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Obesity Indices amongst Diabetics in an Urban Population of Western Nepal

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Abstract

Background: It is estimated that 20% of global burden of Diabetes mellitus resides in South East Asia Region and is likely to triple by 2025. There is a strong correlation between changing lifestyle factors and increase in diabetes.

Objectives: To find out the prevalence of diabetes and to determine the cut-off values of anthropometric indices (Body mass index and waist circumference) that best predict diabetes status among adult population of Pokhara, District Kaski, Nepal.

Methods: The cross sectional field study involved 425 respondents, aged 20 years and above using simple random sampling technique. A study instrument which included socio-demographic information and physical measurements of height, weight, waist circumference was used to collect data. Chi- square test and odds ratio were used to analyze data.

Results: Prevalence of diabetes was significantly higher among individuals, aged 40 years and above, male gender and among those with high body mass index and increased waist circumference (P<.05). The BMI cut-off values that predicted diabetes status best for males and females were observed to be 20 kg/m^2 and 24 kg/m^2 respectively. The cut-off value for WC that predicted best diabetes status was considered to be 80 cm for both males and females.

Conclusions: There is an increase in cases of diabetes amongst adult population of District Kaski. Guidelines should be set for detection of obesity in Nepalese population to enable adequate preventive and curative measures.

Keywords: Prevalence; Diabetes; Obesity indices

Introduction

Diabetes mellitus (DM) refers to a group of common metabolic disorders that share the phenotype of hyperglycemia. Depending on the etiology of the DM, factors contributing to hyperglycemia include reduced insulin secretion, decreased glucose utilization, and increased glucose production [1].

Reports suggest that the prevalence of diabetes is rapidly increasing in developing countries and is one of the leading causes of death and disability in developing countries. It is estimated that 20% of global burden of DM resides in South East Asia Region (SEAR) area, is likely to triple by 2025 increasing from present estimates of about 30 million to 80 million [2,3]. The data from community based surveys show that diabetes is a common problem in Nepal [4,5].

The rapid increase of diabetes worldwide is primarily a consequence of aging in most populations and the increase of obesity and physical inactivity. A positive association between obesity and the risk of developing type 2 diabetes has been consistently observed in many populations [6].

Usual anthropometric parameters used to measure obesity are BMI, WC & WHR. The most commonly used criteria to diagnose obesity is National Cholesterol Education Program (NCEP), ATP III criteria [7]. Epidemiological studies worldwide have shown that these ideally used obesity measures may differ for different populations [8,9].

Further studies to assess the prevalence of diabetes and to establish the cut-off marks for obesity indices are essential to plan preventive strategies and promote the health of these populations. Though several studies have been carried out in developing countries but very few studies have been conducted among adult population of Nepal. Therefore the present study was undertaken to find out association of diabetes with obesity in adult population aged 20 years and above of Pokhara, Kaski district, Nepal and to determine the appropriate cut-off values for Body mass index and waist circumference among the identified diabetics.

Material and Methods

The cross sectional study was carried out in adult population of Pokhara sub metropolitan city of Kaski district, Nepal after obtaining ethical clearance from the institutional ethical committee. Simple random sampling was used to select the study subjects. Adults of age 20 years and above in the selected households were surveyed and comprised the study unit in the present study.

A total of 425 individuals participated in the study. Those adults who were non cooperative or refused to provide the necessary information were not included in the study. Those individuals who were absent on two repeated visits were excluded from the study. Pregnant women were also excluded from the study.

A structured pretested and predesigned questionnaire was used to collect the socio-demographic information and measurement of

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subject's blood sugar and anthropometrical parameters after informed consent.

Diabetes was diagnosed if the individual was on drug treatment for diabetes (insulin or oral hypoglycemic agents) and/or criteria laid by the ADA in 2004 i.e. fasting plasma glucose (FPG) 126 mg/dl or 2 hr post-glucose value [10].

For physical examination common weighing machine and measuring tape were used. Body weight (to the nearest 0.5kg) and height (to the nearest 0.5cm) were measured using standardized techniques.

Body Mass Index was calculated as weight in kilograms divided by weight in meters squared. Waist circumference was measured using a standardized technique.

BMI was categorized as <21, 21–22, 23–24 and ≥25 and the first group was taken as reference for determining the odds ratios. They were arbitrary cut-off values that the authors decided to use.

For waist circumference (WC), the grouping was done as ≤75, 76–80, 81–85 and ≥86. WC ≤75 was taken as the reference category. They were arbitrary cut-off values that the authors decided to use.

