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ASSOCIATION OF ADIPOSITY WITH DIABETES AND HYPERTENSION IN YOUNG ADULTS OF INDORE

Biochemistry

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ABSTRACT

Background: To perform the association of adiposity with diabetes and hypertension in young adults of Indore.

Methods : The analysis to study some measure of adiposity such as body mass index and diagnosis of hypertension and diagnosis of diabetes mellitus.

Results: Out of 425 samples, 274 met the eligibility criteria. Insulin levels found to be elevated (>25 mIU/L) in seven (2.6%) obese and three (1.1%) overweight young adults. Research indicated that the proportional difference in body mass index of young adults with respect to hypertension and diabetes to be statistically strongly significant ($p<0.001$).

Conclusion: Present study concluded that the BMI and WC of young adults noted with significant relationship with some selected biochemical parameters, and may be suggested as the significant factors that impacted the hypertension and diabetes mellitus.

KEYWORDS

Adiposity, Hypertension, Diabetes Mellitus.

INTRODUCTION:-

The WHO estimates that the 180 million people worldwide currently have diabetes and this number is likely to double by 2030. Indians develop hypertension, metabolic syndrome and type 2 diabetes mellitus earlier compared to whites, which is independent of BMI[1,2]. The available evidence suggests the age-adjusted prevalence of obesity has doubled in men and has increased three folds in women over two decades (1970s – 1990s) in India[3]. Increased consumption of unhealthy food and lower levels of physical activity might likely have contributed to an increase in the prevalence of obesity and its comorbidities[4].

In India, hypertension and type 2 diabetes mellitus are the major non-communicable diseases (NCDs) leading to catastrophic complications including death. It is important to investigate the role of modifiable risk factors resulting in NCDs such as obesity, physical activity, tobacco use and alcohol consumption[5].

Available evidence suggests strong associations between obesity and NCDs[6,7]. It is important to determine the quantum of the risk contribution by individual risk factor like obesity. About a third of the adult population in urban India is currently estimated to be overweight or obese. As a result, the number of persons with hypertension and type 2 diabetes mellitus could increase exponentially[8].

MATERIAL AND METHODS:

The study will be carried out on 425 adult individuals (both males & females) catering to all socioeconomic sections of the society in Indore.

A total size of 425 young adults (1:1 ratio of males and females will be maintained if possible) in the age group of 18-25 years will be taken. They will be divided into five groups based on BMI.

Age 18-25Y	BODY MASS INDEX (Kg/m^2)			
	22-24	24-26	26-28	28-30

Total Indore Population according to 2001 population census is 1600000. According to NFHS-3 2005-2006 – 22% of urban population is obese or overweight. (Frequency of disease) Worst acceptable frequency is 25% Population size for our study at 99% confidence level is 425. Ethical approval was granted by the Institutional Ethics Committee (IEC).

DATA COLLECTION:

All adults between the ages of 18 to 25 years will be examined at the allocated time. The collected information will be recorded on a pre-tested Performa. Prior to starting the actual study the measurement techniques and all the instruments that will be used in this study will be standardized.

Details of birth date and birth weight (if available) will be sought from the participants or from their parents. Other information sought will include family background, diet consumption (including food frequency questionnaire) and activity profile.

EXCLUSION CRITERIA:

None of the subjects should be suffering from any systemic illness, obesity due to hormonal misbalance will be ruled out.

METHODS:

Estimation of Glucose:- By GOD- POD method, Normal Value: Serum / Plasma (Fasting) : 70 - 110 mg/dl (2 hrs. P. P.) : upto 150 mg/dl.

Lipid Profile: Estimation of Total Cholesterol:- By enzymatic end point CHOD-POD method,(Allain C,et.al 1974.) Normal Value:

Cholesterol : 150-200 mg/dl.

Estimation of triglyceride:- By GPO-POD method, (Werner et.al.) Normal Values: Triglycerides : <150 mg/dl.

Estimation of HDL :- By method of Burnstein ,M.et .al 1970, Normal Values: HDL cholesterol : 30-60 mg/dl (M), 35-70 mg/dl (F)

Estimation of plasma Insulin :- By ELISA method, Normal values : Serum Insulin : 5-15 µU/ml.

