Revista de APS
ISSN: 1809-8363 (*on-line*)

Original article

Prevalence and factors associated with metabolic syndrome in Community Health Workers

Prevalência e fatores associados à síndrome metabólica em Agentes Comunitários de Saúde

Daniel Vinícius Alves Silva, Kaue Batista Andrade, Gabriel Dias de Araújo, Maria Fernanda Santos Figueiredo Brito, Rosângela Ramos Veloso Silva, Antônio Prates Caldeira, Lucinéia de Pinho, Diego Dias de Araújo

Authorship

Metadata

ABSTRACT

Metabolic syndrome is a complex metabolic disorder characterized by the association of cardiovascular risk factors and insulin resistance. In Primary Health Care, some working conditions to which professionals are exposed can be a source of illness, and the literature shows that aspects of work are associated with metabolic syndrome, i.e. that the occupational context can be an exposure factor for the problem to develop. The aim of this study was to estimate the prevalence of metabolic syndrome and associated factors in Community Health Workers in a city in the north of Minas Gerais, Brazil. This was a cross-sectional study in which sociodemographic, lifestyle, work, anthropometric, biochemical, and emotional data were collected. The dependent variable metabolic syndrome was defined according to the criteria of the National Cholesterol Education Program Adult Treatment Panel III. Descriptive and Poisson multiple regression analyses were carried out, with robust variance, considering a significance level of 5% ($p<0.05$) for the final model. The prevalence of metabolic syndrome was 20.8% and was associated with age ≥40 years, lower schooling (primary and/or secondary), overweight/obesity, low-density lipoprotein ≥130 mg/dl, and C-reactive protein >5.0 mg/dl. A high prevalence of metabolic syndrome was found among Community Health Workers. There is a need for further studies on the subject and the development of actions aimed at promoting healthy behavioral habits and preventing risk factors.

KEYWORDS: Metabolic Syndrome. Community Health Workers. Health Personnel. Occupational Health. Primary Health Care.

RESUMO

A síndrome metabólica é um distúrbio metabólico complexo, caraterizada pela associação de fatores de risco cardiovascular e resistência à insulina. Na Atenção Primária à Saúde, algumas condições laborais as quais os profissionais estão expostos podem ser fonte de adoecimento, e a literatura evidencia que aspectos laborais estão associados à síndrome metabólica, ou seja, que o contexto ocupacional é capaz de ser um fator de exposição para o desenvolvimento deste problema. O objetivo deste estudo foi estimar a prevalência de síndrome metabólica e os fatores associados em Agentes Comunitários de Saúde de uma cidade do Norte de Minas Gerais, Brasil. Estudo transversal, no qual coletaram dados sociodemográficos, estilo de vida, laborais, antropométricos, bioquímicos e aspectos emocionais. A variável dependente síndrome metabólica foi definida conforme o critério do *National Cholesterol Education Program Adult Treatment Panel* III. Realizaram-se análises descritivas e de regressão múltipla de *Poisson*, com variância robusta, considerando um nível de significância de 5% ($p<0,05$) para o modelo final. Foram avaliados 673 Agentes Comunitários de Saúde, a prevalência de síndrome metabólica foi de 20,8% e associou-se à faixa etária ≥40 anos, menor escolaridade (Fundamental e/ou Médio), sobrepeso/obesidade, lipoproteína de baixa densidade ≥130 mg/dl e proteína C-reativa >5,0 mg/dl. Constatou-se uma elevada prevalência de síndrome metabólica em Agentes Comunitários de Saúde. Verifica-se a necessidade de estudos para o aprofundamento sobre a temática e o desenvolvimento de ações que visem a promoção de hábitos comportamentais saudáveis, bem como a prevenção de fatores de riscos.

PALAVRAS-CHAVE: Síndrome Metabólica. Agentes Comunitários de Saúde. Pessoal de Saúde. Saúde do Trabalhador. Atenção Primária à Saúde.

INTRODUCTION

Metabolic Syndrome (MS) is a complex metabolic disorder, characterized by the association of cardiovascular risk factors and insulin resistance. It has been widely studied around the world, as it is considered a public health problem due to the negative impact it can have on the health of populations and, consequently, high costs for the health system[1,2]. It is defined by the aggregation of five factors: hyperglycemia, hypertension, increased triglyceride levels, reduced levels of high-density lipoprotein cholesterol (HDL-c), and abdominal obesity[3].

Epidemiological surveys show a high prevalence of MS worldwide, exceeding 25.0% of the total adult population, with an increase in epidemic proportions[4-8]. In Brazil, a recent systematic review identified a prevalence of MS ranging from 8.9% to 66.1% in the adult Brazilian population, including urban, rural, and traditional populations[2]. The prevalence of MS can be influenced by genetic aspects and individual behaviors, as well as the different criteria for defining MS[2], but mainly by social determinants of health, such as work[1,9].

Health professionals are an important population subgroup, as they are committed to promoting and preventing health or treating diseases that affect not only their own health but also the communities, families, and individuals with whom they work[10]. In the Primary Health Care (PHC) scenario, Community Health Workers (CHWs), as in other countries, are the first professionals to provide health care[8]. This profession has particularities in their daily work that can have an impact on their health[11].

The literature shows that work-related aspects are associated with MS[9,12], i.e. that the occupational context can be an exposure factor for the development of this problem. In PHC, some of the working conditions to which professionals are exposed and which can be a source of illness are precarious infrastructure, low salaries, unstable contracts, and overload of work, among others[12]. CHWs therefore experience progressive fatigue which compromises their health and the quality of the care they provide[12].

Knowledge about MS in CHWs can contribute to subsidizing public policies to promote the health of this population, as well as directing preventive measures towards this condition. Research into this problem in CHWs is still incipient on the national and international scene. Therefore, this study aimed to estimate the prevalence of MS and associated factors in CHWs in a city in the north of Minas Gerais, Brazil.

