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Review Article

Prevalence and the Associated Factors of Kinesiophobia among Patients with Coronary Artery Disease: A Systematic Review and Meta-Analysis

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SUMMARY

Background: Kinesiophobia, one of the most common causes of low secondary prevention compliance of cardiac rehabilitation, severely affects the rehabilitation of patients with coronary artery disease (CAD). However, the estimated prevalence and risk factors of kinesiophobia have not been systematically assessed.

Methods: Cochrane Library, PubMed, Web of Science, CINAHL, EBSCOhost, Embase, China National Knowledge Infrastructure, Weipu Database, Wangfang Database and Sinomed were entirely searched of the observational studies on the prevalence and risk factors of kinesiophobia in CAD patients from the establishment of the database to January 10, 2023. A random-effects model was used to analyze the prevalence of kinesiophobia among CAD patients.

Results: A total of 11 studies were included in the meta-analysis. The prevalence of kinesiophobia among CAD patients varied from 20.0% to 89.6%. The pooled prevalence of kinesiophobia was 53% (95% CI: 37–68%). After controlling for the confounding variables, the following risk factors are related to the occurrence of kinesiophobia: anxiety (OR = 2.07, 95% CI: 1.50–2.86), experienced acute cardiovascular events (OR = 2.09, 95% CI: 1.49–2.76), experienced pain (OR = 2.64, 95% CI: 1.18–5.80), self-efficacy (OR = 2.11, 95% CI: 1.62–2.78), low-income (OR = 1.23, 95% CI: 1.06–1.56), co-morbidities (OR = 2.87, 95% CI: 1.09–7.02).

Conclusion: In conclusion, an overall pooled prevalence of kinesiophobia among CAD patients was 53%. Anxiety, experienced acute cardiovascular events, experiencing pain, self-efficacy, low income, and co-morbidities were identified as risk factors for kinesiophobia in patients with CAD. Understanding the risk factors of CAD patients' kinesiophobia can provide a theoretical basis for medical staff to manage and treat patients.

1. Introduction

Coronary artery disease (CAD) remains a world-widely healthy concern nowadays. The global burden of disease research shows that the number of deaths due to cardiovascular disease accounts for a total of 1/3 of the ball deaths.[1] Cardiac rehabilitation (CR) is considered to be the key to improving the prognosis of patients with CAD. The exercise-based CR provides essential benefits for those people with CAD, including reduced risk of myocardial infarction, coronary artery bypass graft or angina pectoris, or a likely slight reduction in all-cause mortality, and a large reduction in all-cause hospitalization, along with associated healthcare costs, and improved health-related quality of life up to 12 months follow-up.[2,3] Lack of exercise can lead to tachycardia, orthostatic hypotension, thromboembolism and other diseases.[4] There is low compliance among patients in exercise-based CR. Some patients choose to reduce the amount of activity or avoid exercise which may reduce adherence to the heart burden and induces angina pectoris. This phenomenon is called kinesiophobia. The prevalence of kinesiophobia within CAD patients ranges from 20%–89.6%, and different studies reported different results.

There were several reasons for the obvious difference in the prevalence of kinesiophobia in CAD patients. Firstly, diverse scales were used to adjust kinesiophobia. Case in point is the Fear Avoidance Beliefs Questionnaire,[5] Fear of Activity in Patients with CAD (Fact-CAD),[6] Tampa Scale for Kinesiophobia (TSK), and TSK were modified into Swedish Version (TSK-SV Heart),[7] Chinese Version (TSK-SV-C),[8] TSK-13,[9] and so on. The sensitivity and specificity of those scales differ from each other. Secondly, the quality and quantity of the study and the sampling strategy may lead to the variability of the estimated prevalence, which is prone to bring inaccurate values. Thirdly, kinesiophobia is a subjective perception that several influence factors can monitor.[10] Such as anxiety, pain, fatigue, emotions, and psychosocial support.

