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ORIGINAL RESEARCH

Kinesiophobia and associated variables in patients with heart failure

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Aims

Patients with heart failure (HF) can exhibit kinesiophobia, an excessive, debilitating, and irrational fear of movement. This study aimed to enhance the understanding of kinesiophobia in patients with HF by analysing associations with the following variables: musculoskeletal pain, quality of life, quality of sleep, functional capacity, disability, frailty, sex, and age.

Methods and results

In this cross-sectional study, 107 participants were included, with ages ranging from 28 to 97 years (57% men, mean age 73.18 ± 12.68 years). Multiple regression analyses were performed with all variables, including polynomial regressions for variables with a non-linear relationship. Kinesiophobia was significantly correlated ($P < 0.01$) with musculoskeletal pain, quality of life, quality of sleep, functional capacity, disability, and being at risk of frailty, while age and sex were not statistically significant. Frailty disability and musculoskeletal pain intensity were variables linearly associated with kinesiophobia, while quality of sleep and disability had a non-linear relationship with kinesiophobia.

Conclusion

Kinesiophobia needs to be evaluated and better understood in patients with HF to improve physical activity and exercise adherence. This study found that musculoskeletal pain intensity, quality of sleep, disability, and frailty risk have a significant association with kinesiophobia in patients with HF. Our results suggest multi-dimensional associations of kinesiophobia in patients with HF, which require further examination and understanding.

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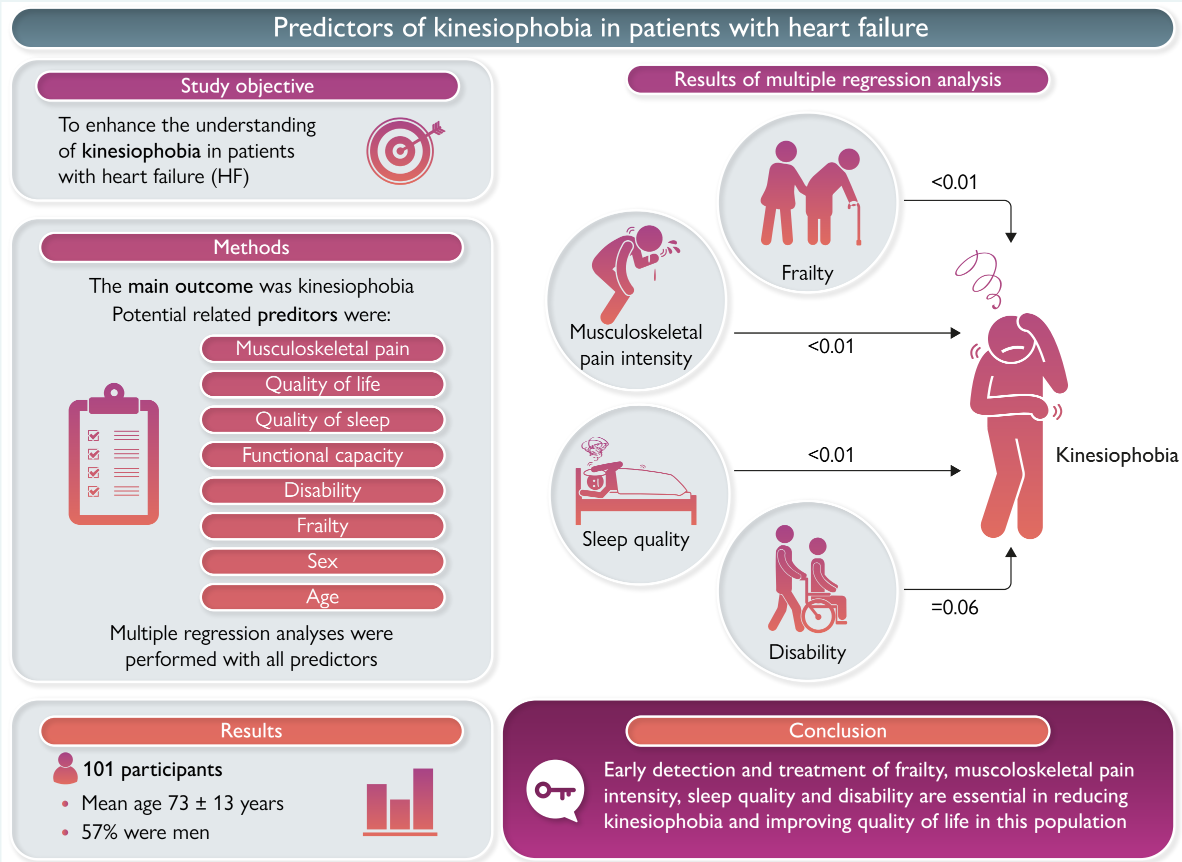
Graphical Abstract



Keywords Fear of movement • Frailty • Heart failure • Kinesiophobia • Musculoskeletal pain • Sleep quality

Novelty

- Kinesiophobia in patients with heart failure (HF) is multi-faceted with significant associations with musculoskeletal pain intensity, quality of sleep, level of disability, and frailty.
- Patients with HF having physical disabilities and sleep disturbances should be assessed for kinesiophobia when recommending physical activity and exercise.

