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Type 2 Diabetes, Hypertension and Nutritional Status among an Urban Population of Southern Rajasthan

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KEYWORDS

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ABSTRACT

The increasing prevalence of Diabetes Mellitus as well as hypertension among Indian population has already become a subject matter for the health planners as well as the researchers who are engaged in mitigating the same in years to come. But lots of work has to be done from the scientific point of view to correlate different biosocial parameters with diabetes as well as hypertension to understand its basic etiology of such diseases to its full extent. Anthropometric parameters are elementary factors which can have profound impact on such health outcome. In the present paper we have observed the relationship of Type 2 Diabetes mellitus and hypertension with the anthropometric outcome among an urban population of Udaipur city, Rajasthan. Strong correlation has been found between diabetes and systolic blood pressure. Most of the diabetic subjects are found to be underweight whereas most of the hypertensive subjects are found to be obese.

Introduction

India is the second most populous country and is leading with other western countries in having increased number of people suffering from non communicable disease, such as type 2 diabetes mellitus, Cardio Vascular Disease (CVD) etc. Now-a-days all these non-communicable diseases have become major determinants of morbidity and mortality particularly in India. Diabetes mellitus is one of the most common chronic diseases in nearly all countries and it continues to increase in number as well as significance with changing lifestyles with reduced physical activity. It has been estimated that the global burden of type 2 diabetes mellitus (T2DM) for 2015 would be 305 million people which is projected to increase to 438 million in 2030 i.e. a sharp 65% increase in 15 years (Snehalatha and Ramachnadaran, 2009). Similarly for India this increase is estimated to be 58%, from 56 million people in 2015 to 87 million in 2030. The prevalence of diabetes for all age-groups worldwide was estimated to be 2.8% in 2000 and 4.4% in 2030. The total number of people with diabetes is projected to rise from 171 million in 2000 to 366 million in 2030. Diabetes is resulting from a defect in insulin secretion, insulin action, or both. Insulin deficiency in turn leads to chronic hyperglycemia with disturbances of carbohydrate, fat and protein metabolism (Kumar et al. 2002; Beverley et al. 2003, Lindblad et al. 2011). T2DM is a non-autoimmune, complex, heterogeneous and polygenic metabolic disease condition in which the body fails to produce enough insulin and characterized by abnormal glucose homeostasis (Gupta et al. 2008). Type 2 Diabetes Mellitus occurs when impaired insulin effectiveness (insulin resistance) is accompanied by the failure to produce sufficient cell insulin (Permutt et al. 2005). Type 2 diabetes mellitus is a major risk factor for blindness, limb amputation, cardiovascular disease and death. There is a sexual as well as rural urban

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variation in the development of diabetes mellitus (Sarah and Bchir et al. 2004).

Among the preventable risk factors for type 2 diabetes, overweight (BMI more than equal to 25 kg/m2) and obesity (BMI more than equal to 30 kg/m2) are regarded as the most important (World Health Organization 2006). Traditionally, Body Mass Index (BMI) has been used to define overweight and obesity and is predictive of cardio metabolic risk including incident of type 2 diabetes (Okosun et al. 2000) and cardiovascular events such as myocardial infarction (Molarius et al. 1999). Central obesity is an independent risk factor for CVD particularly in women. In most developed country, the prevalence of obesity is also increasing steadily and reached epidemic proportion in some population with resulting in an increasing CVD disease burden. Apart from Type 2 diabetes, obesity is also associated with a higher prevalence of hypertension (HT) and dyslipidaemia (Pi-Sunyer 1993; Higgins et al. 1988; Must et al. 1999). Anthropometric indexes for obesity such as body mass index (BMI), waist circumference (WC), waist-hip ratio (WHR) and waist-height ratio (WTH) are therefore very useful indeces to provide important information on cardiovascular risks. Such simple anthropometric measurements have been used as surrogate measurement of obesity and have more practical value in both clinical practice and for large scale epidemiological studies (Dalton et al. 2003).

It is beneficial to healthcare to assess what values of simple anthropometric measurements are associated with the presence of chronic conditions such as diabetes, hypertension or dyslipidaemia in different populations. Apart from the association between obesity indexes and cardiovascular risks, it is also important to define the cut-off values of an individual index to allow effective screening. WHO and NIH have defined BMI, WC and WHR cut-off levels for adults of different ethnic groups (WHO 1998; US National Institutes of Health, 1998) but these cutoff values cannot be readily applied to other populations (Okosun et al. 2000). However with the available cutoff points several works are going on to correlate the disease etiology with the anthropometric outcome. The present work is an addition to what we have known during the studies in last couple of years.

