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Research Article

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Risk Factors Associated With Type-II Diabetes Mellitus in Male Adults in District Mardan

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Abstract

A study was carried out, in order to assess the risk factors associated with type-II diabetes mellitus in males (Age≥40 years) in district Mardan. Four hundred cases and controls (Each 200) were selected from 10 union councils (7 rural and 3 urban) by a systematic sampling method. In order to select cases and controls, all were interviewed for medical history, on fulfillment of which, cases and controls were separately included for study. In anthropometry, weight, and height were taken for Body Mass Index while waist and hip circumference were taken for waist-to-hip ratio. Fasting blood sugar of cases and controls was determined with the glucometer. Cases and controls were interviewed with Food frequency questionnaire and other questionnaires in order to assess the demographic and socioeconomic characters of the families. The results disclosed that most of the cases had family history of diabetes. In addition to that, cases were also found to have higher ($p<0.05$) average weight, height and body mass index, and fasting blood sugar level to those of controls. These results also revealed that there was a distinguished ($p<0.05$) association between dairy and fruit with the health status and about 1/3rd of both cases and controls had satisfactory consumption of dairy and fruit only. A significant link was found among family size, exercise, type of exercise, duration of exercise, watching television, duration of watching television and the status of disease. The study revealed that a combination of anthropometric, dietary and demographic variables were associated with type-II diabetes mellitus in male adult population of district Mardan.

Introduction

Non-Insulin Dependent Diabetes Mellitus (type-II) is a disorder (metabolic), which is identified with high blood glucose alone or in combination with resistance or deficiency of insulin or both. This is totally different from Insulin Dependent Diabetes Mellitus (type-I), in which, insulin are either deficient or non-generation because of destruction or malfunction of islets of langerhauns in pancreas. Obese people are thought to be more genetically susceptible to type-II diabetes [1]. Approximately 366 million people of the world's population suffer from diabetes (IDF 2011), while the prevalence rate in South Asia is estimated at 7% (58.7 million people) (IDF, 2010). About 7.125% people affected by diabetes alone in Pakistan (IDF 2011). In the Province of Khyber Pakhtunkhwa, the overall prevalence rate is 11.1%, as 9.2% and 11.6% (males and females, respectively) [2].

Mardan is having estimated population of 1962253 and ranks 2nd among cities of Khyber Pakhtunkhwa. It has 283 meters altitude (931 feet) and has a location of 34°12 on 72°1` 60E (South-West of the District).

Review of Literature

Frank et al., conducted a study with the objectives that type-II Diabetes is an epidemic in sub-Saharan Africa, however any association of this diseases was found, negligibly [3]. A study of 1221 adults, consisting of 542 cases and 679 controls was conducted in Urban Ghana. It was a case-control study. The anthropometric measurements were taken for diabetes and they found a strong relation between waist-to-hip ratio; where they found 95% confidence interval in females and 1.64 in male. In addition to that, there were few cases, in which risk of diabetes increased with higher waist circumference (1.35) in women while (1.29) in male. On the other hand, hip circumference had an opposite effect (0.69). As they proceeded, they found that there was no relation between body mass index in both, men (0.74) and women (1.01). It was hence proved that among both the genders, waist-to-hip ratio were proven the best variable with the cut off points ≥0.88 in women and ≥0.99 in men while BMI and Waist circumference had a poor impact on the cut off points. They concluded that the central obesity has more impact of diabetes rather than the general. In a wider sense, it is yet to be verified in the larger population in Sub-Saharan Africa.

Grantham et al., investigated the correlation of dairy food and the risk of type-II diabetes mellitus [4]. The purpose of the study was to check, whether the consumption of dairy foods minimizes the risk of diabetes. The study design was that the Australian Diabetes and Lifestyle (AusDiab) conducted a population based survey over 5 years. The tools included FFQ of 121 items and oral glucose

tolerance test. The study included 42 clusters of samples, randomly selected across Australia. The inclusion criteria were adult of age ≥25 years, who had to return 5 years later for the follow up. A total of 5582 eligible participants data was obtained for analysis, of whom, 209 were suffering from incident diabetes. After the adjustment of few variables like age, sex, total energy intake, family history for diabetes, education, physical activity, smoking status, waist and hip circumference, it was found that the third tertile men had a lesser risk for diabetes, as compared to the men in first tertile. Almost, the same relation was found in women. They concluded that people especially men, whose intakes contain higher amount of dairy food are lesser exposed to diabetes.

