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POSITIVE CORRELATION OF GENETIC TRANSMITTANCE OF TYPE 2 DIABETES MELLITUS WITH ANTHROPOMETRIC INDICES IN ADULTS OF MAJHA REGION OF PUNJAB

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Abstract: Family history represents the integration of shared genomic and environment risk factors. First degree relatives (IDRs) share half their genomic information and also behavior, life styles, beliefs, culture and physical environment, so their disease experience may offer a clue to shared susceptibilities. This suggests that a 'low tech' clinical approach-family history-might be a practical and useful way to target interventions and disease prevention efforts to those most at risk. Diabetes Mellitus (DM) is an "iceberg" disease seen in all age groups. India shall have the largest number of diabetics by 2030. Anthropometry provides the single most portable, universally applicable, inexpensive and non-invasive technique for assessing the size, proportions and composition of the human body. This study has been conducted to determine whether such abnormalities can be detected in healthy young adults with a family history of type 2 diabetes mellitus at an early age that may presage the onset of this chronic disease. The present study will be the conducted among 200 healthy adults (20-30 years of age) of Amritsar city (100 having family history of type 2 diabetes mellitus and 100 age matched adults serve as control group).The basic anthropometric measurements of height, weight, hip circumference, waist circumference and the derived indices body mass index (BMI), waist hip ratio (WHR) and waist height ratio (WHtR) were determined from these basic measures. The various basic and derived anthropometric indices showed changes in healthy adult offspring of the parents with history of type 2 diabetes mellitus. The results were statistically analyzed by using SPSS Software version 17.0. All the derived anthropometric indices are significantly increased in young healthy adults (20-30yrs of age) having positive family history of type 2 diabetes mellitus.

Key words: Family history, type 2 diabetes mellitus, derived anthropometric indices

INTRODUCTION

Family history represents the integration of shared genomic and environment risk factors. First degree relatives (IDRs) share half their genomic information and also behaviour, life styles, beliefs, culture and physical environment, so their disease experience may offer a clue to shared susceptibilities. This suggests that a 'low tech' clinical approach-family history-might be a practical and useful way to target interventions and disease prevention efforts to those most at risk.[1] The unprecedented economic development and rapid urbanization in Asian countries, particularly in India has led to a shift in health problems from communicable to non-communicable diseases.[2] Type 2 Diabetes Mellitus has become a worldwide epidemic and a major public health burden in the 21st Century.[3] It is one of the most common non-communicable diseases and the fifth leading cause of death in the world.[4] The Indian Diabetic Federation (IDF) estimated that in 2003 the global prevalence of type 2 diabetes mellitus (among 20-79 years old) was 194 million with the expectation that this number would increase to 333 million by 2025.[4] This figure is in agreement with the World Health Organization (WHO) estimate that 366 million people would have type 2 diabetes mellitus by 2030.[5] The incidence of diabetes mellitus is increasing day by day all over the world. Diabetes mellitus is a leading cause of morbidity and mortality the world over. Diabetes mellitus is expected to continue as a major health problem owing to serious complications.[6] Approximately half of the risk of developing Type 2 diabetes has been attributed to environmental exposures and the other half to genetics, making it a consequence of both modifiable and non-modifiable risk factors.[7] Risk factors for developing Type 2 diabetes, peculiar to the Indian population are high familial aggregation, central obesity, insulin resistance and life style changes due to urbanization. In India nearly 75% of the Type 2 diabetics have first degree family history of diabetes indicating a strong familial aggregation.[8] Microvascular diabetic complications include retinopathy which may lead to adult-onset blindness, nephropathy causing kidney failure, peripheral neuropathy leading to foot ulcers and potential limb amputation, and autonomic neuropathy leading to gastrointestinal and genitourinary complications. In addition, macrovascular complications are common and include sexual dysfunction and cardiovascular disease.[9]

Anthropometry provides the single most portable, universally applicable, inexpensive and non-invasive technique for assessing the size, proportions and composition of the human body. Basic anthropometric measurements (weight, height, waist circumference and hip circumference) and their derived indices (body mass index, waist-hip ratio and waist-height ratio) are used as indicators for the presence of diseases and their assessment in clinical practice.[7] A number of studies have been conducted abroad regarding changes in various anthropometric

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measurements among children and grandchildren of patients of Type 2 diabetes but not much work has been done in India. So this study of young adults, in this geographical region, having family history of Type 2 diabetes has been conducted so that preventive measures of health can be provided to save them from the morbidity and mortality caused by these chronic diseases.

