Metabolic Syndrome and Pre-Metabolic Syndrome among Health Care Workers in Yemen: Prevalence and Associated Risk Factors

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Abstract

Background: There is an increased prevalence of Metabolic Syndrome (MetS) and its risk factors among Health Care Workers (HCWs), which in turn contribute to the development of cardiovascular diseases. This increased prevalence reached alarming levels of global health and socioeconomic concern. This study was conducted to determine the prevalence of MetS and pre-Metabolic Syndrome (pre-MetS), as well as their components, among HCWs in Sana'a City, Yemen.

Subjects and Methods: This is an observational, cross-sectional study conducted between February and July 2021. Two hospitals were randomly selected, one public (Al-Kuwait University Hospital) and one private (the University of Science and Technology Hospital). The study sample consisted of 282 HCWs. Body Mass Index (BMI) and body fat percentage were calculated. All participants underwent physical examinations at baseline. Fasting plasma glucose, uric acid, urea, creatinine, and lipid profile levels were measured. MetS was defined according to the International Diabetes Federation.

Results: Of the 282 HCWs included in our study, 158 (56.0%) were females, and the remaining 124 (44.0%) were males. Their ages ranged from 20 to 59 years, with a mean of 31.8 ± 7.2 years. The majority of subjects were non-smokers (85.1%). The prevalence of pre-MetS and MetS was 26.2% and 16.3%, respectively. HCWs aged 40 or older and smokers had 6.5 and 4.3 times more risk of having MetS than those less than 40 years old and nonsmokers, respectively. The presence of both pre-MetS and MetS was positively associated with BMI, LDL-c/HDL-c, TC/HDL-c, and non-HDL-c ratios.

Conclusion: The study revealed an alarming prevalence of MetS among HCWs, which increased with age. Both pre-MetS and MetS were present only in overweight individuals and associated with a wide range of adiposity and lipid profile measures, reflecting a drastically poor health profile among Yemeni HCWs.

Keywords: Metabolic syndrome; Health care workers; Health personnel; Yemen

Introduction

During the last decades, the world's population has experienced substantial changes in health, lifestyle, and eating behavior [1,2]. These changes are observed in the increasing consumption of sugary beverages and high-calorie foods, as well as a marked decrease in physical activity and a more sedentary lifestyle [3,4]. As a result, the global prevalence of overweight and obesity has been rising steadily and has already reached epidemic levels [5-7]. Concurrently with this progression, there has been a rise in the occurrence of obesityrelated health consequences such as cardiovascular diseases (CVDs) and Type-2 diabetes (T2DM) [8,9]. A common term used to characterize the pathophysiological relationship between these patterns is the metabolic syndrome (MetS). In its last review, the American Heart Association (AHA) defined MetS as a cluster of conditions that occur together, raising an individual's risk for heart disease, Type-2 diabetes, stroke, and other health issues [10]. MetS is complex, and many aspects of its etiology are yet unclear [11,12]. However, this syndrome is indirectly affected by genetic factors such as age, dementia, pro-inflammatory factors, and hormonal changes. In addition, central obesity and insulin resistance are two significant contributors to its incidence, and insulin resistance is sometimes recognized as the basis for it [13,14].

The prevalence of MetS was high in South America (6.2% in Colombia as classified by the Cook definition and 9.5% in Chile by the IDF) [15,16], in the United States (10.1% by the Ford et al. classification) [17], and in the Middle East countries (13 and 6% in Iran [18,19], and almost 5% in Saudi Arabia according to the Cook definition) [20]. Among Yemeni school-aged children, Saeed et al. found that the prevalence of MetS was 0.5%, according to the International Diabetes Federation (IDF). Saeed et al. also concluded that Yemeni school-aged children are at a potential risk of MetS despite its low prevalence [21].

There is an increased prevalence of MetS and its risk factors among health care workers (HCWs), which in turn contribute to the development of CVD. This increased prevalence reached alarming levels of global health and socioeconomic concern [22,23]. HCWs are subjected to life-and-death duality in their work shifts, as well as to inappropriate working conditions, work overload, and stress; in addition, they are exposed to extra working shifts, occupational hazards, physical wear, and other unfavourable conditions that promote the development of various diseases [24-28]. Several studies have demonstrated that the risk of developing Mets is strongly associated with night-shift work [29,30]. According to a recent meta-analysis, compared to day HCWs, shift workers showed a more than twofold increase in the risk of developing MetS [31]. Another study found a significant correlation between the development of MetS and anxiety and stress [32]. Among Yemeni physicians, a study conducted in 2008 demonstrated that the prevalence of MetS was similar to that of western populations [33]. Therefore, the present study was conducted to determine the prevalence of MetS and pre-MetS, as well as their components, among HCWs in Sana'a City, Yemen.