Until recently, there has been no uniform conclusion on the prevalence and influencing factors of kinesiophobia in patients with CAD. Most countries in the world are probably not yet aware of the high prevalence of kinesiophobia and the harm it can cause. Dozens of studies showed that kinesiophobia, which can reduce the level of

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physical activity and the effectiveness of exercise-based CR in CAD patients, is the biggest obstacle to CR.[11,12]

Therefore, it is necessary to conduct a systematic review in an evidence-based manner for the kinesio-phobia of CAD patients. This study aimed to determine a pooled lever of kinesiophobia prevalence in CAD patients and explore the potentially influential factors, thus, providing a reference for better nursing management in the future.

2. Method

The review was conducted following the guidelines of the preferred reporting items for systematic review and meta-analysis statement. A detailed and specific study protocol was procurable on the PROSPERO website (http://www.crd.york.ac.uk/PROSPERO/display_record.php?RecordID=433975) under the registration number CRD42023433975.

2.1. Literature search strategy

Two independent reviewers performed a complete search of the literature database through the English and Chinese databases. PubMed, CINAHL, EBSCOhost, Web of Science, Embase, Cochrane Library, China National Knowledge Infrastructure (CNKI) Database, Weipu (VIP) Database, Wanfang Database, and Sinomed were comprehensively searched and inclusion from database building to January 10, 2023. The search strategy was carried out by combining mesh terms and free words as follows: (coronary heart disease or coronary artery disease or Coronary diseases or disease, coronary or diseases, coronary or coronary heart diseases or disease, coronary heart or diseases, coronary heart or heart disease, coronary or heart diseases, coronary or artery disease, coronary or artery diseases, coronary or coronary artery disease or left main coronary artery disease or left the main disease or left main coronary disease or coronary arteriosclerosis* or arteriosclerosis* coronary or arteriosclerosis, coronary or CHD or CAD) AND (kinesiophobia or fear of movement or fear of exercise or phobia) AND (prevalence or epidemiology or incidence or morbidity or cross-sectional stud* or cross-sectional analysis* or cross-sectional survey). The researchers did not limit the types of publications, besides, we searched some literature and the grey literature manually.

2.2. Study selection

Endnote X9 was applied to remove duplicated studies, and through reading the title and abstract two researchers initially exclude the works of literature which are different from the purpose of the study. Each literature was accessed independently by both investigators for final study inclusion. Include or exclude was determined by a further reading of the full texts. If there were divergences, the corresponding author of this article shall make a judgement.

The study of inclusion criteria was reviewed systematically as follows: ① The subjects are CAD patients; ② The diagnostic criteria for accurate identification are kinesiophobia; ③ Prevalence or risk factors of kinesiophobia; ④ The studies should be observational. The exclusion criteria were as follows: ① The study contains incomplete data; ② A full text of the study could not be retrieved; ③ The sample size is less than 50.

2.3. Data extraction

Two investigators evaluated each included literature independently. The following information was recorded: name of the first author, publication year, study location, sample size, diagnostic criteria, prevalence of kinesiophobia, and risk factors. The extracted data was stored in Microsoft Excel file format.

2.4. Quality assessment

Two investigators evaluated each included literature independently. The corresponding authors will resolve any divergence regarding the quality of the study. The risk of bias in the cross-sectional study was evaluated using 11 evaluation criteria recommended by the Agency for Healthcare Research and Quality in the United States.[13] Each evaluation standard was scored with “Yes”, “No” and “Not clear”. As shown in Figure 1, the greener each criterion was the lesser risk of bias in the studies. The Newcastle-Ottawa Scale was used to evaluate the risk of bias in the cohort study.[14] The scale has three dimensions and eight items, including the selection of subjects (four items, full score of 4 points), intergroup comparability (one item, full score of 2 points), and result measurement (three items, full score of 3 points), the full score of 9 points, 0 to 4 points for low quality, 5 to 6 points for medium quality, and ≥ 7 points for high quality (Table 1).

