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Current status and influencing factors of kinesiophobia in patients with peritoneal dialysis: a multicenter cross-sectional study

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Abstract

Background Kinesiophobia, an irrational fear-avoidance behaviour, can significantly impact the quality of life and prognosis of peritoneal dialysis patients. This study aimed to assess the prevalence of kinesiophobia in patients undergoing peritoneal dialysis and to analyse its influencing factors.

Methods A total of 291 patients who visited the outpatient and ward of peritoneal dialysis in 7 tertiary hospitals in Jiangsu Province from December 2023 to March 2024 were selected as research subjects via the convenience sampling method. A cross-sectional survey was conducted using a general data questionnaire, the Tampa Kinesiophobia-11 Scale, the Chinese Version of the Multidimensional Fatigue Symptom Scale, and the Simplified Coping Style Questionnaire.

Results The score obtained using the Tampa Scale for kinesiophobia in patients with peritoneal dialysis was 22.44 ± 7.46, with a prevalence rate of 69.1%. Binary logistic regression analysis revealed that no complications, daily exercise before illness, and positive coping styles were protective factors ($p < 0.05$), whereas fatigue and negative coping styles were risk factors for kinesiophobia in patients receiving peritoneal dialysis ($p < 0.05$).

Conclusions The prevalence of kinesiophobia in patients receiving peritoneal dialysis was high but at a mild level. Medical staff should combine influencing factors to identify high-risk groups as early as possible, formulate targeted interventions to reduce the occurrence of kinesiophobia and mitigate adverse effects on peritoneal dialysis patients.

Keywords Peritoneal dialysis, Kinesiophobia, Fatigue, Coping style, Influencing factors

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Introduction

Peritoneal dialysis (PD) is a renal replacement therapy for end-stage renal disease (ESRD), and is gradually becoming the preferred choice of therapy because of its low haemodynamic impact, better protection of residual renal function, and absence of dialysis-associated bloodstream infection [1, 2]. Studies have indicated that approximately 35–40% of patients worldwide with ESRD opt for PD treatment, with an annual growth rate of 8% [3, 4]. In addition, the number of PD patients in China had already exceeded 12,000 by the end of 2021 [5].

Owing to insufficient nutrient intake or overconsumption during dialysis, PD patients are prone to muscle mass and strength decline, multimorbidity, weakness, etc., which leads to a decrease in their activity ability [6]. This decline severely affects their quality of life and prognosis [7]. The guidelines [8] indicate that early postoperative exercise management in PD patients can effectively maintain good physical function. Activities such as walking and jogging do not significantly increase intra-abdominal pressure without emptying the peritoneal dialysate. Nevertheless, during the period of abdominal fluid retention in PD patients, they experience strong foreign body sensation and worry about the potential risks of catheter displacement, fracture, bleeding, and PD-related peritonitis owing to inappropriate exercise, resulting in a reduced motivation to exercise and a fear of movement, which is commonly referred to as kinesiophobia in psychological terms.

Kinesiophobia is defined as an excessive, irrational, and debilitating fear of physical movement and activity due to the fear of painful injury or reinjury [9]. Back et al. [10] reported that kinesiophobia significantly affects patients' attendance at exercise rehabilitation, resulting in inadequate exercise levels and decreased compliance, which can severely impact rehabilitation outcomes. Studies [11, 12] have indicated that insufficient exercise can lead to a decline in physical function, muscle atrophy, and sarcopenia in PD patients. Additionally, reduced strength increases the incidence of falls and fractures, increasing the risk of adverse outcomes. Király et al. [13] reported that physical inactivity is associated with decreased quality of life and increased mortality risk in PD patients. Furthermore, exercise has been shown to improve depression and sleep [14], serving as a crucial nonpharmacological intervention. Consequently, it is vital to address kinesiophobia in PD patients to reduce its prevalence and increase patients' motivation to exercise.

Previous studies have focused primarily on chronic low back pain, post-knee or hip arthroplasty, and lumbar disc herniation [15] and identified factors such as gender, age, marital status, education, monthly per capita household income, and psychophysiology as strongly associated with the occurrence of kinesiophobia. However, there are differences in influencing factors between studies. Recently, Tao et al. [16] investigated the maintenance haemodialysis population and reported a high prevalence of kinesiophobia. The main influencing factors were age, fatigue, and active coping, with fatigue having the greatest impact. However, few studies have been conducted on PD patients.

