Association between Waist Circumference and Serum Triglyceride-to-HDL Ratio among Patients with Established Ischemic Heart Disease – A Cross-Sectional Study

Israt Rezwana[a], Arifur Rahman[b], Rezwana Sobhan[c], Parijat Ghosh[d], Mania Parvin[e], Shafikul Islam[f], Khondoker Shoaib Hossain[g], Khaled Hassan[h], Aminul Islam[i]

ARTICLE INFO

Received: 2 Feb 2026
Accepted: 9 Feb 2026
Published Online: 16 Feb 2026

DOI: 10.5281/zenodo.18662479

Volume: 8, Number: 2, Page: 150-155

e-ISSN: 2789-5912
ISSN: 2617-0817

*Corresponding author

ABSTRACT

Background: Central obesity is a key driver of cardiometabolic risk and is highly prevalent among patients with ischemic heart disease (IHD), particularly in South Asian populations. Waist circumference (WC) is a simple and reliable marker of visceral adiposity, while the triglyceride to high-density lipoprotein cholesterol (TG/HDL) ratio has emerged as a strong surrogate of atherogenic dyslipidemia and insulin resistance. However, data exploring the relationship between WC and TG/HDL ratio among patients with established IHD in Bangladesh remain limited.Aim of the study: To evaluate the association between waist circumference and serum TG/HDL ratio among adults with clinically established IHD attending a tertiary care hospital. **Methods & Materials:** This observational analytic study with a cross-sectional design was conducted at the Department of Endocrinology and Metabolism, BIRDEM General Hospital, between March 2018–November 2019 and March 2022–March 2023. A total of 90 adults with documented IHD were enrolled. Demographic and clinical data were collected using structured questionnaires. Anthropometric measurements, including BMI, waist and hip circumference, were obtained according to WHO guidelines. Fasting serum triglycerides and HDL cholesterol were measured, and the TG/HDL ratio was calculated. Participants were stratified by TG/HDL risk categories. Correlations between WC and lipid parameters were assessed using Pearson's correlation. Multivariate linear regression identified independent predictors of TG/HDL ratio, and logistic regression evaluated factors associated with high TG/HDL ratio (≥4.0). Statistical significance was defined as $p < 0.05$. **Result:** The mean age of participants was 60.8 ± 10.2 years; 51.1% were female. The majority were overweight or obese (74.4%) and had central obesity (95.6%). High TG/HDL ratio (≥4.0) was observed in 66.7% of participants. Waist circumference showed a significant positive correlation with TG ($r = 0.42$, $p < 0.001$) and TG/HDL ratio ($r = 0.48$, $p < 0.001$) and a negative correlation with HDL ($r = -0.36$, $p = 0.001$). Multivariate analysis demonstrated that WC ($\beta = 0.21$, $p < 0.001$), BMI ($\beta = 0.18$, $p = 0.007$), and diabetes mellitus ($\beta = 0.94$, $p = 0.011$) were independent predictors of TG/HDL ratio. Participants with increased WC had 6.87-fold higher odds of high TG/HDL ratio (95% CI: 1.45–32.51, $p = 0.015$). **Conclusion:** Waist circumference is strongly and independently associated with serum TG/HDL ratio in adults with IHD. Given its simplicity and low cost, routine measurement of waist circumference can serve as an effective screening tool to identify individuals at elevated cardiometabolic risk, guiding timely preventive interventions and improving risk stratification in clinical practice.

Keywords: *Waist circumference, TG/HDL ratio, central obesity, ischemic heart disease, cardiometabolic risk, South Asian population*

a. *Registrar, Department of endocrinology and metabolism, Sir Salimullah medical College Mitford hospital, Dhaka, Bangladesh (ORCID: 0009-0001-6570-7280)*
b. *Registrar Department of Gastroenterology Dhaka Medical College Hospital, Dhaka, Bangladesh*
c. *Associate professor, Department of Endocrinology and Diabetes, Enam Medical College and hospital, Dhaka, Bangladesh*
d. *Registrar, Department of Endocrinology BIRDEM general hospital, Dhaka, Bangladesh*
e. *Medical Officer, UHC Muksudpur Gopalgonj, Gopalgonj, Bangladesh*
f. *Medical Officer, UHC, Nasirnagar, Brahmanbaria, Bangladesh*
g. *Indoor medical officer, Medicine, Shaheed Suhrawardy Medical College Hospital, Dhaka, Bangladesh*
h. *Assistant Professor (Endocrinology), National Institute of burn and plastic surgery, Dhaka, Bangladesh*
i. *Assistant Professor, Department of Endocrinology and Diabetes, Enam medical College and Hospital, Dhaka, Bangladesh*

