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Examination of the Psychometric Properties of the Persian Version of the Cardiac Health Behavior Scale

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ABSTRACT

Background: Cardiovascular Disease (CVD) is a common chronic disease with a high mortality rate. Patients with CVD need to engage in cardiovascular health behaviors to prevent the complications of the disease.

Objective: The present study aimed to examine the psychometric properties of the Persian version of the Cardiac Health Behavior (CHB) scale among patients with CVD.

Methods: In this methodological study, a total of 325 patients with CVD were selected from public places in Tehran using convenience sampling. The instrument was translated based on the World Health Organization's (WHO) guidelines. The face, content, and construct validities were examined using exploratory and confirmatory factor analyses. The reliability of the scale was also assessed using McDonald's omega and Cronbach's alpha coefficients. Data analyses were performed using Lisrel 8.8 and SPSS 20 software.

Results: Using Exploratory Factor Analysis (EFA), the five following factors were extracted: health responsibility, dietary habits, physical activities, smoking cessation, and stress management. These factors explained 64.96% of the total variance of cardiac health behavior. In Confirmatory Factor Analysis (CFA), the goodness of fit of the five-factor model for cardiac health behavior was confirmed based on standard indices (CFI = 0.92, IFI = 0.92, PNFI = 0.75, and RMSEA = 0.089). Using Cronbach's alpha coefficient, the internal consistency of the total scale was found to be 0.887.

Conclusion: The five-factor model of cardiac health behavior showed good validity and reliability in patients with CVD. According to its good psychometric properties, the Persian version of the CHB scale reflected the importance of health behaviors in the daily activities of the patients with CVD.

1. Background

Cardiovascular Disease (CVD) is the cause of one-third of global deaths (1). CVD, cancer, and diabetes are the first three causes of mortality globally (2). CVD and unintentional accidents are the two leading causes of death in Iran (3). Given the serious complications of CVD, most healthcare providers have focused on proving care for the patients in order to manage the risks of the disease (4). The American Heart Association (AHA) has introduced seven risk factors, including smoking, Body Mass Index (BMI), physical activity, diet, blood pressure, cholesterol, and blood glucose, to assess cardiac health and reduce CVD mortality (5). Patients with CVD are encouraged not to smoke, to increase their physical activity, not to consume alcohol or consume it moderately, to control their weight, to limit their consumption of fat and salt, and to eat more fruits, vegetables, fish, and high-fiber foods (6). However, many patients may not receive proper health recommendations for different reasons, such as lack of proper communication skills, low education, or having wrong beliefs, and may not be able to change their behaviors (7). In contrast to such factors as age, gender, and genetic predisposition, the CVD risk factors that are related to lifestyle can be modified using

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proper interventions (8). Behavior change is an effective strategy that helps people with CVD control their chronic disease or disability (9). CVD prevention depends on the patients' healthy behaviors. Indeed, many diseases that cause premature death can be managed through behavior change (10).

Healthcare providers need valid and reliable instruments to assess health behavior outcomes in patients with CVD. The Cardiac Health Behavior (CHB) scale is a useful instrument for assessing health behaviors in patients with or at risk of developing CVD. It contains 21 items divided into five dimensions, including health responsibility, physical activity, eating behaviors, stress management, and smoking cessation. The CHB scale was first developed in 2000 to assess health behaviors in patients with CVD participating in cardiac rehabilitation programs. Despite being previously used in several studies, the psychometric properties of the CHB scale had not been assessed until 2017 (11). It has been recommended that any measuring instrument should be validated before use, so that reliable evidence could be provided (12).

2. Objectives

The present study aims to explore the psychometric properties of the Persian version of the CHB scale among patients with CVD.

3. Patients and Methods

This methodological study was conducted in Tehran in 2018. The minimum sample size required to perform factor analysis is 3 - 10 participants per item (13). Therefore, a total of 125 patients with CVD were selected from public places in Tehran using convenience sampling. Having been diagnosed with CVD and having the ability to provide information or complete the questionnaire items were the inclusion criteria.