Balogun and Gureje carried out a prospective study on elderly Nigerian population to study the incident of T2DM in rural and urban areas [5]. In this regard, cohort study was performed, where 2149 persons, aged ≥65 were appointed through stepwise cluster sampling techniques, from 8 different areas of Youba-speaking regions of Nigeria. Almost, after 39 months of the initial assessment, a follow-up visit was conducted. Information about social factors and self-report of diabetes was obtained through an approved checklist. People (n=1330), who initially did not have diabetes were determined. At second visit, they found that diabetes got developed in 38 people represent 8.87% incidence rate (95% confidence interval). Progressive correlation existed among occurrence of diabetes, urbanicity and progressing economy. People, who used to reside in urban areas, had the highest diabetic incidence (13.57%) that represented relative risk of 4.25 compared to the residents of rural areas. In addition, people with higher economic status were threatening to get diabetic 3 fold more, as compared to the lowest economic status. They concluded residing in urban areas with increasing socioeconomic status increase the risk of occurrence of diabetes mellitus.

Bhowmik et al., determined the irregularity of fasting blood glucose level and glucose tolerance with the prevalence of type-II diabetes in Bangladesh and to that of the risk indicators of depression and cardio-metabolism [6]. In the purpose, 2293 patients of the age ≥20 years of Bangladeshi urbanizing rural community were examined. Factors including social, demographic, anthropometry, blood pressure and fasting glucose, insulin and lipid profile were investigated. Also, Montgomery-Asberg rating scale was considered. They found that IFG and IGT prevailed 3.4% and 4.0% respectively. Males and females had different impaired glucose regulation and type-II diabetes mellitus but they both had an increase with age and sex. Logistic regression showed that increase in age, waist to hip ratio, blood pressure, cholesterol, fats and depression had independent risk for diabetes. Diabetes was also to be caused by the resistance of insulin and deficiency of β-cells. The sample population also revealed that 26.2% was having general while 39.8% had central obesity. 15.5% had high blood pressure, 28.7% had lipid disorders, 17.6% had diabetes In their family history while 15.3% had depression. They concluded that significant risk of diabetes and irregular glucose level in the said population exist but the public health problems are hidden. Depression, high blood pressure, fat disorders and obesity were also other risk indicators, which prevailed in the study population.

Yu et al., conducted a study with the objectives to know the correlation between dietary intake and risk of type-II diabetes mellitus in adults of China [7]. For the said purpose, they carried a Cohort study. A FFQ was used to know the diet history. To know the regular dietary habits, Principal Component Analysis was used. The glycemic index and different snacks, provided to the subjects were also calculated.1010 Chinese of the age 25-74, who were already included in a dietary and CVD risk factors in a past study (1995-1996) got included in this study. The above said patients were rescreened (9-14 years) to know about the progress of diabetes. They found that among the above said subjects, just 690 (68.3%) fulfilled the follow ups (in the years 2005-2008), where only 74 case were found to be developed with diabetes. They applied 4 dietary patterns i-e., high snacks with drinks, fruits, vegetables and fish, meat and milk and more processed grains. Variables for age, sex, body mass index, waist-hip ratio, smoking, alcohol, exercise and diabetes history was recorded from the subjects and adjusted accordingly. It was found that fruits and fish had lower association with type-II diabetes (14% (CI= 95%, 0.99)) to that of milk and meat, which had association of 39%, showing higher risk (CI=1.04-1.84). On the other hand, other variables like glycemic indices, rice and snack compositions had no independent association with type-II diabetes mellitus. They concluded that higher quantities of fruits, fish and vegetables had reduced association to the disease, as compared to meat and milk, which had higher association to the risk of type-II diabetes.

Cho carried out a study to know the accountable variables, which caused a sudden increase in diabetes to people in Korea [8]. In order to know the said factors, a survey through computer literature was conducted, which also included the genes dependant studies for type-II diabetes mellitus. In order to know the association of diabetes with economy, gross national income data was correlated with the collected data. The said data was analyzed through relative risk and odds ratio. The presumed factors, which were identified in the said study in Korea, were no different to those in other countries. The genetic study showed the associated factors with ≤1.5 of relative risk, which meant that there is no association between genes and type-II diabetes mellitus. He found that, the factor, that is associated with the increase in occurrence of type-II diabetes mellitus is the development of economy, is directly influencing the health policy and also the health of single person.