Introduction

Heart failure (HF) is a disease with increasing prevalence and burden globally.[1] Irrespective of the aetiology of reduced or preserved ejection fraction, HF patients experience symptoms of dyspnoea, fatigue, oedema, exercise intolerance, and decline in physical functioning.[2] Additionally, nearly half of HF patients also exhibit psychological symptoms that include depression, anxiety, and avoidance behaviour such as kinesiophobia.[3]

Kinesiophobia is defined as an excessive, irrational, and debilitating fear of physical movement and activity, resulting from a feeling of vulnerability to painful injury or re-injury.[4] Kinesiophobia often results in a dissonance between the person's real and conceptualized abilities, often resulting in long-term physical inactivity[5] and risk of developing depression and disability.[6]

Although there is evidence that kinesiophobia is common in patients with coronary artery diseases,[7–9] studies exploring kinesiophobia in HF have been limited, with one qualitative study reporting that the presence of kinesiophobia in HF was associated with concerns with a worsening of symptoms or other negative consequences from engaging in exercise.[10] Another study reported that kinesiophobia is higher in advanced HF patients.[11] Fear of physical activity can lead to patients with HF developing defensive mechanisms and avoidance behaviours, thereby making adherence to recommended exercise programmes difficult for this population.[12–14]

A recent cross-sectional study from China estimated that kinesiophobia was present in 63.14% of hospitalized patients with chronic HF. The findings showed that socio-demographic and clinical variables such as educational background, monthly family income, duration of HF, and fatigue explained 41% of the variability in kinesiophobia.[15]

However, no such study has been done to report the factors affecting kinesiophobia among HF patients in Europe.

On the other hand, in populations with musculoskeletal pain, a high level of kinesiophobia has been associated with disability, worse quality of life, increased pain intensity, and a worse psychoemotional status.[16,17] There is reported evidence of the presence of kinesiophobia in older adults[18] and also of sex-related differences in kinesiophobia in patients with musculoskeletal pain.[19] A recent study also found sex to have a mediating effect on kinesiophobia in older adults with musculoskeletal pain.[20] Likewise, a recent scoping review of the literature highlighted that frailty, which is often associated with ageing, can influence kinesiophobia, especially in patients with musculoskeletal problems.[21] Among patients with heart transplantation, a recent study explored the predictors of kinesiophobia, highlighting that low self-efficacy, low extrinsic motivation, and a high level of disability explained high levels of kinesiophobia.[22] Based on previous literature, we wanted to explore whether kinesiophobia could be related to clinical variables that can influence the quantity and quality of movement in the HF population and also whether these relationships could be modulated by sex and age. The study finds grounding in the Theory of Unpleasant Symptoms, highlighting that symptom experience such as kinesiophobia is multi-dimensional and is a result of the relationship and potential interaction between physiological factors and situational factors.[23] This study aimed to enhance the understanding of kinesiophobia in patients with HF by analysing the impact of musculoskeletal pain, quality of life, quality of sleep, functional capacity, disability, frailty risk, sex, and age on kinesiophobia in patients with chronic HF.

Methods

Participants and study design

In this cross-sectional study, participants were recruited from an outpatient cardiology clinic between November 2020 and February 2021. The inclusion criteria included a diagnosis of HF of all aetiology (ischaemic, non-ischaemic, preserved, and reduced ejection fraction), age older than 18 years, and cognitively capable of completing the assessments. Patients with decompensated hypertension and recent symptoms of thoracic pain were excluded. The study was approved by the Ethics Committee for Human Research of the University of Valencia (IE1529273), and all procedures were conducted in accordance with the principles of the Declaration of Helsinki. Written informed consent was obtained before participation.

Using G*Power (version 3.1.9.7),[24] an a priori calculation with an alpha of 0.05, power of 0.80, 13 predictors, and effect size of 0.06 for the coefficients and an R^2 of 0.30, a sample size of 94 subjects was needed.

Measurements

The tools used to measure the outcome and associated variables included the following:

Outcome variable

Kinesiophobia was assessed with the Spanish version Tampa Scale for Kinesiophobia-11 (TSK-11), which has shown good reliability and validity.[25] The TSK-11 consists of 11 items with a four-point Likert scale ranging from 1 (strongly disagree) to 4 (strongly agree). These values yield a total score ranging from 11 to 44, with higher values representing a higher level of fear of movement. Internal consistency estimate for this sample was 0.83.

