IOSR Journal of Dental and Medical Sciences (IOSR-JDMS)
e-ISSN: 2279-0853, p-ISSN: 2279-0861.Volume 19, Issue 7 Ser.10 (July. 2020), PP 01-07
www.iosrjournals.org

Association between Metabolic Syndrome and Acute Coronary Syndrome in a Tertiary Care Hospital of Bangladesh: A Cross Sectional Study

Monish Saha Roy[1], Milton Barua[2], Rokun Uddin[3], Amanat Ullah[4], SyedulAlam Kuryshi[5], PurnaJiban Chakma[6], Labeeba Faria[7], Zulfiquar Seraj[8], Mofizul Islam[9], Faria Quadir[10]

1. MBBS, FCPS (Medicine), MD (Cardiology), MO, UHC, Fatickchari
2. Senior Consultant (Medicine), Sadar Hospital, Khagrachari
3. MO, UHC, Hathazari, Chittagong,
4. Locum Consultant, Acute Medicine, Midway Maritime Hospital, Kent, UK
5. Senior consultant (Cardiology), Sadar hospital, Khagrachari
6. RMO, Sadar Hospital, Khagrachari,
7. Registrar, Dept. of Nephrology, Square Hospital, Dhaka
8. MD Resident, Dept. of Neurology, SSMC, Dhaka
9. SMO, Dept. of Neurology, BIRDEM, Dhaka,
10. ST3+, Diabetes & Endocrinology, CHFT NHS Trust, Huddersfield, UK
***Corresponding Author**: Dr. Milton Barua*
MBBS, FCPS (Medicine), MD (Endocrinology), MRCP (Paces, UK)
Senior Consultant (Medicine), Sadar Hospital, Khagrachari,

Background: Metabolic syndrome describes clustering of factors including dyslipidemia, glucose intolerance and hypertension with central obesity. The metabolic syndrome has a marked impact on the prevalence of cardiovascular disease and type 2 diabetes worldwide. The prevalence of metabolic syndrome is increasing worldwide & in Bangladesh, the prevalence of metabolic syndrome by using ATP III criteria was found to be 20.7 % for both men and women. Objective: To find out the relation between metabolic syndrome and acute coronary syndrome. Methods: The study was a hospital-based observational study conducted at the cardiology department, Sir Salimullah Medical College and Mitford Hospital. A sample of 200 adults was recruited (group 1-100 patients with ACS, group 2-100 subjects with no evidence of CAD). Participants were interviewed on their personal medical history. Blood pressure and anthropometric measurements were taken by using standardized methods. Blood samples were collected in a fasting state to measure triglyceride, FBG and HDL-C. For this study, the ATP criteria IV was used to describe the metabolic syndrome. Results: The prevalence of metabolic syndrome in ACS patients admitted in the hospital was 46% using ATP IV criteria, however, it was lower among subjects with no evidence of CAD (26%). The most prevalent risk factor was low HDL-C followed by elevated TG, hypertension, glucose intolerance and obesity. Hypertension, increased TG and impaired fasting glucose levels were predominant among patients with ACS. Dyslipidemia was identified as the most frequent and obesity was the least frequent component of metabolic syndrome. Conclusions: The study revealed that metabolic syndrome is highly prevalent in patients with acute coronary syndrome. This provides an opportunity for preventive strategies, reinforcing the good practices and learning the advantages of maintaining them to lower the clustering of potential risks for cardiovascular diseases.

Date of Submission: 06-07-2020 Date of Acceptance: 21-07-2020

I. Introduction

The metabolic syndrome is a cluster of metabolic abnormalities including abdominal obesity, hypertension (HTN), diabetes mellitus (DM), atherogenic hypertriglyceridemia (HTG) and low high density lipoprotein (HDL-C)[1].Other name used for this syndrome are Syndrome X, the insulin resistance syndrome, the deadly quartet or the obesity dyslipidemia syndrome[2]. Diet rich in cholesterol and westernization of lifestyle have given rise to this problem. This combination of interrelated metabolic abnormalities significantly increase the risk of cardiovascular disease (CVD) and type 2 diabetes mellitus[3]. Its prevalence is increasing worldwide and is a serious public health problem. Each component of metabolic syndrome is individually associated with an increased risk of cardiovascular disease (CVD); however whether metabolic syndrome leads to greater

cardiovascular risk than sum of its components remains a matter of debate. It has been suggested that the number of metabolic syndrome components may be more useful in predicting cardiovascular disease(CVD) than metabolic syndrome itself, since cardiovascular risk increases as the number of components increase[4].

