RELATIONSHIP BETWEEN CARDIOVASCULAR RISK AND LUNG FUNCTION IN INDUSTRIAL SECTOR WORKERS

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SUMMARY

Introduction: Obesity is considered a pandemic disease as it has a high prevalence in both developed and developing countries and is associated with respiratory dysfunctions. The waist-to-hip ratio (WHR), in addition to being an indicator of obesity, is also considered a cardiovascular risk factor. Objective: To relate cardiovascular risk with pulmonary function in industrial sector workers. Methods: Analytical cross-sectional study involving workers from a construction materials industry. The sample consisted of 143 workers. The WC was calculated by dividing the waist circumference by the hip circumference, and respiratory function was measured by spirometry. The workers were stratified according to the WC (low and high risk). Results: 41 (28.7%) of the industry workers were at high risk, of which 25 were female. The age was higher in workers with high cardiovascular risk. The peak expiratory flow (PEF) ((Δ=0.55 L/s, $p<0.001$), forced vital capacity (FVC) ((Δ=0.65 L, $p<0.001$), %predicted FVC ((Δ=14%, $p<0.001$), forced expiratory volume in the first second (FEV1) ((Δ=0.55 L, $p<0.001$), %predicted FEV1 ((Δ=11.18%, $p<0.001$) were higher in low-risk workers. There was a direct correlation of RCQ with PEF ($r=0.26$, $p<0.001$), FVC ($r=0.22$, $p=0.009$), and FEV1 ($r=-0.19$, $p=0.021$), while it was inverse for %FEV1predicted ($r=0.35$, $p<0.001$) and the FEV1/FVC ratio ($r=-0.19$, $p=0.024$). Conclusion: The pulmonary function of workers with low cardiovascular risk was better. However, a direct relationship was noted between WC and PEF, FVC, and MEF, and an inverse relationship when it comes to %FEVpredicted and FEV1/FVC ratio. For the prevention and promotion of cardiorespiratory health, it is suggested to encourage weight control, improve dietary quality, and increase the level of physical activity.
Keywords: Waist-to-hip ratio; cardiovascular risk; pulmonary function; industrial sector workers.

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Introduction

Obesity is characterized as a syndrome defined by the excess body fat deposited in different parts of the body, which is directly linked to both internal factors, such as high calorie consumption and sedentary lifestyle, and external factors, such as cultural, economic, and psychological issues[1]. It is associated with a high risk of developing non-communicable diseases, such as hypertension, diabetes mellitus, metabolic syndrome, heart diseases, respiratory diseases, and is linked to an increase in the mortality rate[2]

Obesity can be assessed and indicated through anthropometric parameters, such as Body Mass Index (BMI), waist circumference (WC), and waist-to-hip ratio (WHR), the latter being considered an effective tool to evaluate not only the issue of obesity but also the high cardiovascular risk in clinical contexts[3]

There is evidence that abdominal obesity is significantly associated with decreased lung function, which occurs through the impairment of mechanical compression of adipose tissue on the rib cage, which can decrease lung capacity; diaphragmatic contraction, due to the increase in adipose tissue, and the induction of airway inflammation, which causes a decrease in their diameter and hinders the passage of air. In the environment, several factors are associated with this condition, such as working in closed spaces without ventilation and inhaling dust from the production system [2]

It is worth noting that the most commonly used parameter to relate obesity to pulmonary function is BMI, and in the present study, WC was used since it is associated with cardiovascular risk. Thus, the objective of this study is to relate cardiovascular risk with pulmonary function in industrial sector workers.

Methodology

Sample

This is an analytical cross-sectional study. The population of this study consisted of workers from the industrial sector. The industry has approximately 300 employees and produces roofing materials and is located in the Industrial Hub of Anápolis (DAIA). The sectors that constitute the industry are the administrative staff (white-collar) and production (blue-collar) employees. The work shifts are divided into daytime and nighttime (fewer employees). Workers aged 18 to 59, with at least 6 months of employment, with acute respiratory disease, infectious condition, unstable cardiovascular disease, or pulmonary disease were included.

The workers were recruited by invitation and 161 accepted to participate, but 143 workers completed all the stages. The sample power was calculated using the GPower software (version 3.1, University of Düsseldorf, Germany) considering the statistical tests (group comparison and correlation), an effect size (ρ) of medium 0.3, a significance level of 5%, with 143 workers achieving 98% power.

Delineation

The collections were carried out between July and August 2024. The workers were subjected to evaluations before starting their daily work shift, in this order: filling out the identification form with age and sex; measuring body mass (kg) and height (m) to calculate the body mass index; measuring waist and hip circumference to calculate the waist-to-hip ratio (WHR).

