Analysis of the components for classifying Metabolic Syndrome used in older people: an integrative review

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Abstract

Objective: To analyze the components of Metabolic Syndrome (MetS) and the rationale for adopting the criteria used for its classification in older individuals through an integrative review. *Method*: an integrative review of the literature in Portuguese, English, Spanish and Bulgarian involving older people (age ≥60 years) on the electronic databases MEDLINE - via PubMed, Embase, Web of Science and Scopus, without restriction on publication date or study design, was conducted from August 2022 to January 2023. The Medical Subject Headings (MeSH) and Health Sciences Descriptors (DEcS) controlled descriptors "elderly", "elderly 80 or older", "metabolic syndrome", "prevalence", "component" and "criterion" were used. Studies that were off-topic, unavailable in full and that failed to answer the guiding question were excluded. *Results*: Application of the eligibility criteria led to the retrieval of 1340 studies, of which 14 were included in the integrative review. Seven sets of criteria were identified for evaluating MetS in the older population were identified and most studies used two of these criteria. The IDF criterion was cited 7 times and the NCEP - ATP III criterion 8 times in the 14 article reviewed. *Conclusions*: Although the searches retrieved different studies on the subject, the results suggest the criteria for MetS should be revised, with cut-off points defined according to the population studied.

Keywords: Older people. Older people 80 and over. Metabolic Syndrome. Prevalence. Component. Criteria.

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INTRODUCTION

The growth in the older population, promoted by increased life expectancy and shifts in demographic, epidemiological and population transitions, is associated with significant consequences for society[1,2]. Aging favors greater vulnerability, giving rise to functional and physiological changes in the body that lead to the development of chronic non-communicable diseases (NCD), which often cooccur in this age group[3,4]. Chronic conditions, such as diabetes mellitus (DM) and systemic arterial hypertension (SAH), affect a large contingent of the older population. These conditions, when co-occurring with high triglyceride (TG) levels, low high density cholesterol (HDL-c) values and abdominal obesity, define metabolic syndrome (MetS), a highly prevalent NCD in the older population[5-8].

The spatial distribution of MetS is widespread, although some studies show major disparities in different parts of the world. In Brazil, the rate of MetS is around 22.7%, compared with 24.3% in European countries and 34.2% in North America. The contrast in these estimates might be explained by regional differences, disparities in sample characteristics (age, sex, race/ethnicity and economic status), besides differences in diagnostic criteria used to define the syndrome[9-13].

Several sets of criteria, based on different definitions and cut-offs, have been suggested by the leading world health organizations for diagnosing MetS. This definition has been the focus of studies and consensus conducted by important organizations in the field of health. In 1999, the World Health Organization (WHO), with the aim of standardizing the criteria, proposed a first diagnostic criterion, modified shortly after by the EGIR (European Group for the Study of Insulin Resistance), which proposed a new definition[14].

One of the most widely used criteria to date was devised in 2001 in the USA, namely, the National Cholesterol Education Program Adult Treatment Panel III (NCEP-ATP III), defining the presence of the syndrome when 3 or more of the following criteria/components are abnormal: waist circumference, TG, blood pressure and plasma fasting glucose. In 2015, the Brazilian Society of Cardiology deemed the NCEPATP III satisfactory for diagnosing MetS[15-17].

In 2005, another framework widely accepted in the literature, the International Diabetes Federation (IDF) criteria, recommended waist circumference, together with the presence of 2 or more of the following for diagnosing MetS: raised fasting plasma glucose or diagnosed DM, raised HDL-cholesterol or specific treatment, raised triglycerides or specific treatment, and raised blood pressure or specific treatment. In 2017, the Brazilian Diabetes Society endorsed the use of the IDF criteria for diagnosing MetS, including adaptations for diagnosing individuals aged under 18 years given the lack of consensus on reference values[18].

The third National Surveillance of Risk Factors of Non-Communicable Diseases in Iran, conducted in 2007, drew on the definition of MetS according to the criteria established by the NCEP - ATP III and the IDF, adapting the cut-off point for waist circumference for the local population. The Iranian National Obesity Committee adopted this cut-off point, along with the following criteria for MetS, with 3 out of 5 components: Iranian-specific waist circumference ≥ 95cm, fasting plasma glucose or previously diagnosed DM, reduced HDL-cholesterol or specific treatment, raised triglycerides or specific treatment, raised blood pressure or specific treatment[19,20].