With the increasing number of people with PD, there is an urgent need for healthcare professionals to implement targeted measures to enhance patients' postoperative recovery and quality of life, with exercise management playing a crucial role. Hence, it is particularly necessary to explore the current status of the occurrence of kinesiophobia in PD patients and to formulate reasonable countermeasures on the basis of the identified influencing factors. The purpose of this study was to investigate the prevalence of kinesiophobia in PD patients during abdominal retention, analyse its influencing factors, and provide a basis for the development of motor rehabilitation programmes for PD patients.

Materials and methods

Study design

This was a multicenter cross-sectional study to explore the current status and influencing factors of kinesiophobia in PD patients.

Participants

All the research subjects were patients who attended outpatient clinics and wards of the nephrology departments of 7 tertiary first-class hospitals in Jiangsu Province from December 2023 to March 2024. All outpatient visits involved those patients who came to the hospital for regular monthly follow-up and received peritoneal dialysis solution, and all patients in the wards of the nephrology department underwent peritoneal equilibration tests.

The inclusion criteria for the patients were as follows: (1) conformed to the diagnostic criteria for chronic kidney disease stage V [17], maintained regular peritoneal dialysis, and were in stable condition; (2) were aged 18 years and above, regardless of sex; (3) possessed complete cognition, understanding, and communication skills; and (4) had independent exercise capacity. The exclusion criteria were as follows: (1) the presence of active malignant tumours; severe lesions of the heart, liver, or other organs; or contraindications to exercise; and (2) concurrent haemodialysis.

According to the principle of estimating the sample size as 5–10 times the number of items [18], 21 independent variables were proposed for analysis in this study. Considering a 20% sample attrition rate, the sample size was determined to be 132–264 cases. Furthermore, the sample size was calculated using the cross-sectional sample size formula $n = \frac{\mu_{\alpha/2}^2 \sigma^2}{\delta^2}$, α=0.05, $\mu_{\alpha/2}$ = 1.96,

δ=1.5. According to the study by Pan et al. [19], σ=10.2, which resulted in a sample size of 178 cases. Taking into account an invalid sample rate of 20%, a minimum of 213 samples was necessary. Combining the two sample size calculations, we finally decided to distribute 300 questionnaires. This study was approved by the Ethics Committee of the Affiliated Hospital of Nanjing University of Traditional Chinese Medicine (2023NL-277-02), and all participants provided informed consent.

Measures

General data questionnaire

The questionnaire was designed specifically by the researcher through a literature review [16, 20–22] and included social-demographic and disease-related information. The demographic data included gender, age, educational background, marital status, occupation, and monthly per capita household income, whereas the disease-related variables included years of diagnosis of renal disease, dialysis age, daily dialysis times, PD methods, number of complications, and frequency of exercise prior to the disease.

Tampa kinesiophobia-11 scale (TSK-11)

The original vision was developed by Kori [23], and subsequently, Hu introduced and translated it into Chinese. The TSK-11 is an 11-item scale with 3 dimensions, including avoidance beliefs (2 items), activity avoidance (3 items), and somatic focus (6 items). Each item uses a four-point Likert scale, and scores ranging from "strongly disagree" to "strongly agree" are assigned 1−4 points. The total score ranges from 11−44 points. A score of 17 points or higher can indicate a diagnosis of kinesiophobia: scores between 18 and 24 indicate mild kinesiophobia, between 25 and 31 indicate moderate kinesiophobia, between 32 and 38 indicate severe kinesiophobia, and between 39 and 44 indicate extreme kinesiophobia. As the scores increase, so does the level of kinesiophobia in PD patients. The Cronbach's α of this scale is 0.883 [24].

The Chinese version of the multidimensional fatigue symptom scale (MFSS)

The scale was developed by Stein et al. [25], sinicized by the Taiwanese scholar Pien, and simplified by Xue. The MFSS is a 27-item scale with 5 dimensions, and each item uses a five-point Likert scale ranging from 'not at all' to 'very serious', with scores ranging from 0−4 points. The final score is calculated by subtracting the score of the last dimension from the total score of the first four dimensions, ranging from −24−84 points. An MFSS score exceeding 0 indicates fatigue, with higher scores suggesting higher levels of fatigue. The Cronbach's α of this scale is 0.896 [26].

