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Artigo Original

Life's Essential 8 in industrial workers

Life's Essential 8 em trabalhadores do setor industrial

Pedro Henrique de Almeida Silva[1]; Ayse Suzel Martins Cosme[2]; Marcos Filipe Da Silva Mello[3]; Helayne Moreira de Assis Feitosa[4]; Karolina Ribeiro Gonçalves[5]; Filipe Moreira Gomides Sardinha Carvalhedo[5]; Giovanna de Oliveira Fernandes[5]; Kercya de Almeida Silva Sales[5]; Ruy Abdalla Soares[5]; Viviane Soares[6].

1. PhD student. Laboratory of Studies in Cardiorespiratory and Metabolic Health. Postgraduate Program in Human Movement and Rehabilitation. Evangelical University of Goiás – UniEVANGÉLICA, Anápolis, Brazil.
2. [2]PhD student. Postgraduate Program in Human Movement and Rehabilitation. Evangelical University of Goiás – UniEVANGÉLICA, Anápolis, Brazil. Professor of Basic, Technical and Technological Education, Federal Institute of Piauí – Parnaiba Campus, Brazil.
3. MSc. Assistant Professor. Evangelical University of Goiás – UniEVANGÉLICA, Anápolis, Brazil. Laboratory of Studies in Cardiorespiratory and Metabolic Health.
4. Clinical cytology specialist. Evangelical University of Goiás – UniEVANGÉLICA, Anápolis, Brazil.
5. Graduating from the Medicine Course. Evangelical University of Goiás – UniEVANGÉLICA, Anápolis, Brazil.
6. PhD. Associate Professor. Laboratory of Studies in Cardiorespiratory and Metabolic Health. Postgraduate Program in Human Movement and Rehabilitation. Evangelical University of Goiás – UniEVANGÉLICA, Anápolis, Brazil.

Abstract

Introduction: The prevalence of cardiovascular health (CVH) factors defined by Life's Simple 8 (LS8) among men and women in Brazil who work in industry is still incipient. And it is known that low levels of CVH are associated with cardiovascular diseases (CVDs) and early mortality. **Objective:** To evaluate CVH in workers in the industrial sector. **Methods:** Cross-sectional study, carried out with 78 industrial employees. CVH was defined by the LS8 established by the American Heart Association (AHA). The eight factors evaluated were diet, physical activity level (PAL), sleep health, smoking, non-HDL cholesterol, fasting glucose, systemic blood pressure (SBP) and body mass index (BMI). Thus, the International Physical Activity Questionnaire (IPAQ - short version), the Mediterranean Diet and the Pittsburgh Sleep Quality Index were applied to evaluate PAL, diet and sleep health, respectively. **Results:** Women presented higher values for diet (p=0.001), with lower systolic BP (p=0.020). Men had a lower prevalence of high CVH for the diet metric (p=0.002). Women presented a higher prevalence of high CVH for the BMI metric. **Conclusion:** Women in the industrial sector have a more cardioprotective diet and better blood pressure levels. The assessment of CVH in this sector is essential to identify behaviors and health factors that require greater attention, in addition to encouraging industries to implement policies aimed at promoting employee health.

Palavras-chave: Risk factors. Cardiovascular health. Industry. Workers.

Resumo

Introdução: A prevalência dos fatores da saúde cardiovascular (SCV) definida pela Life's Simple 8 (LS8) de homens e mulheres no Brasil que trabalham em indústria ainda é incipiente. E sabe-se que fatores da SCV em níveis baixos estão associados a doenças cardiovasculares (DCVs) e mortalidade precoce. **Objetivo:** Avaliar a SCV em trabalhadores do setor industrial. **Método:** Estudo transversal, realizado com 78 colaboradores da indústria. A SCV foi definida pela LS8 estabelecida pela American Heart Association (AHA). Os oitos fatores avaliados foram dieta, nível de atividade física (NAF), saúde do sono, tabagismo, colesterol-não HDL, glicemia de jejum, pressão arterial sistêmica (PAS) e índice de massa corporal (IMC). ssim, foi aplicado o Questionário Internacional de Atividade Física (IPAQ - versão curta), o da Dieta do Mediterrâneo e o Índice de Qualidade do Sono de Pittisburgh para avaliar o NAF, dieta e saúde do sono, respectivamente. **Resultados:** As mulheres apresentaram valores superiores para a dieta (p=0,001), sendo inferior da PA sistólica (p=0,020). Os homens tiveram menor prevalência de alta SCV para a métrica dieta (p=0,002). As mulheres apresentaram maior prevalência para alta SCV para a métrica IMC. **Conclusão:** Mulheres do setor industrial apresentam uma alimentação mais cardioprotetora e melhores níveis de pressão arterial. A avaliação da SCV nesse setor é fundamental para identificar comportamentos e fatores de saúde que demandam maior atenção, além de incentivar as indústrias a implementarem políticas voltadas para a promoção da saúde dos colaboradores.

