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Case Study

A Study on Correlation of Anthropometric measures and HbA1c in asymptomatic young adults

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ABSTRACT

Introduction: Anthropometric measures are important risk factors for development of non-insulin dependent Diabetes. Previous studies have shown that body mass index (BMI) and waist circumference as well as other anthropometric measurements are predictive of NIDDM. Diabetes Prevention Program Research Group has concluded that HbA1c predicted incident diabetes. Aim and Objective: To study the correlation of Body fat percentage and Waist Circumference with HbA1c. Methodology: In this cross sectional study done in 2016, 33 female subjects of age group between 18-25 years were assessed for BMI, Waist circumference & Body Fat %. Data was analysed to find out the correlation between WC and HbA1c & Body Fat % and HbA1c. Results: The value of Pearson's linear correlation coefficient was determined in the analysis. The results were considered as statistically significant at $p<0.05$. However, there was no correlation found between the variables. Conclusion: Waist circumference and Body fat % do not have any correlation with HbA1c .Future studies may be initiated for further research with an aim that an early intervention to normalize some anthropometric measures may thus help to reduce the occurrence of Diabetes and other cardiovascular complications and mortality.

1. Introduction

There are certain Anthropometric measures which are important risk factors for development of non insulin dependent Diabetes. Previous studies have shown that body mass index (BMI) and waist hip circumference ratio (WHR) as well as other anthropometric measurements are predictive of NIDDM[1]. Shalom Nwodo Chinedu *et al.* (2013) have also studied the correlation between body mass index and waist circumference in nigerian adults and implied it as indicators of health status[2].

Glycated haemoglobin (HbA1c) is a routinely used marker for long-term glycemic control. Ahmad Khan, H investigated the diagnostic value of HbA1c in predicting diabetic dyslipidemia[3].

Diabetes Prevention Program Research Group have concluded that HbA1c predicted incident diabetes[4]. Wei *et al.* (1997) examined a panel of anthropometric variables from 7 year prospective study to assess obesity-related variables as recognized risk factors for NIDDM, as few studies have addressed which one is the best predictor. A cohort of 721 Mexican Americans aged 25–64 years who were free of NIDDM at baseline was followed for an average of 7.2 years; 105 new cases of NIDDM were diagnosed. Body weight, body mass index (BMI), waist and hip circumferences, waist/hip ratio (WHR), triceps and subscapular skinfolds were all positively predictive of NIDDM independent of age and sex. There were modest to strong correlations between these anthropometric variables, however, waist circumference was the strongest predictor of NIDDM. The data indicate that waist circumference is the best obesity-related predictor of NIDDM. This finding suggests that the distribution of body fat, especially abdominal localization, is a more important determinant than the total amount of body fat of the development of NIDDM in Mexican Americans[5].

Weight and body mass index (BMI) are used as the measures of overall adiposity whereas waist hip ratio (WHR) and waist circumference (WC) are used as the measures for abdominal obesity[6]. So the present study was initiated to study the correlation of Body fat percentage and Waist Circumference with HbA1c.

2. Methodology

This is a cross sectional study done in 2016, on 33 female subjects of age group between 18-25 years residing in Delhi of the same socioeconomic status. These subjects were having sedentary lifestyle, were non smokers and negative on PAR-Q, as well as who understood written and verbal English language and consented to participate.

Subjects with any history of/diagnosed case of diabetes, acute or chronic respiratory disorder, cardio-vascular disorder, neurophysiological disorder, musculoskeletal disorder, any major recent illness/surgery, hearing defect, any other known medical/systemic condition, pregnancy and on any regular medication were excluded. They were invited to undergo a physical examination by physiotherapist as well as a HbA1c check up in a mobile clinic with all aseptic

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conditions and antiseptic precautions by trained and qualified individuals, after obtaining informed consent. BMI was calculated in kg/m^2 and Waist circumference was measured as per ACCF/AHA guideline for assessment of cardiovascular risk in asymptomatic adults[7]. Body Fat % was analysed on TANITA Body Analyser. Data was analysed to find out the correlation between WC and HbA1c & Body Fat % and HbA1c.