The simplified coping style questionnaire

The questionnaire was developed by Folkman et al. [27], localized, and improved by Xie. It is a 20-item scale with 2 dimensions, including positive coping (1−12 items) and negative coping (13−20 items). Each item uses a four-point Likert scale, with points assigned from 'not used' to 'often used' ranging from 0−3. The total score of each dimension is calculated by adding the item scores of the same dimension, ranging from 0−36 for the positive coping dimension and 0−24 for the negative coping dimension. The higher the scores, the greater is the possibility of participants adopting corresponding coping styles. The Cronbach's α of this scale is 0.900 [28].

Data collection

The data were collected by uniformly trained researchers, and the survey subjects were selected in strict accordance with the inclusion and exclusion criteria. Before conducting the formal survey, the researchers explained the purpose and significance of the study and obtained informed consent from the respondents. During the investigation, they provided instructions on how to complete the questionnaire and addressed any concerns or questions. After completion of the questionnaire, the entries were reviewed on the spot, and any omissions were promptly added. A total of 300 questionnaires were distributed, and 291 valid questionnaires were collected, with an effective recovery rate of 97%.

Data analysis

The data were analysed using SPSS version 26.0. The Kolmogorov–Smirnov test was used to determine the normal distribution of the data, and quantitative data conforming to a normal distribution are presented as the means±SD, whereas nonnormally distributed data are presented as medians or quartiles. Categorical data are summarized as frequencies and percentages. Univariate analysis was performed via the chi-square test, rank and test or Fisher's exact test. Correlation analysis was conducted via Pearson's correlation analysis. Multivariate analysis was carried out via binary logistic regression, with the significance level set at 0.05.

Results

Characteristics of the participants

Among the 291 PD patients, 133 were males and 158 were females; the ages ranged from 19−88 years, with an average of 50.14±12.858 years. More detailed information is presented in Table 1.

The average score and average item score for the TSK-11 were 22.97±7.189 and 2.37±0.525, respectively, and 201 patients (69.1%) scored more than 17 points. The details are shown below (Table 2).

Table 1 Characteristics of PD patients with kinesiophobia and nonkinesiophobia ($N = 291$)

Item	Total *n* (%)	Nonkinesiophobia *n* (%)	Kinesiophobia *n* (%)	Statistical value	*p*
Gender				1.709[a]	0.191
Male	133 (45.7)	36 (40.0)	97 (48.3)		
Female	158 (54.3)	54 (60.0)	104 (51.7)		
Age				-3.792[c]	< 0.001
18 ~ 29	11 (3.8)	7 (7.8)	4 (2.0)		
30 ~ 44	93 (32.0)	32 (35.6)	61 (30.3)		
45 ~ 59	113 (38.8)	44 (48.9)	69 (34.3)		
≥ 60	74 (25.4)	7 (7.8)	67 (33.3)		
Education background				7.410[b]	0.116
Primary school or less	29 (10.0)	4 (4.4)	25 (12.4)		
Junior school	72 (24.7)	20 (22.2)	52 (25.9)		
Secondary or high school	96 (33.0)	31 (34.4)	65 (32.3)		
College	91 (31.3)	33 (36.7)	58 (28.9)		
Postgraduate or higher	3 (1.0)	2 (2.2)	1 (0.5)		
Marital Status				3.513 [a]	0.061
Married	255 (87.6)	74 (82.2)	181 (90.0)		
Single	36 (12.4)	16 (17.8)	20 (10.0)		
Occupation				0.116 [a]	0.733
Working	77 (26.5)	25 (27.8)	52 (25.9)		
Nonworking	214 (73.5)	65 (72.2)	149 (74.1)		
Family per capita income (monthly)				-0.451 [c]	0.652
≤ 1000	32 (11.0)	3 (3.3)	29 (14.4)		
1001 ~ 3000	75 (25.8)	25 (27.8)	50 (24.9)		
3001 ~ 5000	83 (28.5)	36 (40.0)	47 (23.4)		
5001 ~ 10,000	70 (24.1)	18 (20.0)	52 (25.9)		
≥ 10,000	31 (10.7)	8 (8.9)	23 (11.4)		
Years of diagnosis of renal disease				-0.683 [c]	0.495
< 1	20 (6.9)	11 (12.2)	9 (4.5)		
1 ~ 5	97 (33.3)	26 (28.9)	71 (35.3)		
> 5	174 (59.8)	53 (58.9)	121 (60.2)		
Dialysis age				-1.732 [c]	0.035
< 3 months	23 (7.9)	8 (8.9)	15 (7.5)		
3 months ~ 1 year	47 (16.2)	21 (23.3)	26 (12.9)		
1 ~ 3 years	98 (33.7)	31 (34.4)	67 (33.3)		
3 ~ 5 years	64 (22.0)	10 (11.1)	54 (26.9)		
≥ 5 years	59 (20.3)	20 (22.2)	39 (19.4)		
Daily dialysis times				-2.512 [c]	0.012
< 3	42 (14.4)	20 (22.2)	22 (10.9)		
3 ~ 4	196 (67.4)	58 (64.4)	138 (68.7)		
> 4	53 (18.2)	12 (13.3)	41 (20.4)		
PD methods				0.463 [a]	0.496
CAPD	274 (94.2)	86 (95.6)	188 (93.5)		
APD	17 (5.8)	4 (4.4)	13 (6.5)		
Numbers of complications				-9.446 [c]	< 0.001
0	83 (28.5)	60 (66.7)	23 (11.4)		
1	94 (32.3)	23 (25.6)	71 (35.3)		
2	65 (22.3)	5 (5.6)	60 (29.9)		
≥ 3	49 (16.8)	2 (2.2)	47 (23.4)		
Frequency of exercise prior to the disease				50.471 [a]	< 0.001
Everyday	174 (59.8)	81 (90.0)	93 (46.3)		
1 ~ 3 times weekly	58 (19.9)	6 (6.7)	52 (25.9)		