Metabolic syndrome is the common metabolic disorder that results from increasing prevalence of obesity & the disorder has been defined by various diagnostic criteria.[5] This is partly due to the absence of a "gold standard" diagnostic test which in turn reflects conceptual vagueness, including a lack of clarity about which pathophysiologocal processes reflect a common underlying "syndrome". In fact the very existence of a single "syndrome" has been challenged[6] . The pathophysiology seems to be largely attributable to insulin resistance that leads to high level of insulin in the body, which itself isatherogenic in nature. A proinflammatory state probably contributes to the syndrome. The increased risk for type 2 diabetes and cardiovascular disease (CVD) demands therapeutic attention for those at high risk. Early identification, treatment and prevention of the metabolic syndrome present a major challenge to health care professionals facing an epidemic of overweight and sedentary life style. Mortality resulting from CHD, CVD and all causes in persons with diabetes and preexisting CVD is high. However that risk compared with those with metabolic syndrome is unclear. Several studies have been conducted to examine the impact of metabolic syndrome on CHD, CVD and overall mortality among adults with metabolic syndrome without diabetes and showed that risk of CHD and CVD mortality remain elevated.

Metabolic syndrome is associated with a 2-fold increase in cardiovascular outcomes and 1.5-fold increase in all-cause mortality[7]. Those with even 1 to 2 metabolic syndromes risk factor were at increased risk for mortality from CHD and CVD. Moreover metabolic syndrome more strongly predicts CHD, CVD and total mortality than its individual component.[8]The prevalence of metabolic syndrome in high risk population is obviously high, but it is also important to note that in a healthy population it was found a prevalence of 24%[9] and in patients with ACS it was found a prevalence of 45%-51%[10]. In most of the studies metabolic syndrome had a significant correlation with the CHD in univariate and multivariate analysis[11], but other several studies found that metabolic syndrome had no independent correlation with CHD, in multivariate analysis adjusted for blood pressure, HDL-cholesterol level and diabetes mellitus[12]. A similar study carried out in Bangladesh showed the prevalence of metabolic syndrome is 20.7%, 11.2% and 8.6% following modified Adult Treatment Panel III, International Diabetes Federation and World Health Organization definitions respectively[13]. Patients with metabolic syndrome and acute coronary syndrome had increased incidence of heart failure and worse long term mortality compared to those with metabolic syndrome. However they have less heart failure than those with known diabetes mellitus. Hyperglycemia is a risk factor for poor outcome which is particularly significant in patient with metabolic syndrome. The prevalence of metabolic syndrome increases with age. Greater industrialization worldwide is associated with rising rate of obesity which is anticipated dramatically to increase prevalence of metabolic syndrome especially as the population rises. Moreover the rising prevalence and severity of obesity in children initiating features of metabolic syndrome in young population[14].

II. Methods:

This cross sectional analytical study was conducted in the Department of cardiology of Sir Salimullah Medical College & Mitford Hospital, Dhaka, from April 2017 to March 2018. Purposive sampling was done to study 200 patients who were divided into 2 groups (100 in each) on the basis of inclusion and exclusion criteria. Patients with ACS admitted in hospital during the specified period of time were enrolled in group 1 and subjects (friends/ peers or relatives of ACS patients) with no evidence of CAD and voluntarily participated in the study were enrolled in group 2 where inclusion criteria were ACS patients of both sex and age more than 18 years, furthermore exclusion criteria were patient withvalvular heart disease, malignancy, stroke, severe renal and hepatic impairment. The numerical obtained from the study were analyzed and significance of differences was estimated by using statistical methods. Computer based SPSS (Statistical Package for Social Science) version 22 was used. Data were expressed in percentage, frequencies and means and standard deviations. Continuous

variables were compared through the Student's t-test and for the categorical variables the chi-square test. P value of less than 0.05 was considered as significant. The data was collected anonymously with confidentiality as the research was conducted in full accord with ethical principles.