3. Results

The age of 33 female subjects studied were between 18-25 years. The value of Pearson's linear correlation coefficient was determined in the analysis. The results were considered as statistically significant at p<0.05. They are depicted in Table No.1.

Table No. 1: Correlation between Variables and their R Score and P Value

Variables	Correlation	p Value
WC and HbA1c	0.136798	0.45
BODY Fat % and HbA1c	-0.01969	0.91
BMI and HbA1c	-0.03051	0.86

The mean value for WC was 80.18 ± 6.67 cm and that for Body Fat percentage was 25% ± 0.03%. The mean value for HbA1c was found to be 5.73 ± 0.29.

4. Discussion

Ganz ML *et al.* (2014) studied a large cohort. A total of 12,179 cases were included in the analysis (average age 55, 43% male) along with 25,177 controls (average age 56, 55% female). Body mass index was found to not only to be strongly and independently associated with the risk of being diagnosed with type 2 diabetes but also the magnitude of this positive association was observed to be significantly larger for higher BMI values. They gave their valuable inputs by enlisting the following , "Body mass index is a strong and independent risk factor for being diagnosed with type 2 diabetes mellitus, Type 2 diabetes risk may be incrementally higher in those with a higher body mass index, Understanding the risk factors helps to shorten the time to diagnosis and treatment. "They also found that this association strength increased based upon body mass index category as followings: Overweight individuals (RR=1.5, CI 95%, 1.4 to 1.6); Obesity Class I (RR=2.5, CI 95%, 2.3 to 2.6) Obesity Class II (RR=3.6, CI 95%, 3.4 to 3.8); Obesity Class III (RR=5.1, CI 95% 4.7 to 5.5)[8].

However as per our results we have not found any correlation between BMI and HbA1c. Although as we hypothesized, there are other studies also, which have shown a significant association between BMI and HbA1c. Naveen *et al.* (2014) found a strong positive correlation between insulin resistance (The homeostasis model assessment of insulin resistance or HOMA-IR score) and HbA1c (r=0.338, p=0.0001); and PPBG (r=0.348, p=0.0001). Moreover, a significant association was observed between HOMA IR score, HbA1c and BMI (p value of 0.024** and 0.000** respectively)[9].

Daniel E Singer *et al.* (1992) studied the cross-sectional relationship between HbA1c and cardiovascular disease (CVD) in the survivors of the original cohort of the Framingham Heart Study (*n* = 1045). HbA1c was significantly related to prevalent CVD among women but not men. HbA1c was also related to hypertension and to the ratio of total to high-density lipoprotein cholesterol levels. In regression analyses that controlled for these and other potential risk factors, HbA1c remained significantly related to CVD among women. It was observed that the relative odds of CVD increased 1.39-fold (95% confidence interval 1.06–1.83) for increases in HbA1c of 1% (e.g., for HbA$_{1c}$ from 5 to 6%). The relationship was not weakened when known diabetic subjects or subjects taking β-blocker or thiazide medications were excluded from analysis. In contrast, there was no significant relationship between "casual" blood glucose and prevalent CVD. Their results reveal a strong, significant, independent association between hyperglycemia, measured by HbA1c and CVD among older women[10].

HbA1c is continuously gaining its importance in literature and research. Raja Reddy *et al.* (2013) suggested that HbA1c can be used as a helpful prospective biomarker that sustains the ability of prognosticating serum lipid profile in diabetic patients and hence defining who are at a greater risk of cardiovascular complications. Significant low plasma HDL cholesterol in diabetic patients compared with non-diabetic control group was found in their study. Findings regarding the statistically significant negative correlation found between BMI and HDL-cholesterol in diabetic patients and the statistically significant positive correlation between BMI and LDL-cholesterol and between BMI and TAG make BMI to be an imposing predictor of dyslipidaemia in type 2 diabetic patients[11].

In conclusion the results of this study show that waist circumference and Body fat % do not have any correlation with HBA1c. The reason for not getting the association could be the small sample size. However future studies may be initiated for further research with an aim that an early intervention to normalize some anthropometric measures may thus help to reduce the occurrence of Diabetes and other cardiovascular complications and mortality[7].

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