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Translate and psychometric evaluation of the scale of knowledge of cardiovascular risk factors and lifestyle after coronary event

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Abstract

Background Coronary heart disease (CHD) is a leading cause of morbidity and mortality worldwide. The level of self-care after coronary events is closely linked to understanding cardiovascular risk factors and adopting healthier lifestyle behaviors. An appropriate scale can help healthcare providers measure patients' understanding of cardiovascular risk factors and provide educational interventions. This study aimed to translate and conduct a psychometric evaluation of the scale of knowledge of cardiovascular risk factors and lifestyle after coronary events.

Methods A standardized guideline was followed for translating and culturally adapting the English version of the Scale of Knowledge of Cardiovascular Risk Factors and Lifestyle after Coronary Events. The study included 300 patients with CHD aged 23 to 90. Exploratory factor analysis (EFA) was used to analyze construct validity. Internal consistency was estimated with Cronbach's alpha (0.98), and the intra-class correlation coefficient (ICC) was used to assess scale stability (0.84).

Results A total of 300 patients with an average age of 56.6 ± 12.7 were evaluated. Exploratory factor analysis confirmed construct validity, resulting in a 4-factor model comprising knowledge of cardiovascular risks (7 items), knowledge of lifestyle recommendations (6 items), knowledge of cholesterol and blood pressure control (5 items), and knowledge of diabetes (3 items). Together, these factors explained 67.34% of the total variance. The Cronbach's alpha for internal consistency of the scale was 0.851. Additionally, scale stability, as measured by the test-retest method, was 0.84, which is acceptable according to the minimum value of 0.70.

Conclusion The translated Scale of Knowledge of Cardiovascular Risk Factors and Lifestyle after Coronary Events demonstrated strong psychometric properties among patients with CHD. The scale is both reliable and valid, providing healthcare providers with a practical tool to evaluate patient understanding and guide educational efforts aimed at enhancing post-coronary event self-care.

Clinical trial number Not applicable.

Keywords Coronary heart disease, Psychometric, Cardiovascular risk factors, Lifestyle, Scale, Internal consistency, Reliability

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Background

Coronary heart disease (CHD) is the leading cause of premature death globally [1]. In Iran, cardiovascular diseases, particularly CHD, account for the highest percentage of deaths (33 to 38%) among all age groups and genders, putting a significant burden on the healthcare system [2]. The onset of cardiovascular diseases in Iran occurs 7 to 10 years earlier than in other countries [3].

CHD occurs when there is a decrease in blood supply to the heart muscle due to coronary artery occlusion, leading to a range of conditions from unexplained ischemia to sudden death. Myocardial infarction and unstable angina fall within this spectrum [4]. CHD is influenced by a combination of modifiable and non-modifiable risk factors, including age, hypertension, diabetes, and family history, lack of exercise, smoking, diet, and stress [5]. As a preventable non-communicable disease, it is important to address these risk factors to reduce the incidence of CHD [6].

Cardiac rehabilitation is an outpatient secondary prevention program designed to reduce the burden of cardiovascular disease. Research has shown benefits of cardiac rehabilitation in reducing morbidity and mortality related to cardiovascular diseases [7]. Patient education is an important component of cardiac rehabilitation that focuses on self-management behaviors to reduce risk factors and prevent future cardiac events [8]. Educational interventions for cardiac patients have been associated with promoted preventive behaviors, lower healthcare costs, improved quality of life, and reduced morbidity and mortality [9].

According to the Health Belief Model, knowledge is a powerful influencer of healthy lifestyles [10]. Lifestyle encompasses a broad range of social values, attitudes, and activities that are developed during socialization. These behaviors include physical activity, exercise, sleep, rest, weight control, smoking, alcohol consumption, and stress management. The American Heart Association identifies lifestyle as a key predisposing factor for various diseases and mortality, estimating that approximately 70% of all physical and mental illnesses are linked to lifestyle choices [11, 12].

Research suggests that teachable moments, which are opportunities for individuals to make positive lifestyle changes, often occur after significant life events. Following a cardiac event, patients are more motivated to improve their knowledge and modify their lifestyle [13]. Studies have shown a strong correlation between understanding risk factors and making lifestyle changes in cardiac patients [14, 15]. However, many cardiac patients lack sufficient knowledge of risk factors and the importance of lifestyle modifications [16, 17].