Introduction

Abdominal obesity, commonly assessed using waist circumference, reflects excess visceral adipose tissue and is strongly associated with adverse cardiometabolic risk, including insulin resistance, dyslipidaemia, and chronic low-grade inflammation [1]. The serum triglyceride-to-high-density lipoprotein (TG/HDL) ratio is increasingly recognized as a simple and accessible surrogate marker of insulin resistance, reflecting lipid metabolic alterations associated with impaired insulin action [2]. This ratio has been shown to correlate positively with several cardiovascular risk factors, including waist circumference and blood pressure, suggesting its potential utility in cardiovascular risk assessment [3]. Globally, the prevalence of adult obesity reached approximately 16% in 2022, with over 890 million individuals living with the condition [4]. Within the South Asian region, the burden of abdominal obesity is disproportionately high, with population-based surveys reporting prevalence estimates in adult cohorts ranging from approximately 30% to over 50%, depending on country and measurement criteria [5]. In Bangladesh, abdominal obesity is similarly prevalent among adults, with reported estimates typically ranging from 30% to 50% depending on study setting and measurement criteria [6,7]. In this context, factors such as increasing urbanization, shifts in lifestyle behaviours, and a diet increasingly dominated by high-glycemic-index carbohydrates and trans-fats have been implicated in the rising burden of cardiometabolic disorders in Bangladesh [8]. At the physiological level, excess visceral adipose tissue secretes increased free fatty acids and pro-inflammatory cytokines into the portal circulation, which can promote hepatic insulin resistance and dysregulated lipid metabolism, thereby linking central adiposity to broader cardiometabolic risk [9]. This metabolic cascade is associated with increased hepatic triglyceride synthesis and enhanced catabolism of high-density lipoprotein cholesterol, contributing to an adverse TG/HDL profile and an elevated risk of type 2 diabetes and ischemic heart disease [10]. From a clinical perspective, waist circumference and the TG/HDL ratio are simple, accessible, and low-cost surrogate markers of metabolic risk that are feasible for use in routine clinical practice, particularly in resource-limited settings [1,11]. However, significant barriers persist, including the lack of standardized, ethnic-specific TG/HDL cut-off values for the Bangladeshi population and the continued reliance on body mass index (BMI) alone, which may fail to identify "thin-fat" individuals with high visceral risk [12]. Moreover, despite its clinical importance, waist circumference is not routinely measured in many busy outpatient settings, potentially contributing to the under-recognition of abdominal obesity and metabolic syndrome [1]. This study aimed to evaluate the association between waist circumference and the serum TG/HDL ratio among adults attending a tertiary care hospital, seeking to clarify how central adiposity influences this atherogenic marker and to inform early metabolic risk stratification.

Methods & Materials

This was an observational analytic study with a cross-sectional design conducted in the Department of Endocrinology and Metabolism, along with allied medicine departments, at BIRDEM General Hospital, a tertiary care referral center. The study was carried out during two recruitment periods: March 2018 to November 2019 and March 2022 to March 2023. A total of 90 patients with clinically established ischemic heart disease (IHD) attending both the inpatient and outpatient departments of the study hospital were considered eligible. Participants were enrolled using consecutive purposive sampling, whereby all eligible patients presenting during the study periods were invited to participate until the target sample size was achieved.

