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ORIGINAL RESEARCH

Correlation of respiratory muscle strength with anthropometric measures and physical activity level in adults in primary care

Correlação da força muscular respiratória com medidas antropométricas e nível de atividade física em adultos da atenção primária

Correlación de la fuerza muscular respiratoria con las medidas antropométricas y el nivel de actividad física en adultos en la atención primaria

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ABSTRACT | This study aimed to correlate respiratory muscle strength with anthropometric measures and physical activity level in adults in primary care. This cross-sectional study was conducted in a basic health unit with individuals of both genders aged 18 years or older. Respiratory muscle strength was analyzed by maximal inspiratory (MIP) and expiratory (MEP) pressures using a manovacuometer. Values above 80% of the predicted were considered normal. Anthropometric data was obtained using a mechanical scale, stadiometer, and measuring tape, namely: body mass index (BMI); neck (NC), waist (WC), and hip (HC) circumference; waist-to-hip ratio (WHR), and body adiposity index (BAI). Physical activity level was determined by the international physical activity questionnaire (IPAQ), where individuals were categorized into sedentary, irregularly active A, irregularly active B, active, or very active. The instrument also estimated the achieved metabolic equivalents (MET). Our study sample comprised 110 adults (78.1% female; 51.9±12.3 years) with 96.3 ± 32.4% MIP and 98.9 ± 27.3 % MEP in relation to the predicted. The %MIP showed a weak correlation with BAI (r=0.23; p=0.01) and HC (r=0.20; p=0.03), and %MEP with BMI (r=0.26; p<0, 01) and BAI (r=0.30; p<0.01). We verified no difference between the average %MIP (p=0.61) and %MEP (p=0.54) within the IPAQ categories and no correlations (p> 0.05) with the estimated MET. Respiratory muscle strength of adults in primary care showed a weak correlation with BMI, HC, and BAI, and no correlation with physical activity level.

Keywords | Maximal Respiratory Pressures; Anthropometry; Physical Fitness; Primary Health Care.

RESUMO | O objetivo deste estudo foi correlacionar a força muscular respiratória com as medidas antropométricas e o nível de atividade física de indivíduos adultos da atenção primária. Trata-se de um estudo transversal, realizado em uma unidade básica de saúde, onde foram incluídos indivíduos de ambos os sexos e com idade superior a 18 anos. A força muscular respiratória foi analisada pela pressão inspiratória máxima (PImáx) e pressão expiratória máxima (PEmáx), por meio do manovacuômetro, onde valores pressóricos acima de 80% em relação ao predito foram considerados normais. Utilizou-se balança mecânica, estadiômetro e fita métrica para mensuração das principais medidas antropométricas: índice de massa corporal (IMC), circunferência de pescoço (CP), circunferência abdominal (CA), circunferência de quadril (CQ), relação cintura-quadril (RCQ) e o índice de adiposidade corporal (IAC). O nível de atividade física foi determinado pelo questionário internacional de atividade física (IPAQ), onde os indivíduos foram categorizados como sedentário, irregularmente ativo A, irregularmente

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ativo B, ativo ou muito ativo, sendo realizada também a estimativa dos equivalentes metabólicos (MET) alcançados. Foram avaliados 110 indivíduos adultos (78,1% do sexo feminino; 51,9±12,3 anos), e com porcentagem em relação ao predito (%) de PImáx de 96,3±32,4% e 98,9±27,3% de PEmáx. A %PImáx apresentou fraca correlação com o IAC (r=0,23; p=0,01) e com a CQ (r=0,20; p=0,03), e a %PEmáx com o IMC (r=0,26; p<0,01) e IAC (r=0,30; p<0,01). Não houve diferença dos valores médios de %PImáx (p=0,61) e %PEmáx (p=0,54) entre as categorias do IPAQ, além de não existirem correlações (p>0,05) com os MET estimados. Em adultos da atenção primária, a força muscular respiratória apresentou fraca correlação com IMC, CQ e IAC, porém sem correlação com o nível de atividade física.
Descritores | Pressões Respiratórias Máximas; Antropometria; Aptidão Física; Atenção Primária à Saúde.