MATERIALS AND METHODS

The present study was conducted among 200 healthy adults (20-30 years of age) of Amritsar city (Pb.) (100 having family history of type 2 diabetes mellitus and 100 age matched adults serve as control group). The subjects were taken from the general population of Amritsar city. The subjects were informed about the study, formal consent was taken from them and then relevant informations were taken from them. Complete General Physical Examination was performed and various Anthropometric Measurements were taken.

Anthropometric measurements:

Following basic and derived anthropometric measurements (indices) were taken in each subject, using standard methodology:

Basic Anthropometric Measurements

Height: Height in centimeters was measured (to the nearest 0.1 centimeter) with a steel, anthropometric rod, with the subject, standing barefooted in an erect position against a vertical scale of portable stadiometer and with the head positioned so that the top of the external auditory meatus in level with the inferior margin of the bony orbit.[10]

Weight: Weight in kilograms (to the nearest 0.5kg) was recorded with the subject standing motionless on the weighing scale, barefooted wearing minimum clothes and maintaining the privacy.[10]

Circumferences: The waist and hip circumferences in centimeters were measured with a non-stretchable measuring tape. These circumferences were measured twice, to the nearest centimeter and the mean was used for subsequent analysis.

i. Waist circumference (WC) was measured by using bone landmarks as references. The WHO guidelines recommend the measurement of waist circumference at the mid-point between the lowest rib and the iliac crest (the highest point of the ilium).[11] Elevated WC was defined as WC=102cm for men and 88cm for women.[10]
ii. Hip circumference (HC) was measured at the level of the greater trochanters in centimeters.[10]

Derived Anthropometric Indices

Body Mass Index (BMI): BMI was calculated as weight in kilograms divided by squared height in meters (weight in kg/height m^2). Conventional BMI cut off points were applied to classify the studied population into the following[10]

i) Underweight (BMI <18.5 Kg/m^2).
ii) Normal weight (BMI ≥ 18.5 - <25.0 Kg/m^2)
iii) Over weight (BMI ≥ 25.0 Kg/m^2)

Waist-Hip Ratio (WHR): It was calculated using following formula:

WHR = WC (cm) /HC (cm)

Elevated WHR = 0.95 for men and 0.88 for women.[10]

Waist-Height Ratio (WHtR)/Waist-Stature Ratio (WSR): It was calculated using following formula:

WHtR = WC (cm)/Height (cm)

The cut-off value used was 0.5 for both sexes (men & women).[12]

All the instruments were calibrated and verified before they were used. The measurements were taken single handed by the investigator herself.

Statistical Analyses

All data were analyzed by SPSS (Statistical Package for social sciences, Version 17, SPSS). Mean, standard deviation, ANOVA Post Hoc Test and Pearson's Chi-Square (x^2) test were used to investigate the results and a conclusion was drawn. p" is level of significance NS; p > 0.05; Not Significant; *p < 0.05; Significant at 5% significance level; **p < 0.01; more Significant at 1% significance level; ***p < 0.001; Highly Significant.

RESULTS

Table 1 shows the study was categorized into two groups with 100 healthy adults (20-30 years of age) in each group.

Group I: Healthy adults (20-30 years of age) with no family history of type 2 diabetes mellitus.

