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ORIGINAL ARTICLE

Investigation of Dietary Habits and Lifestyle in relation to Diabetes Mellitus Type II among Private-Sector Employees of Lahore: A Cross-Sectional Study

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ABSTRACT

Background: Although some studies have shown the association between dietary patterns and the risk of type 2 diabetes mellitus in a general population but the associations in Pakistan have been rarely studied to date.
Aim: To characterize the dietary patterns and lifestyle of private sector employees in Lahore adults aged above 25 to evaluate the relationship of dietary habits, and lifestyle with the incidence of type 2 diabetes.
Methodology: A cross-sectional study was conducted on the private sector employees of Lahore, Pakistan. Two hundred and sixteen people participated in it and each provided their informed consent for data collection on their demographic, physical and biochemical characteristics along with the information on lifestyle and dietary patterns.
Result: According to the observations from our study among the private sector employees in relation to their dietary habits, lifestyle and physical activity almost 174 private sector employees are diabetic out of which 42 are pre-diabetic.Their dietary intake was assessed using FFQ. The results show that diabetic people are taking more carbohydrates, saturated, trans-fats and red meat. Furthermore, pre-diabetic people are consuming high processed foods which contain more fats, calories and sugar without nutritional value.
Conclusion: We have found that dietary habit, and lifestyle of private sector employees was associated with increased risk of Type 2 Diabetes Mellitus. As a result, in order to stop or reduce the prevalence of type 2 diabetes, it is necessary to promote healthy eating or dietary habits and physical activity to improve their lifestyle.
Keywords: Cross-sectional study, informed consent, dietary intake, Diabetes Mellitus, FFQ, pre-diabetic.

INTRODUCTION

Diabetes commonly called as sugar, is very common and chronic disease which is a primary concern of global health. The reason of rapid increase in diabetes mellitus is due to economic stress, global aging, increase in urbanization and diet trends in different countries of different income level[1]. 463 million people (9.3% of adults 20–79 years) are suffering with diabetes globally. This number is suspected to increase 578 million by the end of 2030 and 700 million (10.9%) by the end of 2045[2,3].

Diabetes mellitus is spreading rapidly in low and middle-income countries than in high income countries. 80% of the patients lived in underdeveloped countries[4,5].The number of adults with diabetes has been increased by 20% in the developed countries between 2010 and 2030, and by 69% in less developed countries. Pakistan has the third highest number of people living with diabetes in the world, after China (141 million) and India (74 million). According to The World Health Organization, diabetes mellitus is the 7th major cause of death in 2030[6,2]. It has been a prediction that developing counties will constitute 77.6% of all patients with diabetes until2030[7,8].

Although it is a non- communicable disease, yet it is increasing day by day. In last few decades diabetes has broken the restrictions of lifestyle age and restrictions of life style socio economic status and age because of in organic and unhealthy diet.

Dietary patterns having healthy, traditional, Mediterranean and western style are of great value in evaluating relationship between diet and health[9]. Food and nutrients are not used alone. They are metabolized altogether. Therefore, it seems more difficult to know about the relationship between nutrients and diseases as compared to comprehensive view to diet. Dietary patterns affect health more than nutrients. The strong evidence is here that indicates the relationship between high consumption of calories and increased risk of T2D[10,11]. However the relationship of T2D and other dietary patterns is not specified. The total diet of individuals is considered by studying dietary patterns [12, 10]. As per dietary guidelines for Americans in 2010, the analysis of dietary patterns is helpful for public health recommendations[16].Secondly it is convenient to understand health recommendations by dietary patterns than nutrient[10].

Healthy dietary patterns including vegetables, fruits, poultry, fish and whole grains reduce the risk of T2DM.Unhealthy dietary including processed food, red meat, fried products, sweets and desserts, refined grains increase the risk of T2DM[13,14]. Thus, there is a strong link between dietary patterns and risk of T2DM.