RESUMEN | El objetivo de este estudio fue correlacionar la fuerza muscular respiratoria con las medidas antropométricas y el nivel de actividad física de individuos adultos en atención primaria. Este es un estudio transversal, realizado con personas de ambos los sexos y mayores de 18 años en una unidad básica de salud. Se evaluó la presión inspiratoria máxima (PImáx.) y la presión espiratoria máxima (PEmáx.) de la fuerza muscular respiratoria mediante un manovacuómetro, en el que se consideraron normales los valores de presión superiores al 80% en relación al valor predicho. Se utilizó una balanza mecánica, estadiómetro y cinta métrica para obtener las principales medidas antropométricas: índice de masa corporal (IMC), circunferencia del cuello (CC), circunferencia abdominal (CA), circunferencia de la cadera (CCA), relación cintura-cadera (RCCA) y el índice de adiposidad corporal (IAC). El nivel de actividad física fue determinado por el Cuestionario internacional de actividad física (IPAQ), que clasifica a los individuos como sedentarios, irregularmente activos A, irregularmente activos B, activos o muy activos, y también se estimó los equivalentes metabólicos alcanzados (MET). Se evaluaron 110 individuos adultos (78,1% mujeres; 51,9±12,3 años), y con un porcentaje en relación al predicho (%) de PImáx. de 96,3±32,4% y de PEmáx de 98,9±27,3%. El %PImáx. mostró una correlación débil con el IAC (r=0,23; p=0,01) y con el CCA (r=0,20; p=0,03), y el %PEmáx. con el IMC (r=0,26; p<0,01) e IAC (r=0,30; p<0,01). No hubo diferencia en los valores medios de %PImáx. (p=0,61) y %PEmáx. (p=0,54) entre las categorías de IPAQ, además de que no existen correlaciones (p>0,05) con los MET estimados. En los adultos en la atención primaria, la fuerza muscular respiratoria mostró una correlación débil con el IMC, CCA e IAC, pero sin correlación con el nivel de actividad física.
Palabras clave | Presiones Respiratorias Máximas; Antropometría; Aptitud Física; Atención Primaria de Salud.

INTRODUCTION

Respiratory muscle weakness may lead to impaired respiratory mechanics, dyspnea, and exercise intolerance[1,2], thus posing a public health issue[3]. Diaphragmatic overload, caused mainly during physical exercises and due to respiratory muscle weakness, is responsible for changes in gas distribution and consequent ventilatory inefficiency, which may compromise the individual's functional capacity [2,4]. Although a common clinical finding, respiratory muscle dysfunction is often diagnosed late[1]. This occurs because the analysis of respiratory muscle strength (RMS) through maximal respiratory pressures using manovacuometry is not part of most evaluation protocols within the scope of primary healthcare.

Factors such as chronic systemic inflammation, oxidative stress, excessive proteolysis, nutritional insufficiency, and/or hormonal anabolic-catabolic imbalance are already known to affect respiratory strength[4,5]. These alterations are common in patients with progressive diseases such as chronic heart failure, some types of cancer, and chronic obstructive pulmonary diseases (COPD)[5-7]. Understanding other conditions that are possibly associated with respiratory variations is relevant, especially those related to individuals' body composition, indirectly measurable by anthropometric data[8-10].

Although some studies approach the association between RMS and anthropometric data[11-13], their results are conflicting. Histological and metabolic changes proper to body composition may influence the pressure generated by respiratory muscles[12]. Studies suggest that type II skeletal muscle fibers are predominant in the respiratory muscles of obese individuals. Given these fibers have a great potential to build muscle strength, this prevalence may help maintaining pulmonary pressures within predicted values[12-14]. Conversely, other studies have found respiratory muscles of obese individuals to be inefficient, possibly reducing respiratory pressures due to diaphragmatic overload[11].

Physical activity level[15], which may be estimated by questionnaires of easy application[16,17], is yet another variable possibly related to changes in respiratory strength. In primary healthcare, physical activity level has been evaluated to identify possible risk factors for chronic non-communicable diseases, cardiovascular disease, and for exercises prescription[16,18]. However, studies addressing the association between respiratory muscle strength and physical activity level are still scarce in the literature and absent when it comes to primary healthcare. Few incipient research[19-21] assessed such association in specific groups, such as older adults and adolescents, suggesting that individuals considered more physically active according to the international physical activity questionnaire (IPAQ) may present higher maximal respiratory pressures[19,20]. In turn, a study conducted with sedentary and active older adults verified no significant difference in maximum inspiratory pressure (MIP)[21].