Associated variables

The potential variables analysed were musculoskeletal pain, quality of life, quality of sleep, functional capacity, disability, frailty, sex, and age.

Musculoskeletal pain was assessed using the Musculoskeletal System Assessment Inventory (MSSAI), an instrument developed for evaluating the musculoskeletal system and identifying patients' problems especially related to exercise in cardiopulmonary and metabolic rehabilitation programmes.[26] This instrument consists of two parts: (i) the first part of the MSSAI is composed of seven items assessing general information related to musculoskeletal pain, with dichotomous response options (yes = 1 or no = 0). A variable called *pain problems* was obtained by summing all item scores. Values range from 0 to 7, with higher values indicating musculoskeletal pain problems; (ii) the second part of the MSSAI includes information on the location and intensity of pain. A five-point Likert scale ranging from 1 (mild pain) to 5 (unbearable pain) was used to categorize the intensity of the pain felt in Zone 1 (most painful location) and Zone 2 (second most painful location). The scores assigned to each response were added up to produce a total score ranging from 2 to 10. The higher the score, the greater the pain intensity. This second variable was called *intensity of pain.* Satisfactory internal validity and reliability have been demonstrated previously.[26] Internal consistency estimate for pain problems was 0.75, while intensity of pain had a reliability of 0.82.

Quality of life was assessed with the Cantril Ladder of Life. This instrument is a simple, visual, self-anchoring scale graphically represented as a vertical ladder with 11 rungs, in which the rung 0 (bottom of the ladder) corresponds to the worst possible life and step 10 (top of the ladder) to the best possible life. Participants were asked to indicate which step best represented their current life. Higher scores indicate better well-being. The Cantril Ladder of Life questionnaire has been used in various cardiovascular studies and is considered a measure of perceived life satisfaction. The tool has good convergent validity and reliability.[27] Reliability in this sample was 0.79.

Quality of sleep was measured using the Minimal Insomnia Symptom Scale (MISS), a brief insomnia-screening questionnaire.[28] This instrument consists of three items, and the responses are categorized in a five-point Likert scale ranging from 0 (none) to 4 (severe problems). The total score ranges from 0 to 12. A higher score indicates higher sleeping difficulties. The reliability and validity of the MISS has been established among the elderly.[28] Reliability in this sample was 0.79.

Functional capacity was measured with the Duke Activity Status Index, a questionnaire that correlates with peak oxygen uptake (VO_2max) and metabolic equivalents, with established internal consistency (Cronbach's alpha of 0.72).[29] The instrument includes 12 activities related to personal care, ambulation, household tasks, sexual function, and recreational activities. Each item answered positively is assigned an estimated weight that allows total scores between 0 and 58.2. Higher scores represent better functional capacity. Coefficient alpha (internal consistency) was 0.83 in this sample.

Disability was measured with the 12-item World Health Organization Disability Assessment Schedule 2.0 (WHODAS 2.0), a validated international classification of functioning, disability, and health-based disability measure.[30] The instrument comprises 12 questions that capture 6 domains: cognition, mobility, personal care, relationships, daily life activities, and participation. Each item is answered on a five-point Likert scale, where each person has to estimate the magnitude of the disability during the previous 30 days from 1 (none) to 5 (extreme). Simple scoring was obtained by assigning values (from 1 to 5), which were added up to produce a total score ranging from 12 to 60 points. Higher values represent a higher level of disability. The WHODAS 2.0 was found to have high internal consistency (Cronbach's alpha = 0.86), a stable factor structure, high test-retest reliability (intra-class correlation coefficient = 0.98), good concurrent validity, and good responsiveness.[31] The reliability estimate in this sample was 0.91.

Frailty is defined as a biological syndrome of decreased reserve and resistance to stressors, resulting from cumulative declines across multiple physiologic systems, and causing vulnerability to adverse outcomes. It was measured using the FRESH screening instrument, which exhibited high sensitivity and specificity and a good discriminatory ability (AUC = 0.862).[32] This scale consists of five items related to tiredness, falls, endurance, needing support while shopping, and three or more visits to the emergency department in the past 12 months. If patients fulfilled two or more of these five items, they were considered to be at risk of frailty (pre-frail status). This short screening tool, validated for measuring frailty in older adults,[32] is used in our clinic to assess whether patients are at risk for frailty. The estimate of internal consistency in this sample was 0.56.