Generally, the diagnostic criteria for MetS take into account the presence of dyslipidemia (hypertriglyceridemia, low-HDL), systemic arterial hypertension, obesity and hyperglycemia. However, no solid consensus exists on whether DM2 (glycemia > 126 mg/dL in population-based studies without clinical diagnosis) or obesity should be obligatory criteria for MetS, and different reference values have been proposed for systemic arterial hypertension and other biochemical analyses[14].

Given the lack of a consensus definition on the combination of risk factors that should be considered for diagnosing MetS, together with the dearth of articles in the literature on the best criteria for assessing MetS in the older population, the objective of the present study was to analyze

the components of the Metabolic Syndrome (MetS) and the rationale for adopting the criteria used for classifying the syndrome in older adults through an integrative review.

METHOD

An integrative review was carried out in 6 stages: 1- identification of the topic and selection of the guiding question; 2- establishing of criteria for study inclusion/exclusion; 3- definition of the information to be extracted from the studies selected and their classification; 4- methodological assessment of the studies included; 5- interpretation of results; 6- presentation of the review and synthesis of knowledge.

The search was performed between August 2022 and January 2023 based on the guiding question: "*what components are used for diagnosing Metabolic Syndrome in older people available in the literature?"* The PICo framework was used to devise the question, where P denotes the population (older people), I the aspect of interest (components used) and Co the context (Metabolic Syndrome)[21].

The search for studies was conducted on the databases MEDLINE (Medical Literature Analysis and Retrieval System Online)) – via Pubmed (U.S. National Library of Medicine), Web of Science, Scopus and Embase. The last 3 databases, with restricted access, were accessed free of charge via the Federal Academic Community (CAFe) of the National Teaching and Research Network (RNP), using the CAPES Periodicals website portal.

The following controlled descriptors from Medical Subject Headings (MeSH) and Descritores em Ciências da Saúde – Health Science Descriptors (DEcS) were employed*: aged, aged 80 and over, metabolic syndrome, prevalence, component and criteria*, together with the Boolean logic operators AND and OR, as per the search strategy outlined in Chart 1.

The present integrative review was registered on the OSF Registry platform under protocol code no. 10.17605/OSF.IO/V7YJH. Inclusion criteria for studies were primary original articles (cross-sectional, cohort study and case-control studies), addressing the different components of MetS in older adults (age ≥60 years), available in Portuguese, English, Spanish and Bulgarian. No restrictions for study design or publication date were applied. Studies were selected independently by 2 reviewers using the Rayyan selection platform by QCRI (Qatar Computing Research Institute) and all duplicate records removed. The articles were first screened by reading titles and abstracts. Articles that met the eligibility criteria and were selected by both reviewers (agreement) were read in full for inclusion or exclusion in the review. Disagreements at the full reading stage were settled by consensus by recruiting a third reviewer.

Exclusion criteria were studies that addressed other diseases besides MetS, animal studies and review articles.

The Critical Appraisal Skills Programme (CASP) tool was used to appraise the methodological rigor of the articles included (Chart 2). The original CASP contained 8 specific tools for appraising different study designs, such as reviews, cohort studies, cross-sectional studies, clinical trials, among others. An adapted 10-item version of the CASP was scored in the present review: 1) clear statement of aim; 2) appropriate method; 3) presentation and discussion of theoretical and methodological procedures; 4) appropriate sample recruitment; 5) clear data collection; 6) relationship between researcher and participants; 7) ethical standards maintained; 8) rigorous data analysis; 9) clear statement and discussion of findings; and 10) contributions, limitations and identification of new areas of research. Each item was attributed a value of 0 (zero) or 1 (one), where the final result is a tally of the scores, for a maximum of 10 points. The articles selected were classified according to final scores into level A – 6-10 points (good methodological quality and reduced bias) or level B – at least 5 points (satisfactory methodological quality, but with increased risk of bias)[22].