Keyword: Fatores de risco. Saúde cardiovascular. Industria. Trabalhadores.

***Correspondência para/ Correspondence to:**
Pedro Henrique de Almeida Silva: pedrohenri.educacaofisica@gmail.com

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INTRODUCTION

Cardiovascular disease (CVD) is cause of death in Brazil and worldwide.[1] In China in 2021, 4.3 million people were followed over a 10-year period, resulting in 9,660 deaths related to cardiovascular events.[2] Of these, 3,664 deaths were attributed to ischemic heart disease and 2,482 to myocardial infarction. Of these deaths, 3,564 were attributed to ischemic heart disease, of which 2,248 were caused by myocardial infarction.[2] In addition, approximately 5,168 deaths occurred due to cerebrovascular co-morbidities, of which 3,092 were caused by hemorrhagic stroke and 965 by ischemic stroke.[2] In Brazil, 28.2% of deaths in 2019 were caused by CVDs, and 82.6% of them are related to poor nutrition, sedentary lifestyle, obesity, cholesterolemia and diabetes.[3] In addition, physical disability due to these diseases is very common and increases public health costs.[1] Over the years, initiatives have been planned and implemented to measure the extent of the problem and to reduce the prevalence and incidence of CVDs and risk factors,[4] and were established the concept of cardiovascular health (CVH).

The original definition of CVH, known as Life's Simple 7, was based on seven health metrics (four behavioral and three biological) that, when optimal, are associated with increased life expectancy and quality of life.[5] This guideline aimed to reduce CVD deaths by approximately 20% by 2020, as well as public health costs.[5] In addition, it aimed to assess people's level of health rather than focusing solely on disease.[6] In 2022, the construct was updated to include sleep health and was renamed Life's Simple 8 (LS8).[6] However, CVH as defined by LS8 is associated with several comorbidities such as CVDs7-9 and other risk factors or conditions such as anxiety, depression,[7] metabolic syndrome,[8] periodontitis[9] and cognitive function.[10] Therefore, the results are only estimates and more research should be conducted, especially in workers in the industrial sector.

The work environment in the industrial sector operates 24 hours a day, requiring employees to meet demands during this period.[11] To maintain productivity and functioning, shifts are rotated and overtime is worked.[12] As a result, this routine affects sleep quality and is also associated with risk factors such as hypertension, obesity, and sedentary lifestyle.[11,12] Working more than 40 hours a week has an inverse relationship with CVS scores, leading to the development of CVD in adulthood.[13] One way to identify and monitor these risks is to assess CVH in the workplace in relation to occupational factors. To identify these factors can help with preventive measures and minimize sick

leave/retirement due to chronic noncommunicable diseases.

In view of the above, there is a need to assess the CVH of workers in the industrial sector, since the different demands within the work environment affect the CVH metrics and may increase absenteeism due to chronic non-communicable diseases. However, no studies were found on the prevalence of CVH levels defined by LS8 in Brazil, especially in industrial workers. Therefore, the aim of this study was to evaluate CVS in industrial workers.

MATERIALS AND METHODS

Sample

This is a cross-sectional study conducted among employees of an industry located in the Agroindustrial District of Anápolis (DAIA). This sector is considered one of the largest industrial centers in Brazil. The inclusion criteria were to have worked in the industry for at least six months and to be between 18 and 59 years old. Individuals who did not complete all the research procedures and those with heart, chronic lung and/or cardiometabolic diseases were excluded. During the study, there were approximately 300 employees in the industry who were approached after eating in the lunchroom. Of these, only 166 agreed to participate in the study, but 82 did not complete all the procedures. Thus, the data of 84 employees recruited by invitation were analyzed, but eight were excluded because they were hypertensive and diabetic, leaving a final sample of 76.

