ORIGINAL ARTICLE

Physical Activity, Dietary Practices and Body Mass Indices Relationship in type II Diabetics Patients

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ABSTRACT

Background: Data on dietary practices, physical activity and body mass indices of type II diabetics in DG Khan, Pakistan is scanty. This study therefore assessed relationships between dietary practices, physical activity and body mass indices of type II diabetic patients using a cross-sectional survey.
Methods: One hundred and twenty type II diabetic patients were purposely recruited from the Diabetes Centre at the DHQ Hospital DG Khan. Data were collected using a structured questionnaire, dietary assessment methods, anthropometry and a modified Global Physical Activity Questionnaire. Data obtained were analyzed using the SPSS version 20.0 and ESHA-Food Processor Nutrient Database Software (Version 10). The Pearson correlation coefficient was used to test the associations at 5% level of significance.
Results: Most (88%) respondents had lived with diabetes for a year or more and majority (95%) ate 3 times daily with or without snacks. Both male and female respondents exceeded the recommended intakes for protein, calcium, vitamins A and C, and niacin. Energy intakes were however below the recommended values in both males and females. Respondents' level of physical activity was generally low (67%). Thirty eight percent had normal weights while 62% was either overweight or obese. There was a positive correlation and statistically significant relationship between diet quality and BMI. Level of physical activity and BMI were also positively correlated and statistically significant.
Conclusion: Diet quality and physical activity have positive influences on the BMIs of respondents. It is therefore recommended that during clinic visits, respondents should be educated about the importance of physical activity in the management of diabetes and health in general. Overweight and obese respondents need to be advised by health professionals to achieve healthy body weights to avoid complications related to type II diabetes.
Keywords Dietary practices, Diet quality, Physical activity, BMI, Diabetes

INTRODUCTION

Diabetes mellitus (DM) is a metabolic disease characterized by hyperglycemia resulting from defects in insulin secretion or insulin action or both (Begum *et al.,* 2004). It is a major health problem worldwide and many factors contribute to its onset. These include diet, obesity and sedentary lifestyles (Zimmet *et al*.,2001; Sobal, 2001; Kyiamah, 2009), genetic factors, insulin resistance, age and lifestyle changes as a result of urbanization (Ramachandran, 2004). Again epidemiological data suggest interactions between acculturation, urbanization, and genetic disposition to be involved in development of DM type II among DG Khan, Pakistani population. Research suggests that about 23% of adults in DG Khan, Pakistan are overweight, and this has been related to advanced age, female gender, urban environment, high income and tertiary education.

Diabetes is managed by dietary control, exercise and, where applicable, by oral hypoglycemic agents and/or insulin. The aim of such measures is to maintain normal blood glucose level and prevent complications (Begum *et al.,* 2004). Primary prevention of diabetes includes the promotion and adoption of healthy lifestyles such as establishing healthy eating patterns, achieving and maintaining healthy body weights and increasing physical activity. The progress of disease complications may be reduced if appropriate dietary practices are adhered to. Studies report that diet control can improve glycemic control and may reduce glycosylated hemoglobin (HbA1c) by 1.0 to 2.0% (Pastors *et al.,* 2002; Pi-Sunyer *et al.,* 1999; Kulkarni *et al.,* 1998).Physical activity plays a vital role in preventing and managing type II diabetes (Knowler *et al.,* 2002; Boule *et al.,* 2001; Tuomilehto *et al.,* 2001; Pan *et al.,* 1997). Exercise increases insulin sensitivity, reduces