Chart 1. Search strategies for databases. Recife, Pernambuco state, Brazil, 2023

DATABASE	SEARCH STRATEGY	RESULTS
MEDLINE / PUBMED	((((aged[MeSH Terms]) OR (aged, 80 and over[MeSH Terms]) AND (y_5[Filter])) AND ((metabolic syndrome x[MeSH Terms]) OR (prevalence[MeSH Terms])) AND ((component) AND (y_5[Filter])) AND (criteria AND (y_5[Filter]))	229
EMBASE	('aged'/exp OR aged OR 'very elderly'/exp OR 'very elderly') AND ('metabolic syndrome x'/exp OR 'metabolic syndrome x' OR 'prevalence'/exp OR prevalence) AND component AND criteria	958
SCOPUS	((KEY (aged) OR KEY (aged, 80 AND over))) AND ((KEY (metabolic AND syndrome) OR KEY (prevalence))) AND ((KEY (component) AND KEY (criteria)))	9
WEB OF SCIENCE	(TS=(aged)) OR TS=(aged, 80 and over) AND (TS=(Metabolic Syndrome x)) OR TS=(prevalence) AND (TS=(component)) OR TS=(criteria)	144
TOTAL		1340

Source: created by author.

Chart 2. Appraisal of methodological rigor of the 17 articles reviewed. Recife, Pernambuco state, Brazil, 2023

QUESTION	YES	CAN´T TELL	NO
1. Was there a clear statement of the aims of the research?	14	0	0
2. Is a qualitative methodology appropriate?	14	0	0
3. Was the research design appropriate to address the aims of the research?	13	1	0
4. Was the recruitment strategy appropriate to the aims of the research?	14	0	0
5 Was the data collected in a way that addressed the research issue?	14	0	0
6. Has the relationship between researcher and participants been adequately considered?	14	0	0
7 Have ethical issues been taken into consideration?	14	0	0
8. Was the data analysis sufficiently rigorous?	14	0	0
9. Is there a clear statement of findings?	14	0	0
10. How valuable is the research?	14	0	0

Source: created by author.

The level of evidence of the studies was categorized using the Agency for Health Care Research and Quality (AHRQ) system. Quality of evidence is classified into 6 levels, namely: (1) systematic review or meta-analysis; (2) randomized clinical trials; (3) non-randomized clinical trials; (4) cohort and case-control studies; (5) systematic review of descriptive and qualitative studies; and (6) original descriptive or qualitative study[23].

RESULTS

A total of 1340 articles were identified on the databases. After removal of duplicate articles (n=79), 1261 remained for analysis. After screening of titles and abstract, articles eligible for full reading were selected, with the exclusion of 1166 studies for being off-topic or meeting other exclusion criteria. Subsequently, a further 81 articles were excluded for not being available in the literature or because, after full reading, the methods and results failed to meet the eligibility criteria. A total sample of 14 articles met the inclusion criteria and were included in the review (Figure 1).

The articles reviewed were published in English (n=11), Spanish (n=1), Portuguese (n=1) and Bulgarian (n=1) in international journals, between 2012 and 2023. Studies were conducted in 11 countries,

comprising 5 European (Bulgaria, Spain, Finland, Croatia and Ireland), 3 Asian (Iran, India, China) and 3 Latin American (Mexico, Brazil and Cuba) countries. The objectives of the studies addressed the research question and the methodologies used were quantitative.

All studies were rated as Level A for methodological quality by the adapted CASP. Assessment using the AHRQ revealed 2 case-control type studies (Level 4 evidence), 2 prospective cohort studies (Level 4 evidence) and 10 cross-sectional observational studies (Level 6 evidence). None of the studies adopted a qualitative approach. The main information extracted from the articles is presented in Chart 3, providing a range of characteristics of the studies included covering the parameters: author, publication year, country, study design, objective, MetS assessment instruments, sample and key results.

