



Monaldi Archives for Chest Disease

eISSN 2532-5264

<https://www.monaldi-archives.org/>

Publisher's Disclaimer. E-publishing ahead of print is increasingly important for the rapid dissemination of science. The **Early Access** service lets users access peer-reviewed articles well before print / regular issue publication, significantly reducing the time it takes for critical findings to reach the research community.

These articles are searchable and citable by their DOI (Digital Object Identifier).

The **Monaldi Archives for Chest Disease** is, therefore, e-publishing PDF files of an early version of manuscripts that have undergone a regular peer review and have been accepted for publication, but have not been through the typesetting, pagination and proofreading processes, which may lead to differences between this version and the final one.

The final version of the manuscript will then appear in a regular issue of the journal.

E-publishing of this PDF file has been approved by the authors.

All legal disclaimers applicable to the journal apply to this production process as well.

Monaldi Arch Chest Dis 2026 [Online ahead of print]

To cite this Article:

Juriani A, Agarwal B, Murkudkar P, Kadam S. **Association of kinesiophobia with physical function, mental health and health-related quality of life in patients with obstructive airway disease: a cross-sectional study.** *Monaldi Arch Chest Dis* doi: 10.4081/monaldi.2026.3677

Submitted: 7-08-2025

Accepted: 2-03-2026

 ©The Author(s), 2026
Licensee PAGEPress, Italy

Note: The publisher is not responsible for the content or functionality of any supporting information supplied by the authors. Any queries should be directed to the corresponding author for the article.

All claims expressed in this article are solely those of the authors and do not necessarily represent those of their affiliated organizations, or those of the publisher, the editors and the reviewers. Any product that may be evaluated in this article or claim that may be made by its manufacturer is not guaranteed or endorsed by the publisher.

Association of kinesiophobia with physical function, mental health and health-related quality of life in patients with obstructive airway disease: a cross-sectional study

Ashriya Juriani, Bela Agarwal, Payal Murkudkar, Siddhika Kadam

Cardiovascular and Respiratory Physiotherapy Department, MGM School of Physiotherapy,
Navi Mumbai, Maharashtra, India

Correspondence: Bela Agarwal, Cardiovascular and Respiratory Physiotherapy Department, MGM School of Physiotherapy, Kamothe, Panvel, Navi Mumbai, Maharashtra 410206, India. E-mail: bagarwal@mgsopnm.edu.in

Contributions: Ashriya Juriani: investigation, data curation, formal analysis, methodology; writing – original draft; writing -review and editing, visualization; project administration. Bela Agarwal: conceptualization, methodology, formal analysis, supervision, validation, visualization, writing – review and editing. Payal Murkudkar: formal analysis, visualization, supervision, writing – review and editing. Siddhika Kadam: writing – review and editing.

Conflict of interest: the authors declare that they have no conflict of interest.

Ethics approval and consent to participate: the study protocol was approved by the Institutional Ethics Committee of MGM Institute of Health Sciences (IEC-MGMDCH reference no IN/SOP/96/02/2024). The committee reviewed the project and found it ethically acceptable. Written informed consent to participate was obtained from all study participants prior to enrolment.

Informed consent: written informed consent was obtained from all participants for inclusion in the study. The manuscript does not contain any identifiable personal data or images of individual participants.

Patient consent for publication: not applicable.

Availability of data and materials: the datasets generated and/or analyzed during the current study are available from the corresponding author upon reasonable request.

Acknowledgments: the authors sincerely thank all participants for their involvement in the study. They also acknowledge the support of hospital staff and clinical coordinators. Special thanks to their friends and colleagues for their constant encouragement, valuable discussions, and moral support throughout the research process.

Abstract

The study aimed to evaluate the relationship of kinesiophobia with functional capacity, psychological distress, pulmonary function, and quality of life in individuals with obstructive airway disease and to determine the variables that independently predict kinesiophobia. A total of 111 clinically stable patients with obstructive airway disease were assessed using the Tampa Scale for Kinesiophobia (TSK), Numerical Rating Scale (NRS), Modified Medical Research Council Dyspnea Scale (mMRC), Fatigue Severity Scale (FSS), 6-Minute Walk Test (6MWT), International Physical Activity Questionnaire (IPAQ), arm curl test, 30-second sit-to-stand and flexibility tests, pulmonary function test, Depression Anxiety Stress Scale-21 (DASS-21), WHO Quality of Life-BREF (WHOQOL-BREF), and WHO Disability Assessment Schedule 2.0 (WHODAS 2.0). Clinically significant kinesiophobia (TSK>37) was observed in 64.8% of participants. TSK scores showed significant positive correlations with NRS ($r=0.431$), FSS ($r=0.554$), DASS-21 ($r=0.456$), WHODAS 2.0 ($r=0.434$), mMRC ($r=0.309$), and flexibility (back scratch test ($r=0.281$); and significant negative correlations with arm curl ($r=-0.427$), sit-to-stand ($r=-0.433$), 6MWT ($r=-0.421$), IPAQ ($r=-0.421$), and WHOQOL-BREF ($r=-0.538$), all with $p<0.005$. In multiple regression, lower forced vital capacity ($\beta=-0.360$, $p<0.001$), lower WHOQOL-BREF scores ($\beta=-0.302$, $p<0.001$), higher fatigue severity ($\beta=0.230$, $p=0.007$), and lower 6MWT percentage of predicted distance ($\beta=-0.165$, $p=0.023$) independently predicted higher kinesiophobia. The model explained 60.3% of the variance ($R^2=0.603$). These findings highlight the high prevalence and multi-dimensional impact of kinesiophobia in obstructive airway disease, emphasizing the importance of addressing fear of movement to improve physical activity, functional capacity, and quality of life in pulmonary rehabilitation settings.

Key words: obstructive airway disease, kinesiophobia, pulmonary rehabilitation, physical function, mental health, health-related quality of life.

Introduction

Obstructive airway disease is one of the most prevalent non-communicable diseases globally of which the most prevalent condition remains Chronic Obstructive Pulmonary Disease (COPD). According to the World Health Organization, COPD was the third leading cause of death in 2019, accounting for approximately 3.23 million deaths worldwide [1]. A systematic review and meta-analysis estimated that 391.9 million individuals aged 30–79 were living with COPD in 2019, with 80.5% of cases in low- and middle-income countries [2]. A meta-analysis conducted in 2021 reported a COPD prevalence of 7.4% among Indian adults [3].