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glycosylated hemoglobin levels, and also improves lipid profiles (Gordon, 2009). According to Motala and Ramaiya (2010), increasing rates of urbanization has led to reduced physical activity and reliance on motorized transportation in DG Khan, Pakistan. Physical activity recommendations in DG Khan, Pakistan are based on the World Health Organization guidelines which recommend a minimum of 30 minutes of moderate physical activity for at least five days per week. It has been observed in prospective cohort studies that people who maintain a physically active lifestyle develop impaired glucose tolerance and type II diabetes mellitus less often than those with a sedentary lifestyle (Hu *et al.,* 1999; Burchfiel *et al.,* 1995; Helmrich *et al.,* 1991). Reviews on exercise in diabetes patients have revealed the importance of exercise in the diabetes management plan. Regular exercise improves blood glucose control and reduces cardiovascular risk factors, maintain proper weight, blood pressure, fat levels and improve well-being. Furthermore, regular exercise may prevent type II diabetes in high-risk individuals (Ruderman and Schneider, 1990; Wasserman and Zinman, 1994; Williams, 2001). Both observational studies and intervention trials have shown strong beneficial effects of physical activity in reducing insulin resistance and glucose intolerance (Dunstan *et al.,* 2004; Ezzati *et al.,* 2004; Healy *et al.,* 2008).

METHODOLOGY

The study, which was a cross-sectional survey, was carried out at the Diabetes Management Centre at DHQ Hospital in DG Khan. The target population was adults diagnosed with Type II diabetes visiting the Diabetes Centre. Both male and female diabetic patients aged 18 years and above who reported for regular clinic visits were eligible for inclusion. The purposive sampling technique was used to select participants who were willing to participate in the study. On clinic days, while patients were waiting to see the doctor, the researchers explained the purpose of the study to the patients and assured them of the confidentiality of the responses, after which their cooperation was solicited. Patients willing to participate in the study were selected. This procedure was followed on each clinic visit until the end of the study period.

The instruments used for data collection included a structured questionnaire, a 24-hour dietary recall, a food frequency questionnaire, anthropometry and the Global Physical Activity Questionnaire (GPAQ). A structured questionnaire consisting both open-ended and closed-ended questions was used to obtain information on respondents' background characteristics and dietary practices. Dietary practices of respondents were assessed using five dietary practice-related questions of which respondents were classified as having good, fair or poor dietary practices. A food frequency questionnaire (FFQ) comprising 71 commonly consumed food items from the DG Khan, Pakistan Six Food Groups was used to determine the frequency of food consumption. The responses were used to provide descriptive information about respondents' habitual food consumption patterns, dietary diversity and hence dietary quality (classified as adequate, fair or poor). A 24-hour dietary recall method was used to determine the energy and nutrient intakes of respondents. Estimated portions of the various food items consumed by the respondents in the 24-hour dietary recall were converted into weights of food in grams using a food conversion table for analysis of energy and nutrients. The energy and nutrient contents of food were calculated using the ESHA Food Processor Plus Software (Version 10)**.** Adequacy of respondents' dietary intakes were evaluated by comparing the computed values of energy and nutrient intakes of male and female respondents to the Recommended Nutrient Intakes (RNIs) by WHO/FAO (2004).

The levels of physical activities of respondents were assessed using a modified Global Physical Activity Questionnaire (GPAQ) (World Health Organization (WHO, 2002). Physical activity was classified as low, moderate and high using the GPAQ. Weights and heights measurements were used to determine their body mass indices (BMIs) following standard procedures described by Gibson (Gibson, 2005). The World Health Organization classification was used to assess nutritional status of the respondents

The data were analyzed using the Statistical SPSS Version 20.0. Means and standard deviations were generated for continuous variables and frequencies for categorical variables. Pearson's correlation coefficient statistic was used to test associations between dietary practices, physical activity and BMI of respondents at 5% level of significance

RESULTS AND DISCUSSION

One hundred and twenty (120) respondents comprising 62 females and 38 males participated in the study. They were aged between 33 and 77 years (with a mean age of 50.7±10.67 years). Seventy-eight percent (78%) were married while the rest were widowed, single or divorced. About 88% of the respondents had formal education ranging between primary and tertiary level. Half (51%) of the respondents were employed in the informal sector as

traders and artisans, 27.5% were employed in the formal sector as civil servants, 15% were pensioners and the rest (7%) were unemployed. As such, the harsh economic conditions prevailing at the time of the study is likely to make it difficult for them to prepare good and diversified diets and also purchase their medications which would negatively affect the management of their diabetic status. Majority (88.3%) of the respondents had lived with type II diabetes for a year or more. About 34% had lived with the disease for one to five years, with 52.5% having lived with the disease for six years or more.