Educational and rehabilitation interventions for cardiac patients necessitate evaluating patients' knowledge, the efficacy of education, attitude changes, and identifying individual needs. Questionnaires are crucial tools for assessing knowledge [18].

Several questionnaires have been developed and validated to assess individuals' knowledge of cardiovascular risk factors, such as the Mogrel Cardiac Prevention Questionnaire (MICRO) [19], the Cardiac Rehabilitation Barriers Scale (CRBS) [20], the Coronary Artery Disease Education Questionnaire (CADE) [21], and the Information Needs in Cardiac Rehabilitation Scale (INCR) [22, 23]. These tools focus on general knowledge of cardiovascular disease but may not specifically address modifiable risk factors and lifestyle in individuals who have experienced a cardiac event and are in teachable moments. Healthcare professionals have recognized the importance of designing specific tools to evaluate the knowledge of myocardial infarction patients regarding cardiovascular risk factors and lifestyle, as well as to evaluate the impact of educational interventions [1, 24]. To address this need, Bernal James et al. (2020) developed a reliable and valid 24-item scale for this purpose [1].

Patient education is crucial in cardiovascular patient care and rehabilitation to improve self-care behaviors [7]. Healthcare providers play a key role in educating patients and their families. Appropriate tools are needed to assess patients' knowledge of cardiovascular risk factors, lifestyle, and the effectiveness of educational interventions. Cultural and socioeconomic differences in different regions necessitate the validation of these tools. A review revealed that the scale developed in Iran has not been translated and validated.

Given the high prevalence of cardiovascular diseases, particularly coronary heart disease (CHD), in Iran, the younger age of onset compared to other countries, and the critical role of education in cardiac rehabilitation and secondary prevention, the use of accurate and culturally adapted tools to assess patients' knowledge of risk factors and lifestyle is essential. The instrument developed by Bernal James and colleagues, with its focus on the sensitive post-cardiac event period (teachable moment) and its simple, easy-to-understand items, holds strong potential for delivering targeted and effective education. Since this tool has not yet been translated to Persian language or psychometrically evaluated in Iranian culture, and considering that cultural and socioeconomic differences may impact its applicability, its translation and validation in the Iranian context is a necessary step toward enhancing patient education, self-management, and clinical outcomes in cardiac patients. Therefore, the study aims to translate and psychometrically evaluate the knowledge scale of cardiovascular risk factors and lifestyle after a coronary event. To our knowledge, there are currently no validated questionnaires testing the knowledge of CVRFs

and healthy lifestyles in Iranian people who have suffered from a coronary event.

In a study conducted in Sweden as part of the EUROASPIRE II study in patients who had experienced a coronary event 6 months earlier and had attended a cardiac rehabilitation program, a 28-item questionnaire was designed to determine whether knowledge of CVRFs was related to changes in lifestyle and adherence to treatment. The questionnaire included questions about general knowledge of CVRFs, specific knowledge of whether they thought that these factors affected their CHD, their prescribed treatment, and their adherence to it [20]. This questionnaire was later validated [21], obtaining reliability measured by a Cronbach's alpha score of 0.73, although the authors did not analyze the instrument's construct validity. Neither did this study establish a global score for the questionnaire nor cut-off points for levels of knowledge. The authors concluded that a correlation existed between specific knowledge of coronary heart disease itself and self-reported changes in lifestyle and treatment compliance.

Methods

Design and participants

This research is a methodological study of instrumental psychometrics. The focus of methodological research is determining the validity and reliability of measurement tools [25]. This study, conducted from 2023 to 2024, focused on translation and psychometric properties. It was approved by the Ethics Committee of Kashan University of Medical Sciences.

Sample size

The study involved 300 patients with confirmed coronary artery disorders, who were selected through convenience sampling from two hospitals in Kashan, namely Beheshti Hospital and Yasrebi Hospital. The sample size for assessing face validity is 10 to 20 individuals from the target group, and for examining content validity, 8 to 12 experts [26]. In this study, 10 patients with myocardial infarction were used to assess quantitative and qualitative face validity, and 10 experts in the fields of nursing, cardiology, and instrument design were used to assess quantitative and qualitative content validity. In methodological studies, the number of samples is 5–10 equal to the number of items in the instrument [26]. Some researchers suggest 100–300 samples for psychometric and construct validity studies of the instrument [27]. In this study, 300 samples were included for construct validity, ceiling and floor effects, and internal consistency of the scale.