METHOD

This is a cross-sectional, analytical study carried out in a city in the north of Minas Gerais. Data was collected between August and October 2018. The study's target population consisted

of 797 CHWs from a city in the north of Minas Gerais, working in the municipality's 135 Family Health Strategy (FHS) teams (100% coverage) at the time of data collection. All the CHW professionals in the municipality were invited to take part in the study. The inclusion criterion was that they had worked in the FHS team for at least one year. The exclusion criteria were: being absent from work, not working, being pregnant, on maternity leave, or having a leave certificate at the time of the survey.

The estimated participation of the CHW population did not require sample calculation; the statistical power of the contingent of CHW participants (β-type error) was tested *a posteriori* (post hoc test) to compare the groups concerning the variables analyzed.

Before data collection, the interviewers were trained and a pilot study was conducted with CHWs who met the exclusion criteria, to standardize the research procedures. Data collection took place at the Regional Reference Center for Workers' Health (*Centro de Referência Regional em Saúde do Trabalhador* - CEREST) in Montes Claros (MG), on weekdays and in the morning, during working hours, with the CHWs being released by the Municipal Health Department, and were carried out by health professionals (nurses, doctors, physical education professionals, nutritionists, physiotherapists, and speech therapists) and scientific initiation students from the undergraduate physiotherapy and bachelor's physical education courses, from the fourth to the sixth term.

A questionnaire was used which included sociodemographic data, lifestyle, work, emotional aspects, physical assessment, hemodynamics, and metabolic parameters. The physical assessment included measuring anthropometric data such as waist circumference (WC) (cm), height (cm), and weight (kg), and the hemodynamic assessment included measuring blood pressure (mmHg), according to the guidelines for collecting and analyzing anthropometric data in health services[13] and the 7th Brazilian Hypertension Guideline[14]. Metabolic parameters were obtained by collecting peripheral venous blood, using a scalpel and vacuum collection tubes, after fasting for twelve hours. After collection, a responsible researcher stored it properly and transported it to the laboratory. He provided the indications and references for evaluating the results[15,16].

The dependent variable was MS, defined according to the criteria of the revised National Cholesterol Education Program Adult Treatment Panel III (NCEP-ATP III)[3], supported by the definition recommended by the I Brazilian Guidelines for the Diagnosis and Treatment of Metabolic Syndrome (*Diretriz Brasileira de Diagnóstico e Tratamento da Síndrome Metabólica* - I-DBSM) due to its simplicity, practicality and strong clinical evidence[17]. According to the revised NCEP-ATP III[3], MS is characterized by the presence of three or more of the five components listed: abdominal obesity (men: ≥102 cm; women: ≥88 cm); triglycerides (≥150 mg/dL); high-density lipoprotein (HDL) cholesterol (men: <40; women: <50); blood pressure (systolic: ≥130

mmHg and diastolic: ≥85 mmHg); fasting glycemia (≥100 mg/dL).

The independent variables consisted of sociodemographic characteristics, lifestyle, work, Body Mass Index (BMI), biochemical profile, and emotional aspects. The first set of variables covered gender (female; male); age group, in years (<40; or ≥40)[10]; schooling (elementary or high school; incomplete or complete higher education); marital status (with partner; without partner); and family income, in minimum wages (R$ 954.00) (≤ 2 [R$ 1,908.00] or > 2 [R$ 1,908.01]).

The set of lifestyle characteristics was made up of the variables physical activity, food consumption, alcohol intake, and smoking. Physical activity was assessed using the International Physical Activity Questionnaire (IPAQ) short version; it is classified taking into account the duration, intensity, and frequency of these activities during the week prior to the interview. The level of physical activity was determined according to the IPAQ itself, which is divided into sedentary, irregularly active, active, and very active[18].

Sedentary people were those who did not do any physical activity for at least 10 continuous minutes during the week. Irregularly active were those who performed physical activity, but not enough to be classified as active, as they did not meet the recommendations in terms of frequency or duration. For this classification, the frequency and duration of the different types of activity (walking + moderate + vigorous) are added together. Active: those who met the recommendations of ≥ 3 days a week and ≥ 20 minutes per session or moderate activity or walking ≥ 5 days a week and ≥ 30 minutes per session; or any activity added together: ≥ 5 days a week and ≥ 150 minutes a week (walking + moderate + vigorous). Very active: those who met the recommendations of ≥ 5 days a week and ≥ 30 minutes per session or ≥ 3 days a week and ≥ 20 minutes per session. In the end, the individual was divided into three categories (sedentary or irregularly active; active; and very active)[18].

Food consumption was assessed using questions taken from the Surveillance System for Risk and Protective Factors for Chronic Diseases by Telephone Survey (*Sistema de Vigilância de Fatores de Risco e Proteção para Doenças Crônicas por Inquérito Telefônico* - Vigitel)[19] and cluster analysis was carried out, considering protective indicators (healthy food consumption) and risk indicators (unhealthy food consumption). The protective indicator was regular consumption of fruit and vegetables (≥ 5 days a week), and the risk indicators were habitual consumption of saturated fat (≥ 2 days a week, red meat with visible fat or chicken meat with skin); and regular consumption of soft drinks with sugar (at least one can or glass ≥ 5 days a week).

Alcohol intake (yes; no) was based on whether the participant consumed at least one dose (one can of beer, 340 ml; or one glass of wine, 142 ml; or one dose of distilled spirits, brandy, and whisky, among others) per week. Smoking was based on the question: "Have you smoked at least one cigarette in the last 12 months?", dichotomized into "non-smoker" and "smoker".

With regard to work variables, we looked at training in the health area (yes; no); weekly

workload in the FHS (= 24 hours; > 24 hours), and length of time working as a CHW (≤ 5 years; > 5 years). BMI (weight [kg] / height^2 [m]), classified according to the cut-off points established by the World Health Organization (WHO)[20], dichotomized into < 25 kg/m^2 (normal) and ≥ 25 kg/m^2 (overweight/obesity). With regard to biochemical parameters, categorized according to reference values[15]: C-reactive protein (CRP) < 5 mg/L (normal) and ≥ 5.0 mg/L (altered); total cholesterol < 190 mg/dl (normal) and ≥ 190 mg/dl (altered); and low-density lipoprotein (LDL-c) (< 130 mg/dl) (normal) and ≥ 130 mg/dl (altered).