STATISTICAL ANALYSIS:

Appropriate statistical methods will be applied to study the strength of associations between measures of adiposity and risk factors for diabetes and CHD. Descriptive results of continuous variables will be expressed as mean ± SD for normally distributed or as median for non parametrically distributed variables. Comparison between study groups and control will be done by student t-test or Mann Whitney U test whichever is appropriate. Relationship between continuous variables will be expressed by applying Pearson's correlation (r) for normally distributed variables and Spearman's correlation for non parametric distribution. P value <0.05 is considered significant and <0.01 as highly significant.

Linear regression will be performed to evaluate the association among B.M.I. as independent and plasma adiponectin and others, insulin, adipocytokines, TNFα, IL6 as dependent variables. P value <0.05 is considered to be statistically significant and $p<0.01$ as highly significant. All the data will be analyzed using statistical software SPSS version 19.

RESULTS:

The present study entitled **"Association of adiposity with diabetes**

and hypertension in young adults of Indore " is carried out in the Department of Biochemistry at Mahatma Gandhi Memorial Medical College, Indore. Out of a maximum of three hundred twenty two young adults that deemed fit into inclusion criteria, 274 young adults selected randomly had aged from 18 to 25 years of both the sexes that deemed fit into inclusion criteria.

Two hundred seven four young adults divided into four categories as per their body mass index levels (underweight, normal weight, overweight and obese). Out of total 274, thirteen (4.7%) young adults were underweight while one hundred fifty (54.7%) were normal weight but one hundred two (37.2%) were overweight and few (9, 3.3%) found with obesity were studied as subjects for the present study had analyzed statistically.

A total of 274 cases were studied in present observational study and that distributed into four groups based on their body mass index (underweight, normal weight, overweight and obese). The age of all cases (N=274) of young adults found to be in the ranges from 18 to 25 years with mean (Mean ± Standard Deviation) age of 21.90±2.05 years.

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The spread of mean height (Mean ± Standard Deviation) of all young adults (N=274) of four groups based on their body mass index (underweight, normal weight, overweight and obese) found to be 163.22±10.70 centimetre with a range from 139.0 to 192.0 centimetre. The spread of mean weight of all young adults of four groups based on their body mass index (underweight, normal weight, overweight and obese) found to be 62.45±7.27 kilogram with a range from 45.0 to 86.0 kilogram.

The distribution of age and sex with respect to body mass index of studied young adults is highlighted in tables from 5.1 to 5.3.

TABLE 1:- Distribution Of All Studied Young Adults According To Body Mass Index

Body Mass Index (kilogram/meter^2)		Male		Female		Total	
		N	%	n	%	n	%
< 18.5	Underweight	1	0.4	12	4.4	**13**	**4.7**
18.5-24.9	Normal weight	91	33.2	59	21.5	**150**	**54.7**
25.0-29.9	Overweight	67	24.5	35	12.8	**102**	**37.3**
≥30.0	Obese	1	0.4	8	2.9	**9**	**3.3**
Total		**160**	**58.4**	**114**	**41.6**	**274**	**100.0**

TABLE 2:- Distribution Of Age Of Young Adults According To Four Bmi Categories

Age (year)	<18.5 (Underweight)		18.5-24.9 (Normal)		25.0-29.9 (Overweight)		≥30.00 (Obese)	
	n_1	%	n_2	%	n_3	%	n_4	%
18-20	3	23.1	28	18.7	16	15.7	2	22.2
20-22	2	15.4	33	22.0	23	22.5	2	22.2
22-24	4	30.8	50	33.3	35	34.3	2	22.2
24-26	4	30.8	39	26.0	28	27.5	3	33.3
Total	**13**	**100.0**	**150**	**100.0**	**102**	**100.0**	**9**	**100.0**

#The association isn't significant at the 0.05 level of significance. (Probability value of chi square test is 1.54 at 9 degrees of freedom)

Table 3:- Distribution Of Gender Of Young Adults According To Bmi Category

Gender	<18.5 (Underweight)		18.5-24.9 (Normal)		25.0-29.9 (Overweight)		≥30.00 (Obese)	
	n_1	%	n_2	%	n_3	%	n_4	%
Male	1	7.7	91	60.7	67	65.7	1	11.1
Female	12	92.3	59	39.3	35	34.3	8	88.9
Total	**13**	**100.0**	**150**	**100.0**	**102**	**100.0**	**9**	**100.0**

#The association is strongly significant at the 0.001 level of significance. (Probability value of chi square test is 24.59 at 3 degrees of freedom).