Age adjusted odds ratios and the corresponding 95% confidence intervals (CI) were calculated using multiple logistic regression analyses. The upper limit of the anthropometric category above which the risk for diabetes became statistically significant was taken as the cut-off value for diabetes status and p value less than 0.05 was considered as significant. Sensitivity and specificity for diagnosing diabetes were calculated for these cutoff values by using the receiver operator characteristic (ROC) curve. All the analyses were performed separately for men and women.

Data entry and statistical analysis were performed using the Microsoft Excel and SPSS windows version 10.5 software.

Result

A total of 425 individuals were examined, out of which 116 (66 males and 50 females) were diabetics and 309 (131 males and 178 females) were non-diabetics. The mean age of the identified diabetics and non-diabetics was 56.1 years and 50.8 years respectively, the difference being statistically significant (p<0.001).

Characteristics	Diabetics (n_1=116)	Non-Diabetics (n_2=309)	Total (n=425)
	No. (%)	No. (%)	No. (%)
Age (years):			
20-39	6 (5.2)	55 (17.8)	61(14.35%)
40-49	23 (19.8)	95 (30.7)	118 (27.76%)
50-59	35 (30.1)	75 (24.2)	110 (25.88%)
60-69	43 (37.1)	65 (21.1)	108 (25.41%)
≥70	9 (7.7)	19 (6.1)	28 (6.58%)
Chi-square (df), P-value	**22.99 (4), <.001**		
Gender:			
Male	66 (56.9)	131 (42.4)	197 (46.35%)
Female	50 (43.1)	178 (57.6)	228 (53.65%)
Chi-square (df), P-value	**6.56(1), <.05**		

Table 1: Age and gender wise distribution of study subjects.

Indicators	Males		Females	
	BMI	WC	BMI	WC
Sensitivity	92.2	90.9	76	90
Specificity	36.6	43.5	66.3	58.4

Table 2: Gender-wise distribution of subjects according to anthropometric indices.

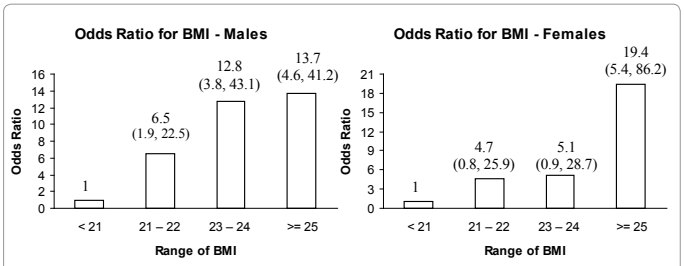

Figure1: Odds ratios for diabetes and categories of BMI in men and women.

The proportion of diabetes showed an increasing trend with age. Prevalence of diabetes was significantly (P <0.001) higher among individuals aged 40 years and above (30.21%) as compared to those aged below 40 years (9.8%). The proportion of diabetes was significantly (P <0.05) higher among males (33.5%) as compared to females (21.9%) (Table 1).

The sensitivity and specificity for BMI for males was 92.2 % and 36.6% respectively. The corresponding values for females were 76% and 66.3% respectively. The sensitivity and specificity for WC for males was 90.9 % and 43.5% respectively. The corresponding values for females were 90% and 58.4% respectively (Table 2).

Significant differences (P <0.05) in the prevalence of diabetes were seen between respondents with a high BMI as compared to those with a normal or low BMI, and among respondents with a high waist circumference as compared to those with a normal or low waist circumference (Figure 1 and Figure 3).

Figure 1 gives the risk of diabetes for different groups of BMI separately for men and women. For males, significant odds ratios (p=0.003 for BMI 21–22 and p<0.001 for groups >22) were observed for all the categories of BMI. Therefore, the BMI cut-off value for males was 20 kg/m^2. But for females, significant association was observed only in BMI ≥25 category (p=0.08 for 21–22, p=0.06 for 23 –24 and p<0.001 for BMI≥25) and so the cut-off value was 24 kg/m^2. The sensitivity and specificity for detecting diabetes for these cut-off values were 92.2% and 36.6% for males and 76% and 66.3% for females respectively.

The association between diabetes and categories of waist circumference (WC) among males and females are shown in Figure 2. For both males and females, significant odds ratios were observed in WC categories of >81–85 cm (males p=0.2, p=0.003 and p<0.001; females p=0.7, P<0.001, p<0.001 for WC categories 76–80, 81– 85 and ≥86 respectively). Therefore the cut-off value for normal WC was considered to be 80 cm for both males and females. The sensitivity and specificity for this cut-off value for males was 90.9% and 43.5% respectively. The corresponding values for females were 90% and 58.4% respectively.