2.5. Data analysis

The pooled prevalence was estimated using a random effect model with a 95% confidence interval (CI) due to the heterogeneity between studies. I^2 statistics were used to evaluate the degree of heterogeneity. For studies measuring, kinesiophobia, subgroup analysis of age, gender, education level, cardiac function grading, and scales for kinesiophobia were performed. The funnel plot and Egger test were used to evaluate the publication bias.

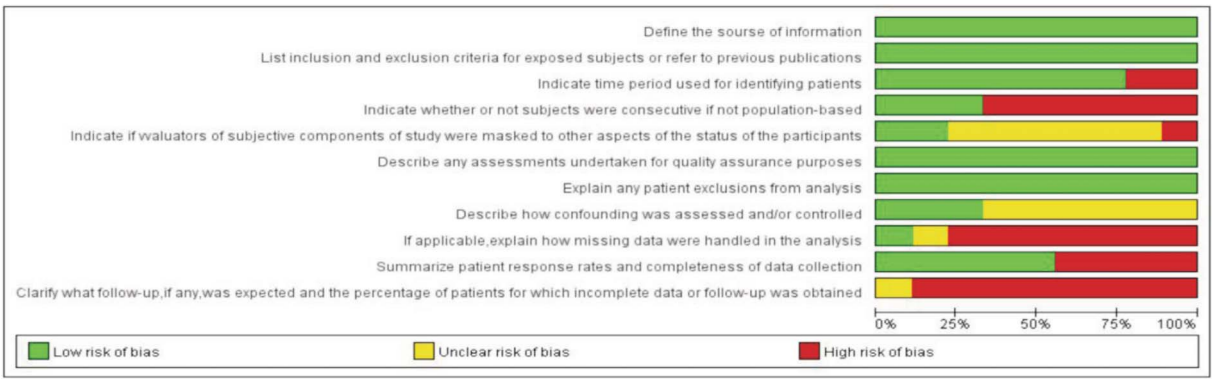

Figure 1. Critical appraisal of studies.

Table 1
Risk of bias assessment in cohort studies.

Study	Research target				Comparability between groups (whether to control confounding factors)	Result measurement			Total points
	Representation of exposure groups	Representation of non-exposed groups	Determination of exposure groups	No outcome indicator is to be observed in the research		Blind independent evaluation	The follow-up time is long enough	Follow-up integrity	
Nienketer HOEVE (9)	1	1	1	1	0	0	1	1	6
Maria Back (15)	1	1	1	1	1	1	1	0	7

3. Results

3.1. Study process

The initial search received 366 pieces of literature, among which 145 were duplicates. Through layer-by-layer screening, 11 articles were included in this study, including 2353 patients with coronary heart disease, and 1209 patients who suffered from kinesiophobia. The document retrieval process was shown in Figure 2.

3.2. Basic characteristics of included studies

9 cross-sectional studies and 2 cohort studies were included in all 11 articles. The characteristics of the 11 articles were summarized in Table 2.

3.3. Prevalence of kinesiophobia with CAD patients

In the 11 articles available for the meta-analysis, the prevalence of kinesiophobia in CAD patients ranged from 20.0% to 89.6%. Based on a random-effect model-based meta-analysis conducted on all data points, the overall kinesiophobia prevalence was estimated to be 53% (95% CI: 37%–68%) (Figure 3).

3.4. The prevalence of kinesiophobia in patients with CAD in different subgroups

The results of subgroup analysis showed that CAD patients, who were ≥ 65 years old with a high level of cardiac function grading, had undergone surgery and experienced angina in the past three months had a higher level of kinesiophobia (Table 3).

3.5. Risk factors

The pooled analysis identified 8 potential risk factors associated with kinesiophobia of CAD patients: anxiety, smoking, experienced acute cardiovascular events, experiencing pain, self-efficacy, low income, co-morbidities, and duration of CAD. Among them, the association of anxiety, experienced acute cardiovascular events, pain, self-efficacy, low income and co-morbidities reached statistical significance (Table 4).

3.6. Publication bias

Funnel diagram analysis showed that the distribution of each research site was asymmetric (Figure 4), and the Egger test result was $p < 0.0001$, indicating that there might be publication bias.