Recently, there has been considerable attention in nutritional epidemiology towards the associations between dietary patterns and the risk of T2DM. However, to date, data on the associations between dietary patterns and T2DM in the Pakistani population are limited. To the authors' knowledge, no previous epidemiological studies have reported the associations between dietary patterns and risk of T2DM among private-sector employees in Pakistan. Therefore, in the present study, we aimed to characterize the dietary patterns and lifestyle of private-sector employees aged 25-80y and to evaluate the association of established dietary risk factors with the incidence of T2DM.

The objective of the study was to figure out the association between dietary patterns and the risk of type 2 diabetes mellitus in a general population

MATERIAL AND METHODOLOGY

The present study was the cross-sectional study conducted to find out the dietary and lifestyle habits in relation to type 2dibates among private sector employees of Lahore. The sample size was calculated to be 216. Written informed consent was taken from the participants prior to data collection and anonymity was maintained.
Sampling technique: The study population included 174 diabetic and 42 pre diabetic individuals selected through simple random sampling technique. The eligibility criteria for the study participants were: (1) Individuals with type 2dibates and pre-diabetes (2) Individuals aged 25-80 years (3) either sex (4) diagnosed by HBA1C fasting plasma glucose ≥ 126 mg/Dl and/or random blood

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glucose (RBG) ≥ 200 mg/DL. (5) All races and religion, residing in Lahore. Individuals with chronic diseases or history of chronic diseases (cardiovascular diseases, liver disease, renal diseases and cancer), type 1 diabetes, gestational diabetes, and people following special dietary pattern or taking drugs that affect their weight and diet, pregnant and breast-feeding women were excluded from the study. The survey was conducted on all participants using a structured questionnaire that employed the self-administered questionnaire method. The questionnaire consisted of five sections: demographic information (demographic characteristics information, social-demographicinformation); medical information (medical history information, diabetes medication history); behavioral measurements (Smoking, physical activity, dietary habit and sleeping hours); physical measurements (height, weight, BMI); and biochemical measurements (blood glucose); and knowledge of dietary and lifestyle modification for prevention and management of diabetes type 2. Dietary information was collected using a food frequency questionnaire (FFQ). The frequency of each food item was classified as follows: never, once a day, less than 1 time/month, 1 to 3 times/ month, 1 to 2 times/week, 3 to 4 times/week, 5 to 6 times/week, 2 to 3 times/day, 4 to 5 times/day, 6+ times per day. Dietary behavior patterns that are associated with type 2 diabetes as having family meals, skippingbreakfast, lunch and dinner, eating out, having snacks, and removing visible fats, were also assessed.

Statistical analysis: SPSS Version 21, and Microsoft Excel 2016 were used to enter and analyze the data. For all variables, basicdescriptive statistics were performed to calculate means and standard deviations for continuousscale variables and frequencies and percentages for categorical variables**.**

Ethical considerations: Ethical consent was acquired from partakers. The principal goal of research was described clearly to the partakers and written informed consent was secured from each one of them before data gathering. Students were informed that their participation in the study is completely voluntary and anonymous.

RESULTS

We analyzed 174 diabetic and 42 pre-diabetic individuals. Table 1 shows characteristics of the diabetic and pre-diabetic individuals and their associations with other covariates. In our study, the no. of diabetic females (55.2%) was greater than males (44.8%) while the no. of pre-diabetic males (57.1%) was higher than females (24.9%). The mean age of diabetics was 47.41 years and that of pre-diabetics was 43.71 years. 69% of diabetics and 71.4% of pre-diabetics had family history of diabetes. The socioeconomic status, literacy rate, and no. of current smokers were significantly higher among pre-diabetics than diabetic individuals. The mean BMI values for diabetics and pre-diabetics were 27.75kg/m2 and 26.8 kg/m2 respectively which fall in the category of overweight. Of the diabetic individuals, 75.9% have fasting blood glucose level ≥ 126mg/dL, 58.6% have random blood glucose level ≥200mg/dL, and 82.8% have HbA1c value 6.5% and above. 51.72% of diabetics were taking oral medication while 34.48% were prescribed both oral drugs and insulin as a treatment. Out of pre-diabetic individuals, 42.9% have FBGL 100–125mg/dL, 57.1% have RBGL 140–200mg/dL, and 71.4% with HbA1c 5.7 – 6.4%. The study also analyzed the frequency intake of different food items (like, rice, chapatti, bread, porridge, meat, diary, fats and oils, fast food, sweets, beverages, and convenience food) among study participants. Table 2 shows distribution of study population according to the dietary intake of various items using FFQ. Table 3 manifests the comparison of dietary behaviors between diabetic and pre-diabetic individuals such as enjoying family meals, skipping meals, eating out, having snack and removing visible fats. Graph 1 reveals the awareness of study individuals about the link of DMT2 with dietary and lifestyle habits. On the other hand, graph 2 represents the participants' perspective of the fact that dietary and lifestyle modification can play a significant role in the prevention and management of DMT2.