III. Results:

Table-1: Comparison of age distribution of the study population (N=200)

Age (in years)	Group 1(n=100)No. (%)	Group 2 (n=100) No. (%)	p value
<30	2(2.0%)	12(12.0%)	
31-50	44(44.0%)	50(50.0%)	
51-70.	54(54.0%)	38(38.0%)	
Mean±SD	53.38±10.29	46.30±13.67	0.008*

Data were expressed in frequency, percentage and mean±SD, *significant,Unpaired Student's t-test was performed to compare between two groups.Figure in parenthesis indicate percentage.

Table 1 showed the mean age of group 1 was 53.38 years and majority of the participants were in between 51-70 years (54%) while the mean age of group 2 was 46.3 years and the majority of the participants were in between 31-50 years (50%). Age distribution was statistically significant (p=0.008).

Table-2: Comparison of sex distribution of study population (N=200)

Sex	Group 1(n=100)No. (%)	Group 2(n=100)No. (%)	p value
Male	72(72.0%)	46(46.0%)	0.008*
Female	28(28.0%)	54(54.0%)	
Male: Female	2.6:1	1.1.2	

Data were expressed in frequency and percentage,*significant, Chi-square test was performed to see the association between two groups, Figure in parenthesis indicate percentage.

Table 2 showed that total numbers of males were 118 and total numbers of females were 82. Males were dominant in group 1 (72%), while females were dominant in group 2 (54%). Sex difference was statistically significant between two groups (p=0.008).

Table-3: Comparison of BMI between two groups (N=200)

BMI (kg/m^2)	Group1 (n=100) No. (%)	Group 2(n=100) No. (%)	P value
Underweight (<18.5)	4(4.0%)	4(4.0%)	
Normal (18.5-24.9)	34(34.0%)	42(42.0%)	
Overweight (25.0-29.9)	40(40.0%)	38(38.0%)	
Obese (>30.0)	22(22.0%)	16(16.0%)	
Mean	26.9±5.68	25.50±4.35	0.151^{ns}

Data were expressed in mean±SD, ns= not significant, Unpaired Student's t-test was performed to compare between two groups.

Table 3 shows that the mean BMI of group 1 was 26.9 kg/m^2 and mean BMI of group 2 was 25.5 kg/m^2 with no significant intergroup difference. Majority of the participants in group 1 were overweight (40%), while majority of them in group 2 had normal BMI (42%).

Figure-1: Pie diagram showing clinical presentation of ACS

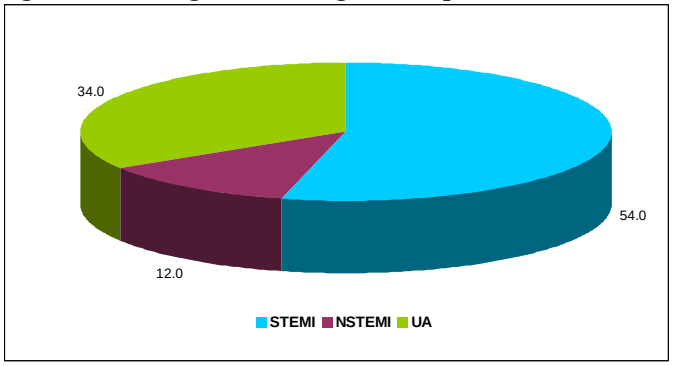


Fig 1 shows that among the 100 cases of ACS, 54 patients presented with STEMI (54%), 34 patients presented with UA (34%) and the remaining 12 patients had NSTEMI (12%).

Table-4: Prevalence of metabolic syndrome in the study population (N=200)

Metabolic syndrome	Group 1(n=100)No. (%)	Group 2 (n=100)No. (%)	P value
Yes	46(46.0%)	26(26.0%)	0.037*
No	54(54.0%)	74(74.0%)	

Data were expressed in frequency and percentage, *significant, Chi-square test was performed to see the association between two groups, Figure in parenthesis indicate percentage.

Table 4 showed that the number of metabolic syndrome in group 1 was 46 (46%) and in group 2 was 26 (26%). Metabolic syndrome was more prevalent in patients with ACS than control (46% vs. 26%) and the result was statistically significant.

Table-5: Prevalence of metabolic syndrome in both sexes(N=200)

Metabolic syndrome	Male (n=118) No. (%)	Female(n=82)No. (%)	P value
Yes	34(28.8%)	38(43.3%)	0.072^{ns}
No	84(71.2%)	44(53.7%)	

Data were expressed in frequency and percentage, ns= not significant, Chi-square test was performed to see the association between two groups, Figure in parenthesis indicate percentage.

