Hypertriglyceridemic Waist in Hypertensive Patients
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Abstract

Background: The adoption of different criteria to determine the occurrence of the hypertriglyceridemic waist (HTW) can result in inaccurate interpretations, compromising the diagnosis of patients at risk of developing cardiovascular diseases.

Objective: To evaluate the diagnostic agreement of HTW using different cut-off points for waist circumference in hypertensive patients.

Methods: Cross-sectional study including 120 patients of both sexes, aged 30 to 74 years and receiving care on an outpatient basis. We assessed the participants’ anthropometric data (weight, height, and waist circumference) and determined their serum triglycerides levels. The diagnosis of HTW was defined by concurrent increased waist circumference and hypertriglyceridemia. The agreement among the diagnoses of HTW was assessed with the kappa index.

Results: In adults of both sexes, the HTW had a higher prevalence (28%) when determined by the criteria defined by the International Diabetes Federation (IDF) and the World Health Organization (WHO) than by those defined by the National Cholesterol Education Program - Adult Treatment Panel III (NCEP-ATP III, 22.7%). We identified an almost perfect agreement (0.864) between the diagnosis of HTW determined by the cut-off points of the IDF versus NCEP-ATP III and by the WHO versus NCEP-ATP III. The correlation was perfect between the diagnoses established by the IDF and WHO.

Conclusion: The cut-off points for waist circumference proposed by the IDF and WHO was better than those by the NCEP-ATP III to characterize individuals with HTW. (Int J Cardiovasc Sci. 2016;29(3)175-180)

Keywords: Hypertriglyceridemic Waist; Obesity, Abdominal; Hypertension; Waist Circumference; Hypertriglyceridemia.

Introduction

Chronic non-communicable diseases are an important health problem and comprise 72% of the causes of death worldwide.¹ Among them, cardiovascular diseases (CVD) affect approximately one-third of the overall world population and are responsible for elevated health care costs due to an increased frequency of hospital admissions.¹⁻³

With the increase in CVD prevalence, it becomes necessary to identify methods capable of detecting earlier those patients at higher risk of developing these diseases.⁴ Within this context, anthropometric indicators have been used as a tool to identify the occurrence of a high cardiovascular risk. Studies have shown an association between anthropometric indicators such as waist circumference (WC), WC/height, and hip circumference (HC) with cardiometabolic changes, mainly associated with lipid profile, fasting blood glucose, and insulin resistance.⁵⁻⁷

The hypertriglyceridemic waist (HTW) has been recently proposed as one of the tools to identify
individuals at a higher risk of developing CVD. The occurrence of HTW is determined by concurrent hypertriglyceridemia and increased WC. According to the literature, the HTW is a predictor of the atherogenic metabolic triad (hyperinsulinemia, high levels of apolipoprotein B, and increased concentrations of small, dense low-density lipoprotein [LDL-c] particles), in addition to identifying individuals at risk of developing coronary artery disease (CAD), acute myocardial infarction, and other cardiometabolic diseases associated with visceral obesity.8-12

The evaluation of the HTW is simple, of low cost, non-invasive, and may assist in identifying excessive visceral adipose tissue and predicting cardiometabolic changes, contributing in clinical practice as an investigative tool13,14 to screen individuals at higher cardiometabolic risk.1

However, the lack of standardization related both to the description of the measuring techniques, as well as the cut-off points for WC (which vary according to age, sex, and ethnic group) may limit the comparison of the results of the studies.7

Therefore, the objective of this study was to evaluate the diagnostic agreement of HTW using different classification criteria for the WC in hypertensive patients undergoing ambulatory care.

Methods

This was a cross-sectional study carried out in an outpatient nutrition clinic in a university hospital in the city of Salvador (Bahia, Brazil). The data were collected from September 2013 to January 2014 during medical appointments. All investigators evaluating the patients received training in order to standardize the data collection.

The sample comprised 120 patients of both sexes, aged 30 to 74 years, with a clinical diagnosis of hypertension previously defined in their medical records.

The following factors were used as exclusion criteria: pregnancy or lactation; neurological and/or motor sequel that could hinder proper understanding about the study and/or collection of anthropometric data; history of myocardial infarction or angina pectoris; and lack of signature in the informed consent form. The project was approved by the Research Ethics Committee of the Nutrition School at Bahia Federal University under the number 376,452. All participants signed an informed consent form.

We collected data regarding the sex and age of the participants, as well as serum triglycerides (TG) levels, which were considered increased when ≥150.0 mg/dL.15 Weight and height were measured according to recommendations by the WHO16 and Lohman et al.17 The WC was measured with an inelastic tape positioned midway between the superior border of the iliac crest and the inferior border of the lowest rib, also according to WHO recommendations18 and considering the cut-off points proposed by the WHO,19 IDF,19 and NCEP-ATP III20 (Table 1).