Inclusion criteria included Iranian patients with coronary artery disorders who exhibit positive troponin tests, ST elevation changes on electrocardiograms, chest pain, or other angina symptoms such as shortness of breath during physical activity, and whose coronary artery disorders have been confirmed by a cardiologist. Participants aged 18 years and older, no cognitive impairment (AMT score of eight or higher), and willingness to participate.

Questionnaire

The study utilized the Scale of Knowledge of Cardiovascular Risk Factors and Lifestyle after a Coronary Event, developed by Bernal Jimenez et al. (2022) in Spain. The scale was psychometrically validated on 113 patients with coronary artery disease after successful stenting. It consists of 24 items across five subscales: familiarity with lifestyle habits, knowledge of cholesterol and blood pressure control, familiarity with lifestyle recommendations, knowledge of cardiovascular risks, and familiarity with diabetes. Each item is rated on a 5-point Likert scale (1 to 5), with a total score ranging from 24 to 120. A higher score indicates greater knowledge. The scale's reliability, as reported by the developers, is high with a Cronbach's alpha of 0.88. The English scale was translated into Persian and underwent psychometric evaluation [1].

Scale translation

After obtaining written permission from the scale developers, two translators back translated the scale into Persian Language using the guidelines outlined by Beaton et al. (2000). A specialized committee reviewed the pre-final Persian version with 20 patients with myocardial infarction to ensure Iranian cross-cultural equivalence and evaluated the final stage of the adaptation process [28]. The psychometric properties of the Persian version scale were then assessed for face validity, content validity, construct validity, and reliability.

Face validity

The translated scale (Persian version) was evaluated for face validity through a qualitative and quantitative approach. In the qualitative assessment, 20 patients provided feedback on the scale to identify any ambiguity or comprehension issues, which were then addressed by the research team. In the quantitative assessment, the same patients rated the importance of each item on a 5-point Likert scale. Items with an impact score above 1.5 were deemed appropriate for further analysis and were kept for the study [29]. The impact score index for each item was calculated using the following formula: Impact score = Frequency (%) × Importance.

Content validity

The content validity ratio (CVR), content validity index (CVI), and modified kappa statistic were used to assess content validity.

The scale was evaluated by 10 experts, including two cardiologists, six nursing faculty members specializing

in scale development, and two experienced nurses in the cardiac intensive care unit. They rated each item on a 3-point Likert scale: absolutely necessary, useful but not necessary, and not necessary [30]. The CVR of each item was calculated based on the Lawshe table, with a higher value indicating greater expert agreement on the item's necessity [31].

$$CVR = \frac{\left(n_e - N/2\right)}{\left(N/2\right)}$$

For the CVI assessment, the same experts rated the relevance of each item on a 4-point Likert scale: completely relevant, relevant, somewhat relevant, and irrelevant. Each item was scored, with a score above 79% deemed appropriate, a score between 70 and 79% requiring revision, and a score below 70% resulting in item removal. The overall CVI value for the scale was calculated by summing the CVIs of each item and dividing by the total number of items [32].

CVI = Number of experts who agree with phrases 3 or 4/ total number of experts.

The scale's construct validity

To ensure construct validity, the researcher visited the cardiac ward of Shahid Beheshti Hospital in Kashan after obtaining permission from the hospital managers. Eligible patients were selected and provided with detailed explanations about the study's purpose and how to complete the scale. Written consent was obtained from each patient before they were discharged. Upon discharge, patients received a Persian version of the Scale of Knowledge of Cardiovascular Risk Factors and Lifestyle after Coronary Event, along with a questionnaire gathering demographic information and medical history, including age, sex, marital status, education, occupation, income status, place of residence, history of hypertension, high cholesterol, diabetes, tobacco use, and body mass index. For illiterate or poorly educated patients, the researcher read the questionnaire items aloud and recorded their responses.

Scale reliability

The scale reliability was assessed using Cronbach's alpha on a sample of 300 participants. The values of these coefficients range from zero to one, with a higher value indicating a stronger correlation between the items. A coefficient above 0.7 is considered acceptable [33]. A test-retest method was used to evaluate the stability of the Persian version of the scale. Ten patients completed the scale again after two weeks, and the intra-cluster correlation coefficient (ICC) was calculated [34]. A coefficient above 0.6 was acceptable [30]. The standard error of measurement (SEM) and the smallest measurable change (SDC) were also determined. Ceiling and floor effects occur when more than 15% of respondents achieve the highest or lowest possible score, respectively. These effects suggest inadequate content validity of the scale [35]. The study assessed the percentage of participants with the highest and lowest scores to determine the presence of ceiling and floor effects.