The last set of variables relates to emotional aspects. Anxiety was assessed using the "State-Trait Anxiety Inventory" - IDATE-6 (reduced form)[21], with the result dichotomized by the median (13.0 points) and considering values below it "no anxiety symptoms". The risk of depression was assessed using the Patient Health Questionnaire - 9 (PHQ-9)[22], with a cut-off score of ≤9 points (no depression and/or mild depression). The ability to cope with stress was checked by the question "I am able to cope with stress in my daily life". This item was arranged in the form of a Likert scale, with five alternative answers (almost never, rarely, sometimes, relatively often, and almost always)[23]. The participant was considered capable of dealing with stress if their score was ≥ 3.

The data was analyzed using the Statistical Package for Social Science (SPSS) software, version 24.0. Descriptive statistics (simple frequency and percentage) were used and the results are presented in tables. Pearson's chi-square test was used to verify the association between MS components (abdominal circumference, HDL-c, triglycerides, blood pressure, and fasting glucose) and gender. A bivariate analysis was carried out using the Poisson model with robust variance to verify the association between MS and the independent variables, with the strength of the association measured by the crude (unadjusted) Prevalence Ratio (PR).

Variables whose p-value was ≤ 0.20 in the bivariate analysis were included in the multivariate analysis model. Poisson multiple regression with robust variance was used to identify the covariates studied that influenced the outcome, and the strength of association was measured by the adjusted PR and their respective 95% Confidence Intervals (95%CI). In the final analysis, a final significance level of 0.05 ($p<0.05$) was considered and the deviance test was used to assess the quality of the model's fit.

The study project was approved by the Research Ethics Committee of the State University of Montes Claros, under opinion no. 2.425.756, issued on December 8, 2017. The Free and Informed Consent Term (FICT) was signed by the CHWs as a precondition for data collection.

RESULTS

Of the 797 CHWs linked to the FHS teams in the municipality studied, 675 (84.70%) took

part. Once the established criteria had been met, 122 (15.30%) were excluded from the study because they were not working, were pregnant, had been working for less than a year, were on maternity leave, or had a sick leave certificate. In addition, there were two (0.25%) losses due to the absence of an assessment of at least one component of MS. Thus, the final sample consisted of 673 (84.45%) CHWs.

The majority were female (83.7%), with a mean age of 36.7 years (±9.86), a minimum of 19 and a maximum of 68. Of the total, 56.8% reported having attended primary or secondary school; 59.6% had a partner and 52.5% had a family income of two minimum wages or less, with an average of R$2,311.67 (±1,134.44).

The prevalence of MS in the sample was 20.8% (95%CI 17.7-23.9). The prevalence was higher among the men's group, 21.8% (95%CI 14.0-29.7) when compared to the women's group, 20.6% (95%CI 17.2-24.0). The mean age was higher in the group with MS compared to the group without it, 41.1 and 35.6 years, respectively.

Among the components of MS, the most prevalent in the total sample was altered blood pressure (41.8%) and the least prevalent was altered blood glucose levels (12.0%). When stratified by gender, HDL-c was the most prevalent MS component (40.9%) among women, followed by altered blood pressure (38.5%). Among men, the most frequent component was altered blood pressure (58.2%) and hypertriglyceridemia (46.4%). There was a significant difference between the sexes in the following MS components: blood pressure, HDL-c, triglycerides, and waist circumference. The co-occurrence of the components that define MS occurred mostly with the presence of three components, 13.4% of the total sample (Table 1).

Table 1 – Prevalence of Metabolic Syndrome components stratified by sex and in the total Community Health Workers sample (n=673). Montes Claros (MG), Brazil, 2018

(continues)

Components	Male	Female	Total	p-value*
	n (%)	n (%)	n (%)	
Blood Pressure				**<0.001**
Normal	46 (41.8)	346 (61.5)	392 (58.2)	
Altered	64 (58.2)	217 (38.5)	281 (41.8)	
HDL-c**				**<0.001**
Normal	91 (82.7)	333 (59.1)	424 (63.0)	
Altered	19 (17.3)	230 (40.9)	249 (37.0)	
Triglycerides				**0.003**
Normal	59 (53.6)	385 (68.4)	444 (66.0)	
Altered	51 (46.4)	178 (31.6)	229 (34.0)	

(conclusion)

Components	Male n (%)	Female n (%)	Total n (%)	p-value*
Waist circumference				**0.004**
Normal	94 (85.5)	408 (72.5)	502 (74.6)	
Altered	16 (14.5)	155 (27.5)	171 (25.4)	
Fasting blood glucose				0.376
Normal	94 (85.5)	498 (88.5)	592 (88.0)	
Altered	16 (14.5)	65 (11.5)	81 (12.0)	
No. of co-occurrences				0.841
0	25 (22.7)	131 (23.3)	156 (23.2)	
1	35 (31.8)	186 (33.0)	221 (32.8)	
2	26 (23.6)	130 (23.1)	156 (23.2)	
3	17 (15.5)	73 (13.0)	90 (13.4)	
4	7 (6.4)	35 (6.2)	42 (6.2)	
5	0 (0.0)	8 (1.4)	8 (1.2)	

* Pearson's chi-square test; **HDL-c: high-density lipoprotein

Source: prepared by the authors

In the bivariate association analysis between MS and independent variables, the statistical significance of up to 20% was identified for the following variables: age group (≥ 40 years), lower schooling (primary and/or secondary), physical activity (sedentary or irregularly active), high BMI, high total cholesterol, high LDL-c, positive CRP and low ability to cope with stress (Table 2).

