Due to the new Bologna process, the requirement to publish peer-reviewed articles prior to defending a doctoral thesis is becoming increasingly popular in Portugal, ranging from advisable to mandatory in some universities. In fact, in the Faculty of Medicine of Porto University the doctoral candidate must have a minimum of 2 articles as first author in peer-reviewed journals with impact factor. The Standards for PhD Education in Biomedicine and Health Sciences in Europe,[5] even recommend that the minimum requirement for the PhD thesis in medicine and health sciences should be the equivalent of at least three ''in extenso'' papers published in internationally recognized journals.

In addition the quality of the thesis will be judged by the impact factor of the journals. Again in the Faculty of Medicine of Porto University to be approved ''with honours'' the PhD candidate must have one of the following: (1) one article published as first author, in a journal within the percentile 90 from ISIS ranked list in its area; (2) two articles published as first author, in a journal within the percentile 70 from ISIS ranked list in its area; (3) four articles published as first author, in journals with an average ranking within the percentile 40 from ISIS ranked list in its area.

So it seems that the trends for PhD doctorates will rise significantly in the coming years and with them good quality publications will be emerging from such a high number of PhD thesis.

What else can we do to enhance our PhD programmes?

Mobility and collaborations between universities and research organizations, at all stages of the PhD career should be encouraged. Receiving training in biomedical engineering, molecular biology, chemistry and business & management in the more qualified centres would create a better skilled researcher. New funding strategies should be explored to increase our record in science and innovation. Centralized leadership could serve as a hub for global excellence to increase our share in global respiratory research.

In conclusion, if the new requirements for PhD theses are widespread among Portuguese respiratory medicine academia we can expect in the future an advance in the quality and quantity of research. Although the expected rise in doctorates will bring an increase in academic research will all of these respiratory medicine specialists with a PhD degree reach the long way to professorship? Or will they turn their talents outside the academia?

Conflicts of interest

The authors have no conflicts of interest to declare.

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http://dx.doi.org/10.1016/j.rppnen.2016.01.005

Is there relationship between dynamic volumes of pulmonary function and cardiac workload (maximal oxygen uptake) in young athletes?

Dear Editor,

In many obstructive airway diseases, the abnormal pulmonary function, with impaired distribution of ventilation and consecutive gas exchange disturbance, limits aerobic working capacity and maximal oxygen consumption (VO2max).[1] With regard to pulmonary function and VO2max importance in athletic performance,[2] as well as to the close relationship between these two variables, we here report on the causality between dynamic volumes of pulmonary function and maximal oxygen uptake, measured in young elite athletes and their age- and psychometric-matched controls. The study included 45 Caucasian men, all nonsmokers with no history of cardiovascular and respiratory diseases, equally divided into three groups: group A (15 elite aerobic football players (23.7 ± 4.4 years)), group B (15 elite anaerobic karate players (23.8 ± 3.5 years)), group C (15 sedentary controls (23.8 ± 1.7 years)). The research protocol was approved by the local ethical committee and complied with the guidelines of the Declaration of Helsinki.

All participants gave informed written consent before their inclusion. Each subject underwent two protocol measurements: an incremental exercise test on treadmill for VO2max measurement and spirometry tests for the measurement of the pulmonary function: vital capacity – VC, forced vital capacity – FVC, forced expiratory volume in the first second – FEV1 (all presented in percent predicted and as measured values both in liters and percentages); Peak Expiratory Flow – PEF (shown in liters per second) and FEV1/FVC (as percentage). Spirometry was performed using standard spirometer (Turnaic, Pneumotach) Pony FX (Cosmed Pulmonary Function Equipment, Italy). Bruce treadmill protocol (T200; COSMED Ltd, Rome, Italy with Jaeger, Oxycon pro, Wurzburg, Germany) was the standard exercise protocol for this study.[3] The duration of the test, measured in seconds and limited by the subject's heart rate, was 12.81 (1.19),

Table 1 Pulmonary and cardiac parameters for aerobics (A), anaerobics (B) and controls (C).