The Global Initiative for Chronic Obstructive Lung Disease (GOLD) 2025 defines COPD as “a heterogeneous lung condition characterized by chronic respiratory symptoms (dyspnea, cough, expectoration, exacerbations) due to abnormalities of the airways (bronchitis, bronchiolitis) and/or alveoli (emphysema) that cause persistent, often progressive, airflow obstruction” [4]. These symptoms, along with ongoing pharmacological and behavioural management, often impair daily functioning and reduce quality of life, contributing to decreased activity levels, sleep disturbances, and heightened anxiety and depression [5]. Although COPD accounts for the majority of chronic obstructive presentations, obstructive airway diseases encompass a spectrum of clinical, physiological, and functional variability in routine practice, reflecting differences in symptom burden, airflow limitation, and disease trajectory.

One of the strongest predictors of poor outcomes in obstructive airway disease is physical inactivity, which is closely linked to increased rates of exacerbations, hospital admissions, and all-cause mortality [6]. A recent scoping review highlighted a broad spectrum of barriers to physical activity in this population, including symptom burden, psychological factors, and environmental influences [7].

Among the psychological barriers, kinesiophobia which is an excessive and irrational fear of movement, remains largely underrecognized in clinical settings. Recurrent episodes of exertional dyspnea may lead individuals with obstructive airway disease to avoid physical activity altogether, reinforcing sedentary behaviour [8]. Although this avoidance may initially feel protective, it ultimately contributes to a downward spiral of deconditioning, diminished cardiorespiratory capacity, worsening symptoms, and progressive functional decline [9].

This study was designed to investigate the associations and predictors of kinesiophobia in patients with obstructive airway disease focusing on its relationship with physical function, mental health and health related quality of life. It was hypothesized a priori that higher levels of kinesiophobia would be significantly associated with poorer physical performance, greater psychological distress and reduced quality of life in individuals with obstructive airway

disease. The findings intend to support the integration of kinesiophobia assessment and management into pulmonary rehabilitation, optimizing rehabilitation effectiveness, fostering greater patient engagement, and reducing morbidity associated with physical inactivity in obstructive airway disease.

Materials and Methods

The study was approved by the Institutional Ethics Committee and registered with the Clinical Trials Registry of India (CTRI/2025/02/081180). Informed consent was obtained from eligible participants, and ethical standards as per the Declaration of Helsinki were followed. Using G*Power (v3.1.9.4) with an effect size of 0.3, 95% power, and 5% significance, the required sample size was 111 [10,11].

Patient recruitment process

Participants were purposively recruited from outpatient clinics, inpatient wards, and medical camps of a tertiary care hospital between May 2024 and February 2025. Adults aged 30–75 years with a physician-confirmed diagnosis of obstructive airway disease were included. The diagnosis had been established by the treating pulmonologist based on clinical evaluation and spirometry assessment prior to recruitment. Participants who were able to understand instructions and perform study assessments were enrolled. Patients with other chronic respiratory diseases such as interstitial lung diseases or restrictive thoracic disorders were excluded. Additional exclusion criteria included age >75 years, history of unstable angina or myocardial infarction within the past month, had a resting heart rate >120 bpm, systolic blood pressure >180 mm Hg, or diastolic blood pressure >100 mm Hg. Participants were also excluded if they reported musculoskeletal pain >5/10 on the Numerical Rating Scale, grade 3–4 osteoarthritis, unhealed fractures, neurological or psychological disorders, and impaired cognition or significant hearing loss without aids. These criteria ensured participant safety during physical testing (e.g., 6MWT) and the validity of self-reported questionnaire data (Figure 1).

Kinesiophobia assessment

Kinesiophobia was assessed using the Tampa Scale for Kinesiophobia, a 17-item questionnaire developed by Kori and culturally adapted by Hu Wen (2012). Items are rated on a 4-point Likert scale (score range 17–68), with scores ≥ 37 indicating clinically significant kinesiophobia. The scale demonstrates good reliability ($\alpha = 0.778$; test–retest = 0.960) [12].

Physical function assessment

Pain Severity

Pain intensity was assessed using the 11-point Numeric Rating Scale (NRS) where participants rate their pain on a scale from 0 to 10, where 0 indicates no pain and 10 represents the worst pain imaginable. It is quick to administer, easy to understand, and has demonstrated strong reliability and validity in populations with chronic respiratory diseases [13].

Dyspnea

Dyspnea was assessed using the Modified Medical Research Council Dyspnea Scale, a simple and validated 0–4 grading system. The scale quantifies the severity of breathlessness based on functional limitations in daily activities. Higher scores indicate greater dyspnea [14].

Fatigue

Fatigue was measured using the Fatigue Severity Scale, a 9-item self-report tool scored on a 7-point Likert scale (range 9–63), with higher scores indicating greater fatigue. Fatigue levels were classified as mild/no fatigue (≤ 35), moderate (36–52), and severe (≥ 53), categories aligned with HRQoL indices. The FSS has demonstrated good validity and reliability in obstructive airway disease and is a meaningful measure of fatigue severity in this population [15,16].

Functional performance tests

- **Arm Curl Test:** Participants sat holding a dumbbell (2 kg for females, 4 kg for males) and performed as many arm curls as possible in 30 seconds. Total repetitions were recorded [17].
- **30-Second Sit-to-Stand Test:** Participants stood up and sat down repeatedly for 30 seconds, and the number of correct repetitions was counted [17,18].

Studies support the arm curl and sit-to-stand tests as valid functional performance measures in adults with obstructive airway disease. Both tests are simple, reliable, and feasible in clinical settings, making them valuable tools for assessing functional performance [17].

Flexibility

Flexibility was evaluated as part of the Senior Functional Fitness Test (SFT) battery, a validated set of functional performance measures for older adults and clinical populations [19].

- Upper Body Flexibility was measured using the Back Scratch Test, recording the distance between fingertips when reaching one hand over the shoulder and the other up from behind the back. Each side was tested twice, with the best score recorded [19].
- Lower Body Flexibility was assessed with the Sit and Reach Test (ACSM guidelines). Participants sat with legs extended and reached forward along the measuring scale, holding the farthest position. The best of two attempts was recorded in centimetres [19].

Functional capacity

The 6-Minute Walk Test (6MWT) was conducted following ATS guidelines. Participants walked as far as possible on a flat corridor for six minutes, with standardized encouragement at set intervals. Distance covered in meters was recorded. It is a valid indicator of functional capacity in obstructive airway disease [20].