Table 1 (continued)

Item	Total *n* (%)	Nonkinesiophobia *n* (%)	Kinesiophobia *n* (%)	Statistical value	*p*
1 ~ 3 times monthly	15 (5.2)	2 (2.2)	13 (6.5)		
0	44 (15.1)	1 (1.1)	43 (21.4)		

Note a Chi-square test; b Fisher's exact test; c Rank and test

Table 2 Scores of kinesiophobia (*N* = 291)

Item	Scores (Mean ± SD)	Scores of each item (Mean ± SD)
Kinesiophobia	22.97 ± 7.189	2.37 ± 0.525
Avoidance beliefs	4.96 ± 1.291	2.48 ± 0.646
Activity avoidance	7.56 ± 1.946	2.52 ± 0.649
Somatic focus	13.52 ± 3.325	2.25 ± 0.554

Comparison of the kinesiophobia scores of PD patients with demographic characteristics

A total of 291 PD patients were divided into two groups based on the criteria of kinesiophobia, with scores of ≤ 17 for the nonkinesiophobic group and > 17 for the kinesiophobic group. The demographic characteristics of the two groups were compared. The results showed that age, dialysis age, daily dialysis time, number of complications, and frequency of exercise prior to the disease had an impact on whether PD patients developed kinesiophobia, and the differences were statistically significant ($p < 0.05$), as illustrated in Table 1.

Correlations between kinesiophobia and fatigue, positive coping styles and negative coping styles

The multidimensional fatigue symptom scores of PD patients ranged from −4−60, with an average of 15.60 ± 9.50. The positive coping style scores ranged from 0−36, with an average of 20.84 ± 6.10, whereas the negative coping style scores ranged from 0−24, with an average of 11.95 ± 4.65. Pearson's correlation analysis revealed a positive correlation between kinesiophobia and multidimensional fatigue symptoms among PD patients ($r = 0.586$, $p < 0.001$), as did negative coping styles ($r = 0.308$, $p < 0.001$). Additionally, the TSK-11 scores were negatively correlated with positive coping styles ($r = -0.659$, $p < 0.001$).

