NICOTINE DEPENDENCY LEVEL AND PERIPHERAL MUSCLE STRENGTH IN SMOKERS

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A B S T R A C T

Introduction: Nicotine is primarily responsible for dependence on smokers and its effects on the nervous and cardiovascular systems are known. The impact on peripheral muscle strength is unclear. **Objective:** To determine whether there is a correlation between the levels of addiction to nicotine and peripheral muscle strength (PMS). **Method:** cross-sectional study, with a sample of smokers admitted in the program ""Deixando de Fumar sem Mistérios"" ("Quitting Smoking Easily, in the Brazilian Portuguese acronym)". After signing the consent form, demographic, tolerance and Fagerstrom, IPAQ - short version questionnaires were applied. The handgrip test was performed to measure the PMS. Spearman correlation test was performed for relationship assessment and the student t test for comparison was used. **Results:** a sample of 37 participants with an average age of 53.05 ±10.8 years, among which 26 were women. Regarding the level of addiction to nicotine, 18 (48.6%) subjects displayed high dependency, 17 (45.9%) low dependence, and two (5.4%) an average dependency. The median FTND score was five (3 to 6.5) and the smoking history was 23.4 (22.2 to 50.0). The PMS obtained predicted an average of 33.68±8.64 kgf, while median of 28.3 (22.9 to 38.0) kgf was obtained. There was no difference between the PMS predicted and found. **Conclusion:** there was an inverse correlation between the score of Fargestrom and the PMS assessed. However no correlation was found between smoking history and peripheral muscle strength (PMS) and the difference between the predicted and found PMS.

Key Words: Smoking, Abandonment of Tobacco Use, Muscle Strength and Musculoskeletal System.

ABSTRACT

Introduction: Nicotine is the main responsible for dependence. Studies indicate it has effects on the nervous and cardiovascular systems. It is believed that may interfere with peripheral muscle strength. **Objective:** To determine whether there is a correlation between the levels of addiction to nicotine and peripheral muscle strength. **Methodology:** Cross-sectional with admitted smokers in the program "Leaving Smoking without Mysteries." After signing the consent form, applied the demographic questionnaire, tolerance and Fagerstrom, IPAQ - short version. Handgrip was performed to measure the PMS. Spearman correlation test for relation and the Student t test for comparisons was used. **Results:** Sample of 37 participants with an average age of 53.05 ± 10.8 years, 26 are women. The level of addiction to nicotine, 18 (48.6%) subjects have high dependency, 17 (45.9%) low dependence, and two (5.4%) average dependency. The median FTND score was five (3 to 6.5) and the smoking history was 23.4 (22.2 to 50.0). Peripheral muscle strength obtained predicted average mean of 33.68 ± 8.64 kgf, while the median obtained was 28.3 (22.9 to 38.0) kgf. There was no difference between peripheral muscle strength predicted and found. **Conclusion:** There is a slight and inverse correlation between the score of Fargestrom and PMS assessed. However it was not found correlation was found between smoking history and peripheral muscle strength (PMS) and difference between the predicted and found PMS.

Key Words: Smoking Smoking, Abandonment of Tobacco Use, Muscle Strength and Musculoskeletal System.

INTRODUCTION

Smoking is considered by the World Health Organization (WHO) to be a chronic disease with a high prevalence of consumption[1]. It is estimated that in the year 2014, the smoking was responsible for more than six million deaths worldwide[2]. In Brazil, about 110 million cigarette units are smoked per year, which leads to more than two thousand deaths per year due to excessive consumption of cigarettes[3,4]. Due to this, the Brazilian Ministry of Health developed the program: "Quitting Smoking Easily." That program has the objective of assisting smoking cessation and reducing costs for the Unified Health System[4] (UHS, or SUS in the Brazilian Portuguese acronym).

The cigarette, has a low cost and it is easy to access[3]. On the cigarette around 4,700 substances are found, among those there is the nicotine, the main responsible for dependence[5]. Researches have shown that it does have systemic consequences, and may have an impact on muscle function. Reagrding the action of nicotine in the nervous system, on the motor plaque, it would realease Acetylcholine and bind with the receptors, starting a relaxation phase of the musculature, and thus increasing the probability of tissue injury[6]. In addition, nicotine reduces the capacity of proliferation of myofibroblasts, which are responsible for the regeneration of muscle tissues[7]. For these reasons, it is thought that these factors may influence on the peripheral muscle strength (PMF) of smokers.