4. Discussion

4.1. There is a high prevalence of kinesiophobia in patients with CAD

Based on 11 studies included in the current meta-analysis, the prevalence of kinesiophobia among CAD patients was 53% (95% CI:

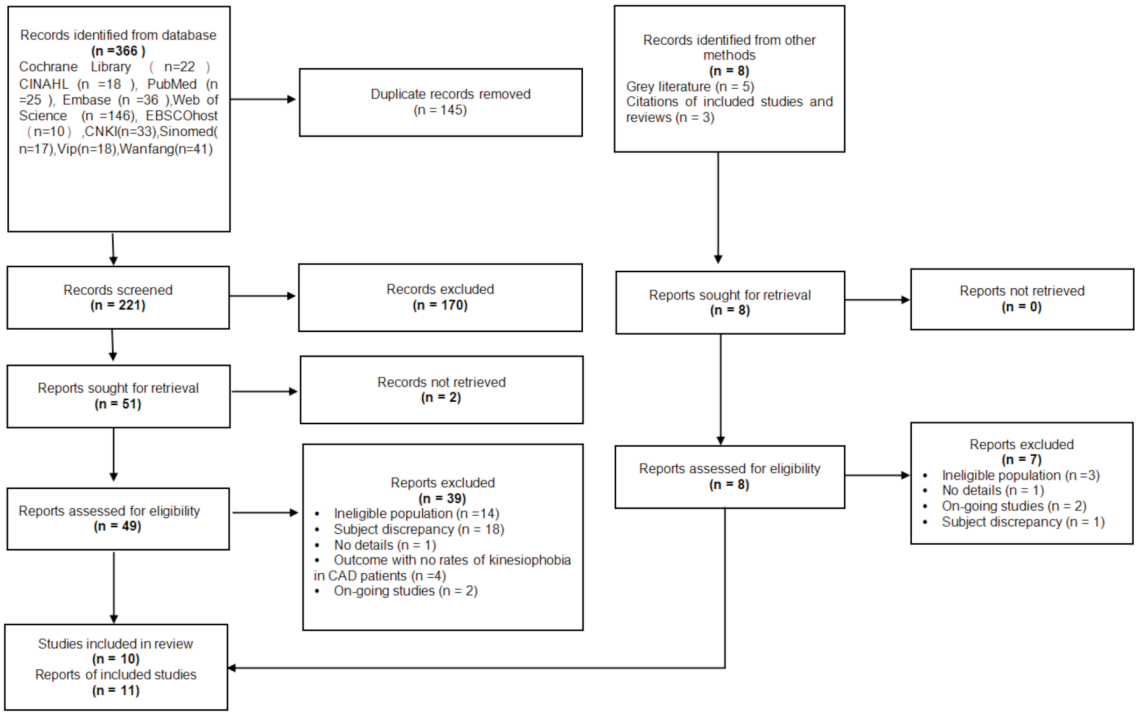

Figure 2. Study selection flow diagram. Cochrane Library, PubMed, Web of Science, CINAHL, EBSCOhost, Embase, China National Knowledge Infrastructure, Weipu Database, Wangfang Database and China Biology Medicine database.

Table 2
Characteristics of the included studies.

First-author	Publication years	Country	Sample size	Diagnostic criteria	Prevalence (%)	Risk factors
Dabek (16)	2020	Polish	217	CAD	72.81%	Self-efficacy, classification of CAD
Ter Hoeve (9)	2022	Netherlands	109	Cardiac disease	40.4%	Anxiety, depression, CR exercise
Keessen (17)	2020	Netherlands	152	Heart rehabilitation patients	43.8%	Anxiety, depression, interventional surgery, risk perception, fear of injury
Knapik (18)	2019	Polish	135	Elderly patients with CAD	76.3%	Educational level
Yao S (8)	2022	China	278	CAD	75.7%	Age, educational level, income, cardiac function grading, pain-related variables
Back (19)	2013	Sweden	332	CAD	20%	Anxiety, the incidence rate of heart failure, general health
Back (15)	2018	Sweden	106	CAD	25.4%	Time of CAD, gender
Baykal (7)	2021	Turkey	98	CAD	74.5%	Pain, physical activity level
Ghisi (20)	2017	Brazil	300	CAD	89.6%	Education, income, classification of CAD, disease priority, duration of CR
Ozyemisci (6)	2020	Turkey	250	CAD	22%	Classification of CAD, employment
Sun MM (21)	2019	China	376	Young and middle-aged with CAD	41.76%	Income, education, age, gender, payment method

CAD, coronary artery disease; CR, cardiac rehabilitation.