Table 5 shows that metabolic syndrome was more prevalent in women (43.3% vs. 28.8%) though the result was not statistically significant.

Table-6: Comparison of number of components of metabolic syndrome between two groups (N=200)

Number of components of metabolic syndrome	Group 1(n=100) No. (%)	Group 2(n=100) No. (%)	P value
0	06(6.0%)	08(8.0%)	0.583^{ns}
1	33(33.0%)	30(30.0%)	0.882^{ns}
2	15(15.0%)	36(36.0%)	0.001^{*}
3	30(30.0%)	16(16.0%)	0.020^{*}
4	15(15.0%)	10(10.0%)	0.285^{ns}
5	01(1.0%)	0(0.0%)	0.316^{ns}

Data were expressed in frequency and percentage, ns= not significant, Chi-square test was performed to see the association between two groups, Figure in parenthesis indicate percentage.

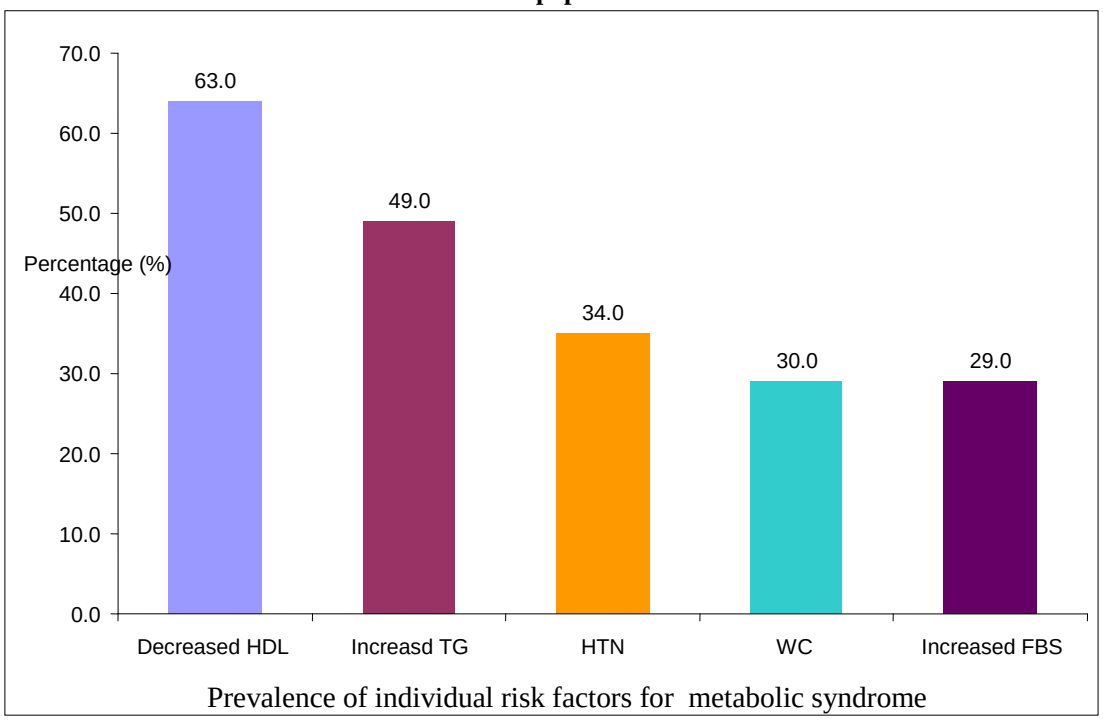
Table 6 showed that there were differences of number ofmetabolic syndrome componentsbetween two groups. In group 1 majority of the patient had either one (33%) or three (30%) components of metabolic syndrome while in group 2 majority of the subject had either one (30%) or two (36%) components of metabolic syndrome.

Table-7: Distribution of different components of metabolic syndrome between two groups

Components of metabolic syndrome	Group 1(n=100) No. (%)	Group 2(n=100) No. (%)	P value
HTN	43(43.0%)	25(25.0%)	0.007*
Waist circumference	26(26.0%)	34(34.0%)	0.220^{ns}
Increased TG	56(56.0%)	42(42.0%)	0.047*
Low HDL-C	62(62.0%)	64(64.0%)	0.771^{ns}
Impaired FBS	44(44.0%)	14(14.0%)	0.0001*

Data were expressed in frequency and percentage, *significant, ns= not significant
Chi-square test was performed to see the association between two groups, Figure in parenthesis indicate percentage.
Table 7 shows that among the five components of metabolic syndrome, low HDL-C was the most frequent (62% in group 1 and 64% in group 2). Hypertension (46% vs. 25%), increased TG (56% vs. 42%) and impaired FBS (44% vs. 14%) were significantly prevalent in group 1 than group 2.

