International Journal of Science and Research (IJSR)
ISSN: 2319-7064
Impact Factor 2024: 7.101

To Evaluate the Effectiveness of Neck Circumference as an Innovative and Simple Marker for Detecting Metabolic Syndrome and Associated Cardiometabolic Risk Factors in the Indian Population

Dr. Aditya Tamboli[1], Dr. Anil K Kem[2]

[1]Post Graduate Resident, Department of General Medicine, Saraswathi Institute of Medical Sciences Hapur

[2]Professor and Head of the Department, Department of General Medicine, Saraswathi Institute of Medical Sciences Hapur

Abstract: ***Introduction: Waist circumference (WC) is used as a measure of metabolic syndrome (MeS); neck circumference (NC) can predict MeS. It is simpler to measure and may provide an indication of obstructive sleep apnea (OSA). Materials and methods: NC was measured. The mean NC was correlated with the markers of MeS and sleep apnea. Results: A total of 183 participants were recruited in the study. The average age was 48.13 ± 13.3 years in men and 48.09 ± 11.1 years in women. The mean body mass index (BMI) was 26.42 ± 4.69 kg/m2 in men and 28.25 ± 4.92 kg/m2 in women. The mean WC in men and women were 91.1 ± 12.92 cm and 90.86 ± 12.7 cm, respectively, while the NC was 38.4 ± 6.60 cm in men and 33.9 ± 2.40 cm in women. MeS was diagnosed in 17.6% of men and 12.7% of women. Sleep apnea was noted in 33.1% of males and 29.2% of females. There was a positive correlation between the NC and systolic blood pressure (SBP) (r = 0.316 in males), fasting blood glucose (FBG) (r = 0.522 in males and 0.263 in females), triglyceride (TG) (r = 0.172 in males; 0.320 in females), while highdensity lipoprotein cholesterol (HDL - C) showed a negative correlation in males and females. There was a positive correlation of NC with sleep duration in both males and females (r = 0.346 in males and 0.344 in females). Those with a NC of <35 cm had a sleep score of 7, while those with a NC of >35 cm had a score of 15, showing poor sleep quality. Conclusion: NC was comparable to WC and waist - hip ratio (WHR) for cardiometabolic risk factors and also showed a good association with sleep apnea.***

Keywords: Body mass index, Cardiometabolic risk, Metabolic syndrome, Neck circumference, Sleep apnea.

1. Introduction

Metabolic syndrome (MeS) encompasses various biochemical and physiological parameters. MeS is an important risk factor for heart disease and type 2 diabetes, as defined by the International Diabetes Federation.1 MeS is an important cause of increased morbidity and mortality, especially in the Asian population. Data from various studies have also shown that the presence of MeS poses a greater cardiovascular risk in women compared to men.2 MeS further highlights the importance of the distribution of fat; that is, heart disease is more likely to be associated with abdominal fat compared to fat in other places, such as the hips. Central obesity and insulin resistance play a pivotal role in the above pathogenesis.

Traditionally, markers like waist circumference (WC), waist - hip ratio (WHR), and hip circumference (HC), along with body mass index (BMI), were used as markers for obesity and MeS.3 Some studies have also looked at triceps skinfold thickness as a marker of MeS.4 All these clinical markers prove to be useful in screening patients at high risk for MeS, especially in low - income countries. Obstructive sleep apnea (OSA) is also an important cardiometabolic risk factor. It occurs due to the deposition of fat in the neck region. However, this does not reflect in the WC, HC, or WHR. Hence, a novel concept of neck circumference (NC) has emerged, which also takes into account the fat deposition in the neck. The present markers of MeS can have some fallacies and may be difficult to measure. In some cases, especially in obese patients, WC may not be reliable.

Also, doing a lipid profile would be time - consuming. Keeping this in mind, various other markers have been described in various studies in adults as well as children.5–9 The neck, from man's earliest days, is the most decorated part of the body. But it holds importance in the field of clinical medicine as well. It has been considered that the NC can be used as a marker in the detection of MeS and has the potential to replace the use of WC as a diagnostic marker.10 Many studies on NC have been carried out in different ethnic groups. However, very few studies have been done in India focusing on this aspect. Also, there is a good correlation between OSA and NC, which is an advantage over other traditional anthropometric markers.