Statistical analyses

Descriptive statistics [mean, standard deviation (SD), and percentages] for all variables were computed. Bivariate correlations and scatterplots were calculated among all the variables, and additionally, a smoothing LOESS function was added to each scatterplot in order to discover potential non-linear functions in the data. These scatterplots and correlations were calculated in the package Performance Analytics (version 2.0.4, 2020). For the variables with a non-linear relation (via visual inspection) with the dependent variables, polynomial regressions were estimated. Finally, multiple regression analyses were calculated with all the variables of interest. All potential models from one variable up to the maximum number of available variables using the function 'regsubsets' were estimated in the R-package leaps (version 3.1, 2020). This function chooses from all the potential multiple regressions with all variables, the best performing according to the adjusted R^2, Bayesian Information Criteria, or Mallows' Cp values. We chose the number of variables according to the adjusted R^2 criteria. Residuals were analysed to test for departure from model assumptions. Additionally, Cook's distances were graphically estimated to find and remove influential observations in the final multiple regression. Statistical analyses were performed using R.

Results

Descriptive and bivariate analyses

A total of 107 participants (57% men) were included in the study. The mean age was 73.18 years (SD = 12.68) ranging from 28 to 97 years. *Table 1* depicts the descriptive information for all variables. The bivariate correlations of all variables with kinesiophobia are presented in *Figure 1* (upper triangular matrix). Most correlations were moderate to large and statistically significant. Exception included correlation between kinesiophobia and age ($r = 0.12$, $P > 0.05$), and kinesiophobia and sex ($r = 0.13$, $P > 0.05$). Kinesiophobia was statistically and positively correlated with: musculoskeletal pain ($r = 0.27$, $P < 0.01$); intensity of musculoskeletal pain ($r = 0.41$, $P < 0.01$); quality of sleep ($r = 0.28$, $P < 0.01$); disability ($r = 0.56$, $P < 0.01$); and risk of frailty ($r = 0.51$, $P < 0.01$). On the contrary, quality of life ($r = -0.38$, $P < 0.01$) and functional capacity ($r = -0.53$, $P < 0.01$) were negatively and significantly correlated with kinesiophobia.

Figure 1 also offers the scatterplots among all the variables in the model in the lower triangular matrix, together with smoothing loess functions added to each scatterplot in order to discover potential non-linear functions in the data. A careful examination of these scatterplots and smooth functions allowed for the examination of potential non-linear functions associated with quality of sleep and disability.

Regression analyses

The two variables, quality of sleep and disability, that were found to have non-linear relations to kinesiophobia were analysed with a sequence of polynomial models. In both cases, a linear, a quadratic polynomial, and a cubic polynomial were estimated, and the improvement in the adjusted R^2, the proportion of variance explained, was compared. For the quality of sleep, the linear model explained 6.8% of the variance in kinesiophobia, a percentage that improved to a 9.4% in the quadratic model and to a further 12.9% in the cubic model. Therefore, a cubic polynomial model was retained. The same happened with disability. The adjusted R^2 values for the linear, quadratic, and cubic models were, respectively, 0.307, 0.338, and 0.384. The models fitted to the data can be seen in *Figure 2*. The cubic relations show the same pattern. For low values of the variable, there is an increase in the scores of kinesiophobia, which then enters a plateau, and finally, at high scores of the variable, there is again an increase in kinesiophobia scores.

We then applied a statistical sequence of regressions to test models with all the variables and evaluated the model that yielded the highest prediction in terms of adjusted R^2. All potential models with 13 variables, including linear and non-linear relations, were modelled. The 13 potential variables analysed were as follows: pain problems, intensity of pain, quality of life, quality of sleep, quality of sleep—quadratic, quality of sleep—cubic, functional capacity, disability, disability—quadratic, disability—cubic, being at risk of frailty, age, and sex. Cook's distances were then calculated to detect influential observations. Only three observations were influential in the results. They were removed, and the model was estimated again. *Figure 3* shows the graphical results of Cook's distance that allows detecting the three influential observations. The maximum prediction (adjusted $R^2 = 0.538$) is achieved with nine variables, which included the two cubic polynomials previously adjusted.

The final regression model found cubic relations, as already shown in *Figure 2*, between quality of sleep and disability with kinesiophobia, although the latter was not statistically significant, and therefore, it can only be considered a cubic relation in bivariate terms. While musculoskeletal pain was not a statistically significant factor, the intensity of musculoskeletal pain had a positive and statistically significant association, relation with the dependent variable. Finally, being at risk of frailty was positively and significantly related to kinesiophobia as seen in *Table 2*.

Discussion

To our knowledge, this is the first study that reports findings on the association of clinical variables related to pain, sleep, quality of life, functional capacity, disability, and being at risk of frailty in HF patients with kinesiophobia. Our findings showed that intensity of musculoskeletal pain, quality of sleep, level of disability, and being risk of frailty were factors associated with kinesiophobia, overall explaining 53.87% of the variance. Age and sex showed no association with kinesiophobia, once other clinical variables are controlled for. In addition, quality of sleep presented a non-linear relationship with kinesiophobia, showing the key moments in which more clinical attention should be paid to this variable due to the risk of appearance or increase of kinesiophobia in HF patients.