Figure-2: Bar diagram showing clustering of individual risk factors of metabolic syndrome in study population.



IV. Discussion

The present study was intended to find out the prevalence of metabolic syndrome in group 1 and in group 2 and to determine the association of metabolic syndrome with ACS. The distribution of components of metabolic syndrome among group 1 and group 2 were also determined. In this study 200 subjects were enrolled. Out of them 100 were in group 1(patients with ACS) and 100 were in group 2 (subjects with no evidence of CAD). The mean age of group 1 was 53 years and group 2 was 46 years. Majority of the participants in group 1 were in between 51-70 years (54%) and group 2 were in between 31-50 years (50%). This age difference reflecting the fact that CAD are more common in elderly population. There was also significant sex difference between the two groups. Males were predominant in group 1 (72%) and females were predominant in group 2 (54%). This finding may be due to the fact that CAD is less common in female in reproductive age group.

The prevalence of metabolic syndrome in group 2 was found to be 26%. This prevalence was higher than that in the previous study done in Bangladesh which was 20.7%[13] but lower than that in the study done in BIRDEM among obese children and adolescents which was 36.6%[14]. This prevalence of 26% was also higher than that in the other studies done in Europe among adults aged more than 20 years which was 12%-15%[15],[16],[17]. But the prevalence was lower than that in the USA population among adults aged more than 20 years which was 44%[18].

In this study the prevalence of the metabolic syndrome in group 2 was found to be 46%. There was no available previous data regarding the prevalence of metabolic syndrome in patients with ACS in Bangladeshi population. This prevalence matched with other studies done in Romania and France, Spain and Middle East which was 47.26%, 50.9% and 46% respectively. But it was much lower than that in Indian population which was 59%[19]. In Pakistan Junaid found that the prevalence of metabolic syndrome in patients with ACS was 32%[20].

The current study showed that the prevalence of metabolic syndrome was higher in females than males (43.3% vs. 28.8%). It was similar to that what Rahima and Khanamfoundin their study[21].But Virendra, Madhu

and Ajay (2013) found that the prevalence was higher in males in Indian population[19].

Regarding the prevalence of risk factors for metabolic syndrome, the most prevalent risk factor was low HDL-C (62% in group 1 and 64% in group 2) followed by elevated TG, hypertension, glucose intolerance and obesity. Prevalence of low HDL-C was also higher in other study done in our country[22]. Rapid urbanization with less physical activities might have led to this problem. Another explanation is that the cut- off level used to assess HDL-C was mainly studied in European or American population which might differ from our population. HDL-C levels are slightly lower among Asians compared with non-Asians. There is low HDL-C among South Asians in comparison to rest of Asia[23].

Elevated level of serum triglyceride was the second most prevalent risk factor (56% in group 1 and 42% in group 2). This finding is supported by other studies done in Bangladesh[24] but is contrary to what had been shown in a study done in Sub Saharan Africa where elevated triglyceride was the least frequent[25]. Sedentary lifestyle and changes in dietary habits might have given rise to this problem.Systemic hypertension was also found to be one of the most important component of metabolic syndrome. It was more common in group 1 than group 2 (43% vs. 25%) because it is also a risk factor for CAD.Impaired fasting glucose level predominated in group 1 (44%) compared to group 2 (14%). This could make the population to have greater odds of having cardiovascular disease and type 2 diabetes and eventually metabolic syndrome in the future.

This study showed that obesity was the least frequent component of metabolic syndrome (26% in group 1 and 34% in group 2). This finding could be explained by the fact that all study participants were involved on physical activities. There were also differences of number of metabolic syndrome components between two groups. In group 1 majority of the patient had either one (33%) or three (30%) components of metabolic syndrome while in group 2 majority of the subject had either one (30%) or two (36%) components of metabolic syndrome.