Group	Mean (SD)			$p^{\dagger}$	$p^{\dagger\dagger}$		
	A	B	C	A/B/C	A vs B	A vs C	B vs C
Pulmonary parameters							
Predicted							
VC	5.82 (0.33)	5.96 (0.68)	5.57 (0.17)	ns			
FVC	5.58 (0.31)	5.78 (0.69)	5.47 (0.55)	ns			
FEV1	4.68 (0.25)	4.79 (0.58)	4.71 (0.31)	ns			
PEF	10.35 (0.37)	10.77 (1.44)	11.97 (0.97)	0.000**	ns	0.000**	0.004**
Measured (L)							
VC	6.14 (0.37)	6.04 (0.66)	5.62 (0.51)	0.017*	ns	0.002**	ns
FVC	6.11 (0.37)	5.89 (0.73)	5.37 (0.49)	0.001**	ns	0.000**	ns
FEV1	5.03 (0.34)	4.98 (0.58)	4.48 (0.35)	0.002**	ns	0.000**	0.018*
%FEV1/VC	93.93 (5.41)	95.86 (6.02)	102.11 (5.97)	0.002**	ns	0.002**	0.004**
PEF	10.58 (1.63)	10.96 (1.04)	10.08 (0.51)	0.044*	ns	ns	0.018*
Measured (%)							
VC	105.27 (6.76)	106.87 (9.29)	98.80 (6.34)	0.011*	ns	0.006**	0.015*
FVC	109.80 (7.15)	111.07 (9.76)	101.87 (5.54)	0.003**	ns	0.002**	0.005**
FEV1	107.47 (6.53)	110.40 (12.71)	105.13 (8.48)	ns			
FEV1/VC	82.14 (5.06)	84.08 (4.60)	81.97 (9.82)	ns			
PEF	102.53 (17.75)	111.07 (13.18)	118.67 (7.96)	0.001**	ns	0.000**	0.046*
Cardiac parameters							
VO2max							
	57.71 (4.41)	48.98 (6.79)	44.13 (6.04)	0.000**	0.001**	0.000**	ns

VC, vital capacity; FVC, forced vital capacity; FEV1, forced expiratory volume in1 second; PEF, peak expiratoy flow; VC, vital capacity; FEV1/VC-Tiffeneau-Pinelli index; PEF, peek expiratory flow.

* Level of significance: $p < 0.05$.

** Level of significance: $p < 0.01$.

† Kruskal–Wallis one way ANOVA test for independent samples.

†† Mann–Whitney test for two independent samples.

14.53 (2.90) and 15.87 (3.23) for controls, football players and karate players, respectively.

The test was interrupted if any of the following parameters were achieved: age-predicted maximal heart rate; oxygen consumption plateau; respiratory coefficient (RQ) >1.2 and because of any subjective reason. Kruskal–Wallis one way ANOVA test was used to determine differences between groups in relation to measured parameters; Mann–Whitney test was used for inter-group differences. Correlation between dynamic volumes and VO2max was determined by Pearson coefficient. The level of significance was set at 95% for all statistical analyses.

There were no significant differences for any of the pulmonary function measures among athletes. Significant differences were found in VC, FVC, FEV1, FEV1/FVC between aerobics and controls, as well as in PEF (%). Also, higher FEV1, FEV1/FVC and PEF were found in anaerobics than in controls. Statistical difference was observed in percentage of VC, FVC and PEF (%) between groups B and C. As expected, group A had the highest reached value of VO2 max, which proved to be statistically significant as compared to both groups B and C, the latter two showing no significant differences between them (Table 1). No significant correlations were found between VO2max and VC, FVC, FEV1 and FEV1/FVC in any of the investigated groups, although there were noticeable differences in those parameters among them (Fig. 1).

The results of the present study have clearly shown positive connection between exercise and both pulmonary and cardiac function. Lung volumes in athletes are disputable and according to some studies depend on the type of sport.[4,5] Our previous experiments have shown higher lung volumes in almost all athletes as compared to non-athletes,[6,7] which was also confirmed by the current study-higher lung volumes were observed in athletes than in sedentary controls. Physical training improves aerobic capacity. According to a number of studies, VO2max can be increased by 20–30% with 8–10 weeks of training, and 40–50% with one to four years.[4,5,8] Indeed, according to our study, athletes (both groups) had higher VO2max than the control group.