Subjects and Methods

Study design and participants

This is an observational, cross-sectional study conducted between February and July 2021. Medical staff (doctors, dentists, nurses, pharmacists, psychologists, physiotherapists, physical trainers, biochemists, and nutritionists) and those who work in the hospital, including paramedics, ambulance drivers, assistants, clerks, cleaners, receptionists, and managing personnel inside the hospital, were considered. Diverse recruitment channels (hospital administration, professional societies) were utilized to avoid the overrepresentation of specific groups. Moreover, a plan was developed to reach a representative sample of HCWs from different specialties and levels of experience.

Two hospitals in Sana'a City, Yemen, were randomly selected, one public (Al-Kuwait University Hospital) and one private (the University of Science and Technology Hospital). A total of 282 participants were randomly enrolled. Individuals with malignant diseases, any chronic or acute diseases, inflammation, women who were pregnant or breastfeeding, and those who were on regular medication during the study were excluded. All enrolled subjects attended an interview at which a pre-designed questionnaire was completed, assessing the following socioeconomic data: age, gender, marital status, smoking, and education level. The study was conducted in accordance with the Declaration of Helsinki by including basic principles of ensuring the study subject's privacy, risk, and benefit, being conducted by trained professionals, obtaining written informed consent, and even allowing the right to withdraw if the study participants requested it.

Clinical and anthropometric assessments

All participants underwent physical examinations at baseline. They were instructed to refrain from smoking or consuming tea or coffee for at least 30 minutes before the measurements. After 5–10 minutes of rest, BP was twice measured in the sitting position using a standardized mercury column sphygmomanometer and stethoscope while supporting the arm on a firm surface. After 1-2 minutes, a second reading was taken, and the mean of the two measurements was recorded. Height was measured to the nearest 0.1 cm using a portable Shorr Board. Weight was determined with the participants wearing light clothing and without shoes. A Balance Non-Digital Scale (SCOEHNLE-CERTIFIED classic XL) was used to measure the weight to the nearest 0.1 kg. The body mass index (BMI) was calculated by dividing the body weight in kilograms by the square of the height in meters. Participants were classified according to the World Health Organization criteria as having normal weight (BMI<25 kg/m^2), overweight (25–29.9 kg/m^2), or obese (≥30 kg/m^2) [34]. The body fat percentage (BFP) was calculated in women by the formula (1.20 x BMI) + (0.23 x Age) - 5.4, while in men by (1.20 x BMI) + (0.23 x Age) - 16.2. Waist circumference (WC) was measured in the abdominal region while the participant was standing, breathing normally, and without clothing. The waist was measured midway between the costal margin and the iliac crest using a 1.50-meter flexible nonstretch tape measure with 0.5 cm divisions.

Biochemical analysis

Standard laboratory methods were used to measure serum parameters. All participants were instructed not to undertake any vigorous exercise in the 24 hours prior to blood sample collection. After an 8-hour fasting period, the lipid profile and fasting plasma glucose (FPG) were evaluated. Assessment of the lipid profile was done by measuring triglycerides (TGs), total cholesterol (TC), high-density lipoprotein cholesterol (HDL-c), and low-density lipoprotein cholesterol (LDL-c). Roche COBAS5001 analyzer (Germany) was used in all laboratory assessments.

Definitions of metabolic syndrome and pre-metabolic syndrome

MetS has been defined as having three or more of the five risk factors: 1) raised FPG (≥100 mg/dL or use of hypoglycemic medication); 2) abdominal obesity (WC ≥ 80 cm in women and ≥ 90 cm in men); 3) raised TGs (≥150 mg/dL or use of medications to lower triglycerides); 4) reduced HDL-c (<50 mg/dL in women and <40 mg/dL in men or specific treatment for this lipid abnormality); 5) raised BP (systolic BP (SBP) ≥130 mm Hg and/or diastolic BP (DBP) ≥85 mm Hg or on anti-hypertensive treatment) [35]. Pre-MetS has been defined as the presence of no less than two components of MetS without the fulfillment of diagnostic criteria for MetS [36].

