ISSN: 0975-833X

Available online at http://www.journalcra.com

INTERNATIONAL JOURNAL OF CURRENT RESEARCH

International Journal of Current Research
Vol. 13, Issue, 12, pp.20047-20050, December, 2021

DOI: https://doi.org/10.24941/ijcr.42804.12.2021

RESEARCH ARTICLE

RELATIONSHIP BETWEEN IRON RESERVE (FERRITINE) AND PHYSICAL ACTIVITY IN PATIENTS WITH CHRONIC OBSTRUCTIVE PULMONARY DISEASE

Victor Riberio de Sant'Ana[1,*], Vitória Junqueira Nelli Mota[2] and Leonardo Marzola Hirata[1]

[1]Federal University of Mato Grosso do Sul
[2]University for the Development of the State and Region of Pantanal (Uniderp)

ARTICLE INFO

Article History:
Received 17th September, 2021
Received in revised form
28th October, 2021
Accepted 10th November, 2021
Published online 29th December, 2021

Keywords:

COPD, Ferritin,
Physical Activity.

Corresponding author:
Victor Riberio de Sant'Ana

ABSTRACT

The objective of this work was to verify the relationship between the iron reserve in the form of ferritin and the amount of physical activity performed by patients with COPD. The study was carried out at the pneumology outpatient clinic of University Hospital Maria Aparecida Pedrossian and in it individuals with a diagnosis of COPD had the concentration of ferritin and blood ferric profile measured and correlated with the amount of physical activity verified through the short version of the International Activity Physics Questionnaire, converted to weekly energy expenditure in Kcal, using the AINSWORTH compendium. It was concluded that COPD patients with higher blood ferritin levels were able to perform more physical activity.

Citation: Victor Riberio de Sant'Ana, Vitória Junqueira Nelli Mota and Leonardo Marzola Hirata. *"*Relationship between iron reserve (ferritine) and physical activity in patients with chronic obstructive pulmonary disease*", 2021. International Journal of Current Research, 13, (12), 20047-20050.*

INTRODUCTION

Chronic Obstructive Pulmonary Disease (COPD) is an important public health problem in the world. An estimated prevalence of COPD in the world population, for stages II or later, is equivalent to 10.1 ± 4.8%, in general, with 11.8 ± 7.9% for men and 8.5 ± 5.8% for women (BUIST, 2005). In São Paulo, most populous city in Brazil, there is a prevalence of 15.8% (MENEZES, 2004). Associated with this, it is possible to predict the maintenance of this situation due to the high prevalence of smoking. Even with a reduction in recent decades, smoking remains high in Brazil (GIOVINO, 2012; MALTA, 2017), and this practice contributes to 80 to 90% of the identifiable causes of COPD. Iron is essential in cellular processes regulating the response to hypoxia, oxidative stress, proliferation, metabolism and cellular bioenergetics, its low being associated with decreased basal aerobic capacity and muscle dysfunction, contributing to the decrease in physical activity and exercise intolerance in COPD. In addition, a decrease in ferritin may increase pulmonary hypertension in COPD, as the human vasoconstrictor response depends on iron, limiting physical activity in these patients (BARBERAN-GARCIA, 2015; NICKOL, 2015; PLESNER, 2017). The change in global social and economic patterns is causing sedentary lifestyles to become a frequent phenomenon around the world (LEE, 2011; BOON, 2008) and, with sedentary lifestyle being the fourth most important risk factor for global mortality, it is estimated that physical inactivity is mild to 5.5% of deaths worldwide (KNUTH, 2009; World Health Organization, 2009). COPD limits physical activity in patients, even in the early stages of the disease (SOLER-CATALUÑA *et al*., 2018; VAN HELVOORT *et al*., 2016; VAN REMOORTEL *et al*., 2013). In addition, sedentary lifestyle is one of the most important predictors of mortality in COPD (GARCIA-RIO, 2012; WASCHKI, 2011) and has been associated with a high risk of hospitalization and hospital readmission (GARCIA-AYMERICH, 2006). Physical activity can be measured using motion sensors or questionnaires. Motion sensors primarily include step counters (pedometers) or body acceleration monitors (accelerometers). These devices record the number of steps taken in each period, the distance covered, the activity pattern, the estimated energy expenditure or its intensity and the level of physical activity.