Materials and Method

A cross sectional study was undertaken on 217 Mewari participants from Udaipur city. They belong to the middle income group category. The subjects were recruited from a diabetes health checkup in Udaipur city. Upon investigation 107 subjects were found to have Type 2 Diabetes (Male-75, Female 32) and 110 were non diabetes (Male - 66, Female - 44). The subjects were informed about the study well in advance and formal consent was taken accordingly. Relevant information was taken from them whenever required. Complete General Physical Examination was performed and anthropometric measurement, detailed medical history of each subject was recorded accordingly. Apart from screening the detection of Type 2 diabetic was also based on subject's medical history or who were taking medicines for diabetes. Anthropometric as well as physiological measurements like weight (kg), height (cm), systolic blood pressure (SBP) and diastolic blood pressure (DBP) were collected using standard technique. Anthropometric measurements were taken following the standard techniques of Lohman et al. (Lohman et al.1988). Height and weight were recorded to the nearest 0.1 cm and 0.5 kg, respectively. BMI was calculated as weight in kilograms divided by height square in meters (weight in kg /height m2). Conventional BMI cut off points were applied to classify the studied population into four categories following WHO expert group (WHO 1995, 2000, 2004). Blood pressure was measured from the right arm using a regularly calibrated validated automated Blood pressure monitor M4 (OMRON Corporation, Tokyo 105, Japan). Each individual was made comfortable and made to seat at least for 15 minutes in the chair before measurement. Hypertension was defined as systolic blood pressure (SBP) >140 mmHg and/or diastolic blood pressure (DBP) >

90 mmHg as per US Seventh Joint National Committee on Detection, Evaluation and Treatment of Hypertension (JNC VII) criteria (Chobanian et al. 2003, 2560–2572). Capillary Glucose (mg/dl) was measure by Bayer's Breeze 2 blood glucose meter (Bayer Health Care LLC, Mishawaka, I M 46544, USA). All the instruments were calibrated and verified before use.

Statistical analysis

All data were analyzed with SPSS (Statistical Package for social sciences, Version 16, SPSS). Data were presented as mean and standard deviation of mean (Mean ± SD). Statistical significance was assumed at the 1% and 5% level.

Results

Table 1 and Table 2 show the descriptive statistics of metric variable among the males and females respectively as per their diabetic status. 53.19% males and 42.6% females are found to have suffering from type 2 diabetic mellitus. Diabetic male persons were found to have significantly shorter height as well as having high systolic blood pressure as compared to non-diabetic males. On the other hand significantly higher glucose level as well as systolic blood pressure has also been noticed among the diabetic females as compared to non-diabetic ones. Thus both the tables show significantly higher systolic blood pressure among the diabetic patients than the non-diabetic one. Pearson correlation test has been performed to know the relationship of metric variables with each other. The results have been shown in Table 3. The table shows significant positive relation between height and weight, BMI and weight, blood glucose level and age, SBP with BMI, DBP with weight.

It has also been tried to see the distribution of Diabetic patients with respect to different categories of nutritional status as per BMI and the results have been shown in Figure 1 to Figure 2. The same has been attempted among the hypertensive patients also and the results have been shown in Figure 3 and Figure 4. Figure 1 and Figure 2 show that most of the Diabetic patients are having underweight status. 75% of diabetic males and 100% of diabetic females are found to be underweight. Figure 3 and Figure 4 shows that most of the obese males (64.7%) as well as females (69.2%) as per BMI criteria are hypertensive.