To establish preventive measures for the onset of respiratory muscle weakness, we must acquire adequate knowledge of the factors possibly related to changes in maximal respiratory pressures. Manovacuometry a is low-cost, noninvasive, easy to apply test,[22,23] which contributes to its applicability in primary healthcare for the early diagnosis of respiratory muscle weakness – a condition that may compromise the population respiratory capacity[1]. Considering the lack of protocols to analyze respiratory muscle strength and physical activity level in the scope of primary healthcare, this study sought to correlate respiratory muscle strength with anthropometric data and physical activity level in adults in primary healthcare. Our study hypothesis is that respiratory muscle strength may be correlated with anthropometric data, especially body mass index (BMI), and physical activity level. In that sense, physically active individuals would have higher maximal respiratory pressure values than sedentary individuals.

METHODS

This is an observational cross-sectional study conducted in a basic health unit (BHU) of the municipality of Macapá (AP), northern Brazil. Data was collected between March and December 2018. The sample size was calculated based on a previous pilot study (n=10), using the obtained maximum inspiratory pressure (MIP - 96.0±30.6 cmH_2O) as an outcome variable, and considering a 5% margin of error, a 95% confidence interval, and a 20% increase for possible losses, resulting in at least 42 individuals. Sample was calculated based on the following formula[24]: $n=(Z\alpha/2\times\delta/E)^2$, where $Z\alpha/2$ is the critical value for the desired confidence level, usually equal to 1.96 (95%); δ is the population standard deviation of the variable; and E the standard error, usually ±5% of the mean (1.05× mean).

Individuals of both genders and older than 18 years were included in the study using a non-probabilistic, convenience sampling. Pregnant women and individuals with some type of functional or cognitive limitation that precluded the evaluation methods were excluded from the study. Personal identification data, age, presence of comorbidities, history of smoking, vital signs, anthropometric measurements, respiratory muscle strength test results, and physical activity level were collected using an evaluation form. Previously trained researchers performed all evaluations.

Respiratory muscle strength was measured with a MV150 WIKA analog manovacuometer, coupled to a diver nozzle with 2-mm diameter[23]. Participants were comfortably positioned in seating position, with pending lower limbs, and using nasal clip. MIP was measured from residual volume and maximum expiratory pressure (MEP) from total lung capacity. Each effort was performed at least three and at most five times, with 60-second rest in between, and sustained for at least 1.5 seconds. We considered a variability of up to 10% among measurements[22] and recorded the highest value obtained. Prediction was calculated based on the formula proposed by Neder et al.[25], and MIP and MEP values above 80% of the predicted were considered normal.[26,27]

Regarding anthropometric measurements, weight and height were measured with a mechanical scale and a 110CH Welmy stadiometer. Individuals' BMI was calculated based on these values, using the formula: weight× height (weight in kilograms and height in meters)[28]. According to the BMI, individuals were stratified into normal weight (18.5-24.9), overweight (25.0-29.9), grade I obesity (30-34.9), grade II obesity (35.0-39.9), and grade III obesity (≥ 40)[28]. Neck circumference (NC) was measured in standing position, with the individual's head in the Frankfort horizontal plane. The measuring tape was positioned below the laryngeal prominence, perpendicular to the neck axis, at the level of the thyroid cartilage. As for abdominal circumference (AC), the measuring tape was positioned at the level of the widest circumference of the abdomen, between the last rib and the iliac crest.

Hip circumference (HC) was measured at the level of the widest circumference of the hip, passing over the greater trochanters[29]. The waist-to-hip ratio (WHR) was calculated by dividing AC by HC, and body adiposity index (BAI) using the following formula[10]: BAI=(HC)/(height×height)-18.

Physical activity level was evaluated using the short form of IPAQ[17], validated for the Brazilian population. Although a self-applicable instrument, IPAQ was administered by experienced researchers to maintain the standard. Based on the frequency and duration of activities (walking, moderate, and vigorous), each individual was classified into sedentary, irregularly active A, irregularly active B, active, or very active[30]. Metabolic equivalents (MET) were calculated using the formula: duration (in minutes) × frequency per week × MET intensity – summed within activity domains to produce a weighted estimate of each individual total weekly physical activity[31].