Table 1: Characteristics of Study Population (Baseline and Biochemical)

Variables	Diabetic Individuals (n=174),%	Pre-diabetic Individuals (n=42),%
Gender, (n%)		
Male	78 (44.8)	24 (57.1)
Female	96 (55.2)	18 (42.9)
Age (years)	47.41	43.71
BMI (kg/m2)	27.75	26.8
BMI categorization, (n%)		
Normal (BMI 18.5 – 24.5)	42 (24.14)	6 (14.29)
Obese (BMI > 30)	54 (31.03)	12 (28.6)
Overweight (BMI 25 – 30)	72 (41.4)	24 (57.14)
Underweight (BMI <18.5)	6 (3.45)	--
Education, (n%)		
High	126 (72.41)	42 (100)
Low	6 (3.45)	--
Middle	42 (24.14)	--
Socio-economic status, (n%)		
Balanced	60 (34.5)	24 (57.1)
Sufficient	114 (65.5)	18 (42.9)
Family history of diabetes, (n%)	120 (69)	30 (71.4)
Fasting blood glucose level, (n%)		
99mg/dL or lower	12 (6.9)	24 (57.1)
100 – 125mg/dL	30 (17)	18 (42.9)
≥126mg/dL	132 (75.9)	--
Random blood glucose level, (n%)		
140 – 200mg/dL	60 (34.5)	24 (57.1)
≥200mg/dL	102 (58.6)	--
70 – 140mg/dL	12 (6.9)	18 (42.9)
HbA1c, (n%)		
5.7 – 6.4%	--	30 (71.4)
6.5% or above	144 (82.8)	--
Treatment, (n%)		
Oral drugs	90 (51.72)	--
Insulin	24 (13.79)	--
Both drugs and insulin	60 (34.48)	--
Smoking, (n%)		
Current smokers	18 (10.34)	12 (28.6)
Past smokers	18 (10.34)	12 (28.6)
Non smokers	138 (79.31)	18 (42.9)
Sleeping hours, (n%)		
6-8 hours	84 (48.28)	12 (28.6)
Less than 6 hours	78 (44.83)	6 (14.3)
More than 8 hours	12 (6.90)	24 (57.1)
Physical activity, (n%)		
Heavy (60 minutes/day, 5-7 days /week)	30 (17.24)	--
Mild (20 minutes/day, 1-3 times /week)	54 (31.03)	18 (42.9)
Moderate (30-60 minutes/day, 3-4 times/week)	60 (34.5)	12 (28.6)
Sedentary (No exercise)	30 (17.42)	12 (28.6)

Graph 1: Awareness of Study Individuals about the Relationship of DMT2 with Dietary and Lifestyle Habits

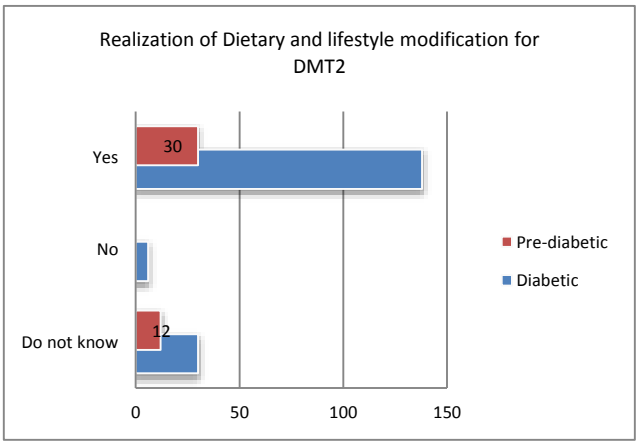


Table 2: Distribution of Study Population according to the Dietary Intake of Various Items using FFQ