Multivariate Logistic regression analysis of kinesiophobia in PD patients

Binary logistic regression analysis was conducted with the presence of kinesiophobia in patients with PD as the dependent variable (nonkinesiophobia = 0, kinesiophobia = 1, taking the nonkinesiophobia group as the reference group), and variables that exhibited significant differences in univariate and correlation analyses were considered independent variables. Categorical variables, such as age, daily dialysis times, dialysis age, number of complications, and frequency of exercise prior to the disease, were coded by dummy variables, and the last variable was uniformly retained as the reference group. Continuous variables, such as the scores of multidimensional fatigue symptoms and coping styles, retained their original values. The results revealed that no complications, daily exercise prior to the disease, and positive coping styles were protective factors ($p < 0.05$), whereas fatigue and negative coping styles were risk factors for kinesiophobia in patients with PD ($p < 0.05$), which explained 84.8% of the total variation, as shown in Table 3.

Table 3 Binary logistic regression of kinesiophobia in PD patients (*N* = 291)

Independent variables	B	SE	Wald	OR (95% CI)	*p*
Age					
18 ~ 29	-2.233	2.462	0.823	0.107 (0.001,13.359)	0.364
30 ~ 44	-1.146	0.894	1.642	0.318 (0.055, 1.835)	0.200
45 ~ 59	-0.417	0.759	0.301	0.659 (0.149, 2.921)	0.583
Dialysis age					
< 3 months	-0.489	1.003	0.238	0.613 (0.086, 4.377)	0.626
3 months ~ 1 year	-0.726	0.964	0.566	0.484 (0.073, 3.204)	0.452
1 ~ 3 years	0.902	0.792	1.296	2.464 (0.522, 11.64)	0.255
3 ~ 5 years	1.706	0.989	2.979	5.509 (0.794, 38.244)	0.084
Daily dialysis times			3.629		0.163
< 3	-1.932	1.038	3.463	0.145 (0.019, 1.108)	0.063
3 ~ 4	-0.607	0.77	0.622	0.545 (0.12, 2.465)	0.430
Numbers of complications					
0	-2.729	1.136	5.771	0.065 (0.007, 0.605)	0.016
1	-1.575	1.16	1.844	0.207 (0.021, 0.605)	0.175
2	0.293	1.531	0.037	1.34 (0.067, 26.911)	0.848
Frequency of exercise prior to the disease					
Daily	-3.079	1.43	4.635	0.046 (0.003, 0.759)	0.031
1 ~ 3 times weekly	-0.648	1.728	0.141	0.523 (0.018,15.47)	0.708
1 ~ 3 times monthly	0.922	5.9	0.024	2.514 (0, 264512.905)	0.876
Fatigue	0.146	0.052	7.806	1.157 (1.044, 1.281)	0.005
Positive coping style	-0.444	0.078	32.248	0.642 (0.550, 0.748)	0.000
Negative coping style	0.154	0.066	5.403	1.166 (1.024, 1.328)	0.020

Discussion

The prevalence of kinesiophobia is high in patients with PD but at a mild level

In this study, the total score of kinesiophobia in PD patients was 22.44±7.46, which was lower than the reported score in older patients with primary osteoporosis [22]. In particular, a survey revealed that the prevalence rate was 69.1%, which was slightly higher than that of tumor patients with PICC [29]. These findings suggested that kinesiophobia was prevalent in PD patients and required more attention from medical staff. The possible explanation is that PD patients generally consume protein energy, which manifests as fatigue, mental depression, sedentary behaviour, an increased risk of falling, and fear of exercise. These symptoms are associated with foreign body sensation and pain associated with catheterization, and patients are uncertain about the complications and prognosis of the disease and worried about wound infection caused by pipeline slippage or exercise sweating, resulting in negative emotions, such as anxiety, avoidance, and fear.

The average item scores of the dimensions were very similar. In comparison, the score for the somatic focus dimension was the lowest, indicating that patients had a certain disease understanding, which indirectly reflected the efforts of medical staff in disease guidance and health education. Moreover, the activity avoidance dimension scored the highest, indicating that the patients were unable to apply scientific theoretical knowledge to actual rehabilitation exercise, with low self-management and a lack of subjective initiative. Thus, further encouragement and supervision by health care professionals were needed to stimulate enthusiasm for exercise.

