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Association of disease knowledge and management on sedentary time and physical inactivity in individuals with COPD

Associação do conhecimento e automanejo da doença no tempo sedentário e inatividade física em indivíduos com DPOC

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Abstract

Background: Chronic obstructive pulmonary disease (COPD) is characterized by persistent airway obstruction and systemic manifestations, leading to symptoms such as dyspnea and fatigue, which contribute to a typical behavior of physical inactivity and high sedentary time in daily life. However, it is still unclear whether disease knowledge has any correlation with this behavior. **Aim:** To identify whether the level of knowledge and disease self-management in individuals with COPD are correlated with higher levels of sedentary behavior, physical inactivity, or both. **Methods:** This is a cross-sectional study including individuals with COPD who underwent assessment of physical activity in daily life over seven consecutive days using an accelerometer. Additionally, pulmonary function was assessed by spirometry, and disease knowledge was evaluated using the Understanding COPD (UCOPD) and the Pulmonary Rehabilitation Adapted Index of Self-Efficacy (PRAISE) questionnaires. **Results:** 34 individuals with COPD were analyzed (17 men, 69±6 years, FEV_1 48±19% predict). Only weak or non-existing and not statistically significant correlations were observed between time spent/day in activities of moderate-to-vigorous intensity (MVPA) and the PRAISE and UCOPD questionnaires (r = 0.25 and 0.10, respectively, $p > 0.05$ for both), as well as between sedentary time and the same instruments (r = -0.05 and 0.25, respectively, $p>0.05$ for both). **Conclusion:** In individuals with COPD, the level of physical inactivity and sedentary behavior are not well correlated with the knowledge and self-management of the disease.

Keywords: Chronic Obstructive Pulmonary Disease; Sedentary Behaviour; Self-Management.

Resumo

Introdução: A doença pulmonar obstrutiva crônica (DPOC) é caracterizada por obstrução persistente das vias aéreas e manifestações sistêmicas, gerando sintomas como dispneia e fadiga, que contribuem para um comportamento de inatividade física e alto tempo sedentário na vida diária. Ainda não está claro, porém, se o conhecimento sobre a doença tem alguma correlação com esse comportamento. **Objetivo:** Identificar se o nível de conhecimento e o automanejo da doença em indivíduos com DPOC se correlacionam com piores níveis de sedentarismo, inatividade física ou ambos. **Métodos:** Trata-se de um estudo transversal que incluiu pacientes com DPOC submetidos à avaliação da atividade física na vida diária durante sete dias consecutivos por meio do uso de um acelerômetro. Adicionalmente, foi realizada a avaliação da função pulmonar por meio de espirometria e avaliação do conhecimento da doença por meio do uso dos questionários *Understanding COPD* (UCOPD) e *Pulmonary Rehabilitation Adapted Index of Self-Efficacy* (PRAISE). **Resultados:** 34 indivíduos com DPOC foram analisados (17 homens, 69±6 anos, VEF_1 48±19%pred). Observou-se correlação inexistente ou fraca e sem significância estatística entre o tempo gasto/dia em atividade física moderada a vigorosa (AFMV) com os questionários PRAISE e UCOPD (r= 0,25 e 0,10, respectivamente, $p>0,05$ para ambos), assim como também entre o tempo sedentário/dia com os mesmos instrumentos (r= -0,05 e 0,25, respectivamente, $p>0,05$ para ambos). **Conclusão:** Em indivíduos com DPOC, o nível de inatividade física e comportamento sedentário não se correlacionam de forma relevante com o conhecimento e o automanejo da doença.

Palavras-chave: Doença Pulmonar Obstrutiva Crônica; Comportamento Sedentário; Autogestão.

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INTRODUCTION

The regular practice of physical activity (PA) provides various health benefits, such as improvements in exercise capacity, muscle strength, and body composition, along with reduced blood pressure[1]. These benefits extend to the entire population, including individuals with chronic diseases[2]. On the other hand, the absence of PA increases the risk factors for several conditions, such as cardiovascular diseases, diabetes mellitus, cancer, hypertension, and dementia[1].