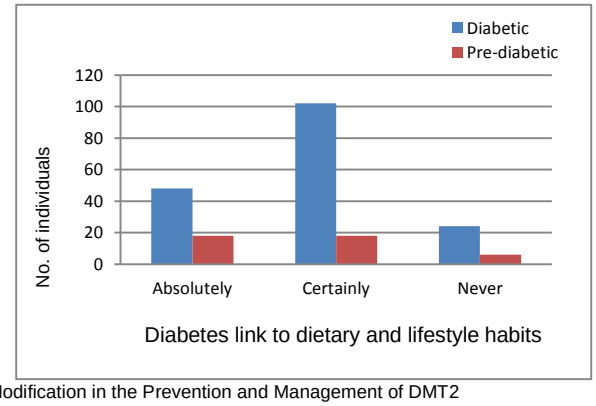
Food items	Once a day(n%)	2-3 times per day(n%)	4-5 times per day(n%)	6+ times /day(n%)	Once a week(n%)	2-4 times per week(n%)	5-6 times per week(n%)	1-3 times per month(n%)	Never, less than once/ Month(n%)
Chapatti	48(22.2)	150(69.4)	6(2.8)	6(2.8)	--	6(2.8)	--	--	--
Rice	18(8.3)	--	6(2.8)	--	84(38.9)	78(36.1)	6(2.8)	24(11.1)	--
Bread	108(50)	--	6(2.8)	--	24(11.1)	30(13.9)	6(2.8)	6(2.8)	36(16.7)
Porridge	54(25)	6(2.8)	--	--	36(16.7)	12(5.6)	--	12(5.6)	96(44.4)
Mutton	18(8.3)	6(2.8)	--	--	66(30.6)	18(8.3)	6(2.8)	24(11.1)	78(36.1)
Beef	6(2.8)	6(2.8)	6(2.8)	--	46(21.3)	6(2.8)	--	24(11.1)	120(55.6)
Fish	18(8.3)	--	12(5.6)	--	24 (11.1)	60(27.8)	--	36(16.7)	66(30.6)
Chicken	24(11.1)	12(5.6)	6(2.8)	--	48(22.2)	108(50)	6(2.8)	6(2.8)	6(2.8)
Egg	84(38.9)	54(25)	--	--	24(11.1)	24(11.1)	24(11.1)	6(2.8)	--
Legumes	30(13.9)	--	18(8.3)	6(2.8)	90(41.7)	24(11.1)	6(2.8)	84(38.9)	18(8.3)
Milk	96(44.4)	60(27.8)	18(8.3)	--	18(8.3)	--	6(2.8)	6(2.8)	12(5.6)
Yoghurt	96(44.4)	42(19.4)	12(5.6)	--	24(11.1)	12(5.6)	--	--	30(13.9)
Butter	18(8.3)	36(16.7)	24(11.1)	6(2.8)	6(2.8)	12(5.6)	12(5.6)	--	102(47.2)
Fruits	72(33.3)	72(33.3)	6(2.8)	--	6(2.8)	30(13.9)	--	12(5.6)	18(8.3)
Vegetables	48(22.2)	36(16.7)	6(2.8)	--	6(2.8)	24(11.1)	84(38.9)	12(5.6)	--
Nuts(almonds, peanuts, pistachios, walnut)	54(25)	12(5.6)	6(2.8)	--	24(11.1)	24(11.1)	30(13.9)	24(11.1)	42(19.4)
Sweets (cake, ice cream, chocolates, biscuits)	18(8.3)	6(2.8)	--	--	12(5.6)	54(25)	6(2.8)	30(13.9)	90(41.7)
Fried items	18(8.3)	6(2.8)	--	--	30(13.9)	36(16.7)	30(13.9)	18(8.3)	78(36.1)
Bakery products	30(13.9)	6(2.8)	6(2.8)	--	24(11.1)	36(16.7)	18(8.3)	42(19.4)	54(25)
Ready to eat food	30(13.9)	12(5.6)	--	--	18(8.3)	12(5.6)	12(5.6)	36(16.7)	96(44.4)
Soups, sauces and spreads	24 (11.1)	--	6(2.8)	--	48(22.2)	18(8.3)	6(2.8)	42(19.4)	72(33.3)
Fast food items	12(5.6)	6(2.8)	--	--	24(11.1)	30(13.9)	30(13.9)	36(16.7)	78(36.1)
Juices and soft drinks	24(11.1)	12(5.6)	--	--	24(11.1)	24(11.1)	24(11.1)	429.4)	66(30.6)

