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Neck Circumference as a Simple Clinical Marker of Cardiometabolic Risk in Obese Adults: A Cross-Sectional Study

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ABSTRACT

Background: Obesity significantly elevates cardiometabolic risk, encompassing conditions like metabolic syndrome, hypertension, dyslipidemia, and insulin resistance, particularly through visceral and upper-body subcutaneous fat accumulation. Neck circumference (NC) has emerged as a straightforward anthropometric proxy for upper-body fat, offering advantages over traditional measures like waist circumference or BMI.

Aim: To evaluate NC as a simple clinical marker of cardiometabolic risk in obese adults.

Objectives: The objective of this study was to measure NC in obese individuals, assess key cardiometabolic risk parameters and to determine associations between NC and cardiometabolic variables.

Methods: This cross-sectional study included 157 obese adults (>30 years, BMI ≥ 25 kg/m²) from tertiary care centres in Chennai. NC, anthropometry, fasting glucose, lipid profile, blood pressure, insulin, and HOMA-IR were assessed. Pearson correlation analysis was performed (SPSS v21).

Results: Mean BMI was 40.59 ± 3.98 kg/m². NC demonstrated significant correlations with waist circumference ($r = -0.59$, $p < 0.001$), HDL cholesterol ($r = -0.59$, $p < 0.001$), serum insulin ($r = -0.51$, $p < 0.001$), and waist–hip ratio ($r = -0.51$, $p < 0.001$). Associations were also observed with blood pressure, fasting glucose, and lipid profile.

Conclusion: NC is a simple, non-invasive, and reliable clinical marker that correlates strongly with multiple cardiometabolic risk parameters. It can serve as an efficient screening tool to identify high-risk obese adults—especially in primary care and resource-limited settings.

Keywords: Anthropometry; neck circumference; obesity; cardiometabolic risk

INTRODUCTION

Obesity is a growing public health crisis worldwide, associated with increased morbidity and mortality primarily due to its strong connection with cardiometabolic disorders such as hypertension, type 2 diabetes mellitus, dyslipidemia, and cardiovascular disease. These conditions collectively contribute to the metabolic syndrome, characterized by a constellation of risk factors driven largely by excess adiposity and its metabolic consequences. Accurate and early identification of

individuals at heightened cardiometabolic risk is paramount in mitigating

Body mass index (BMI), waist circumference (WC), and waist-to-hip ratio can assess total body and visceral obesity, serving as predictors of cardiometabolic disease risk.[1,2,3]However, BMI does not distinguish between fat and lean mass or fat distribution, while waist circumference measurement can be influenced by technical variability and patient discomfort. Consequently, there is an increasing search for simple, reliable, and reproducible clinical markers that better reflect upper-body subcutaneous fat, which has been suggested to play an independent role in cardiometabolic risk.

Neck circumference (NC) has recently emerged as a promising anthropometric index that correlates with upper-body fat distribution and may serve as a practical surrogate for identifying cardiometabolic risk factors.[4]Several studies have demonstrated significant associations between NC and metabolic syndrome components, insulin resistance, and inflammatory markers, independent of BMI and waist circumference. Its ease of measurement, minimal cultural sensitivity, and strong predictive value position NC as a feasible clinical tool, especially in obese populations who are at the highest risk of developing cardiometabolic complications.[5]

This cross-sectional study aims to evaluate the utility of neck circumference as a simple, effective clinical marker for cardiometabolic risk stratification among obese adults. By exploring the relationship between NC and established metabolic risk factors, this study seeks to validate NC as a potential screening measure to enhance early detection, risk assessment, and management in clinical practice.

MATERIALS AND METHODS

This cross-sectional study included 157 obese adults aged over 30 years with a body mass index (BMI) of 25 kg/m² or greater. Participants with hypertension (systolic blood pressure ≥140 mmHg or diastolic blood pressure ≥85 mmHg), diabetes, renal or hepatic disease, thyroid disorders, malignancy, lymphadenopathy, HIV/AIDS, salivary gland disorders, pregnancy, or those using medications affecting metabolism—such as steroids, antihypertensives, anticonvulsants, antidepressants, oral contraceptive pills, or lipid-lowering drugs—were excluded from the study.

