to tea, coffee, etc., buns and fattayer and chocolates were being consumed "once a day." Pastries, milk puddings, ice-cream, and crisps and snacks were being consumed "2-4 times per week". Whereas, fruit pies and sweets were being consumed "once a week."The median consumption of drinks by type 2 diabetics in last 3 months was 38 (28-52) or (2-4 times per week). Whereas, according to food guide pyramid, the recommended consumption of drinks is to use sparingly or once a week. Patients were consuming energy drinks and fresh fruit juice "once a day," whereas, consumption of tea, coffee, Arabic coffee and soft drinks was "5-6 times per week". Moreover, coffee whitener and fruit squash were being consumed "2-4 times per week" Table 1.

Consumption of Fruits and Vegetables

The median consumption of fruits by type 2 diabetics in last 3 months was 44 (22-63) or (5-6 times per week). Whereas, according to food guide pyramid, the recommended consumption of fruits is 2-4 times per day. Patients were consuming apples, oranges, grapefruits, melon, watermelon, pear, peaches, plums, apricots, tinned fruits, dates and dried fruits "once a day." Whereas, consumption of bananas, mangoes, strawberries, and raspberries was "2-4 times per week". However, grapes were the only fruit that was being consumed "once a week." The median consumption of vegetables by type 2 diabetics in last 3 months was 40 (31-52) or (5-6 times per week). Whereas, according

Table 2. Comparison of Type 2 Diabetic's Median Consumption of Foods with the hypothesized Median as per Food Frequency Questionnaire.

Food Group	Median consumption by Diabetics	Range of recommended consumption as per Food Frequency Questionnaire	Mid - Point (Rounded) and Hypothesised Median	One sample Wilcoxon Signed Rank Test (p-value)
Proteins	39	60-69	65	< 0.001*
Carbohydrates	44	≥ 80	80	< 0.001*
Dairy Products	31	60-69	65	< 0.001*
Lipids and Fats	47	20-29	25	< 0.001*
Sweets and Bakery	40	20-29	25	< 0.001*
Drinks	38	20-29	25	< 0.001*
Fruits	44	60-69	65	< 0.001*
Vegetables	40	70-79	75	< 0.001*
Soup and Sauces	49	20-29	25	< 0.001*

*statistically significant at 5% level of significance

to food guide pyramid, the recommended consumption of vegetables is 3-5 times per day. Vegetables like sweet corns, spinach, cabbage, lettuce, eggplant, and turnips were being consumed "once a day." Peas and tomatoes were being consumed "5-6 times per week", whereas, carrots, mushrooms, potatoes, okra, broccoli, and cauliflower were being consumed "once a week." Table 1.

Discussion

The results of our study have reported significant unhealthy DH of type 2 diabetics. We have compared our study results with the literature and have tried to identify the factors that can help to achieve the optimum results from dietary management. Most of the patients in our study were consuming foods that were high in saturated fat. Moreover, the consumption of these foods was significantly more than the recommended intake. Whereas, Babio et al (15) suggested that low carbohydrate, and low-fat hypo-caloric diets both are beneficial in reducing the serum glucose and HbA1c levels. Most of the patients in our study were consuming red meat on daily basis. This result is supported by a systematic review of 12 cohort studies which stated that consuming red meat > 3 times a week significantly increases the risk of developing diabetes complications (16).

Type 2 diabetic patients on a low carbohydrate and low saturated fat diet had a better blood glucose control (17). Comparing this study result with ours showed that majority of the patients in our study were on high carbohydrate diet. The reason is that, in last 3 months, consumption of eggs, i.e., low carbohydrate food by most of the diabetics was once a week, whereas, most of the diabetics were consuming beef, chicken, lamb, fish and organ meat on daily basis. Average consumption of low carbohydrate food like vegetables was 5-6 times per week. Whereas, fruits that were low in carbohydrate, i.e., strawberries and raspberries were being consumed 2-4 times a week by most of the diabetics. Oranges, grapefruit, apricots and dried fruits were being consumed daily by most of the diabetics. Diabetics who consume rice a main meal deteriorates their glucose metabolism that increases of risk of complications (18,6). In our study type 2 diabetics were also consuming rice on daily basis that can lead to develop any diabetes complication. Consumption of bakery items routinely could increase the risk of T2DM by three times (6). Though our research is conducted on patients already diagnosed with type 2 diabetes, still their consumption of sweets and bakery items was significantly more than the recommended intake. This can have a direct influence on HbA1c and blood sugar levels.