The HTW was characterized by the concurrence of increased WC and hypertriglyceridemia, as shown in Table 1.

Data analysis was performed using the software Statistical Package for Social Sciences (SPSS), version 20.0. The population was characterized using frequencies for categorical variables and means and standard deviations for continuous variables. The agreement between the prevalence of HTW by different cut-off points for the WC was assessed using the kappa index.21 The significance level for p values was < 0.05.

Results

The HTW prevalence was 26.3% when determined by the cut-off points recommended by the WHO and the IDF, and 23.2% when calculated by the cut-off points suggested by the NCEP-ATP III. Regarding the sex of the participants, the HTW phenotype was more prevalent in men (30%) than women (26.3%) when determined by the IDF and WHO criteria; however, the prevalence was higher in women (23.2%) than men (15%) when determined by the NCEP-ATP III criteria (Table 2).

Regarding age, we identified a higher prevalence of the HTW phenotype in adults when compared with elderly individuals of both sexes. Using the cut-off points for the WC set by the IDF and WHO criteria, the prevalence of HTW was 28%; in contrast, it was 22.7% when determined by the NCEP-ATP III criteria. In the elderly population, we found an HTW prevalence in both sexes of 25% for the HTW determined by the IDF and WHO criteria and 20.5% by the NCEP-ATP III criteria (Table 2).

When we evaluated the diagnosis of HTW using the cut-off point for WC suggested by the IDF and WHO, we found a perfect agreement between both (kappa = 1.0; p = 0.001). The agreement between the diagnoses of HTW was almost perfect when we evaluated the cut-off points for WC determined by the IDF and the NCEP-ATP III (kappa = 0.864; p = 0.054), and by the WHO and the NCEP-ATP III (kappa = 0.864; p = 0.054) (Table 3).
### Table 1
Diagnosis of hypertriglyceridemic waist according to different criteria for waist circumference measurements

<table>
<thead>
<tr>
<th>HTW</th>
<th>Waist circumference (cm)</th>
<th>Triglycerides (mg/dL)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Male</td>
<td>Female</td>
</tr>
<tr>
<td>IDF</td>
<td>≥ 90.0</td>
<td>≥ 80.0</td>
</tr>
<tr>
<td>WHO</td>
<td>≥ 94.0</td>
<td>≥ 80.0</td>
</tr>
<tr>
<td>NCEP-ATP III</td>
<td>&gt; 102.0</td>
<td>&gt; 88.0</td>
</tr>
</tbody>
</table>


### Table 2
Prevalence of hypertriglyceridemic waist in hypertensive patients receiving outpatient care, using the waist circumference determined by different cut-off points, Salvador-BA, 2014

<table>
<thead>
<tr>
<th></th>
<th>HTW IDF (%)</th>
<th>HTW WHO (%)</th>
<th>HTW NCEP-ATP III (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Men</td>
<td>30.0</td>
<td>30.0</td>
<td>15.0</td>
</tr>
<tr>
<td>Women</td>
<td>26.3</td>
<td>26.3</td>
<td>23.2</td>
</tr>
<tr>
<td>Adults</td>
<td>28.0</td>
<td>28.0</td>
<td>22.7</td>
</tr>
<tr>
<td>Elderly</td>
<td>25.0</td>
<td>25.0</td>
<td>20.5</td>
</tr>
</tbody>
</table>


### Table 3
Agreement among the diagnoses of hypertriglyceridemic waist determined by different cut-off points for waist circumference, Salvador-BA, 2014

<table>
<thead>
<tr>
<th>Kappa index</th>
<th>HTW IDF</th>
<th>p</th>
<th>HTW WHO</th>
<th>p</th>
<th>HTW NCEP-ATP III</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>HTW IDF</td>
<td>-</td>
<td></td>
<td>1.0</td>
<td>0.001</td>
<td>0.864</td>
<td>0.054</td>
</tr>
<tr>
<td>HTW WHO</td>
<td>1.0</td>
<td>0.001</td>
<td>-</td>
<td></td>
<td>0.864</td>
<td>0.054</td>
</tr>
<tr>
<td>HTW NCEP-ATP III</td>
<td>0.864</td>
<td>0.054</td>
<td>0.864</td>
<td>0.054</td>
<td>-</td>
<td></td>
</tr>
</tbody>
</table>

When we compared the diagnosis of HTW using the cut-off points for WC determined by the NCEP-ATP III with those by the IDF and WHO, we found that 18.8% of the patients diagnosed with HTW by the IDF and WHO failed to be diagnosed by the NCEP-ATP III.