Waist-to-hip ratio

The calculation of the WC was done by dividing the CC perimeters by the hip circumference. For this, a measurement was taken using a non-stretchable tape measure (Cescorf brand, scientific model, Brazil) positioned at the midpoint between the 12th rib and the iliac crest, while the waist circumference was measured by positioning the tape in the area of greatest gluteal prominence. Furthermore, the WC

was considered with an increased cardiovascular risk in cases with a value above 0.95 for men and above 0.80 for women4

Respiratory function

The spirometry was performed with a portable device (MIR, MiniSpir, Rome, Italy) and disposable mouthpieces. The conduct of the exam was carried out according to the guidelines American Thoracic Society/European Respiratory Society5,6 and interpreted according to Knudson7. The parameters analyzed were peak expiratory flow (PEF), forced expiratory volume in the first second (FEV1), forced vital capacity (FVC), forced expiratory flow (FEF25-75%), forced expiratory time (FET), FEV1/FVC ratio, and the respective age-predicted values.

Statistical analysis

The results were presented as mean, standard deviation, frequencies, and percentages. The normality of the data was verified using the Kolmogorov-Smirnov test. For comparison between groups via RCQ stratification, the independent t-student test (normal distribution) or Mann-Whitney test (asymmetric distribution) was used. The delta variation was calculated between the means (Δ). The correlation of the RCQ with the spirometric parameters was tested using the Pearson or Spearman correlation coefficient. The significance level adopted was 5%. The analysis was conducted using the Statistical Package for the Social Science (SPSS, version 23.0, IMB, Armont, NY) software.

Results

Among the sample, 41 (28.7%) industrial workers had a high-risk WC, of which 25 (61%) were female. The age (p= 0.031) was higher in workers with high-risk WC, while height (p= 0.020) and BMI (p<0.001) were lower. Furthermore, these workers

exhibited lower values of FVC (p<0.001), predicted FVC (p<0.001), FEV1 (p<0.001), predicted FEV1 (p<0.001), and FEF25-75% (p=0.004) (Table 1).

Table 1. Basic characteristics and lung function (n=143).

Variables	Waist-to-hip ratio		p*
	Low risk (n=102)	High risk (n=41)	
Sexo	**n (%)**	**n (%)**	
Female	24 (23,5)	25 (61,0)	<0,001
Male	78 (76,5)	16 (39,0)	
	Média±DP	**Média±DP**	
Age (years)	31,93±9,67	35,85±9,80	0,031
Mass (kg)	76,67±14,20	82,93±18,85	0,060
Height (m)	1,73±0,83	1,68±0,12	0,020
BMI (kg/m2)	25,65±4,07	29,16±5,97	<0,001
Lung function			
PFE (L/s)	6,78 ± 2,25	6,23±1,89	0,173
CVF(L)	4,30 ± 0,87	3,65 ± 0,91	<0,001
%CVFpredito	90,21±14,42	76,21±18,17	<0,001
VEF1(L)	3,71±0,83	3,16±0,74	<0,001
%VEFpredito	78,36±17,49	67,18±16,16	<0,001
FEF 25 – 75% (L)	4,65±1,42	4,04±0,99	0,004
%FEFpredito	110,04±28,57	110,54±28,65	0,925
TEF (L/s)	2,57±1,01	2,84±1,04	0,085
VEF1/CVF	0,86±0,87	0,87±0,06	0,836

PEF- peak expiratory flow; FVC- forced vital capacity; FEV- forced expiratory volume in the first second; FEF25-75%- forced expiratory flow; FET- forced expiratory time; SD= standard deviation. * Data for p<0.05. Source: authors (2024).

There was a direct relationship between RCQ and PEF (p<0.001), FVC (p=0.009), and FEV1 (p<0.001), while it was inverse for %FEVpredicted (p=0.021) and FEV1/FVC (p=0.024) (Table 2).

Table 2. Correlation between waist-to-hip ratio and lung function (n=143).

Variables	Waist-to-hip ratio	
	r	p
PFE (L/s)	0,26	<0,001
CVF(L)	0,22	0,009
%CVFpredito	0,08	0,336
VEF1(L)	0,14	0,085
%VEF1predito	-0,19	0,021
FEF25 – 75 (L)	0,83	0,325
%FEF25-75%predito	0,26	0,755
TEF (s)	0,35	<0,001
VEF1/CVF	-0,19	0,024

PEF = peak expiratory flow; FVC = forced vital capacity; FEV1 = forced expiratory volume in one second; FEF25-75% = forced expiratory flow; ETT = forced expiratory time. *Data for p<0.05. Source: authors (2024).

Conclusion

In conclusion, in the comparison results, lung function was better in workers with low cardiovascular risk. However, a direct relationship was noted between WCQ and PEF, FVC, and MEF, and an inverse relationship when it comes to %FEVpredicted and FEV1/FVC ratio. For the prevention and promotion of cardiorespiratory health, it is suggested to encourage weight control, improve dietary quality, and increase the level of physical activity.

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