All data were analyzed using the Statistica 10.0 software (StatSoft, USA), where all variables were tested for normality using the Shapiro-Wilk Test. For continuous variables with normal and median distribution, results were expressed as mean and standard deviation; for those that did not show normal distribution, results were expressed in interquartile range (25-75%). Frequency tables were produced for categorical variables. Student's t-test was used to compare the means of parametric variables for genders and the presence or not of comorbidities. For nonparametric variables (IPAQ and comorbidities) between genders, the Mann-Whitney test was used. Pearson's coefficient was calculated for the correlation between respiratory muscle strength and anthropometric measurements, and Spearman's coefficient for the correlation between respiratory muscle strength and physical activity level (MET values). All analyses were stratified by gender. One-way ANOVA analysis of variance was performed to compare the means of maximal respiratory pressures between IPAQ categories. For all analyses, a significance level of 5% was considered.

RESULTS

Eleven of the 121 individuals recruited were excluded from the study – 10 pregnant women and one individual with functional limitation. Thus, 110 participants were included in this study, most of whom where middle-aged (51.9±12.3 years), and women (78.1%, n=86). Regarding anthropometric measurements, the overall mean BMI was 30.3kg/m2 (±11.1kg/m2). We verified a statistical difference in weight, height, BAI, NC, and WHR measurements between the genders. Respiratory muscle strength was preserved in relation to predictions, both regarding %MIP (96.3±32.4%) and %MEP (98.9±27.3%), with statistically significant difference between genders only for MPI and MEP values (cmH_2O) ($p<0.001$) (Table 1).

Table 1. Demographic characteristics, anthropometric measurements, and respiratory muscle strength of the study population

Variables	Total (n=110)	Female (n=86)	Male (n=24)	*p-value
Age (years)	51.9±12.3	52.0±12.0	51.5±13.4	0.84
Weight (kg)	72.0±15.8	70.1±15.4	78.9±15.6	< 0.001
Height (cm)	156.1±8.4	153.3±6.5	166.1±6.4	< 0.001
BMI (kg/m^2)	30.3±11.1	30.1±9.6	31.1±15.6	0.69
18.5-24.9	30 (27.3)	23 (26.7)	7 (29.2)	-
25.0-29.9	42 (38.2)	31 (36.0)	11 (45.8)	-
30.0-34.9	21 (19.1)	17 (19.8)	4 (16.7)	-
35.0-39.9	13 (11.8)	11 (12.8)	2 (8.3)	-
≥ 40	4 (3.6)	4 (4.7)	-	-
BAI (%)	36.3±8.9	38.0±9.1	30.1±3.6	< 0.001
NC (cm)	36.6±3.8	35.7±3.4	40.0±3.3	< 0.001
AC (cm)	95.5±13.5	94.8±14.2	98.1±10.3	0.28
HC (cm)	104.3±10.4	104.7±11.0	102.8±7.7	0.43
WHR	0.91±0.09	0.90±0.09	0.95±0.06	0.04
MIP obtained (cmH_2O)	88.4±32.2	80.6±29.6	116.4±24.7	< 0.001
% MIP predicted	96.3±32.4	95.0±35.0	101.0±20.2	0.42
MEP obtained (cmH_2O)	90.5±27.9	82.6±24.2	118.5±21.7	< 0.001
% MEP predicted	98.9±27.3	99.7±29.6	96.0±17.0	0.55

The data are expressed in mean ± standard deviation and in absolute number and percentages (%). BMI: body mass index; BAI: body adiposity index; NC: neck circumference; AC; abdominal circumference; HC: hip circumference; WHR: waist-to-hip ratio; MIP: maximum inspiratory pressure; MEP: maximum expiratory pressure. *Student's t-test.