Muscle strength is the capacity of the contracting muscle[8], being an important predictor of mortality over the years[9]. It has an impact on quality of life, functional capacity and daily living activities (ADLs)[10] due to physical restrictions brought about by the muscle weakness[11]. It is known that some diseases common to smokers12 such as chronic obstructive pulmonary disease (COPD) have an influence on PMS. However little is known about the behavior of PMS in smokers who are not diagnosed with chronic obstructive pulmonary disease.

The present study aimed to verify if there is a correlation between the levels of nicotine dependence and the peripheral muscle strength on smokers.

METHOD

This is an observational cross-sectional study in smokers from the "Quitting Smoking Easily" program by the Brazilian Ministry of Health, which takes place at the Clinica Avançada de Fisioterapia (CAFIS) of Escola Bahiana de Medicina e Saúde Publica (EBMSP) in Salvador - BA, from December 2015 to July 2016. The study was approved by the ethics and research committee with the following CAAE registration number: 246229815.7.0000.5029. Smokers at the time of admission to the program, of both sexes, aged eighteen years or more were included. Those who presented difficulties to understand the questionnaires, with diagnosis of COPD and (or) physical limitations to the test of peripheral muscle strength (handgrip) were excluded.

All the individuals signed the Informed Consent Term (ICT) and were sent to a room reserved for the application of the questionnaires. To measure the level of dependence to nicotine, the "Questionnaire of Tolerance of Fargestrom"(FTND) was employed, an instrument that scores the activities related to the smoking habit. After the sum of the points, a score was generated that allowed to classify the dependence in: low, moderate and elevated. The higher the score, the greater the level of nicotine dependency[13].

In order, to verify the level of physical activity, the "International Questionnaire of Physical Activity" - IPAQ Short Version was applied, which takes into account the time that the individual spends doing vigorous or moderate activities, and that he or she stays seated or lying during the day. This questionnaire allows for a classification in: sedentary, moderately active and active[14].

For the measurement of peripheral muscle strength, the handgrip (palmar grip strength) was used with the Camry brand digital model EH 101® dynamometer, according to the protocol of the American Society of Hand Therapists (ASHT), the member tested was dominant, with three contractions of 30 seconds and one-minute intervals between measurements. The value used for the subsequent analysis was the largest one found in the three replicates[15]. The reference values were established through the Novaes 2009 formula: FMP - D = 39,996 (0,382x)

+ (0,174xpeso) + (13,628xg) * and FMP - E = 44,968 - (0,42xity) + (0,110xpeso) + (9,274x gender *) Gender * (Men = 1, Women = 0)[16].

The sample size was estimated using the Stats ToDo calculator (https://www.statstodo.com/index.php), with the correlation command between nicotine dependence levels and peripheral muscle strength, the correlation coefficient adopted was of 0.4, for a moderate correlation, test power 80% with a significance level of 5%, estimating a population of 37 participants. The Statistical Package for Social Sciences (SPSS) version 14.0 for Windows was used for data analysis and analysis through descriptive and analytical statistics. The normality of the variables was verified through the descriptive statistical analysis and the Kolmogorov-Smirnov test, being the descriptive considered as sovereign, in cases of divergence.

The Spearman correlation coefficient was used to verify the correlation between the FTND score and the peripheral muscle strength, as well as the smoking load with the PMS. The paired Student's t test was used to compare the predicted peripheral muscle strength with that found.

RESULTS

Initial sample consisting of 39 participants, two were excluded, one due to understanding of the questionnaires applied and one by limitation in the application of the PMS test, totaling a sample of 37 Individuals. Of these 26 (70.3%) are female, with mean age of 53.05±10.8 years and BMI of 25.8±4.4 kg/m2 (table 1).

Table 1. Sociodemographic and anthropometric characteristics of participants in the "Quitting Smoking without Mysteries" program. Salvador. Bahia. N = 37

Variables	n	%
Sex		
Male	11	29.7
Female	26	70.3
Marital status		
Not Married	16	43.2
Divorced	13	35.1
Married	5	13.5
Widowed	3	8.1
Schooling		
Illiterate	1	2.7
1 degree	6	16.3
2 degree	17	51.3
higher level	11	29.7
Family income		
Up to 2 wanges	15	40.5
Between 2 and 4 salaries	12	32.4
Between 5 and 10 salaries	7	18.9
Between 11 and 20 salaries	1	2.7
Not declared	2	5.4
Variable	**Average**	**SD**
Age years)	53,05	10.8
BMI	25,8	4.4

BMI = Body Mass Index, SD = Standard Deviation

As to the self-report of diseases associated with smoking, 22 (59.5%) participants had them, being[14] with systemic arterial hipertension (SAH) (37.8%), followed by respiratory diseases in three of them (8.1%), Diabetes Mellitus in two (5.4%), and central vascular diseases in one (2.7%). According to the IPAQ 17 (46%) participants were considered active, ten (27%) moderately active and ten (27%) sedentary.