The absence of correlation between pulmonary parameters and maximal oxygen uptake in elite athletes is the most noticeable finding of our research. It is in contrast to previously reported study claiming relationship between pulmonary function and VO2max for various sport disciplines,[8] finding that subjects with higher VO2max have lower airway resistance. From this point of view it comes to the same thing, since athletes have higher VO2max due to their regular system of training, with a lower incidence of

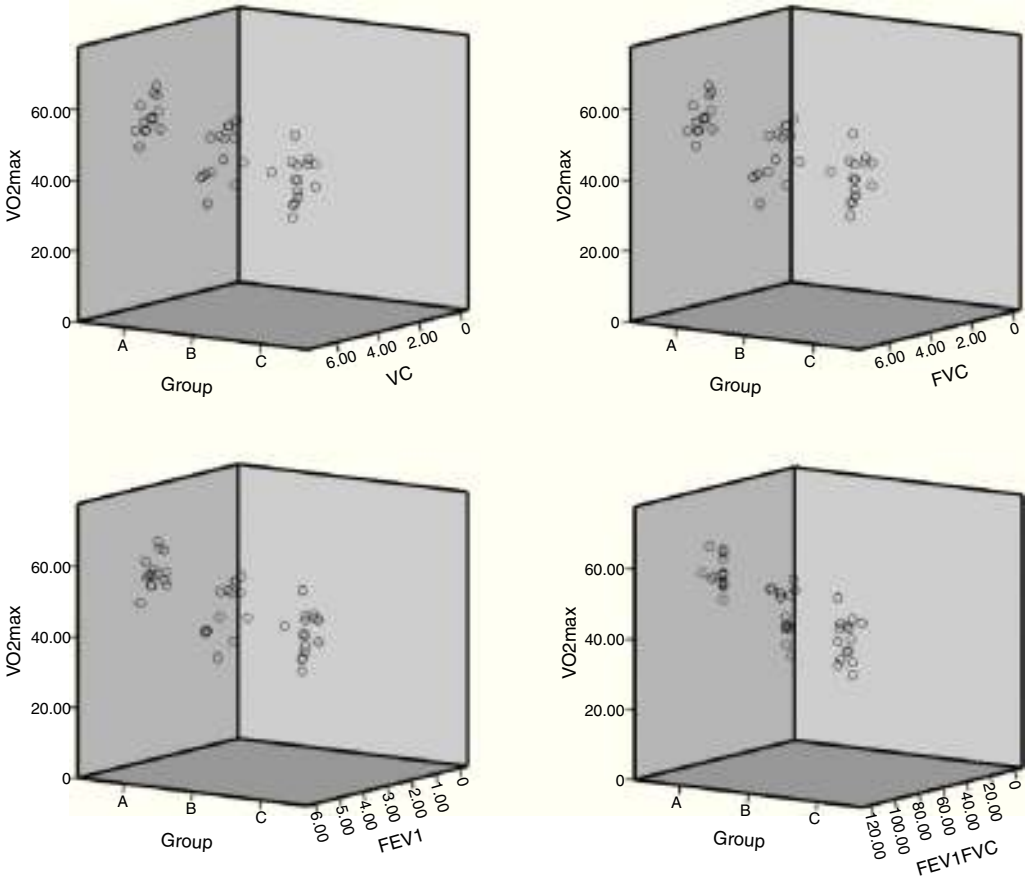

Figure 1 Scatter-dot diagram of cardiac and pulmonary parameters in athletes performing aerobic type of sport (A), athletes-anaerobic sport (B) and sedentary controls (C).

airway resistance coming as a consequence. We should take into account difficulties in distinguishing between exercise-induced bronchospasm and bronchospasm caused by cold or dry air inhalation or previously unrecognized asthma. In mild asthma, exercise is the only cause of asthmatic symptoms sometimes.[9] All pulmonary parameters not affecting VO2 max were normal in all of the investigated subjects.

In conclusion, exercise training improves the subject's pulmonary function and VO2max. VO2max is most improved by aerobic type of training; there were no observed differences with regard to respiratory parameters.

Conflicts of interest

The authors have no conflicts of interest to declare.