Even though they are more accurate, these analyzes are less accessible for daily clinical practice (BENZO, 2009; PITTA, 2006). Questionnaires, although they are subjective and vary widely in terms of data collected, period of research, reporting of results and other aspects, compared to these devices, they are a simple and inexpensive way to measure physical activity (BENZO, 2009; JACOBS, 1993). The International Physical Activity Questionnaire (IPAQ) was developed to assess population levels of physical activity across countries (WANNER, 2016; CRAIG, 2003). It presents two versions, a long and a short one. Its summarized version provides information on the time spent walking, in physical activity of moderate and vigorous intensity, and sitting (WANNER, 2016; CRAIG, 2003) and it has been validated in different countries, including Brazil (CRAIG, 2003; MATSUDO, 2001) Energy expenditure can be calculated considering the minutes per week for each physical activity and the estimation of this activity in METS, using the AINSWORTH compendium (MATSUDO, 2001; AINSWORTH, 2000; AINSWORTH *et al*., 2011; FARINATTI, 2003). Thus, it appears that physical activity is an important predictor of mortality in COPD, a highly prevalent disease in Brazil. Thus, it is important to verify possible factors that may be leading to decreased physical activity in patients with this pathology, such as the iron reserve, which is usually insufficient in these patients, which makes it essential to verify the correlation between this deficiency and physical activity in COPD. A simple and inexpensive way to check physical activity is questionnaires. The long version of the IPAQ has been validated in Brazil and can be applied to these patients to quantify physical activity and correlate it with iron reserve in patients with COPD.

MATERIALS AND METHODS

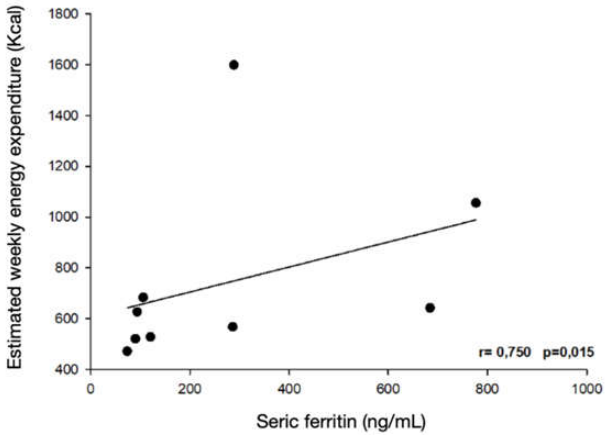
This is a prospective, convenience study, carried out at the pulmonology clinic of the University Hospital Maria Aparecida Pedrossian, which is specialized in COPD and is a state reference for this disease carried out from August 2019 to January of 2020. Patients diagnosed with COPD, defined as FEV1/FVC less than 70% of predicted, without significant change after the bronchodilator test, GOLD II, without asthma, had peripheral blood collected and laboratory analysis was performed, including complete blood count, iron dosage, ferritin and transferrin saturation. Patients with hemoglobin values greater than 12 g/dL had their laboratory tests tabulated and the short version of the IPAQ was applied to them. Then, the data of serum iron, ferritin and transferrin saturation were correlated with the values obtained in the questionnaire. The results were described as mean and standard deviation and the multiple variables correlated by Pearson product-moment correlation. A $p < 0.05$ was considered significant.

RESULTS AND DISCUSSION

Laboratory tests were collected from 9 patients, 4 women and 5 men, with a mean age of 62 years, with the values listed in Table 1. None of the patients with COPD evaluated had laboratory results outside the Hospital's normal standards. In the case of patients under long-term outpatient follow-up, alterations in the hemoglobin and ferric profile are promptly corrected until they reach the reference values of normality, however the correlation of these exams with the amount of physical activity is not carried out. After the result of blood collection, the short version IPAQ questionnaire was applied. The short quiz features 4 categories. The first (CAT 1) corresponds to vigorous activities, the second category (CAT 2) to moderate activities, the third (CAT 3) to walking and the fourth to the time the respondent remains seated during the week and at the weekend. In categories 1, 2 and 3, it is asked how many times in a usual week the respondent performs certain activities for at least 10 continuous minutes and how much time in total is spent performing these activities per day. In all categories, the physical activity was asked so that it would be possible to identify them in the compendium. In the case of walking, speed was classified as slow, moderate and fast and the slope of the terrain as flat, uphill or downhill. The questionnaire results were converted into MET using the AINSWORTH compendium and then converted into Kcal by multiplying MET x Weight (kg) x Activity time (min). Categories that did not contain any or none of the answers were considered as "0" (Table 2).

When walking speed was not identified, 4.8 km/h on flat ground was used as standard speed. The time spent sitting, the fourth category of the questionnaire, raised doubts for the interviewees, as they generally did not know how to report or estimate how long they remain seated in the week, thus this item was not used for subsequent analyses. Even so, it was found that these patients remain sitting or lying down for a long time, a fact that meets the incapacitation provided by the underlying disease of these patients. In general, the evaluated patients do not practice sports and the most common activity was house cleaning, which was classified as light or heavy. Examples of light cleaning are dusting, vacuuming, changing bedding, and taking out garbage. The heavy ones are related to vigorous effort like washing the car. Walking reported by patients was generally used as a means of locomotion. Thus, the evaluated patients only perform physical activities to perform daily activities, being generally sedentary.