Statistically significant findings were identified in the univariate analysis, highlighting variables such as age, number of dialysis years, and daily dialysis times. Age was found to determine the physical fitness of patients [30]. Owing to a large loss of muscle and poor nutritional metabolism, the overall physical condition of the elderly population had deteriorated, leading to decreased mobility and a fear of exercise. Yuichiro et al. [31] reported that the duration of dialysis is a risk factor for peritonitis. A greater dialysis age and higher number of PDs trigger a greater risk of infection [32], which seriously affects health and quality of life, increases the economic burden, and reduces the overall motivation for physical activity. In future clinical practice, it is recommended that medical staff focus not only on health education but also on promoting self-management awareness. This goal can be achieved by effectively communicating the treatment plan and assessing the disease and potential complications with patients. By doing so, patients can increase their motivation to engage in physical activity while prioritizing safety and comfort.

Analysis of the factors influencing kinesiophobia in patients with PD

The absence of complications is a protective factor for kinesiophobia in patients with PD

In this study, complications had a significant negative effect on the occurrence of kinesiophobia in PD patients, and the greater the number of complications, the higher was the level of motor fear in patients, consistent with the findings of He [33]. Patients with complications often experience pain [34], and the degree of pain is recognized as a factor affecting patients with postoperative kinesiophobia [35, 36], resulting in the adoption of an "avoidance" mentality. Additionally, the more complications patients experience, the more serious the restriction of physical activity becomes. This phenomenon is often accompanied by tension, anxiety, and worry that exercise may worsen pain and impact prognosis, ultimately increasing the economic burden. Accordingly, during hospitalization, medical staff should explain the PD operation process and precautions in detail, emphasize the importance of the aseptic principle, create instructional videos, and perform assessments before discharge to ensure that patients operate accurately and correctly. The patient will be urged to visit the outpatient clinic promptly after discharge from the hospital, undergo regular balanced peritoneal testing to assess peritoneal function and adjust the PD programme in a targeted manner to reduce the incidence of complications. Concurrently, it is necessary to take the initiative to pay attention to the patient's emotional changes, provide full understanding and tolerance, offer psychological counselling, and guide the way to relieve the feeling of pain, ultimately achieving the goal of reducing kinesiophobia.

Daily exercise prior to disease onset is a protective factor for kinesiophobia in patients with PD

The findings of this survey revealed that the lower the exercise frequency of patients prior to disease, the greater was the level of kinesiophobia. This phenomenon may be explained by the propensity for individuals with low exercise frequency to not engage in physical activity for extended periods, resulting in decreased muscle strength and quality, osteoporosis, and an increased risk of falls. In terms of nutrition, it can lead to slow gastrointestinal motility, indigestion, and insufficient nutritional intake. Moreover, decreased cardiopulmonary function can cause fatigue, slow blood circulation, and poor basic metabolism. All of the above factors are associated with weakness and kinesiophobia [37, 38]. Thus, medical staff should assist patients in formulating exercise prescriptions and encourage them to develop good habits of adhering to exercise. To ensure safety, patients should perform low-intensity aerobic exercise 3–5 times a week

for 20–30 min in each session to improve their physical activity capacity.

Fatigue is a negative factor for kinesiophobia in patients with PD

Fatigue is a subjective feeling of an organism that may be influenced by sociodemographic, disease, and psychological and behavioural factors [39]. Chang et al. [40] reported that, in comparison with other alternative treatments, PD had the greatest risk of fatigue, ranging from 60 to 97%. The results of the present study revealed that the prevalence of fatigue was approximately 96%. The level of fatigue influenced the degree of kinesiophobia in patients with PD, as higher fatigue scores were significantly associated with increased kinesiophobia, which is consistent with the findings of Baday-Keskin et al. [41]. Fatigue symptoms are common in PD patients and require urgent attention from health care professionals. Previous studies [42] have identified fatigue as a major factor influencing patients' exercise adherence. Patients mostly present with limb weakness, mental depression, an increased risk of sports injuries, and physiological and psychological avoidance of exercise; simultaneously, long-term fear of exercise leads to insufficient physical inactivity, decreased exercise endurance, and aggravated degrees of fatigue. Patients fall into a vicious cycle of fatigue-insufficient physical activity-kinesiophobia, resulting in further deterioration of their quality of life. In serious cases, this cycle can become life-threatening. A study by Patrizia et al. [43] revealed that exercise effectively alleviates fatigue symptoms in dialysis patients. On this basis, establishing a positive and effective way of communicating with patients, remaining informed about their physical condition, and dynamically assessing the level of fatigue are particularly crucial. Through a well-designed follow-up system and remote supervision and management, a personalized exercise programme can be formulated to improve exercise motivation and compliance, gradually reduce the degree of fatigue, and decrease the level of kinesiophobia.