Group II: Healthy adults (20-30 years of age) with positive family history of type 2 diabetes mellitus

Table 1: Classification of the subjects according to the family history

Group	No. of Subjects (20-30 years of age)	Criteria
I	100	With no family history of type 2 diabetes mellitus
II	100	With positive family history of type 2 diabetes mellitus

Table 2: Basic Statistical Characteristics of the studied sample of 200 healthy adults (20-30yrs) of Amritsar city (Mean values and standard deviation)

Anthropometric and Physiological variables	Group I (n=100) Mean ± SD	Group II (n=100) Mean ± SD
Age (Years)	22.06±1.98	22.02±2.47
Weight (Kg)	57.38±9.88	61.59±11.24
Height (cm)	165.96 ±8.12	163.51 ±7.98
Systolic Blood Pressure (mm of mercury)	111.42±11.04	113.90±9.25
Diastolic Blood Pressure (mm of mercury)	73.66±7.21	74.38±5.70
Hip Circumference (cm)	93.03±6.38	93.82±6.18
Waist Circumference (cm)	79.00±7.33	85.78±8.21
Body Mass Index (Kg/m^2)	20.76±2.68	23.01±3.68
Waist Hip Ratio	0.85±0.05	0.91±0.05
Waist Height Ratio	0.48±0.04	0.52±0.05

Table 2 shows the basic statistical characteristics of the overall studied sample of 200 healthy adults (20-30 years of age) with the mean values and standard deviations of all anthropometric and physiological variables viz age, weight, height, systolic blood pressure, diastolic blood pressure, hip circumference, waist circumference, body mass index, waist hip ratio and waist height ratio respectively.

In Table 3 on statistical analysis it was observed that increase of systolic blood pressure, diastolic blood pressure and hip circumference was not significant between group I Vs group II. The mean difference of increase of waist circumstance, BMI, WHR and WHtR showed highly significant results between group I Vs group II (p<0.001).

Table 3: Statistical analysis for comparison between groups according to Mean difference of Anthropometric and Physiological variables

Anthropometric and Physiological variables	Mean difference	P value
Systolic Blood Pressure (mm of mercury)	2.480	0.388^{NS}
Diastolic Blood Pressure (mm of mercury)	0.720	0.879^{NS}
Hip Circumference (cm)	0.790	0.827^{NS}
Waist Circumference (cm)	6.780	<0.001***
Body Mass Index (Kg/m^2)	2.249	<0.001***
Waist Hip Ratio	0.064	<0.001***
Waist Height Ratio	0.049	<0.001***

NS; p > 0.05; Not Significant; *p < 0.05; Significant at 5% significance level; **p < 0.01; more Significant at 1% significance level; ***p < 0.001; Highly Significant

In Table 4 BMI showed 21%underweight cases, 72% normal cases, 7% overweight cases in group I while 9%underweight cases, 61% normal cases, 30% overweight cases in group II respectively. It was observed that number of overweight cases was more in group II than group I. On statistical analysis it was observed that on comparison of BMI between group I Vs group II (chi sq =20.007, p<0.001) was highly significant.

Table 4: Showing Statistical Significance with Pearson Chi Square (x^2) test for comparison for the number of subjects according to Body Mass Index (BMI)

BMI	Group I	Group II
Underweight (BMI <18.5 Kg/m^2)	21	9
Normal (BMI ≥ 18.5 - <25.0 Kg/m^2)	72	61
Overweight (BMI ≥ 25.0 Kg/m^2)	7	30
Total	100	100

Chi-Square (x^2) = 20.007, p = < 0.001***

NS; p > 0.05; Not Significant; *p < 0.05; Significant at 5% significance level; **p < 0.01; more Significant at 1% significance level; ***p < 0.001; Highly Significant

Table 5: Showing Statistical Significance with Pearson Chi Square(x^2) test for comparison for the number of subjects having normal and elevated values according to Waist Circumference (WC), Waist Hip Ratio (WHR) & Waist Height Ratio (WHtR)

Anthropometric variables		Subjects Having Normal Values	Subjects Having Elevated Values	Chi-Square (x^2)	P Value
WC	Gp I	93	07	7.236	0.007**
	Gp II	80	20		
WHR	Gp I	88	12	38.313	<0.001***
	Gp II	47	53		
WHtR	Gp I	74	26	32.206	<0.001***
	Gp II	34	66		

NS; p > 0.05; Not Significant; *p < 0.05; Significant at 5% significance level; **p < 0.01; more Significant at 1% significance level; ***p < 0.001; Highly Significant

Table 5 showed that in a studied sample of 200 subjects, elevated WC was seen in 7% cases in group I & 20% cases in group II on statistical analysis it was observed that it was more significant. The elevated WHR was seen in 12%cases in group I & 53% cases in group II. On statistical analysis it was observed that comparison of WHR between group I Vs group II highly significant (chi sq=38.313, p<0.001). The elevated WHtR was seen in 26% cases in group I & 66% cases in group II showing highly significant results (chi sq=32.206, p<0.001).