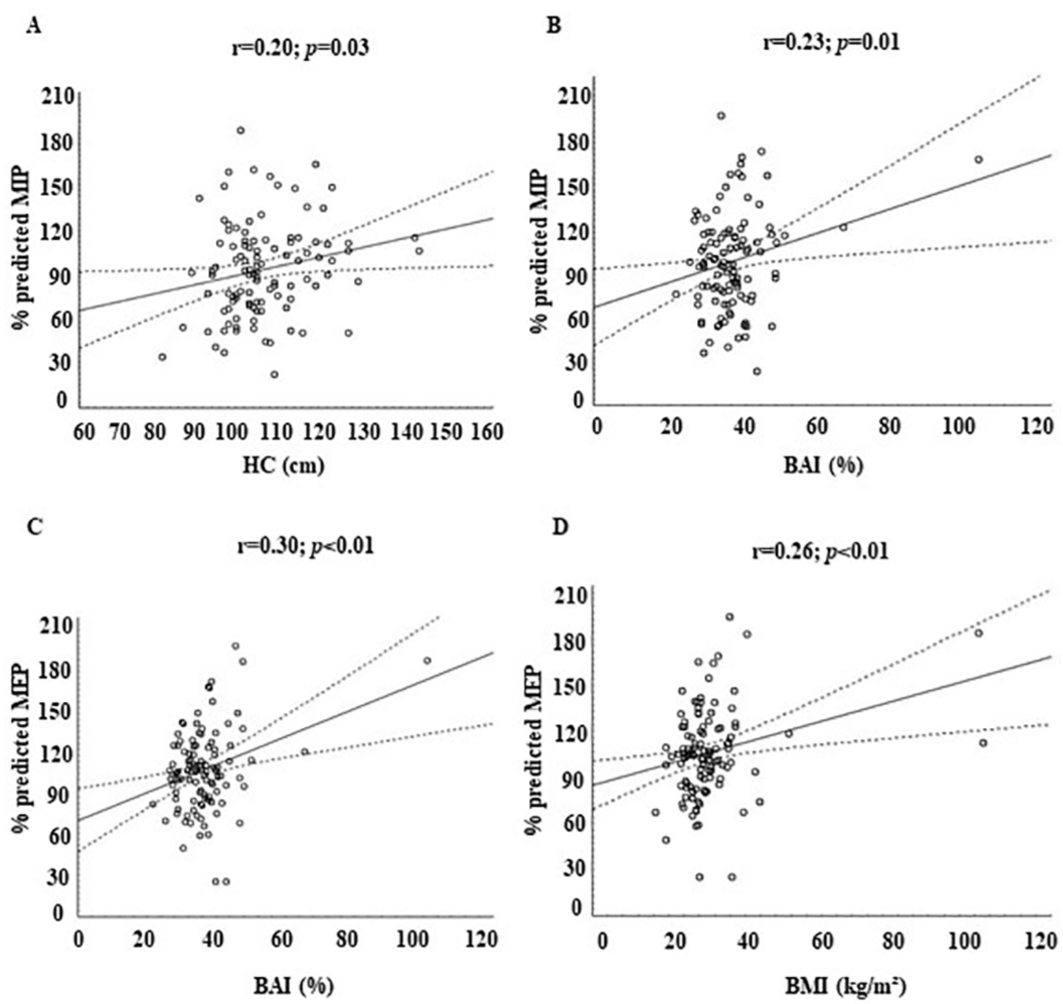
Systemic arterial hypertension (n=48; 46.3%), obesity (n=38; 34.5%), dyslipidemia (n=37; 33.6%), and diabetes mellitus (n=28; 25.4%) were the most common comorbidities. Although to a lesser extent, individuals also presented controlled asthma (n=12; 10.9%), chronic kidney disease (n=4; 3.6%), and chronic obstructive pulmonary disease (COPD) (n=1; 0.9%); 10.9% (n=12) were smokers and 23.6% (n=26) former smokers, unrelated to the maximal respiratory pressures values (p>0.05). We also found no statistical difference (p>0.05) for comorbidities between genders.

Table 2 presents the analysis of maximal respiratory pressures in relation to predicted values (%) according to BMI classification, indicating that MIP and MEP tend to increase BMI. Considering the total sample, %MIP presented a weak positive correlation with HC (r=0.20; p=0.03) and BAI (r=0.23; p=0.01), and %MEP with BMI (r=0.26; p<0.01) and BAI (r=0.30; p<0.01) (Figure 1). The gender-stratified analysis revealed that %MIP was also weakly positively correlated with HC (r=0.22; p=0.03), BAI (r=0.28; p<0.01), and BMI (r=0.30; p<0.01) in women, and %MEP with AC (r=0.22; p=0.04), BMI (r=0.35; p<0.01), and BAI (r=0.32; p<0.01). For men alone, we found no significant correlation between respiratory muscle strength and anthropometric measurements.