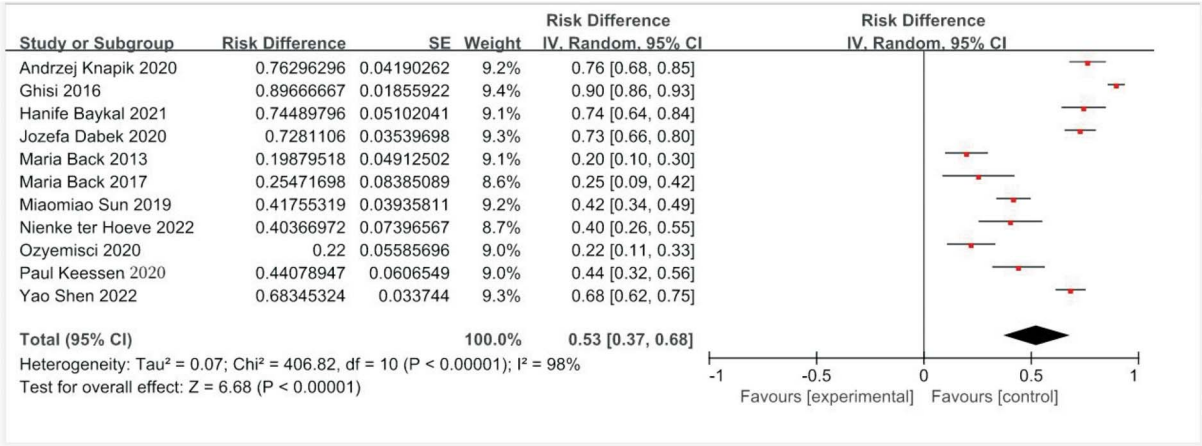

Figure 3. Forest plot of prevalence of kinesiophobia in patients with CAD.

Table 3
Subgroup analyses.

Subgroups	Number of included studies	Kinesiophobia			
		Prevalence	95% CI	I^2	p value
Gender					
Male	9	37%	30–53%	89.7%	0.050
Female	9	38%	33–59%	98.5%	0.055
Age					
< 65	7	40%	33–54%	98.2%	0.000
≥ 65	8	49%	42–56%	97.9%	0.000
Education level					
Illiteracy	6	50%	37–63%	97.5%	0.000
Primary	6	45%	32–60%	98.3%	0.000
Junior or senior	6	35%	30–44%	98.9%	0.000
College/university	6	33%	23–46%	97.6%	0.000
Cardiac function grading					
Grade I	4	23%	15–38%	96.7%	0.000
Grade II	4	35%	21–66%	96.5%	0.000
Grade III	4	46%	26–80%	98%	0.000
Disease priority					
Acute event	3	52%	47–63%	99.0%	0.660
Not acute event	3	48%	46–64%	97.6%	0.672
Scales for kinesiophobia					
Tsk-heart-13	3	44%	36–72%	99.0%	0.000
Tsk-heart-17	7	54%	39–71%	99.3%	0.000
Fact-CAD	1	22%	13–36%	100%	0.000

Table 4
Pooled risk factors of kinesiophobia.