Generally, the dietary practices of most respondents were good (71.7%), though, 28.3% had poor to fair dietary practices. According to Pastors *et al.* (2002), appropriate dietary practices are basic and integral parts of diabetes management and may lead to the reduction of the development of disease complications by improving risk factor profiles. The dietary practices of respondents in this study therefore are encouraging hence they should be urged to continue with the practices to enhance their health status. These findings however differ from the study conducted on dietary practices among patients with type II diabetes in Riyadh, Saudi Arabia which revealed inadequate dietary practices of respondents (Mohammed *et al,* 2013).

Table 1 presents the mean energy and nutrient intakes of respondents. Males had a mean calorie intake of 2,124.7 kcal while females had 1,870.3 kcal. Female respondents met 89% of the recommended energy intake while the males met 82% of recommended energy intake. The body needs energy for maintaining metabolic activities, support growth and maintenance and for physical activity. Inadequate intake as observed in this study may lead to breakdown of tissues and fat for energy. This situation is not good for diabetics hence the need to encourage adequate consumption of carbohydrate-based foods, especially the complex types. Both male and female respondents exceeded the RNIs for protein, calcium, Vitamin A, Niacin and Vitamin C.

Assessment of physical activity revealed that two-thirds (67%) of the respondents level of physical activity was low although 95% of the respondents exercised 2-5 times in a week. This indicates that the intensity of their exercise was low. Only a third (33%) had moderate level of physical (Table II). According to Warburton and co-workers (2006), regular physical activity benefits both physical and psychological health in people of all ages and may aid in warding off some metabolic diseases such as hypertension, some cancers, heart disease and diabetes in adults. In some cohort studies in United States, it was observed that persons who maintained physically active lifestyles developed impaired glucose tolerance and type II diabetes mellitus less often than do those with a sedentary lifestyle (Hu *et al.,* 1999; Burchfiel *et al.,* 1995; Helmrich *et al.,* 1991). Helmrich and co-workers (1991) reported that men who exercised regularly, at moderate or vigorous intensity, had a 35% lower risk of developing type II diabetes mellitus than men who were sedentary.

Although health benefits of exercise are well-established, a U.S study by Nelson *et al.* (2002) revealed that 69% of people with type II diabetes did not engage in sufficient physical activity, a finding which is similar to what was observed in this study. As such, finding strategies to increase physical activity in respondents in this present study would be highly desirable. This is because besides the health benefits listed above, physical activity helps increase insulin sensitivity, maintains blood pressure and blood fat levels of the diabetic patient (Williams, 2001). There was no statistically significant difference between the level of physical activity of males and females ($p=0.165$) in this study sample. However, a statistically significant difference existed between age and level of physical activity of respondents ($p=0.043$). Physical activity of respondents decreased with age. Diabetics should therefore be encouraged to engage in moderate physical activities as they get older to prevent diabetes complications.

Mean weights, heights and BMIs of respondents are presented in Table 3. The heights of respondents ranged between 1.49 m and 1.74 m while their weights were between 43 kg to 90kg. The mean BMI of the sample was 24.4±3.17kg/m^2. The mean BMI of respondents in this study is slightly lower and better than that reported in the study by Danquah *et al*. (2012) among type II diabetics (BMI of 25.9±5.1kg/m^2) in urban DG Khan, Pakistan. Table 4 presents the categorization of BMIs of respondents. About a half (52%) of the respondents were overweight and 10% were obese. Only 38% of the sample had normal BMIs. Findings of this study are similar to a study on DMII in urban DG Khan, Pakistan by Danquah and co-workers (2012). They reported that about a half (53%) of their respondents were overweight. This study also compares well with Abubakari *et al* (2008) in terms of prevalence of obesity in West Africa, which was reported to be 10%. This suggests that the findings of this study might be a good representation of what is going on in West Africa.

There was no significant difference between the BMIs of males and females ($p=0.336$), indicating that BMIs of respondents were not influenced by gender in this study sample. There was a statistically significant relationship between age and BMIs of respondents, with BMI increasing with age ($p=0.00$). Close to 41% of respondents who were overweight or

obese were aged 50 years and above. This finding confirms the report by the Expert Committee on the Diagnosis and Classification of Diabetes Mellitus (2007) that DMII is more prevalent in older overweight or obese individuals. Respondents should therefore be encouraged to maintain healthy weights as they grow older to avoid complications of the disease.