Physical activity

Physical activity levels were measured using the International Physical Activity Questionnaire-Short Form (IPAQ-SF), a self-administered questionnaire assessing walking, moderate, and vigorous activity over the past week, reported as MET-minutes/week. The findings support that the IPAQ-sf has acceptable reliability and validity in this population, making it useful tool to measure physical activity levels in patients for both clinical and research settings [21].

Pulmonary function

Pulmonary function was assessed using a Cosmed Pony FX spirometer, following American Thoracic Society/European Respiratory Society (ATS/ERS) standardization of spirometry guidelines. Spirometry was performed as part of routine clinical assessment while participants continued their prescribed maintenance therapy. Bronchodilator withholding was not undertaken due to ethical and practical considerations in stable patients. Therefore, the spirometry values obtained represent treatment modified lung function rather than standardised pre- or post-bronchodilator diagnostic measurements. Participants were seated comfortably and instructed to wear a nose clip and perform maximal inhalation followed by a forceful and complete exhalation into the mouthpiece. Each maneuver was repeated at least three times to ensure reproducibility, and the best values for Forced Expiratory Volume in one second (FEV₁), Forced Vital Capacity (FVC), and FEV₁/FVC ratio were recorded. Pulmonary

function parameters were expressed as absolute values and percentages to evaluate severity of the condition.

Psychological health

Mental Health: depression, anxiety, and stress were assessed using the Depression Anxiety Stress Scale-21 (DASS-21). Each item is scored 0–3, and subscale scores (depression, anxiety, stress) are multiplied by 2. It has demonstrated good validity and responsiveness in obstructive airway disease populations, making it suitable for screening and monitoring psychological symptoms in this study [22].

Health-related quality of life and disability

Quality of Life

Quality of life was measured using the WHO Quality of Life-BREF, a 26-item questionnaire covering physical, psychological, social, and environmental well-being. This instrument shows good reliability and construct validity in individuals with obstructive airway disease. Higher scores reflect better quality of life [23].

Disability

Disability was assessed using the World Health Organization Disability Assessment Schedule 2, a comprehensive tool evaluating six domains of functioning, including mobility, self-care, life activities, and participation. It has demonstrated strong reliability and validity in obstructive airway disease populations, effectively capturing functional limitations and participation restrictions. Higher scores indicate greater disability [24].

Statistical analysis

Data analysis was conducted using the Statistical Package for the Social Sciences (SPSS) version 24. Descriptive statistics were presented as medians and interquartile ranges (IQRs) for continuous variables that were not normally distributed, and as frequencies and percentages for categorical variables. Normality was assessed with the Kolmogorov–Smirnov test; non-normal data were analyzed using non-parametric methods. Spearman’s correlation evaluated associations between kinesiophobia (TSK) and physical, psychological, and quality-of-life measures. Stepwise linear regression identified predictors of kinesiophobia. Significance was set at $p < 0.05$; the dataset was complete, and no missing values were observed.

Results

Demographic and clinical characteristics

The study included 111 patients with obstructive airway disease (48 males, 63 females), of whom 72 demonstrated clinically significant kinesiophobia (Tampa score >37). Females had higher kinesiophobia than males (median TSK: 41 vs. 37; $p = 0.047$). Overall, 44 participants (39.6%) had fixed airflow obstruction ($FEV_1/FVC < 0.70$), while 67 (60.4%) had preserved or borderline ratios ($FEV_1/FVC \geq 0.70$). The latter group likely includes patients with borderline obstruction, asthma–COPD overlap, or predominantly reversible airway obstruction under ongoing bronchodilator and/or anti-inflammatory therapy. Because only single, on-treatment spirometry values were available, formal bronchodilator reversibility could not be assessed, and patients were not classified as ‘reversible’ or ‘irreversible’. (Demographic and clinical characteristics are summarized in Table 1.)

Comparison of patients with and without kinesiophobia

Of 111 participants, 72 had clinically significant kinesiophobia. These patients showed lower physical function, with higher fatigue (FSS), reduced Arm Curl performance, and fewer 30-second Sit-to-Stand repetitions. Flexibility tests (Back-Scratch, Sit-and-Reach) trended lower but were not statistically significant. Physical activity (IPAQ) and mental health (DASS-21) were poorer, while WHOQOL-BREF scores indicated lower quality of life. Lung function (FVC, FEV_1 , PEF) was significantly reduced, linking kinesiophobia to reduced respiratory capacity. Overall, kinesiophobia was associated with multidimensional impairment in physical function, activity, mental health, quality of life, and lung function. (Comparison characteristics summarized in Table 2.)

Association between kinesiophobia and functional outcomes in patients with obstructive airway disease

Spearman’s correlation analysis demonstrated significant associations between kinesiophobia and various domains of health in individuals with obstructive airway disease. For physical function, higher TSK scores were moderately positively correlated with pain (NRS: $r = 0.431$, $p < 0.001$), fatigue (FSS: $r = 0.554$, $p < 0.001$) and weak positive correlation with dyspnea (mMRC: $r = 0.309$, $p = 0.001$). Moderate negative correlations were observed with functional muscle performance measures such as arm curl tests (left: $r = -0.427$, right: $r = -0.436$), 30-second sit-to-stand test ($r = -0.433$; *Supplementary Figure 1*) and weak negative correlation with flexibility measures including sit-and-reach ($r = -0.199$, $p = 0.036$). Kinesiophobia also

showed a moderate negative correlation with physical activity level (IPAQ: $r = -0.421$, $p < 0.001$; *Supplementary Figure 2*) and 6-minute walk distance ($r = -0.431$, $p < 0.001$).

In the mental health domain, kinesiophobia was moderately and positively correlated with depression, anxiety, and stress levels measured by DASS-21 ($r = 0.456$, $p < 0.001$), indicating a moderate association with psychological distress.

Regarding lung function, TSK scores were moderately and negatively correlated with FEV₁ ($r = -0.517$, $p = 0.000$; *Supplementary Figure 3*), FVC ($r = -0.510$, $p = 0.000$), and PEF ($r = -0.488$, $p < 0.000$), suggesting that reduced pulmonary function is associated with increased fear of movement.

For health-related quality of life, a moderate negative correlation was found between kinesiophobia and WHOQOL-BREF scores ($r = -0.538$, $p < 0.001$), while a moderate positive correlation was noted with WHODAS 2.0 disability scores ($r = 0.434$, $p < 0.001$), indicating that greater kinesiophobia is associated with poorer quality of life and increased disability. (All correlations are provided in Table 3, and representative scatter plots for key variables including 6MWT, FVC, DASS-21, and WHOQOL-BREF are presented in Figures 2-5).