Table 3: Comparison of dietary behaviors between diabetic and pre-diabetic individuals

Dietary Behaviors	Diabetic Individuals(n=174)	Pre-diabetic Individuals (n=42)
Enjoying family meals	174 (100%)	42 (100%)
Skipping breakfast	78 (44.8%)	30 (71.4%)
Skipping lunch and Dinner	120 (69%)	36 (85.7%)
Eating out	108 (62.1%)	42 (100%)
Having snack	150 (86.21%)	36 (85.7%)
Removing visible fats	168 (96.6%)	42 (100%)

*These values are calculated according to the practice of these dietary behaviors by the studied participants on always, often and rare basis.

Graph 2: Participants' Perspective about Role of the Dietary and Lifestyle Modification in the Prevention and Management of DMT2



DISCUSSION

The quality of carbohydrates is more important to health than the amount we eat. Quality of carbohydrates can be assessed using glycemic index, glycemic load and fiber content[15]. The pathogenesis of insulin resistance and glucose intolerance is complex which involves signaling proteins communicating across cell membranes and cytoplasm and nuclear receptors in multiple tissues with tissue specific effects in muscle, adipose, liver, pancreatic β-cells and the brain[16].

The people examined in our survey mostly rely on chapatti as a major source of carbohydrates because 69.4% have it 2-4 times a day. Other than chapatti 50% like to have bread once a day while rice consumption is high once week for 38.9% participants. Increased consumption of nutrient dense fruit and vegetables can result in a significant reduction of fat and sugar intake (in our study population 8.3% like to take sweets once daily). Targeting a reduction in less nutrient dense sources of fat and sugar did not result in increased fruit and vegetable intake although an increase of green leafy vegetables was associated with a modest risk reduction of diabetes[17]. 33.3% participants among our survey indulge in the intake of fruits 2-3 times daily, while 38.9% take vegetables 5-6 times in a week. These findings are consistent with the results from the Women's Health Initiative randomized trial which also found no significant effects of total fat intake on the incidence of T2DM[18].

The replacement of saturated and trans fatty acids with unsaturated fat seems to help prevent T2DM[19]. Classifying by fat content the visible protective effect was present for low fat dairy products but no association was found for high fat dairy. According to the responses received in our questionnaire 57.5% always remove visible fat and 78% do not consume fried items or have them once a month. Same is for butter as 47.2% people have butter once a month. As for dairy products like milk and yoghurt their consumption is 44.4% each daily. They have a neutral effect and can help reduce your risk of type 2 diabetes. Increasing the absolute protein intake to 20-30% of total caloric intake has been suggested for overweight and obese patients with type 2 diabetes. Increased protein intake does not increase plasma glucose but it does increase the insulin response and results in a significant reduction in hemoglobin A1c[20]. In the National Health Service meat, total processed meats and individual products were strongly associated with increased risk of T2DM. These results are consistent with the conclusion of a meta-analysis of prospective cohort studies in the US, Europe, and Japan[21]. The responses in our Food frequency questionnaire reported that 50% participants have a consumption of chicken 2-4 times a day, 30.6% consume mutton once a week and 38.9% have an egg daily.