Table 2 - Description of the sociodemographic profile, lifestyle, working conditions, body mass index, biochemical components and emotional aspects of Community Health Workers for association (bivariate analysis) between Metabolic Syndrome and independent variables. Montes Claros (MG), Brazil, 2018

(continues)

Independent variables	n (%)	Metabolic Syndrome		*p-value
		Absence n (%)	Presence n (%)	
Sociodemographic				
Sex				
Male	110 (16.3)	86 (78.2)	24 (21.8)	
Female	563 (83.7)	447 (79.4)	116 (20.6)	0.773
Age group				
< 40 years old	418 (62.1)	359 (85.9)	59 (14.1)	
≥ 40 years old	255 (37.9)	174 (68.2)	81 (31.8)	**<0.001**

(continued)

Independent variables	n (%)	Metabolic Syndrome		*p-value
		Absence	Presence	
		n (%)	n (%)	
Level of education				
Higher education incomplete and/or complete	291 (43.2)	248 (85.2)	43 (14.8)	
Elementary and/or high school	382 (56.8)	285 (74.6)	97 (25.4)	**0.001**
Marital status				
With a partner	401 (59.6)	314 (78.3)	87 (21.7)	
Without a partner	272 (40.4)	219 (80.5)	53 (19.5)	0.477
Family income**				
> 2 minimum wages	320 (47.5)	259 (80.9)	61 (19.1)	
≤ 2 minimum wages	353 (52.5)	274 (77.6)	79 (22.4)	0.291
Lifestyle habits				
Physical activity				
Very active	210 (31.3)	161 (76.7)	49 (23.3)	
Active	396 (58.9)	328 (82.8)	68 (17.2)	**0.066**
Sedentary or irregularly active	66 (9.8)	43 (65.2)	23 (34.8)	**0.056**
Food consumption				
Healthy	432 (70.1)	343 (79.4)	89 (20.6)	
Unhealthy	184 (29.9)	145 (78.8)	39 (21.2)	0.868
Alcohol consumption				
No	418 (62.2)	335 (80.1)	83 (19.9)	
Yes	254 (37.8)	197 (77.6)	57 (22.4)	0.422
Smoking				
Non-smoker	635 (94.5)	503 (79.2)	132 (20.8)	
Smoker	37 (5.5)	29 (78.4)	8 (21.6)	0.903
Characteristics of working conditions				
Health training				
Yes	240 (35.7)	190 (79.2)	50 (20.8)	
No	433 (64.3)	343 (79.2)	90 (20.8)	0.988
Weekly workload in the FHS				
≤ 24 hours	42 (6.2)	35 (83.3)	7 (16.7)	
> 24 hours	631 (93.8)	498 (78.9)	133 (21.1)	0.507

(conclusion)

Independent variables		Metabolic Syndrome		
		Absence	Presence	
	n (%)	n (%)	n (%)	*p-value
≤ 5 years	380 (56.5)	304 (80.0)	76 (20.0)	
> 5 years	293 (43.5)	229 (78.2)	64 (21.8)	0.559
BMI				
< 25 kg/m2	265 (39.4)	252 (95.1)	13 (4.9)	
≥ 25 kg/m2	407 (60.6)	280 (68.8)	127 (31.2)	**<0.001**
Biochemical components				
Total cholesterol				
< 190 mg/dl	478 (71.0)	403 (84.3)	75 (15.7)	
≥ 190 mg/dl	195 (29.0)	130 (66.7)	65 (33.3)	**<0.001**
LDL-c				
< 130 mg/dl	603 (89.6)	496 (82.3)	107 (17.7)	
≥ 130 mg/dl	70 (10.4)	37 (52.9)	33 (47.1)	**<0.001**
C-reactive protein				
< 5.0 mg/L	568 (84.5)	469 (82.6)	99 (17.4)	
≥ 5.0 mg/L	104 (15.5)	63 (60.6)	41 (39.4)	**<0.001**
Emotional aspects				
Anxiety (IDATE-E)				
Without anxiety symptoms	388 (57.9)	312 (80.4)	76 (19.6)	
With anxiety symptoms	282 (42.1)	218 (77.3)	64 (22.7)	0.328
Anxiety (IDATE-T)				
Without anxiety symptoms	388 (57.9)	312 (80.4)	76 (19.6)	
With anxiety symptoms	282 (42.1)	218 (77.3)	64 (22.7)	0.328
Depression				
No depression and/or mild depression	543 (80.9)	432 (79.6)	111 (20.4)	
With depression	128 (19.1)	99 (77.3)	29 (22.7)	0.576
Ability to cope with stress				
Yes	432 (64.3)	349 (80.8)	83 (19.2)	
No	240 (35.7)	183 (76.3)	57 (23.8)	**0.163**

* Poisson regression with robust variance; **Minimum wage: R$ 954.00 in the year 2018; BMI: Body Mass Index; LDL-c: low-density lipoprotein; IDATE: State-Trait Anxiety Inventory; p-value ≤ 0.20

Source: prepared by the authors

In the multiple models, the following variables remained associated (p ≤ 0.05) with MS in CHW: age group ≥ 40 years (PR=1.62; 95%CI 1.22-2.14), lower schooling (elementary and/or high school) (PR=1.45; 95%CI 1.08-1.96), overweight/obesity (PR=4.78; 95%CI 2.76-8.29), low-density lipoprotein ≥130 mg/dl (PR=2.18; 95%CI 1.64-2.90) and C-reactive protein >5.0 mg/L

(PR=1.68; 95%CI 1.28-2.20) (Table 3).

Table 3 – Factors associated with Metabolic Syndrome in Community Health Workers (adjusted multiple analysis). Montes Claros (MG), Brazil, 2018

Variable	PR (95%CI) Crude analysis	PR (95%CI) Adjusted analysis	p-value
Age group			
< 40 years old	1	1	
≥ 40 years old	2.25 (1.67-3.03)	1.62 (1.22-2.14)	0.001
Level of education			
Higher education incomplete and/or complete	1	1	
Elementary and/or high school	1.72 (1.24-2.38)	1.45 (1.08-1.96)	0.014
BMI			
< 25 kg/m^2	1	1	
≥ 25 kg/m^2	6.36 (3.67-11.02)	4.78 (2.76-8.29)	<0.001
LDL-c mg/dl			
Desirable (< 130 mg/dl)	1	1	
Altered (≥ 130 mg/dl)	2.66 (1.96-3.59)	2.18 (1.64-2.90)	<0.001
C-reactive protein			
Negative	1	1	
Positive	2.26 (1.68-3.05)	1.68 (1.28-2.20)	<0.001

PR: Prevalence ratio after Poisson Regression with robust variance; CI: Confidence Interval; BMI: Body Mass Index; LDL-c: low-density lipoprotein; p-value ≤ 0.05; Deviance Test: 339.511.

