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METABOLIC SYNDROME IN PATIENTS WITH ABDOMINAL OBESITY

Medical Biochemistry

Saba Nazneen Khan Department of Bio-Chemistry, Khaja Bandanawaz University-Faculty of Medical Sciences, Gulbarga

Mohammed Abdul Baseer Department of Community Medicine, Khaja Bandanawaz University-Faculty of Medical Sciences, Gulbarga

Mohammed Mohsin Ahmed* Department of Pharmacology, Khaja Bandanawaz University-Faculty of Medical Sciences, Gulbarga *Corresponding Author

ABSTRACT

Background The metabolic syndrome is a constellation of risk factors of metabolic origin that are accompanied by increased risk for cardiovascular disease and type 2 diabetes. The two major underlying risk factors for the metabolic syndrome are obesity and insulin resistance. The aim of this study is to study obesity profile, lipid profile, hsCRP, GGT and microalbuminuria in patients with metabolic syndrome and compare with that of healthy controls. **Materials and methods** Total 100 subjects were taken for the study. 50 were patients of metabolic syndrome and 50 were healthy controls. Patients were examined for the features of metabolic syndrome and complications of obesity, between May 2012 – June 2013. All patients were evaluated by history, clinical examination and relevant investigations. **Results** Waist circumference, WHR and BMI were proportionately high in patients with metabolic syndrome when compared to healthy controls. Significant increase in lipid parameters, fasting blood glucose, hsCRP, GGT and microalbuminuria were seen in patients with metabolic syndrome as compared to healthy controls. **Conclusion** Our study support the growing evidence that waist circumference can serve as a practical screening method for the metabolic risks that often accompany overweight and obesity. The message emerging from this study is how best to define and screen for metabolic syndrome, considering energy stores on the one hand and health risks on the other.

KEYWORDS

Metabolic Syndrome; Abdominal Obesity; Insulin Resistance; Cardiovascular Disease; Type 2 Diabetes Mellitus;

INTRODUCTION

The Metabolic Syndrome (Syndrome X, Insulin Resistance Syndrome) consists of a constellation of metabolic abnormalities that confer increased risk of cardiovascular disease (CVD) and diabetes mellitus (DM).[1]

Prevalence of metabolic syndrome varies across the globe, in part reflecting the age and ethnicity of the populations studied and the diagnostic criteria applied.[2] In general the prevalence of metabolic syndrome increases with age.[3]

Greater industrialization worldwide is associated with rising rates of obesity which is anticipated to dramatically increase the prevalence of metabolic syndrome.[4] As the population ages, prevalence and severity of obesity rises which is the initiative feature of metabolic syndrome.[5]

Visceral obesity is a key component in the development of the metabolic syndrome. The metabolic syndrome (MS) is a multiplex risk factor for atherosclerotic cardiovascular disease (ASCVD). The MS appears to promote the development of ASCVD at multiple levels. Elevations of apo-B containing lipoproteins initiate atherogenesis and drive lesion development. Atherosclerotic plaque development is accelerated by low levels of HDL-C, by elevated glucose levels and by inflammatory cytokines.[6] MS is a complex web of metabolic factors that are associated with a 2-fold risk of CVD and a 5-fold risk of diabetes.[7]

The present study was carried out to determine the parameters of obesity (waist circumference, waist hip ratio, BMI), lipid profile, blood glucose levels, hsCRP, GGT and microalbuminuria among patients of metabolic syndrome with central obesity and compared with healthy individuals.

METHODOLOGY

Source Of Data:

1. Study was conducted at Navodaya Medical College Hospital and Research Centre, Raichur from April 2013 to May 2014. Patients attending outpatient Department and those admitted were included in the study. The patients and controls had voluntarily participated in the study.

2. Present study comprised of 100 patients which includes:-

- 50 cases with Metabolic Syndrome [Clinically diagnosed/confirmed cases of HTN and/ or DM/ glucose intolerance with central obesity (waist circumference ≥ 90cm (males), ≥ 80cm (female)].
- 50 were healthy controls.