Study Design

The Human Research Ethics Committee of the Universidade Evangélica de Goiás - UniEVANGÉLICA approved the project under number 6.898.839/2024. All employees who agreed to participate signed a Free and Informed Consent Form (FICF).

The data were collected between July and August 2024 in a reserved room provided by the participating industry. The study began with the explanation and signing of the ICF, followed by the collection of socio-demographic data and the application of questionnaires: 1) Mediterranean Diet Questionnaire;[14] 2) International Physical Activity Questionnaire - Short Version (IPAQ-short version);[15] 3) Pittsburgh Sleep Quality Index (PSQI);[16] Second, blood samples were taken in the morning to analyze fasting glucose and lipid profile (non-HDL cholesterol).

Protocols

Sociodemographic data

An identification form was completed with data on age, sex, education level, marital status, current job position,

monthly income, medication use, and pre-existing medical conditions.

Life's Essential 8 Definition of Cardiovascular Health

CVH was assessed according to the new LS8 guidelines recommended by the AHA.[6] Eight parameters were defined, four of which are considered health behaviors (diet, physical activity level, nicotine exposure, sleep health) and four health factors (body mass index, non-HDL cholesterol, fasting glucose, systemic blood pressure). A new scoring methodology was introduced, in which the score ranges from 0-100 points.[6] In this way, the eight CVS metrics were categorized as high (80-100 points), moderate (50-79 points) and low (0-49 points) (Table 01).[6]

Table 01. Cardiovascular health metrics according to Life's Essential 8 established by the American Heart Association.

Cardiovascular health			
Health behaviors		**Health factors**	
Diet (points)	**Classification**	**BMI (kg/m²)**	**Classification**
0-11	0	≥40.0	0
12-22	25	35.0–39.9	15
23-34	50	30.0–34.9	30
35-44	80	25.0–29.9	70
45-55	100	<25	100
PAL (min/week)	**Classification**	**Colesterol não-HDL (mg/dL)**	**Classification**
0	0	≥220	0
1-29	20	190–219	20
30-59	40	160–189	40
60-89	60	130–159	60
90-119	80	<130	100
120-149	90		
≥150	100		
Nicotine exposure	**Classification**	**Fasting glycemia (mg/dL)**	**Classification**
Current smoker	0	≥227	0
Former smoker, quit <1 year ago	25	188-226	10
Former smoker, quit smoking 1–<5 years ago	50	170-187	20
Former smoker, quit smoking ≥5 years ago	75	154-169	30
Never smoked	100	126-153	40
		100–125	60
		<100	100
Sleep health (sleeping hours)	**Classification**	**SBP (mmHg)**	**Classification**
<4	0	≥160 or ≥100	0
4–<5	20	140–159 or 90–99	25
5–<6 or ≥10	40	130–139 or 80–89	50
6–<7	70	120–129/<80	75
9–<10	90	<120/<80	100
7–<9	100		

BMI, body mass index. PAL, Physical activity level; SBP, Systolic blood pressure; HbA1c, glycated hemoglobin.

According to the AHA, the diet and the PAL should be adapted according to the characteristics of the study population.[6] In the case of the diet, the adaptations were made using the Cardioprotective Diet Manual developed by the Ministry of Health in collaboration with the Heart Hospital (HCor).[17] The dietary components in this manual are the same as those in the Mediterranean Diet Questionnaire, which was used in the study.[14] This instrument has a degree of adherence and is composed of 11 items with a score ranging from 0-55 points.[14] Thus, the higher the score, the more cardioprotective the diet.[14] These scores were adjusted according to the degree of adherence to classify CVH. PAL was assessed using the IPAQ (short version) validated in Brazil.[15] This questionnaire collects information on the frequency, duration and intensity (moderate and vigorous) of physical activity.[15]

Smoking was assessed using a self-report questionnaire (current smoker, former smoker, never smoker). Hours of sleep (day or night) were calculated using the IQSP.[16] This instrument is validated in Brazil and produces a score of 0-21 points.[16] The IQSP assesses seven components (subjective sleep quality, sleep latency, sleep duration, habitual sleep efficiency, sleep disturbances, use of sleep medication, and daytime dysfunction).[16] However, in this study, only sleep duration was considered to determine hours slept.