The values of the results of laboratory tests were correlated with the amount of total weekly physical activity in Kcal, and only the correlation of ferritin with physical activity showed a moderate and statistically significant positive relationship ($r=0.750$ and $p=0.015$). (Graphic 1).



Graphic 1. Correlation between the amount of total weekly physical activity and serum ferritin

Through the relationship established between ferritin and the amount of physical activity, it can be seen that the greater the body stores of iron in the form of ferritin, the more physical activity these patients performed.

Table 1. Results of laboratory tests requested

PACIENS	HEMOGLOBIN (g/dL)	FERRITIN (ng/ml)	SERIC IRON (ug/dL)	SATURATION INDEX (%)
E. M. S.	18,2	73,51	112	34
A. C. B.	14,5	93,61	89	31
M. J. A.	15,1	89,87	86	25
D. O.	13.2	684,2	65	22
R. S.	14,8	776,5	84	36
I. B.	12,5	105,8	80	27
J. F. M.	15,1	286,2	86	39
J. R. C.	14,3	120,5	157	32
N. P.	15,5	288,4	70	23

Table 2. Converted IPAQ results (TPA: total physical activity, PA: physical activity, APA: amount of physical activity)

PACIENTS	WHEIGT (Kg)	TPA (min/week)	PA CAT 1 (Kcal/week)	PA CAT 2 (Kcal/week)	PA CAT 3 (Kcal/week)	APA TOTAL (CAT 1+CAT 2+CAT 3) (Kcal/week)
E. M. S.	78	110	0	0	471.9	471.9
A. C. B.	57	220	513	0	114	627
M. J. A.	57,5	140	0	191.66	189.75	521,41
D. O.	56	150	168	140	184.79	642,79
R. S.	60	240	660	0	396	1056
I. B.	57	480	0	684	0	684
J. F. M.	62	200	0	258.33	310	568,33
J. R. C.	40	270	280	116.66	132	528,66
N. P.	92	350	0	536.66	1062.6	1599,26

This relationship reaffirms the role of iron in baseline aerobic capacity and the reduction of muscle dysfunction and pulmonary hypertension present in patients with COPD.

CONCLUSION

Patients with COPD with higher levels of blood ferritin were able to perform more physical activity. This relationship was not possible to be performed with the other laboratory tests requested. The short version of the IPAQ questionnaire, as it is a small and quick-to-apply questionnaire, establishes itself as an important tool for the assessment of physical activity. This, associated with the dosage of ferritin, can help to verify the ability to perform physical activity. Furthermore, it was found that patients with COPD perform little physical activity and thus it is important that this is encouraged among them.

REFERENCES

BUIST, A. *et al*. 2005. The Burden of Obstructive Lung Disease Initiative (BOLD): Rationale and Design. COPD: *Journal of Chronic Obstructive Pulmonary Disease*, v. 2, n. 2, p. 277-283.

MENEZES, A.; VICTORA, C.; PEREZ-PADILLA, R. The Platino project: methodology of a multicenter prevalence survey of chronic obstructive pulmonary disease in major Latin American cities. *BMC Medical Research Methodology*, v. 4, n. 1, 2004.

GIOVINO, G. *et al*. Tobacco use in 3 billion individuals from 16 countries: an analysis of nationally representative cross-sectional household surveys. *The Lancet*, v. 380, n. 9842, p. 668-679, 2012.

MALTA, D. *et al*. Evolução de indicadores do tabagismo segundo inquéritos de telefone, 2006-2014. *Cadernos de Saúde Pública*, v. 33, n. suppl 3, 2017.

CORREA DA SILVA, L. C. Pneumologia: princípios e prática. Porto Alegre: Artmed, 2012.

BARBERAN-GARCIA, A. *et al*. Non-anaemic iron deficiency impairs response to pulmonary rehabilitation in COPD. *Respirology*, v. 20, n. 7, p. 1089-1095, 2015.

NICKOL, A. *et al*. A cross-sectional study of the prevalence and associations of iron deficiency in a cohort of patients with chronic obstructive pulmonary disease. *BMJ Open*, v. 5, n. 7, p. 1-9, 2015.

PLESNER, L. *et al*. Iron Deficiency in COPD Associates with Increased Pulmonary Artery Pressure Estimated by Echocardiography. *Heart, Lung and Circulation*, v. 26, n. 1, p. 101-104, 2017.