Shera et al., conducted a study to assess the occurrence of type-II diabetes mellitus and impaired glucose tolerance in relation to obesity and age in the province of Punjab (Pakistan) [2]. In order to know Impaired Glucose Tolerance and diabetes, Oral glucose tolerance test (WHO standards) was used in 1852 study population (aged > 25 years). They found 12.14% occurrence of the said disease in males while 9.83% in females. The glucose tolerance for both the variables was found to be 19.37% for females while 16.68% for males. Obesity of central point, High Blood Pressure and diabetic positive history for families was found to be strongly correlated with type-II diabetes mellitus. They concluded that the occurrence of type-II diabetes mellitus and glucose intolerance is relatively higher (studied by the same group) of the other three provinces of Pakistan.

Esposito et al., arranged a review of all the completed studies in order to estimate the role of a Mediterranean diet in type-II diabetes mellitus [9]. They included 17 studies, which have been published till the end of November 2009. A strong lower risk (83% and 35%) in association to type-II diabetes, in patients with highest adherence to the studied diet was shown by two big prospective studies. On the basis of glycemic index, 5 cases showed strong relation between diabetes and the said Mediterranean diet as compared to other regular

diets. No cases, having bad glycemic index, were reported in the overview in relation to the study diet. 2 studies suggested that CVD patients, which had been caused to them by Mediterranean diet, had diabetes. The overview of the studies suggested that converting to a Mediterranean diet could not only prevent diabetes but may also improve glycemic index. It also suggests that the said diet may also increase the risk of CVD in diabetic patients.

Jafar et al., studied the effect of diabetes among the small areas, deviating from each other in diabetes in regards to central obesity in Asians from South region [10]. For this purpose, 9442 people having age, more than 15 was considered from National Health Survey of Pakistan (1990-1994), and their particulars were analyzed. The criteria for being diabetic was fasting blood glucose >7.8mmol/liter. Waist circumference represented obesity. The primary language of Pathans, Punjabis, Sindhis and Muhajirs divided them into different ethnicity. They found that the occurrence of diabetes in age-differentiated was varying in the subgroups i-e., Muhajirs were having the highest (5.7% for men and 7.9% for women), Punjabis had 4.6% for men and 7.2% for women, Sindhis had 5.1% for men and 4.8% for women, Pathans had 3.0% for men and 3.8% for women and Baloch, who had the lowest among all were having 2.9% for men and 2.6% for women. The study also disclosed that urban people were suffering more from its occurrence as compared to rural i-e., Odds Ratio=1.50 and 95% CI (1.24 and 1.82); but after measuring the obesity (Odds Ratio=1.15 and 95% CI=1.42, the said difference didn't exist long. They concluded that inaccessible genetic and environmental factors are responsible for those variations, which are caused by ethnicity in central obesity and needed to be studied more.

Choi and Shi studied factors, threatening, for diabetes by sex and age in order to create control and precautions in Canada [11]. They examined 69,494 people of age 12 years and above from National Health Survey (Canada, 1996-1997). The occurrence of type-II diabetes mellitus was analyzed in connection with BMI, energy expense, sex, age, activity and other such variables. They found that the occurrence of type-II diabetes mellitus was directly proportion to age and BMI while inversely proportion with energy in both sexes. Similarly, the occurrence of diabetes mellitus was inversely proportion to money, specifically, female class. Smokers of both, current and former class were found to be at higher risk for diabetes while there was no association for the drinkers. According to their findings, single women (aged 35 to 64 years) were at a greater risk as compared to married of the same age. Occurrence of the said disease was neither associated to education level nor residency class (urban or rural). They concluded that both the sexes should be cautious about their BMI, not to become overweight (for men, BMI<25kg/m^2 and for women, BMI<27kg/m^2). People with the disease of diabetes must quit smoking while precautions and controls must be addressed to the female class of low income.