BMI was calculated using the formula weight [kg]/height [m]. A digital scale (G-Tech, model Balgl10, São Paulo, Brazil) was used to measure body mass, while height was measured with a portable stadiometer (Sanny, São Paulo, Brazil). The enzymatic colorimetric method was used for serum glucose and non-HDL cholesterol, with the recommendation of 8 to 12 hours of fasting. Diastolic BP (DBP) and systolic BP (SBP) were measured with a semi-automatic device (OMRON, model HEM 705CP, Kyoto, Japan). The reference values for the eight CVH indices are shown in Table 01.

Data analysis

The results were expressed as means, standard deviations, frequencies, percentages, tables and graphs. The Kolmogorov-Smirnov test was used to verify the normality of the data. The Student's t-test for independent samples (symmetrical distribution) and the Mann-Whitney test for independent samples (asymmetrical distribution) were used to compare the groups (male and female). The chi-squared test was performed to associate gender with the eight metrics of the CVH. The p-value considered was < 0.05,

and the data was analyzed using the Statistical Package for Social Science (SPSS, IBM, version 23, Armont, NY).

RESULTS

A total of 76 industrial workers participated in the study, of which 47 (61.8%) were male and 29 (38.2%) were female. Body mass (p=0.015) and height (p<0.001) were higher in men. In terms of occupational status, the majority of women and men were employed in the administrative sector (79.3% and 59.6%, respectively). In addition, 61.7% of men earned between two and three times the minimum wage and did not use continuous medication (91.5%) (Table 02).

Table 02. Sociodemographic and clinical data of the sample (n=76).

Variables	Sex			
	Total (n=76)	Male (n=47)	Female (n=29)	
	Mean±SD	Mean±SD	Mean±SD	p
Age (Years)	31.86±9.84	32.85±10.21	30.27±9.14	0.282
Body mass (kg/m²)	78.69±16.42	82.14±15.13	73.09±17.13	0.015
Height (m)	170.64±9.97	175.38±6.55	162.96±9.84	<0.001
	n (%)	n (%)	n (%)	
Education				0.253
Elementary Education	05 (6.6)	04 (8.5)	01 (3.4)	
Incomplete High School	21 (27.6)	06 (34.0)	05 (17.2)	
Complete High School	06 (7.9)	05 (10.6)	01 (3.4)	
Incomplete Higher Education	20 (26.3)	10 (21.3)	10 (34.5)	
Complete Higher Education	18 (23.7)	09 (19.1)	09 (31.0)	
Postgraduate	06 (7.9)	03 (6.4)	03 (10.3)	
Marital Status				0.617
Single	38 (50.0)	26 (55.3)	12 (41.4)	
Married	30 (39.5)	16 (34.0)	14 (48.3)	
Divorced	02 (2.6)	01 (2.1)	01 (3.4)	
Other	06 (7.9)	04 (8.5)	02 (6.9)	
Position				<0.001
Administrative	51 (67.1)	28 (59.6)	23 (79.3)	
Production	19 (25.0)	18 (38.3)	01 (3.4)	
General Services	06 (7.9)	01 (2.1)	05 (17.2)	
MI (minimum wage)				0.006
Up to one	28 (36.8)	14 (29.8)	14 (48.3)	
Two to three	39 (51.3)	29 (61.7)	10 (34.5)	
Four to five	06 (7.9)	01 (2.1)	05 (17.2)	
Over five	03 (3.9)	03 (6.4)	00 (0.0)	
Medications				0.006
Anti-inflammatories	01 (1.3)	01 (2.1)	00 (0.0)	
Hormonal	03 (3.9)	02 (4.3)	01 (3.4)	
Multivitamins	02 (2.6)	00 (0.0)	02 (6.9)	
Anxiolytics	01 (1.3)	01 (2.1)	00 (0.0)	
Contraceptive	05 (6.6)	00 (0.0)	05 (17.2)	
No drugs	64 (84.2)	43 (91.5)	21 (72.4)	
Comorbidities				0.334