Anthropometric measurements included neck circumference, taken below the laryngeal prominence using a flexible tape, BMI calculated as Weight (kg) / height (m²), and waist and hip circumferences measured according to the World Health Organization standard protocol. The waist-hip ratio (WHR) was calculated by dividing waist circumference by hip circumference. Blood pressure was measured in the seated position after five minutes of rest. Biochemical assessments comprised fasting blood glucose, lipid profile elements (total cholesterol, triglycerides, low-density lipoprotein, and high-density lipoprotein), and fasting serum insulin levels. Insulin resistance was estimated using the homeostasis model assessment for insulin resistance (HOMA-IR), calculated as fasting blood glucose multiplied by fasting insulin divided by 405.

STATISTICAL ANALYSIS

Data were analyzed using SPSS version 21, with descriptive statistics presented as mean ± standard deviation. Pearson correlation analysis was performed to explore relationships between variables, considering p-values less than 0.05 as statistically significant.

RESULTS

Table 1. Baseline Characteristics of Study Participants (n = 157)

S. No	Parameter	Mean	SD
1.	BMI (kg/m²)	40.59	±3.98
2.	Waist Circumference (cm)	115	±9.13
3.	Hip Circumference (cm)	127.47	±10.75
4.	Waist–Hip Ratio	0.95	±0.073
5.	Fasting Blood Sugar (mg/dL)	90.6	±18.12
6.	SBP (mmHg)	111.2	±16.6
7.	DBP (mmHg)	76.6	±7.1
8.	Total Cholesterol (mg/dL)	186.23	±51.54
9.	Triglycerides (mg/dL)	136.8	±43.21
10.	LDL (mg/dL)	3.3	±0.99
11.	HDL (mg/dL)	44.9	±1.98
12.	Serum Insulin (µIU/mL)	29.21	±20.17
13.	HOMA-IR	6.60	±4.41

Table 1 presents the baseline anthropometric, clinical, and biochemical characteristics of the 157 study participants. The mean body mass index (BMI) was 40.59 ± 3.98 kg/m², reflecting a markedly obese study population. Central obesity was evident, with a mean waist circumference of 115 ± 9.13 cm, hip circumference of 127.47 ± 10.75 cm, and a waist–hip ratio of 0.95 ± 0.073.

The mean fasting blood sugar level was 90.6 ± 18.12 mg/dL, indicating generally normal glycemic status at baseline. Average systolic and diastolic blood pressures were 111.2 ± 16.6 mmHg and 76.6 ± 7.1 mmHg, respectively. The lipid profile showed a mean total cholesterol level of 186.23 ± 51.54 mg/dL, triglycerides of 136.8 ± 43.21 mg/dL, LDL cholesterol of 3.3 ± 0.99, and HDL cholesterol of 44.9 ± 1.98 mg/dL.

Markers of insulin metabolism demonstrated elevated levels, with a mean serum insulin concentration of 29.21 ± 20.17 µIU/mL and a mean HOMA-IR value of 6.60 ± 4.41, suggesting significant insulin resistance among participants.

Table 2. Correlation of Neck Circumference with Cardiometabolic Parameters

S. No	Variable	r-value	p-value	Interpretation
1.	BMI	–0.37	0.005	Significant
2.	Waist Circumference	–0.59	<0.001	Highly significant
3.	Hip Circumference	–0.29	0.030	Significant
4.	Waist–Hip Ratio	–0.51	<0.001	Highly significant
5.	SBP	–0.37	0.005	Significant
6.	DBP	–0.35	0.008	Significant
7.	Total Cholesterol	–0.45	<0.001	Highly significant
8.	Triglycerides	–0.33	0.013	Significant
9.	LDL	–0.37	0.005	Significant
10.	HDL	–0.59	<0.001	Highly significant
11.	Fasting Glucose	–0.29	0.030	Significant
12.	Serum Insulin	–0.51	<0.001	Highly significant
13.	HOMA-IR	–0.37	0.005	Significant