Comparison between patient groups

Patients stratified by airway obstruction severity (FEV₁/FVC < 0.70 vs ≥ 0.70) showed no significant differences in kinesiophobia, physical performance, fatigue, mental health, activity levels, or quality of life (all $p > 0.05$), indicating comparable outcomes across these domains. Correlation patterns between kinesiophobia and functional outcomes were also similar in both groups, suggesting consistent multidimensional associations regardless of obstruction severity. (Detailed characteristics are provided in *Supplementary Table 1*, confirming consistent associations across both patient groups.)

Predictors of kinesiophobia

Multiple linear regression analysis identified key predictors of kinesiophobia in patients with obstructive airway disease. Lower quality of life (WHOQOL-BREF; $\beta = -0.302$, $p < 0.001$), reduced forced vital capacity (FVC; $\beta = -0.360$, $p < 0.001$), higher fatigue severity (FSS; $\beta = 0.230$, $p = 0.007$), and lower percentage of predicted 6-minute walk test distance (6MWT%; $\beta = -0.165$, $p = 0.023$) were independently associated with higher TSK scores. For every 1-unit increase in FVC, TSK scores decreased by 5.56 points, a 1-point increase in FSS led to a 0.20-point increase in TSK. Similarly, a 1% improvement in 6MWT% of predicted distance reduced TSK by 0.11 points, and a 1-point increase in WHOQOL reduced it by 0.17 points. The final model explained 60.3 % of the variance in TSK scores ($R^2=0.603$, Adjusted

R²=0.589), with no significant multicollinearity or deviations from linearity observed. All GOLD stages (1-4) were included in the analysis, although the number of severe patients was limited due to exclusion criteria. (Detailed characteristics of predictors are given in *Supplementary Table 2*).

Discussion

Kinesiophobia, as defined by Kori et al., refers to an excessive and irrational fear of physical movement and activity due to the belief that such actions may lead to pain, injury, or exacerbation of symptoms [25]. In patients with obstructive airway disease, kinesiophobia is often characterized by a fear of dyspnea, discomfort, or symptom exacerbation during physical activity, which leads to avoidance behaviours that exacerbate functional decline and reduce quality of life [26]. The fear-avoidance model (FAM) provides a theoretical framework to explain this process, wherein individuals who experience distress due to dyspnea or physical discomfort develop avoidance behaviours to protect themselves from perceived harm [27]. Over time, this avoidance of physical activity leads to physical deconditioning, muscle weakness, and a heightened symptom burden, which reinforces the initial fear and perpetuates a vicious cycle of inactivity and disability [28]. Gender differences were observed, with females exhibiting higher TSK scores. Previous evidence suggests that women may experience greater symptom burden, heightened anxiety, and stronger behavioural sensitisation to breathlessness and pain, which together contribute to higher kinesiophobia levels [12]. These findings highlight the need for clinicians to pay closer attention to fear-of-movement concerns in female patients and consider tailored support strategies.

A moderate correlation was observed between kinesiophobia and lung function, consistent with the regression results identifying lower FVC as an independent predictor, indicating that physiological impairment such as respiratory muscle weakness, reduced ventilatory capacity, systemic inflammation, and oxidative stress heightens the effort required during activity and reinforces avoidance behaviors. Some patients in our study had treatment modified spirometry values, including FEV₁/FVC ratios above the diagnostic threshold, reflecting effects of ongoing bronchodilator therapy and hyperinflation [29]. Despite this, lower FVC remained independently associated with kinesiophobia, highlighting that even in clinically stable, treated patients, residual ventilatory limitations contribute meaningfully to fear of movement. Previous studies have often reported stronger associations between kinesiophobia and functional capacity or psychological factors, but our findings underscore that lung function itself is a meaningful contributor to movement fear [30]. It is consistent with findings from Göktuğ Er and Angln (2017), who reported a significant association between kinesiophobia

and reduced pulmonary function, respiratory muscle strength, and functional capacity in patients with ankylosing spondylitis, indicating that respiratory impairment may contribute to movement-related fear even in non- obstructive airway disease populations [31].

The findings of this study highlight the intricate relationship between chronic pain and kinesiophobia in patients with obstructive airway disease. Consistent with previous research by Tanaka et al., chronic pain emerges as a central factor contributing to elevated fear of movement in this population. Pain not only causes physical discomfort but also amplifies psychological distress, including anxiety and depression, which further exacerbate fear-avoidance behaviors [32].

Another critical finding in this study was the association between higher kinesiophobia and reduced functional capacity, reflected by lower 6MWT performance. The median 6MWD in our sample (330 m for males and 288.6 m for females) indicates moderate functional limitation, and a lower percentage of predicted 6MWT distance emerged as an independent predictor of higher TSK scores. As noted in the ECLIPSE cohort study by Spruit et al., multiple factors including psychological components influence poor performance on the 6MWT, highlighting the importance of addressing fear of movement alongside physical impairments to optimize rehabilitation outcomes [33]. Furthermore, the overall level of physical activity was low in our participants (280–330 MET min/week), as assessed using the IPAQ. These results align with a meta-analysis demonstrating a moderate to strong negative correlation between kinesiophobia and physical activity levels, showing that higher kinesiophobia scores were consistently associated with reduced physical activity across various populations [34]. The findings further support the concept that kinesiophobia contributes to physical inactivity, which leads to progressive deconditioning and worsening symptom burden in patients with obstructive airway disease.

Perceived fatigue, measured by the Fatigue Severity Scale (FSS), emerged as an independent predictor of kinesiophobia. In our sample, most participants reported mild (55.1%), moderate (24.3%), or severe (19.6%) fatigue [16]. Consistent with prior evidence, higher FSS scores were associated with greater kinesiophobia, suggesting that fear of movement may reduce activity, promote deconditioning, and heighten exertional perception [35]. These findings highlight the importance of incorporating strategies such as energy conservation, graded pacing, and cognitive-behavioural approaches into pulmonary rehabilitation.

Kinesiophobia was also associated with psychological distress, including higher depression, anxiety, and stress. The fear-avoidance model explains that perceived threat drives avoidance, worsening disability and reinforcing emotional distress [25]. As dyspnea and fatigue intensify,

activity is limited, leading to muscle deconditioning, reduced exercise tolerance, and heightened symptom perception, further exacerbating psychological distress [9].