Statistical analysis

The data analysis was conducted using SPSS 16. Normality of quantitative data was assessed using the Kolmogorov-Smirnov test. Descriptive statistics such as central and dispersion indices were used for quantitative variables, while absolute and relative frequencies were used for categorical variables. The suitability of the data for factor analysis was determined through the Kaiser-Mayer-Olkin (KMO) test and Bartlett's test of sphericity. Construct validity was assessed using exploratory factor analysis. SEM was calculated based on the intra-cluster correlation coefficient (ICC) using $SEM = SD \times (1\text{-}ICC)$. The smallest measurable change (SDC) was estimated using $SDC = 1.96 \times \sqrt{2} \times SEM$. A significance level of < 0.05 was considered for all tests.

Results

The demographic and clinical characteristics of patients with CHD are summarized in Table 1.

Face validity

The face validity results indicated that all items had an impact factor exceeding 1.5. Additionally, eight items were revised for clarity, difficulty, and ambiguity (Table 2).

Content validity

The content validity of the scale revealed that all items had a CVR value greater than 0.67, indicating good content validity. No items were removed during this stage. Three items had an I-CVI of 0.75, which was reviewed and revised by the research team. The remaining items had an I-CVI score of 0.80 or higher. The scale-content validity index (S-CVI) was 0.937, indicating strong content validity. Based on experts' recommendations, four items were revised to align with Iranian culture and the Persian language Table 2).

The scale's construct validity

An exploratory factor analysis was conducted to assess the construct validity of the questionnaire on patients with coronary heart disease (CHD) ($n = 300$). Principal components with eigenvalue < 1 were used to explain the total variance. The analysis resulted in a 4-factor scale with 21 items based on the KMO (0. 82). Bartlett's test

Table 1 Demographic characteristics of the older adults ($n=300$)

quality variables		Participants $n=300$ (%)
Gender	Female	131(43.7)
	Male	169(56.3)
Marital status	Married	273(91)
	Single (single, divorced, widowed)	27(9)
Education	Illiterate	50(16.7)
	High school or lower	144(48)
	Diploma	57(19)
	University	49(16.3)
Occupation	Self-employee	89(29.7)
	Retired	49(16.3)
	Housekeeper	116(38.7)
	State employee	46(15.3)
Income	Sufficient	149(49.7)
	Insufficient	151(50.3)
place of residence	Urban	227(75.7
	Rural	73(24.3)
History of hypertension	Yes	134(44.7)
	No	166(55.3)
History of diabetes	Yes	106(35.3)
	No	194(64.7)
History of hyperlipidemia	Yes	105(35)
	No	195(65)
Smoking history	Yes	68(22.7)
	No	232(77.3)
Quantity variables	Rate	Mean ± SD
Age	23–90	56.6 ± 12.7
BMI*	17- 47.1	26.7 ± 4

*Body mass index

of sphericity confirmed the adequacy of the sample size and the correlation between the items ($\chi 2 = 4506.37$, $P < 0.0001$). Three items were eliminated during the analysis, two due to cross-factor loadings and one due to a factor loading below 0.4. A minimum factor loading value of 0.40 was used to maintain the items in the extracted factors (Williams et al., 2010). (Table 3). In construct validity, cross-factor loadings refer to the degree to which an item loads onto multiple factors. Ideally, cross-loadings should be as low as possible to ensure that each item is strongly associated with only one factor. While there isn't a universally fixed threshold, many researchers suggest that cross-loadings should be below 0.3 to avoid significant overlap between factors. Additionally, the difference between an item's primary loading and its cross-loading should typically be at least 0.2 or higher to confirm discriminant validity. The sample size for conducting construct validity is estimated based on the number of items in each tool. Researchers generally consider 3 to 10 participants per item to be appropriate. In addition, Williams et al. (2010) considered a sample volume of 300 as suitable for EFA.

The minimum factor loading was 0.4. Factor loadings less than 0.4 are not included in the table. * Items 15 were removed due to factor loadings less than 0.3, items 14 and 23 due to cross factor loadings.