Shera et al., designed a population based study for rural areas in KPK, Pakistan to assess the occurrence of NIDDM and high blood sugar levels with correlation to obesity and age [2]. Cluster sampling technique was used to enroll 828 females and 207 males (Total of 1035) of age ≥ 25 years. In order to know the levels of high sugar levels and NIDDM, oral glucose tolerance tests were applied (as per WHO rules). Weight, height and waist to hip ratio were noted from the subjects. A standard questionnaire was used to collect the demographic data. To know the correlation among the selected variables, Chi Square test was applied. They found that total occurrence of diabetes between both, males and females were 11.1% and 9.4% respectively; while the said occurrence was found to be 9.2% in males and 11.6% in females. Higher ages, people having diabetes in their elders and obesity were found to be highly affected with the said disease. Waist to hip ratio was more positive than BMI in both the sexes. They concluded that occurrence of NIDDM in rural areas was found to be high in KP and is about having the same values to that of Sindh and Balochistan.

Shera et al., estimated the occurrence of NIDDM and high blood glucose its association to age and obesity in Shikarpur (Sindh, Pakistan) in 1994 [2]. Oral glucose tolerance tests were applied (as per WHO rules) on 967 subjects (age ≥ 25) which included 387 males and 580 females. 71% males and 80% females responded to the total study. The occurrence of diabetes was in 16.2% males, of which 9.0% were existing and 7.2% new cases while11.7% in females, where 6.3% were existing and 5.3% were new cases. The occurrence increased to the highest with 30% in males while 21% in females, with respect to age (65-74 years). High blood sugar was found 8.2% in males and 14.3% in females and hence the total glucose intolerance (NIDDM as well as high blood sugar) was found in 25% cases. No insulin was used by the 72 cases, which were suffering from diabetes while 57 (79%) were found to take blood sugar-reducing agents. Family history with diabetes and central obesity were showing high numbers of association to diabetes. Females revealed higher percentages of association with obesity to that of males, which makes a point of modifying the life style for the said class.

Materials and Method

Location and Design of Study

A case-control study was carried out on male adults (≥40 years of age) at district Mardan. The study comprising 200 cases and 200 controls, randomly selected from rural and urban population, following the two stage systematic sampling techniques. Inclusion Criteria Subjects' inclusion criteria for cases and controls were male adult, age > 40 years, free from any other infection or disease with fasting blood sugar level > 126 mg/dl and < 105 mg/dl for controls (Agha Khan Research Institute, Mardan / Karachi).

Sampling Procedure

District Mardan comprised of 75 union councils (233602 households/935 PSUs), representing 60 (83.05%) union councils from rural areas and 15 (16.95%) union councils from urban areas. The subjects fulfilling the inclusion criteria of cases and controls were briefed for the aims and objectives of the said study. Sample of fasting blood glucose was got from the selected subjects and was determined with digital gluco-meter. The subjects, whose fasting blood sugar level was 126mg/dl or above was characterized as diabetic while those, whose blood sugar level was <105mg/dl were classified as non-diabetic (IDF, 2010). Subjects, meeting the inclusion criteria of cases and controls were interviewed for a detailed medical history. Anthropometry of both, cases and controls was obtained according to WHO criteria [12].

Abdominal obesity was assessed by waist and hip circumferences and waist to hip ratio. The scale was kept on a place, which would be flat and give the best possible result. To measure the height, stadiometer was used. Measurement of waist circumference was taken at central point (all around the body) of the body in-between lower rib and iliac crest. Measurement of hip circumference was taken at

as a maximal circumference over the buttock. FFQ was developed and used in order to know the consumption of food and beverages by the subject. Descriptive statistics was run to check the frequencies and distribution of data for appropriate uni-variate and multi- variate statistical analysis. Student t-test was applied to examine the mean differences among continuous variable. 5% level of significance was used to accept or reject the null hypothesis. In order to know the relation among categorical variables, to the significance level at 5%, Chi-square test was run.