Statistical analysis

All data was collected in a database, and obvious errors and non-plausible data were cleaned. The Kolmogorov-Smirnov test was used to check the normality of continuous data. Accordingly, the normally distributed continuous variables were presented as the means and Standard Deviations (SD), and the nonparametric data as the medians and ranges (minimum and maximum). HCWs were dichotomized into two groups (with MetS or without MetS). The prevalence of MetS and pre-MetS was reported in percents with 95% confidence intervals (CIs). The chi-square test or Fisher's exact test was used for the comparison between both cohorts, as appropriate. Depending on the distribution pattern, the student t-test or the Mann- Whitney U test was used to analyze the differences between two groups of continuous variables. Thereafter, HCWs were reclassified into three analytic groups based on the number of MetS components (0-1, 2, or ≥3 components). For comparison of means, Analysis of Variance (ANOVA) with a post hoc Tukey test was used for normally distributed variables, while Kruskal-Wallis H with a post hoc Dunn's test was used for nonparametric variables. With the use of simple logistic regression analysis, Odds Ratios (ORs) and their 95% CIs were calculated to assess the association between the variables studied and the MetS. All statistical analysis was conducted using the Statistical Package for Social Science Analysis (SPSS, Inc., Chicago, Illinois, USA) version 28.0, adopting a significance level of 5% for all hypothesis tests.

Results

The present study recruited 282 HCWs, with 158 (56.0%) being female and the remaining 124 (44.0%) being male. Their ages ranged from 20 to 59 years, with a mean of 31.8 ± 7.2 years. The majority of subjects were non-smokers (85.1%) and married (71.6%). Table 1 shows the sociodemographic and behavioral data of all enrolled subjects. As the age of HCWs increased, so did the prevalence of MetS. The prevalence of MetS was significantly higher in smokers than nonsmokers (38.1% vs. 12.5%, respectively).

Both anthropometric parameters (BMI and WC), BFP, DBP, SBP, and FPG were significantly higher among HCWs with MetS. Likewise, HCWs with MetS had higher values of TGs, TC, LDL-c, non-HDL-c, TC/HDL-c, LDL-c/HDL-c, and lower HDL-c than those without MetS. Heart rate (HR), uric acid (UA) concentrations, urea levels, and creatinine levels did not differ between groups (Table 2).

Table 1: Sociodemographic and behavioral data of HCWs with MetS and without MetS (n= 282).

Variables	Total (n= 282)	With MetS (n= 46)	Without MetS (n=236)	P
Age, mean (SD)	31.8 (7.2)	37.6 (10.1)	30.7 (5.9)	**<0.001**
Marital status, n (%)				
Unmarried	80 (28.4)	10 (12.5)	70 (87.5)	0.276
Married	202 (71.6)	36 (17.8)	166 (82.2)	
Educational level, n (%)				
≤ Diploma	102 (36.2)	20 (19.6)	82 (80.4)	0.259
University/postgraduate	180 (63.8)	26 (14.4)	154 (85.6)	
Smoking, n (%)				
Yes	42 (14.9)	16 (38.1)	26 (61.9)	**<0.001**
No	240 (85.1)	30 (12.5)	210 (87.5)	

Abbreviations: MetS: Metabolic Syndrome; SD: Standard Deviation.

Table 2: Anthropometric, clinical, and biochemical parameters among HCWs with MetS and without MetS (n = 282).

Parameters	Total (n = 282)	With MetS (n =46)	Without MetS (n =236)	P
Body weight (kg), mean (SD)	63.4 (14.0)	76.3 (17.1)	60.8 (11.8)	**<0.001**
Height (m), mean (SD)	1.62 (0.08)	1.65 (0.08)	1.62 (0.8)	**0.020**
BMI (kg/m2), mean (SD)	23.9 (4.7)	27.8 (6.3)	23.1 (3.9)	**<0.001**
WC (cm), mean (SD)	88.5 (13.5)	99.1 (15.9)	86.4 (11.9)	**<0.001**
BFP (%), mean (SD)	26.0 (8.1)	31.5 (8.6)	24.9 (7.5)	**<0.001**
SBP (mmHg), mean (SD)	105.5 (13.6)	116.5 (16.2)	103.6 (12.0)	**<0.001**
DBP (mmHg), mean (SD)	74.5 (17.6)	88.7 (27.9)	71.8 (13.2)	**<0.001**
HR (beats per minute), mean (SD)	81.2 (14.1)	86.8 (22.6)	80.1 (11.6)	0.229
FPG (mg/dL), mean (SD)	83.2 (25.0)	102.3 (43.5)	79.5 (11.1)	**<0.001**
TGs (mg/dL), median (range)	98.4 (27-377)	168.1 (73.2-329.3)	95.8 (27-377.1)	**<0.001**
TC (mg/dL), median (range)	183.6 (71-290)	205.1 (111-253.6)	179.8 (71.4-203.2)	**0.001**
LDL-c (mg/dL), mean (SD)	115.9 (31.5)	128.5 (27.3)	113.4 (31.8)	**<0.001**
HDL-c (mg/dL), median (range)	45.9 (21-127)	40.8 (26.3-59.6)	49.1 (31.7-127.1)	**<0.001**
Non-HDL-c (mg/dL), mean (SD)	138.8 (37.9)	157.3 (30.7)	135.3 (38.1)	**<0.001**
TC /HDL-c (mg/dL), mean (SD)	4.13 (1.2)	5.0 (1.3)	3.9 (1.1)	**<0.001**
LDL-c/HDL-c (mg/dL), mean (SD)	2.58 (0.92)	3.2 (0.8)	2.4 (0.8)	**<0.001**
UA (mg/dL), mean (SD)	3.0 (0.7)	3.2 (0.7)	3.2 (0.7)	0.502
Urea (mg/dL), mean (SD)	22.1 (5.8)	21.8 (5.8)	23.5 (5.5)	0.165
Creatinine (mg/dL), mean (SD)	0.84 (0.1)	0.86 (0.1)	0.86 (0.1)	0.136