In individuals with chronic obstructive pulmonary disease (COPD), marked physical inactivity (i.e., insufficient time spent in moderate-to-vigorous physical activity [MVPA]) is directly related to a higher risk of exacerbations and mortality[3]. It is also known that individuals with COPD present high sedentary time (ST) that is, activities performed in a sitting, lying, or reclining position that result in low energy expenditure (<1.5 metabolic equivalents of task [METs])[4]. Frequently, a sedentary lifestyle is associated with limitations in performing activities of daily living (ADLs) due to symptoms such as fatigue and dyspnea, which contributes to the worsening of physical conditioning[3]. Furthermore, as in the case of physical inactivity, this sedentary behavior is also related to worse health outcomes and a higher mortality risk in these individuals[5].

Currently, one of the main focuses of interventions in individuals with COPD is the reduction of ST, currently promoted through more realistic and accessible goals for this population, such as replacing ST with an increase in light PA during daily tasks, which in a way still involves a relatively low energy expenditure (1.5-2.9 METs)[6,7]. Furthermore, understanding which psychosocial factors influence ST[8] allows for raising hypotheses about other potentially effective interventions to promote more intense PAs and reduce ST. For example, the general level of knowledge about COPD has demonstrated a positive relationship with behavioral change regarding self-care and clinical management[9], and, although it is not its only determinant[10], knowledge and self-management should be encouraged. This is important since behavioral change significantly improves the experience of patients with COPD regarding the practice of PA[11].

Taking these factors into consideration, the present study aims to identify whether the level of disease knowledge and self-management correlate with sedentary time or with the time spent/day in MVPA, or both. The aim is to identify which physical behavior the level of disease knowledge and management is best associated with, in order to guide professionals towards specific interventions that can more effectively bring benefits to this population. We hypothesize that greater knowledge and better disease self-management are associated with lower levels of physical inactivity and sedentary behavior, believing that individuals with better disease management have a greater understanding of the benefits of remaining more active and less sedentary.

METHODS

This cross-sectional study was conducted at the Pulmonary Physiotherapy Research Laboratory (LFIP) of the State University of Londrina. This is a sub-analysis involving only baseline data (i.e., initial or pre-intervention assessment) from a larger longitudinal project with individuals who subsequently underwent a pulmonary rehabilitation (PR) program. Data collection occurred from August 2022 to December 2024. The larger project was approved by the institution's Human Research Ethics Committee (approval number 5.459.958). An informed consent form, detailing the ethical and legal aspects of the research, was signed by all participants prior to the start of data collection.

Candidates were recruited from the Pulmonology and Respiratory Physiotherapy outpatient clinics of the Hospital das Clínicas and the University Hospital of the State University of Londrina (UEL). The inclusion criteria were the same as those of the larger project, namely: clinical diagnosis of chronic obstructive pulmonary disease (COPD), established according to the criteria of the Global Initiative for Chronic Obstructive Lung Disease (GOLD)[12]; clinical stability, with no infections or exacerbations in the last month; absence of severe and/or unstable heart disease; absence of severe osteoneuromuscular disorders that could influence the level of daily life physical activity (PADL); and not having participated in any regular physical exercise program in the last 3 months. The specific exclusion criteria for the present analysis were: failure to complete the proposed tests for any reason; occurrence of a severe acute exacerbation requiring hospitalization or any other severe condition during the assessment period; and lack of the minimum number of valid days for DLPA assessment (i.e., at least 4 days with a minimum wear time of 8 hours/day).

Lung function

After obtaining demographic and anthropometric data, the patients underwent spirometry using a plethysmograph (Vmax® Carefusion, Germany). The test was conducted according to the guidelines of the American Thoracic Society (ATS)/European Respiratory Society (ERS)[13,14], and the reference values by Pereira et al. for the Brazilian population were used[15].

Level of sedentary behavior and physical inactivity

The assessment was performed using the Actigraph® physical activity monitor (model wGT3X-BT, United States of America [USA]), with analysis through the ActiLife software (USA). It is a small, portable accelerometer widely used in physical inactivity and sedentary behavior research[16]. It provides as main variables the number of steps, energy expenditure, and the time spent per day in activities of different intensities: sedentary activities (<1.5 METs) and light (1.5-2.9 METs), moderate (3-5.9 METs),

vigorous (6-8.9 METs), and very vigorous (>9 METs) PA, in addition to the traditional combination of moderate-to-vigorous intensity activities (MVPA).

