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Research Article

GLYCATED HEMOGLOBIN LEVELS IN METABOLIC SYNDROME PATIENTS

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ABSTRACT

Objectives: Metabolic syndrome (MetS) is a cluster of several metabolic disorders including hyperglycemia, reduced high-density lipoprotein cholesterol, and raised triglyceride level in serum, hypertension, and abdominal obesity. Glycated hemoglobin (HbA1c) is used as one of the diagnostic criteria for diabetes and diagnostic tool for MetS.

Methods: The present study was conducted at Prasad Institute of Medical Sciences. The study includes 150 patients with MetS as a case and 150 healthy volunteers as a control. MetS was diagnosed according to National Cholesterol Education Program's Adult Treatment Panel III criteria. HbA1c was assayed in various components of MetS.

Results: It was found that HbA1c was significantly higher in MetS patients when compared to control group.

Conclusion: Our study suggests that HbA1c might be used as a diagnostic criterion for MetS. Therefore, proper glycemic control should be maintained by maintaining HbA1c level <6.5% to prevent from diabetes and MetS.

Keywords: Metabolic syndrome, Glycated hemoglobin, Diabetes.

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INTRODUCTION

Metabolic syndrome (MetS) is a clustering of hypertension, obesity, glucose intolerance, and dyslipidemia [1]. In world, it is expected that about 20–25% of adult population have MetS and they are 2 times likely to die from MetS and 3 times as likely to have a stroke or heart attack compared with people without MetS [2]. It poses a rise in public health and clinical challenge worldwide in the wake of urbanization, increasing obesity, sedentary lifestyle habits, and surplus energy intake [3]. The prevalence of MetS ranges from <10% to more as 84% worldwide, depending on the age, sex, race, environmental factor, and ethnicity as well as the method of defining MetS [4].

Glycated hemoglobin (HbA1c) levels reflect the mean glucose control vary for the previous 2–3 months in patients with or without diabetes mellitus [5]. Several studies conducted in the Europe, China, and the USA have found that HbA1c may be used in place of fasting blood sugar (FBS) in identifying persons with MetS. Study predicts the prevalence of MetS and compared FBS ≥5.6 mmol/L and HbA1c 5.6% as glycemic component of MetS [4].

HbA1c was related among increased waist circumference (WC), low high-density lipoprotein (HDL) cholesterol, and high triglycerides which were more closely than the glucose. Succurro *et al*. reported that enhanced correlation of HbA1c with the measurements of HDL cholesterol, visceral obesity, and triglycerides [6]. Similar, in Succurro *et al*., analysis found that glucose was correlated better than HbA1c through systolic blood pressure and pulse pressure, suggests that the different pathways of pathophysiological trigger the clustering of blood pressure and other metabolic parameters. In fact, the complex of pathophysiology of the MetS which conveys separately, that is, vasomotor and lipid pathways [7].

Succurro *et al*. also suggested that the MetS using HbA1c instead of glucose estimation not as good as in detecting some subjects who have still an unfavorable condition like cardiometabolic risk profile. Insulin resistance has been frequently used as gold standard and pathophysiology for the MetS [8].

Aims and Objectives

1. Selection of the MetS patients and control subjects
2. Measurement of systolic blood pressure (SBP), diastolic blood pressure (DBP), and WC in MetS patients and control subjects
3. Assay of FBS, triglyceride, HDL-C, and HbA1c in MetS and control subjects.

METHODS

Study area

The present study was conducted in the Department of Biochemistry in collaboration with the Department of Medicine, Prasad Institute of Medical Sciences, Banthara, Lucknow, India.

Study populations

Group 1: One hundred and fifty subjects diagnosed with MetS
Group 2: One hundred and fifty controls without MetS

Informed consent has been taken from the participants included in the study.

Ethical considerations

The proposed study has been approved by the Institutional Ethics Committee vide letter no. 18 date January 13, 2020.

