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Research Article

NECK CIRCUMFERENCE AS AN INDICATOR OF OBESITY IN YOUNG ADULTS

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ABSTRACT

Objective: Neck circumference (NC) is considered to be an indicator of upper-body subcutaneous adipose tissue distribution. An upper body distribution of fat, especially with increased visceral adipose tissue, is considered to be predictive of cardiometabolic outcomes. Therefore, in this study, we have studied the relationship between NC and the conventional marker of obesity, namely, body mass index (BMI) and also the triglyceride levels in a group of young adults.

Methods: There were 60 participants in this study in the age group of 18-42 years of both genders with no known major medical conditions (viz., diabetes, coronary artery disease, hypertension, thyroid diseases, or malignancy) NC was measured at mid-neck height. The analysis of serum triglycerides was carried out after an overnight fast using Beckman Coulter autoanalyzer.

Results: A significantly positive correlation was found between NC and BMI ($r=0.8154$, $p<0.0001$). A positive correlation was found between NC and triglyceride levels ($r=0.0316$, $p=0.9934$).

Measurement of NC may be more useful in morbidly obese people, bedridden patients, and pregnant women. NC is found to have a positive correlation with insulin resistance and various components of the metabolic syndrome.

Conclusion: NC can be considered as a simple, useful, and reliable tool to identify overweight and obesity. This can be used as an alternative method to assess the fat distribution in health-care centers and also in population studies.

Keywords: Obesity, Body mass index, Neck circumference.

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INTRODUCTION

Obesity is one of the most important risk factors for various cardiometabolic diseases namely diabetes, hypertension, dyslipidemia, and coronary heart disease [1-3]. With the increasing proportions of the global prevalence of obesity, it becomes important to identify measures of obesity in a quick and accurate manner. An early and quick assessment of obese individuals may help to improve the stratification of disease risk and also help in planning prevention and intervention strategies in an effective manner [4].

Body mass index (BMI) is one of the most widely used tools to assess the weight status in adults and children [5] despite the advantages of ease of measurement and interpretation, BMI is associated with significant limitations as not representing the body fat distribution [6,7]. An upper body distribution of fat, especially with increased visceral adipose tissue (VAT), is considered to be predictive of cardiometabolic outcomes [8-10].

Computed tomography and MRI and dual-energy X-ray absorptiometry are considered to be the gold standard methods for measuring visceral fat [11]. However, these techniques are expensive and not feasible for large epidemiological studies or routine use [12].

Neck circumference (NC) is a marker of upper body subcutaneous adipose tissue distribution and is considered to be a reliable index for obesity [13].

NC measurement is a simple and time-saving screening measure that can be used to identify overweight and obese individuals [14]. Type II diabetes mellitus is associated with and obesity regardless of age, race, and gender [15]. Regional adipose tissue handles and stores excess dietary energy, which may result in significant cardiometabolic implications. Therefore, the distribution of this regional adipose tissue or ectopic fat may be an important vascular risk in addition to overall obesity. Among the various ectopic fat deposition, the VAT is regarded as the most pathogenic fat depot, beyond the standard obesity indices [16]. Visceral adiposity predicts hepatic insulin resistance in patients with diabetes mellitus [17].

Waist circumference (WC) has long been used as a measure of central adiposity, and many studies have reported the strong association of WC with cardiovascular and metabolic risk [18,19]. However, it includes both visceral and subcutaneous fat [20]. Enzyme analysis may also be useful to assess the visceral fat deposition in the body. Serum gamma-glutamyltransferase levels have been reported to be a simple and reliable marker of obesity [21].

An independent association of NC with visceral adiposity and BMI has been demonstrated by the Framingham heart study [22]. NC has shown to have a positive correlation with insulin resistance and various components of the metabolic syndrome [10,23]. Since anthropometric assessment is easy and practical, the NC can be used as an early predictor for excess body fat in children also [24]. Unlike the WC, measurement of NC does not show variations throughout the day.