The monitor was worn on the waist for 7 consecutive days during all waking hours and was only to be removed momentarily during the day for water-based activities (e.g., showering). For the assessment to be considered valid, individuals had to wear the monitor for at least 4 valid assessment days, with a valid day consisting of a minimum body wear time of 480 minutes (i.e., 8 hours) per day[17,18].

Self-efficacy questionnaires

The Understanding COPD (UCOPD) questionnaire[19,20] was used to assess the patients' understanding of COPD. The instrument assesses self-efficacy, the use of self-management skills, and patient satisfaction regarding PR programs. The UCOPD consists of two sections: Section A has 18 items across three domains ("About COPD", "Management of COPD Symptoms", and "Access to Help and Support"); and Section B consists of five questions about patient satisfaction with the educational component of the rehabilitation program. The score obtained in the domains and the total score of Section A range from 0 to 100%, where a higher score indicates better understanding, self-efficacy, medication use, and satisfaction.

The Pulmonary Rehabilitation Adapted Index of Self-Efficacy (PRAISE) tool[21,22] was used to verify other aspects related to self-efficacy, within a broader context of the disease and in responses to PR. It is composed of 15 items with scores ranging from 1 to 4, and the final score can vary from 16 to 60, where a higher total score indicates better levels of self-efficacy.

Functional exercise capacity (Six-Minute Walk Test – 6MWT)

The 6MWT was performed according to the ATS/ERS standardization[23]. The individuals were instructed to walk and cover the greatest possible distance in 6 minutes in a flat 30-meter-long corridor. Two tests were performed with a minimum interval of 30 minutes, and the one with the longest distance achieved was used for the analysis. The reference values used were those specific to the Brazilian population, developed by Britto et al.[24].

Statistical analysis

Data tabulation and statistical analysis were conducted using Microsoft Excel (Microsoft, USA) and SPSS version 27.0 (IBM, USA), respectively. The Shapiro-Wilk test was used to assess the normality of the data distribution. Data that followed a normal distribution were presented as mean ± standard deviation, whereas those with a non-normal distribution were reported as median [interquartile range 25–75%]. Correlations were analyzed using either Pearson or Spearman coefficients based on the data distribution, with the strength of the correlations classified as follows: weak <0.29, moderate 0.30 < r < 0.69, and strong r > 0.70[25]. Previous sample size calculations were not required since the study used convenience sampling. A p-value <0.05 was adopted to indicate statistical significance.

RESULTS

The study sample consisted of 38 individuals diagnosed with COPD; however, 4 were excluded due to missing questionnaire data. Therefore, the final sample comprised 34 individuals with COPD (17 men, 69±6 years, FEV_1 48±19% pred). A more detailed description of the sample is provided in Table 1.

The PA monitor wear time was 810 minutes (13.5 hours) per day (Table 2). The time spent/day in MVPA (expressed in minutes) showed a weak correlation with the PRAISE and UCOPD questionnaires (r = 0.25 [p = 0.14] and 0.10 [p = 0.55], respectively) (Figure 1). Similarly, ST/day (also expressed in minutes) showed a weak correlation with the PRAISE and UCOPD questionnaires (r = -0.05 [p = 0.75] and 0.25 [p = 0.14], respectively) (Figure 2).

Table 1. Sample characterization.

Variables	n = 34
Sex, M/F	17/17
Age, years	69±6
BMI, kg/m²	26±5
FEV_1, % predicted	48±19
FEV_1/FVC	49±10
Smoking status	
Smoker, n (%)	9 (26%)
Former smoker, n (%)	21 (62%)
Never smoked, n (%)	3 (9%)
GOLD	
I/II/III/IV, n (%)	2 (6%)/ 14 (41%)/ 10 (29%)/ 8 (24%)
6MWT, % predicted	81±19
6MWT, meters	438±106
Retired, n (%)	30 (88%)
Living alone, n (%)	7 (21%)
PRAISE, score	53±7
UCOPD, score	73±16

Data presented as mean ± standard deviation. F: Female; M: Male; BMI: Body mass index; FEV_1: Forced expiratory volume in the first second; FVC: Forced vital capacity; GOLD: Global Initiative for Obstructive Lung Disease; 6MWT: 6-minute walk test; PRAISE: Pulmonary Rehabilitation Adapted Index of Self-Efficacy; UCOPD: Understanding *COPD*.

Source: Created by the authors with research data.