Table 2. Analysis of respiratory muscle strength according to body mass index classification

BMI	Total (n=110)		Female (n=86)		Male (n=24)	
	%predicted MIP	%predicted MEP	%predicted MIP	%predicted MEP	%predicted MIP	%predicted MEP
18.5-24.9	88.8±33.1	96.5±24.3	84.7±24.0	93.5±26.7	102.3±27.8	106.3±10.0
25.0-29.9	96.7±30.2	93.6±25.9	95.9±33.3	94.6±27.8	99.0±19.8	90.9±20.3
30.0-34.9	102.0±33.6	107.2±23.2	101.9±37.2	110.7±23.7	102.3±12.0	92.4±15.6
35.0-39.9	100.7±40.2	105.2±36.8	100.0±43.7	106.9±30.0	104.7±16.0	95.9±7.9
≥ 40	105.3±12.9	109.9±34.0	105.3±12.9	109.9±34.0	-	-

Data were expressed as mean and standard deviation. BMI: body mass index; MIP: maximum inspiratory pressure; MEP: maximum expiratory pressure.



HC: hip circumference; BAI: body adiposity index; BMI: body mass index; MIP: maximum inspiratory pressure; MEP: maximum expiratory pressure.

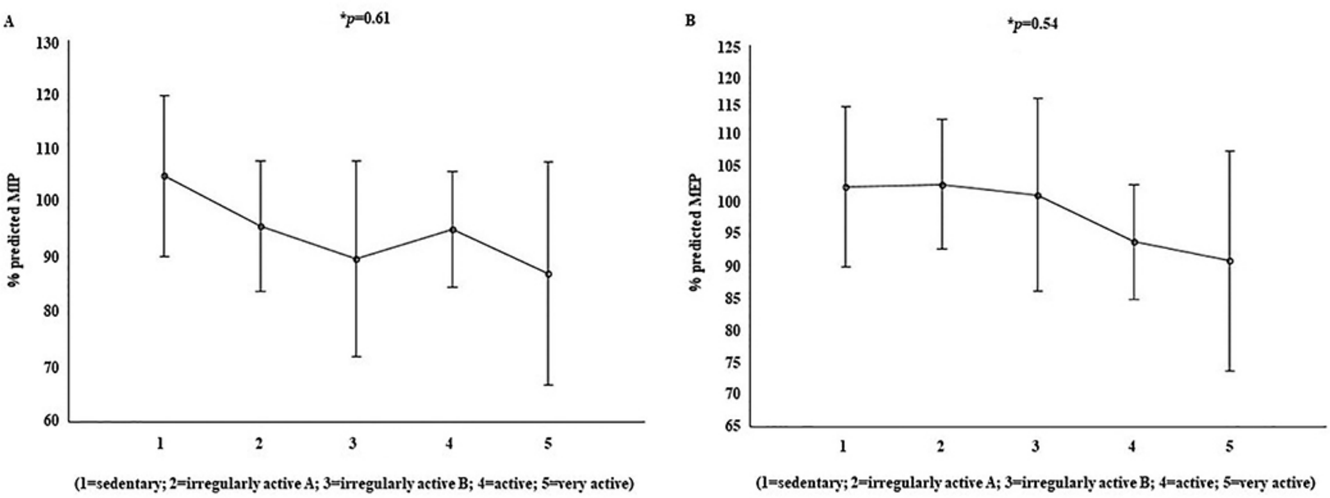
Figure 1. Correlation between anthropometric measurements and maximal respiratory pressures considering the overall sample

Two of the 110 participants included in the study did not answer the IPAQ because they had to leave before the evaluation completion, so that 108 participants completed the questionnaire. According to the IPAQ, most participants were considered active (n=37; 33.6%) when classified by physical activity level. This behavior was also found in the gender-stratified analysis (Table 3), without significant difference between them (p=0.47). Both %MIP (p=0.61) and %MEP (p=0.54) means showed no significant difference within IPQA categories (Figure 2) and compared to obtained values (MIP, p=0.65 and MEP, p=0.85). The total MET value (median and interquartile range) per week was 625.4 (126.0 – 1,348.7). We found no significant correlation between MET values and the obtained (MIP, r=-0.10/p=0.26; MEP, r=-0.009/p=0.91) and predicted maximal respiratory pressures (%MIP, r=-0.13/p=0.16; %MEP, r=-0.08/p=0.36).

Table 3. Frequency of physical activity according to the international physical activity questionnaire classification

IPAQ classification	Total (n=108)	Female (n=85)	Male (n=23)
Sedentary	19 (17.2)	14 (16.2)	5 (20.8)
Irregularly active B	29 (26.3)	25 (29.0)	4 (16.6)
Irregularly active A	13 (11.8)	10 (11.6)	3 (12.5)
Active	37 (33.6)	31 (36.0)	6 (25.0)
Very Active	10 (9.0)	5 (5.8)	5 (20.8)

The data are expressed in absolute number and percentages (%). IPAQ: international physical activity questionnaire.