The cumulative variance of the scale explained by the 4 factors was 67.34%. The factors identified were: familiarity with heart disease risk factors (7 items), familiarity with health recommendations (6 items), knowledge of lipid and blood pressure control (5 items), and familiarity with diabetes (3 items). The mean score of patients' knowledge of cardiovascular risk factors and lifestyle after coronary event in Kashan was 92.75 ± 7.69. The ceiling and floor effect analysis showed maximum and minimum possible scores of 0.6 and 0.3 on the scale, respectively.

Scale reliability

The scale demonstrated high internal consistency with a Cronbach's alpha coefficient of 0.949, indicating strong reliability. Values > 0.70 suggest inconsistency, while values between 0.70 and 0.90 are considered excellent, and values above 0.90 may indicate redundancy of items in the scale [33] (Table 2).

The Intraclass Correlation Coefficient (ICC) of 0.84 was calculated using the two-way mixed-effects model and the absolute agreement. The scale's reliability was excellent (ICC = 0.84, 95% CI = 0.82–0.87). An ICC value above 0.8 is considered excellent, between 0.6 and 0.79 is considered moderate, and below 0.4 is considered poor (Kottner et al., 2011). The Standard Error of Measurement (SEM) value of ± 2.72 suggests that individual scores may vary within this range upon repeated testing. Additionally, the Smallest Detectable Change (SDC) value of 7.5 with 95% confidence level indicates the minimum measurable change by the Scale of Knowledge of Cardiovascular Risk Factors and Lifestyle after Coronary Event in patients with CHD (Table 2).

Discussion

This study translated and psychometrically evaluated the 24-item scale designed to assess knowledge of cardiovascular risk factors and lifestyle after a coronary event.

The scale's structure encompassing four critical domains—Knowledge of cardiovascular risks, Knowledge of lifestyle recommendations, Knowledge of control of cholesterol and blood pressure, and Knowledge of diabetes mellitus reflects the multifaceted nature of post-coronary event management.

The importance of accurate and comprehensive knowledge of the disease and its risk factors is essential for making health care decisions in people who have experienced a coronary event is clear to every person [36]. This

Table 2 Development of candidate items

Stage 1. Questionnaire construction		
scale of knowledge of CVRFs and lifestyles by Bernal-Jiménez et al(2022)	**Translation of the tool with the approach of Beaton et al. (2000)**	**24 items**
Patent with CHD **evaluation** (***n*** **= 20)**	**Face validity**	**1) Qualitative face validity**: Eight items were modified for clarity, difficulty, and ambiguity. **2) Quantitative face validity**: Impact score of all items greater than 1.5 and all the items remained.
Expert evaluation (***n*** **= 12)**	**Content validity**	**1) Content Validity Ratio (essential)**: All of items had CVR > 0.67and none of the items were deleted. † **2) Content Validity Index** (relevancy): I-CVI†† value of 3 items = 0.75 and were revised. S-CVI/Ave = 0.93. †††
Main study (***n*** **= 300)**	**Structural validity**	4-Fctor model - Knowledge of cardiovascular risks (7 -items) - Knowledge of lifestyle recommendations (6–items) - Knowledge of control of cholesterol and blood pressure (5 items) - Knowledge of diabetes mellitus (3–items) knowledge of CVRFs and the recommended lifestyle = 21 items (final version)
	Ceiling and floor effect	1% had the minimum possible score (Min score = 21). 2% the maximum score possible (Max score = 105).
Scale' Reliability and stability		
The subsample (***n*** **= 14)**	**Internal consistency**	Cronbach's alpha = 0.85
The subsample (***n*** **= 14)**	**Test-retest reliability**	ICC = 0.84, 95% CI = 0.82–0.87. †††† SEM agreement = 2.72. ††††† SDC_{95} = 7.5. ††††††

†*CVR*: Content Validity Ratio, ††*I-CVI*: Item Content Validity Index, †††*S-CVI/Ave*: Scale Content Validity Index/Average, ††††*ICC*: Intra class Correlation Coefficient, †††††*SEM agreement*: Standard Error of Measurement, ††††††SDC_{95}: Smallest Detectable Change

knowledge helps patients manage risk factors and adopt behaviors that promote cardiovascular health [36, 37]. Deficiencies in knowledge can lead to poor adherence, increased risk of recurrent coronary events, and diminished quality of life [38]. In addition, people should be motivated to participate actively in following a healthy lifestyle [39].