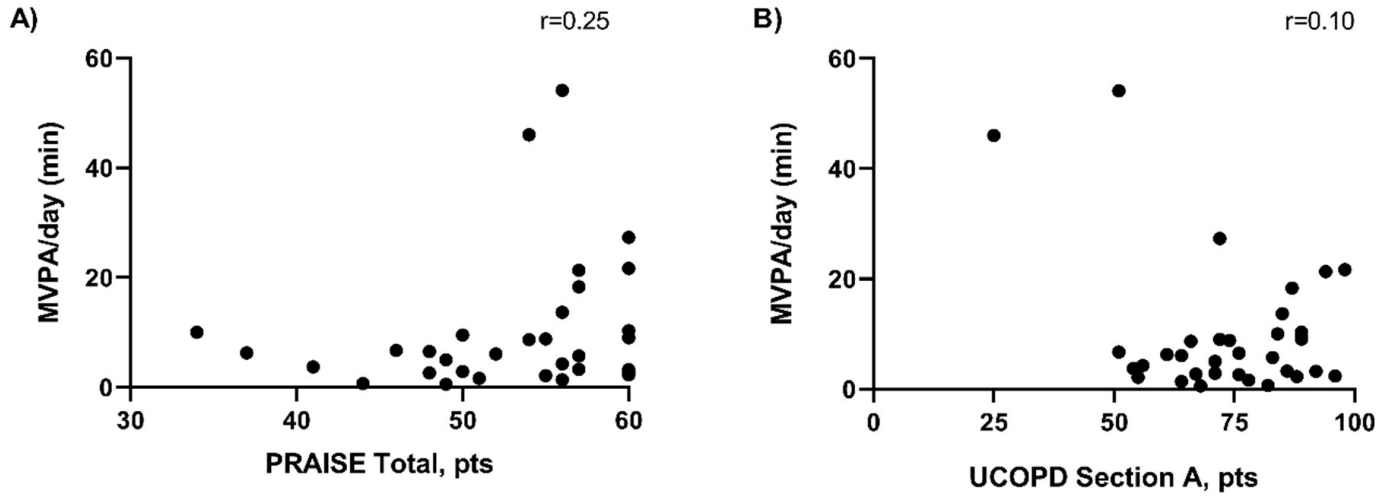

Figure 1. Correlation between time spent per day in MVPA (in minutes) and the Pulmonary Rehabilitation Adapted Index of Self-Efficacy (PRAISE) **(Panel A)** and Understanding COPD (UCOPD) **(Panel B)** questionnaires.
Source: Elaborated by the authors based on research data.