In KSA and other GCC countries, in comparison to dietary macronutrients distribution recommendation, intakes of carbohydrates, total and saturated fat was found to be high and dietary fiber was low (19,10). Our study results are also confirming this, most of the patients were on a high-fat diet as consumption of lipids and fats and soup and sauces was significantly more than the recommended intake. Margarine, olive oil, French and other dressings, chocolate spread, honey, jam / marmalade, peanut butter, salad cream, and mayonnaise were being consumed daily by most of the patients. Diabetics in our study were consuming fish significantly less than the recommended intake, though it has been stated in the literature that consumption of fish and related nutrients especially long-chain omega-3 fatty acids have several beneficial metabolic effects on patients with diabetes (20,21).

A study conducted in KSA among type 2 diabetics reported that the median consumption of soft drinks was 3 (1 - 5) times per day (10). Comparing these results with our study showed that consumption of soft drinks by most of the type 2 diabetics was 5-6 times per week which is significantly more than the recommended intake. However, the intake is less than what has been reported by Mohamed et al (10). In KSA, consumption of energy drinks is on the rise. Most of the published literature regarding consumption of energy drinks is focused on non-diabetics only or related to the incidence of diabetes, obesity, etc. (22,23). Our study is also the first to inquire about the consumption of energy drinks from type 2 diabetics. Despite adverse effects of consumption of energy drinks on overall health, our study results showed that most of the patients were consuming them daily.

Foods that have been consumed by type 2 diabetics in our study shall be shared with the healthcare

providers, this would help in modifying / improving diabetes self-management structure in KSA. Reasons for deviations from recommended food intake levels need an urgent attention. One of the reasons might be lack of patient empowerment by the treating doctor, and another might be because of lack of awareness of diabetics about the importance of diet in the management of DM. The treating doctor should empower the patients by imparting individualized self-management dietary education and identify the barriers that are hindering the patients from not following the recommended dietary guidelines. Subsequently, the importance of dietitians in dietary management should not be neglected, patients should be referred to trained dietitians for better dietary self-management. A recently conducted meta-analysis concluded that type 2 diabetics who received dietary counselling from dietitians achieved a greater reduction in weight (24). Dietitians should carry out intensive patient-centered sessions by assessing the DK of diabetics, showing them local food models and identify misconceptions of diabetics about nutritive value of certain foods like "dates and honey, etc." Moreover, dietitians can make use of the technology in imparting dietary education to diabetics by asking them to record their dietary intake information (25).

Education level, occupation, and income may also play a significant role in non-adherence to dietary recommendations. These socioeconomic factors have been reported as a barrier between patient-dietitian communications. Therefore, dietitians should pay special emphasis on patients with low income, and less educated, etc. and provide tailored dietary advice to such patients. Side by side, awareness campaigns have been proved to be helpful in modifying unhealthy lifestyle. However, such campaigns launched in the KSA have not been successful so far (26). Therefore, state-of-the-art nutritional interventional programs should be organized on a regular basis by the authorities in KSA, the focus should be specifically on the dietary recommendations, the importance of diet in the management of DM, foods that are based on local models, serving sizes and meal planning. To achieve best results from self-care management, patients, doctors, and dietitians should work together.

Conclusion

The dietary habits of type 2 diabetics have been reported to be poor. The health care professionals can help their patients in achieving health goals by individualizing their nutrition interventions and continuing the support for changes. They should also identify the barriers that are hindering the patients from not following the recommended dietary guidelines. To achieve optimum results from self-care management, patients, doctors, and dietitians should work together.

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Conflicts of Interest

The authors declare no conflicts of interest.

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