RELATIONSHIP BETWEEN CARDIOVASCULAR RISK AND LUNG FUNCTION IN INDUSTRIAL WORKERS

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ABSTRACT

Introduction: Obesity is considered a pandemic disease because it is highly prevalent in developed and developing countries and is associated with respiratory disorders. The waist-to-hip ratio (WHR) is not only an indicator of obesity but is also considered a cardiovascular risk factor. **Objective:** To relate cardiovascular risk to lung function in industrial workers. **Methods:** This was a cross-sectional analytical study involving workers in a construction materials industry. The sample consisted of 143 workers. The WHR was calculated by dividing the waist circumference by the hip circumference, and respiratory function was measured by spirometry. Workers were stratified according to WHR (low and high risk). **Results:** Forty-one (28.7%) of the industrial workers were at high risk, of whom 25 were female. Age was higher in workers with high cardiovascular risk. Peak expiratory flow (PFE) ((∆=0,55 L/s, p<0,001), forced vital ((∆=0,65 L, p<0,001), $\%CVF_{predita}$ ((∆=14%, p<0,001), forced expiratory volume in the first second (VEF_1) ((∆=0,55 L, p<0,001), $\%VEF_{1predito}$ ((∆=11,18%, p<0,001) were higher in low-risk workers. There was a direct correlation between RCQ and PFE (r=0,26 p<0,001), FVC (r=0.22 p-0.009) and TEF (r= -0.19 p=0.021), while it was inverse for $\%FEV_{(1)\ (predicted)}$ (r=0.35, p<0.001) and the $VEF(1)$ /FVC ratio (r= -0.19, p=0.024). **Conclusion:** Lung function was better in workers with low cardiovascular risk. However, a direct relationship was observed between WHR and PEF, FVC, and TEF, and an inverse relationship when it came to $\%FEV_{(predicted)}$ and the $FEV_{(1)}$ /FVC ratio. For prevention and promotion of cardiorespiratory health, we suggest encouraging weight control, improving dietary quality, and increasing physical activity levels.

KEYWORDS: Waist-hip ratio; Cardiovascular risk; Lung function; Industrial workers.

INTRODUCTION

Obesity is characterized as a syndrome defined by excess body fat deposited in different parts of the body, which is directly linked to both internal factors, such as high calorie intake and physical inactivity, 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 disease, respiratory diseases, and it is linked to an increased 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 for assessing not only obesity but also high cardiovascular risk in clinical settings. [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 increased 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 these conditions, such as working indoors without ventilation and inhaling dust from the production system. ([2])

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

METHODOLOGY

Sample

This is a cross-sectional analytical study. The population of this study consisted of industrial workers. The industry has approximately 300 employees and produces roofing materials and is located in the Anápolis Industrial Park (DAIA). The sectors that make up the industry are administrative (white-collar) and production (blue-collar) employees. Work shifts are divided into day and night (fewer employees). Workers aged 18 to 59 years, with at least 6 months of employment, with acute respiratory disease, infectious disease, unstable cardiovascular disease, or lung disease were included.

Workers were recruited by invitation, and 161 agreed to participate, but 143 workers completed all stages. The sample power was calculated using GPower software (version 3.1, Universitat Dusseldorf, Germany), considering statistical tests (comparison between groups and correlation), effect size (ρ) of 0.3, significance level of 5%, and 143 workers, achieving a power of 98%.

Design

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

Waist-to-hip ratio

The WHR was calculated by dividing the waist circumference by the hip circumference. To do 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 HC was measured by positioning the tape in the area of greatest gluteal protrusion. In addition, WHR was considered to indicate an increased cardiovascular risk in cases with a value above 0.95 for men and above 0.80 for women. ([4])

Respiratory function

Spirometry was performed with a portable device (MIR, MiniSpir, Rome, Italy) and disposable mouthpieces. The test was conducted according to the *American Thoracic Society/European Respiratory Society* guidelines [5,6] and interpreted according t[Knudson7]. The parameters analyzed were peak expiratory flow (PEF), forced expiratory volume in the first second ($FEV_{(1)}$,forced vital capacity (FVC), forced expiratory flow ($FEF_{(25-75\%)}$), forced expiratory time (FET), FEV_1 /FVC, and the respective predicted values for age.