The prevalence of pain in HF varies between 23 and 85%.[33] Patients with HF who experience moderate to severe levels of chronic back pain are more likely to be prescribed opioids or gabapentin than those with back pain alone.[34] Our findings showed that although general musculoskeletal condition and pain intensity were associated with kinesiophobia, only the intensity of musculoskeletal pain was a significant factor associated with kinesiophobia in HF patients. In the same vein, positive associations between pain intensity and kinesiophobia have previously been shown in patients with chronic musculoskeletal pain.[35]

We found quality of life to be negatively and moderately associated with kinesiophobia, which is consistent with previous studies on chronic musculoskeletal pain[17] and in cardiac patients post-surgery.[7] General health quality of life is indirectly mediated by kinesiophobia and attendance at exercise-based cardiac rehabilitation after coronary artery disease.[36] In our study, quality of life (perceived life satisfaction) was not a significant factor associated with kinesiophobia. These results are controversial in the scarce literature on the subject. In light of differing results, we suggest further investigation of the relationship between kinesiophobia and quality of life, which is a broad construct with many dimensions.

Our results show that quality of sleep is significantly associated with kinesiophobia. Sleep has a crucial role in defining the pattern of ventilation in patients with HF.[37] Several studies have suggested that sleep-disordered breathing is experienced in 50% of HF patients, including central sleep apnoea syndrome and obstructive sleep apnoea, and it reflects uncompensated instability of the ventilator feedback mechanism.[38] Furthermore, poor sleep can be mediated by the medications, such as diuretics, that can cause urination and nocturnal enuresis.[39] These disorders affect different aspects of life, including general health, physical and cognitive performance, daily activities, or mental health.[40] Another finding of the current study is the non-linear relation detected visually between quality of sleep and kinesiophobia. From a clinical point of view, it becomes more important at the extremes of this condition,

Table 1 **Means, standard deviations (quantitative variables), and percentages (categorical variables) for all variables under study**

Variables	Mean ± SD	Skewness	Kurtosis	Minimum–maximum
Kinesiophobia	28.82 ± 8.46	−0.19	2.14	11–44
Pain problems	2.61 ± 1.88	0.11	2.23	0–7
Intensity of pain	4.57 ± 2.70	0.58	1.99	2–10
Quality of life	5.84 ± 2.31	−0.60	2.89	0–10
Quality of sleep	3.51 ± 3.21	0.66	2.33	0–12
Functional capacity	19.98 ± 13.95	1.80	3.20	0–58.2
Disability	24.25 ± 11.68	1.26	3.88	12–59
Frailty score	2.72 ± 1.27	0.04	2.21	0–5
No frailty (Score 0–1)	19.6%			
At risk of frailty (Score 2–5)	80.4%			
Age	73.18 ± 12.68	−0.78	3.78	28–97
Sex				
Men	57%			
Women	43%			
Body mass index	26.42 ± 4.72	0.68	2.11	14.52–46.29
Time since diagnostic (months)	96.54 ± 134.8	2.50	7.08	3–744
Marital status				
Married	84.1%			
Single	1.9%			
Widow or widowed	14%			
Working status				
Retired	69.2%			
Working	9.9%			
Others	20.9%			
Education				
No education	12.1%			
Primary	40.2%			
Secondary	30.8%			
Superior	16.8%			

SD, standard deviation.

as seen in *Figure 2*. Early detection and treatment of sleep disorders would have a protective effect on HF patients' ability in overcoming kinesiophobia.

Functional capacity although strongly associated was not significantly related to kinesiophobia. In other words, the bivariate association between functional capacity and kinesiophobia disappeared once other variables were controlled for in the multivariate model. Lower VO_2max in patients with a high level of kinesiophobia is reported in coronary artery disease populations.[7] Future studies should verify the effect of functional capacity on kinesiophobia in more complex models when other confounding variables are tested or in longitudinal designs with HF.

Disability, mostly in the form of functional decline, can occur with the progression of HF or in a hospital-acquired phase, increasing the risk of longer hospitalization and mortality.[41] Furthermore, functional decline can be a result of non-adherence to exercise and sedentary lifestyles.[36,42] Consistent with findings in the heart transplant population, we saw a trend ($P = 0.06$) in the level of disability in HF patients influencing kinesiophobia in our study.[22] In addition, our findings showed a marked non-linear trend in the relationship between disability and kinesiophobia at the bivariate level, highlighting that the key moments in which the levels of disability cause a clinically striking change with respect to kinesiophobia were at its beginning and at the end with higher values of disability (see *Figure 2*). Hence, the management of disability requires a biopsychosocial approach centred on the patient, attending not only to the physical and mental consequences of the disease but also to the contextual characteristics and environmental factors. Attending to the levels of disability, mainly in its beginnings, can improve exercise adherence by reducing kinesiophobia.