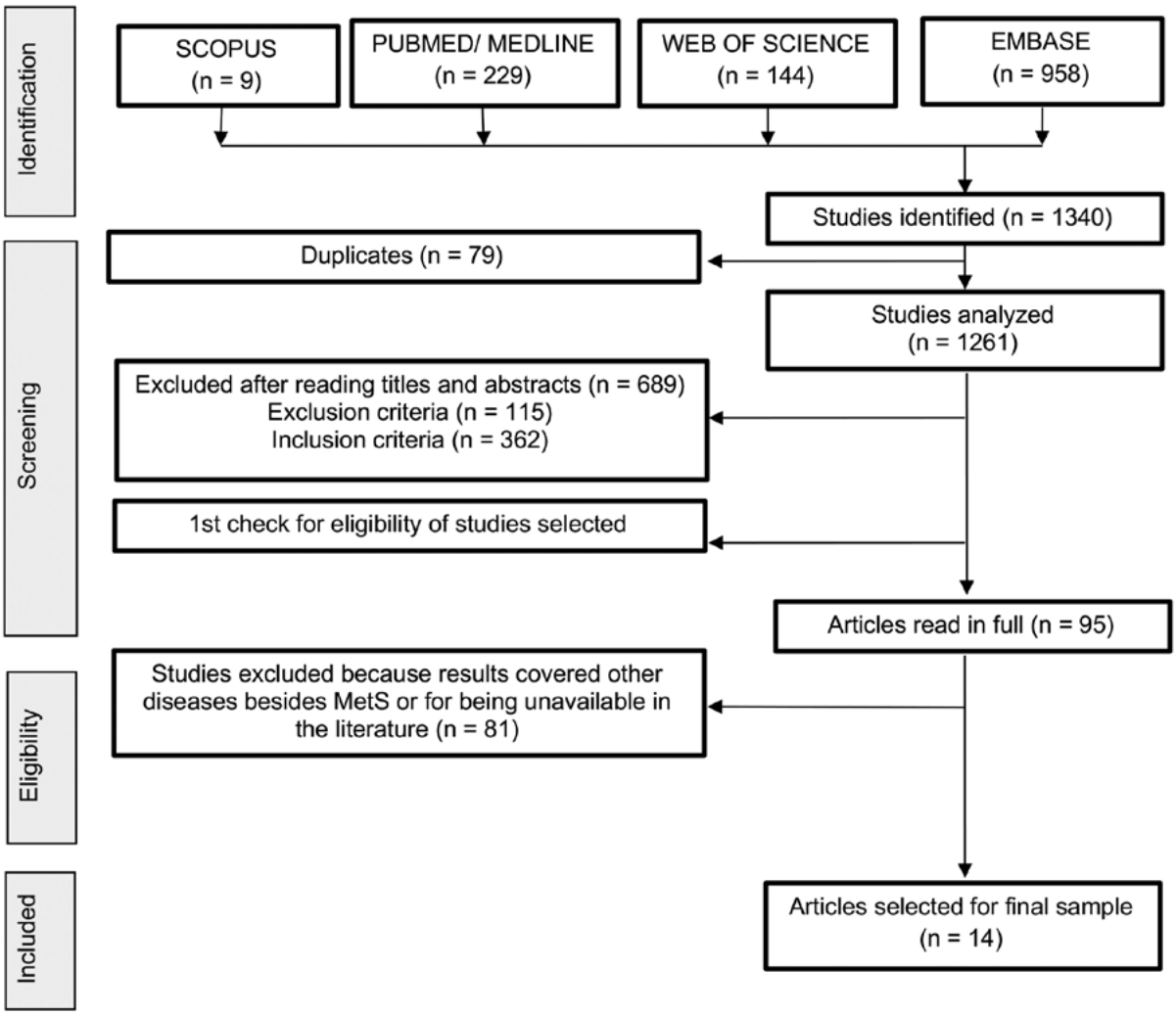

Figure 1. Flow diagram of search and selection process and reasons for exclusion of studies selected for integrative review**.** Recife, Pernambuco state, 2023.

Source: created by author.

Chart 3. Characteristics of studies included in integrative review. Recife, Pernambuco state, 2023.