Inclusion and Exclusion criteria

Inclusion criteria

Participants were included if they met all of the following criteria:

- Diagnosed and documented cases of ischemic heart disease manifested as chronic coronary syndrome
- No prior diagnosis of hypothyroidism before the diagnosis of established IHD
- Age >18 years

Exclusion criteria

Participants were excluded if they met any of the following conditions:

- Pregnant women
- Female patients taking oral contraceptive pills
- Patients receiving thyroid hormone replacement therapy, antithyroid drugs, amiodarone, corticosteroids, lithium, or with a recent history of iodine-containing contrast media exposure
- Severely ill patients, including those with clinical evidence of sepsis, acute coronary syndrome, or any predominant severe systemic illness (to avoid the confounding effect of sick euthyroid syndrome)
- Patients with other forms of structural heart disease

Data collection and clinical assessment

After obtaining informed written consent, demographic and clinical information was collected using a structured, pretested questionnaire. Data included age, sex, smoking status, and history of hypertension, diabetes mellitus, and dyslipidemia. Blood pressure was measured with a standardized mercury sphygmomanometer after at least 5 minutes of rest, and the mean of two readings was recorded.

Lipid-lowering therapy:

Information on lipid-lowering therapy, including statin use, was extracted from participants' medical records. Approximately 77.8% of participants were receiving statin therapy at the time of assessment. This was included to account for potential confounding effects on TG/HDL ratio.

Anthropometric measurements

Anthropometric measurements were obtained according to World Health Organization (WHO) guidelines. Waist circumference (WC) was measured at the midpoint between the lower margin of the last palpable rib and the top of the iliac crest using a non-stretchable measuring tape, with participants standing upright and breathing normally. Hip circumference was measured at the widest part of the buttocks. The waist–hip ratio (WHR) was calculated as WC divided by hip circumference.

Body mass index (BMI) was calculated as weight (kg) divided by height squared (m^2) and categorized according to Asian-specific BMI cut-off values. Increased waist circumference was defined as >90 cm for men and >80 cm for women, based on South Asian population criteria.

Biochemical measurements

After an overnight fast of 8–10 hours, venous blood samples were collected under aseptic conditions. Serum triglycerides and high-density lipoprotein (HDL) cholesterol levels were measured using enzymatic colorimetric methods in the hospital's central laboratory, following standard internal quality control procedures. Fasting plasma glucose was measured using the glucose oxidase method.

The triglyceride to HDL cholesterol (TG/HDL) ratio was calculated by dividing serum triglyceride levels (mg/dL) by HDL cholesterol levels (mg/dL). TG/HDL ratio was categorized as <3.0 (low risk), 3.0–3.9 (intermediate risk), and ≥4.0 (high risk), in accordance with established cardiometabolic risk thresholds.

Statistical analysis

Data were entered and analyzed using the Statistical Package for the Social Sciences (SPSS) software (version 25). Continuous variables were expressed as mean ± standard deviation (SD), and categorical variables were presented as frequencies and percentages. Comparisons between groups were performed using the independent sample *t*-test or one-way analysis of variance (ANOVA), as appropriate.Pearson's correlation coefficient was used to evaluate the relationship between waist circumference and lipid parameters, including triglycerides, HDL cholesterol, and TG/HDL ratio. Multivariate linear regression analysis was performed to identify independent predictors of TG/HDL ratio after adjusting for potential confounders such as age, sex, BMI, and diabetes mellitus. Binary logistic regression analysis was used to estimate odds ratios (ORs) with 95% confidence intervals (CIs) for factors associated with a high TG/HDL ratio (≥4.0). A p value <0.05 was considered statistically significant.

Ethical considerations

The study protocol was reviewed and approved by the Institutional Ethics Review Committee of BIRDEM General Hospital. The study was conducted in accordance with the principles of the Declaration of Helsinki. Written informed consent was obtained from all participants, and confidentiality of participant information was strictly maintained throughout the study.

Result

The study included 90 adults with established ischemic heart disease. The mean age was 60.8 ± 10.2 years, with the majority aged ≥55 years (77.78%). Gender distribution was nearly equal, with 51.11% females and 48.89% males. Never-smokers comprised 66.67% of participants, while 33.33% were ex-smokers. Cardiometabolic comorbidities were highly prevalent, including diabetes mellitus (97.78%), hypertension (85.56%), and dyslipidemia (94.44%). Approximately 77.78% of participants were receiving statin therapy at the time of assessment (*Table I*).

Table I
Demographic and clinical characteristics of the study population (*n* = 90).