Source: prepared by the authors

DISCUSSION

Among the CHW professionals studied, approximately one-fifth had MS and it was associated with older age, less schooling, inadequate BMI, and higher LDL-c and CRP levels.

The overall prevalence of MS in CHWs is similar to the prevalence estimated for the adult population worldwide, 25%[4], in Europe, 24.3%[6], and in other studies that assessed this outcome in PHC nursing professionals in the state of Bahia, Brazil[9], and hospital staff in Nigeria[5] and

Taiwan[24], finding a prevalence of between 19.3-24.4%. However, the estimate was higher than the prevalence observed in multicenter studies carried out in Brazil[10] and Mexico[25], with a prevalence of 4.5% and 7.0% respectively, which also assessed MS in health professionals.

On the other hand, it was lower than the prevalence of other studies that investigated this outcome in health workers of both sexes from the Hospital de Huaycán, Peru, 36.2%[26], and nurses working in a hospital in Mexico, 38.7%[7]. It should also be noted that this was lower than that shown in the only identified study carried out in the Philippines with the same public as the study in question, CHWs, in which a prevalence of 52.3% was found[8]. In a meta-analysis aimed at determining the prevalence of MS in the general adult population in Brazil over the last 10 years, the overall prevalence grouped together was 33%, with a high degree of heterogeneity observed[2].

The variation in the prevalence of MS worldwide or nationally, even considering the different states of the country, can be explained by the different diagnostic criteria used to define MS, as well as by cultural differences, which directly influence the lifestyle and consumption patterns of populations[2,6]. The high prevalence of MS in CHWs, affecting one in every five individuals investigated, indicates the need to value these professionals from a holistic perspective, implementing actions to promote and protect their health, consequently contributing to fewer illnesses and time off work[27].

In the multiple analysis, the results of this study show that CHWs aged ≥ 40 years have a higher prevalence of MS (PR=1.62; 95%CI 1.22-2.14) compared to those aged less than 40 years. The relationship between age and MS has been reported in several studies with health professionals[5,8,10,25]. One study[8] found that MS was more prevalent among CHWs aged at least 50 (OR=2.7; 95%CI 1.4-5.1; p= 0.002). Aging is one of the main contributors to the prevalence of the constellation of cardiovascular and metabolic risk factors that make up the syndrome, being associated with the development of insulin resistance, hormonal changes, and an increase in visceral adipose tissue fat[5,10,25].

Another study found that individuals aged 40 or over were 14.3 times more likely to have MS compared to those under 40[10]. In this study, the average age of CHWs diagnosed with MS was 41.5 years, showing a risk of these individuals suffering cardiovascular complications at an early age[28]. This highlights the importance of early planning and implementation of preventive measures and control of risk factors for MS[28].

This investigation showed that there is an association between schooling and MS, similar to Brazilian studies for the general population[1] and for health professionals working in PHC[9], which found, respectively, a higher occurrence of MS among individuals with less schooling (PR = 1.32; 95%CI 1.17-1.49) and (PR = 1.64; 95%CI 1.29-2.06)[9]. The results of this study point to the need to assess health literacy among CHW professionals, since the concept goes beyond

just reading health information and using health services; it refers to an individual's state of empowerment in accessing and using health information to improve their own health and the health of others[29].

Overweight (BMI ≥ 25 kg/m2)/obesity (BMI ≥ 30 kg/m^2) was associated with the development of MS (PR=4.77; 95%CI 2.75-8.27; p<0.001) in this study. This result is confirmed by other studies which have found an association between BMI and MS[5,26,28] and by the LATINMETS multicenter studies carried out in Brazil (OR=1.75; 95%CI 1.35-2.27)[10] and Colombia (OR=17.293; 95%CI 7.871-37.993)[30]. Obesity negatively affects many risk factors associated with cardiovascular diseases (CVD), such as hypertension, dyslipidemia, insulin resistance, and type 2 diabetes mellitus, thus increasing morbidity and mortality[31].

In relation to the lipid profile, in addition to altered triglycerides and HDL-c, which are components of MS, LDL-c has been shown to be associated. Similar to this finding, a study that assessed factors associated with MS in rural communities in Minas Gerais (Brazil) found that the prevalence of MS was higher in individuals with LDL-c > 160 mg/dl (PR = 2.98; 95%CI 1.95-4.56)[32] and the study carried out in Huaycán (Peru), which compared cardiometabolic and hematological variables by gender in the presence of MS in health professionals, found an association between altered LDL-c and males[26]. However, this finding was not observed in another study that assessed MS and LDL-c in health professionals[5].

Although both MS and LDL-c are individually associated with increased cardiovascular risk, the interaction and synergy between the two in this respect remains uncertain[33]. Clinical trials, meta-analyses, and clinical consensus suggest that controlling dyslipidemia, especially reducing LDL-c levels, has important benefits associated with reducing morbidity and mortality from CVD, Peripheral Arterial Disease (PAD), and Cerebral Vascular Accident (CVA)[3,33-35].

C-reactive protein has also been identified as an associated factor for MS. A population-based study carried out in Brazil involving elderly people showed a statistically significant association between MS and high CRP levels, with an odds ratio of 2.03 (95%CI 1.14-3.59)[36]. As well as being an important marker of inflammation, the assessment of CRP has been recommended in different guidelines as a complementary parameter for classifying cardiovascular risk, since it has been associated with insulin resistance, the progression of atherosclerosis, and greater chances of mortality[35,37].

It should be noted that no previous studies investigating the factors associated with MS in CHW in Brazil have been identified. CHWs are essential to PHC in Brazil, as it is impossible to think of developing the work and guaranteeing the implementation of its principles without the presence of these professionals.