Authors, year and country	Study design and objective	Instruments used	Sample	Key results
Vilela et al,[24] 2013, Spain	Descriptive, prospective study. Objective: to determine MetS prevalence.	Criteria: National Cholesterol Education Program-Adult Treatment Panel III (NCEP-ATP III) and International Diabetes Federation (IDF) definitions of MetS and its relation to cardiovascular disease (CVD) in hospitalized older patients.	200 older hospitalized patients	Prevalence of MetS was 65% (NCEP-ATP III) and 67.5% (IDF), proving greater in women (NCEP-ATP III= 72.8%, IDF=73.6%) than men (NCEP-ATP III=50.7%; IDF=56.3%).
Nevajda et al,[25] 2013, Croatia	Cross-sectional study. Objective: To investigate the prevalence of MetS in an older population in Croatia.	Criteria: WHO.	561 older nursing home residents in Zagreb, Croatia. There were 160 men (28.5%) and 401 women (71.5%).	The prevalence of MetS in the older residents was around 20.8%. The most common MetS component was hypertension, being significantly more frequent in women than in men.
Vieira et al,[26] 2014, Brazil	Cross-sectional study. Objective: to evaluate the prevalence and factors associated with metabolic syndrome in older adults.	Criterion: Harmonized criteria proposed by the WHO.	A total 133 individuals were randomly selected from users of primary health services of the Unified Health System.	The overall prevalence of metabolic syndrome was 58.65%, with 60.5% for females and 55.7% for males. Hypertension was the most prevalent component of the syndrome in both men (80.8%) and women (85.2%).
Borissova et al,[27] 2015, Bulgaria	Cross-sectional study. Objective: to explore the prevalence of MetS in the Bulgarian population and the role of some major factors such as age, gender and place of residence.	Criteria: IDF (2005), WHO (2000) and the newer harmonized MetS definition (2009).	1050 women (53.4%) and 917 males (46.6%), of which 538 were older adults (60-80 years).	Increased waist circumference was found in all older subjects with MetS (as an obligatory component). Most often MetS was diagnosed with three components (in 49.6%). MetS was found in 35.7% and was more prevalent in males (40.9%) than in females (31.1%). MetS prevalence increased with age reaching 53% in older individuals. MetS prevalence in Bulgaria was similar to that in other countries.

to be continued

Continuation of Chart 3

Authors, year and country	Study design and objective	Instruments used	Sample	Key results
Gholamreza Yousefzadeh; Mehrdad Sheikhvata,[28] 2015, Iran	Retrospective cohort study. Objective: to estimate the prevalence of the different MetS combinations in younger and older men and women in Iran.	Criteria: Adult Treatment Panel III (ATPIII) and International Diabetes Foundation (IDF).	6000 individuals, aged 15-75 years, resident in the city of Kerman, of which 874 were aged >60 years.	The prevalence of MetS increased with age for both genders in the older population. MetS was significantly more prevalent in females for both criteria used.
DM O'Connor, S. Leahy et al[29], 2016, Ireland	Retrospective cohort study. Objective: to determine the national prevalence of MetS in older adults using data from the first wave of the Irish Longitudinal Study on Aging (TILDA).	Criteria: Adult Treatment Panel III (ATPIII) and International Diabetes Foundation (IDF).	5026 participants, of which 1811 were older adults.	The ATPIII-defined prevalence of MetS in the population was 41·6 %, while the IDF criteria identified 47·3 % as having MetS. For both methods, MetS was more prevalent in men than women and increased with age in both sexes.
Rodríguez et al, [30] 2017, Cuba	Descriptive cross-sectional study. Objective: To determine the manifestations of MetS in people over 60 years of age in three elderly homes in Boyeros municipality.	Criterion: Adult Treatment Panel III (NCEF- ATP)	103 older people	33.01% of patients had MetS, with predominance (44.12%) in those aged 60-64 years and in female patients (64.71%).
Xianghua He et al,[31] 2017, China	Cross-sectional with a control group Objective: to estimate the prevalence of MetS in longevity in the Guangxi Zhuang Autonomous Region, China.	Criteria: revised National Cholesterol Education Program's Adult Treatment Panel III (NCEP ATPIII)	226 women and 81 men (mean age: 95.06 ± 4.91 years and 94.60 ± 4.09 years old for women and men, respectively; range: 90–111 years old). The control group comprised 185 women and 301 men (mean age: 47.98 ± 4.07 and 47.24 ± 3.70 years old for women and men, respectively; range: 35–68 years old).	The overall prevalence estimates of MetS among longevity group were 28.0% based on NCEP ATPIII criteria. The most common metabolic component was elevated blood pressure (61.1%), In the control group, the overall prevalence of MetS was 5.1%, irrespective of the criteria used, while triglycerides was the most common component.