Frailty is highly prevalent in HF independent of age and the functional classification of HF.[43] Frailty negatively impacts self-efficacy,[44] increases risk of morbidity and mortality, and is independently associated with higher healthcare utilization.[45,46] In our study, we found that being at risk of frailty is significantly associated with kinesiophobia in HF. The literature is limited on this topic and needs further investigation. Early identification of this condition and its reversal could have a positive impact on kinesiophobia and overall health.

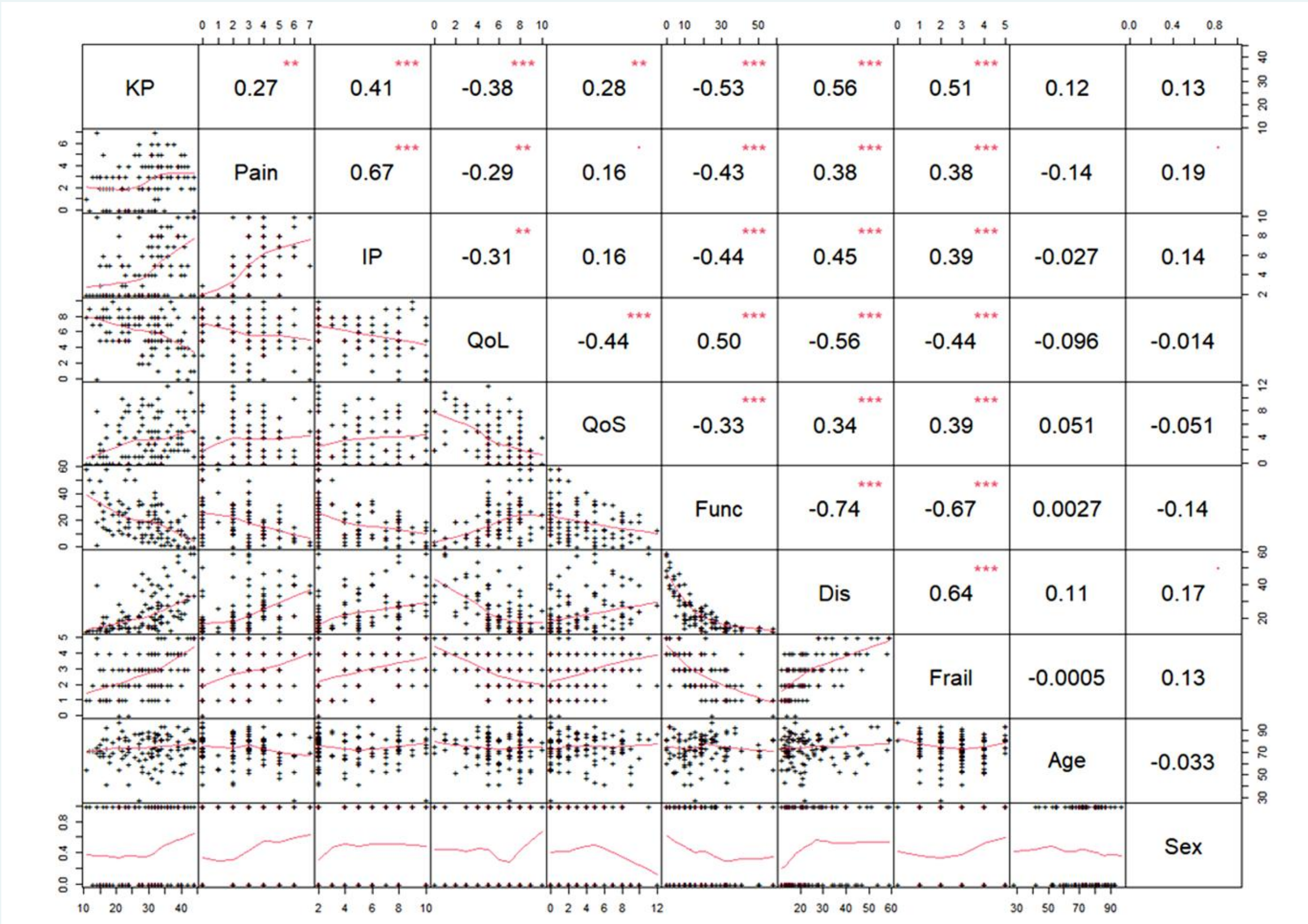


Figure 1 Correlations and scatterplots with loess function fitted for all variables in the study. KP, kinesiophobia; Pain, pain problems; IP, intensity of pain; QoL, quality of life; QoS, quality of sleep; Func, functional capacity; Dis, disability; Frail, frailty.