Discussion

Diabetes, obesity as well as hypertension are increasing health problems throughout the world. The present study descries the interrelation of anthropometric variables with blood glucose level as well as blood pressure level among the Mewari population group of Rajasthan. The diabetic subjects are showing higher systolic blood pressure than the non-diabetic subjects. It is a fact that corroborate various other studies. Baseline blood pressure data from different recently performed clinical trials indicate nearly fourfold increase in systolic blood pressure (difference between baseline pressure and target pressure) over diastolic pressure (Osher and Stern, 2008). However the impact of age as shown in Table 1 cannot be ruled out in this case. Diabetic subjects as found in this study are from aged group than the non-diabetic subjects which might have distal impact on the outcome of systolic blood pressure. More males are found to be diabetic than females. The outcome contradicts some studies (Scavini et al. 2003). However there are fundamental studies that hardly found any sexual variation in terms of diabetes (King and Rewers, 1993). Ethnic specific, lifestyle related issues are the key factors to assume any sexual difference in diabetes outcome. The positive relation between short stature with Type 2 diabetes is obscure in this study but recent evidences suggest linkage of shorter height with less favourable metabolic profiles among young adults (Sato et al. 2014). A similar study however shows that out of the total components of height, leg length is more inversely proportional to diabetes whereas trunk length has no such association with the diabetes outcome (Lawlor et al. 2002). There is recent evidence that shows leg length to be independently and inversely related to the increase in the ethnic specific prevalence of diabetes (Weitzman et al. 2010). The relation between low BMI and diabetes is uncertain in this study. Insulin secretion generally declines in older adults (Basu et al. 2003) and lean diabetic older people exhibit a profound impairment in glucose insulin release while obese diabetic adults seldom (Meneilly et al. 1996). Various experimental studies using rats showed that protein calorie malnutrition and magnesium deficiency cause low insulin secretion and a low pancreatic insulin store (Legrand et al. 1987; Okitolonda et al. 1987). Infact some studies also accounted poor nutritional status as an associated factor for type 2 diabetes, as well as low mean serum albumin level among the diabetics (Castaneda et al. 2000). We have also found a clear association between obesity and hypertension as most of the hypertensive adults are found to be obese and vise versa. This relationship between body weight and BP was demonstrated prospectively in the Framingham Heart Study in the 1960s (Kannel et al. 1967). The nature of the linkage between hypertension and body weight remained obscure until the mid-1980s when basic clinical and population-based research significantly clarified many aspects of the relationship between these two common and complex regulatory disturbances. Appreciation of the clinical significance of obesity-related hypertension has grown substantially over this same time period, to the point where obesity is recognized as a major cause of hypertension and the combination of obesity and hypertension is recognized as a pre-eminent cause of cardio vascular disease.[1]

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1 Contribution: MS conceived the study and wrote the paper; PP collected the data; MS, PP and PS analyzed the data.

II Diabetes and Insulin Resistance: British Women's Heart and Health Study'. *Diabetologia*.45(8), 1097-106.

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Appendix

Table 1: Descriptive statistics of metric variables among the males

Variables	MALE				
	Non Diabetic (n=66)		Diabetic (N=75)		t test (2-tailed) p value
	Mean	SD	Mean	SD	
Age	52.74	7.24	57.56	9.90	0.001*
Height	169.20	7.68	165.27	7.25	0.002*
Weight	72.06	11.75	70.45	13.96	0.460
BMI	25.19	3.94	25.65	3.99	0.500
Glucose	142.47	79.08	162.80	86.56	0.150
SBP	127.77	19.26	140.59	21.09	0.000*
DBP	85.85	11.47	83.65	12.17	0.270

Table 2: Descriptive statistics of metric variables among the females

	FEMALE				
Variables	Non Diabetic (n=44)		Diabetic (N=32)		t test (2-tailed) p value
	Mean	SD	Mean	SD	
Age	51.86	8.14	57.16	9.32	0.010*
Height	156.50	6.43	155.71	5.97	0.590
Weight	64.68	11.40	62.03	11.49	0.320
BMI	26.39	4.35	25.63	5.05	0.480
Glucose	126.23	32.92	151.47	68.73	0.037*
SBP	125.77	25.79	139.16	25.12	0.027*
DBP	83.73	10.86	86.22	12.54	0.360

Table 3: Pearson Correlation between anthropometric, physiological variable and Glucose level in the studied population

	Age	Height	Weight	BMI	Glucose	SBP
Height	-0.112					
Weight	-0.074	.529**				
BMI	-0.019	-0.058	0.810**			
Glucose	0.163*	0.022	0.031	0.034		
SBP	0.432**	-0.110	0.048	0.151*	0.154*	
DBP	0.104	0.011	0.262**	0.321**	0.019	0.580**
* Correlation is significant at the 0.05 level (2-tailed)						
** Correlation is significant at the 0.01 level (2-tailed)						