No.	Risk factors	Number of include studies	OR	95% CI	I^2	p value
1	Anxiety	3	2.07	1.50–2.86	42.2%	0.000
2	Smoke	3	3.92	0.96–17.02	97.3%	0.052
3	Experienced acute cardiovascular events	4	2.09	1.49–2.76	95.6%	0.000
4	Pain	3	2.64	1.18–5.80	97.5%	0.016
5	Self-efficacy	3	2.11	1.62–2.78	98.3%	0.000
6	Low income	4	1.23	1.06–1.56	88.9%	0.017
7	Co-morbidities	6	2.87	1.09–7.02	97.2%	0.000
8	Duration of CAD	4	3.52	0.99–14.96	97.5%	0.063

CAD, coronary artery disease.

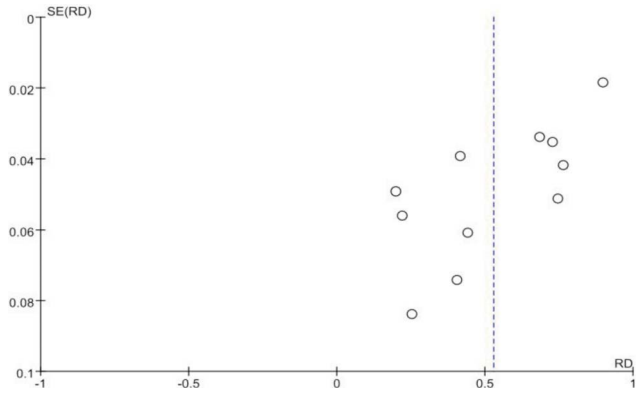

Figure 4. Funnel plot for assessing publication biases.

37–68%), indicating a high level. The negative physical, psychological and social effects that come from negative exercise are receiving increasing attention. At this stage, scholars have gradually realized that kinesiophobia, as a mediator variable, has a greater impact on the quality of life and the process of exercise rehabilitation of patients with CAD. Therefore, it's necessary to evaluate and manage kinesiophobia. The intervention strategy for kinesiophobia among CAD patients is at the initial stage. The intervention strategy based on cognitive behavioural therapy,[22] peer support education,[23] and mental health education have been proposed by scholars, but it still needs to be verified by targeted randomized controlled trials. It is also important to correctly implement systematic de-synthesis, which may require the cooperation of doctors, physiotherapists and psychologists.[24]

4.2. There is an absence of focalization of the current assessment instrument

Among the 11 studies, the most frequently employed tool was the TSK-SV Heart. This scale was developed by Back in 2012 based on the exercise fear scale for chronic pain patients. It is one of the most widely used tools for exercise kinesiophobia of heart disease. The Tampa Scale of Kinesiophobia (TSK) is specially developed for measuring the kinesiophobia of 75 kinds of chronic pain patients. The modified and adapted measurement attributes of the CAD Tampa Heart Scale seem to be reliable and effective for CAD. However, it was not originally developed for CAD. Most scholars in various countries have made appropriate modifications to make the scale more suitable for local use. Due to cultural differences, some contents cannot be measured, and the internal consistency of some factors is low. Ozyemisci designed a special kinesiophobia scale for patients with CAD, which demonstrated good reliability and validity but has not been popularized and used by others.[6]

Researchers can combine the latest research results at home and abroad and the kinesiophobia experience of CAD patients to develop more appropriate assessment tools.

4.3. More influencing factors of kinesiophobia among CAD patients still need to be further explored

The results of the subgroup analysis showed that the gender of patients had no relationship with the occurrence of kinesiophobia. Similarly, Knapi[18] also proved that gender was not a predictor of kinesiophobia. The present meta-analysis has indicated that different levels of age, education level, cardiac function grading and scales for kinesiophobia will affect the prevalence of kinesiophobia among CAD patients. The results of this study are similar to previous studies. Relevant research shows that age is positively related to the level of kinesiophobia.[25] Older patients may be more afraid of sports injuries due to poor health, so the level of kinesiophobia will be higher. Brunetti's research on acute cardiovascular disease also found that the lower the educational background, the higher the level of kinesiophobia.[26] Patients with higher education levels pay more attention to disease-related knowledge and can correctly understand the importance of CR. Meanwhile, health education provided by medical staff on sports needs to be further evaluated. A higher level of cardiac function grading results in higher kinesiophobia, different from triggered from the pain, CAD patients' kinesiophobia is more related to the fear of death, that is, the conditioned fear reflex induced by the ventral medial medulla to regulate vasoconstriction, heart rate and other reflexes under special circumstances.[27] The study also showed a small difference in CAD's kinesiophobia between acute and elective admission, suggesting that patients in remission should also be evaluated for kinesiophobia.