The evidence is controversial about the influence of sex and age on kinesiophobic beliefs. While there is evidence of the male sex being associated with kinesiophobia in musculoskeletal pain disorders,[19,47] our study did not show sex differences, which is in line with several studies on patients with other cardiovascular diseases.[7,22] In contrast, there is a report of significantly higher levels of kinesiophobia in women,[8] with 80% of women experiencing kinesiophobia in another study.[48] Finally, in agreement with another study on patients with other cardiac diseases, no correlations were found between kinesiophobia and age in this study.[7] Qin *et al.*[15] in exploring these demographic factors in chronic HF found both age (categorized into two groups) and sex to be associated with kinesiophobia. However, these relationships became non-significant when controlled for other variables.

The statistical analyses applied to this study modelled all the potential models with 13 variables. All possible combinations were tested, and the model with the best trade-off and with the number of variables to achieve the best associations was chosen, resulting in nine variables proposed in this final model (see *Figure 3*). The variables that were left out in the model were quality of life, functional capacity, age, and sex. Those that are left out are not relevant in the context of multiple variables being handled. When the model becomes multivariate, some effects disappear when other variables are controlled. At the clinical level, within a context where the different conditions analysed are presented, clinical attention should be given to the variables with the greatest potential impact. Importantly, as postulated by the Theory of Unpleasant Symptoms,[23] our study found that symptom experiences such as kinesiophobia in patients with HF are multidimensional and stem from a complex interactions of pathophysiologic and psychological factors (disease condition, functional capacity, disability, at risk of being frail, sleep status). Our findings are in line with the results of a recent meta-analysis that highlighted the significant impact of gender, self-efficacy, pain intensity, and physical disability on the extent of kinesiophobia experienced by patients with chronic, non-specific back pain.[49] Similarly, a recent path analysis on cardiac rehabilitation initiation revealed that cardiac anxiety, social complexity, and self-efficacy were associated with kinesiophobia at hospital discharge.[50] HF pathology leads patients to experience fatigue and shortness of breath, and psychological and emotional states of anxiety and depression are highly prevalent in this population.[51–53] These factors are intricately associated with HF disease severity that tend to worsen over time. Additionally, the Theory of Unpleasant Symptoms posits that situational factors of lifestyle, social support, socio-economic status, etc. can impact symptom experience. Future studies should provide careful consideration of other physiological, psychological, and situational factors not investigated in this study in kinesiophobia in patients with HF.

This study has some limitations that need to be highlighted. Firstly, since the majority of participants was older adults, it may have generated little variability, thus biasing the results related to age. Nevertheless, the sample is representative of the HF population.

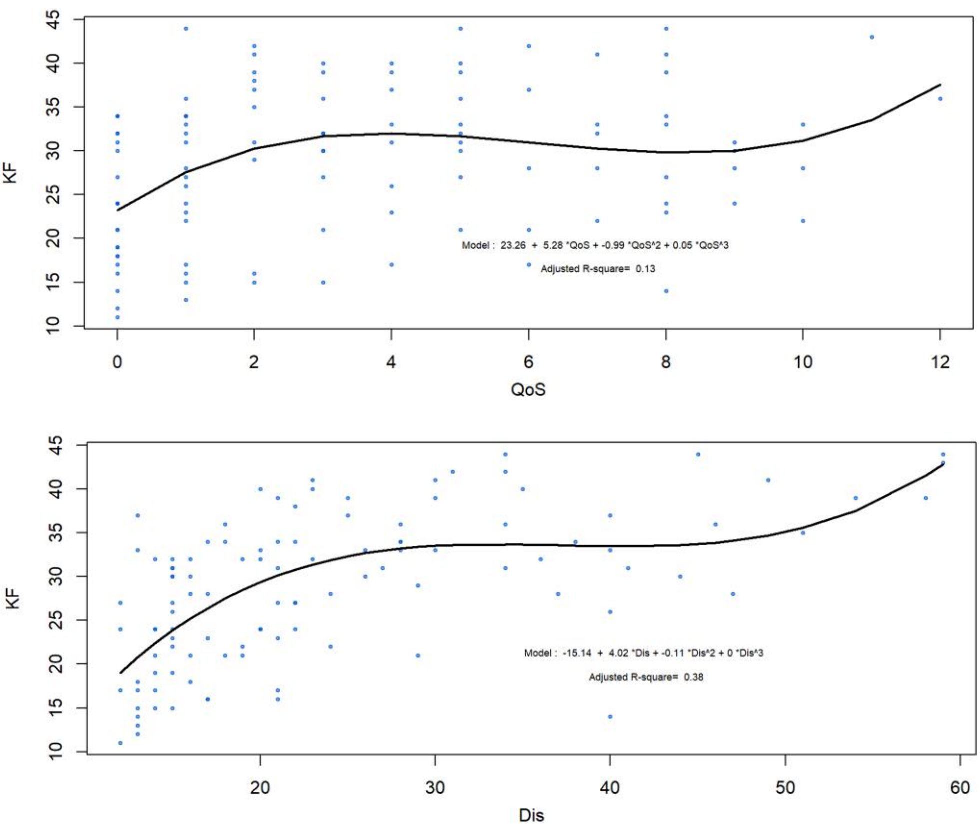


Figure 2 Cubic polynomial regression models relating quality of sleep and disability, respectively, and kinesiophobia. KF, kinesiophobia; Dis, disability; QoS, quality of sleep.