MIP: maximum inspiratory pressure; MEP: maximum expiratory pressure; IPAQ: international physical activity questionnaire. *one-way ANOVA.

Figure 2. Comparison of respiratory muscle strength among IPAQ categories considering the overall sample

DISCUSSION

Our main findings indicate a weak positive correlation between respiratory muscle strength and body mass index (BMI), body adiposity index (BAI) and hip circumference (HC). In women, maximum inspiratory pressure (MIP) was correlated with CQ, BAI, and BMI, and maximum expiratory pressure (MEP) with abdominal circumference (AC), BAI, and BMI. We found no significant correlation for men, which may be explained by their reduced number within the sample (n=24; 21.9%), where only six (n=6) were obese. Although most individuals were classified as active in terms of physical activity, we found no correlation between respiratory pressures and physical activity level, assessed by metabolic equivalents (MET) values, in both genders.

The few studies addressing the association between respiratory muscle strength and anthropometric measurements reached controversial results, varying according to the study population, sample size, and methodology. When comparing morbidly obese (BMI ≥ 40kg/m^2) and non-obese adults (between 18 and 30kg/m2), Sant'Anna et al.[32] found no difference in respiratory muscle strength between groups (p>0.05), both for predicted and obtained MIP and MEP values. However, these authors verified a weak negative correlation between the obtained maximal respiratory pressures (in relation to %predicted) and AC, BMI, and WHR in the morbidly obese group (79% female). This finding suggests that both BMI and the body mass distribution pattern may influence respiratory muscle strength. Mafort et al.[11] conducted a literature review and found that the respiratory muscles of obese adults may be ineffective, consequently reducing respiratory pressures due to diaphragm load, where excess adipose tissue on the chest and abdomen may cause mechanical disadvantages to the respiratory system. These findings corroborate those reported by Rosa and Schivinski[33], who compared maximal respiratory pressures in three groups of a pediatric population (eutrophic, overweight, and obese) and found a lower value of the MIP obtained in obese (p=0.014) and overweight children (p=0.043).

However, some authors such as Shinde et al.[34] reached findings similar to ours. When comparing two groups of adult men, they found a significant increase ($p < 0.01$) in the obtained MIP and MEP among those with higher BMI. According to Sanchez et al.[35], the R^2 coefficient was able to predict 21.3% of the MIP and 28.3% of the MEP obtained for healthy adults when BMI was the independent variable (64.9% female). Costa et al.[12] compared respiratory pressure measurements of obese and eutrophic women, and found the obese group to show higher blood pressure (p=0.001). These findings corroborate ours, as the gender-stratified analysis indicated a positive and significant correlation between BMI and %MIP and %MEP among women. Magnani and Cataneo[14] found no impairment of respiratory muscle strength in obese adults (76.7% female) candidates for bariatric surgery (BMI=44.42±7.36kg/m^2) of both genders, even after stratifying BMI at various cutoff points, without difference between groups (p>0.05).

The preservation of respiratory muscle strength in obese individuals may be explained both histologically and metabolically. Obesity may induce changes in skeletal muscles such as the shift of type I muscle fiber predominance to type II. Given that these fibers have greater potential to build muscle strength, such shift may justify respiratory pressures preservation within normal values[12]. Another hypothesis for MIP increase among individuals with high BMI is the excess fat deposits on the chest region, increasing diaphragm load and consequently reducing functional residual capacity[11]. This condition requires the respiratory muscles to exert sustained and extensive efforts to obtain better ventilation, thus being forced to work harder[34]. Although we believe that both genders present those adaptations, evidence is scarcer when it comes to men, especially because research samples are predominantly composed of women due to the greater worldwide prevalence of obesity among them[36].

Other reflections disregarded in our study are also relevant, such as the impairment of lung volumes and capacities in individuals with high BMI regardless of the preserved respiratory muscle strength. Dixon and Peters[37] highlight changes in pulmonary function due to obesity, which causes fat accumulation in the mediastinum, abdominal cavities, and upper airways to considerably modify the mechanical properties of the lungs and chest wall, reducing pulmonary compliance and increasing airway resistance. Such condition may cause dyspnea, exercise intolerance, hypoventilation, and sleeping disorders[11,38,39].