Results and Discussions

Table 1: Medical history of cases and controls

Variable	Status	Cases N (%)	Controls N (%)	Chisq-value	p-value
Family History	Positive	41 (20.50%)	21 (10.50%)	7.635	0.006
	Negative	159 (79.50%)	179 (89.50%)		
Health Status	Good	170 (85.00%)	192 (96.00%)	14.074	0.001
	Weak	30 (15.00%)	8 (4.00%)		
Smoking	Yes	54 (27.00%)	44 (22.00%)	1.352	0.245
	No	146 (73.00%)	156 (78.00%)		
Smoking Duration	No	146 (73.00%)	156 (78.00%)	21.726	0.001
	< 1 year	0 (0.00%)	8 (4.00%)		
	1-5 years	5 (2.50%)	15 (7.50%)		
	> 5 year	49 (24.50%)	24 (12.00%)		
Age	<50 years	75 (37.50%)	122 (61.00%)	22.095	0.001
	>50 years	125 (62.50%)	78 (39.00%)		
Diabetic Duration	< 1 year	23 (11.50%)	0		0.001
	1- 5 years	77 (38.50%)	0		
	>5 years	100 (50.00%)	0		
Medicine	Positive	180(90.00%)	0	327.273	0.001
	Negative	20 (10.00%)	200(100.00%)		
Weight	Normal	32 (16.00%)	100 (50.00%)	52.284	0.001
	Overweight	168 (84.00%)	100 (50.00%)		

The results in table 1 revealed a high proportion of diabetic individuals having family history of diabetes to that of non- diabetic individuals. A significant association was found between the family history and health status of the studied population. Health status of most of the controls (96%) was better than that of diabetic individuals (85%). The association between smoking status and health status was not significant ($p>0.05$). The association between duration of smoking and health status was significant ($p<0.05$). Similarly, a higher proportion (63%) of diabetic individuals had age >50 years than those of 39% for controls. Most of the diabetic individuals were overweight (84%) than those of non-diabetic (50%) and nutritional status (weight) and health status was found to be significantly associated ($p<0.05$).

Table 2: Anthropometric and biochemical values of cases and controls

Variable	Cases (n=200) Mean ± SD	Controls (n=200) Mean ± SD	p-value
Age (yrs)	52.90+8.26	48.70+6.67	0.0001
Weight (kg)	81.92+7.10	75.77+6.46	0.0001
Height (cm)	173.94+4.97	172.89+5.50	0.0448
BMI	26.72+2.40	24.97+2.09	0.0001
FstGlc	157.38+15.24	117.16+9.13	0.0001
Waist (cm)	84.83+6.17	85.25+6.54	0.5095
Hip (cm)	90.54+6.53	91.35+7.09	0.2356
WHR	0.9370+0.208	0.9335+0.025	0.1338

BMI= Body mass index, FstGlu= Fasting blood glucose level, WHR= Waist to hip ratio

Table 2 shows that the mean age of the cases and controls was 52.90 and 48.70 years respectively, which reveals that cases had significantly ($p<0.05$) greater average age than those of controls. Similarly, cases had significantly greater average weight, height, BMI and fasting blood glucose than that of controls but no significance ($p> 0.05$) was found among the average waist, hip and waist-to-hip ratio between cases and control. The outcomes show that anthropometric values between cases and controls had significant difference except in waist, hip and waist-to-hip ratio.

Table 3: Food consumption pattern of cases and controls

Variable	Status	Cases N (%)	Control N (%)	Chi-square value	p-value
Dairy	Satisfactory	65 (32.50%)	64 (32.00%)	8.335	0.015
	Moderate	67 (33.50%)	91 (45.50%)		
	Unsatisfactory	68 (34.00)	45 (22.50%)		
Meat	Satisfactory	179 (89.50%)	183 (91.50%)	0.515	0.773
	Moderate	19 (9.50%)	15 (8.50%)		
	Unsatisfactory	02 (1.00)%	02 (1.00%)		
Vegetables	Satisfactory	0	0	0.00	1.000
	Moderate	124 (62.00%)	124 (62.00%)		
	Unsatisfactory	76 (38.00%)	76 (38.00%)		
Fruits	Satisfactory	65 (32.50%)	64 (32.00%)	8.335	0.015
	Moderate	67 (33.50%)	91 (45.50%)		
	Unsatisfactory	68 (34.00%)	45 (22.50%)		
Cereals	Satisfactory	113 (56.50%)	122 (66.00%)	0.959	0.619
	Moderate	58 (29.00%)	54 (27.00%)		
	Unsatisfactory	29 (14.50%)	24 (12.00%)		