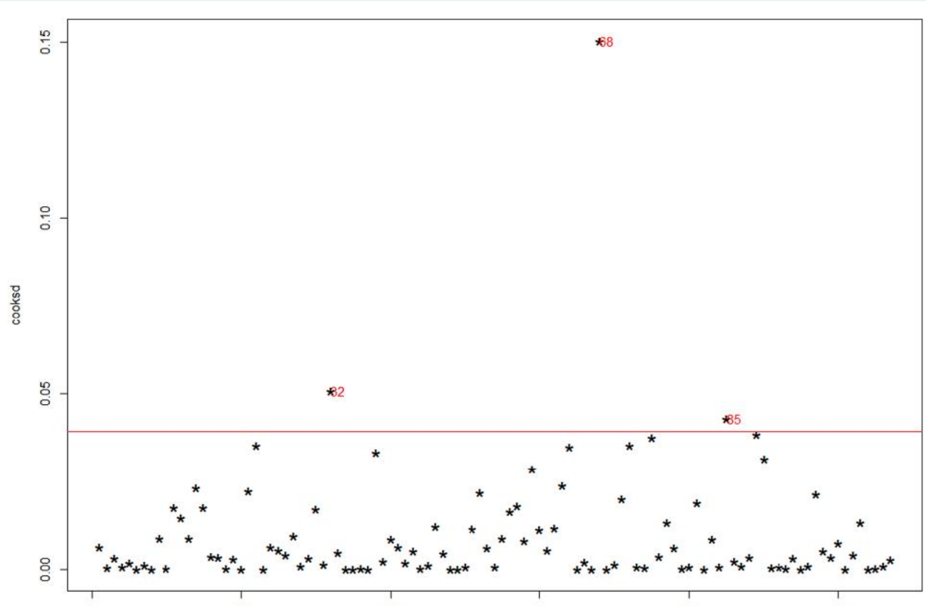


Figure 3 Detection of multivariate outliers: Cook's distances.

Table 2 **Multiple regression to predict kinesiophobia**

Variables	b	SE	t	P
Intercept	−4.20	8.77	−0.47	0.63
Pain problems	−0.57	0.42	−1.33	0.18
Intensity of pain	0.89	0.32	2.85	<0.01**
Quality of sleep	4.36	1.19	3.64	<0.01**
Quality of sleep—quadratic	−0.94	0.29	−3.21	<0.01**
Quality of sleep—cubic	0.05	0.01	2.80	<0.01**
Disability	1.92	1.01	1.90	0.06
Disability—quadratic	−0.04	0.03	−1.46	0.14
Disability—cubic	0.01	0.01	1.19	0.23
Frailty	1.84	0.61	2.98	<0.01**

b, slopes; SE, standard error; t, *t*-test.
**Statistically significant $P < 0.01$.

Secondly, even though all measurements used were valid and reliable, some of them have not been specifically tested in patients with HF. The TSK-11, which has been extensively used to study kinesiophobia across populations including older adults,[54] has not been validated in patients with HF presenting as a limitation of the study. Other measures have been tested in older adults, which may represent the HF population. Socio-economic factors, disease duration, and body mass index can contribute towards kinesiophobia, which were not included in this study.[9,11] Additionally, the outcomes were mostly self-reported, which can be subject to bias and under- and over-estimation. The internal consistency of the FRESH tool is low, and more objective measures should be considered. Also, different study designs need to be employed to investigate the variables used in this study before classifying them as risk factors for kinesiophobia in patients with HF. In addition, indicators of disease severity have not been analysed as covariates in the regression models. The study was done in a European country with a predominantly Caucasian population. Cultural differences and healthcare access and support can impact kinesiophobia. As such, the sample may not represent all HF patients, and the results need to be interpreted and generalized with caution. Finally, longitudinal studies should confirm the evidence obtained.

Conclusions

Barriers to physical activity should be considered from a broader biopsychosocial perspective, which includes considering kinesiophobia in HF. Our findings provide new insights into kinesiophobic beliefs and individuals with HF. Musculoskeletal pain intensity, quality of sleep, level of disability, and risk of being frailty need to be further studied to understand their effects on kinesiophobia and improving health outcomes in patients with HF.

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Conflict of interest: none declared.

Data availability

The data that support the findings of this study are available from the corresponding author upon reasonable request.

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