When analyzing the level of nicotine dependence, 18 (48.6%) individuals displayed high dependence, 17 (45.9%) low dependence, and two (5.4%) mean dependence. The mean score of the tolerance questionnaire for Fargestrom was five (3-6.5) and that of the smoking load was 23.4 (22.2-50.0), as

described in table 2.

Variables	Medium	Quartile
FTND score	5	3 – 6.5
Tobacco load	23.4	22.2 - 50

Variables	N	%
Associated Diseases		
Do not have	15	40.5
SAH	14	37.8
Respiratory diseases	3	8.1
Diabetes mellitus	2	5.4
Others	2	5.4
CVD	1	2.7
Physical Activity Level		
Sedentary	10	27.0
Moderately Active	10	27.0
Active	17	46.0
Dependency Level		
Low	17	45.9
Moderate	2	5.4
High	18	48.6

FTND = Fagerstrom Tolerance Questionnaire, SAH = Systemic Arterial Hypertension, CVD = Central Vascular Disease.

The predicted peripheral muscle strength obtained a mean of 33.68±8.64 Kgf, while that found 31.32±11.4. There was no statistical difference between the predicted and found peripheral muscle strength. As described in table 3.

FTND Score	FMP - Predita	FMP – Found	p
Low	35.7 ± 10.04	34.1 ± 11.9	0.642
Moderate	38.3 ± 9.73	29.1 ± 8.6	0.054
High	31.2 ± 6.6	28.8 ± 11.1	0.352
General	33.6 ± 8.6	31.32 ± 11.4	0.221

Paired Student's T test, PMS = Peripheral Muscle Strength

No correlation was found between smoking burden and peripheral muscle strength (p=0.21). However, a slight and inverse correlation (p=0.02 and r=-0.366) was observed between the peripheral muscle strength and the FTND score.

Spearman's correlation test p = 0.02 r = -0.366
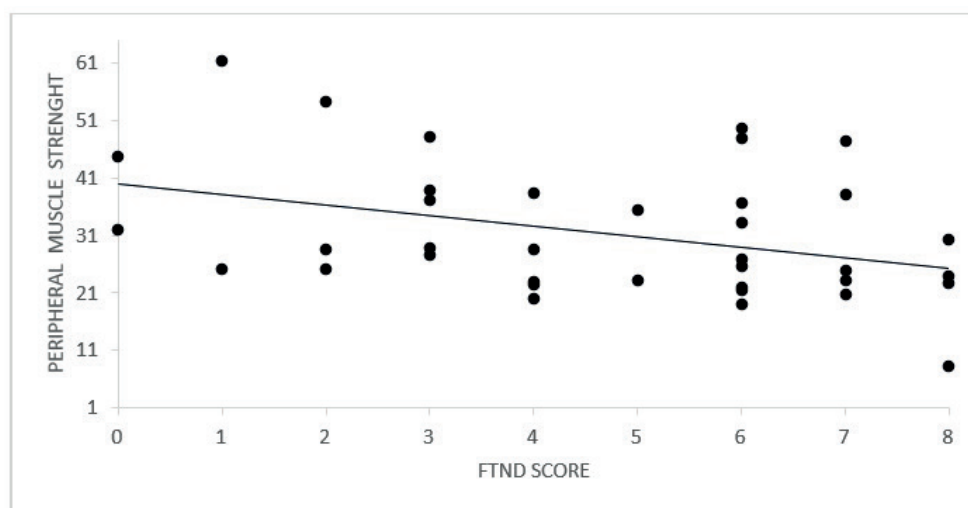
Graph 1. Correlation between the FTND score and the peripheral muscle strength found among participants in the "Quit Smoking Without Mysteries" program. Salvador. Bahia. N = 37.
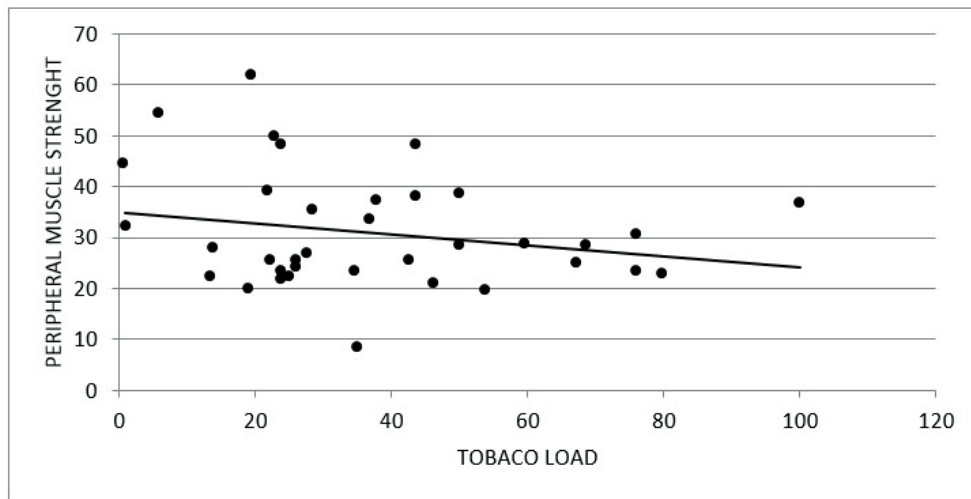
Spearman's correlation test. p = 0.21