Table 3 indicates that 33% cases had satisfactory consumption of dairy products as compared to 32% in the controls. About 34% of the cases were characterized to have a moderately satisfactory dairy consumption while 34% had unsatisfactory consumption of dairy products. The corresponding figures for the controls were 46 % and 23% respectively. The meat consumption results revealed that a good proportion (>90%) of individuals from both, diabetic and non- diabetic groups had satisfactory meat consumption and almost to the negligible proportion (2%) of both diabetic and non-diabetic group had unsatisfactory meat consumption. No significant association was found in meat consumption status and health status. Results on vegetables consumption by both cases and controls presented in table 3 shows that none of the individuals from both diabetic and non-diabetic had satisfactory servings of vegetables which is somewhat surprising and contrary to the common prevailing perception that vegetable consumption by adults is satisfactory. In fruit consumption, 33% cases had satisfactory consumption of fruits as compared to 32% in the controls. About 34% of the cases of fruit consumption characterized as moderately satisfactory while 34% had unsatisfactory of fruits.

The corresponding figure for the controls were 46 % and 33%, respectively, suggesting that two quarters of the diabetic and non-diabetic population had inadequate recommended servings of fruits. The results also neglected any notable relation between high consumption of cereals and health status. A small proportion (10-15%) of individual from both diabetic and non-diabetic group had unsatisfactory cereal consumption while the rest had moderate satisfactory to satisfactory cereal consumption.

Table 4: Demographic and socioeconomic characteristics of cases and controls

Variable	Status	Cases N (%)	Control N (%)	Chisq Value	p-value
Family Size	<5	70 (35.00%)	82 (41.00%)	10.466	0.034
	>5	130(65.00%)	118 (59.00%)		
Income	Not Willing	4 (2.00%)	0 (0.00%)	8.062	0.089
	<5000	11 (5.50%)	19 (9.50%)		
	5-10000	42 (21.00%)	34 (17.00%)		
	>10000	143(71.50%)	147 (73.50%)		
Exercise	Yes	181(90.50%)	114 (57.00%)	67.238	0.001
	No	19 (9.50%)	86 (43.00%)		
Exercise Type	Walking	91 (50.27%)	76 (66.66%)	66.181	0.001
	Jogging	61 (33.70%)	22 (19.30%)		
	Games	29 (16.03%)	16 (14.04%)		
Exercise Freq	Daily	28 (15.46%)	49 (43.00%)	88.388	0.001
	2-3 Days	57 (31.50%)	39 (34.21%)		
	4-5 Days	100 (53.04%)	35 (22.79%)		
Exercise Duration	Half an Hour	68 (37.59%)	52 (45.61%)	66.130	0.001
	1 Hour	83 (48.86%)	56 (49.12%)		

	> 1 hour	30 (16.57%)	6 (5.27%)		
Years of Exercise	<1 year	13 (7.18%)	4 (3.50%)	68.376	0.001
	1-5 years	128(70.71%)	65 (57.01%)		
	> 5 year	40 (22.11%)	45 (39.49%)		
Watching TV	Yes	191(95.50%)	181 (90.50%)	9.865	0.020
	No	9 (4.50%)	19 (9.50%)		
Duration of watching TV	No	9 (4.50%)	19 (9.50%)	27.444	0.001
	< 1 hour	39 (19.50%)	7 (3.50%)		
	1-5 hours	143(71.50%)	162 (81.00%)		
	> 5 hours	9 (4.50%)	12 (6.00%)		
Education	No	2 (1.00%)	4 (2.00%)	11.066	0.026
	Metric	56 (28.00%)	63 (31.50%)		
	Intermediate	39 (19.50%)	47 (23.50%)		
	Graduate	41 (20.50%)	18 (9.50%)		
	Post-Graduation	62 (31.00%)	68 (34.00%)		

Table 4 shows that the family size and health status are significantly associated. The diabetic individuals had a higher proportion of greater family size (65%) than that of controls (59%). On the other hand, family income and health status were not associated significantly. Since both of the groups (diabetic and non-diabetic) were having similar proportion of income and different income categories suggests that income did not have any significant role in disease progress. Interesting to find that a higher proportion of diabetic individuals were more physically active (91%) than those of controls (57%) which are against the general perception that sedentary life style increases the risk of diabetes.

