بسم الله الرحمن الرحيم

Evaluation of Neck circumference measurement as an indicator of obesity (a hospital based study)

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«رَبَّنَا عَلَيْكَ تَوَكَّلْنَا وَإِلَيْكَ أَنَبْنَا وَإِلَيْكَ الْمَصِيرُ»

(الممتحنة: الآية ٤)

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Abbreviations

- **AIDS**: Acquired immune deficiency syndrome.
- **ASAT:** Abdominal subcutaneous adipose tissue.
- **AT:** Adipose tissue.
- **ATP III**: Adult Treatment Panel III.
- **BMI**: Body mass index.
- **BP:** blood pressure.
- **CHD:** Coronary heart disease.
- **CVD**: Cardiovascular disease.
- **CMRF**: Cardio metabolic risk factors.
- **DBP:** Diastolic blood pressure.
- **DM:** Diabetes mellitus.
- **ED:** Erectile dysfunction.
- **FBS:** Fasting blood sugar
- **FFM:** Fat free mass.
- **FM**: Fat mass.
- **GERD:** Gastro esophageal Reflux disease.
- **HBP:** High blood pressure.
- **HDL**: High density lipoprotein.
- **HPA:** Hypothalamo-pituitary adrenal
- **HRT:** Hormone replacement therapy.
- **IDF:** International diabetes federation
- **ISH:** Isolated systolic hypertension.
- **LBM:** Lean body mass
- **MS**: Metabolic syndrome.
- **NAFLD:** Nonalcoholic fatty liver disease.
- **NASH**: Nonalcoholic steatohepatitis.

- **NC:** Neck circumference.
- **NPV:** Negative predictive value**.**
- **NIDDM:** Non-insulin-dependent diabetes mellitus
- **NIH:** National institutes of health.
- **NT :** Normotensives
- **OA :** Osteoartheritis
- **OSAS:** Obstructive sleep apnea syndrome.
- **PIH:** Pregnancy induced hypertension.
- **PPS:** Post prandial sugar.
- **PPV:** Positive predictive value.
- **ROC:** Recipient operating characteristics.
- **SD:** Standard deviation**.**
- **SBP:** Systolic blood pressure.
- **TAAT**: Total abdominal adipose tissue.
- **TC:** Total cholesterol.
- **UA:** Uric acid.
- **USA:** United States of America.
- **VAT:** Visceral adipose tissue.
- **WC:** Waist circumference.
- **WHO:** World health organization.
- **WHR:** Waist hip ratio.

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Abstract

***Aim of the study*:** The study aims at diagnosis of obesity cases through simple, time saving measurement that helps early intervention and thus reducing the obesity problem and its consequences among Egyptian population.

***Subjects and methods*:** A cross-sectional descriptive study conducted in the faculty of dentistry -Cairo university clinic. In which 401 Egyptian adults (18-70 years old) both genders were participated. Data was collected by a special designed questionnaire completed by the investigator .Weight ,height ,neck ,waist and hip circumferences were measured according to standard procedure as well as blood pressure measurements for the entire studied sample (401 subjects) .Blood examination were done for a sub sample of 130 subjects After a 10 hours fasting, blood samples were sent to the laboratory for analyses of, fasting blood glucose, HDL-cholesterol, triglycerides and serum uric acid using standard biochemical procedures

***Results*:** NC was found positively correlated with obesity anthropometric diagnostic tools (BMI, WC and WHR) among the studied males and females. Through recipient operating characteristic (ROC) analysis, the optimal NC of (39.5 cm, 32.5cm) was considered equivalent to BMI ≥30 kg/m2, with sensitivity (84.6%, 89.2%) and a specificity of (66.7%, 63.2%) for males and females respectively. An optimal NC of (39.5 cm, 32.5cm) was considered equivalent to WC≥ 102cm, ≥88cm with sensitivity (80.2%,97.4%) and a specificity of (58.8%,81.3%) for males and females respectively. NC was found positively correlated with changes in both systolic Bp and diastolic BP among the studied males and females .On examining the relationship between NC measurement and the presence of some factors which are related to increased cardio metabolic risk, a positive correlation was found between changes in NC and FBS and triglycerides, also negative correlation was found between NC and HDL cholesterol among studied females. While No significant statistical relation was found between NC any laboratory investigation tested among studied males

Conclusion: NC is a reasonable, reliable, simple, quick method for the assessment of obesity in primary care clinics to consider it as a screening test. Men with NC≥ 39.5cm and women with ≥32.5cm require additional comprehensive evaluation of their obesity status. NC is related to both systolic and diastolic hypertension among males and females. It is related also to some elements of increased cardio metabolic risk (fasting blood sugar, triglycerides, HDL cholesterol) among studied females.

***Key words*:** Obesity, neck circumference, indicator.

Introduction

Obesity is defined as abnormal or excessive fat accumulation that may impair health. Once considered a problem only in high-income countries, obesity is now dramatically on the rise in low- and middle-income countries, particularly in urban settings .The estimated prevalence of obesity in Egypt in 2005 was 22.5%,45.5% among males and females respectively ***(WHO, 2006).***

WHO, (2005) projections indicated that globally at least 400 million adults age 18 years and above were obese and approximately more than 700 million will be obese by the year 2015.

In ***Egypt*** The prevalence of obesity was found 18.7%,46.6% among males and females respectively in a population based study conducted by ***Shaheen et al.,(2004).***while in another study conducted by ***Hassan et al.,(2004)*** it was found it to be 28.6%.42.1% among males and females respectively .