Identifying the factors related to MS is a fundamentally important element in supporting actions to control the health of this population, especially in promoting a healthy lifestyle and,

consequently, better health indices. The management of MS has a dual objective: to reduce the underlying causes, i.e. weight reduction and increased physical activity, as well as to treat the associated non-lipid and lipid risk factors, thus effectively minimizing all the associated factors[3].

It is understood that an adequate quality of life for these professionals can improve the service provided to the community, allowing them to act more effectively, identifying acute and chronic problems early on, and thus reducing the use of acute and secondary care services by the community, as well as the workload for the health team[27].

The study's limitation is the use of self-reported information, which may underestimate the real prevalence of inadequate habits by omission and represent a source of information bias with an impact on the interpretation of the results. Another limitation is that the use of fibrates, antihypertensive drugs, and a previous diagnosis of diabetes mellitus were not checked.

Despite these limitations, the data on dyslipidemia and diabetes was obtained by collecting biological material, as well as information on abdominal obesity and hypertension, through anthropometric measurement and the measurement of blood pressure levels, which can help mitigate underestimates of the outcome. Some investigations using laboratory data make it possible to estimate the prevalence of health problems in subclinical stages and in populations with less access to health services and, consequently, still without diagnosis and treatment, i.e. they have a more accurate estimation power when compared to those using self-reported data[1].

CONCLUSION

A significant prevalence of MS was found among CHW, with an association with age (≥ 40 years), lower schooling, high BMI, LDL-c, and CRP. It is of the utmost importance to develop measures aimed at promoting lifestyle changes, especially in terms of weight reduction, as well as treating the individual components of MS, in order to reduce the risk factors and complications resulting from the outcome under study.

There is also a need to assess health literacy among CHW professionals, since they are committed to health promotion and prevention, serving as an example to the population, and should be empowered to access and use health information to improve not only their own health but also the health of the community, family and individuals with whom they work. To this end, strategies should be promoted to improve CHWs' access to health information, to develop their capacity to actively engage with other health professionals in order to improve health literacy levels, sensitive to the health literacy needs of the population in different groups.

REFERENCES

1. Oliveira LVA, Santos BNS, Machado ÍE, Malta DC, Velasquez-Melendez G, Felisbino-Mendes MS, et al. Prevalence of the Metabolic Syndrome and its components in the Brazilian adult population. Ciên Saúde Colet. 2020 [acesso em 2023 dez. 27]; 25: 4269-80. DOI: https://doi.org/10.1590/1413-812320202511.31202020

2. Valadares LTS, Souza LSB, Salgado Júnior VA, Bonomo LF, Macedo LR, Silva M. Prevalence of metabolic syndrome in Brazilian adults in the last 10 years: a systematic review and meta-analysis. BMC Public Health. 2022 [acesso em 2023 dez. 27]; 22: 1-22. DOI: https://doi.org/10.1186/s12889-022-12753-5

3. Grundy SM, Cleeman JI, Daniels SR, Donato KA, Eckel RH, Franklin BA, et al. Diagnosis and management of the metabolic syndrome an American Heart Association/National Heart, Lung, and Blood Institute Scientific Statement. Circulation. 2005 [acesso em 2023 dez. 27]; 112: 2735-52. DOI: https://doi.org/10.1161/CIRCULATIONAHA.105.169404

4. Saklayen MG. The global epidemic of the metabolic syndrome. Curr Hypertens Rep. 2018 [acesso em 2023 dez. 27]; 20:1-8. DOI: https://doi.org/10.1007/s11906-018-0812-z

5. Adeoye AM, Adewoye IA, Dairo DM, Adebiyi A, Lackland DT, Ogedegbe G, et al. Excess Metabolic Syndrome Risks Among Women Health Workers Compared With Men. J Clin Hypertens. 2015 [acesso em 2023 dez. 27]; 17:880-4. DOI: https://doi.org/10.1111/jch.12595

6. Scuteri A, Laurent S, Cucca F, Cockcroft J, Cunha PG, Mañas LR, et al. Metabolic syndrome across Europe: different clusters of risk factors. Eur J Prev Cardiol. 2015 [acesso em 2023 dez. 27]; 22:486–91. https://doi.org/10.1177/2047487314525529

7. Chico-Barba G, Jiménez-Limas K, Sánchez-Jiménez B, Sámano R, Rodríguez-Ventura AL, Castillo-Pérez R, et al. Burnout and Metabolic Syndrome in Female Nurses: An Observational Study. Int J Environ Res Public Health. 2019 [acesso em 2023 dez. 27]; 16:1993. DOI: https://doi.org/10.3390/ijerph16111993

8. Sison O, Castillo-Carandang N, Ladia MA, Sy R, Punzalan FE, Llanes EJ, et al. Prevalence of Metabolic Syndrome and Cardiovascular Risk Factors among Community Health Workers in Selected Villages in the Philippines. J ASEAN Fed Endocr Soc. 2019 [acesso em 2023 dez. 27]; 34:171-9. DOI: https://doi.org/10.15605/jafes.034.02.08

9. Santana AIC, Merces MC, Souza MC, Lima BGC, Galdino MJQ, Félix NDC, et al. Interaction between Work and Metabolic Syndrome: A Population-Based Cross-Sectional Study. Healthcare (Basel, Switzerland). 2022 [acesso em 2023 dez. 27]; 10:544. DOI: https://doi.org/10.3390/healthcare10030544

10. Vidigal FC, Ribeiro AQ, Babio N, Salas-Salvadó J, Bressan J. Prevalence of metabolic syndrome and pre-metabolic syndrome in health professionals: LATINMETS Brazil study. Diabetol Metab Syndr. 2015 [acesso em 2023 dez. 27]; 7:1-9. DOI: https://doi.org/10.1186/s13098-015-0003-x

11. Barbosa MS, Freitas JFO, Praes Filho FA, Pinho L, Brito MFSF, Rossi-Barbosa LAR. Fatores sociodemográficos e ocupacionais associados aos sintomas de ansiedade entre Agentes Comunitários de Saúde. Ciên Saude Colet. 2021 [acesso em 2023 dez. 27]; 26:5997–6004. DOI: https://doi.org/10.1590/1413-812320212612.15162021

12. Merces MC, Santana AIC, Lua I, Silva DAR, Silva DDSE, Gomes AMT, et al. Metabolic Syndrome Among Primary Health Care Nursing Professionals: A Cross-Sectional Population-Based Study. Int J Environ Res Public Health. 2019 [acesso em 2023 dez. 27]; 16:2686. DOI: https://doi.org/10.3390/ijerph16152686

13. Ministério da Saúde. Orientações para coleta e análise de dados antropométricos em serviços de saúde: norma técnica do sistema de Vigilância Alimentar e Nutricional - SISVAN.