LEE, P. *et al*. Validity of the international physical activity questionnaire short form (IPAQ-SF): A systematic review. *International Journal of Behavioral Nutrition and Physical Activity*, v. 8, n. 1, p. 115, 2011.

BOON, R. *et al*. Validation of the New Zealand Physical Activity Questionnaire (NZPAQ-LF) and the International Physical Activity Questionnaire (IPAQ-LF) with accelerometry. *British Journal of Sports Medicine*, v. 44, n. 10, p. 741-746, 2008.

KNUTH, A. *et al*. Changes in physical activity among Brazilian adults over a 5-year period. *Journal of Epidemiology & Community Health*, v. 64, n. 7, p. 591-595, 2009.

World Health Organization. Global health risks: mortality and burden of disease attributable to selected major risks. Bull World Health Organ, 2009.

SOLER-CATALUÑA, J. *et al*. Creation of the SAQ-COPD Questionnaire to Determine Physical Activity in COPD Patients in Clinical Practice. *Archivos de Bronconeumología (English Edition)*, v. 54, n. 9, p. 467-475, 2018.

WATZ, H. *et al*. An official European Respiratory Society statement on physical activity in COPD. *European Respiratory Journal*, v. 44, n. 6, p. 1521-1537, 2014.

TROOSTERS, T. *et al*. Improving physical activity in COPD: towards a new paradigm. *Respiratory Research*, v. 14, n. 1, p. 115, 2013.

VAN HELVOORT, H. *et al*. Respiratory constraints during activities in daily life and the impact on health status in patients with early-stage COPD: a cross-sectional study. *npj Primary Care Respiratory Medicine*, v. 26, n. 1, 2016.

VAN REMOORTEL, H. *et al*. Daily physical activity in subjects with newly diagnosed COPD. *Thorax*, v. 68, n. 10, p. 962-963, 2013.

GARCIA-RIO, F. *et al*. Prognostic Value of the Objective Measurement of Daily Physical Activity in Patients With COPD. *Chest*, v. 142, n. 2, p. 338-346, 2012.

WASCHKI, B. *et al*. Physical Activity Is the Strongest Predictor of All-Cause Mortality in Patients With COPD. *Chest*, v. 140, n. 2, p. 331-342, 2011.

GARCIA-AYMERICH, J. *et al*. Regular physical activity reduces hospital admission and mortality in chronic obstructive pulmonary disease: a population based cohort study. *Thorax*, v. 61, n. 9, p. 772-778, 2006.

BENZO, R. Activity Monitoring in Chronic Obstructive Pulmonary Disease. Journal of Cardiopulmonary Rehabilitation and Prevention, v. 29, n. 6, p. 341-347, 2009.

PITTA, F. *et al*. 2006. Quantifying physical activity in daily life with questionnaires and motion sensors in COPD. *European Respiratory Journal*, v. 27, n. 5, p. 1040-1055.

SHEPHARD, R. 2003. Limits to the measurement of habitual physical activity by questionnaires. *British Journal of Sports Medicine*, v. 37, n. >3, p. 197-206.

JACOBS, D. *et al*. 1993. A simultaneous evaluation of 10 commonly used physical activity questionnaires. *Medicine & Science in Sports & Exercise*, v. 25, n. 1, p. 81-91.

WANNER, M. *et al*. 2016. Validation of the long international physical activity questionnaire: Influence of age and language region. *Preventive Medicine Reports*, v. 3, p. 250-256.

CRAIG, C. *et al*. 2003. International Physical Activity Questionnaire: 12-Country Reliability and Validity. *Medicine & Science in Sports & Exercise*, v. 35, n. 8, p. 1381-1395.

MATSUDO, S. *et al*. 2001. Questionario internacional de atividade fÍsica (IPAQ): estudo de validade e reprodutibilidade no brasil. *Revista Brasileira de Atividade Física e Saúde*, v. 6, n. 2, p. 5-18.

AINSWORTH B. E. *et al*. 2000. Compendium of physical activities: an update of activity codes and MET intensities. *Med Sci Sports Exer,* v.32, p.498-504.

AINSWORTH, B. *et al*. 2011. Compendium of Physical Activities. *Medicine & Science in Sports & Exercise*, v. 43, n. 8, p. 1575-1581, 2011.

FARINATTI, P. T. V. 2003. Apresentação de uma versão em português do compêndio de atividades físicas: uma contribuição aos pesquisadores e profissionais em fisiologia do exercício. *Revista Brasileira de Fisiologia do Exercício*, Rio de Janeiro, v. 2, n.2, p. 177-208.

MARTÍN-ONTIYUELO, C. at al. 2019. Is iron deficiency modulating physical activity in COPD?. *International Journal of Chronic Obstructive Pulmonary Disease*, v. 14, p. 211-214.

****