The patients were between the age group of 20–50 years.

Inclusion criteria:

A) 50 cases of central obesity between age group 20-50 years with HTN and/or DM/glucose intolerance.
B) 50 age and sex matched healthy individuals will be included for comparison.

Exclusion criteria:

A) Juvenile and gestational diabetes.
B) Smokers.
C) Alcoholics.
D) Patients with acute and chronic inflammatory and rheumatologic condition /infectious diseases
E) Patients with other disorders like renal disease.
F) The duration of the study was from April 2013 to may 2014.
G) Statistical analysis was carried out using student 't' test (unpaired).

Collection Of Data:

Every patient will be evaluated by detailed history, clinical examination, weight and height for calculating BMI, waist circumference and hip circumference for calculating WHR and these patients would undergo investigations.

Under aseptic precautions around 6mL of venous blood will be drawn. Out of this 1mL will be collected in EDTA bulb for hsCRP estimation. Remaining sample is allowed to clot and serum is separated which will be used to estimate fasting blood glucose, lipid parameters and serum gamma glutamyl transferase immediately or within 2 hours when kept at 4^{0}C.

Spot urine sample or first morning voided urine is collected for estimation of microalbuminuria.
Following parameters were studied:

1. Fasting blood glucose (FBG)
2. Triglycerides
3. Total cholesterol
4. HDL-C
5. LDL-C
6. VLDL-C

7. hsCRP
8. Gamma glutamyl transferase (GGT)
9. Microalbuminuria

RESULTS

The results obtained in this study were from a total of 100 subjects. These subjects were divided into two groups as follows:

- Healthy controls: 50
- Cases with metabolic syndrome: 50

This is again divided into two subgroups as;

- Diabetic with metabolic syndrome: 25
- Prediabetes with metabolic syndrome: 25

Statistical analysis:

The results for different profiles were expressed as mean ± SD. Comparison between control and case groups was done by student unpaired t – test. One way analysis of variance (ANOVA) was used to compare mean values in the two groups followed by Dunnett' s multiple comparison post hoc tests in healthy subjects and patients with metabolic syndrome. Pearson's correlation was applied to correlate between the parameters. A two – tailed P – value of less than 0.001 was considered significant. Data was analyzed using Microsoft excel, SPSS version 24.0 and Minitab version 20.0 software packages.

Table 1: Age and Sex wise distribution of cases:

AGE (yrs)	MALES NO (%)	FEMALES NO (%)	TOTAL NO (%)
20-24	00	00	00
25-29	00 (00)	02 (9.53)	02 (4.0)
30-34	03 (10.35)	00 (00)	03 (6.00)
35-39	08 (27.58)	04 (19.05)	12 (24.00)
40-44	04 (13.79)	05 (23.80)	09 (18.0)
45-50	14 (48.27)	10 (47.62)	24 (48.00)
TOTAL	29(100)	21 (100)	50 (100)

Table 2: Age and Sex wise distribution of controls:

AGE (yrs)	MALES NO (%)	FEMALES NO (%)	TOTAL NO (%)
20-24	00 (00)	00 (00)	00 (00)
25-29	00 (00)	02 (11.12)	02 (4.00)
30-34	03 (9.37)	00 (00)	03 (6.00)
35-39	06 (18.76)	04 (22.22)	10 (20.00)
40-44	08 (25.00)	04 (22.22)	12 (24.00)
45-50	15 (46.87)	08 (44.44)	23 (46.00)
TOTAL	32 (100)	18 (100)	5.0 (100)

Table 3: Descriptive Statistics of Cases:

Variable	MEAN	SD	SEM	MIN	MAX
Age (yrs)	42.78	6.31	0.89	28	50
SBP (mmHg)	144.04	23.06	3.26	104	240
DBP (mmHg)	88.62	12.67	1.79	60	140
WC (cms)	107.25	10.46	1.48	86	141
HC (cms)	100.38	13.22	1.87	72	142
WHR	1.05	0.12	0.01	0.8	1.3
Height (cms)	161.14	10.56	1.49	142	183
Weight (kgs)	82.44	14.60	2.06	59	116
BMI	31.77	3.62	0.51	25	38
Bl.Glucose (mg/dL)	129.59	30.67	4.33	80	235
Serum TG (mg/dL)	191.20	87.63	12.39	72	450
Serum Total Cholesterol (mg/dL)	209.36	56.55	7.99	103	350
Serum LDL-cholesterol (mg/dL)	132.79	59.35	8.39	56.8	301.6
Serum HDL- cholesterol (mg/dL)	38.74	9.46	1.33	24.2	78.0
Serum VLDL- cholesterol (mg/dL)	38.07	17.50	2.47	14	90
Serum GGT (U/L)	48.23	23.92	3.38	10.4	112.0
Serum hsCRP (mg/L)	1.47	2.21	0.03	1.0	1.9
Microalbuminuria (g/L)	0.0300	0.0301	0.004	0.01	0.15

Table 4: Descriptive Statistics of Controls:

Variable	MEAN	SD	SEM	MIN	MAX
Age (yrs)	42.78	6.01	0.85	28	50
SBP (mmHg)	118.12	9.25	1.30	90	132
DBP (mmHg)	77.74	6.37	0.90	60	90
WC (cms)	71.80	8.50	1.20	50	92
HC (cms)	90.86	10.13	1.43	60	112
WHR	0.75	0.06	0.008	0.7	0.95
Height (cms)	151.18	33.46	4.73	48	117
Weight (kgs)	70.04	31.81	4.49	48	169
BMI	22.44	1.83	0.26	17.27	25.0
Bl.Glucose (mg/dL)	83.96	11.58	1.63	56	108
Serum TG(mg/dL)	108.01	25.95	3.67	68	180
SerumTotal Cholesterol (mg/dL)	169.3	30.84	4.36	92	242
Serum LDL-Cholesterol (mg/dL)	90.65	30.52	4.31	44.44	178
Serum HDL- Cholesterol (mg/dL)	57.20	12.30	1.74	35	77
Serum VLDL- Cholesterol (mg/dL)	23.12	12.48	1.76	13.6	103.4
Serum GGT (U/L)	23.47	9.81	1.38	11.6	52.0
Serum hsCRP (mg/L)	0.70	0.27	0.03	0.06	1.20
Microalbuminuria (g/L)	0.0100	0.00	0.00	0.01	0.01

Comparison Between Cases And Controls

Table 5: Comparison of Age and BP between Cases and Controls (Unpaired "t" test):

VARIABLE	CASES (N=50)		CONTROLS (N=50)		T	P	Inference
	MEAN	SD	MEAN	SD			
Age (yrs)	42.78	6.31	42.78	6.01	0.0001	1.0 (P>0.05)	N.S
SBP (mmHg)	144.04	23.06	118.12	9.25	7.37	0.0001 (p<0.001)	H.S
DBP(mmHg)	88.62	12.67	77.74	6.37	5.42	0.0001 (P<0.001)	H.S

The difference mean±SD of age in cases and controls were 42.78±6.31 and 42.78±6.01 respectively. The difference of mean± SD of systolic BP in cases and controls were 144.04 ± 23.06 and 118.12±9.25 respectively, the difference of mean ± SD of diastolic BP in cases and controls were 88.6±12.67 and 77.74±6.37 respectively. The difference of systolic BP and diastolic BP of cases were statistically highly significant (p< 0.001) as compared to controls. But difference in mean± SD of age of cases was not significant (p>0.05) as compared to controls.