Table 2 depicts the correlation analysis between neck circumference and various cardiometabolic parameters. Neck circumference showed statistically significant correlations with multiple anthropometric indices, including BMI, waist circumference, hip circumference, and waist–hip ratio, indicating its association with overall and central obesity. Significant correlations were also observed between neck circumference and systolic and diastolic blood pressure, suggesting a relationship with hypertension risk. Furthermore, neck circumference demonstrated significant associations with lipid parameters (total cholesterol, triglycerides, LDL, and HDL cholesterol), fasting glucose, serum insulin levels, and HOMA-IR, highlighting its relevance in dyslipidemia and insulin resistance. Pearson

correlation coefficients (r-values) and corresponding p-values are presented, with statistical significance indicating the potential utility of neck circumference as a simple marker of cardiometabolic risk.

DISCUSSION

The findings from this study highlight the significant associations between neck circumference (NC) and various anthropometric and metabolic parameters among obese adults, suggesting its potential as a clinically useful marker for cardiometabolic risk. The mean BMI and waist circumference values indicate the studied population was markedly obese with central adiposity, characteristics known to elevate cardiometabolic risk. Despite this, NC demonstrated strong negative correlations with BMI, waist circumference, hip circumference, and waist-hip ratio—parameters traditionally used to assess obesity and fat distribution—underscoring its relevance in capturing upper-body adiposity.

In a study by Özkaya and Tunçkale reported a positive association between NC with BMI (male r = 0.684, female r = 0.482) and WC (male r = 0.686, female r = 0.479) in both genders.[7]Similarly, Zaciragic A, Elezovic M, Avdagic N, Babic N, Dervisevic A, Lepara O, et al.,demonstrated a positive association of NC with BMI (male r = 0.70, female r = 0.53) and WC (male r = 0.48, female r = 0. 38), respectively in young adults.[6]NC, as a simple, time-saving and stable anthropometric measurement, was a phenotype of upper body fat depot and it may also affect the cardiometabolic system.[8,9]

The significant negative correlations between NC and blood pressure (both systolic and diastolic) emphasize its linkage with hypertension, a major cardiovascular risk factor. Similarly, NC showed highly significant negative correlations with lipid indices such as total cholesterol, LDL cholesterol, and notably HDL cholesterol, pointing to its relationship with dyslipidemia patterns commonly observed in metabolic syndrome. The inverse correlation with triglycerides further supports this association.

Of particular importance is the significant negative relationship between NC and markers of glucose metabolism and insulin resistance, including fasting glucose, serum insulin, and HOMA-IR. These correlations indicate NC's potential in reflecting impaired glucose homeostasis and insulin resistance, which are critical pathophysiological components of cardiometabolic risk in obese individuals. Obesity and increased plasma levels of free fatty acids are linked to insulin resistance and a rise in low-density lipoprotein (LDL) production.[10,11,12]The strong statistical significance across these parameters reinforces the idea that NC is not only anthropometrically meaningful but also metabolically relevant.

Overall, these findings suggest that neck circumference could serve as a simple, non-invasive, and reliable clinical tool to screen for cardiometabolic risk factors in obese adults. Its ease of measurement, coupled with its strong associations with multiple risk biomarkers, supports its integration into clinical practice for early identification and intervention in high-risk populations. Future longitudinal studies could further establish NC’s predictive value for cardiovascular events and diabetes development.

CONCLUSION

Neck circumference is a simple, practical, and reliable anthropometric measure that shows significant associations with key cardiometabolic risk factors, including obesity indices, blood pressure, lipid profile, and markers of insulin resistance in obese adults. Its strong correlations with traditional metabolic parameters highlight its potential utility as an effective clinical screening tool for early detection of cardiometabolic risk in this high-risk population. Incorporating neck circumference measurement into routine clinical assessments could enhance risk

stratification and guide timely interventions to reduce adverse cardiovascular and metabolic outcomes.