Variable	Frequency (n)	Percentage (%)
Age (years)		
≤35	2	2.22
36–44	4	4.44
45–54	14	15.56
55–64	32	35.56
≥65	38	42.22
Gender		
Male	44	48.89
Female	46	51.11
Smoking status		
Never smoker	60	66.67
Current smoker	0	0.00
Ex-smoker	30	33.33
Hypertension		
Absent	13	14.44
Present	77	85.56
Diabetes mellitus		
Absent	2	2.22
Present	88	97.78
Dyslipidemia		
Absent	5	5.56
Present	85	94.44
Statin therapy		
Yes	70	77.78
No	20	22.22

Nearly half of participants were obese (47.78%), while 26.67% were overweight and 22.22% had normal BMI; mean BMI was 25.12 ± 3.89 kg/m². Increased waist circumference was present in 95.55%, with a mean of 102.82 ± 7.41 cm. Mean TG/HDL ratio was 6.93 ± 5.21, triglycerides 211.64 ± 150.05 mg/dL, and HDL 30.53 ± 8.89 mg/dL (*Table II*).

Table II
Anthropometric and biochemical characteristics of the study population.

Variable	Value
BMI (kg/m²)	
Underweight (<18.5)	3 (3.33)
Normal (18.5–22.9)	20 (22.22)
Overweight (23–24.9)	24 (26.67)
Obese (≥25)	43 (47.78)
Mean ± SD	25.12 ± 3.89
Waist circumference (cm)	
Male >90 cm	40 (44.44)
Male ≤90 cm	4 (4.44)
Female >80 cm	46 (51.11)
Female ≤80 cm	0 (0.00)
Mean ± SD	102.82 ± 7.41
Hip circumference (cm)	104.61 ± 7.43
Waist–Hip Ratio	0.97 ± 0.05
Triglycerides (mg/dL)	211.64 ± 150.05
HDL (mg/dL)	30.53 ± 8.89
TG/HDL Ratio	6.93 ± 5.21
Fasting plasma glucose (mmol/L)	9.67 ± 3.41
Systolic BP (mmHg)	127.44 ± 14.63
Diastolic BP (mmHg)	76.22 ± 9.34

When categorized according to TG/HDL ratio, 66.7% of participants were classified as high risk (≥4.0), while 20% and 13.3% fell into the intermediate and low-risk categories, respectively (*Table III*).

Table III
Distribution of participants by TG/HDL risk categories.

TG/HDL Ratio Category	Frequency (n)	Percentage (%)
<3.0 (Low risk)	12	13.3
3.0–3.9 (Intermediate risk)	18	20
≥4.0 (High risk)	60	66.7

TG/HDL ratio cut-offs (<3.0: low risk; 3.0–3.9: intermediate risk; ≥4.0: high risk) are based on established cardiometabolic risk thresholds[11].

Participants with increased waist circumference had a significantly higher mean TG/HDL ratio compared to those with normal waist circumference (7.12 ± 5.27 vs. 3.21 ± 1.14; p < 0.001) (*Table IV*).

Table IV
Waist Circumference vs TG/HDL Ratio.

Waist Circumference Status	Mean TG/HDL Ratio ± SD	p value
Normal WC	3.21 ± 1.14	<0.001†
Increased WC	7.12 ± 5.27	

Table V
Correlation between waist circumference and lipid parameters.

Variable	Correlation coefficient (r)	p value
Waist circumference vs TG	0.42	<0.001
Waist circumference vs HDL	−0.36	0.001
Waist circumference vs TG/HDL ratio	0.48	<0.001

Participants with increased WC had significantly higher TG/HDL ratios compared to those with normal WC (7.12 ± 5.27 vs 3.21 ± 1.14; p < 0.001). Pearson correlation analysis demonstrated that WC was positively correlated with triglyceride levels (r = 0.42, p < 0.001) and TG/HDL ratio (r = 0.48, p < 0.001), and inversely correlated with HDL cholesterol (r = −0.36, p = 0.001). A progressive increase in TG/HDL ratio was observed across WC quartiles, with participants in the highest quartile exhibiting the highest mean ratio (10.21 ± 6.88; p < 0.001) (*Table VI*).

Table VI
TG/HDL Ratio across Waist Circumference Quartiles.