Comparison of biochemical parameters and lipid profile to rule out the difference with respect to overweight and obesity

The assessment of FBS, Insulin and Lipid profile was carried out among young adults who were classified as underweight, normal weight, overweight and obese to detect the changes with respect to body mass index and in order to observe the risk factors for hypertension and diabetes at different body mass index levels among young adults of Indore city.

Table 4:- Comparison Of Total Cholesterol, Triglyceride, Ldl, Hdl And Vldl Of Young Adults With Respect To Four Types Of Body Mass Index Levels

Variable	Group	Spread	95% Confidence Intervals of Mean		p-value (LOS)
		Mean ± SD	LB	UB	
Total Cholesterol (mg/dl)	***Underweight***	163.54±13.36	155.46	171.61	F=16.95 p<0.001
	Normal weight	176.47±15.27	174.01	178.94	
	Overweight	186.22±20.71	182.15	190.28	
	Obese	206.11±14.20	195.20	217.03	
Triglyceride (mg/dl)	***Underweight***	107.38±16.23	97.58	117.19	F=7.10 p<0.001
	Normal weight	129.93±36.40	124.05	135.80	
	Overweight	139.40±28.95	133.72	145.09	
	Obese	163.89±15.33	152.11	175.67	
LDL (mg/dl)	***Underweight***	101.31±7.47	96.80	105.82	F=15.45 p<0.001
	Normal weight	123.81±26.70	119.51	128.12	
	Overweight	138.57±23.80	133.89	143.24	
	Obese	153.11±17.07	139.99	166.23	
HDL(mg/dl)	***Underweight***	45.31±6.68	41.27	49.34	F=23.55 p<0.001
	Normal weight	43.62±6.68	42.54	44.70	
	Overweight	39.78±6.05	38.60	40.97	
	Obese	27.56±4.98	23.73	31.38	
VLDL(mg/dl)	***Underweight***	25.77±2.32	24.37	27.17	F=52.31 p<0.001
	Normal weight	34.64±4.13	33.97	35.31	
	Overweight	36.91±6.44	35.65	38.18	
	Obese	52.78±7.65	46.90	58.65	

#The mean differences are highly significant at the 0.001 level of significance. [DM-Diabetes Mellitus; non-pro.-non-proliferative; SD-Standard Deviation; LB-Lower Bound, UB- Upper Bound; LOS-Level of Significance]

Determination of relationship between studied measure of adiposity with hypertension, level of Insulin

Significance of relationship of measures of adiposity such as body mass index and waist circumference with hypertension, level of Insulin among studied young adults was identified and analyzed statistically.

TABLE 5:-measuement Of Association Of Body Mass Index With Hypertension

Body mass index (kilogram/meter^2)		Hypertension		Total
		Absent	Present	
< 18.5	**Underweight**	13 4.7%	0 0.0%	**13** **4.7%**
18.5-24.9	**Normal weight**	150 54.7%	0 0.0%	**150** **54.7%**
25.0-29.9	**Overweight**	100 36.5%	2 0.7%	**102** **37.2%**
≥30.0	**Obese**	0 0.0%	9 3.3%	**9** **3.3%**
Total		**263** **96.0%**	**11** **4.0%**	**274** **100.0%**
$\chi^2_3 = 223.12$ and p<0.001				

#The association is strongly significant at the 0.001 level of significance.

TABLE 6:- Measuement Of Association Of Body Mass Index With Insulin Levels

Body mass index (kilogram/meter^2)		Levels of Insulin		Total
		No Risk (≤25 mIU/L)	At Risk (>25 mIU/L)	
< 18.5	Underweight	13 4.7%	0 0.0%	**13 4.7%**
18.5-24.9	Normal weight	150 54.7%	0 0.0%	**150 54.7%**
25.0-29.9	Overweight	99 36.1%	3 1.1%	**102 37.2%**
≥30.0	Obese	2 0.7%	7 2.6%	**9 3.3%**
Total		**264 96.4%**	**10 3.6%**	**274 100.0%**
and p<0.001				

#The association is strongly significant at the 0.001 level of significance.