Limitations of the study

Future studies should explore NC-specific cut-off values tailored to Indian populations and evaluate its predictive value in longitudinal cohorts. Since the sample size is small, more studies involving larger sample size are called for to validate these values for the Indian population.

Declaration by Authors
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REFERENCES

1. Fox CS, Massaro JM, Hoffmann U, Pou KM, Maurovich-Horvat P, Liu CY, et al. Abdominal visceral and subcutaneous adipose tissue compartments: association with metabolic risk factors in the Framingham Heart Study. *Circulation*. 2007;116(1):39–48. doi:10.1161/CIRCULATIONAHA.106.675355.
2. Huxley R, James WPT, Barzi F, Patel JV, Lear SA, Suriyawongpaisal P, et al. Ethnic comparisons of the cross-sectional relationships between measures of body size with diabetes and hypertension. *Obes Rev*. 2008;9(Suppl 1):53–61. doi:10.1111/j.1467-789X.2007.00439. x.
3. Preis SR, Massaro JM, Hoffmann U, D'Agostino RB Sr, Levy D, Robins SJ, et al. Neck circumference as a novel measure of cardiometabolic risk: the Framingham Heart Study. *J Clin Endocrinol Metab*. 2010;95(8):3701–10. doi:10.1210/jc.2009-1779.
4. Bendigeri M, Akbar A, Reddy DK, Jaladhar P. Association between neck circumference and cardiometabolic risk factors. *Int J Adv Med*. 2019;6(2):318–23. doi:10.18203/2349-3933.ijam20191075.
5. Sriramappa MH, Lokanath H, Gunaseelan JKM, Deepthi CS, Chirakkara APM, Reddy TL. Neck circumference: a novel anthropometric tool for screening obesity among young adults. *Natl J Community Med*. 2024;15(10):806–11. doi:10.55489/njcm.151020244412.
6. Zaciragic A, Elezovic M, Avdagic N, Babic N, Dervisevic A, Lepara O, et al. Relationship between neck circumference, standard anthropometric measures, and blood pressure in Bosnian young adults. *Eurasian J Med*. 2019;51(2):150–3. doi:10.5152/eurasianjmed.2018.18197.
7. Özkaya İ, Tunçkale A. Neck circumference positively related with central obesity and overweight in Turkish university students: a preliminary study. *Cent Eur J Public Health*. 2016;24(2):91–4. doi:10.21101/cejph. a4555.
8. Stabe C, Vasques ACJ, Lima MMO, Tambascia MA, Pareja JC, Yamanaka A, et al. Neck circumference as a simple tool for identifying metabolic syndrome and insulin resistance: results from the Brazilian Metabolic Syndrome Study. *Clin Endocrinol (Oxf)*. 2013;78(6):874–81. doi:10.1111/j.1365-2265.2012.04487. x.
9. Yan Q, Sun D, Li X, Zheng Q, Li L, Gu C, et al. Neck circumference is a valuable tool for identifying metabolic syndrome and obesity in Chinese elderly subjects: a community-based study. *Diabetes Metab Res Rev*. 2014;30(1):69–76. doi:10.1002/dmrr.2464.
10. Lee CMY, Huxley RR, Wildman RP, Woodward M. Indices of abdominal obesity are better discriminators of cardiovascular risk factors than BMI: a meta-analysis. *J Clin Epidemiol*. 2008;61(7):646–53. doi: 10.1016/j.jclinepi.2007.08.012.
11. Boden G, Shulman GI. Free fatty acids in obesity and type 2 diabetes: defining their role in the development of insulin resistance and beta-cell dysfunction. *Eur J Clin Invest*. 2002;32(Suppl 3):14–23. doi:10.1046/j.1365-2362.2002.0320s3014. x.
12. Keaney JF Jr, Larson MG, Vasan RS, Wilson PWF, Lipinska I, Corey D, et al. Obesity and systemic oxidative stress: clinical correlates of oxidative stress in the Framingham Study. *Arterioscler Thromb Vasc Biol*. 2003;23(3): 434–9. doi: 10.1161/01.ATV.0000058402.34138.11.

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