The data were gathered using a demographic questionnaire and the CHB scale whose items were rated on a five-point Likert-type scale ranging from one (rarely) to four (never). The original CHB scale was translated into Persian by two translators who had a good command of both Persian and English using the forward/backward translation method. Then, the two generated translations and their items were semantically compared and a single scale was generated. In the next step, in order make sure that the Persian version was matched with the original version of the scale and that the items were clear enough, the translated scale was back-translated into English by two other translators. After making some modifications, a single English version was developed that was also confirmed by the original developer (14). In order to assess the psychometric properties of the scale, face validity, content validity, and construct validity (factor analysis and discriminant validity) were assessed as follows:

3.1. Face Validity

In order to examine the face validity, the scale was administered to 10 patients with CVD and they were asked to provide feedback on how congruent, related, ambiguous, or problematic the items were for them. Accordingly, the necessary modifications were made to the scale.

3.2. Content Validity

Given that the CHB scale is a culture-based instrument, Content Validity Index (CVI) was used based on Polit and Beck's suggestions (2017) (15). In this context, the experts were asked to indicate how culture-related the items were (1. highly culturally related, 2. culturally relevant, 3. slightly culturally related, and 4. not culturally related). CVI was calculated according to the proportion of the experts who selected the first two options. Then, the inter-rater agreement was assessed using Cohen's kappa index. This index ranges from -1 to +1 and has been suggested as a supplementary method for CVI. Kappa values ranging from 0.4 to 0.59, 0.6 to 0.74, and above 0.74 have been considered as poor, good, and excellent, respectively (16).

3.3. Construct Validity

First, latent variables were extracted using EFA. Then, Kaiser-Meyer-Olkin (KMO) and Bartlett's test of sphericity were calculated. KMO values between 0.70 and 0.80 and between 0.80 and 0.90 were considered as good and excellent, respectively (17). The factors were extracted by the maximum likelihood estimation using the Varimax rotation with the null hypothesis stating that the factors were independent.

Data analysis was performed using the SPSS software, version 20 (SPSS, Inc., Chicago, Illinois). The number of components was determined based on eigenvalues above one and using a scree plot. A minimum cut-off point of 0.40 was used for determining the variables loaded by each item (the items with absolute loading values of 0.4 or above were considered as appropriate). Using CFA, the construct validity of the scale was assessed to find out how well the items represented their respective dimensions. In this step, a total of 200 patients with CVD were examined. According to the experts' suggestions, the following fit indices were assessed: $\chi 2$ goodness-of-fit index (CMIN), Root Mean Square Error of Approximation (RMSEA), Comparative Fit Index (CFI), Normed Fit Index (NFI), and Adjusted Goodness of Fit Index (AGFI) (18, 19). These analyses were performed using Lisrel 8.8 (Scientific Software International, Cook County, Illinois).

3.4. Reliability

The reliability of the scale was assessed using two methods: McDonald's omega and Cronbach's alpha coefficient. An alpha coefficient of 0.70 or higher was considered to be acceptable (19). In addition, stability over time was assessed using the test-retest reliability method and Intra-class Correlation Coefficient (ICC) with the two-way mixed effects model and absolute agreement with 95% confidence interval (an ICC of 0.75 or higher was considered to be acceptable). McDonald's omega coefficient was calculated using the following formula: $\Omega = 1 - [\![a - \sum h_i']/[a + 2b]\!]$, in which 'a' represented the number of items in the factor, 'h_i'' was the total communality, and 'b' was the total factor loadings of the items in the factor. The omega coefficient could range from 0 to 1 (20).

3.5. Ethical Considerations

The present article was extracted from a research project at Kurdistan University of Medical Sciences (IR.MUK.REC.1396/378). Before being included in the study, the participants were informed about the study objectives and their consents were obtained. In addition, they were reassured that their personal information would remain completely confidential.

4. Results

This methodological study was conducted in Tehran in 2018. The sample included 72 males and 53 females with CVD with the mean age of 58.4 ± 11.6 years. The majority of the sample were married (70.4%), had high school education (28%), and had an average financial status (57%). The demographic characteristics of the participants have been presented in Table 1.

The face and content validities were assessed by examining and applying the opinions of the patients with CVD and the qualified experts. In item 3, the term "experts" was replaced with "nurses and physicians". In item 18, "I use stress management strategies" was changed to "I can manage my stress". In item 20, "I avoid second-hand smoke" was changed to "I avoid sitting near smokers". Means and standard deviations of the total scores of the CHB scale and its dimensions have been presented in Table 2.