Abbreviations: BFP: Body Fat Percentage; BMI: Body Mass Index; DBP: Diastolic Blood Pressure; FPG: Fasting Plasma Glucose; HDL-c: High-Density Lipoprotein Cholesterol; HR: Heart Rate; LDL-c: Low-Density Lipoprotein Cholesterol; TC: Total Cholesterol; TGs: Triglycerides; MetS: Metabolic Syndrome; SBP: Systolic Blood Pressure; SD: Standard Deviation; UA: Uric Acid; WC: Waist Circumference.

Table 3: The prevalence of Metabolic syndrome, pre-metabolic syndrome, and their components in health care workers (n = 282).

	Total (n= 282)	Males (n= 124)	Females (n=158)	P
MetS, % (95% CI)	16.3 (12.2-21.2)	17.7 (11.5-25.6)	15.2 (10.0-21.8)	0.565
Pre-MetS, % (95% CI)	26.2 (21.2-31.8)	29.0 (21.2-37.9)	24.1 (17.6-31.5)	0.345
Components of MetS, % (95% CI)				
High BP	15.6 (11.6-20.4)	24.2 (17.0-32/7)	8.9 (4.9-14.4)	**<0.001**
Hypertriglyceridemia	28.4 (23.2-34.0)	46.8 (37.8-55.9)	13.9 (8.9-20.3)	**<0.001**
Abdominal obesity	15.6 (9.5-22.7)	8.1 (3.9-14.3)	23.2 (15.1-31.1)	**<0.001**
High FPG	8.50 (5.51-12.4)	12.9 (7.6-20.1)	5.1 (2.20-9.70)	**0.019**
Low HDL-c	51.8 (45.8-57.7)	48.4 (39.3-57.5)	54.4 (46.3-62.4)	0.313

Abbreviations: BP: Blood Pressure; CL: Confidence Interval; FPG: Fasting Plasma Glucose;
HDL-c: High-Density Lipoprotein Cholesterol; MetS: Metabolic Syndrome.

Table 3 demonstrates the prevalence of MetS and its components. The prevalence of MetS was 16.3% (95% CI: 12.2-21.2) among HCWs, with no significant difference between the genders (P = 0.565). Low HDL-c was the most prevalent component of MetS in both genders, with 48.4% of men and 54.4% of women having it. The other two most common components of MetS in men were hypertriglyceridemia (46.8%), followed by high BP (24.2%), and in women, abdominal obesity (23.2%) and hypertriglyceridemia (13.9%). The presence of hypertriglyceridemia, high FBG, and high BP MetS components was higher among men. Conversely, abdominal obesity was more frequent among women.

Table 4 describes the odds ratio for the association between age, smoking, adiposity indicators, and biochemical parameters, and pre-MetS and MetS in HCWs. The pre-MetS was associated with BMI, TC/HDL-c, and LDL-c/HDL-c ratios. For each increase of 1 kg/m2 in BMI, there was a 7% increased risk of MetS. The investigation of biochemical markers showed that the risk of MetS went up by about 1.5 times for every unit increase in the TC/HDL-c or LDL-c/HDL-c ratios. Age, smoking, BMI, BFP, TC/HDL-c ratios, and LDL-c/HDL-c all positively increased the risk of MetS. HCWs aged 40 or older had 6.5 times more risk of having MetS than those less than 40 years old (95% CI: 2.97–14.01). Smokers who work in health care were 4.3 times more likely to have MetS compared to their nonsmoker counterparts (95% CI: 2.07-8.95). For each 1 kg/m2 increase in BMI and 1% body fat, there was a 23% and 11% increased risk of MetS, respectively. The investigation of biochemical markers showed that the risk of MetS almost doubled for every unit increase in the TC/HDL-c or LDL-c/HDL-c ratio.