The evaluation of potential risk factors related to kinesiophobia among CAD patients showed that six factors were statistically significantly related: anxiety, experienced acute cardiovascular events, self-efficacy, the experience of pain within three months, low income, and co-morbidities. There is strong evidence that anxiety has an impact on kinesiophobia among chronic pain patients. This is meaningful in theory, because anxiety is the main emotional component of kinesiophobia, and it can be concluded that fear and the tendency to avoid certain situations are partly mediated by anxiety sensitivity. And in subsequent studies, anxiety is a predictor of kinesiophobia.[19] Experienced acute cardiovascular may bring cardiac arrhythmia, significantly reduced myocardial contractility, uncoordinated exercise, heart failure, stent blockage and other complications to CAD patients,[28] which weaken the psychological security line of patients, thus causing strong kinesiophobia. Studies have shown that kinesiophobia can indirectly impact sports activities through the mediation of sports self-efficacy.[29] Patients with higher self-efficacy are more willing to adhere to exercise behaviour under different environmental conditions. About one-third of CAD patients

will experience angina pectoris.[30–32] Our study also indicated CAD patients who have experienced angina are more likely to suffer kinesiophobia. This point coincides with the initial research point of kinesiophobia focusing on pain. And our present meta-analysis has demonstrated that CAD patients who had a lower income were more likely to have kinesiophobia. The lower the income, the more serious the kinesiophobia. It shows that cost is an important issue for patients to consider when they are ill. Therefore, patients are prone to a serious psychological burden, and patients will try to avoid exercise, leading to kinesiophobia. Besides, this study also found that CAD patients with comorbidities were more prone to occur kinesiophobia. The possible reason is that the existence of comorbidities affects the self-care ability of CAD patients and makes them have a dangerous perception.[33] However, the specific types of comorbidities in this study have not been distinguished, and further research should be explored.

5. Limitations

There were some limitations in this study. (1) Due to the characteristics of the individual rate meta-analysis, the included literature was highly heterogeneous. We use I^2 to deal with statistical heterogeneity. From the perspective of methodological heterogeneity, our meta-analysis showed significant heterogeneity and subgroup analysis failed to identify the source of heterogeneity, which may affect the accuracy of the meta-analysis. Considering the clinical characteristics of different patients, there may be many influencing factors. The studies we reviewed from Europe, Asia, and South America. There may be some differences between different continents, race, and ethnicity. Moreover, the medical level varies among different countries, and the cognitive concepts of exercise rehabilitation in patients with CAD may also lead to heterogeneity in research. The investigation environment varies, and the subjects of this study may be inwards, in rehabilitation clinics, or receiving telephone interviews, which also leads to the possibility of heterogeneity. We saw large differences in sample sizes and different measurement tools in the original studies, which also led to heterogeneity in the study results. (2) Some studies were not included in the literature selection process without complete data. And we could not control the effects of bias for the included studies in study design, selection, measurement, etc. (3) The search process is limited by the language, which may lead to incomplete searche and missing articles.

6. Conclusion

In conclusion, this systematic review found that the prevalence of kinesiophobia among CAD patients is 53%, indicating the it is needed to raise public awareness of kinesiophobia. Age, education level, cardiac function grade, anxiety, exercise self-efficacy, pain experience within three months, low income and comorbidities are the influencing factors of kinesiophobia. These findings suggest that future management of kinesiophobia in CAD should focus on the risk factors affecting this situation. The study on the risk factors of kinesiophobia of CAD can provide a theoretical basis for nurses to manage and prevent kinesiophobia. Further studies still need to explore the clinical variables that affect kinesiophobia in patients with CAD in the long-term continuous study with dynamic observation.

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