The four domains of the scale align with established guidelines for cardiac rehabilitation and secondary prevention. For instance, knowledge of a healthy lifestyle directly addresses the need for dietary modifications, physical activity, and smoking cessation, all of which are cornerstone components of cardiac rehabilitation programs [40]. In addition, knowledge of control of cholesterol and blood pressure reflects the importance of pharmacological management and monitoring of coronary event risk factors. It is also crucial to include knowledge of diabetes, given its strong association with cardiovascular disease and its impact on disease prognosis [41].

The high validity and reliability of the scale demonstrate that the translated scale is a vigorous tool for measuring relevant knowledge in patients with a coronary event [30].

The findings regarding the Persian version of the Scale of Knowledge of Cardiovascular Risk Factors and Lifestyle after Coronary Event highlight its robust psychometric properties, particularly in terms of face and content validity. A study on the Persian version of the Coronary Artery Disease Education Questionnaire (CADE-Q) also emphasized cultural adaptation and psychometric evaluation. Similar to the scale in current study, the CADE-Q underwent forward-backward translation and expert review. However, while the CADE-Q focused on broader educational aspects, the scale of knowledge of cardiovascular risk factors and lifestyle after a coronary event provides a more targeted assessment of specific risk factors and lifestyle knowledge [42]. In contrast, KAP Questionnaire included additional dimensions like attitudes and practices, whereas the Persian scale focuses solely on knowledge [43]. The findings reinforce the importance of cultural adaptation and rigorous validation in developing health assessment tools. The Persian version of the scale serves as a model for creating reliable and culturally relevant instruments, which can be used to identify knowledge gaps and design targeted interventions. This approach can be replicated in other regions to address the unique needs of diverse populations.

The construct validity findings of the Persian version of the scale highlight its robustness in capturing key dimensions of cardiovascular health knowledge. The identification of four factors—familiarity with heart disease risk factors, health recommendations, knowledge of lipid and blood pressure control, and familiarity with diabetes—demonstrates the scale's comprehensive approach

Table 3 Factor analysis and internal reliability of scale

	Item of knowledge of CVRFs and the recommended lifestyle	Factors Loadings			
No		**1**	**2**	**3**	**4**
1: Knowledge of cardiovascular risks					
Q18	Stress is harmful to cardiovascular health.	0.942			
Q6	High blood cholesterol increases the risk of cardiovascular disease.	0.934			
Q2	High blood pressure increases the risk of cardiovascular diseases.	0.814			
Q13	Tobacco is harmful to cardiovascular health.	0.724			
Q24	Lack of physical activity increases the risk of cardiovascular diseases.	0.706			
Q9	Overweight and obesity increase the risk of cardiovascular diseases.	0.690			
Q7	Weight gain has little influence on cardiovascular health.	0.615			
	2: Knowledge of lifestyle recommendations				
Q16	Stress has little effect on cardiovascular health		0.950		
Q19	The type of food consumed has a slight effect on cardiovascular health.		0.904		
Q20	Eating fresh food is better than ready-made food (canned foods and fast foods).		0.897		
Q17	Doing exercise reduces stress.		0.845		
Q21	Daily consumption of fruits and vegetables is recommended for cardiovascular health.		0.721		
Q22	Every person should walk for 30 to 45 min daily.		0.718		
3: Knowledge of control of cholesterol and blood pressure					
Q8	People don't need to measure their body weight regularly.			0.867	
Q4	All adults should have regular blood tests to control blood cholesterol levels.			0.847	
Q5	Adherence to diet and physical exercise helps to lower blood pressure.			0.838	
Q1	Only adults with high blood pressure should measure their blood pressure regularly.			0.759	
Q3	Adherence to diet and physical exercise helps to lower blood cholesterol levels.			0.469	
	4: Knowledge of diabetes mellitus				
Q12	Diet is part of the treatment of diabetes.				0.897
Q10	Losing weight in obese people helps control blood sugar.				0.884
Q11	High blood sugar very slightly increases the risk of cardiovascular diseases.				0.655
		1	2	3	4
Eigenvalue		5.49	4.1	2.83	1.73
Percentage of variance explained		21.36	20.59	14.71	10.68
Total percentage of the factor model		67.34			
Cronbach's alpha per factor		0.88	0.92	0.85	0.79
*ICC		0.88	0.91	0.84	0.78

*Intraclass Correlation Coefficient

to assessing critical areas of health literacy. The explanation of 67.34% of the total variance further underscores the scale's effectiveness in measuring these constructs. The removal of three items with factor loadings below 0.4 reflects a rigorous validation process. This ensures that only items with strong correlations to the underlying constructs are retained, enhancing the scale's reliability and validity. The comparison with Bernal-Jimenez et al.'s (2022) study highlights the influence of cultural and lifestyle differences on health assessments [1]. Variations in dietary preferences and lifestyle habits among Iranian individuals likelynecessitated the exclusion of certain items, emphasizing the importance oftailoring health assessment tools to specific populations.