Gastrointestinal	01 (1.3)	01 (2.1)	00 (0.0)
Hormonal	01 (1.3)	00 (0.0)	01 (3.4)
Anxiety	01 (1.3)	01 (2.1)	00 (0.0)
Cardiovascular	01 (1.3)	01 (2.1)	00 (0.0)
Respiratory	01 (1.3)	00 (0.0)	01 (3.4)
Other	02 (2.6)	01 (2.1)	01 (3.4)
No diseases	69 (90.8)	43 (91.5)	26 (89.7)

MI, Monthly income; SD, Standard Deviation.

In relation to the eight CVH metrics, diet showed higher values in women (p=0.001) and was lower than systolic BP (p=0.020) (Table 03).

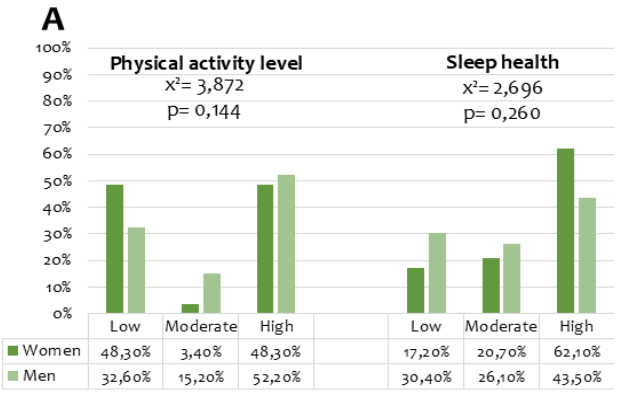
Table 03. Comparison of the eight cardiovascular health metrics according sex (n=76).

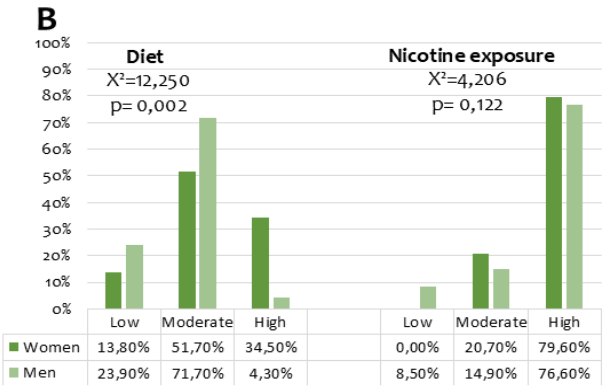
	Sex			
Cardiovascular health	**Total (n=76)**	**Male (n=47)**	**Female (n=29)**	**p**
Health Behaviors	n (%)	n (%)	n (%)	
Nicotine exposure				0.242
Current smoker	04 (5.3)	04 (8.5)	00 (0.0)	
Former smoker	13 (17.1)	07 (14.9)	06 (20.7)	
Never smoked	59 (77.6)	36 (76.6)	23 (79.3)	
	Mean±SD	**Mean±SD**	**Mean±SD**	**p**
Diet (points)	27.81±6.9	25.78±6.9	31.03±5.9	0.001
Vigorous physical activity (min/day)	12.23±23.4	15.24±27.7	7.73±14.1	0.229
Moderate physical activity (min/day)	19.49±32.7	20.91±36.2	17.61±27.2	0.968
Sleep health (hours)	6.39±1.3	6.20±1.3	6.70±1.3	0.066
Health Factors				
Body mass index (kg/m2)	27.0 ±5.3	26.61±4.2	27.64±6.7	0.465
Blood lipids (mg/dL)	132.89±51.2	135.23±43.6	123.13±53.2	0.484
Glycemia (mg/dL)	93.64±14.3	93.04±16.1	95.17±10.8	0.536
Systolic blood pressure (mmHg)	125.57±15.4	128.89±14.4	120.20±15.6	0.020
Diastolic blood pressure (mmHg)	81.27±10.8	81.40±11.0	81.06±10.7	0.896

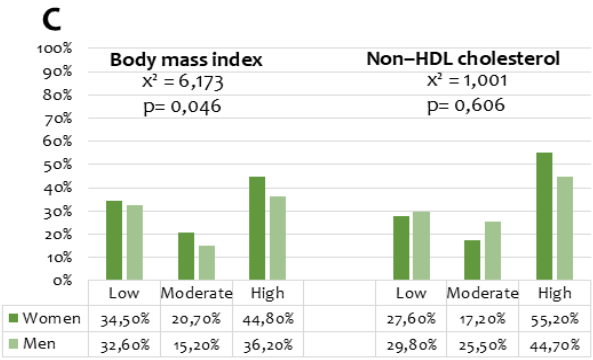
SD, Standard Deviation.