A positive correlation (r^2 = 0.150) but statistically insignificant (p = 0.101) relationship existed between dietary practices and diet quality of respondents. The finding suggests that as respondents dietary practices improved, their diet quality would also improve. A positive correlation (r^2= 0.213) existed between level of physical activity and BMI which was of statistical significance (p = 0.019). This means that as physical activity increased, the BMI also improved. As such, diabetics need to engage in regular moderate physical activities, at least five times a week, to be able to maintain healthy weights and to prevent diabetes complications. There was also a positive correlation (r^2 = 0.217) between diet quality and BMI which was statistically significant (p=0.017). This indicates that as the diet quality of respondents increased, BMI also improved. This implies that consumption of a good diet greatly affects the BMI of a person. Diabetics should therefore consume healthy and diversified diets to improve their BMIs to prevent complications of the disease.

Table 1: Mean energy and nutrient intakes of respondents**

	Male				Female			
Energy/Nutrients	**Mean**	**±SD**	**RNI***	**%RNI**	**Mean**	**±SD**	**RNI***	**%RNI**
Energy (kcal)	2124.7	341.1	2600	81.7	1870.3	350.8	2100	89.1
Protein (g)	52.2	17.6	49	106.5	47.5	15.7	41	115.8
Calcium (mg)	696.4	350.9	600	116.1	717.9	348.6	600	119.7
Iron (mg)	11.03	5.8	10	110.3	15.94	5.6	18	88.6
Zinc (mg)	5.2	1.6	5.5	94.5	6.05	0.6	5.5	110.0
Vitamin A (µg RE)	1478.0	513.2	600	246.3	1544.2	294.7	500	308.8
Thiamin (mg)	1.01	0.4	1.25	80.8	1.34	0.6	1.0	134.0
Riboflavin (mg)	1.3	0.2	1.5	86.7	1.6	0.4	1.2	133.3
Niacin (mg)	14.9	4.1	13	114.6	21.5	4.7	13	165.4
Vitamin C (mg)	139.2	38.3	30	464.0	163.3	32.7	30	544.3

*RNI values by WHO/FAO (2004) **Intakes obtained from a single 24-hour dietary recall.

Table 2: Frequency of performance and classification of respondents physical activities

Performance/ Classification	**No.**	**%**
Frequency of Physical Activity per week		
Once	2	1.7
2-3 times	86	71.6
4-5 times	28	23.3
6-7 times	4	3.3
Level of Physical Activity		
Moderate	40	33.3
Low	80	66.7
Total	120	100

Table 3: Mean weights, heights and BMIs of respondents

Measurements	**Male**	**Female**	**Mean**	**±SD**	**Minimum**	**Maximum**
Weight (kg)	63.8	65.2	64.5	9.94	43.0	90.0
Height (m)	1.62	1.61	1.62	0.06	1.49	1.74
BMI (kg/m^2)	24.32	24.96	24.4	3.17	19.11	32.35

Table 4: Categorization of BMIs of respondents

Categorization of BMI	**No.**	**%**
Normal (18.50-24.99 kg/m^2)	46	38.3
Overweight (25.00-29.99 kg/m^2)	62	51.7
Obese (> 30.00 kg/m^2)	12	10.0
Total	120	100

CONCLUSION

In conclusion, dietary practices and diet quality of most respondents were good but their levels of physical activity were generally low which probably contributed to overweight or obesity in two-thirds of the respondents. Whereas dietary practices did not significantly affect diet quality of respondents, as diet quality increased, BMIs improved and increased physical activity also improved BMIs of respondents. It is therefore recommended that both overweight and obese respondents should be encouraged to achieve healthy body weights by engaging in more moderate physical activities and consuming quality diets in order to effectively manage the disease. There is also the need to emphasize education on diet diversity for diabetics to make healthy food choices in order to have quality diets to enable them manage the disease well.

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