Discussion

The present study investigated the agreement between the occurrence of HTW evaluated by different cut-off points for the WC and found that when using the reference values proposed by the IDF and WHO, the agreement for the diagnosis of HTW was perfect. The HTW has been proposed as a diagnostic tool to identify individuals with the atherogenic metabolic triad (hyperinsulinemia, high levels of apolipoprotein B, and increased concentrations of small and dense LDL-c particles), a condition that predisposes individuals to a high risk of cardiovascular events. It is now well known that HTW is associated with chronic non-communicable diseases such as hypertension, CAD, insulin resistance, and diabetes. HTW is also a predictor of cardiac events and higher mortality due to CVD, and is considered an important marker of cardiometabolic risk factors.

A study conducted by Lemieux et al. (2000) found that individuals with a diagnosis of HTW when compared with others with WC and TG levels within the normal range, were 3.6 times more likely to develop CAD and other heart diseases.

In the present study, the prevalence of the HTW phenotype in adults of both sexes was similar to that found in a study published by Díaz-Santana et al. (20.1%) evaluated on the basis of the cut-off point for WC suggested by the NCEP-ATP III.

In a study in adult women with hypertension conducted in northeast Brazil, the prevalence of HTW was higher (33%) than that observed in women in our study (23.2%) when the HTW was identified using the NCEP-ATP III cut-off point for WC.

In a study in adult women with hypertension conducted in northeast Brazil, the prevalence of HTW was higher (33%) than that observed in women in our study (23.2%) when the HTW was identified using the NCEP-ATP III cut-off point for WC.

Blackburn et al. (2009) observed the occurrence of HTW in 28% of healthy adults and 25% of elderly individuals when evaluated with the IDF and WHO criteria. These prevalences were similar to those found in the present study in populations of adults and elderly individuals.

Manrique-Vera et al. found an HTW frequency of 30.0% in their population when evaluated according to the values of WC determined by the WHO, with no significant difference between men (29.7%) and women (30.3%). We identified similar values in the present study when the HTW was determined according to the cut-off points for WC determined by the WHO.

The cut-off point for the WC proposed by the IDF is lower than that recommended by the WHO and NCEP-ATP III. As in the present study, others using the cut-off point determined by the IDF also found a higher prevalence of HTW.

As a result of using different cut-off points to characterize an increased WC and hypertriglyceridemia, the prevalence of HTW is quite variable. These differences hinder a comparison of the results found in different studies. Additionally, the absence of a standardization of the location to obtain the measurements and the cut-off points for the WC among different populations, age, and sex may interfere with the diagnosis of HTW and, consequently, identification of patients with cardiometabolic risk, since these differences may underestimate or overestimate the prevalence of HTW in the studied populations.

Studies have investigated the cut-off points for WC proposed by the different organizations. Barbosa et al. used the cut-off point defined by the NCEP-ATP III and found it unsuitable for their population due to lack of sensitivity and underestimation of the diagnosis of obesity, dyslipidemia, and, consequently, metabolic syndrome. In this context, there is a paucity of studies assessing the influence of different cut-off points to classify the WC in the diagnosis of HTW.

In this study, the agreement between the diagnoses of HTW using different cut-off points for WC found that the use of the values proposed by the IDF and WHO showed perfect agreement. In spite of the almost perfect agreement between the diagnosis of HTW by the IDF and WHO when compared with the NCEP-ATP III, some individuals characterized as having HTW were no longer diagnosed with HTW when the latter criterion was adopted. Thus, the cut-off point used by the NCEP-ATP III underestimated the diagnosis of HTW in the population evaluated in this study, since a significant percentage of individuals with HTW failed to be identified as such. This fact may be harmful in the identification of individuals at risk of developing CVD who have a potential to receive early treatment.

The findings of this study show a requirement for additional studies to identify and standardize
cut-off points for WC taking into account sex, age, and ethnicity of the participants to properly identify individuals with HTW.

**Conclusion**

With respect to the studied population, the adoption of the WC determined by the WHO and IDF criteria identified all individuals with HTW and was better than the use of the WC determined by the NCEP-ATP III. In addition, the prevalence of HTW using the definition of the IDF and WHO was greater than that assessed by the NCEP-ATP III. Thus, the use of the NCEP-ATP III criteria may underestimate the diagnosis of HTW.

It is worth noting that in the absence of a standardization of the WC cut-off points, there is a need for further studies assessing whether the use of different cut-off points may interfere with the diagnosis of HTW.

**Author contributions**

Conception and design of the research: Mota AP, Machado MEPC, Almeida MR, Silva MR, Matos DB, Medeiros JMB. Acquisition of data: Mota AP, Machado MEPC, Almeida MR, Silva MR, Matos DB, Oliveira TL. Analysis and interpretation of the data: Mota AP, Machado MEPC, Almeida MR, Medeiros JMB. Statistical analysis: Mota AP, Machado MEPC. Writing of the manuscript: Mota AP, Machado MEPC. Critical revision of the manuscript for intellectual content: Mota AP, Machado MEPC, Medeiros JMB.

**Potential Conflict of Interest**

No potential conflict of interest relevant to this article was reported.

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**Study Association**

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**References**