The association between exercise, exercise type, duration of exercise and health status was found significant ($p<0.05$). However, the diabetic individuals with exercise, its frequencies and duration were better than those of non-diabetic. The results also revealed that a higher proportion (95%) of diabetic individuals were watching television than those (91%) of non-diabetic individuals but proportion of individuals watching television for longer hours was higher in non-diabetic individuals. The association between television watching and its duration with health status was significant ($p<0.05$). The table also shows that there was significant association between education level and health status i.e. the diabetic individuals had relatively higher proportion of individuals with higher education (graduate and post-graduate degrees) than those of non-diabetics. The association between education status and health status suggests that higher proportion of individuals with higher education in diabetic group may have higher income, that may influence dietary habits of the individuals to more energy dense food consumption as well as affecting their life style i.e. increased smoking and television watching etc [13-21].

Conclusion

The anthropometric values show a high risk of diabetes to the aged population. Majority of the diabetic individuals fell in the class of overweight, resulting in higher mean readings of BMI. The study showed that genetics is also a contributor in the development of diabetes as a high proportion of individuals from the diabetic group were having family history of the said disease to those individuals from non-diabetic group. Health status in the community has been a concern as most of the cases have the issue of health. The higher the age, the bigger the threats of diabetes are which means that with increase in age, physiological function to cope the stress from situation impair. At the same time, overweight and obesity have been associated with diabetes, which need greater attention in the better health to each individual. Income has shown no impact, as all the families get optimum income to serve their families.

The results also showed that cases were more physically active than those of the controls; however, a greater population of cases was watching television, which reflects their sedentary lifestyle, which is one of the main reasons to become overweight and diabetic. These results also revealed that most of the individuals from both the groups were educated, still many of the people were unaware of the risk factors. The food frequency results revealed that a good proportion of diabetic individuals had moderately satisfactory to satisfactory dairy fruits and vegetables consumption. This study suggests that age, overweight, obesity, duration of smoking and inappropriate dieting practices, large family size are increasing risk for developing diabetes in adults, male population, which needs to be reduced and control through improved life style.

Results

Regarding medical history revealed significant association between family history health status, smoking duration, age, diabetic duration, medicine, weight and health status. Anthropometric results unfolded that diabetic individuals were having significantly higher ($p<0.05$) average weight, height, body mass index and fasting blood glucose level than those of non-diabetic individuals. Food frequency results showed that about 1/3rd of the diabetic individuals and 1/4th of the non-diabetic individuals had unsatisfactory dairy consumption and about 1/3rd of both the groups had satisfactory dairy consumption. The association between dairy status and health status was significant. Meat consumption results showed no significant association between the consumption and health status. Results regarding vegetable consumption showed that none of the individual from diabetic and non-diabetic had satisfactory vegetable consumption. Fruit consumption results showed that only 33% of individuals from diabetic and 32% of individuals from non-diabetic group had satisfactory fruit consumption and the association between fruit consumption and health status was found significant. Conversely, a very small percentage (10-15%) of individuals from both the

groups had unsatisfactory cereal consumption suggesting that dietary pattern of both the groups was not optimal to meet the daily nutrient requirement of both the groups.

Results in demographic and socioeconomic characteristics showed that there was significant association between family size and health status. The diabetic group had higher proportion of large family size than that of control groups. No significant association between family income and health status was found. But significant association ($p<0.05$) between exercise, its time duration with health status were found. Significant association was found between watching television, duration of watching television, education level and health status.

Recommendations

1. Changing dietary practices and lifestyle are needed to prevent the incidence of type II diabetes in adult male population.
2. Nutrition education to public for adopting healthy dietary practices and improved lifestyle are essential for reducing and combating type II diabetes.
3. Increased fruits and vegetable consumption and optimal amount of dairy, meat and cereals are recommended for adults.
4. Avoidance of caloric dense foods to reduce overweight and obesity is recommended.
5. A healthy diet should include foods (having carbohydrates from whole grains), vegetables and fruits, and milk with low fats.
6. Increased physical activity to burn extra fats and maintain optimal weight and body activity is recommended.
7. For a successful weight loss plan, physical activity and modification of behavior should be core components. It also helps in the maintenance of weight loss. Foods, low in carbohydrates and/or low in fat, which are calorie-restricted, might be helpful in short term, for weight loss.

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