The high validity and reliability of the scale demonstrate that the translated scale is a vigorous tool for measuring relevant knowledge in patients with a coronary event. Both of these parameters arecrucial for ensuring the scale's utility in both clinical and research settings. Validity indicates that the scale accurately measures the intended construct (knowledge of cardiovascular risk factors and lifestyle), while reliability signifies the consistency and stability of the measurement overtime. These psychometric properties are essential for generating meaningful and trustworthy data.

Future studies could explore the scale's applicability indiverse populations with varying cultural backgrounds. Additionally, longitudinal studies could examine the relationship between knowledge levelsand long-term clinical outcomes. Investigating the impact of educational interventions on knowledge acquisition and subsequent behavioral changes would also be valuable.

The absence of ceiling or floor effects in the Persian version of the scale is a significant finding, as it indicates that the scale effectively captures the full range of variability in patients' knowledge and understanding. This ensures that the scale can differentiate between individuals with the highest and lowest levels of knowledge, enhancing its

reliability and utility. Furthermore, the absence ofthese effects makes the scale suitable for diverse patient groups, as it can effectively differentiate between varying levels of knowledge and understanding. In Comparison with Other Studies, The Persian version of the Cardiac Rehabilitation Barriers Scale (CRBS) also demonstrated strong psychometric properties, including the absence of ceiling or floor effects. However, while the CRBS focuses on barriers to cardiac rehabilitation, the Persian scale assesses knowledge of cardiovascular risk factors and lifestyle, offering a broader perspective [44].

Conclusions

The study confirmed the translation and psychometric properties of the Scale of Knowledge of Cardiovascular Risk Factors and Lifestyle after Coronary Event, which consists of 21 items and four subscales. These subscales include familiarity with heart disease risk factors, health recommendations, lipids and blood pressure control, and familiarity with diabetes. The scale, measured on a 5-point Likert scale, explained 67.34% of the total variance. Therefore, using this valid, reliable and adaptive tool for Iranian patients is recommended to evaluate patient's knowledge about risk factors and lifestyle in coronary event and allowing personalized interventions to improve self-care. It also helps managers in providing tailored interventions to improve quality care and evidence based care in these patients. In addition, to improve and address potential shortcomings of the scale, it is recommended that the psychometric properties of the scale be analyzed and studied across different regions of the country and among various population groups.

Abbreviations

CHD	Coronary heart disease
EFA	Exploratory factor analysis
ICC	Intra-class correlation coefficient
MICRO	Mogrel cardiac prevention questionnaire
CRBS	Cardiac rehabilitation barriers scale
CADE	Coronary artery disease education questionnaire
INCRS	Information needs in cardiac rehabilitation scale
CVR	Content validity ratio
CVI	Content validity index
SEM	Standard error of measurement
SDC	Smallest measurable change
KMO	Kaiser-mayer-olkin
S-CVI	Scale-content validity index
BMI	Body mass index

Supplementary Information

The online version contains supplementary material available at https://doi.org/10.1186/s12872-025-04819-0.

Supplementary Material 1

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Author contributions

F.S.I-A., T.S.M. and M.S. did the conception and design of the study, and T.S.M. did data collection. Statistical analysis by F.S.I-A. Interpretation of data by F.S.I-A and M.S. Writing of the manuscript by T.S.M. All authors approved the final version of the article for submission.

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Data availability

Data is provided within the manuscript.

Declarations

Ethics approval and consent to participate

The study was conducted in conformity with the Helsinki Declaration on Human Experimentation, 1964, with subsequent revisions, latest Seoul, October 2008. Ethical approval was obtained from the Ethics and Protocol Review Committee of Kashan University of Medical Sciences (Protocol ID number: IR.KAUMS.NUHEPM.REC.1402.056). Written informed consent was obtained from all participants after a thorough explanation of the procedures involved.

Consent for publication

Not applicable.

Competing interests

The authors declare no competing interests.

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