WC Quartile	Mean WC (cm)	TG/HDL Ratio Mean ± SD	p value
Q1 (Lowest)	91.4 ± 2.6	3.98 ± 1.92	—
Q2	98.6 ± 1.9	5.72 ± 3.14	—
Q3	104.7 ± 2.1	7.31 ± 4.66	—
Q4 (Highest)	112.3 ± 3.8	10.21 ± 6.88	<0.001‡

Multivariate linear regression identified waist circumference (β = 0.21, 95% CI 0.12–0.31, p < 0.001), BMI (β = 0.18, 95% CI 0.05–0.32, p = 0.007), and diabetes mellitus (β = 0.94, 95% CI 0.22–1.66, p = 0.011) as independent predictors of TG/HDL ratio after adjusting for age, sex, BMI, and diabetes (*Table VII*).

Table VII
Multivariate Linear Regression Analysis for TG/HDL Ratio.

Predictor	β coefficient	95% CI	p value
Waist circumference (cm)	0.21	0.12–0.31	<0.001
Age (years)	0.03	−0.01–0.07	0.11
Female gender	0.42	−0.31–1.15	0.26
BMI (kg/m²)	0.18	0.05–0.32	0.007
Diabetes mellitus	0.94	0.22–1.66	0.011

Binary logistic regression showed that participants with increased WC had 6.87-fold higher odds of high TG/HDL ratio (≥4.0; 95% CI 1.45–32.51, p = 0.015). Obesity (OR = 4.12, 95% CI 1.58–10.75, p = 0.004) and poor glycemic control (HbA1c ≥10%; OR = 3.94, 95% CI 1.47–10.54, p = 0.006) were also significant risk factors, whereas hypertension was not associated with high TG/HDL ratio (OR = 1.61, p = 0.49) (*Table VIII*).

Table VIII
Odds of high TG/HDL ratio (≥4.0) according to risk factors.

Variable	OR	95% CI	p value
Increased WC	6.87	1.45–32.51	0.015
Obesity (BMI ≥25 kg/m²)	4.12	1.58–10.75	0.004
HbA1c ≥10%	3.94	1.47–10.54	0.006
Hypertension	1.61	0.42–6.11	0.49

Adjusted for age, sex, BMI, and diabetes mellitus unless otherwise specified.

Discussion

The growing burden of central obesity and its close link with adverse lipid profiles has emerged as a major metabolic health concern, prompting increasing interest in the relationship between waist circumference and the serum TG/HDL ratio [13]. This study assessed the association between waist circumference (WC) and serum TG/HDL ratio among adults attending a tertiary care hospital. The demographic and clinical profile showed that the majority of participants were elderly, with 77.8% aged ≥55 years with 55–64 years having 35.56% and ≥65 years having 42.22%. Gender distribution was nearly equal, and two-thirds of participants were never smokers. A high prevalence of cardiometabolic comorbidities was observed, including diabetes mellitus (97.8%), hypertension (85.6%), and dyslipidemia (94.4%). These findings highlight a high-risk cohort, consistent with previous studies demonstrating elevated metabolic risk in older adults with diabetes and obesity [14]. Anthropometric and biochemical characteristics indicated that nearly half of the participants were obese (BMI ≥25 kg/m²), with a mean Waist circumference of 102.82 ± 7.41 cm and an elevated TG/HDL ratio of 6.93 ± 5.21. The mean HDL level was low (30.53 ± 8.89 mg/dL), while triglycerides were elevated (211.64 ± 150.05 mg/dL), reflecting an atherogenic lipid profile commonly observed in insulin-resistant and diabetic populations [15]. The high prevalence of abdominal obesity in both males and females underscores the metabolic risk associated with central adiposity in this population. The distribution of participants by TG/HDL risk categories revealed that 66.7% had a high-risk TG/HDL ratio (≥4.0), confirming that the majority of this cohort exhibited atherogenic dyslipidemia. This prevalence is in line with prior research by Ray et al., who reported that elevated TG/HDL ratio is a reliable marker of insulin resistance and cardiovascular risk among obese and diabetic adults [16]. When examining WC in relation to TG/HDL ratio, participants with increased WC had significantly higher mean TG/HDL ratios compared to those with normal WC (7.12 ± 5.27 vs 3.21 ± 1.14; p<0.001). This demonstrates the direct relationship between central obesity and an atherogenic lipid phenotype, supporting previous findings that visceral adiposity is a stronger determinant of metabolic risk than BMI alone [17]. Importantly, this association persisted despite the high prevalence of statin therapy (77.78% of participants), suggesting that waist circumference reflects underlying visceral adiposity and insulin resistance beyond the effects of lipid-lowering pharmacotherapy."Correlation analysis showed that WC was positively correlated with triglycerides (r = 0.42, p<0.001) and TG/HDL ratio (r = 0.48, p<0.001), and inversely correlated with HDL (r = −0.36, p=0.001). These results align with the known pathophysiology of central obesity, where excess visceral fat increases free fatty acid flux to the liver, promoting triglyceride synthesis and reducing HDL levels [18]. TG/HDL ratio progressively increased across WC quartiles, with participants in the highest quartile showing the highest ratio (10.21 ± 6.88), indicating a dose–response relationship between abdominal obesity and atherogenic dyslipidemia [19]. This gradient emphasizes the importance of WC as a simple clinical measure for stratifying metabolic risk. Multivariate linear regression confirmed WC as an independent predictor of TG/HDL ratio (β = 0.21, 95% CI 0.12–0.31, p<0.001), after adjusting for age, gender, BMI, and diabetes. BMI (β = 0.18, p=0.007) and diabetes mellitus (β = 0.94, p=0.011) were also significant predictors. These findings are consistent with prior studies demonstrating that central obesity and hyperglycemia synergistically worsen dyslipidemia and insulin resistance [20]. Finally, the odds of having a high TG/HDL ratio (≥4.0) were significantly higher among participants with increased WC (OR = 6.87, p=0.015) and obesity (OR = 4.12, p=0.004). This emphasizes WC as a stronger predictor of atherogenic dyslipidemia than BMI, consistent with evidence from South Asian populations showing that WC more accurately reflects visceral fat and cardiometabolic risk [21].