Obstructive airway disease imposes a multifaceted burden on patients, leading to significant declines in HRQoL [29]. In the present study, lower HRQoL, as measured by WHOQOL-BREF, too emerged as a significant predictor of higher kinesiophobia, indicating that poorer perceived well-being is associated with greater fear of movement. The interaction between physical inactivity, psychological distress, and avoidance behaviour perpetuates a cycle of functional decline, emotional vulnerability, and social isolation, ultimately deteriorating the quality of life in patients with obstructive airway disease [29].

Taken together, these findings show that kinesiophobia in patients with obstructive airway disease and its phenotypes results from a complex interplay of physiological impairment, symptoms, emotional distress, and functional limitation. Recognizing it as both a consequence and driver of inactivity highlights the need for rehabilitation programs combining physical training, symptom management, psychological support, and patient education. By addressing barriers to activity, clinicians can help patients engage confidently, break the cycle of deconditioning, and improve functional capacity and quality of life.

Limitations

This single-centre study may have limited generalizability. Exclusion of patients with severe obstruction, age >75, or on oxygen led to few GOLD stage 4 patients, introducing potential selection bias. Some spirometry values reflected ongoing bronchodilator therapy rather than baseline obstruction. Studying multiple variables increased type 1 error risk, and self-reported measures (IPAQ, DASS-21, WHOQOL-BREF, WHODAS) may have recall bias. Despite these limitations, the findings offer clinically meaningful insights into the multidimensional nature of kinesiophobia and provide a foundation for future multicentre and longitudinal studies.

Conclusions

This study demonstrates that kinesiophobia is closely associated with reduced functional capacity, greater psychological distress, and poorer health-related quality of life in individuals with obstructive airway disease. Lower quality of life, reduced forced vital capacity, higher fatigue severity, and lower percentage of predicted 6-minute walk distance emerged as significant predictors of higher kinesiophobia scores. Identifying these predictors helps clinicians recognize patients susceptible to fear-avoidance behaviors. Addressing kinesiophobia through multidimensional, patient-centered interventions like physical training, psychological counselling, and health education is crucial. Routine assessment and early

intervention can help patients overcome fear, improve activity, and achieve better long-term outcomes.

References

1. World Health Organization. Chronic obstructive pulmonary disease (COPD). Available from: [https://www.who.int/news-room/fact-sheets/detail/chronic-obstructive-pulmonary-disease-\(copd\)](https://www.who.int/news-room/fact-sheets/detail/chronic-obstructive-pulmonary-disease-(copd))
2. Adeloye D, Song P, Zhu Y, et al. Global, regional, and national prevalence of, and risk factors for, chronic obstructive pulmonary disease (COPD) in 2019: a systematic review and modelling analysis. *Lancet Respir Med* 2022;10:447-58.
3. Daniel RA, Aggarwal P, Kalaivani M, Gupta SK. Prevalence of chronic obstructive pulmonary disease in India: a systematic review and meta-analysis. *Lung India* 2021;38:506-13.
4. American Thoracic Society. GOLD 2023 Report. <https://site.thoracic.org/about-us/news/2023-gold-report-proposes-a-new-definition-of-chronic-obstructive-pulmonary-disease>
5. Garrido PC, de Miguel Diez J, Gutierrez JR, et al. Negative impact of chronic obstructive pulmonary disease on the health-related quality of life of patients. *Health Qual Life Outcomes* 2006;4:31.
6. Garcia-Aymerich J, Farrero E, Felez MA, et al. Risk factors for hospitalization for COPD exacerbation: a prospective study. *Thorax* 2003;58:117-21.
7. Xiang X, Huang L, Fang Y, et al. Physical activity and chronic obstructive pulmonary disease: a scoping review. *BMC Pulm Med* 2022;22:301.
8. Wlazło M, Szlacheta P, Grajek M, et al. The impact of kinesiophobia on physical activity and quality of life in patients with chronic diseases: a systematic literature review. *Appl Sci* 2025;15:2086.
9. Yohannes AM, Kaplan A, Hanania NA. Anxiety and depression in chronic obstructive pulmonary disease: recognition and management. *Cleve Clin J Med* 2018;85:S11-8.
10. Gignac GE, Szodorai ET. Effect size guidelines for individual differences researchers. *Pers Individ Dif* 2016;102:74-8.
11. Ozden F, Ozkeskin M, Tumturk I, et al. The investigation of kinesiophobia, pain catastrophizing, physical activity, anxiety, and depression in patients with or without myocardial infarction. *J Basic Clin Health Sci* 2023;7:684-92.
12. Liang F, Liu M, Han H, et al. Identifying patterns of kinesiophobia trajectories among COPD patients: a longitudinal study. *Nursing Open* 2023;10:3925-35.

13. van Dam van Isselt EF, Groenewegen-Sipkema KH, van Eijk M, et al. Pain in patients with chronic obstructive pulmonary disease indicated for post-acute pulmonary rehabilitation. *Chron Respir Dis* 2018;16:1479972318809456.
14. Mahler DA, Ward J, Waterman LA, et al. Patient-reported dyspnea in COPD: reliability and association with stage of disease. *Chest* 2009;136:1473-9.
15. Inal-Ince D, Savci S, Saglam M, et al. Fatigue and multidimensional disease severity in chronic obstructive pulmonary disease. *Multidiscip Respir Med* 2010;5:162-7.
16. Goodwin E, Hawton A, Green C. Using the Fatigue Severity Scale to inform healthcare decision-making in multiple sclerosis: mapping to three quality-adjusted life-year measures (EQ-5D-3L, SF-6D, MSIS-8D). *Health Qual Life Outcomes* 2019;17:136.
17. Benton MJ, Alexander JL. Validation of functional fitness tests as surrogates for strength measurement in frail, older adults with chronic obstructive pulmonary disease. *Am J Phys Med Rehabil* 2009;88:579-83.
18. Zanini A, Aiello M, Cherubino F, et al. The one repetition maximum test and the sit-to-stand test in the assessment of a specific pulmonary rehabilitation program on peripheral muscle strength in COPD patients. *Int J Chron Obstruct Pulmon Dis* 2015;10:2423-30.
19. Rutkowski S, Rutkowska A, Kiper P, et al. Virtual reality rehabilitation in patients with chronic obstructive pulmonary disease: a randomized controlled trial. *Int J Chron Obstruct Pulmon Dis* 2020;15:117-24.
20. Zeng GS, Chen LC, Fan HZ, et al. The relationship between steps of 6MWT and COPD severity: a cross-sectional study. *Int J Chron Obstruct Pulmon Dis* 2018;14:141-8.
21. Flora S, Marques A, Hipólito N, et al. Test-retest reliability, agreement and construct validity of the International Physical Activity Questionnaire short-form (IPAQ-sf) in people with COPD. *Respir Med* 2023;206:107087.
22. Yohannes AM, Dryden S, Hanania NA. Validity and responsiveness of the Depression Anxiety Stress Scales-21 (DASS-21) in COPD. *Chest* 2019;155:1166-77.
23. Liang WM, Chen JJ, Chang CH, et al. An empirical comparison of the WHOQOL-BREF and the SGRQ among patients with COPD. *Qual Life Res* 2008;17:793-800.
24. Zacarías LC, Câmara KJDC, Alves BM, et al. Validation of the World Health Organization Disability Assessment Schedule (WHODAS 2.0) for individuals with COPD. *Disabil Rehabil* 2022;44:5663-8.
25. Kori SH, Miller RP, Todd DD. Kinesiophobia: a new view of chronic pain behavior. *Pain Manag* 1990;3:35-43.