2. Materials and Methods

It is a cross - sectional study, conducted on the patients visiting the outpatient Department of Medicine in tertiary care hospital of Uttar Pradesh.

Inclusion Criteria

- Age 30–60 years.
- Those willing to give informed consent.

Exclusion Criteria

- Patients with thyroid disorders.
- Patients with neck malignancy.
- Patients with any neck swellings such as goiter.
- Patients unwilling to give informed consent.

Written informed consent was taken from the study population. The patients were asked to observe an overnight fasting period of 8 hours. NC was measured in the horizontal plane. A single investigator asked the subjects to stand barefoot in an upright position, look ahead, and keep their shoulders relaxed. A plastic tape (calibrated weekly) was used to measure NC (measured to within 0.5 mm). The upper border of the tape was placed just below the Adam's apple and at right angles to the neck.

Weight was measured using a digital scale to within 0.1 kg with loose clothing. A stadiometer (least count 0.1 cm) was used to measure height. WC was measured halfway between the lowest rib and the uppermost point of the iliac crest, and HC was measured at the level of the great trochanters. The skin fold thickness (SFT) was measured over the triceps using a Harpenden caliper.

Body mass index was derived using the weight and height in kg/m2 and WHR by dividing the WC by the HC. Blood pressure (BP) was measured in the right arm in the sitting position after 5 minutes of rest using a calibrated sphygmomanometer. The subjects' various blood parameters were recorded from their files. Blood samples were taken, and processing was done in the biochemistry laboratory of the hospital. Blood sugar was determined by the glucokinase method. An enzymatic calorimetric method was used to measure the total cholesterol (TC), triglyceride (TG), and low - density lipoprotein cholesterol (LDL - C). The selective inhibition method was used to measure high - density lipoprotein cholesterol (HDL - C).

The diagnosis of MeS was as per IDF criteria, that is, WC >90 cm in males and >80 cm in females (South Asians) was used to define central obesity. This measure, along with any two of the below mentioned parameters: • Triglyceride level >150 mg/dL (or on treatment for hypertriglyceridemia). • High - density lipoprotein cholesterol <40 mg/dL in males and <50 mg/dL in females (or on treatment). • High BP >130/85 mm of mercury (or if on medication to treat high BP). • High fasting blood sugar ≥100 mg/dL (or if on anti - diabetic drugs).

Statistical Methods

Mean and standard deviation were used to express continuous variables, while the discrete variables were expressed as frequencies (percentages). Continuous variables were analyzed using Student's t - test or ANOVA. MannWhitney U or Kruskal–Wallis tests were used to compare the nonparametric variables, while categorical variables were compared using the Pearson test or Fisher's exact test. Logistic regression analysis was used to evaluate the association of cardiometabolic risk factors with NC. $P < 0.05$ was considered statistically significant. Before starting the study, Ethics Committee approval was taken from the Institution's Committee.

3. Results

A total of 183 participants aged 30–60 years participated in the study, of which 101 were males and 82 were females. The mean age was 48.13 ± 13.3 years in men and 48.09 ± 11.1 years in women. The mean BMI was 26.42 ± 4.69 kg/m2 in men and 28.25 ± 4.92 kg/m2 in women. The mean WC in men was 91.1 ± 12.92 cm, and in women, WC was 90.86 ± 12.7 cm. The mean NC was 38.4 ± 6.60 cm in men and 33.97 ± 2.40 cm in women.

Metabolic syndrome was diagnosed in 17.6% of men and 12.7% of women. High BP was diagnosed in 38.48 and 25.34% of men and women, respectively. Hyperglycemia was found in 33.9% of men and 28.8% of women. Hypertriglyceridemia was

	WC (cm)	*NC (cm)*	*BMI (kg/m²)*	*HC (cm)*	*WHR*
Males					
SBP	0.372*	0.316*	0.319*	0.214	0.344*
DBP	0.220	0.104	0.183	0.142	0.203
Fasting blood glucose (FBG)	0.054	0.522*	0.085	0.036	0.568
TG	0.227	0.172	0.1229	0.0817	0.360*
HDL	0.197	−0.147	0.178	0.154	0.288
TC	0.024	0.085	0.092	0.078	0.075
LDL	0.238	0.041	0.272	0.133	−0.02
Females					
SBP	0.235	−0.05	0.091	0.143	0.187
DBP		0.035	−0.017	0.172	−0.04
FBG	−0.115	0.263	0.098	0.112	0.02
TG	0.131	0.32	0.194	0.181	0.216
HDL	0.070	−0.082	0.033	0.219	0.002
LDL	0.063	0.22	−0.016	0.185	0.319*

found in 28.76% of men and 26.5% of women. Decreased HDL cholesterol was found in 22.6% of males and 23.2% of females. Increased LDL cholesterol was detected in 35.6% of males and 33.8% of females. Sleep apnea was noted in 33.1% of males and 29.2% of females.