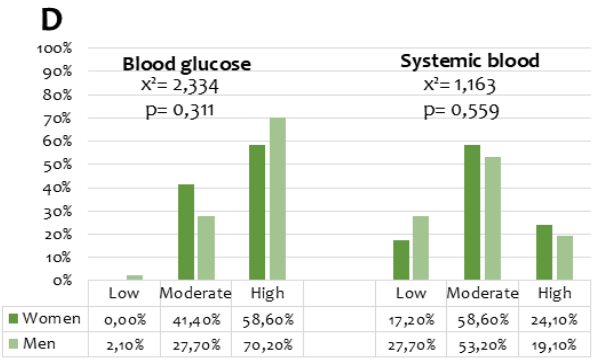
Gender was associated with diet (p=0.002) and BMI (p=0.046). In the case of diet, women had a higher prevalence of high CVS (34.5%), while men had a lower prevalence of low CVH (4.3%). For BMI, women had a higher prevalence of high CVH (44.8%) compared to men (36.2%) (Figure 01).

Figure 01. Association of sex with the eight cardiovascular health (CVH) metrics (chi-square test). Data for p<0.05. A) sex x diet; sex x nicotine exposure; B) sex x physical activity level; sex x sleep health; C) sex x body mass index; sex x non-HDL cholesterol; D) sex x fasting blood glucose; sex x systemic arterial pressure.









DISCUSSION

The aim of this study was to determine the prevalence of CVH in industrial workers. Two main findings were found: 1) women had higher values for diet, while it was lower for systolic BP; 2) the categorical association identified an association of gender with diet and BMI. It is well established in the literature that a favorable CVH contributes to a reduction in the prevalence and incidence of CVD and all-cause mortality in adults.[18,19] In addition, CVH as assessed by the LS8 has an inverse association with anxiety and depression scores.[7] The same association has been found with stroke and atherosclerosis.[20]

CVH is an important health indicator in primary assessment because it allows effective public and private health policies to be established for the prevention and promotion of occupational health. The assessment of CVH in this study showed that men have a less cardioprotective diet and higher systolic blood pressure. Companies/industrial sectors should implement educational strategies with incentives for physical activity and dietary monitoring of employees,[21,22] since changes in behavioral habits can improve the health factors (BMI, total cholesterol, fasting glucose, systemic BP) of CVH and can improve productivity and reduce sick-leave rates due to chronic diseases.[21,23] A healthy lifestyle is known to improve endothelial function[24] and reduce the risk of hypertension, obesity, diabetes, and chronic

noncommunicable diseases.[24–27] CVH was assessed based on the recommendations of the AHA LS8 guideline. The results showed that women had the highest prevalence of high CVH for diet and BMI. Although not statistically significant, men had a lower prevalence of low CVH in relation to PAL. These results are similar to those of the study by Benziger et al.[27] using the previous guideline (Life's Essential 7), which showed that both sexes had low fruit and vegetable consumption and insufficient physical activity. In relation to other metrics such as smoking, glycemia and total cholesterol are more favorable in women[4] and were similar in the present study for both sexes. The health behaviors assessed by the LS8, especially diet and PAL, deserve attention because they are the metrics with the lowest prevalence of high CVH in adults.[28] To date, this is the first scientific study to assess the prevalence of CVH using the LS8 according to the sexes of industrial workers.