NC as an indicator of upper-body subcutaneous adipose tissue distribution has been investigated as a screening tool to identify overweight individuals due to its ease in measurement and in being inexpensive and noninvasive. Therefore, in this study, we have studied the relationship between NC and the conventional marker of obesity,

Table 1: Correlation between NC and BMI

Parameters	Mean±SD value	Regression value	p value
Neck circumference (cm)	40.5±3	0.8154	<0.0001
BMI (kg/mt^2)	24.2±5.1		

NC: Neck circumference, BMI: Body mass index, SD: Standard deviation

Table 2: Correlation between NC and triglycerides

Parameters	Mean±SD value	Regression value	p value
NC (cm)	40.5±3	0.0316	<0.9934
Triglycerides (mg/dl)	179.8±84.6		

NC: Neck circumference, SD: Standard deviation

namely, BMI and also the triglyceride levels in a group of young adults.

METHODS

The study was conducted after obtaining approval from the Institutional Ethics Committee (661/IEC/2014). There were 60 participants in the study in the age group of 18-42 years of both genders with no known major medical conditions (viz., diabetes, coronary artery disease, hypertension, thyroid diseases, or malignant disease) all the subjects were recruited from the master health checkup program of our medical college hospital. Those who were on lipid-lowering drugs were not recruited for the present study.

Informed consent was obtained from all of them. All measurements were made by one investigator using standard techniques as follows: weight by standardized digital scales to within 100 g, without heavy clothing; height by standardized stadiometer to within 0.5 cm, while barefoot. NC was measured at mid-neck height, between mid-cervical spine and mid-anterior neck, to within 1 mm, with plastic measuring tapes. In men with a laryngeal prominence (Adam's apple), NC was measured just below the prominence. All the measurements were taken with the participants in upright posture and facing the investigator, with their shoulders relaxed.

After an overnight fast, 3 ml of venous blood sample was collected from the participants using a vacutainer. Analysis of triglycerides was carried out using Beckman Coulter automated clinical chemistry analyzer by means of standard biochemical procedures in the clinical biochemistry laboratory at our medical college hospital.

RESULTS

We examined the relationship between NC and BMI. The linear regression analysis was carried out on a scatter plot of NC and BMI. The Pearson's correlation coefficient was determined. A significantly positive correlation was found between NC and BMI ($r=0.8154$, $p<0.0001$).

We examined the relationship between NC and triglycerides levels. The linear regression analysis was carried out on a scatter plot of NC and triglycerides levels. The Pearson's correlation coefficient was determined. A positive correlation was found between NC and Triglycerides levels ($r=0.0316$, $p=0.9934$).

DISCUSSION

Obesity is a known risk factor for the development of various cardiovascular and metabolic disturbances. Obesity is usually assessed by BMI, WC, and waist/hip ratio. An independent association of NC with visceral adiposity and BMI has been demonstrated by the Framingham heart study [20]. We have observed a positive correlation between NC and BMI in our study Table 1. An upper body distribution of fat, especially with increased VAT, is considered predictive of cardiometabolic conditions [8-10].

Several studies have shown a significant positive association of NC with BMI and WC [23,25,26]. Due to cultural factors, the measurement of hip or WC may be difficult in certain situations [26]. Measurement of NC may be more useful in morbidly obese people, bedridden patients, and pregnant women [27].

A positive association has been reported between NC and serum triglyceride levels in our study Table 2. The upper body subcutaneous fat depots are one of the main determinants of the systemic-free fatty acid concentrations [28]. The free fatty acid release from upper body subcutaneous fat has been reported to be larger than that from lower-body subcutaneous fat. The measurement of upper body subcutaneous adipose tissue depots assumes greater relevance in this regard [23].

The association observed between neck fat, and components of metabolic syndrome may be attributed to an excess release of free fatty acids into plasma from the upper body subcutaneous fat [10]. NC is found to have a positive correlation with insulin resistance and the various biochemical components of the metabolic syndrome.

The NC was found to correlate with the various components of the metabolic syndrome, namely, high triglycerides and fasting glucose levels, low high-density lipoprotein cholesterol levels, and insulin resistance index in a large population-based study [10,22].

The Korean Genome and Epidemiology Study involving 10038 subjects reported a positive correlation of NC with serum triglyceride levels [29]. The limitations of our study are that the participants were chosen from a single center and only single estimations of the anthropometric measurements and blood estimations were carried out.

In conclusion, NC can be considered as a simple, useful, and reliable tool to identify overweight and obesity. This can be used as an alternative method to assess the fat distribution in health-care centers and also in population studies.

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AUTHORS CONTRIBUTION

All the authors have contributed equally.

CONFLICTS INTEREST

All authors have no conflicts of interest to declare.

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