Discussion

The prevalence of MetS was 16.3% in our study, with no significant difference between the genders, based on the IDF criteria. Our study reported a lower prevalence of MetS than previously published among Yemeni physicians (16.3% vs. 23.8%, respectively), based on different criteria for defining MetS [33]. Conversely, our study's prevalence of MetS was extremely higher than the 4.5% identified by the LATINMETS Brazil study [23]. Using the same criteria as our study, another LATINMETS study reported a comparable MetS prevalence of 17.5% among Columbian health professionals [37]. A study in Germany found that 1.7% of HCWs had MetS [38]. In another study in Italy, on night shift HCWs, 9% of the population had MetS [29]. A study among HCWs in Iran reported a prevalence of MetS of 22.4% [14]. According to the criteria

Table 4: Odds ratio for the association between age, smoking, adiposity indicators, and biochemical parameters, and pre-MetS and MetS.

Variables	Pre-MetS	MetS
	OR (95% CI)	
Age (≥ 40 years)	0.34 (0.12-0.99) *	6.45 (2.97-14.01)
Smokers	1.15 (0.55-2.38) *	4.31 (2.07-8.95)
BMI (kg/m2)	1.07 (1.02-1.14)	1.23 (1.14-1.33)
BFP (%)	1.02 (0.98-1.05) *	1.11 (1.06-1.16)
TC /HDL-c	1.64 (1.30-2.06)	1.96 (1.49-2.58)
LDL-c/HDL-c	1.66 (1.23-2.24)	2.58 (1.76-3.79)
Non-HDL-c	1.11 (1.01-1.24)	1.16 (1.01-1.21)

Abbreviations: BFP: Body Fat Percentage; BMI: Body Mass Index; BP: Blood Pressure; CL: Confidence Interval; HDL-c: High-Density Lipoprotein Cholesterol; LDL-c: Low-Density Lipoprotein Cholesterol; MetS: Metabolic Syndrome; TC: Total Cholesterol; * = Non-significant Relationship.

established by the IDF, the prevalence of MetS in the adult US population decreased from 25.5% in 1999–2000 to 22.9% in 2009–2010, as indicated by the NHANES data [39]. In one of the largest meta-analyses to date of 59 studies in the Middle East, the pooled estimated prevalence of this syndrome was 25% in the adult population [40]. It is important to note that our entire sample consisted of HCWs and/or educated subjects, with none having an education level below high school, thereby ensuring homogeneity in terms of educational attainment. Therefore, our findings are not comparable when considering the general population. Research comparing the prevalence of MetS among HCWs and non-HCWs shows mixed results. One study in Nigeria observed a similar prevalence of MetS in both groups (29.5% vs. 28.0%, respectively, P = 0.789) [41]. Interestingly, while the prevalence was comparable in the above study, certain risk factors were more frequent in HCWs. In particular, abdominal obesity, high TC, and high LDL-c were more common in HCWs than in non-HCWs [41]. On the other hand, another study reported that the prevalence of MetS was higher in physicians and administrative personnel than in other populations [42]. These discrepancies highlight the need for further research to understand the true scope of MetS in this population. The fact that the previous Yemeni study was physician-based, suggesting a higher prevalence of MetS among physicians, could explain the relatively lower prevalence of MetS in our study. However, our finding is still alarming.

We also found that the prevalence of MetS increased with age, presenting as high in subjects over 40 years of age, which is in line with the results of the LATINMETS Brazil study [23]. Corroborating these findings, four other studies from different geographical regions of the world also found an increased prevalence of MetS with age [14,22,30,43]. In general, age significantly influences the prevalence of MetS among HCWs, yet the underlying reasons remain poorly understood. However, physiological changes and lifestyle factors can contribute to this age-related trend. In addition, age can influence the pattern of MetS components.