Statistical analysis

The results were presented as mean, standard deviation, frequencies, and percentages. Data normality was verified using the *Kolmogorov-Smirnov* test. For comparison between groups via QHR stratification, the independent *t-test* (normal distribution) or *Mann-Whitney test* (asymmetric distribution) was used. The delta variation was calculated between the means (Δ). The correlation between RCQ and spirometric parameters was tested using *Pearson's* or *Spearman's* correlation coefficient. The level of significance adopted was 5%. The analysis was conducted *using Statistical Package for the Social Sciences* (SPSS, version 23.0, IMB, Armonk, NY).

RESULTS

Among the sample, 41 (28.7%) industrial workers had high-risk WHR, of whom 25 (61%) were female. Age (p= 0.031) was higher in workers with high-risk WHR, while height (p=0.020) and BMI (p< 0.001) were lower. In addition, these workers had lower FVC (p< 0.001), $FVC_{predicted}$ (p< 0.001), FEV_1 (p< 0.001), FEV_1 predicted (p< 0.001), and $FEF_{25-75\%}$ (p=0.004) (Table 1).

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

Variables	Waist-to-hip ratio		
	Low risk (n=102)	High risk (n=41)	p
Sex	**n**	**n**	
Female	24	25 (61.0)	<0.001
Male	78 (76.5)	16 (39.0)	
	Mean±SD	**Mean± SD**	
Age (years)	31.93±9.67	35.85±9.80	0
Weight (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/m^2)	25.65±4.07	± 5.97	<0
Pulmonary function			
PFE (L/s)	6.78 ± 2.25	6.23±1.89	0.173
FVC (L)	4.30 ± 0.87	3.65 ± 0.91	<0
% predicted FVC	90.21±14.42	76.21±18.17	<0.001
FEV_1 (L)	3.71±0.83	3.16±0.74	<0
% predicted FEV	78.36±17.49	67.18±16.16	<0.001
$FEF_{25–75\%}$ (L)	4.65±1.42	4.04±0.99	0
% predicted FEF	110.04±28.57	110.54±28.65	0.925
TEF (L/s)	2.57±1.01	2.84±1.04	0.085
FEV_1/FVC	0.86±0.87	0.87±0.06	0

PEF - peak expiratory flow; FVC - forced vital capacity; FEV - forced expiratory volume in the first second; $FEF_{25-75\%}$- forced expiratory flow ; TEF - forced expiratory time; SD = standard deviation . *Data for p<0.05. Source: authors (2024).

There was a direct relationship between WHR and PEF (p< 0.001), FVC (p=0.009) and TEF (p< 0.001), while it was inverse for % $VEF_{predicted}$(p=0.021) and VEF_1/FVC (p=0.024) (Table 2).

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

Variables	Waist-to-hip ratio	
	r	p
PFE (L/s)	0.2	<0.001
CVF(L)	0.22	0.009
$\%CVF_{predicted}$	0.08	0.336
FEV_1 (L)	0	0.085
$\%FEV_{1predicted}$	-0	0
FEF_{25-75} (L)	0	0
$\%FEF_{25-75\%predicted}$	0	0.755
TEF (s)	0	<0.001
FEV_1/FEV	-0.19	0

PEF= peak expiratory flow; FVC - forced vital capacity; FEV_1- forced expiratory volume in the first second; $FEF_{25-75\%}$- forced expiratory flow; TEF - forced expiratory time. *Data for p<0.05. Source: authors (2024).

CONCLUSION

In conclusion, the comparison results showed that lung function was better in workers with low cardiovascular risk. However, a direct relationship was noted between WHR and PEF, FVC, and TEF, and an inverse relationship when it came to %FEV($_{predicted}$) and the FEV($_1$)/FVC ratio. For prevention and promotion of

cardiorespiratory health, we suggest encouraging weight control, improving dietary quality, and increasing physical activity levels.

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