Discussion

The prevalence of diabetes has been increasing worldwide. It is estimated by 2030 AD their will be around 340 million people with diabetes worldwide [11]. The major proportion of this will be in developing countries [12]. A rising trend of diabetes Factors which are attributable to these changes are rapid urbanization, lifestyle changes, and dietary changes and increased life expectancy.

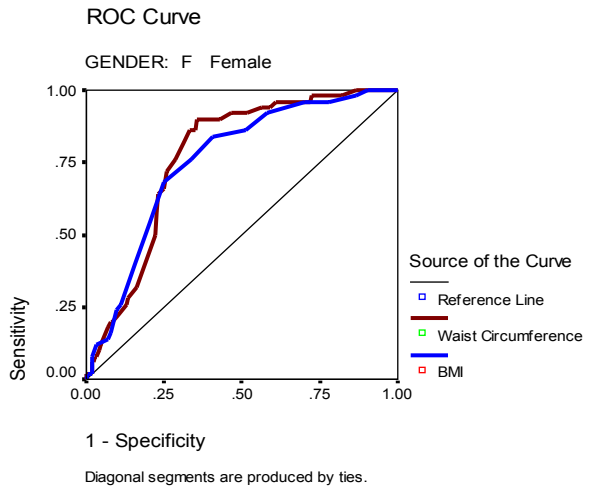

Figure 2: Roc Curves.

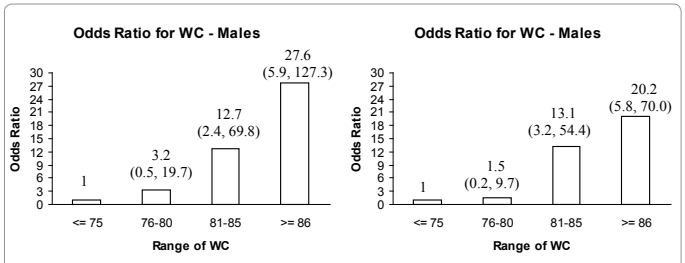

Figure 3: Odds ratios for diabetes and categories of WC in men and women.

The proportion of diabetes showed an increasing trend with age. Prevalence of diabetes was significantly higher among individuals aged 40 years and above (30.21%) as compared to those aged below 40 years (9.8%). The proportion of diabetes was significantly higher among males (33.5%) as compared to females (21.9%). Similar findings were observed in Nepalese population by Shah et al. [13]. Our findings are also in agreement with those reported by Shrestha et al. and Ono et al. in urban communities of Nepal [14,15].

Significant differences in the prevalence of diabetes were seen between respondents with a high BMI as compared to those with a normal or low BMI, and among respondents with a high waist circumference as compared to those with a normal or low waist circumference. Similar trends were reported by Ahmed et al (2011) in their Kashmir study [16]. Seventy percent of diabetic patients were found obese in a very recent study by Pandya et al (2011) in Gujarati population and the word "Diabesity" as synonym for diabetes was used by them [17]. Mean waist circumference was significantly associated with diabetes in the survey by Chhetri et al. [18].

The normal BMI cutoff values for males and females were observed to be 20 kg/m^2 and 24 kg/m^2 respectively in our study. Shah et al (2006) recommended that a BMI ≥ 23 kg/m^2 should be taken as the determining factor for denoting over-weight in Nepalese population [13].

Several studies have examined appropriate cut points to define overweight and obesity in Asian populations [19,20]. A recent study in Chennai reported that the age standardized prevalence of obesity using the Asia Pacific definition of obesity BMI ≥ 25 kg/m^2 was 26.5%, while using the Modified III criteria for south Asian Population of BMI ≥ 23 kg/m^2, it was 45.9% [21].

The WC criteria specified for South Asian population (WC > 90 cm in males & > 80 cm in Female) as parameter for obesity detection has been used in several studies [19]. However the cut-off value for normal WC was considered to be 80 cm for both males and females in the current study. Abdominal obesity was observed in 11.5% of the participants as per NCEP criteria and in 34.7% of the participants as per IDF criteria in a community based screening program held in eastern Nepal [22].

According to sensitivity, our study also found WC a better indicator than BMI for diabetes status (Table 2). Similar trends were observed by Pandya et al. [17].

This study emphasizes the need for further epidemiological studies among adult populations of Nepal as presently there is an increase in cases of diabetes among them. Guidelines should be set for detection of obesity in Nepalese population to enable adequate preventive and curative measures. Primary prevention of diabetes is possible by modifying environmental factors such as obesity, diet and physical activity.

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