In concordance with the results of the LATINMETS Brazil study [23], our study revealed that there was no significant difference between the genders in the prevalence of MetS. One study suggested that men are more likely to develop MetS than women [43]. The authors have argued that this could be due to biological factors like hormonal influence and behavioral aspects like men being less likely to prioritize preventive healthcare [43]. On the other hand, a different study revealed that women were significantly more likely to have MetS than men, with 34.9% of women and 2.4% of men having the syndrome [44]. Additionally, another study noted that the prevalence of MetS among female HCWs was about three times that of male subjects [45]. These conflicting findings suggest a lack of clear consensus, with various factors such as work environment, lifestyle, and socioeconomic status influencing the likelihood of MetS.

The presence of two MetS components appears to enhance atherogenic dyslipidemia and anthropometric indicators of obesity. Pre-MetS may be able to detect anthropometric indicators and metabolic abnormalities, suggesting that this early phase preceding the MetS is also marked by an elevated risk of insulin resistance and atherosclerosis complications [36,46]. A recent study has shown that Yemeni children are at potential risk for pre-MetS later in life [21]. Hyperuricemic individuals have a cardiometabolic risk factor even in asymptomatic clinical manifestations. Research observed that concentrations of UA increased linearly with the increasing number of MetS components [23,46]. Studies in Asian populations (Japan, Thailand, South Korea, and China) also demonstrated a positive relationship between MetS and UA concentrations [47-50]. These findings seem in accordance with our study, although statistically unproven. Furthermore, research has shown that among obese individuals (10 to 15.9 years old), UA concentration is a reliable predictor of pre-MetS [46].

Limitations

It must be acknowledged that there are several potential limitations to this study, and it is therefore important to interpret its findings in the context of these limitations. First, due to the inherent characteristics of the cross-sectional design, causality between the syndrome and variables, as well as the temporal sequence between risk factors and the syndrome, cannot be established. Second, the relationships between the syndrome and both long working hours and night shift work have not been investigated. Third, the study was based on data from HCWs at two hospitals and may not be generalizable to other populations or settings. Despite these limitations, this observational study provided valuable insights into the prevalence and associated risk factors of the syndrome, which, in the future, could inform interventions and might be a building block of input for longitudinal studies.

Conclusion

The study revealed an alarming prevalence of MetS among HCWs, which increased with age. Both pre-MetS and MetS were present only in overweight individuals and associated with a wide range of adiposity and lipid profile measures, reflecting a drastically poor health profile even in individuals without established MetS. The country faces significant healthcare challenges, hence the need for a multi-prolonged approach and an effective strategy focusing on early identification, promoting healthy lifestyles, and adapting to the Yemeni context to prevent or delay MetS. Further studies are required to understand more about this syndrome and its implications for the Yemeni population.

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Conflicts of Interest

The authors declare no conflict of interest.

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References

1. Li R, Li W, Lun Z, Zhang H, Sun Z, et al. (2016) Prevalence of metabolic syndrome in Mainland China: a meta-analysis of published studies. BMC public health 16: 1-10.

2. Ranasinghe P, Mathangasinghe Y, Jayawardena R, Hills AP, Misra A (2017) Prevalence and trends of metabolic syndrome among adults in the asia-pacific region: a systematic review. BMC public health 17: 1-9.

3. Ng M, Fleming T, Robinson M, Thomson B, Graetz N, et al. (2014) Global, regional, and national prevalence of overweight and obesity in children and adults during 1980–2013: a systematic analysis for the Global Burden of Disease Study 2013. The lancet 384: 766-781.

4. Bray GA, Popkin BM (2013) Calorie sweetened beverages and fructose: what have we learned 10 years later. Pediatr Obes 8: 242-248.

5. Bastien M, Poirier P, Lemieux I, Després J-P (2014) Overview of epidemiology and contribution of obesity to cardiovascular disease. Prog Cardiovasc Dis 56: 369-381.

6. Yumuk V, Tsigos C, Fried M, Schindler K, Busetto L, et al. (2015) European guidelines for obesity management in adults. Obes facts 8: 402-424.

7. Reisinger C, Nkeh-Chungag BN, Fredriksen PM, Goswami N (2021) The prevalence of pediatric metabolic syndrome- critical look on the discrepancies between definitions and its clinical importance. Int J Obes 45: 12-24.

8. Kaur J (2014) A comprehensive review on metabolic syndrome. Cardiol res pract.

9. OECD (2023) Health at a Glance 2023.

10. American Heart Association (2023) What is Metabolic Syndrome?

11. Al-Hamad D, Raman V (2017) Metabolic syndrome in children and adolescents. Transl Pediatr 6: 397.

12. Vanlancker T, Schaubroeck E, Vyncke K, Cadenas-Sanchez C, Breidenassel C, et al. (2017) Comparison of definitions for the metabolic syndrome in adolescents. The HELENA study. Eur J Pediatr 176: 241-252.