To evaluate the dietary practices observed by the participants of our survey, our questionnaire inquiries about the general habits like skipping meals, eating out, eating with the family and if they like to snack or not. Eating frequency and snack consumption were both directly linked with the risk of developing diabetes type 2 and mediated by BMI which indicated that the

unfavorable effects of increased eating frequency or snacks put a risk on type 2 diabetes. Eating frequency only 1 or 2 times a day was also associated with an increased T2D risk compared with eating 3 times a day. Having 3 main meals per day including breakfast, seemed to be the optimal eating pattern for a decreased type 2 diabetes risk compared with any other combination of eating occasions and breakfast consumption[22]. According to our data 12.3% participants like to have a snack between two meals. Both breakfast consumption and its healthy composition have been shown to control appetite and blood glucose concentrations. Breakfast consumption has independent metabolic effects over the role of dietary quality. Only less than 10% people skip their breakfast on a daily basis in our research. Those skipping breakfast have higher energy intake at night, afternoon or evening in the form of snack consumption especially if the snack is eaten in a non-hungry state. This may be associated with excess weight gain mostly because of the snack being high in energy content, palatability and high amounts of refined carbohydrates and sugar that may result in low satiety and increased hunger[23]. On the other hand, strong relationship between family meal frequency and individual dietary intake among diabetic patients was recorded. The present study is one of the few studies that have examined family cohesion as a mediator of the relationship. Family meal frequency would be positively associated with healthy food items intake[24].

The etiology of diabetes is a complex multi factorial process with both lifestyle and genetic origins. It is only since about 1990 that convincing evidence from large perspective studies began to emerge on the role of regular physical activity and adequate levels of cardio-respiratory fitness in the prevention of diabetes[25]. The sedentary habits and low cardio-respiratory fitness are involved in the progression from normal glucose metabolism to Type 2 diabetes and that they are sole predictors of cardiovascular events and premature mortality in individuals with diagnosed diabetes[26]. In our statistical data collection about 17.24% of the total 80.6% diabetic participants have a sedentary lifestyle and 28% of 19% of pre-diabetic participants follow a sedentary lifestyle. Any strategy to deal with the global problem of increasing rates of diabetes and its complications must give major attention to physical inactivity and how to reverse it at the population level. Poor sleep quality apart from its usual effect of daytime sleepiness, has problems that affect every aspect of life. The pertinent ones are exacerbation of seizures, short-term memory deficits, long-term cognitive effects and frequent headaches. When combined with already worsened quality of life in patients with chronic diseases can have several disadvantageous consequences in an individual's life.

Our research has shown that up to 44% patients with diabetes mellitus get sleep less than 6 hours day as compared with 28.6% without diabetes mellitus. Sleep deprivation and sleep fragmentation has been shown to correlate with insulin resistance in obese individuals. Poor sleep quality has implications on diabetes self-management[27].

The chemicals in cigarettes cause harm to your body's cells and can interfere with their normal function. This can cause inflammation throughout the body which may decrease the effectiveness of insulin. The percentage of pre-diabetic smokers in our research is 28.5% and that of diabetic smokers is 10.3%. These participants need to quit smoking in order to reduce the risk it poses on their diabetic health.

CONCLUSIONS

According to our observation, we recommend that if they can change their lifestyle and dietary behavior and take more fruits, vegetables, whole grain and reduce their intake of highly processed meat, refined carbohydrates, high fat food, and sweetened beverages, can control the risk of developing type 2 diabetes in pre diabetic patients and improved dietary habit of diabetic patients can help to have controlled glycemic index, blood lipids and prevent further complications.

Authorship and contribution declaration: Each author of this article fulfilled the following criteria.

1. Conception and design of or acquisition of data or analysis and interpretation of data.
2. Drafting the manuscript or revising it critically for important intellectual content.
3. Final approval of the version for publication.
4. All authors agree to be responsible for all aspects of their research work

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