26. de Araújo CLP, Karloh M, Machado FVC, Mayer AF. Kinesiophobia and its association with functional status in patients with COPD. *J Cardiopulm Rehabil Prev* 2019;39:E1-6.
27. Vlaeyen JW, Linton SJ. Fear-avoidance and its consequences in chronic musculoskeletal pain: a state-of-the-art. *Pain* 2000;85:317-32.
28. Hartman JE, Boezen HM, De Greef MH, et al. Consequences of physical inactivity in chronic obstructive pulmonary disease. *Expert Rev Respir Med* 2010;4:735-45.
29. Wei-Chun H, Chih-Yu C, Liao WC, et al. Differences in pulmonary function improvement after once-daily LABA/LAMA fixed-dose combinations in patients with COPD. *J Clin Med* 2022;11:7165.
30. Kahraman BO, Ozsoy I, Tanriverdi A, et al. The relationship between kinesiophobia, dyspnea level, functional exercise capacity and quality of life in patients with chronic obstructive pulmonary disease. *ERS International Congress 2020 abstracts*.
31. Er G, AngIn E. Determining the relationship of kinesiophobia with respiratory functions and functional capacity in ankylosing spondylitis. *Medicine* 2017;96:e7486.
32. Tanaka T, Okita M, Kozu R. The relationship between kinesiophobia due to chronic pain and physical functioning in patients with COPD. *ERS International Congress 2020 abstracts*.
33. Spruit MA, Watkins ML, Edwards LD, et al. Determinants of poor 6-min walking distance in patients with COPD: the ECLIPSE cohort. *Respir Med* 2010;104:849-57.
34. Goubran M, Farajzadeh A, Lahart IM, et al. Kinesiophobia and physical activity: a systematic review and meta-analysis. *MedRxiv* 2023;2023-08.
35. Vardar-Yagli N, Calik-Kutukcu E, Saglam M, et al. The relationship between fear of movement, pain and fatigue severity, dyspnea level and comorbidities in patients with chronic obstructive pulmonary disease. *Disabil Rehabil* 2019;41:2159-63.

Online supplementary material

Supplementary Table 1. Correlation of Tampa Scale for Kinesiophobia with functional outcomes across lower versus higher forced expiratory volume in one second/ forced vital capacity (FEV₁/FVC) groups.

Supplementary Table 2. Predictors of kinesiophobia in patients with obstructive airway disease.

Supplementary Figure 1. Correlation between kinesiophobia and 30-second sit-to-stand repetitions.

Supplementary Figure 2. Correlation between kinesiophobia and International Physical Activity Questionnaire (IPAQ) scores.

Supplementary Figure 3. Correlation between kinesiophobia and forced expiratory volume in 1 second (FEV₁).

Table 1. Demographic and clinical characteristics of patients

| Variable | N/ Median (IQR) |
|---|-------------------|
| Age | 65 (60-70) |
| Gender | |
| Male | 48 |
| Female | 63 |
| BMI (kg/m ²) | 23.5 (21-26) |
| Tobacco exposure | |
| Never smoked/No tobacco exposure | 28 |
| Former smoker | 42 |
| Current smoker | 31 |
| Oral tobacco | 10 |
| Co-morbidities | |
| None | 30 |
| Hypertension | 64 |
| Diabetes Mellitus | 45 |
| Hypothyroidism | 03 |
| GOLD stage | |
| Stage 1 (FEV1 >80%) | 22 |
| Stage 2 (FEV1 =50-79%) | 54 |
| Stage 3 (FEV1=30-49%) | 31 |
| Stage 4 (FEV1 <30%) | 04 |
| Lung function parameters at time of assessment | |
| FEV ₁ (L) | 1.26 (0.94-1.71) |
| FEV ₁ (% predicted) | 63.0 (43.0-77.0) |
| FVC (L) | 1.78 (1.53-2.25) |
| FVC (% predicted) | 67.0 (53.0-81.0) |
| FEV ₁ /FVC | 0.74 (0.615-0.85) |
| FEV ₁ /FVC (% predicted) | 96.0 (79.0-105.0) |
| Spirometry category | |
| Fixed airflow obstruction | 44 (39.6%) |
| Preserved ratio / borderline | 67 (60.4%) |

Spirometry patterns at the time of assessment reflect current lung function under routine maintenance therapy and may include preserved or borderline FEV₁/FVC ratios due to treatment effects or overlap phenotypes.