Neck circumference correlated positively with systolic blood pressure (SBP) (r = 0.316 in males), FBS (r = 0.522 in males and 0.263 in females), and TG (r = 0.172 in males; 0.320 in females), while there was a negative correlation of NC with HDL - C in both sexes. NC was positively correlated with sleep duration in both males and females (r = 0.346 in males and 0.344 in females). Those with a NC <35 cm had a sleep score of 7, while those with a NC >35 cm had a score of 15, showing poor sleep quality. Neck circumference was comparable to WC and WHR for cardiometabolic risk factors and also showed a good association with sleep apnea.

4. Discussion

The aim of this study was to determine if there was any association of NC with cardiometabolic risks and also to compare NC with the traditional anthropometric indices as a predictor of MeS. It was a cross - sectional study involving 183 patients from India. The study demonstrated a significant association of NC with cardiometabolic risk factors and showed that NC can be used to predict cardiometabolic risks in both males and females. Neck Circumference and Metabolic Syndrome Obesity is widely associated with metabolic disorders and a high cardiovascular morbidity and mortality, as seen in a study by Nikolopoulou and Kadoglou.2 Traditional anthropometric markers like BMI, WC, and WHC are used to define obesity, as shown in studies from WHO.

5. Conclusion

A significant association of NC with cardiometabolic risk factors was observed in our study beyond the classical anthropometric indices. NC is easily measured in comparison to WC and WHR. In addition, NC is not affected by ascites. NC also takes into account the neck fat, which contributes to sleep apnea.

References

[1] Alberti KGMM, Zimmet P, Shaw J. Metabolic syndrome—a new world - wide definition. A consensus statement from the International Diabetes Federation. Diabet Med 2006; 23: 469–480.
[2] Nikolopoulou A, Kadoglou NPE. Obesity and metabolic syndrome as related to cardiovascular disease. Expert Rev Cardiovasc Ther 2012; 10: 933–939.
[3] Ashwell M, Gunn P, Gibson S. Waist - to - height ratio is a better screening tool than waist circumference and BMI for adult cardiometabolic risk factors: systematic review and meta - analysis. Obes Rev 2012; 13: 275–286.
[4] Vasheqhani Farahani A, Majidzadeh - A K, Masoudkabir F, et al. Sagittal abdominal diameter to triceps skinfold thickness ratio: a novel anthropometric index to predict premature coronary atherosclerosis. Atherosclerosis 2013; 227: 329–333.
[5] Ben - Noun L, Sohar E, Laor A. Neck circumference as a simple screening measure for identifying overweight and obese patients. Obes Res 2001; 9: 470–477.
[6] Ben - Noun L, Laor A. Relationship of neck circumference to cardiovascular risk factors. Obes Res 2003; 11: 226–231.
[7] Kurtoglu S, Hatipoglu N, Mazicioglu MM, et al. Neck circumference as a novel parameter to determine metabolic risk factors in obese children. Eur J Clin Invest 2012; 42: 623–630.
[8] Onat A, Hergenc G, Yuksel H, et al. Neck circumference as a measure of central obesity: associations with metabolic syndrome and obstructive sleep apnea syndrome beyond waist circumference. Clin Nutr 2009; 28: 46–51.
[9] Preis SR, Pencina MJ, D'Aqostino RB Sr, et al. Neck circumference and the development of cardiovascular disease risk factors in the Framingham heart study. Diabetes Care 2013; 36: e3.
[10] Preis SR, Massaro JM, Hoffmann U, et al. Neck circumference as a novel measure of cardiometaboolic risk: the Framingham heart study. J Clin Endocirnol Metab 2010; 95: 3701–3710.