A positive coping style is a protective factor, whereas a negative coping style is a negative factor, for kinesiophobia in patients with PD

The results of this study revealed that coping styles affected the level of kinesiophobia in PD patients. A higher score for positive coping style was associated with a lower level of kinesiophobia, whereas a higher score for negative coping style was associated with a higher level of kinesiophobia, which is in line with the results of Shi et al. [44] and Cai et al. [45]. Qin et al. [46] reported that a positive coping style is a protective factor against the development of kinesiophobia in patients with chronic heart failure. Patients with a positive coping style tend to actively seek help to build confidence in facing diseases and meeting challenges, explore solutions by learning from others' ways of dealing with problems, and have better adherence to treatment and care. Chen et al. [47] conducted qualitative interviews and reported that negative coping styles exacerbated kinesiophobia in stroke patients with hemiplegia and diminished their confidence in recovery. Patients who adopt a negative coping style have a serious fear of escape and poor self-regulation ability, resulting in an attempt to solve problems through others and poor compliance behaviour, which further leads to physical deterioration and increased sensitivity in mental health. As a result, medical staff should concentrate on the physical and psychological changes of patients to address any negative coping styles promptly, assist in building confidence in disease treatment, and improve their cognitive and behavioural abilities. Simultaneously, family members and friends are invited to participate in the rehabilitation process to help patients adapt quickly to bodily changes and reintegrate into society with the aid of social support.

Limitations

First, although this study adopted a multicentre investigational method, it was carried out in the same region, which may have affected the representativeness of the sample. Thus, the results may not be generalizable to patients in other areas. Second, we initially employed convenience sampling for the survey, which introduced bias into the study results to some extent. Random sampling should be considered in future studies to generate more scientifically sound results. Third, the current survey limited the inclusion of influencing factors. In the future, additional influencing factors, such a-s the number and content of health education sessions, could be explored. Fourth, despite emphasizing the purpose and significance of the research and explaining the questionnaire items prior to the survey, the self-reported nature of the questionnairs may still introduce reporting errors. In future studies, combining quantitative and qualitative studies may provide a deeper understanding of the factors influencing kinesiophobia and the real experiences of PD patients. These findings could provide valuable references for the development of exercise rehabilitation programmes.

Conclusions

The study suggested that the prevalence of kinesiophobia in patients with PD was high but at a mild level. The number of complications, frequency of exercise prior to the disease, degree of fatigue, and coping styles were the factors influencing kinesiophobia. Kinesiophobia can significantly reduce the motivation of PD patients to participate in exercise rehabilitation, leading to decreased

physical function, muscle atrophy, increased incidence of falls and fractures, diminished quality of life, and a heightened risk of death. Therefore, medical staff should address kinesiophobia and implement appropriate measures. Health education should be guided by knowledge-attitude-practice (KAP) theory, which uses personalized educational content to explain the disease in detail. Additionally, establishing a trusting doctor–patient relationship, enhancing peer and family support systems, and promoting positive beliefs about exercise are crucial. Furthermore, patients should be encouraged to self-manage their health, improve their health literacy, and enhance their self-efficacy in exercise to alleviate kinesiophobia.

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Author contributions
Investigation, M.X., L.Y. and X.Z.; Data curation, Y.Y.G.; Software, M.X., Y.Y.G.; Writing—original draft preparation, M.X.; Writing—review and editing, L.Y., Y.Y.G., X.Z. and R.Q.Z.; Supervision, R.Q.Z. All authors have read and agreed to the published version of the manuscript.

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Data availability
The data are not publicly available due to privacy concerns; however, the datasets used in this study can be obtained from the corresponding author upon reasonable request.

Declarations

Ethics approval and consent to participate
The study was conducted in accordance with the Declaration of Helsinki and approved by the Ethics Committee of the Affiliated Hospital of Nanjing University of Traditional Chinese Medicine (2023NL-277-02). Informed consent was obtained from all the subjects involved in the study.

Consent for publication
Not applicable.

Competing interests
The authors declare no competing interests.

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