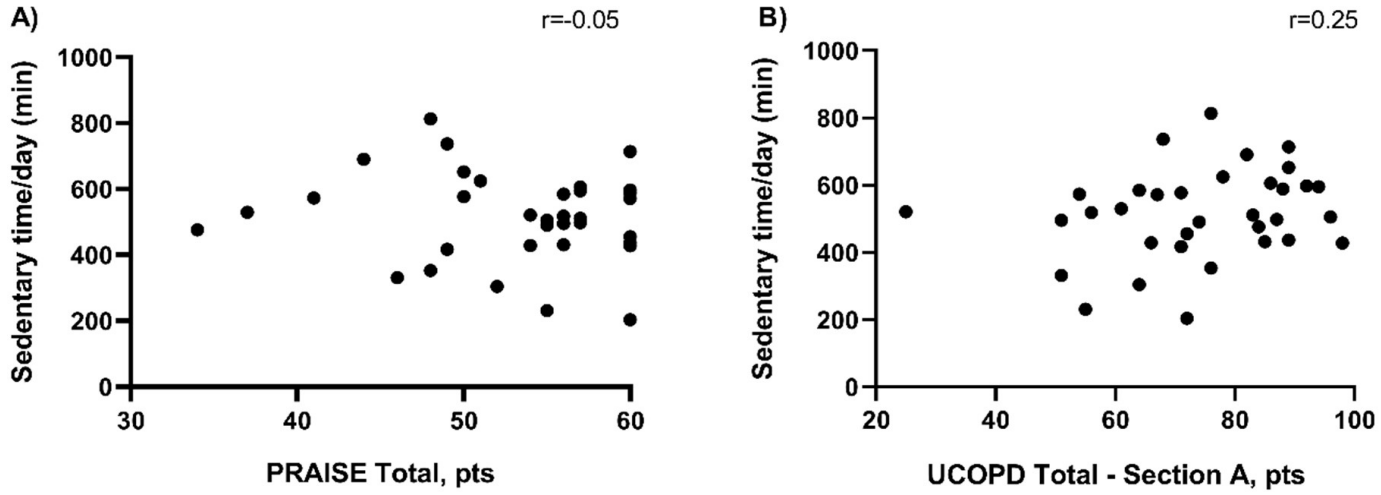

Figure 2. Correlation between sedentary time per day (in minutes) and the Pulmonary Rehabilitation Adapted Index of Self-Efficacy (PRAISE) **(Panel A)** and Understanding COPD (UCOPD) **(Panel B)** questionnaires.
Source: Elaborated by the authors based on research data.

Table 2. Characteristics of physical activity assessment in daily life.

Variables	n = 34
Wear time, min/day	810±96
Steps count, steps/day	4832 (2499-6822)
Time/day spent in sedentary activities, min/day	514±135
Time/day spent in sedentary activities, % of the day	64±12
Time/day spent in MVPA, min/day	9±12
Time/day spent in MVPA, % of the day	1±1

Data presented as mean ± standard deviation or median (IQR). MVPA: Moderate-to-vigorous physical activity.
Source: Elaborated by the authors based on research data.

In the PRAISE questionnaire, the time spent/day in MVPA showed weak or moderate correlations with sections 1 (awareness and knowledge about the disease), 4 (social support), 11 (self-confidence in disease management), and 13 (action planning) (r= 0.25 [p=0.14]; 0.37 [p=0.03]; 0.34 [p=0.05], and 0.30 [p=0.09]). Also, no significant correlations were found between the time spent/day in MVPA and the sections of the UCOPD questionnaire.

Regarding ST/day, a moderate correlation was observed with section 1 of the UCOPD, which addresses knowledge about COPD (r = 0.42, p = 0.01), as well as with the total score of the section (r = 0.34, p = 0.04). In the dimension related to symptom management, there was a weak correlation with section 11, regarding symptom self-management (r = 0.23, p = 0.20). In the PRAISE questionnaire, question 1 (level of knowledge about the disease) showed a weak and negative correlation with ST/day (r = -0.28, p = 0.11).

DISCUSSION

The present study demonstrated weak correlations between ST/day and time spent/day in MVPA with the scores of the PRAISE and UCOPD questionnaires. Although weak correlations were observed, and in some specific items the correlations were moderate, overall, the p-values indicate low statistical significance. These results do not evidence a close relationship between the level of disease knowledge and self-management with physical inactivity and sedentary behavior in individuals with COPD. Although engagement in PA is essential for the clinical management of COPD, the present findings do not demonstrate, in this sample, that the PADL outcomes of interest are strongly related to the understanding or self-management capacity reported by patients regarding their disease.

Previous literature demonstrates that reduced exercise capacity, lung function, and dyspnea are some of the main factors that hinder the performance of PA in individuals with COPD[26]. Failure to perform MVPA at the recommended levels, i.e., equivalent to 150 minutes per week[27], is associated with an increased risk of developing concomitant diseases, such as cardiovascular diseases, diabetes mellitus, cancer, hypertension, and dementia[1]. Specifically in individuals with COPD, physical inactivity is directly related to an increased frequency of exacerbations and a higher mortality rate, reinforcing the importance of promoting regular PA as an essential component of disease management[3], regardless of the patient's level of knowledge.

Self-management in individuals with chronic diseases aims to facilitate individual confidence, favoring an increased capacity to make behavioral changes to cope with the impact of the disease across all aspects of health[28]. However, the need for health education to be individualized and tailored to each person's needs must be highlighted. This approach favors the adoption of new behaviors through the development of personalized action plans, problem-solving strategies, and decision-making support[29].