to be continued

Continuation of Chart 3

Authors, year and country	Study design and objective	Instruments used	Sample	Key results
Sales, et al,[32] 2018, Brazil	Analytical and cross-sectional. Objective: to determine the frequency of metabolic syndrome and associated. factors in older individuals living in nursing homes.	Criterion: National Cholesterol Education Program – Adult Treatment Panel III.	202 older participants of both sexes.	The frequency of MetS was 29.2%. The most frequent MetS components were low HDLc (63.9%) and abdominal obesity (42.7%).
James et al,[33] 2020, India	Cross-sectional study. Objective: to identify the occurrence of MetS and to evaluate the gender-associated difference in each component of MetS	Criteria: International Diabetic Federation (IDF) and National Cholesterol Education Program Adult Treatment Panel III (NCEP ATP III).	350 patients, of which 144 were aged >60 years.	MetS increased with age, peaking at 51-60 years followed by 61-70 years. MetS prevalence was found to be significantly associated with age for both criteria.
Jesús D. Meléndez-Flores, et al,[34] 2021, Mexico	Cross-sectional study. Objective: To determine the prevalence and clinical features of MetS and its components in patients with Parkinson Disease (PD).	Criterion: World Health Organization.	99 patients with median age of 66 years, with most patients male.	Among components of MetS, arterial hypertension showed the greatest prevalence among patients with PD with 30%. MetS was reported in 8% of the PD population.
SAUKKONEN et al,[35] 2021, Finland	Cross-sectional study. Objective: to investigate the prevalence of MetS and its components in an aging population by using different definitions.	Criteria: National Cholesterol Education Panel (NCEP), the modified NCEP (NCEPm), and the International Diabetes Federation (IDF).	539 participants comprising 320 women and 219 men	Overall, the prevalence of MetS was 24.7%, 35.2%, and 37.2% in men, by NCEP, modified NCEP, and IDF-definitions, respectively. In women the corresponding figures were 20.9%, 33.1%, and 47.8%.
Zoghi et al,[20] 2021, Iran	Prospective cohort study. Objective: to determine the prevalence of MetS, its components, and related factors in the southern coastal area of Iran, Bandare-Kong Non-Communicable Diseases (BKNCD).	Criteria: National Cholesterol Education Program (NCEP) and the Iranian-specific cut-off for waist circumference (95 cm), the IDF and Iranian-specific cut-off point for Iran.	Of 3,927 participants included in this study, 598 were aged ≥60 years.	Females, the widowed/ divorced, the illiterate, rural residents, the unemployed, and non-smokers showed a higher number of MetS components compared to their counterparts. 54.6% of the older population met the Iranian definition of MetS.

to be continued

Continuation of Chart 3

Authors, year and country	Study design and objective	Instruments used	Sample	Key results
Sinha, et al,[36] 2023, India	Cross-sectional study. Objective: to determine the prevalence of MetS and its correlates among the residents of care homes for the elderly in Hyderabad city, India.	Criteria: International Diabetes Federation.	114 older residents (aged ≥60 years) from 2 care homes.	The overall prevalence of MetS was 42.1% (48/114) among the study population. A higher prevalence (50.9%; 27/53) was found among women. High blood pressure or taking antihypertensive medication was the most common (95.8%; 46/48) cardiometabolic component. The risk of metabolic syndrome did not differ significantly by age group or sex.

Source: created by author.

The articles selected addressed the main criteria and components used for assessing MetS older populations worldwide. Seven sets of criteria for assessing MetS in the older population were identified in the 14 articles reviewed. The data extracted from the studies were analyzed and compiled to assess for possible differences in classification among the criteria used for diagnosing MetS (Chart4). The results showed that most studies used 2 out of the 7 criteria. The IDF criteria was used in 7 of the 14 articles reviewed, while the NCEP - ATP III and modified NCEP III were used by 8 and 1 study, respectively. The Iranian-specific criteria (both IDF and NCEP III) were used once only in the articles reviewed. The WHO criteria was cited in 3 of the articles reviewed, whereas the Harmonized Criteria for MetS was used once only in the 14 articles reviewed.

Chart 4. Criteria/components used for diagnosing metabolic syndrome in older adults: WHO, IDF, NCEP-ATP III, modified NCEP-ATP III, IDF with cut-off point for Iran, NCEP - ATP III with cut-off point for Iran and Harmonized MetS. Recife, Pernambuco state, Brazil,2023.