Table 2. Variables with median and Interquartile range in patients

| Variable | Kinesiophobia Median (IQR) | No kinesiophobia Median (IQR) | p-value |
|---|-------------------------------|----------------------------------|---------|
| Tampa Scale of Kinesiophobia | 37.0 (30.2-43.0) | 41.0(36.0-47.0) | |
| Physical function | | | |
| Numerical Rating Scale | 1.0 (1.0-2.0) | 0.0 (0.0-1.0) | 0.000* |
| Modified Medical Research Council | 2.0 (1.0-2.0) | 1.0 (1.0-2.0) | 0.121 |
| Fatigue Severity Scale (FSS) | 38.0 (33.5-46.0) | 28.0 (24.0-35.0) | 0.000* |
| Arm Curl Test (Left) | 9.0 (7.0-12.0) | 12.0 (10.0-15.0) | 0.000* |
| Arm Curl Test (Right) | 10.0 (8.0-12.0) | 12.0 (11.5-15.0) | 0.000* |
| 30-sec Sit to Stand Test (seconds) | 8.0 (6.0-9.5) | 10.0 (8.0-12.0) | 0.000* |
| Back Scratch Test (inches) | 2.0 (1.2-2.9) | 2.0 (1.1-2.2) | 0.080 |
| Sit and Reach Distance (cm) | 20.1 (19.0-22.0) | 21.2 (19.4-22.0) | 0.163 |
| 6-Minute Walk Distance (meters) | 270.0 (240.0-330.0) | 360.0 (316.5-395.0) | 0.000* |
| International Physical Activity Questionnaire (IPAQ) (MET/min/week) | 99.0 (66.0-198.0) | 264.0 (132.0-371.3) | 0.000* |
| Mental health | | | |
| DASS-21 Total | 10.0 (7.0-13.5) | 7.0 (4.0-11.5) | 0.001* |
| Health related quality of life | | | |
| WHODAS 2.0 (Disability Score) | 43.5 (38.5-48.0) | 47.0 (42.0-53.0) | 0.059 |
| WHOQOL-BREF (Score) | 62.0 (55.0-68.5) | 80.0 (67.5-88.0) | 0.000* |
| Lung function | | | |
| Forced Vital Capacity FVC(L) | 1.67 (1.35-1.96) | 2.22 (1.87-2.42) | 0.000* |
| Forced Expiratory Volume in one second FEV1(L) | 1.08 (0.88-1.36) | 1.70 (1.53-2.00) | 0.000* |
| Peak Expiratory Flow PEF(L) | 1.19 (0.86-1.73) | 2.23 (1.88-2.71) | 0.000* |

p<0.05 was considered statistically significant.

Table 3. Correlation coefficients of Tampa Scale with functional outcomes in obstructive airway disease patients.

| Domain | Functional Outcome | Spearman's Correlation Coefficient | p |
|--------------------------------|---|------------------------------------|--------|
| Physical function | Numerical Rating Scale | 0.431 | 0.000* |
| | Modified Research Council Scale (Grade) | 0.309 | 0.001* |
| | Arm Curl Test (Left) | -0.427 | 0.000* |
| | Arm Curl Test (Right) | -0.436 | 0.000* |
| | 30sec Sit to Stand Test | -0.433 | 0.000* |
| | Back Scratch Test | 0.281 | 0.003* |
| | Sit and Reach Test | -0.199 | 0.036* |
| | Fatigue Severity Score | 0.554 | 0.000* |
| | IPAQ Score (MET/min/week) | -0.421 | 0.000* |
| Mental health | 6 Min Walk Distance | -0.431 | 0.000* |
| | Depression, Anxiety, and Stress-21 | 0.456 | 0.000* |
| Lung function | FEV ₁ (Forced Expiratory Volume in 1 second) | -0.517 | 0.000* |
| | FVC (Forced Vital Capacity) | -0.51 | 0.000* |
| | PEF (Peak Expiratory Flow) | -0.488 | 0.000* |
| Health related quality of life | WHOQOL BREF | -0.538 | 0.000* |
| | WHODAS 2.0 | 0.434 | 0.000* |

p<0.05 was considered statistically significant. *indicates a statistically significant difference between groups.

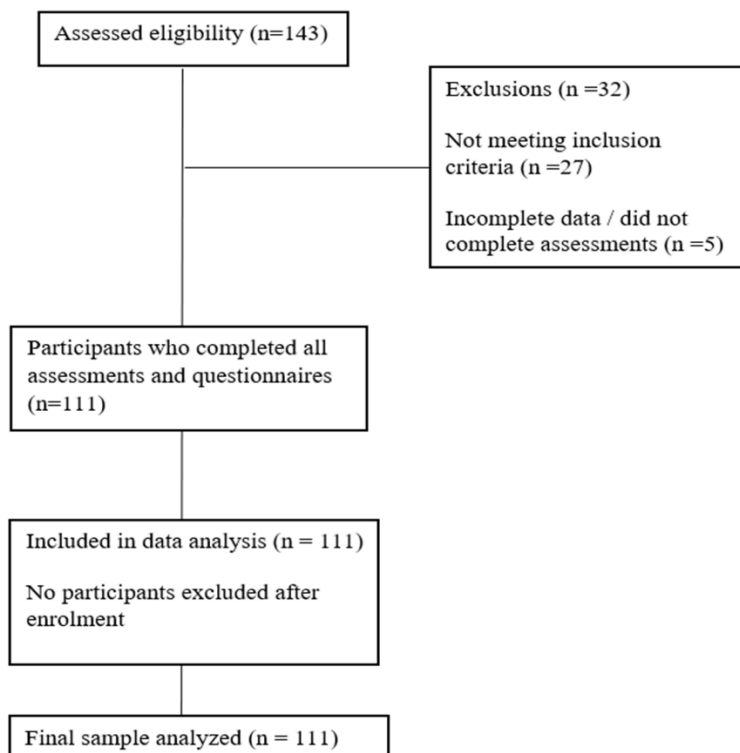


Figure 1. Patient recruitment flow diagram.

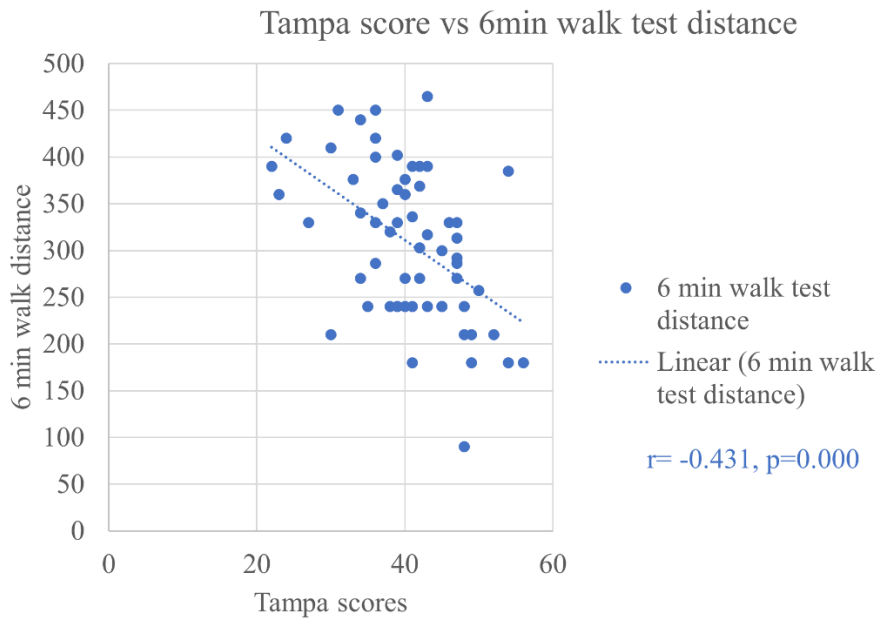


Figure 2. Correlation between kinesiophobia and 6minute walk test distance.