WHO, (2006) defines obesity as a body mass index equal to or more than 30kg/m^2. This cut-off point provides a benchmark for individual assessment, and there is evidence that risk of chronic disease in different population increases progressively as BMI increases. Obesity leads to serious health consequences such as:

- Cardiovascular disease (mainly heart disease and stroke) - already the world's number one cause of death- killing 17 million people each year.
- Diabetes that has rapidly become a global epidemic. WHO projects that diabetes death will increase by more than 50% worldwide in the next 10 years.
- Musculoskeletal disorders – especially osteoarthritis.
- Some cancers (endometrial, breast, and colon) ***(WHO, 2006).***

There are numerous methods of assessing obesity. Some techniques are applicable at primary care facilities, such as measurements of weight, height, abdominal sagittal diameter, abdominal and hip circumferences, and calculations of waist to hip ratio and BMI. It is not always practical to use these techniques, especially in winter, in busy, everyday primary care practice. Other procedures, such as ultrasound, computed tomography and

magnetic resonance imaging are expensive and are primarily used for research purposes ***(Bjorntorp. 2001).***

Jean Vague was the first researcher to realize that different body morphology or types of fat distribution are related to the health risks associated with obesity. He used a neck skin fold in his index of masculine differentiation to assess upper-body fat distribution ***(Vague, 1956)*** .

Furthermore, the free fatty acid release from upper-body subcutaneous fat was found to be larger than that from lower-body subcutaneous fat a fact that further strengthens the relevance of measuring upper-body subcutaneous adipose tissue depots. These observations indicated that neck circumference (*NC*) as an index of upper body fat distribution can be used to identify obese patients ***(Jensen, 1997).***

As a first step to achieve obesity control, it is important to develop a reliable, more simple and time saving method for the assessment of obesity in primary care clinics ***Ben-Noun et al.,(2001)*** studied the relation between *NC* and other anthropometric measurements used to diagnose obesity *(BMI,WC,WHR)* and concluded that neck circumference measurement is correlated with obesity. Another study confirming that was done by ***Carlos .et al., (2005)*** who studied Body compositions obtained by anthropometry and bio-impedance and some body indices and found *NC* correlated positively with weight, percent body fat determined by bio-impedance and anthropometry, *BMI* , and negatively with lean body mass (*LBM*) calculated by anthropometry and bio-impedance.

Although obesity results in metabolic abnormalities, upper-body obesity is more strongly associated with glucose intolerance, hyperinsulinemia, diabetes, hypertriglyceridemia, gout, and uric calculous disease than is lower-body obesity (***Kissebach. et al., 1982)***

NC, as an index of upper-body subcutaneous adipose tissue distribution, was evaluated in relation to cardiovascular risk factors by ***Sjostrom. et al., (1995)*** they concluded that estimated *LBM*, visceral and subcutaneous adipose tissue masses measured by computed tomography as well as neck circumference (used in this study to indicate subcutaneous adipose tissue distribution) are independently related to cardiovascular risk factors in severely obese.

Carlos .et al.,(2005) and Ben-Noun et al., (2004) found *NC* correlated with blood pressure. *NC* was also found positively correlated with some factors related to metabolic syndrome; therefore, it is likely to increase the risk of coronary heart disease (***Ben-Noun et al., 2003).***Further more ,*NC* was found correlated with biochemical variables included uric acid, *HDL* and *LDL* cholesterol***(Carlos .et al., 2005).***

These findings have not been examined yet in Egypt; this study is conducted to verify these findings among Egyptians.

Research question

Can Neck circumference reflect the obesity status of the individual?

Aim

The study aims to diagnosing obesity through a simple, time saving measurement that helps early intervention and thus reducing the obesity problem and its consequences among Egyptian population.

Specific Objectives

- To test the validity of neck circumference (NC) as a screening measurement for obesity against (body mass index, waist circumference and waist to hip ratio) as standards used to identify obesity.
- To test the relationship between NC and blood pressure measurement.
- To test the relationship between NC and some factors related to cardio metabolic risk **.**

The "Globesity" concept

The global epidemic of obesity - "Globesity" - is rapidly becoming a major public health problem in many parts of the world. Paradoxically coexisting with under nutrition in developing countries, the increasing prevalence of o obesity is associated with many diet-related chronic diseases including diabetes mellitus, cardiovascular disease, stroke, hypertension and certain cancers ***(WHO, 2008).***

Obesity is a major public health and economic problem of global significance. Prevalence rates are increasing in all parts of the world, both in affluent Western countries and in poorer nations. Men, women and children are affected. Indeed, overweight, obesity and health problems associated with them are now so common that they are replacing the more traditional public health concerns such as under nutrition and infectious disease as the most significant contributors to global ill health (***WHO, 1998).***

Obesity has reached epidemic proportions globally, with more than 1 billion adults overweight - at least 300 million of them clinically obese - and is a major contributor to the global burden of chronic disease and disability. Often coexisting in developing countries with under-nutrition, obesity is a complex condition, with serious social and psychological dimensions, affecting virtually all ages and socioeconomic groups (***WHO, 2008).***

Definition of obesity

Obesity is an excessive accumulation of energy in the form of body fat, which impairs health (***WHO, 1997).*** It is a complex multi-factorial chronic disease that develops from an interaction of genotype and the environment. The understanding of how and why obesity develops is incomplete, but involves the integration of social, behavioral, cultural, physiological, metabolic and genetic factors ***(NIH, 1998).***

Hill, (1998) described obesity as a chronic complex condition, with serious social and psychological dimensions, affecting virtually all ages and socioeconomic groups. A chronic disease is disruption of body functions that develops slowly, sometimes insidiously, and persists for an extended period, often for the life of the affected individual.