V. Conclusion

Metabolic syndrome is highly prevalent in patients with acute coronary syndrome.Among the five components of metabolic syndrome hypertension, increased TG and impaired FBS are significantly prevalent in patients with acute coronary syndrome.Dyslipidemia was identified as the most frequent component of metabolic syndrome.All the components of metabolic syndrome namely obesity, hyperglycemia, hypertension and dyslipaedimia are potentially modifiable and preventable. Lifestyle modifications related to dietary habit and physical activities can decrease the incidence of metabolic syndrome and its consequences.

Limitation:

The study was conducted in a single center with small sample size. In this study participants' dietary habits were not assessed. Dietary lipids, fibers or carbohydrates might have influence fasting glucose level and diet with a high glycemic load and low cereal fiber contents might have been associated with the increased risk of the metabolic syndrome.

Reference:

[1]. Alberti, K.G.M.M., Eckel, R.H., Grundy, S.M., Zimmet, P.Z., Cleeman, J.I., Donato, K.A., et al., 2009. Harmonizing the metabolic syndrome: a joint interim statement of the international diabetes federation task force on epidemiology and prevention; national heart, lung, and blood institute; American heart association; world heart federation; international atherosclerosis society; and international association for the study of obesity. *Circulation*, *120(16)*, pp.1640-1645.

[2]. Eckel, R.H., Alberti, K.G.M.M., Grundy, S.M. and Zimmet, P.Z., 2010. The metabolic syndrome. *The Lancet*, *375*(9710), pp.181-183.

[3]. Alberti, K.G.M., Zimmet, P. and Shaw, J., 2005. The metabolic syndrome—a new worldwide definition. *The Lancet*, *366*(9491), pp.1059-1062.

[4]. Jassim Al Suwaidi, Mohammad Zubaid, Ayman A, Menyar, Rajvir Singh, WafaRashed, et al, 2010. Prevalence of the metabolic syndrome in patients with acute coronary syndrome in six middle Eastern countries. *The clinical journal of hypertension*, *12*, pp. 380.

[5]. Alberti, K.G.M.M. and Zimmet, P.F., 1998. Definition, diagnosis and classification of diabetes mellitus and its complications. Part 1: diagnosis and classification of diabetes mellitus. Provisional report of a WHO consultation.*Diabetic medicine*, *15(7)*, pp.539-553

[6]. Kahn, R., 2007. Metabolic syndrome: is it a syndrome? Does it matter?. *Circulation*, *115*(13), pp.1806-1811

[7]. Mottillo, S., Filion, K.B., Genest, J., Joseph, L., Pilote, L., Poirier, P., et al., 2010.The metabolic syndrome and cardiovascular risk: a systematic review and meta-analysis. *Journal of the American College of Cardiology*, *56(14)*, pp.1113-1132.

[8]. Shais Malik, Stanley's Franklin, Tripti V. Kamath, Gilbert J, L'Italian, Jose R Pio, et al, 2004. Impact of the metabolic syndrome on mortality from coronary heart disease, cardiovascular disease and all causes in United States adults.*110(10):* pp. 1245-50.

[9]. Olijhoek, J.K., van der Graaf, Y., Banga, J.D., Algra, A., Rabelink, T.J. and Visseren, F.L., 2004. The metabolic syndrome is associated with advanced vascular damage in patients with coronary heart disease, stroke, peripheral arterial disease or abdominal