Although no statistically significant correlations were observed, the PRAISE questionnaire correlated, albeit weakly, with time spent in MVPA in the sections related to disease awareness, social support, self-confidence in disease management, and action planning. These findings, even if not statistically significant, suggest a possible association between psychosocial factors and physical behavior in individuals with COPD[30]. Self-confidence in disease management, for example, has previously been identified as an important predictor of adherence to PA[31] in these patients, while social support, particularly from family or partners, is widely recognized as a facilitator for engagement in active behaviors[32]. Action planning can be interpreted as the intention and practice of exercise; in individuals with COPD, previous studies have demonstrated that the incorporation of individualized action plans, combined with monitoring and the setting of daily goals, results in increased PA practice[33]. Reinforcing this idea, the study by Liacos et al.[34] demonstrated that higher scores on the PRAISE questionnaire, meaning greater self-efficacy, can be used as a predictor for the reduction of sedentary behavior in individuals with COPD following PR. Despite this, the authors highlighted the low responsiveness of the instrument, as it was not possible to identify reliable values for the minimal important difference, which limits its application as a marker of relevant changes.

The present study also showed a modest correlation between ST/day and knowledge about COPD (UCOPD questionnaire – section 1), as well as with symptom self-management (section 11). In contrast, Wshah et al.[10] identified that a lack of knowledge, low self-confidence, and limited use of self-management strategies are determinants of sedentary behavior in individuals with COPD. Although studies have already demonstrated that an increase in self-efficacy in individuals with COPD can favor the practice of PA in sedentary individuals with COPD[35,36], the results of the present study suggest, in agreement with Hartman et al.[37], that even when there is an understanding of the benefits of physical activity, psychosocial factors can act as a barrier.

Cameron-Tucker et al.[38] observed that a health education program, when combined with PR, resulted in a self-reported increase of approximately one hour in moderate-intensity physical activity compared to the control group. These findings reinforce that, although health education can contribute to the promotion of PA, increased knowledge alone is not sufficient to induce sustainable behavioral changes. Even when inserted into a structured educational plan[39], education alone does not guarantee an increase in the practice of PA nor a reduction in ST[40]. Some studies have demonstrated that the combination of education, realistic goal setting, and monitoring with feedback are promising for encouraging the reduction of sedentary behavior[32], reinforcing once again that behavioral change occurs when there is involvement of social support, motivational counseling, and individualized strategies[41]. However, even with the use of multiple strategies, unfortunately, few interventions have yet demonstrated significant reductions in ST[42], a behavior that is difficult to intervene upon.

Strategies to promote PA in individuals with COPD must go beyond the provision of information. In this context, it becomes fundamental to engage individuals through realistic and achievable goals, such as setting a target number of steps per day[7]. The identification of individual barriers must also be considered whether they are physical, emotional, social, or environmental, that may interfere with the adoption of a healthier lifestyle, with the aim of facilitating the transition to a more active lifestyle.

One of the limitations of the present study is the use of two assessment instruments for the level of knowledge that may not have been sensitive enough to identify subtle nuances in knowledge associated with complex physical behaviors such as physical inactivity and sedentary behavior. The lack of a cognitive assessment among the study outcomes prevents us from knowing the extent to which this cognitive level may have affected the individuals' responses regarding their level of knowledge about the disease. Furthermore, due to the profile of individuals typically referred to and enrolled in PR programs, individuals with mild disease were not proportionally well represented in the present sample, which may not reflect the entire COPD population and is primarily restricted to the profile of individuals with moderate to severe disease

CONCLUSION

The present findings indicate that in individuals with COPD, both the time spent in moderate-to-vigorous physical activity and sedentary time present modest or non-existent correlations with the level of disease knowledge and self-management, as assessed by the PRAISE and UCOPD questionnaires.

Therefore, the results do not evidence clinically relevant associations of physical inactivity or sedentary behavior levels with the knowledge or self-management capacity of COPD. This finding reinforces the need for complementary approaches, such as more targeted educational strategies, to promote greater awareness and engagement in self-care, regardless of the level of daily life physical activity.

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Nothing to declare.

CONFLICTS OF INTERESTS

Nothing to declare.

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DATA AVAILABILITY STATEMENT

The research data are available upon reasonable request.

ARTIFICIAL INTELLIGENCE USE STATEMENT

Not applicable.

AUTHOR'S CONTRIBUTIONS

Heloisa Krokoch: Drafting – original draft, Conceptualization, Methodology, and Investigation. Thais Moçatto Tofoli: Conceptualization, Methodology, Supervision, Writing – Review. Laís Santin: Investigation, Writing – Review. Franciele Del Nobile: Investigation. Amanda Pucca: Investigation. Gustavo Pakuszewski: Research, Writing – Editing. Fabio Pitta: Conceptualization, Methodology, Writing – Review and Editing, Project Administration.

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