Inclusion criteria

In this hospital-based cross-sectional study, subjects of MetS were selected from patients attending outpatient department of the Prasad Institute of Medical Sciences for treatment. MetS was diagnosed according to National Cholesterol Education Program's Adult Treatment Panel III criteria. Healthy controls were chosen from the medical students, teaching, and non-teaching staffs of the Prasad Institute of Medical Sciences.

Exclusion criteria

- Pregnancy
- Taking treatment for thyroid disorders
- Renal dysfunction
- Tuberculosis
- Hepatitis
- Cushing's syndrome
- Chronic alcoholism
- History of known heart disease
- Recent history of fever and infection.

WC measurement: WC was measured with a tape in a horizontal plane, mid-way between the inferior margin of the ribs, and the superior border of the iliac crest.

Sample collection

Five milliliters of blood sample were aseptically collected as per the standard guidelines and protocol. Serum was allowed to separate and subsequently analyzed for various parameters as under – FBS was assayed by glucose oxidase and peroxidase method, triglyceride by glycerol-oxidase peroxidase, and HDL-C by enzymatic assay method. HbA1c was estimated by immunoturbidimetric method, using commercially available kits on the same day of collection.

Statistical analysis

Data obtained were analyzed using SPSS 21 version software and results were compared in cases and controls. $p<0.05$ was taken as significant at 95% confidence intervals. Student's t-test was used to find the association between HbA1c levels and various components of MetS (WC, FBS, BP, triglyceride, and HDL-C).

RESULTS

The total number of patients in our study was 300 (100%) out of which 150 (50%) were healthy controls subjects and 150 (50%) with MetS patients were considered.

Table 1 shows that the mean and standard deviation (SD) of WC for control subjects is 80.74±4.65 cm and for MetS patients is 101.75±8.32 cm. A statistically highly significant difference was observed among two groups ($p<0.000$). The mean and SD of SBP for control subjects is 115.39±6.88 mmHg. In MetS patients, the corresponding mean and SD of SBP is 145.86±20.92 mmHg. A statistically highly significant difference was observed among two groups ($p<0.000$). The mean and SD of DBP for control subjects is 77.35±5.53 mmHg. The corresponding mean and SD of DBP for MetS patients is 89.87±11.06 mmHg. A statistically highly significant difference was observed among two groups ($p<0.000$). The mean and SD of FBS for control subjects is 79.71±6.34 mg/dl. The mean and SD of FBS for MetS patients is 131.94±48.61 mg/dl. A statistically highly significant difference was observed among two groups ($p<0.000$). The mean and SD of triglyceride (TG) for control subjects is 127.95±14.0 mg/dl. The corresponding mean and SD of triglyceride for MetS patients is 170.68±36.86 mg/dl. A statistically highly significant difference was observed among two groups ($p<0.000$). The mean and SD of HDL-C for control subjects is 51.14±6.15 mg/dl. The corresponding mean and SD of HDL-C for MetS patients is 35.43±14.14 mg/dl. A statistically highly significant difference was observed among two groups ($p<0.000$). The mean and SD of HbA1c for control subjects is 5.6±0.25 %. The corresponding mean and SD of HbA1c for MetS patients is 10.06±0.57%. A statistically highly significant difference was observed among two groups ($p<0.000$).

DISCUSSION

In our study, the mean WC (101.75±8.32) was significantly higher in MetS patients than in control group (80.74±4.65) ($p <0.000$). The mean SBP (145.86±20.92) was significantly higher in MetS patients than in control group (115.39±6.88) ($p <0.000$); similarly, the mean DBP (89.87±11.06) was significantly higher in MetS patients then in control group (77.35±5.53) ($p <0.000$). In our study, the mean

Table 1: Result of WC, SBP, DBP, FBS, TG, HDL, and HbA1c among MetS patients and control subjects

Parameters	Control	Case	p-value
WC (cm)	80.74±4.65	101.75±8.32	<0.000
SBP (mmHg)	115.39±6.88	145.86±20.92	<0.000
DBP (mmHg)	77.35±5.53	89.87±11.06	<0.000
FBS (mg/dl)	79.71±6.34	131.94±48.61	<0.000
TG (mg/dl)	127.95±14.00	170.68±36.86	<0.000
HDL (mg/dl)	52.14±6.15	35.43±14.14	<0.000
HbA1c (%)	5.6±0.25	10.06±0.57	<0.000