Graph 2. Correlation between the smoking load and the peripheral muscle strength found among participants in the "Quitting Smoking Without Mysteries" program. Salvador. Bahia. N = 37.

DISCUSSION

Nicotine dependency is a complex process that involves the pharmacological, behavioral and psychological processes of the individual[13]. This is associated with the number of cigarettes smoked per day, smoking time, genetic predisposition and social environmental conditions[14]. In the studied sample, a mild and inverse correlation was found between levels of nicotine dependency and the peripheral muscle strength of smokers. However, despite this finding, the predicted PMS values were similar to those of the muscle strength found in the smokers evaluated.

In 2002 Tanamaki[17] evaluated the behavior of the soleus muscle fibers of rats exposed to cigarette smoke and observed that the exposure contributes to a decline in the oxidative capacity of endurance of type I fibers, due to the reduction of the oxygen supply offered to the muscle. In the present study, the maximum isometric force of the individual[18] was evaluated through the palmar grip test, which assesses type II fibers, with a characteristic of rapid contraction. The study of Dourado 2006[19] revealed that there are changes of type I fibers in the upper limbs muscles of people with COPD. Another study revealed that type II fibers of the upper limbs do not undergo major changes due to their use in most daily activities[18]. Those results are similar with ours,

especially when associated with the absence of a diagnosis of COPD.

Peripheral muscle strength is an important predictor of functional capacity and mortality over the years[18,19]. The study by Ichinose et al. in 2010, showed that there is a reduction in the production of nitric oxide and an increase in the synthesis of collagen in rats exposed to cigarette's smoke, those factors may contribute to muscle tendon injuries due to the increase of their elasticity[20]. For this reason, the PMS assessment in this population is quite necessary in order to guide health professionals on their clinical practices. Handgrip is a validated and reliable test for its measurement and can be easily used due to its low cost and easy applicability[18, 21].

The sample of this study was comprised mainly of women. According to the Gomes et al.[22] study in 2007, women seek health services more often due to historical and cultural reasons. The mean age was 53.05 years, it is at this age that women stop menstruating, and enter the menopause, a period marked by various physiological and psychological changes[23]. These alterations reduces their energetic metabolism at rest, increases the tendency for the development of cancer and the presence of Sarcopenia, with the subconsequent reduction of

PMS[23,24].

In relation to diseases associated with smoking, the following stand out: cancer, cardiovascular and respiratory diseases as the main causes of hospitalization[3]. In the present study we observed a predominance of arterial hypertension, probably this finding is due to the fact that the diseases were self-reported by the program participants, what may result in underdiagnosed diseases associated with smoking.

This study had as limitation to use only one test to evaluate muscle strength, besides not developing a control group with non-smokers to compare the dependent variables.

CONCLUSION

In the studied population there was a light and inverse correlation between the Fargestrom score and the peripheral muscle strength evaluated. However, the PMS found is similar to the predicted.

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