The limitations of this study were: 1) because it was a cross-sectional study, it was not possible to establish a cause-and-effect relationship; 2) blood sampling for glucose and non-HDL cholesterol analysis was performed at different times due to the need to fast, which resulted in low worker compliance; and; 3) in addition to fasting glucose analysis, the guideline requires the use of glycated hemoglobin, which could not be measured. On the other hand, the main strengths were that the eight CVH metrics are inexpensive and effective in minimizing cardiovascular and cardiometabolic events in industrial workers. In addition, the results can help companies develop educational programs in their environments to prevent and promote employee health.

CONCLUSÃO

It can be concluded that in this sample, men need more attention in terms of CVH metrics (diet and SBP). The importance of assessing the CVH of workers in this sector is emphasized, since a less favorable CVH can favor the development of CVD and other conditions such as hypertension, obesity and diabetes. This contributes to an increase in absenteeism due to chronic non-communicable diseases among workers and a reduction in productivity. In addition, CVH assessment helps to inform educational policies in private and public industries that promote improvements in employee lifestyles.

DECLARATION OF CONFLICTS OF INTEREST

No conflicts of interest.

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REFERÊNCIAS

1. Roth GA, Mensah GA, Johnson CO, Addolorato G, Ammirati E, Baddour LM, et al. Global Burden of Cardiovascular Diseases and Risk Factors, 1990–2019. Journal of the American College of Cardiology. 2020 Dec;76(25):2982–3021.

2. Guo J, Lv J, Guo Y, Bian Z, Zheng B, Wu M, et al. Association between blood pressure categories and cardiovascular disease mortality in China. PLoS One. 2021;16(7):e0255373.

3. Brant LCC, Nascimento BR, Veloso GA, Gomes CS, Polanczyk C, Oliveira GMM de, et al. Burden of Cardiovascular diseases attributable to risk factors in Brazil: data from the "Global Burden of Disease 2019" study. Rev Soc Bras Med Trop. 2022 Jan 28;55:e0263.

4. Seron P, Irazola V, Rubinstein A, Calandrelli M, Ponzo J, Olivera H, et al. Ideal Cardiovascular Health in the southern cone of Latin America. Public Health. 2018 Mar;156:132–9.

5. Lloyd-Jones DM, Hong Y, Labarthe D, Mozaffarian D, Appel LJ, Van Horn L, et al. Defining and Setting National Goals for Cardiovascular Health Promotion and Disease Reduction: The American Heart Association's Strategic Impact Goal Through 2020 and Beyond. Circulation. 2010 Feb 2;121(4):586–613.

6. Lloyd-Jones DM, Allen NB, Anderson CAM, Black T, Brewer LC, Foraker RE, et al. Life's Essential 8: Updating and Enhancing the American Heart Association's Construct of Cardiovascular Health: A Presidential Advisory From the American Heart Association. Circulation. 2022 Aug 2;146(5):e18–43.

7. Xu Y, Ning W, Zhang Y, Ba Y, Liu H, Liu L, et al. Associations Between Cardiovascular Health (Life's Essential 8) and Mental Disorders. Clinical Cardiology. 2024;47(9):e70019.

8. Zhang R, Qiu X, He C, Deng R, Huo C, Fang B. From Life's Essential 8 to metabolic syndrome: insights from NHANES database and network pharmacology analysis of quercetin. Front Nutr. 2024 Oct 7;11:1452374.

9. Hou K, Zhang H, Song W, Li S, Liu J, Ma Z. Association between life's essential 8 and periodontitis: a study based on NHANES 2009–2014. Front Med. 2024 Apr 12;11:1342792.

10. Liang K, Zhang X. Association between Life's Essential 8 and cognitive function: insights from NHANES 2011–2014. Front Aging Neurosci. 2024 Apr 4;16:1386498.

11. Silva PHDA, Pires-Oliveira DADA, Sales KDAS, Fernandes GDO, Carvalhedo FMGS, Cosme ASM, et al. Does work shift affect workers' sleep quality? a systematic review. Cuad Ed Desar. 2024 Apr 10;16(4):e3888.

12. Maisey G, Cattani M, Devine A, Lo J, Dunican IC. The Sleep of Shift Workers in a Remote Mining Operation: Methodology for a Randomized Control Trial to Determine Evidence-Based Interventions. Front Neurosci. 2021 Jan 7;14:579668.

13. Gonçalves HCB, Silva PHDA, Soares V. Cardiovascular health and workload in university workers. Rev Bras Med Trab. 2024;22(03):01–8.