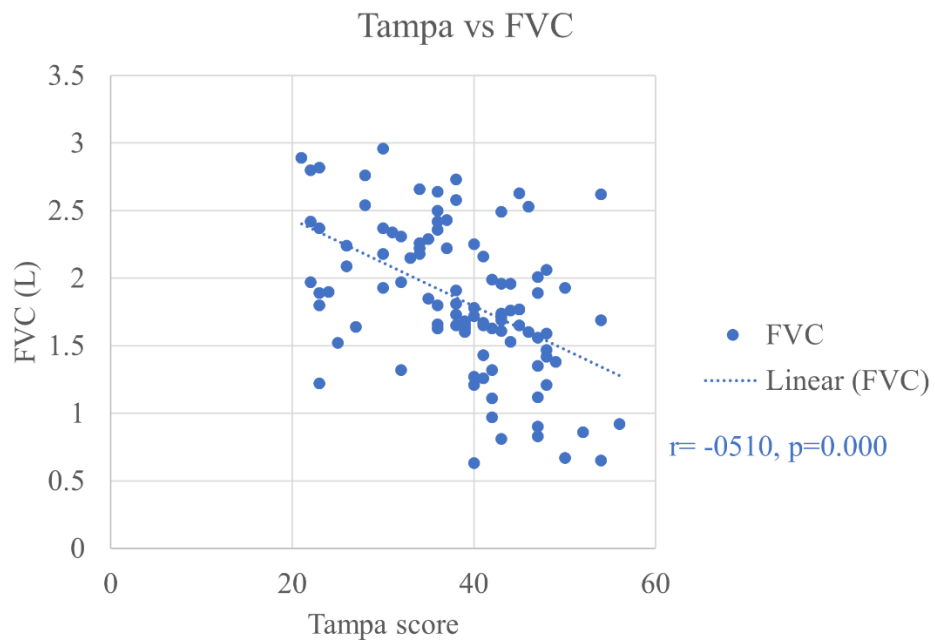


Figure 3. Correlation between kinesiophobia and Forced Vital Capacity (FVC).

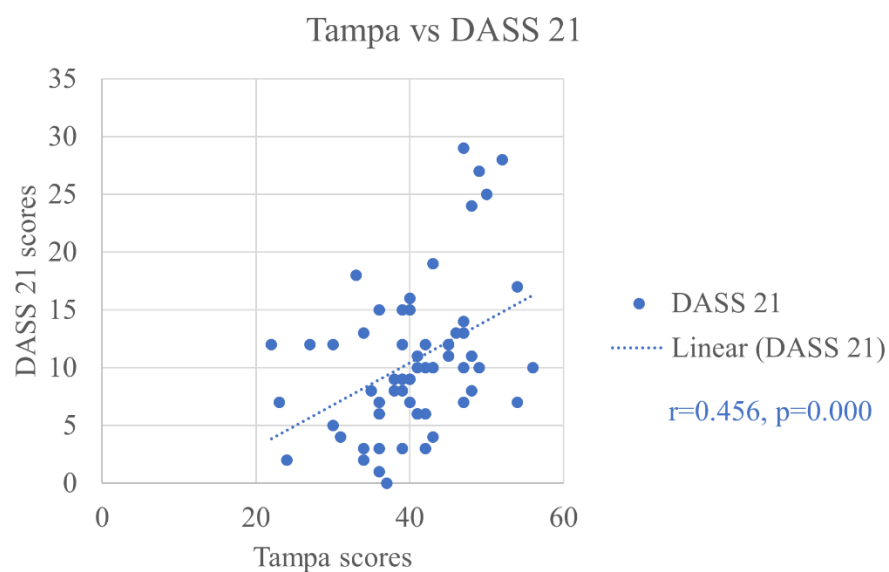


Figure 4. Correlation between kinesophobia and Depression, Stress, Anxiety Score (DASS-21).

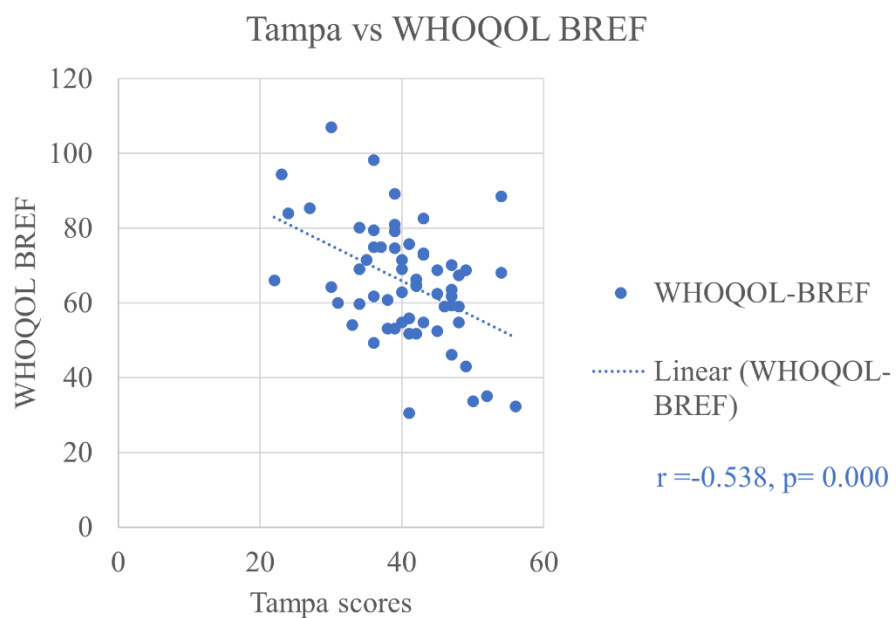


Figure 5. Correlation between kinesophobia and WHO-Quality of life BREF.