13. Achike FI, To NHP, Wang H, Kwan CY (2011) Obesity, metabolic syndrome, adipocytes and vascular function: a holistic viewpoint. Clin Exp Pharmacol Physiol 38: 1-10.

14. Niazi E, Saraei M, Aminian O, Izadi N (2019) Frequency of metabolic syndrome and its associated factors in health care workers. Diabetes Metab Syndr: Clinical Research & Reviews 13: 338-342.

15. Burrows R, Correa-Burrows P, Reyes M, Blanco E, Albala C, et al. (2016) High cardiometabolic risk in healthy Chilean adolescents: associations with anthropometric, biological and lifestyle factors. Public health nutr 19: 486-493.

16. Ramírez-Vélez R, Anzola A, Martinez-Torres J, Vivas A, Tordecilla-Sanders A, et al. (2016) Metabolic syndrome and associated factors in a population-based sample of schoolchildren in Colombia: the FUPRECOL study. Metab Syndr Relat Disord 14: 455-462.

17. Miller JM, Kaylor MB, Johannsson M, Bay C, Churilla JR (2014) Prevalence of metabolic syndrome and individual criterion in US adolescents: 2001–2010 National Health and Nutrition Examination Survey. Metab Syndr Relat Disord 12: 527-532.

18. Asghari G, Eftekharzadeh A, Hosseinpanah F, Ghareh S, Mirmiran P, et al. (2017) Instability of different adolescent metabolic syndrome definitions tracked into early adulthood metabolic syndrome: Tehran Lipid and Glucose Study (TLGS). Pediatr Diabetes 18: 59-66.

19. Bahrani R, Chan YM, Khor GL, Rahman HA, Esmailzadeh A, et al. (2016) The relationship between metabolic syndrome and its components with socio-economic status among adolescents in Shiraz, southern Iran. Southeast Asian J Trop Med Public Health 47: 263.

20. Al-Hussein FA, Tamimi W, Al Banyan E, Al-Twaijri YA, Tamim H (2014) Cardiometabolic risk among Saudi children and adolescents: Saudi children's overweight, obesity, and lifestyles (S. Ch. OO Ls) study. Ann Saudi Med 34: 46-53.

21. Saeed W, Al-Habori M, Saif-Ali R, Al-Eryani E (2020) Metabolic syndrome and prediabetes among Yemeni school-aged children. Diabetes Metab Syndr Obes 2020: 2563-2572.

22. Ahmed HF, Qader S, Hussene B (2014) Prevalence of metabolic syndrome among health care providers. Merit Res J Med Med Sci 2: 238-244.

23. Vidigal FdC, Ribeiro AQ, Babio N, Salas-Salvadó J, Bressan J (2015) Prevalence of metabolic syndrome and pre-metabolic syndrome in health professionals: LATINMETS Brazil study. Diabetol Metab Syndr 7: 1-9.

24. Garrido RA, Semeraro MB, Temesgen SM, Simi MR (2009) Metabolic syndrome and obesity among workers at Kanye Seventh-day Adventist Hospital, Botswana. S Afr Med J 99: 331-334.

25. Ahmad Faris A, S. MN, Mohd W, Zahiruddin W (2010) Metabolic syndrome and occupational risk factors among healthcare workers in Kelantan.

26. Costa FMd, Vieira MA, Sena RRd (2009) Absenteísmo relacionado a doenças entre membros da equipe de enfermagem de um hospital escola. Revista Brasileira de Enfermagem 62: 38-44.

27. Sancinetti TR, Soares AVN, Lima AFC, Santos NC, Melleiro MM, et al. (2011) Taxa de absenteísmo da equipe de enfermagem como indicador de gestão de pessoas. Revista da Escola de Enfermagem da USP 45: 1007-1012.

28. Luedy A, Barreto DL, Júnior HC-R (2018) Impact of metabolic-syndrome risk factors on the absenteeism of health workers from a Brazilian University Hospital. Health 10: 853-877.

29. Pietroiusti A, Neri A, Somma G, Coppeta L, Iavicoli I, et al. (2010) Incidence of metabolic syndrome among night-shift healthcare workers. Occup Environ Med 67: 54-57.

30. Rossa CEB, Caramori PRA, Manfroi WC (2012) Metabolic syndrome in workers in a university hospital. Rev Port Cardiol (English Edition) 31: 629-636.

31. Sooriyaarachchi P, Jayawardena R, Pavey T, King NA (2022) Shift work and the risk for metabolic syndrome among healthcare workers: A systematic review and meta analysis. Obes Rev 23: e13489.

