ORIGINAL ARTICLE

ASSESSMENT OF DIAPHRAGMATIC INDEX IN HOSPITALIZED PATIENTS WITH LUNG DISEASE AND OBESITY

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Abstract

Fundamentation: The obesity is a factor that cause alterations in the respiratory mechanics, had to the accumulation of fat, reducing the complacency and the diaphragmatic movement. The association between the diaphragmatic index (DI) with the values of maximal inspiratory pressure (MIP) and maximal expiratory pressure (MEP) shows changes in the respiratory system. **Objective**: The aim of this study is to evaluate the DI, body max index (BMI), waist to hip ratio (WHR), MIP and MEP of interned patients and to relate it with the respiratory diseases and with the obesity. **Methods**: To do that were evaluated 30 subjects and they were divided of the following form. A control group, with 10 individuals without disease of respiratory system and with normal weight, according to the World Health Organization. Group two, with 10 individuals with pulmonary disease and group three, with 10 obesity individuals, but without pulmonary disease. The collected information had been analyzed statistical using Anova e t-Students, with the level of significance p<0, 05. **Results**: In accordance with the accomplish analysis, it was observed that has not a significant difference in the values of BMI, WHR, MIP and DI. The obesity has not generated changes in the static respiratory muscular force, as it has been evaluated in the variable MIP and MEP. **Conclusion**: There is evidence of the bigger muscular force in individuals of regular weight.

Keywords: Obesity; Lung Diseases; Body Mass Index

Resumo

Fundamentação: A obesidade também é um fator que pode causar alterações na mecânica respiratória, devido ao acúmulo de gordura, reduzindo a complacência e o movimento diafragmático. A associação entre o índice diafragmático (ID) com os valores de Pressão Inspiratória Máxima (Pimáx) e Pressão Expiratória Máxima (Pemáx), podem nos mostrar mudanças com relação ao sistema respiratório. **Objetivo**: Avaliar o ID, índice de massa corporal (IMC), índice cintura quadril (ICQ), Pimáx e Pemáx de pacientes internados e relacioná-lo com as doenças do sistema respiratório e com a obesidade. **Métodos**: Foram avaliados 30 indivíduos divididos da seguinte forma. Um grupo controle, composto por 10 indivíduos sem comprometimento do sistema respiratório e com peso normal de acordo com a OMS. O grupo dois composto por 10 indivíduos com comprometimento pulmonar e o grupo três, por 10 indivíduos obesos, mas sem comprometimento pulmonar. A análise estatística foi realizada utilizando a análise de variância Anova e t-Students, com o nível de significância p<0,05. **Resultados**: De acordo com a análise realizada, observa-se que não houve uma diferença significativa nos valores de IMC, ICQ, Pimáx e ID; a obesidade não gerou prejuízo com relação à força muscular respiratória estática, como foi avaliado nas variáveis Pimáx e Pemáx. **Conclusão**: Evidenciando maior força muscular em relação a indivíduos com peso normal.

Palavras-chave: Obesidade; Pneumopatias; Índice de Massa Corporal

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INTRODUCTION

The diaphragmatic index (DI) shows the variation of the thoraco-abominal movement determined by changes in the anteroposterior dimensions of the chest and abdomen, which can be altered by pulmonary[1] impairment. Obesity can also cause changes in respiratory function due to the accumulation of fat, thereby reducing compliance and diaphragmatic movement, which can lead to higher consumption of oxygen[2]. Obesity is increasing significantly in Brazil[3,4], so we see the importance of the study of this index, associated with body mass index (BMI), waist hip ratio (WHR), maximal inspiratory pressure (MIP) and maximal expiratory pressure (MEP) in hospitalized patients. Such indexes can tell us about cardiac and respiratory abnormalities[5].

MIP and MEP are considered since the decade of 60/70 as a key factor in assessing the strength of respiratory muscles in static manner, both in healthy individuals or with respiratory dysfunction[4,6]. MIP is related to the inspiratory muscles and MEP related to respiratory muscle strength[6].