Brasília: Ministério da Saúde; 2011 [acesso em 2023 dez. 27]. Disponível em: https://bvsms.saude.gov.br/bvs/publicacoes/orientacoes_coleta_analise_dados_antropometricos.pdf

14. Malachias M, Souza W, Plavnik F, Rodrigues C, Brandão A, Neves M, et al. 7th Brazilian Guideline of Arterial Hypertension: Chapter 2 - Diagnosis and Classification. Arq Bras Cardiol. 2016 [acesso em 2023 dez. 27]; 107:3 Suppl 3. DOI: https://doi.org/10.5935/abc.20160152

15. Sociedade Brasileira de Análises Clínicas (SBAC). Consenso Brasileiro para a Normatização da Determinação Laboratorial do Perfil Lipídico. 2016 [acesso em 2023 dez. 27]; versão1.13. Disponível em: https://www.sbac.org.br/wp-content/uploads/2017/09/ConsensoOficial_PerfilLipidico_2016_v13.pdf

16. Genuth S, Alberti KG, Bennett P, Buse J, Defronzo R, Kahn R, et al. Follow up Report on the Diagnosis of Diabetes Mellitus. Diabetes Care. 2003 [acesso em 2023 dez. 27]; 26:3160-7. DOI: https://doi.org/10.2337/diacare.26.11.3160

17. I Diretriz Brasileira de Diagnóstico e Tratamento da Síndrome Metabólica. Arq Bras Cardiol. 2005 [acesso em 2023 dez. 27]; 84:3-28. DOI: https://doi.org/10.1590/S0066-782X2005000700001

18. Matsudo S, Araújo T, Matsudo V, Andrade D, Andrade E, Oliveira LC, et al. Questionário internacional de atividade física (IPAQ): estudo de validade e reprodutibilidade no Brasil. Rev Bras Ativ Fís Saúde. 2001 [acesso em 2023 dez. 27]; 6:5-18. DOI: https://doi.org/10.12820/rbafs.v.6n2p5-18

19. Ministério da Saúde. Vigitel Brasil 2016: vigilância de fatores de risco e proteção para doenças crônicas por inquérito telefônico. Brasília: Ministério da Saúde; 2017 [acesso em 2023 dez. 27]. Disponível em: https://bvsms.saude.gov.br/bvs/publicacoes/vigitel_brasil_2016_fatores_risco.pdf

20. World Health Organization. WHO Expert Committee on Physical Status: the use and Interpretation of Anthropometry. Geneva: World Health Organization; 1995 [acesso em 2023 dez. 27]. Technical Report Series, 85. Disponível em: https://iris.who.int/handle/10665/37003

21. Fioravanti-Bastos ACM, Cheniaux E, Landeira-Fernandez J. Development and validation of a short-form version of the Brazilian state-trait anxiety inventory. Psicol Reflex Crít. 2011 [acesso em 2023 dez. 27]; 24:485-94. Disponível em: https://doi.org/10.1590/S0102-79722011000300009

22. Santos IS, Tavares BF, Munhoz TN, Almeida LSP, Silva NTB, Tams BD, et al. Sensibilidade e especificidade do Patient Health Questionnaire-9 (PHQ-9) entre adultos da população geral. Cad Saúde Pública. 2013 [acesso em 2023 dez. 27]; 29:1533–43. DOI: https://doi.org/10.1590/0102-311X00144612

23. Rodriguez Añez CR, Reis RS, Petroski EL. Brazilian version of a lifestyle questionnaire: translation and validation for young adults. Arq Bras Cardiol. 2008 [acesso em 2023 dez. 27]; 91:102-9. DOI: https://doi.org/10.1590/S0066-782X2008001400006

24. Tsou MT, Chen JY. Burnout and metabolic syndrome among healthcare workers: Is subclinical hypothyroidism a mediator? J Occup Health. 2021 [acesso em 2023 dez. 27]; 63:e12252. DOI: https://doi.org/10.1002/1348-9585.12252

25. Núñez AB, Sandoval FM, Babio N, Vizmanos B. Metabolic syndrome components in young health professionals; LATIN America METabolic Syndrome (LATINMETS) Mexico study. Nutri Hosp. 2018 [acesso em 2023 dez. 27]; 35:864-73. DOI: https://dx.doi.org/10.20960/nh.1694

26. Castro-Diaz SD, Rojas-Humpire R, Condori-Meza B, Bonifacio-García LE, Gutierrez-Ajalcriña R, Huancahuire-Vega S. Cambios hematológicos relacionados con componentes del síndrome metabólico en personal de salud con alimentación balanceada. Nutr Clín Diet Hosp. 2021 [acesso em 2023 dez. 27]; 41:130-8. DOI: https://doi.org/10.12873/411huancahuire

27. Magalhães NP, Sousa PS, Pereira GV, Silveira MF, Brito MFSF, Rocha JSB, et al. Hábitos relacionados à saúde entre agentes comunitários de saúde de Montes Claros, Minas Gerais: estudo transversal, 2018. Epidemiol Serv Saúde. 2021 [acesso em 2023 dez. 27]; 30:e2020976. DOI: https://doi.org/10.1590/S1679-49742021000300002