When it comes to accurately measuring body fat distribution, BMI is a limited variable. Considering that, Bergman et al.[10] proposed a new anthropometric measure capable of quantifying the percentage of adiposity for considering the HC within its formula – the body adiposity index (BAI). When compared to BMI, BAI is a new way of assessing body composition, which may justify the lack of studies associating respiratory muscle strength with this anthropometric measure. However, Sung, Oh and Lee[40] showed BMI and BAI to be correlated in terms of indirectly assessing individuals' body composition, so that our findings (maximal respiratory pressures are positively correlated with HC and BAI) may be justified by the aforementioned foundations related to BMI.

To the best of our knowledge, this is the first study to analyze the association between respiratory muscle strength, anthropometric measurements, and physical activity level among adults in primary healthcare, given that respiratory muscle strength is not often assessed in the primary level of health. This occurs mostly due to the lack of professionals experienced and trained in respiratory physiotherapy – often attributable to managers' misunderstanding that these professionals' performance is conditioned to large infrastructures, despite its numerous actions for risk control both in the individual and community spheres being already known[41,42]. The limited public resources destined to BHU[43] and scarce evidence to underpin its applicability may also justify the lack of protocols aimed to evaluate respiratory muscles in the population.

Research approaching groups different from that analyzed here are likewise insufficient. Chaves et al.[19] compared the respiratory muscle strength of 182 adolescents according to IPAQ classifications of physical activity. The authors found that active and very active adolescents presented significantly higher maximum respiratory pressures than those considered as irregularly active A and B. Miranda et al.[20] found no significant difference in obtained MIP and MEP between active and irregularly active older adults. Bastos et al.[44] found the predicted MIP and MEP (p=0.010; p=0.002) to be significantly higher in older women who reported practicing physical activity than in those who reported not practicing. In turn, Baltieri et al.[21] found no significant difference in predicted MIP when comparing sedentary older adults (n=13) to active volleyball practitioners (n=13) (p=0.09). Ageing may compromise the respiratory muscle strength, either due to the predominance shift in glycolytic and anaerobic enzymes, the decrease in capillary volume and density, or by the decline in muscle fiber number[45]. This might justify the higher maximal respiratory pressures in physically active compared to sedentary older adults, as they present a previous muscle deterioration condition.

The above expressed allow us to observe that the results are conflicting and vary according to the study population. When comparing respiratory muscle strength with IPAQ categories in adults, we found no significant difference in the means of predicted MIP and MEP and no correlation with estimated MET values. However, our sample was composed mostly of physically active individuals with preserved respiratory muscle strength, without progressive and middle-aged chronic illnesses – that is, they were not older adults. We also assumed that the activities performed were not specific to respiratory muscles, as occurs in inspiratory muscle training, which, according to Edwards et al.[46], effectivelly improves respiratory muscle strength and functional capacity in obese adults.

Knowing the factors that may or not be related to respiratory muscle weakness onset in the UBS is important, mainly because they involve populations vulnerable to chronic diseases[47]. We also reiterate that manovacuometry is a simple and low-cost test[22,23], favoring its applicability in primary healthcare and management of the respiratory system. Articulated with managers, the manovacuometry may play a role in mobilizing resources and strengthening actions to promote a healthy lifestyle for the population.

This study has some limitations. First, data on physical activity level was self-reported by means of a questionnaire, preventing objectivity. We also collected no data related to type, intensity, and volume of exercises – important aspects that deserve attention in further investigations. Collecting anthropometric data by indirect measurements was yet another limitation of this study, as other methods can assess body composition more accurately, such as dual X-ray densitometry, considered the gold standard. However, other more far-fetched evaluation methods could be unfeasible regarding practicality and accessibility, as we analyze individuals in primary healthcare. We also acknowledge the weak correlations found in our study, so that these results should be interpreted with caution and cannot be extrapolated to other populations, given that our study sample was mostly composed of women.

CONCLUSIONS

Our results indicate that anthropometric variables such as BMI, HC, and BAI showed a weak positive correlation with maximal respiratory pressures in adults in primary healthcare, especially women. However, we found no correlation between physical activity level and respiratory muscle strength. To understand the correlation of respiratory muscle strength with anthropometric measurements and physical activity level in adults in primary healthcare, further studies must be conducted with different populations and with a greater number of male participants.

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