BMI is one of the most commonly used anthropometric indicators, due to its ease of use and low cost for the evaluation of patients who are at nutritional risk[5]. The World Health Organization (WHO) defines overweight as a BMI at or above 25 and obesity equal to or above 30, and these values refer to an individual assessment. There is evidence showing the risk of chronic diseases from a BMI above 21[3].

Aware that obesity and high prevalence of respiratory system diseases are often factors related decline health[7], we should seek assessment methods to early identify the loss of respiratory muscle tone. This fact would reduce the installation complications and reduce the length of hospitalization. Thus, due to insufficient data on the DI relationship with diseases of the respiratory system and obesity, this study aims to assess the DI, BMI, WHR, MIP and MEP of hospitalized patients and relate them to the respiratory disease and obesity.

METHODS

To this end, we performed a study in Hospital Maternidade Therezinha de Jesus (HMTJ), located in the city of Juiz de Fora/MG, which we selected 30 individuals of both genders, adults with an average age between 25 and 60 years, lucid, cooperative, and possessing a compromised respiratory system, obese or both. Exclusion criteria: patients with degenerative lesions, grade III obesity (BMI above 40kg/m2)[3], decreased level of consciousness or some compromise that would hinder data collection.

After sample selection the patients were divided into three groups. A control group of 10 individuals without respiratory system impairment and normal weight according to WHO. Group two consisted of 10 individuals with pulmonary disease and group three, 10 obese but without pulmonary involvement.

With the patient sitting at the bedside, feet flat and knees flexed at 90°, we performed the application of a questionnaire with personal habits and physical activity, which was completed by the researcher through interviews. Later we performed the chest circumference perimetry, abdomen and waist with the use of a plastic tape measure, performed with the patient standing. Data such as height and weight were also collected. The height assessment was performed using a manual tape and weight was measured using a Filizola brand digital scale with capacity of 150kg and 100g range. The weighing was performed in the morning with the patient walking barefoot with minimal clothing, head in midline and arms along the body.

All patients underwent DI assessment, as follows: (DI=Ä AB/ Ä AB+ Ä TC), where DI is the diaphragmatic index and Ä is the difference between waist (AB) and thoracic (CT), measured at the end of smooth inspiration and expiration1. Later, we performed assessment of MIP and MEP which were obtained with the use of an analog manometer MVD300 brand with graduation of -120cmH2O to +120 cmH_2O and variations every 4cmH_2O for both MIP and for MEP. To this end, three measurements were taken from the residual volume and total lung capacity, and the largest was recorded. The MIP and MEP values were compared with normal values shown in Table 1[10] .

From the perimetry, height and weight the BMI was calculated, which is defined as the weight in kilograms divided by the square of height in meters (BMI=weight/height^2)[3] and WHR which is waist circumference (between the last rib and the iliac crest=wc) by hip circumference (greatest trochanter level of the femur=cq), given by WHR=wc/hc[8], we used the classification. WHR above recommended in women, WHR ≥ 0.80 in men, WHR ≥ 0.90[9].

Patients did not undergo any treatment and there was no interruption or intervention in their clinical treatment. Participants were aware of the study and authorized their participation through a written informed consent (Appendix 1). All assessments and measurements were performed at a single time by a single evaluator.

After collecting data they were subjected to statistical test for analysis of variance ANOVA and Students t-test, both with a significance level of $p<0.05$. This project was approved by the Research Ethics Committee of the Faculty of Medical and Health Sciences of Juiz de Fora/MG (CEP 014/08).

RESULTS

Of the 30 patients, one was excluded for presenting a BMI below normal. In Table 1, we observe the results for the 29 subjects with an indication of the parameters assessed (mean ± standard deviation). It was observed an average homogeneous age between the assessed samples.

The Group three consisted of patients with obesity, is highlighted for having achieved a better result in DI, MIP and MEP in relation to the other groups (Table 1 and 2). When evaluating the WCR we observed a greater outcome in the group consisting of patients with respiratory problems (group two) when compared with the other groups, but with inferior results in DI and MIP.