In the quantitative content analysis based on CVI, none of the items was removed. Means and standard deviations of the total scores of the CHB scale and its dimensions have been reported in Table 2. The score of each dimension was calculated based on the sum of the scores of the same items. The overall score was also calculated based on the sum of the scores of the dimensions. A higher score indicated better cardiac health behavior.

In order to test how much of the variance of the data was explained by the factors and to assess how suited the data were for factor analysis, Bartlett's test of sphericity and KMO test of sampling adequacy were used. The KMO was 0.881 and Bartlett's test was significant ($P < 0.001$). Therefore, based on the sampling adequacy and the correctional matrix of the sample, performing the factor analysis was justifiable. In EFA, five factors were extracted, including health responsibility, dietary habits, physical activity, smoking cessation, and stress management. These five factors with eigenvalues of 6.53, 2.81, 1.92, 1.32, and 1.04, respectively explained 64.96% of the total variance of cardiac health behavior. It should be noted that the factors were named based on the names in the main tool and the items arrangement (Tables 3 and 4).

CFA was performed on 200 patients with CVD from Tehran who were selected using convenience sampling. The results of chi-square test were acceptable ($\chi2 = 465.96$, $df = 179$; $P < 0.001$). Other indices also confirmed the fitness of the final model to the data (CFI = 0.92, Incremental Fit Index (IFI) = 0.92, Parsimonious Normed Fit Index (PNFI) = 0.75, and RMSEA = 0.089). Based on the five-factor model from the EFA, the results of CFA indicated that the model had a good fit to the data (Table 5 and Figure 1).

The Cronbach's alpha and McDonald's omega coefficients were used to estimate the reliability of the scale and its components. The alpha coefficient was found to be 0.887

Table 1. The Mean Cardiac Health Behavior Score based on Demographic Characteristics

Variable		Frequency (%)	Mean ± SD
Gender	Male	72 (57.6%)	50.25 ± 10.97
	Female	53 (42.4%)	56.54 ± 11.74
Marital status	Married	88 (70.4%)	53.51 ± 11.43
	Single	37 (29.6%)	51.51 ± 12.31
Occupation	Unemployed or homemaker	52 (41.6%)	51.76 ± 10.70
	Civil servant	26 (20.8%)	57.57 ± 14.19
	Self-employed	34 (27.2%)	49.17 ± 10.98
	Other	13 (10.4%)	58 ± 7.25
Education level	Illiterate	25 (21.6%)	47.56 ± 9.49
	Primary or middle school	31 (24.6%)	54.65 ± 10.94
	High school	35 (27.8%)	54.65 ± 10.94
	Academic	34 (27%)	56.65 ± 10.94
Financial status	Good	47 (37.6%)	55 ± 13.25
	Average	57 (45.6%)	52.42 ± 11.34
	Poor	21 (16.8%)	49.61 ± 7.78
Underlying diseases	Yes	45 (36%)	48.20 ± 10.45
	No	80 (64%)	55.57 ± 11.56

Table 2. The Total Score of the CHB Scale and Its Dimensions in the Patients with CVD

Domains	Min	Max	Mean ± SD
Health responsibility	6	24	12.94 ± 4.42
Dietary habits	4	16	9.15 ± 3.31
Physical activity	5	20	14.43 ± 3.95
Smoking cessation	3	12	7.15 ± 2.26
Stress management	3	12	9.24 ± 2.50
Total score	31	82	52.92 ± 11.68

Table 3. Exploratory Factor Analysis for the CHB Scale among the Patients with CVD

Factors	Eigenvalue	% of Variance	Cumulative %	Number of Items	Reliability	
					McDonald's omega coefficient	Cronbach's alpha
Health responsibility	6.53	31.09	31.09	1, 2, 3, 4, 5, 6	0.852	0.847
Dietary habits	2.81	13.40	44.50	11, 12, 13, 14, 15	0.849	0.819
Physical activity	1.92	9.17	53.68	7, 8, 9, 10	0.875	0.817
Smoking cessation	1.32	6.32	60	19, 20, 21	0.865	0.765
Stress management	1.04	4.95	64.96	16, 17, 18	0.847	0.694

Table 4. The Factors Extracted from the EFA for the CHB Scale among the Patients with CVD