COMPONENTS	CRITERIA						
	WHO	IDF	NCEP - ATPIII	NCEP-ATPIII(m)	IRANIAN-SPECIFIC CRITERIA – IDF	IRANIAN-SPECIFIC CRITERIA - NCEP	HARMONIZED CRITERIA for MetS (2009)
SAH (mmHg)	>140/90	>130/85					
Obesity	BMI >30 kg/m²	WC > 80 cm (F) WC > 94 cm (M)	> 102 cm (M) WC > 88 cm (F)		WC>95 cm		Population and country-specific definitions
TG (mg/dL)	Triglycerides > 150 or specific treatment for this lipid abnormality		Triglycerides > 150	Triglycerides > 150 or specific treatment for this lipid abnormality	>150		Triglycerides > 150 or specific treatment for this lipid abnormality
HDL-c (mg/dL)	<35 (M) <39 (F)	<40 (M) <50 (F)	<40 (M) <50 (F)	<40 (M) <50 (F) or specific treatment for this lipid abnormality	<40 M <50 F		<40 (M) <50 (F)
Glycemia (mg/dL)	>126	>100 or DM	>100	Raised fasting plasma glucose > 100 or specific treatment for high glucose is alternative indicator	>100		Raised fasting plasma glucose > 100 or specific treatment for high glucose is alternative indicator
Diagnostic criteria	DM2+ two factors	Obesity + 2 factors	Presence of 3 factors				

WHO: World Health Organization; NCEP-ATP III: National Cholesterol Education Program Adult Treatment Panel III; IDF: International Federation of Diabetes; NCEP-ATP III (m): modified National Cholesterol Education Program Adult Treatment Panel III; SAH: Systemic Arterial Hypertension; WC: Waist Circumference; TG: triglycerides; HDL-c: High-density lipoprotein cholesterol; BMI: body mass index; DM2: type 2 diabetes mellitus; M: male; F: female

Source: created by author.

DISCUSSION

Metabolic syndrome is a condition affecting a large contingent of the population, with a high prevalence in older people[3]. No specific criteria for classifying MetS in this older group was found, with all available criteria used for adults and adolescents, extending to the older population.

A 2021 study was conducted in Finland investigating 539 older individuals, comprising 320 women and 219 men. For diagnosing MetS, 3 comparative instruments were applied: the IDF, NCEP ATP III and the modified NCEP ATP III. Overall, the prevalence of MetS was 24.7%, 35.2%, and 37.2% in men, according to the NCEP, modified NCEP, and IDF definitions, respectively.

In women, the corresponding figures were 20.9%, 33.1%, and 47.8%[35].

According to the 2016 study by O'CONNOR et al. performed in Ireland, the prevalence of MetS in the population was 41.6% when defined using the NCEP ATP III criteria versus 47.3% according to the IDF criteria. For both methods, MetS was more prevalent in men than in women and increased with age[29].

Consistent with results of the Irish study, in a 2015 study by YOUSEFZADEH et al. in Iran of 874 individuals aged >60 using the same IDF and NCEP ATP III criteria, increased age was directly associated with the development of MetS and its prevalence was high in females for both criteria[28].

In India, a 2023 study of 114 older adults comparing both the IDF and NCEP ATP III criteria was published. The prevalence of MetS in the diabetic population was 42.3% and 28.9% according to the IDF and NCEP ATP III, respectively. A higher prevalence was found in women than men using both criteria[33,36].

The same two criteria were used to classify MetS in 200 older hospitalized patients in a Spanish study determining MetS prevalence with the IDF and NCEP ATP III criteria. The prevalence of MetS was 65% (NCEP-ATP III) and 67.5% (IDF), proving greater in women (NCEP-ATP III=72.8%; IDF=73.6%) than in men (NCEP-ATP III=50.7%; IDF=56.3%)[24].

In Brazil, 2 studies assessing MetS in older adults were conducted, In the first, a group of 202 institutionalized older adults diagnosed with MetS using the NCEP ATP III revealed a MetS rate of 29.2%[32]. In the second investigation, 113 older adults were randomly selected from among users of the primary care service of the Brazilian national health system (SUS) and MetS assessed using the WHO harmonized criteria. The overall prevalence of MetS was 58.65%. The rate among females was 60.5% versus 55.7% for men, with no statistically significant gender difference ($p = 0.589$)[26].

The NCEP ATP III was one of the most widely used frameworks in China and Cuba for assessing MetS in older individuals. A study investigating MetS prevalence in longevity in the Guangxi Zhuang Autonomous Region, China, recruited 307 oldest-old to assess the presence of MetS. Overall, 28% of the participants had MetS diagnosed using the NCEP ATP III criteria[31]. In Cuba, 103 older residents of 3 nursing homes were assessed using the same criteria, revealing that 33% of patients had MetS, with predominance in in females[30].