14. Panagiotakos DB, Pitsavos C, Stefanadis C. Dietary patterns: A Mediterranean diet score and its relation to clinical and biological markers of cardiovascular disease risk. Nutrition, Metabolism and Cardiovascular Diseases. 2006 Dec 1;16(8):559–68.

15. 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. Revista Brasileira de Atividade Física & Saúde. 2001;6(2):5–18.

16. Bertolazi AN, Fagondes SC, Hoff LS, Dartora EG, Da Silva Miozzo IC, De Barba MEF, et al. Validation of the Brazilian Portuguese version of the Pittsburgh Sleep Quality Index. Sleep Medicine. 2011 Jan;12(1):70–5.

17. Brasil M da saúde. O Guia Alimentar Para a População: alimentação cardioprotetora. Ministerio da Saúde e hospital do coração. 2018;

18. Dong Y, Hao G, Wang Z, Wang X, Chen Z, Zhang L. Ideal Cardiovascular Health Status and Risk of Cardiovascular Disease or All-Cause Mortality in Chinese Middle-Aged Population. Angiology. 2019 Jul;70(6):523–9.

19.Gao B, Wang F, Zhu M, Wang J, Zhou M, Zhang L, et al. Cardiovascular health metrics and all-cause mortality and mortality from major non-communicable chronic diseases among Chinese adult population. International Journal of Cardiology. 2020 Aug;313:123–8.

20.Wu, Doutor em, Medicina, Wu Z, Yu D, Chen S, et al. Life's Essential 8 and Risk of Stroke: A Prospective Community-Based Study. Stroke. 2023 Sep;54(9):2369–79.

21. Ogunmoroti O, Utuama O, Spatz ES, Rouseff M, Parris D, Das S, et al. Trends in Ideal Cardiovascular Health Metrics Among Employees of a Large Healthcare Organization (from the Baptist Health South Florida Employee Study). The American Journal of Cardiology. 2016 Mar;117(5):787–93.

22.Silva PH de A, Oliveira-Silva I, Venâncio PEM, López-Bueno R, Cosme ASM, Soares V. Association of cardiovascular health with anthropometric markers, cardiorespiratory fitness and quality of life of university workers. Revista Eletrônica Acervo Saúde. 2024 Jul 3;24(7):e15358.

23.Gao J, Pan X, Li G, Chatterjee E, Xiao J. Physical Exercise Protects Against Endothelial Dysfunction in Cardiovascular and Metabolic Diseases. J of Cardiovasc Trans Res. 2022 Jun 1;15(3):604–20.

24.Moro T, Tinsley G, Pacelli FQ, Marcolin G, Bianco A, Paoli A. Twelve Months of Time-restricted Eating and Resistance Training Improves Inflammatory Markers and Cardiometabolic Risk Factors. Medicine & Science in Sports & Exercise. 2021 Dec;53(12):2577.

25.Silva PH de A, Venâncio PEM, Silva MS, Borges AR, Cosme ASM, Bernardes PS, et al. Association and comparison of physical activity with cardiovascular health, quality of life and anthropometric measurements in adult women. Research, Society and Development. 2022 Jun 29;11(8):e55711831368–e55711831368.

26.Folta SC, Paul L, Nelson ME, Strogatz D, Graham M, Eldridge GD, et al. Changes in diet and physical activity resulting from the Strong Hearts, Healthy Communities randomized cardiovascular disease risk reduction multilevel intervention trial. Int J Behav Nutr Phys Act. 2019 Oct 25;16(1):91.

27.Benziger CP, Zavala-Loayza JA, Bernabe-Ortiz A, Gilman RH, Checkley W, Smeeth L, et al. Low prevalence of ideal cardiovascular health in Peru. Heart. 2018 Aug;104(15):1251–6.

28.Lloyd-Jones DM, Ning H, Labarthe D, Brewer L, Sharma G, Rosamond W, et al. Status of Cardiovascular Health in US Adults and Children Using the American Heart Association's New "Life's Essential 8" Metrics: Prevalence Estimates From the National Health and Nutrition Examination Survey (NHANES), 2013 Through 2018. Circulation. 2022 Sep 13;146(11):822–35.