WC: Waist circumference; SBP: Systolic blood pressure; DBP: Diastolic blood pressure; FBS: Fasting blood sugar; TG: Triglyceride; HDL: High-density lipoprotein; HbA1c: Glycated hemoglobin. $p<0.05$ is considered significant. MetS: Metabolic syndrome

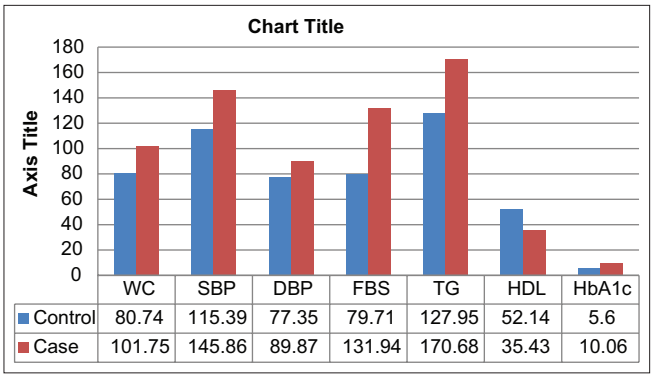

Figure 1: Bar diagram showing result of waist circumference, systolic blood pressure, diastolic blood pressure, fasting blood sugar, triglycerides, high-density lipoprotein, and glycated hemoglobin among metabolic syndrome patients and control subjects

FBS (131.94±48.61) was significantly higher in MetS patients when compared to control group (79.71±6.34) ($p <0.000$). The mean triglyceride (170.68±36.86) was significantly higher in MetS patients when compared to control group (127.95±14.00) ($p <0.000$). The mean HDL-C (35.43±14.14) was significantly lower in MetS patients when compared to control group (52.14±6.15) ($p <0.000$). The mean HbA1c (10.06±0.57) was significantly higher in MetS patients when compared to control group (5.6±0.25) ($p <0.000$) (Table 1 and Fig. 1).

The levels of HbA1c within 5.7–6.4% had increased in some components of MetS, which ramparts the influence of HbA1c in MetS diagnosis. In another study between non-diabetic Korean adults, Rhee and Sung reported that the mechanism of insulin resistance found the etiology of MetS which had increased quartile of HbA1c [9].

Saravia *et al*. in his cross-sectional study of 3200 non-diabetic male who had participants in the Aragon Workers' Health Study observed that HbA1c was correlated with increase in WC, reduced HDL-C, and elevated triglycerides compared to FPG [8].

Succurro *et al*. in his cohort study found that in Italian non-diabetic White subjects observed that HbA1c was associated with visceral obesity, triglycerides, and HDL-C, than FPG [6].

Kong Chinese adults observed that applying of HbA1c criteria which improved the identification of subjects with MetS by 13% compared to FPG; FPG criterion (90.7%, κ=0.62) having a good agreement with HbA1C [10]. According to Ong *et al*. study among the United States, adults observed that an increased level of agreement, that is, 91.3% in between HbA1c and FPG in diagnosing of MetS [11]. Likewise, identification of MetS subjects who used HbA1c for diagnosis was a good union with FPG which was observed by Janghorbani *et al*. in an Iranian population [12].

CONCLUSION

In our study, we found that HbA1c levels were significantly higher in MetS patients when compared to control groups. Our study suggests that HbA1c might be used as a diagnostic criterion for MetS. Therefore, proper glycemic control should be maintained by maintaining HbA1c level less than 6.5% to prevent from diabetes and MetS.

AUTHORS' CONTRIBUTIONS

Gunjan Kumar Mandal – Protocol preparation, data collection, manuscript editing, review, and correspondence. Sanjay Bhatt – Protocol preparation, data analysis, statistical analysis, and manuscript preparation.

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Self.

CONFLICTS OF INTEREST

Nil.

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