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http://dx.doi.org/10.1016/j.rppnen.2016.02.004

The impact of neck and abdominal fat accumulation on the pathogenesis of obstructive sleep apnea

Dear Editor,

Obesity seems to play an important role in the pathogenesis of obstructive sleep apnea (OSA).[1,2] The prevalence of OSA is estimated to be around 5–25% in the adult population,[2–4] reaching up to 45% in obese subjects.[2] However, it is the location of body fat accumulation rather than the total amount which seems to be most relevant in assessing the risk of OSA.[3,5] Neck and visceral fat accumulation has been described as risk factors for OSA in obese patients.[3] Several mechanisms have been proposed for the greater impact of fat accumulated in the abdomen and neck regions in OSA compared with the peripheral ones: reduced pharyngeal lumen size due to fat deposition in the airway walls and increased abdominal pressure in the thorax reducing end-expiratory lung volumes, consequently reducing tracheal traction and increasing collapsibility of the upper airway.[1] Nevertheless the impact of regional fat accumulation on the onset and progression of the disease is unclear and studies investigating this complex association would be helpful for a better management of these patients.

The authors, therefore, designed a prospective cross-sectional study which aimed to analyze and compare the impact of cervical and abdominal fat accumulation on the presence and severity of OSA, in a Portuguese group of individuals with suspected diagnosis.

Overnight polygraphy and CT scan of the neck and abdomen, for the measurement of neck fat area (NFA), subcutaneous abdominal fat area (SFA) and visceral fat area (VFA), were performed on a cohort of subjects attending our sleep laboratory with symptoms of sleep disordered breathing, between October 2013 and May 2014. Body mass index (BMI), neck circumference (NC) and waist circumference (WC) were recorded.

Fifty-two patients were enrolled in the study: the mean ± SD BMI was 32.4 ± 4.3 kg/m^2, 69.2% of the subjects were obese (BMI ≥30 kg/m^2). The subjects with OSA (n = 38, apnea/hypopnea index (AHI) ≥5 h^{-1}) had a greater BMI, WC, NFA and VFA than those without OSA (n = 14, AHI <5 h^{-1}) (Table 1). There was a positive correlation of AHI with BMI (r = 0.490, P < 0.001), VFA (r = 0.417, P = 0.002), WC (r = 0.417, P = 0.002), NFA (r = 0.377, P = 0.007), SFA (r = 0.308, P = 0.026) and NC (r = 0.282, P = 0.04). The BMI, VFA, NFA and WC increased significantly from snorers to severe OSA (Table 2). The multivariate stepwise linear regression analysis was used to analyze the independent factors contributing to AHI: only BMI and VFA were independent risk factors for AHI (model R^2 = 0.303).

Although more marked in OSA group (81.6%), 35,7% of isolated snorers were obese, probably due to the association of obesity with snoring and daytime sleepiness[6] leading to the suspicion of OSA. Among fat measures, VFA and NFA were significantly higher in OSA subjects. Both increased significantly from snorers to severe OSA and were positively correlated with the AHI, although correlation between AHI and NFA was somewhat less strong than with VFA. In multivariate analysis, only BMI and VFA were significantly associated with AHI, suggesting that VFA had a greater impact on the increasing severity of OSA in our sample. The association of OSA with several body habitus measures has been studied and results vary widely among trials. At present, there is no consensus that any one particular habitus phenotype is more important in the pathophysiology of OSA. It is possible that different types of fat distribution are more important in specific subgroups defined by factors such as sex[4,7] or ethnicity.[7,8] Furthermore the impact of body habitus as a predictor of OSA may vary with age.[9]

In this study, we found a significant positive correlation between AHI and the anthropometric measures WC and BMI, but not NC. The reason why NC did not show differences between groups and was not correlated with AHI while NFA did, could probably be due to the greater impact of cervical fat depot compared to NC on the presence and severity of OSA in our sample. Thus, a greater amount of NFA to the same perimeter could lead to a reduction of the size of the cervical airway structures and facilitate upper airway collapse.

The main limitation of our study was the small cohort size; however, this could be offset by the prospective nature of the study which allowed the measurement of anthropometric values by the same professional and control of the timing of when sleep and imaging studies took place.

This study characterizes the distribution of body fat accumulation in our OSA patients, analyzes its association with disease severity, and assesses the location of fat distribution with the greatest impact on the disease. These findings suggest a complex association of interactive effects between visceral fat and OSA, with pathophysiologic and therapeutic implications. Continuous positive airway pressure has proven beneficial in these patients[3] and they could also benefit from personalized nutrition interventions,