28. Mathiew-Quirós A, Salinas-Martínez AM, Hernández-Herrera RJ, Gallardo-Vela JA. Síndrome metabólico en trabajadores de un hospital de segundo nivel [Metabolic syndrome in workers of a second level hospital]. Rev Med Inst Mex Seguro Soc. 2014 [acesso em 2023 dez. 27]; 52:580-7. Disponível em: https://www.medigraphic.com/pdfs/imss/im-2014/im145u.pdf

29. Budhathoki SS, Pokharel PK, Jha N, Moselen E, Dixon R, Bhattachan M, et al. Health literacy of future healthcare professionals: a cross-sectional study among health sciences students in Nepal. International Health. 2019 [acesso em 2023 dez. 27]; 11:15-23. DOI: https://doi.org/10.1093/inthealth/ihy090

30. González-Zapata LI, Deossa GC, Monsalve-Álvarez J, Díaz-García J, Babio N, Salas-Salvadó J. Metabolic syndrome in healthcare personnel of the university of Antioquia-Colombia; LATINMETS study. Nutr Hosp. 2013 [acesso em 2023 dez. 27]; 28:522-31. DOI: https://doi.org/10.3305/nh.2013.28.2.6315

31. Piché ME, Poirier P, Lemieux I, Després JP. Overview of Epidemiology and Contribution of Obesity and Body Fat Distribution to Cardiovascular Disease: An Update. Prog Cardiovasc Dis. 2018 [acesso em 2023 dez. 27]; 61:103-13. DOI: https://doi.org/10.1016/j.pcad.2018.06.004

32. Pimenta AM, Gazzinelli A, Velásquez-Meléndez G. Prevalência da síndrome metabólica e seus fatores associados em área rural de Minas Gerais (MG, Brasil). Ciênc Saúde Colet. 2011 [acesso em 2023 dez. 27]; 16:3297–306. DOI: https://doi.org/10.1590/S1413-81232011000800029

33. Kim SY, Go T-H, Lee JH, Moon JS, Kang DR, Bae SJ, et al. Differential association of metabolic syndrome and low-density lipoprotein cholesterol with incident cardiovascular disease according to sex among Koreans: a national population-based study. Eur J Prev Cardiol. 2020 [acesso em 2023 dez. 27]; 18; 28:2021-9. DOI: https://doi.org/10.1093/eurjpc/zwaa114

34. Nayor M, Vasan RS. Recent Update to the US Cholesterol Treatment Guidelines. Circulation. 2016 [acesso em 2023 dez. 27]; 133:1795–806. DOI: https://doi.org/10.1161/CIRCULATIONAHA.116.021407

35. Faludi A, Izar M, Saraiva J, Chacra A, Bianco H, Afiune Neto A, et al. Atualização da Diretriz Brasileira de Dislipidemias e Prevenção da Aterosclerose – 2017. Arq Bras Cardiol. 2017 [acesso em 2023 dez. 27]; 109:1-76. DOI: https://doi.org/10.5935/abc.20170121

36. Silva PAB, Sacramento AJ, Carmo CID, Silva LB, Silqueira SMF, Soares SM. Factors associated with metabolic syndrome in older adults: a population-based study. Rev Bras Enferm. 2019 [acesso em 2023 dez. 27]; 72:221-8. DOI: https://doi.org/10.1590/0034-7167-2018-0620

37. C-Reactive Protein, Fibrinogen, and Cardiovascular Disease Prediction. N Engl J Med. 2012 [acesso em 2023 dez. 27]; 367:1310–20. DOI: https://doi.org/10.1056/NEJMoa1107477

Authorship			
Name	**Institutional affiliation**	**ORCID**	**CV Lattes**
Daniel Vinícius Alves Silva	Universidade Estadual de Montes Claros (UNIMONTES)	https://orcid.org/0000-0001-9280-9146	http://lattes.cnpq.br/8550500444719958
Kaue Batista Andrade	Universidade Estadual de Montes Claros (UNIMONTES)	https://orcid.org/0000-0001-6184-8513	http://lattes.cnpq.br/9249912176000589
Gabriel Dias de Araújo	Universidade Federal dos Vales do Jequitinhonha e Mucurí (UFVJM)	https://orcid.org/0000-0003-0525-3085	http://lattes.cnpq.br/1558430002679642
Maria Fernanda Santos Figueiredo Brito	Universidade Estadual de Montes Claros (UNIMONTES)	https://orcid.org/0000-0001-5395-9491	http://lattes.cnpq.br/2215319716880740
Rosângela Ramos Veloso Silva	Universidade Estadual de Montes Claros (UNIMONTES)	https://orcid.org/0000-0003-3329-8133	http://lattes.cnpq.br/7422217198777738
Antônio Prates Caldeira	Universidade Estadual de Montes Claros (UNIMONTES)	https://orcid.org/0000-0002-9990-9083	http://lattes.cnpq.br/3347971335752720
Lucinéia de Pinho	Universidade Estadual de Montes Claros (UNIMONTES)	https://orcid.org/0000-0002-2947-5806	http://lattes.cnpq.br/7278576493532093
Diego Dias de Araújo	Universidade Estadual de Montes Claros (UNIMONTES)	https://orcid.org/0000-0002-8927-6163	http://lattes.cnpq.br/7595154736421539
Corresponding Author	Daniel Vinícius Alves Silva daniel.v.a.s@hotmail.com		

Metadata		
Submission: January 15th, 2024	Approval: May 31th, 2024	Published: July 19th, 2024
Cite this article	Silva DVA, Andrade KB, Araújo GD, Brito MFSF, Silva RRV, Caldeira AP, Pinho L, Araújo DD. Prevalência e fatores associados à síndrome metabólica em Agentes Comunitários de Saúde. Rev.APS [Internet]. 2024; 27 (único): e272443311. DOI: 10.34019/1809-8363.2024.v27.43311	

Conflict of interests	No conflicts of interest
Financing	No financing
Author contributions	Conception and/or design of the study: DVAS, LP, DDA. Acquisition, analysis or interpretation of data: DVAS, LP, DDA, MFSFB, RRVS. Critical review of the preliminary version: DVAS, LP, DDA, KBA, GDA, MFSFB, RRVS. All authors approved the final version and agreed to be accountable for all aspects of the work.

Go to top