Factors	Items	Factor Loading	% of Variance	Eigenvalue
Health responsibility	5. I have enough information about blood pressure, heart rate, blood glucose, and blood lipids.	0.774	31.09	6.53
	3. I use the Internet, cyber space, TV, and journals to gather health information.	0.757		
	4. I receive complete physical examination.	0.740		
	2. I consult with nurses and physicians about my health status.	0.733		
	6. When using different foods, I carefully check their expiration dates, calorie levels, and ingredients.	0.681		
	1. I carefully notice my bodily symptoms or abnormal states.	0.657		
	= 3.835	b = 4.342		
Dietary habits	12. I always eat breakfast.	0.781	13.40	2.81
	14. I prefer eating homemade food over fast food or restaurant food.	0.766		
	11. I eat three meals during the day.	0.732		
	15. I prefer natural foods over processed foods for cooking.	0.683		
	13. I try to include all five food groups (bread and cereals, fruits and vegetables, meat and eggs, beans, and milk and dairy products) in my everyday meals.	0.509		
	= 3.207	b = 3.471		
Physical activity	9. I exercise three times a week each time for 20 - 30 minutes until I sweat.	0.802	9.17	1.92
	8. I walk for exercising.	0.796		
	10. I perform stretching exercises to rest my muscles.	0.748		
	7. In short distances, I walk instead of using a car.	0.690		
	= 2.743	b = 3.036		
Smoking cessation	20. I avoid sitting near smokers.	0.838	6.32	1.32
	21. I try not to smoke.	0.659		
	19. I am aware of the negative effects of smoking.	0.620		
	= 2.028	b = 2.117		
Stress management	16. Before sleeping, I think about happy things to reduce my worries.	0.758	4.95	1.04
	17. I express my real thoughts and feelings to other people.	0.715		
	18. I can manage my stress.	0.696		
	= 1.832	b = 2.169		

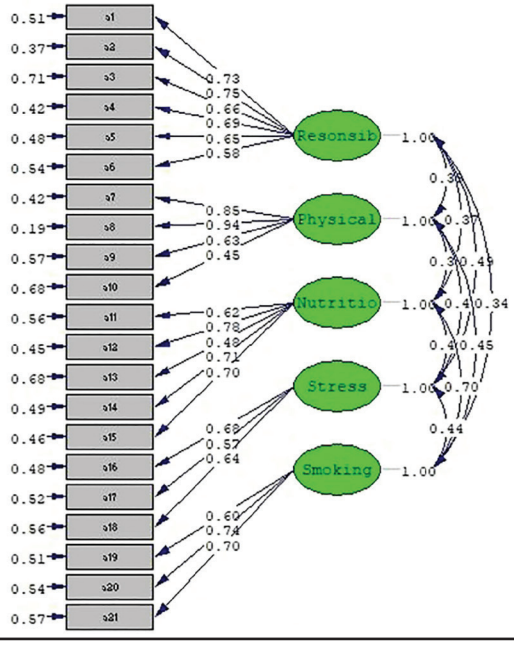
Table 5. The Accepted Thresholds of the Indices and the Fitness of the CFA Model

Fitting Indices	Acceptable Range	Results
X^2 P value	> 0.05	465.96
RMSEA	< 0.1	0.089
CFI	> 0.9	0.92
IFI	> 0.9	0.92
AGFI	> 0.8	0.77
PNFI	> 0.5	0.75
AGFI	> 0.8	0.77
CMIN/df	< 3	2.59

Abbreviations: X^2 P value, chi-squared P value; RMSEA, root mean square error of approximation; CFI, comparative fit index; IFI, incremental fit index; AGFI, adjusted goodness of fit index; PNFI, parsimonious normed fit index; AGFI, adjusted goodness of fit index; CMIN/df, chi-squared/degree of freedom ratio

for the entire scale, 0.847 for health responsibility, 0.817 for physical activity, 0.819 for dietary habits, 0.765 for smoking cessation, and 0.694 for stress management. Indeed, McDonald's omega coefficient was higher than 0.80 for all dimensions. The floor and ceiling effects were also found to be zero for the whole scale. Finally, the scree plot of the factors showed that their eigenvalues were higher than one and that the first factor played a more important role in explaining the variance of the items in comparison to the other factors.