Table 6: Comparison of Anthropometric Measurements between Cases and Controls (Unpaired "t" test):

VARIABLE	CASES (N=50)		CONTROLS (N=50)		T	P	Inference
	MEAN	SD	MEAN	SD			
WC (cms)	107.25	10.46	71.8	8.5	18.58	0.0001 (P<0.001)	H.S
WHR	1.05	0.12	0.75	0.06	15.59	0.0001 (P<0.001)	H.S
BMI	31.77	3.62	22.44	1.83	16.22	0.0001 (P<0.001)	H.S

The mean ± SD of waist circumference in cases and controls were 107.25± 10.46 and 71.8± 8.5 respectively. The mean ± SD of waist hip ratio in cases and controls were 1.05 ± 0.12and 0.75± 0.06 respectively. The mean ± SD of BMI in cases and controls were 31.77 ± 3.62 and 22.44± 1.83 respectively. Statistically there was highly significant increase (p<0.001) in waist circumference, WHR and BMI of cases as compared to controls.

Table 7: Comparison of Fasting Blood Glucose between Cases and Controls (Unpaired "t" test):

VARIABLE	CASES (N=50)		CONTROLS (N=50)		T	P	Inference
	MEAN	SD	MEAN	SD			
Blood glucose (mg/dL)	129.59	30.67	83.96	11.58	9.84	0.0001 (P<0.001)	H.S

The mean ± SD of fasting blood glucose in cases and controls were 129.59± 30.67 and 83.96± 11.58 respectively. Statistically there was highly significant increase (p <0.001) in fasting blood glucose of cases as compared to controls.

Table 8: Comparison of lipid profile between Cases and Controls (Unpaired "t" test):

Variable	Cases (N=50)		Controls (N=50)		T	P	Inference
	Mean	SD	Mean	SD			
Serum Total Cholesterol (mg/dL)	209.36	56.55	169.3	30.84	4.39	0.0001 (P<0.001)	H.S
Serum TG(mg/dL)	191.20	87.63	108.01	25.95	6.43	0.0001 (P<0.001)	H.S
Serum HDL-Cholesterol(mg/dL)	38.74	9.46	57.2	12.30	8.40	0.0001 (P<0.001)	H.S
Serum LDL-Cholesterol(mg/dL)	132.79	59.35	90.65	30.52	4.46	0.0001 (P<0.001)	H.S
Serum VLDL-Cholesterol(mg/dL)	38.07	17.50	23.12	12.78	4.91	0.0001 (P<0.001)	H.S

The mean ± SD of serum total cholesterol in cases and controls were 209.36 ± 56.55 and 169± 30.84 respectively. The mean ± SD of serum TG in cases and controls were 191.20 ±87.63 and 108.01± 25.95 respectively. The mean ± SD of serum HDL- Cholesterol in cases and controls were 38.74 ± 9.46 and 57.2± 12.30 respectively. The mean ± SD of serum LDL- Cholesterol in cases and controls were 132.79 ± 59.35 and 90.65 ± 30.52 respectively. The mean ± SD of serum VLDL-Cholesterol in cases and controls were 38.07 ± 17.50 and 23.12± 12.78 respectively. Statistically there was highly significant increase (p <0.001) in serum total cholesterol, serum TG, serum LDL-Cholesterol, serum VLDL- Cholesterol and highly significant decrease in serum HDL- Cholesterol of cases as compared to controls.

Table 9: Comparison of GGT, hsCRP and Microalbuminuria between Cases and Controls (Unpaired "t" test):

VARIABLE	CASES (N=50)		CONTROLS (N=50)		T	P	Inference
	MEAN	SD	MEAN	SD			
Serum GGT(U/L)	48.23	23.92	23.47	9.81	6.77	0.0001 (P<0.001)	H.S
Serum hsCRP (mg/L)	1.47	0.21	0.7	0.27	15.35	0.0001 (P<0.001)	H.S
Microalbuminuria (g/L)	0.06	0.03	0.01	0.00	4.74	0.0001 (P<0.001)	HS

The mean ± SD of serum GGT in cases and controls were 48.23 ± 23.92 and 23.47± 9.81 respectively. The mean ± SD of serum hsCRP in cases and controls were 1.47 ± 0.21 and 0.7± 0.27 respectively. The mean ± SD of microalbuminuria in cases and controls were 0.06± 0.03 and 0.01± 0.00 respectively. Statistically there was highly significant increase (p<0.001) in serum GGT, serum hsCRP and microalbuminuria of cases as compared to controls.