32. Ribeiro RP, Marziale MHP, Martins JT, Ribeiro PHV, Robazzi MLdCC, Dalmas JC (2015) Prevalence of Metabolic Syndrome among nursing personnel and its association with occupational stress, anxiety and depression. Revista latino-americana de enfermagem 435-440.

33. Al Mikhlafy AA (2008) Metabolic syndrome among Yemeni Physicians in Sana'a. Suez Canal University Medical Journal 11: 31-34.

34. World Health Organization (2024) Body mass index (BMI).

35. Alberti KG, Eckel RH, Grundy SM, Zimmet PZ, Cleeman JI, et al. (2009) Harmonizing the metabolic syndrome: a joint interim statement of the international diabetes federation task force on epidemiology and prevention; national heart, lung, and blood institute; American heart association; world heart federation; international atherosclerosis society; and international association for the study of obesity. Circulation 120: 1640-1645.

36. Yin Q, Chen X, Li L, Zhou R, Huang J, et al. (2013) Apolipoprotein B/ apolipoprotein A1 ratio is a good predictive marker of metabolic syndrome and pre metabolic syndrome in Chinese adolescent women with polycystic ovary syndrome. J Obstet Gynaecol Res 39: 203-209.

37. González Zapata LI, Deossa GC, Monsalve Álvarez J, Díaz García J, Babio N, et al. (2013) Metabolic syndrome in healthcare personnel at the University of Antioquia-Colombia. LATINMETS study. Nutr Hosp 28: 522-531.

38. Pan A, Keum N, Okereke OI, Sun Q, Kivimaki M, et al. (2012) Bidirectional association between depression and metabolic syndrome: a systematic review and meta-analysis of epidemiological studies. Diabetes care 35: 1171-1180.

39. Beltrán-Sánchez H, Harhay MO, Harhay MM, McElligott S (2013) Prevalence and trends of metabolic syndrome in the adult US population, 1999–2010. J Am Coll Cardiol 62: 697-703.

40. Ansarimoghaddam A, Adineh HA, Zareban I, Iranpour S, HosseinZadeh A, et al. (2018) Prevalence of metabolic syndrome in Middle-East countries: Meta-analysis of cross-sectional studies. Diabetes Metab Syndr: Clinical Research & Reviews 12: 195-201.

41. Dele-Ojo BF, Raimi TH, Fadare JO, Dada SA, Ajayi EA, et al. (2021) Association between metabolic syndrome and healthcare work status in Ekiti State, Nigeria. Pan Afr Med J 39.

42. Yeh W-C, Chuang H-H, Lu M-C, Tzeng I-S, Chen J-Y (2018) Prevalence of metabolic syndrome among employees of a Taiwanese hospital varies according to profession. Medicine 97: e11664.

43. Buckland G, Salas-Salvadó J, Roure E, Bulló M, Serra-Majem L (2008) Sociodemographic risk factors associated with metabolic syndrome in a Mediterranean population. Public health nutr 11: 1372-1328.

44. Adeoye AM, Adewoye IA, Dairo DM, Adebiyi A, Lackland DT, et al. (2015) Excess metabolic syndrome risks among women health workers compared with men. J Clin Hypertens (Greenwich) 17: 880-884.

45. Adaja TM, Idemudia JO (2018) Metabolic syndrome among healthcare workers in a tertiary hospital in South-South, Nigeria. Asian J Med Health 12: 1-9.

46. Denzer C, Muche R, Mayer H, Heinze E, Debatin K-M, et al. (2003) Serum uric acid levels in obese children and adolescents: linkage to testosterone levels and pre-metabolic syndrome. J Pediatr Endocrinol Metab 16: 1225-1232.

47. Lee J-M, Kim HC, Cho HM, Oh SM, Choi DP, et al. (2012) Association between serum uric acid level and metabolic syndrome. J Prev Med Public Health 45: 181.

48. Dai X, Yuan J, Yao P, Yang B, Gui L, et al. (2013) Association between serum uric acid and the metabolic syndrome among a middle-and old-age Chinese population. Eur J Epidemiol 28: 669-676.

49. Jaipakdee J, Jiamjarasrangsri W, Lohsoonthorn V, Lertmaharit S (2013) Prevalence of metabolic syndrome and its association with serum uric acid levels in Bangkok Thailand. Southeast Asian J Trop Med Public Health 44: 512-522.

50. Oda E (2014) Serum uric acid is an independent predictor of metabolic syndrome in a Japanese health screening population. Heart vessels 29: 496-503.

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