25

aortic aneurysm. *European heart journal, 25(4),* pp.342-348.
[10]. Chung, E.H., Curran, P.J., Sivasankaran, S., Chauhan, M.S., Gossman, D.E., Pyne, C.T., et al., 2007.Prevalence of metabolic syndrome in patients≤ 45 years of age with acute myocardial infarction having percutaneous coronary intervention. *American Journal of Cardiology*, *100*(7), pp.1052-1055.
[11]. Grundy, S.M., Brewer, H.B., Cleeman, J.I., Smith, S.C. and Lenfant, C., 2004. Definition of metabolic syndrome: report of the National Heart, Lung, and Blood Institute/American Heart Association conference on scientific issues related to definition. *Circulation, 109(3),* pp.433-438
[12]. Ryden, L., Standl, E., Bartnik, M., Berghe, G.V.D., Betteridge, J., de Boer, M.J., et al., 2007. † Guidelines on diabetes, pre-diabetes, and cardiovascular diseases: full text‡: The Task Force on Diabetes and Cardiovascular Diseases of the European Society of Cardiology (ESC) and ofthe European Association for the Study of Diabetes (EASD). *European heart journal supplements, 9(suppl_C),* pp.C3-C74.
[13]. Rahim, M.A., Khan, A.A., Sayeed, M.A., Akhtar, B., Nahar, Q., Ali, S.M.K. et al., 2007. Metabolic syndrome in rural Bangladesh: Comparison of newly proposed IDF, modified ATP III and WHO criteria and their agreements. Diabetes & Metabolic Syndrome: *Clinical Research & Reviews, 1(4),* pp.251-257.
[14]. Mohsin, F., Baki, A., Nahar, J., Akhtar, S., Begum, T., Azad, K. Et al., 2012. Prevalence of metabolic syndrome among obese children and adolescents. *BIRDEM Medical Journal, 1(1),* pp.21-25.
[15]. Laaksonen, D.E., Lakka, H.M., Niskanen, L.K., Kaplan, G.A., Salonen, J.T. and Lakka, T.A., 2002. Metabolic syndrome and development of diabetes mellitus: application and validation of recently suggested definitions of the metabolic syndrome in a prospective cohort study. *American journal of epidemiology, 156(11),* pp.1070-1077.
[16]. Rennie, K.L., McCarthy, N., Yazdgerdi, S., Marmot, M. and Brunner, E., 2003.Association of the metabolic syndrome with both vigorous and moderate physical activity. *International journal of epidemiology*, *32*(4), pp.600-606.
[17]. Sattar, N., Gaw, A., Scherbakova, O., Ford, I., O'Reilly, D.S.J., Haffner, S.M., et al., 2003. Metabolic syndrome with and without C-reactive protein as a predictor of coronary heart disease and diabetes in the West of Scotland Coronary Prevention Study. *Circulation*, *108*(4), pp.414-419.
[18]. Ervin, R.B., 2009. Prevalence of metabolic syndrome among adults 20 years of age and over, by sex, age, race and ethnicity, and body mass index: United States. *National health statistics reports, 13,* pp.1-8.
[19]. Virendra Dhakhada, Madhu Panjwani, Ajay Dabhi, 2013. Study of association between metabolic syndrome and acute coronary syndrome.*Indian Journal of Clinical Pract; 24:* pp. 4.
[20]. JunaidZaffar, Usman Butt, Muhammad ayaz, ShahzadShoukat, Mamoon Akbar Qureshi, Zubair Akram.,2014. Frequency and characteristics of metabolic syndrome in patients with acute coronary syndrome among Pakistani adults. *Pak Heart J; 47(04):* pp.175-178.
[21]. Khanam, M.A., Qiu, C., Lindeboom, W., Streatfield, P.K., Kabir, Z.N. and Wahlin, Å., 2011. The metabolic syndrome: prevalence, associated factors, and impact on survival among older persons in rural Bangladesh. *PLoS One*, *6*(6), p.e20259.
[22]. Alam, M.B., Ahasan, H.N., Islam, M.Z., Islam, M.N., Mohammed, F.R., Nur, Z., et al., 2009.Pattern of lipid profile and obesity among secretariat employees of Bangladesh.*Journal of Medicine, 10(3),* pp.3-6.
[23]. Karthikeyan, G., Teo, K.K., Islam, S., McQueen, M.J., Pais, P., Wang, X., et al., 2009. Lipid profile, plasma apolipoproteins, and risk of a first myocardial infarction among Asians: an analysis from the INTERHEART Study. *Journal of the American College of Cardiology, 53(3),* pp.244-253.
[24]. Zaman, M.M., Ahmed, J., Choudhury, S.R., Numan, S.M., Islam, M.S. and Parvin, K., 2006.Prevalence of metabolic syndrome in rural Bangladeshi women.*Diabetes care, 29(6),* pp.1456-1457.
[25]. Motala, A.A., Mbanya, J.C. and Ramaiya, K.L., 2009. Metabolic syndrome in sub-Saharan Africa. *Ethn Dis, 19(Suppl 2),* pp.S2-8.

Monish SahaRoy. "Association between Metabolic Syndrome and Acute Coronary Syndrome in a Tertiary Care Hospital of Bangladesh: A Cross Sectional Study."*IOSR Journal of Dental and Medical Sciences (IOSR-JDMS),* 19(7), 2020, pp. 01-07.