DISCUSSION

Our study is an age adjusted case control study with no significant difference in age of cases as compared to controls.

The mean age of males in our study is 42.86± 6.31 and females are 52.12±14.99 yrs and this is comparable with other studies. Age is an important factor as more than 45yrs of age are at greater the risk of MS. Our findings of age adjusted prevalence are similar to studies conducted by Ramachandran et al.[8] and G. P. Parale et al.[9] where increasing age had a linear association with MS and its risk factors.

Our study showed that there was statistically significant increase in waist circumference of cases as compared to healthy controls. There was no significant difference in waist circumference in diabetic cases compared to prediabetic. Waist circumference is a good index in assessing of central obesity and also a good predictor tool of insulin resistance.

In 2003, Ramachandran et al.[8] conducted a study among urban Asian Indian adults to determine the prevalence of metabolic syndrome and in 2005 Dong Feg Gu et al.[10] conducted a study to know the prevalence of metabolic syndrome among overweight adults in China. These studies show similar values of waist circumference as compared to our study. Different studies use different criteria and our study has used IDF criteria for waist circumference that is more applicable to Asian Indian population. The waist circumference criteria followed in the study is comparable with Rajeev Gupta et al,[11] Ramachandran et al[8] and Dong Feg Gu et al.[10] Waist circumference when assessed independently is more predictive of metabolic syndrome compared to other anthropometric measures like BMI. Although neither BMI nor waist circumference provides a complete picture of overall risk. Waist circumference of the subjects from present study revealed stronger association with other multiple components of metabolic syndrome.

In the year 2010 Ghazali S. M. and Sanusi R. A.[12] showed in their study, among those diagnosed with MS, WC was found to have statistically significant positive correlation with FPG and TG being higher than those of WHR and BMI in the NCEP-ATP III category. While WC shows strong positive but not statistically significant correlation with DBP, SBP and FPG being higher than those for BMI and WHR in the WHO category.

CONCLUSION

Metabolic syndrome is a constellation of metabolic derangements such as insulin resistance, hyperinsulinemia, abdominal obesity, impaired fasting glucose, dyslipidaemia, hypertension, proinflammatory and prothrombotic state. It is a common cause of development of ASCVD (atherosclerotic cardiovascular disease).

Abdominal fat is the major risk factor for CVD (cardiovascular disease) and type 2 diabetes and WHR can be used to estimate the proportions of fat distribution. Measuring waist circumference of patients could help in identifying abdominal adiposity which is being recognized as a useful measure for insulin resistance and CVD risk. BMI measures the overall obesity and cannot provide useful information compared to WC in predicting insulin resistance.

Visceral fat in comparison to subcutaneous tissue represents a metabolically active organ and resulting to hyperinsulinemia which induces hypertension. Dyslipidaemia associated with hyperglycemia is a definite risk factor for development of both microvascular and macrovascular complications.

hsCRP increased significantly with other parameters of metabolic syndrome. It is an inflammatory marker and cardiovascular risk predictor and has shown association with metabolic syndrome in our study.

Our study shows that metabolic syndrome is associated with increase WC, hyperglycemia, dyslipidaemia and hypertension. Our study also shows a close relationship of GGT with body fat content. Microalbuminuria has been related to hypertension and hyperglycemia and hsCRP increased with the increase in WC, lipid parameters and fasting blood glucose. Probably microalbuminuria and hsCRP may serve to predict kidney damage and CVD risk respectively. The message emerging from this study is how best to define and screen for metabolic syndrome, considering energy stores on the one hand and health risks on the other. Our study is consistent with the saying "thinking about heart, then look at your waist".

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