A study in Iran including 598 participants aged ≥60 years found that females, the widowed/divorced, the illiterate, rural residents, the unemployed, and non-smokers showed a higher number of MetS components compared to their counterparts. The results also found that, of the sample of participants, 15.3% had no MetS components, 23.7% only one, 24.5% two, 20.3% three, 12.2% four, while 4.1% exhibited all of the components of MetS. Thus, 84.7% of the subjects had at least one MetS component[20,37].

In another Iranian study investigating MetS components, the IDF criteria showed a higher prevalence of raised systolic blood pressure and reduced HDL cholesterol levels, while central obesity was more frequent in men. Using the NCEP ATP III definition, the study results showed that systolic and diastolic blood pressure, mean levels of plasma triglycerides and fasting glucose and reduced HDL were lower in women than in men[28].

Similar findings were reported by a study in Finland when comparing the component of elevated blood pressure using the NCEP and modified NCEP ATP III or IDF criteria (91.8% in men versus 89.0% in women). In men, the second most commonly component detected by the 3 definitions was glucose abnormality, with rates of 53.2% by NCEP and 78.4% by the modified NCEP and/or IDF criteria. In women, the second most prevalent single component was also glucose abnormality, with rates of 33.1% and 59.7% measured by the NCEP and modified NCEP, respectively[35].

In Brazil, a study of institutionalized older individuals using the NCEP ATP III criteria showed that the most frequent MetS components were low HDLc (63.9%) and abdominal obesity (42.7%)[32]. According to Vieira et al., in another Brazilian study, of older individuals selected from users of the Unified Health System and assessed using the WHO harmonized criteria, hypertension was the

most prevalent component of the syndrome in both men (80.8%) and women (85.2%)[26].

In Bulgaria, 1050 women, comprising 538 older adults, were explored to determine the prevalence of MetS using the IDF criteria and new WHO harmonized definition. Results showed that the 41.7% (527/1265) of participants with increased waist circumference had no data on MetS because at least 2 of the total 5 components for MetS were missing. The SAH component proved a strong predictor and was second only to obligatory waist circumference in the Bulgarian population[27].

Give the growing prevalence of MetS in the older population, mechanisms linking MetS with neurodegenerative diseases have been investigated[38]. In 2021, FLORES Jesús et al. performed a study in Mexico of a population of 99 patients, predominantly males, with median age of 66 years that had Parkinson Disease, using the World Health Organization (WHO) criteria for diagnosing MetS. MetS was reported in 8% of the population with Parkinson Disease. Of the different components of MetS, arterial hypertension had the greatest prevalence among PD patients, with a rate of 30%. Results also showed that patients who had both PD and MetS exhibited greater motor impairments than those without MetS[34].

In 2013, NEVAJDA used the WHO criteria to investigate the prevalence of MetS in an older population in Croatia. A total of 561 older nursing home residents in Zagreb were studied. The prevalence of MetS in the older residents was 20.8% and the most common component was hypertension, being significantly more frequent in women[25].

The present review has some limitations, such as the small number of studies addressing MetS criteria in older people and also the dearth of studies on the Brazilian population included in the review. The weakness of the criteria regarding the cut-off point for assessing waist circumference in the population studied may hamper or introduce bias in the true diagnosis of MetS, leading to a possible overestimation of the prevalence of the syndrome in women.

CONCLUSION

This integrative review showed that different organizations have developed specific criteria for assessing MetS, which were applied in different parts of the world, according to the choice of study authors. The NCEP ATP III and IDF criteria were the most used by the studies, proving more rigorous than other criteria.

The WHO criteria appears to be less commonly used given its disparate results compared to other criteria, possibly due to its use of the type 2 diabetes as an obligatory factor for MetS. The Harmonized MetS criteria was less cited in the literature, although it uses abdominal obesity as an assessment component based on country-specific cut-off points, rendering the criteria more flexible.

Overall, the NCEP ATP III set of criteria was the most cited by the articles reviewed, proving more workable in that data on the components measured are more easily collected in original studies.

Although the search retrieved different studies on the subject, the results suggest the components of MetS criteria should be investigated in more depth, with specific cut-off points defined according to the population studied.

AUTHORSHIP

- Áurea J. B.Costa – data analysis and interpretation, writing of article, approval of article to be published and oversight of all aspects of the study
- Gessica C. de Medeiros - writing of article
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