Limitations

The cross-sectional design precludes causal inference, limiting mechanistic interpretation of the association between waist circumference and TG/HDL ratio. A high proportion of participants were receiving statin therapy, which may have influenced lipid parameters, particularly triglyceride and HDL cholesterol levels; however, TG/HDL ratio remained significantly associated with waist circumference despite this potential confounding.

Conclusion

Waist circumference is strongly and independently associated with the TG/HDL ratio in adults with ischemic heart disease, highlighting central adiposity as a key driver of atherogenic dyslipidemia. This relationship reflects underlying visceral fat–mediated insulin resistance and lipid derangements. Routine assessment of waist circumference provides a simple, cost-effective tool for identifying high-risk individuals and guiding early interventions. We recommend incorporating waist circumference measurement into standard cardiovascular risk evaluation in all patients with IHD to improve stratification and preventive care.

Funding: No funding sources
Conflict of interest: None declared
Ethical approval: The study was approved by the Institutional Ethics Committee.

References

1. Ross R, Neeland IJ, Yamashita S, Shai I, Seidell J, Magni P, Santos RD, Arsenault B, Cuevas A, Hu FB, Griffin BA. Waist circumference as a vital sign in clinical practice: a Consensus Statement from the IAS and ICCR Working Group on Visceral Obesity. Nature Reviews Endocrinology. 2020 Mar;16(3):177-89.
2. Baneu P, Văcărescu C, Drăgan SR, Cirin L, Lazăr-Höcher AI, Cozgarea A, Faur-Grigori AA, Crișan S, Gaiță D, Luca CT, Cozma D. The triglyceride/HDL ratio as a surrogate biomarker for insulin resistance. Biomedicines. 2024 Jul 5;12(7):1493.
3. Akpinar, E., et al. (2019). Association between cardiovascular risk factors and triglyceride to high-density lipoprotein ratio. *Archives of Medical Science*, 15(4), 850-855.
4. WHO I. Obesity and overweight fact sheet. Geneva: World Health Organization. 2018 Nov 2.
5. Gupta RD, Parray AA, Kothadia RJ, Pulock OS, Pinky SD, Haider SS, Akonde M, Haider MR. The association between body mass index and abdominal obesity with hypertension among South Asian population: findings from nationally representative surveys. Clinical Hypertension. 2024 Feb 1;30(1):3.
6. Ali N, Mohanto NC, Nurunnabi SM, Haque T, Islam F. Prevalence and risk factors of general and abdominal obesity and hypertension in rural and urban residents in Bangladesh: a cross-sectional study. BMC Public Health. 2022 Sep 8;22(1):1707.
7. Ali N, Ahmed S, Mahmood S, Trisha AD, Mahmud F. The prevalence and factors associated with obesity and hypertension in university academic staff: a cross-sectional study in Bangladesh. Scientific Reports. 2023 May 5;13(1):7309.
8. Akanda MA, Ali Z, Choudhury KN, Sayami LA, Huda RM, Hossain S, Mohsin M, Ali MA. Study of lipid profile in adult population of Bangladesh. Cardiovascular Journal. 2016 Feb 25;8(2):128-34.
9. Item F, Konrad D. Visceral fat and metabolic inflammation: the portal theory revisited. Obesity Reviews. 2012 Dec;13:30-9.
10. . Klop B, Elte JW, Castro Cabezas M. Dyslipidemia in obesity: mechanisms and potential targets. Nutrients. 2013 Apr 12;5(4):1218-40.
11. McLaughlin T, Abbasi F, Cheal K, Chu J, Lamendola C, Reaven G. Use of metabolic markers to identify overweight individuals who are insulin resistant. Annals of internal medicine. 2003 Nov 18;139(10):802-9.