According to statistical analysis, it was observed that there was no significant difference in BMI, WCR, MIP and DI. Regarding WCR, when comparing the group one with group two, we observed a statistically significant difference (p=<0.02) which shows an increase in body circumference in these individuals. It was also observed reduction in BMI values of group one and two when comparing the group three with statistically significant values (p=<0.05). And lastly there was an increase in the MEP of group three with statistically significant values when compared with the control group (p=< 0.02) (Table 2).

Table 1 - *Analysis of variables by mean±standard deviation in different groups.*

	Group 1 (average ± *DP)*	Group 2 (average ± *DP)*	Group 3 (average ± *DP)*
Age (years)	40,6 ± 9,2	41,4 ± 10,5	40,1 ± 10,3
BMI (kg.m²)	21,8 ± 2	23,9 ± 4,5	31,2 ± 3,3
WHR	*0,8 ± 0*	0,9 ± 0 **	0,8 ± 0
DI	*0,4 ± 0,2*	0,3 ± 0,1	0,4 ± 0,2
MIP (cm H_2O)	*66,4 ± 25,8*	56 ± 18,3	77,2 ± 25,3
MEP (cm H_2O)	*48,4 ± 13,0*	63,6 ± 20,6	71 ± 19,0 ***

**Level of significance p <0.05 when compared with the other groups. **Level of significance p <0.05 of group one compared to the group two. ***Level of significance p <0.05 of group three compared to group one.*

Table 2 - *Analysis of MIP and MEP variables between men and women.*

MIP	*- Women: y=-0,49 (idade) + 110,4 ; standard error of estimate = 9,1*
	- Men: y= -0,80 (idade) + 155,3; standard error of estimate = 17,3
MEP	*- Women: y=-0,61 (idade) + 115,6; standard error of estimate = 11,2*
	- Men: y= -0,81 (idade) + 165,3; standard error of estimate = 15,6

DISCUSSION

According to the results, we found that the group with higher BMI had a better DI, MIP and MEP which contradicts study presented by Santiago at al.[2], which reports on the increase in adipose tissue associated with a decrease in lung volume, resulting changes in the ventilation/perfusion relationship[11]. This fact can be proven in obese who experienced reduction in their BMI of 50 to 37 kg/m² because these patients achieved a 75% increase in expiratory reserve volume, 25 % residual volume and functional residual capacity and 10% improvement in voluntary maximum ventilation[12,14,15].

Therefore, this shows that obesity is a factor that causes significant reduction in the strength of the muscles of respiration and thus decreased DI, which can be found in other studies[16-18]. In another study, 29 patients were compared before and after losing weight, but there were no significant changes in the values of inspiratory capacity, total lung capacity, functional residual capacity and forced expiratory volume in the first second[13]. But we emphasize the influence of sample size on the values obtained, which is indicated as critical factor by the discrepancy in the values of MIP and MEP, and we can refer their variability[6].

The BMI is associated with a higher body circumference, which can lead to better DI, but not necessarily improved lung compliance. The DI has not been validated in the literature, therefore, it cannot be used as a parameter separately because when the same abdominal and thoracic circumference occurs, the result will always 0.5.

There is evidence that explains the relationship of obesity with better muscle strength, relating to the amount of fiber musculares[19, 20]. Obese individuals have a higher amount of type II fibers than fibers of type I. This might be related to an adaptation of muscle in response to overload imposed by obesity and/or metabolic changes. Thus, if the type II fiber is predominant, the potential stress of the respiratory muscles may remain within the normal range without generating changes in MIP and MEP. Another important fact is that the muscles of obese individuals have different metabolic and histological characteristics, presenting more muscle mass and greater energy reserves and thus a larger contractile force[21].

CONCLUSION

There was no correlation between pulmonary parameters and anthropometric measurements. It shows that obesity did not cause prejudice with respect to static respiratory muscle strength, as assessed variables in MIP and MEP, with increased muscle strength compared to normal weight individuals.

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