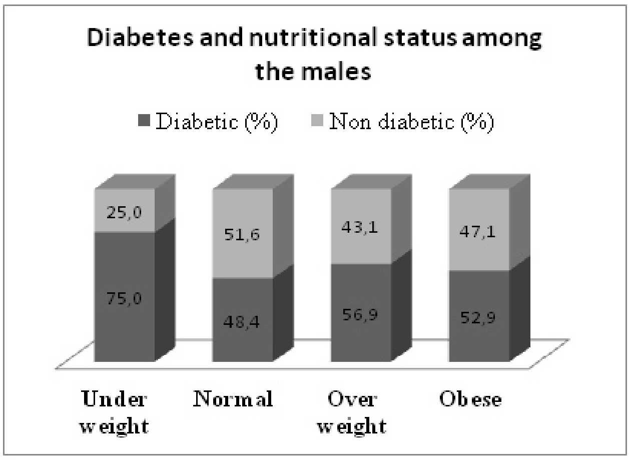

Figure 1. Diabetes and nutritional status among the Mewari Males

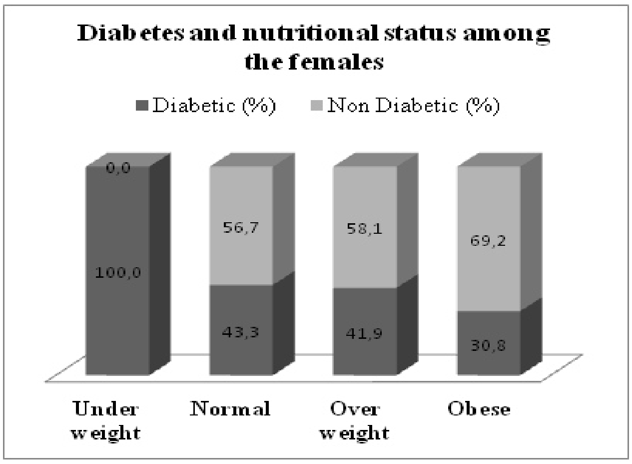

Figure 2. Diabetes and nutritional status among the Mewari females

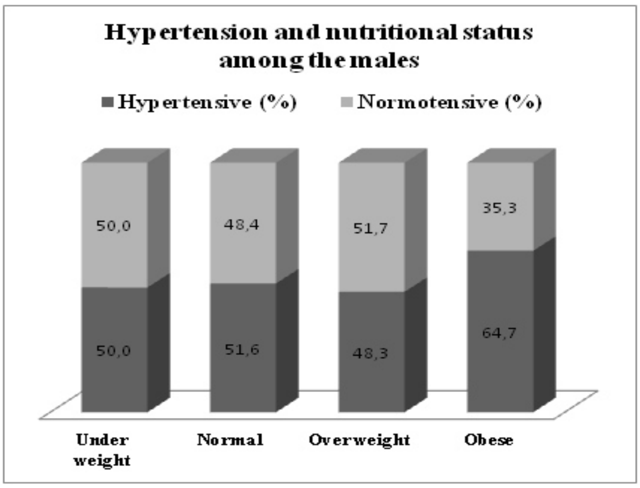

Figure 3. Hypertension and nutritional status among the Mewari males

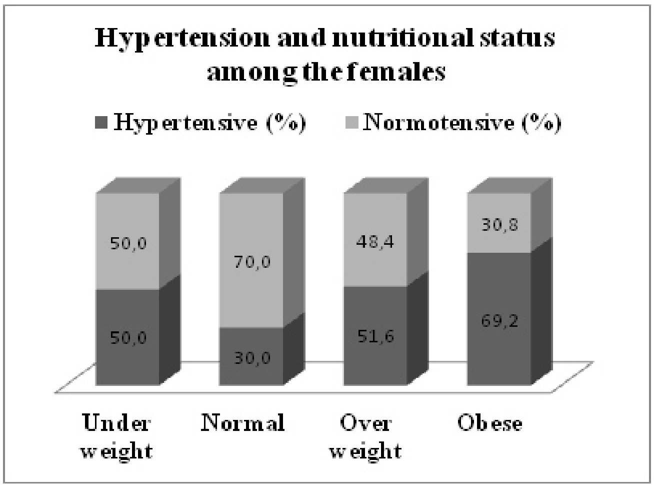

Figure 4. Hypertension and nutritional status among the Mewari females