12. Misra A, Chowbey P, Makkar BM, Vikram NK, Wasir JS, Chadha D, Joshi SR, Sadikot S, Gupta R, Gulati S, Munjal YP. Consensus statement for diagnosis of obesity, abdominal obesity and the metabolic syndrome for Asian Indians and recommendations for physical activity, medical and surgical management. Japi. 2009 Feb;57(2):163-70.
13. Abbasi F, Blasey C, Reaven GM. Cardiometabolic risk factors and obesity: does it matter whether BMI or waist circumference is the index of obesity?. The American journal of clinical nutrition. 2013 Sep 1;98(3):637-40.
14. Miralles CS, Wollinger LM, Marin D, Genro JP, Contini V, Dal Bosco SM. Waist-to-height ratio (WHtR) and triglyceride to HDL-C ratio (TG/HDL-c) as predictors of cardiometabolic risk. Nutrición hospitalaria. 2015;31(5):2115-21.
15. Azarpazhooh MR, Najafi F, Darbandi M, Kiarasi S, Oduyemi T, Spence JD. Triglyceride/high-density lipoprotein cholesterol ratio: a clue to metabolic syndrome, insulin resistance, and severe atherosclerosis. Lipids. 2021 Jul;56(4):405-12.
16. Ray S, Talukdar A, Sonthalia N, Saha M, Kundu S, Khanra D, Guha S, Basu AK, Mukherjee A, Ray D, Ganguly S. Serum lipoprotein ratios as markers of insulin resistance: A study among non-diabetic acute coronary syndrome patients with impaired fasting glucose. Indian Journal of Medical Research. 2015 Jan 1;141(1):62-7.
17. Shen W, Punyanitya M, Chen J, Gallagher D, Albu J, Pi-Sunyer X, Lewis CE, Grunfeld C, Heshka S, Heymsfield SB. Waist circumference correlates with metabolic syndrome indicators better than percentage fat. Obesity. 2006 Apr;14(4):727-36.
18. Ebbert JO, Jensen MD. Fat depots, free fatty acids, and dyslipidemia. Nutrients. 2013 Feb 7;5(2):498-508.
19. Kosmas CE, Rodriguez Polanco S, Bousvarou MD, Papakonstantinou EJ, Peña Genao E, Guzman E, Kostara CE. The triglyceride/high-density lipoprotein cholesterol (TG/HDL-C) ratio as a risk marker for metabolic syndrome and cardiovascular disease. Diagnostics. 2023 Mar 1;13(5):929.
20. Lu S, Kuang M, Qiu J, Li W, Zhang M, Sheng G, Zou Y, Peng X. Lipids as the link between central obesity and diabetes: perspectives from mediation analysis. BMC Endocrine Disorders. 2024 Oct 28;24(1):229.
21. Abbasi F, Mathur A, Reaven GM, Molina CR. Cardiometabolic risk in South Asian inhabitants of California: hypertriglyceridemic waist vs hypertriglyceridemic body mass index. Ethnicity & Disease. 2016 Apr 21;26(2):191.