Figure 1. The Final Structure of the Cardiac Health Behavior Scale



Chi-Square: 465.96, df = 179, P value = 0.0000, RMSEA = 0.089

5. Discussion

The present study aimed at examining the psychometric properties of the Persian version of the CHB scale among the patients with CVD. Using EFA, five factors were extracted, including health responsibility, dietary habits, physical activity, smoking cessation, and stress management that explained 64.96% of the total variance of cardiac health behavior. In the same line, in the original version of the CHB scale, these factors explained 61.44% of the total variance of the scale. Kim and Myungsun (2007) conducted a study in order to identify the factors affecting health behaviors in patients with CVD. They indicated that 51% of the variance of health behaviors was explained by two variables; i.e., self-efficacy (self-confidence in having healthy behaviors) and perceived benefits (21).

The first dimension of the CHB scale was 'health responsibility' that explained 31.09% of the total variance. This dimension involved awareness of medical examinations, gathering information on the treatment team, receiving regular physical examinations, checking food calories, and noticing abnormal signs and symptoms in one's body. Awareness of CVD and its risk factors is a vital prerequisite for changing one's attitude, behaviors, and performance regarding one's lifestyle (22). Lack of awareness of signs and symptoms may have a significant role in delay in seeking for prehospital care and receiving help from medical centers among patients with CVD (23, 24). In a study by Mead et al., inadequate information was identified as a main obstacle against adherence to treatment among patients with CVD (25). On the other hand, lack of knowledge about the disease and inability to seek for the related information could lead to poor disease management and self-care in patients (26).

'Dietary habits' was the second dimension of the CHB scale that explained 13.40% of the total variance of cardiac health behavior. This dimension involved eating breakfast, eating homemade food instead of fast food or restaurant food, and including the five food groups in the three everyday meals. Various studies have shown a relationship between cardiac heart disease management and eating diet. In the Persian version of the Hypertension Self-Efficacy Scale (17 items) that contained three dimensions, the diet dimension (with nine items) explained the biggest part of the variance of self-efficacy (27).

The third important dimension; i.e., 'physical activity', explained 9.17% of the variance of cardiac health behavior. Myers listed the lack of regular activity, abnormal values for blood lipids, hypertension, smoking, and obesity as five main risk factors for CVD (28). In fact, lack of physical activity is the fourth leading risk factor for mortality in the world, accounting for about 6% of global deaths. It is also implicated in 6%, 7%, and 10% of the incidence of CVD, diabetes, and breast and lung cancers, respectively (29).

'Smoking cessation' and 'stress management' were the fourth and fifth important dimensions of the CHB scale that explained 6.32% and 4.95% of the total variance, respectively. The risk of CVD in people who smoke 5 and 20 cigarettes a day was respectively 1.5 and 2 times higher than that in non-smokers (30). The results of a meta-analysis by Fischer and Kraemer showed that the relative risk of heart attack in people who were exposed to second-hand smoke was 1.35 times higher compared to those who had never been exposed to cigarette smoke (31). Overall, one-third of CVD-related deaths result from cigarette smoking. On the other hand, the risk of CVD decreases by half one year after smoking cessation and becomes the same as that of non-smokers after 15 years (32). Furthermore, chronic stress is a modifiable risk factor that increases the risk of Coronary Heart Disease (CHD) by 50% (33). The negative effect of stress on CVD is not less important than that of cigarette smoking. In a meta-analysis by Kivimäki et al. (2006), it was found that the risk of CHD was 50% higher in the people who were exposed to stress than those who were not (34). By reducing blood circulation through the heart, stress imitates a heart attack with lower severity.

The internal consistency of the CHB scale was assessed using the Cronbach's alpha coefficient. The Cronbach's alpha coefficient was found to be 0.68 for 'stress management' and 0.76 - 0.84 for the other dimensions. In the original version of the scale, the alpha coefficient was found to be 0.68 for the diet dimension and higher than 0.7 for the other dimensions (11). The low alpha coefficient of the 'stress management' dimension might be attributed to its limited number of items. Therefore, McDonald's omega coefficient was also used to assess the reliability of all CHB scale dimensions. This coefficient was found to be higher than 0.8 for all dimensions.

Understanding the cardiac health behaviors can help healthcare providers design effective interventions to encourage the patients to engage in proper cardiac health behaviors. Finally, it can be concluded that the Persian version of the CHB scale had strong validity and reliability. This could reflect the importance of health behaviors in the everyday activities of the patients with CVD.

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Authors' Contribution

Study concept and design: MS and RGG; data acquisition: MS, MG, and AF; data analysis and interpretation: AE and SHN; manuscript drafting: RGG and MG.

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