DISCUSSION:

Our study entitled "Association of adiposity with diabetes and hypertension of young adults in Indore" was carried out in the Department of Biochemistry, Mahatma Gandhi Memorial Medical College, Indore.

Diabetes and obesity both increases mortality, but recent research have shown that lean persons were at greater risk for mortality than obese persons (Nilsson G et al, 2011)[9].

Out of a maximum of three hundred twenty two young adults that deemed fit into our inclusion criteria, 274 young adults were selected randomly between the ages of 18 to 25 years of both sexes.

Two hundred seventy four young adults were divided into four groups with respect to their body mass index categorization namely underweight, normal weight, overweight and obese and were purposively allocated a group as per their respective categorization.

An increase in body fat is generally associated with an increase in risk of metabolic diseases such as type 2 diabetes mellitus, hypertension, dyslipidemia and cardiovascular disorders (WHO, 2007) [10].

Irregular lipid content in blood is closely associated with hypertension. Out of different fractions of lipoprotein, definite association of elevated LDL-Cholesterol (LDLc) and other lipid parameters has been well observed in hypertensive patients.

Statistical analyzes projected that the total cholesterol, triglyceride, low density lipoprotein and very low density lipoprotein of obese and overweight young adults found to be significantly elevated as compared to young adults who were underweight and normal weight. The analysis clearly showed that the body mass index found to be the dependent factor on lipid profile parameters.

The statistical agreement indicated that the body mass index of young adults found to be the significant factor that impacted strongly the hypertension.

Weight gain is accompanied by insulin resistance along with amplified plasma glucose levels. Relationship of body mass index of studied young adults that classified as underweight, normal weight, overweight and obese with two levels of insulin (≤25 mIU/L and >25 mIU/L). Analysis clearly projected that the body mass index in young adults was found to be associated significantly with increased risk of insulin levels. The body mass index in young adults found to be the dependent factor on insulin.

Statistical analyzes projected the strong bonding of waist circumference with hypertension in young adults. Results revealed that major part of young adults (195, 71.2%) were more frequently waist circumference of ≤33.46 inches (85 cm) and followed by 79 (28.8%) had waist circumference of >33.46 inches (85 cm) was measuredamong all studied (N=274) young adults.

Analysis of research showed that 2.9% young adults had had waist circumference of >33.46 inches diagnosed with elevated insulin level (>25 mIU/L) had at more risk of diabetes mellitus while few (2, 0.7%) young adults had waist circumference of ≤33.46 inches were had no risk of diabetes mellitus noted with normal insulin level (≤25 mIU/L).Moreover, the association of waist circumference classed as ≤ 33.46 inches (85 cm) and >33.46 inches (85 cm) with two levels of insulin (≤25 mIU/L and >25 mIU/L) was statistically strongly significant (p<0.001).

CONCLUSION:

Present study involved 274 young adults were studied and that distributed into four groups based on their body mass indexes (underweight, normal weight, overweight and obese).

Out of total studied population, 102 were overweight were second most common had body mass index between 25.0-29.9 kilogram per meter2 whereas few (4.7% and 3.3%) young adults were underweight and obese and that body mass indexes were <18.5 kilogram per meter2 and ≥30.0 kilogram per meter2 respectively. Rests (54.7%) were normal.

Insulin levels found to be elevated (>25 mIU/L) in seven (2.6%) obese and three (1.1%) overweight young adults. Research indicated that the proportional difference in body mass index of young adults with respect to hypertension and diabetes to be statistically strongly significant (p<0.001).

Results of present study concluded that the BMI and WC of young adults classed into four groups (underweight, normal weight, overweight and obese) noted with significant relationship with some selected biochemical parameters, and may be suggested as the significant factors that impacted the hypertension and diabetes mellitus. However, the correlation indicated the strength and direction of relationship between studied these biochemical parameters and studied measures of adiposity.

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