DISCUSSION

Obesity is an increasing world-wide health problem, especially in developed countries with changing food habits and increasingly sedentary lifestyles, the prevalence of obesity has increased markedly over recent decades.[13] Obesity is a major risk factor for the development of chronic diseases such as type 2 diabetes mellitus and hypertension and for mortality. The risk of cardiovascular events rises with increasing body mass index (BMI). The World Health Organization recommends measurement of the BMI as a universal criterion of overweight (≥25) and obesity (≥30); measures of abdominal fat distribution such as

waist circumference (WC) or waist to hip ratio (WHR) and waist height ratio (WHtR) are also encouraged. Prospective epidemiological studies have shown increased abdominal fat accumulation to be an independent risk factor for type 2 diabetes.[14] The aim of our study was to see the changing trends of increasing various anthropometric measurements in healthy adults having positive family history of this chronic disease. So that by controlling the obesity we could presage the early onset of this chronic disease in healthy young adults. In the present study, 200 healthy adults (20-30 years of age) were taken in two groups to compare the various anthropometric indices among them.

The increase of hip circumference was not significant statistically in the subjects having positive family history of type 2 diabetes mellitus as compare to control group. Increased HC is not a good indicator for the onset of this chronic disease.[15]

On comparison of increase of WC between subjects having positive family history of type 2 diabetes mellitus and subjects having no such family history showed more significant results statistically. Our study is corroborative with the Bogalusa Heart Study of Caucasian and a study done in Italy in which the offsprings of type 2 diabetes mellitus parents had significantly higher WC than in those of non-diabetic parents.[16,17] Cases of elevated WC from the cut off values was seen 20%cases in group II and 7%cases in groupI(Table 5). On statistically the comparison of elevated cases was more significant.

On comparison of BMI between subjects having positive family history of type 2 diabetes mellitus and subjects having no such family history showed highly significant results statistically. Our study is corroborative with the studies showed that adolescents had high BMI with positive family history of type 2 DM. [17,18,19]

In our study it was seen that according to WHO, BMI ≥ 25.0 Kg/m^2 were overweight cases, these cases were 30% in group II and 7% in group I. So this showed that percentage of overweight cases were more in healthy adults having positive family history of type 2 diabetes mellitus than subjects having no such family history. Statistically these results were highly significant. So increase of BMI is a best indicator for the onset of type 2 diabetes mellitus.

On comparison of increase of WHR between study and control group was highly significant statistically which showed that healthy adults having positive family history of type 2 diabetes mellitus had more WHR than those having no such family history. Our study is corroborative with other study showing that WHR is a better predictor for type 2 diabetes.[20] The percentage of number of cases of increase WHR from the cut off values was 53% in group II and 12% in group I. The study of comparison between group I Vs group II showed more significant results which also indicated that healthy adults having positive family history of type 2 diabetes mellitus had more number of cases of increase WHR than those having no such family history. Statistically the comparison of increase of WHtR between study and control group was highly significant. Also the percentage of number of cases of increase WHtR from the cut off values was 66% in case group and 26% in control group. On statistically this showed highly significant results. Our present study is corroborative with various other studies[21, 22] in which also WHtR predicts the risk for type 2 diabetes.

CONCLUSION

The various basic and derived anthropometric indices showed changes in healthy adult offsprings of the parents having type 2 diabetes. BMI, WC, WHR and WHtR which are the anthropometric indices gave important inferences by showing increasing values in predicting the onset of this chronic disease in healthy adults in their later life if family history happened to be positive. They should be advised to do regular exercise to control their weight and avoid obesity and also educate them to abstain from taking junk and oily food and motivate them for regular monitoring of their blood sugar. This sincere effort on our part will help them to live a healthy active life free from this type of chronic disease such as type 2 diabetes mellitus.

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