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Original article

Mental consequences and behavioral health 18 month after outpatient cardiac rehabilitation in three separated profiles at baseline

Mozhgan Saeidi[a], Hadis Rezaeeyan[b], Delaram Bagherirad[c], Mahdieh Saeidi[a], Mahbobeh Sharyatmadari[a], Nahid Amani[a], Saeid Komasi[d,*]

[a] Cardiac Rehabilitation Center, Kermanshah University of Medical Sciences, Kermanshah, Iran
[b] Department of Psychology, Payame-Noor University, Kermanshah, Iran
[c] Department of Psychology, Razi University, Kermanshah, Iran
[d] Clinical Research Development Center, Imam Reza Hospital, Kermanshah University of Medical Sciences, Kermanshah, Iran

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ABSTRACT

Objectives: The study aims to perform a cluster analysis on the mental health of patients at the cardiac rehabilitation (CR) baseline as well as attendance in sessions and to compare the mental health and healthy behaviors of the samples in an 18-month follow-up.

Methods: In the first phase of this longitudinal study, 148 CR patients in western Iran participated from January to April 2016. After completing the standard questionnaires, the participants attended 7–26 exercise sessions on average. Then, the cluster analysis was performed based on anxiety, depression, and the number of attended sessions. During the 18-month phone follow-up, 113 participants answered the other standard instruments. The long-term mental and behavioral consequences were compared among the derived clusters using ANOVA and Tukey post-hoc test.

Results: The average age of participants (69.9% male) was 59.3 ± 9.1. The analysis suggested three clusters: (i) patients with medium distress and weak participation, (ii) patients with mild distress and average participation, and (iii) patients with medium distress and good participation. While there was no significant difference among the clusters with regards to healthy behaviors and mortality rate, the difference was significant with regards to psychological distress, somatic symptoms, duration and quality of sleep, and general quality of life ($P < 0.05$).

Conclusion: Initial distress and weak participation of outpatients in CR has more severe long-term somatic and psychological consequences. Screening of increased psychological distress and identification of candidates for failure to adhere to CR at the baseline are considered among the most important responsibilities of the CR team.

1. Introduction

At the moment, cardiovascular diseases (CVDs) are among the most common health complications in various societies which lead to a significant number of deaths around the world.[1] CVDs are caused by various reasons including poor lifestyle, underestimating risk factors, adopting unhealthy behaviors, and weak mental health.[2–4] Not only do adopting unhealthy behaviors and failure to manage mental health affect the vulnerability to CVDs,[3] but also they may persist after the therapy as well.[5] Management of mental health and adopting healthy behaviors in cardiovascular patients in short and long-term are among the objectives of the second and third levels of prevention plans.[6–8] Besides improving mental health and quality of life, CR programs, in outpatient and hospitalization phases, are seeking to replace unhealthy behaviors with healthy behaviors promoting health.[7] So far, the effectiveness of CR programs in patients with various levels of mental health and extent of adherence to the treatment course on improving mental health and adopting healthy behaviors, in the long run, has garnered little attention. Therefore, partitioning patients based on these components at the beginning of the outpatient phase of CR programs may provide useful information on the long-term health consequences of such programs.[9,10] Based on these considerations and in order to provide a consistent classification of CR patients in the outpatient and follow-up phases to compare long-term consequences of each category, the current study tries to perform a cluster analysis on the mental health of patients at the baseline along with their adherence to exercise sessions and to compare the mental health and health behaviors of these patients in the 18-month follow-up.

* Corresponding author. Clinical Research Development Center, Imam Reza Hospital, Kermanshah University of Medical Sciences, Zakarya Razi Boulevard, Kermanshah, Iran.
E-mail address: s_komasi63@yahoo.com (S. Komasi).

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2. Materials and methods

The first phase of this prospective study was carried out in the CR department of OOO Hospital of OOO City in Iran from January to April 2016. The statistical population of the study included all the patients participating in the outpatient CR program. In the timeframe of the study, 176 patients participated in the program, and after applying the inclusion criteria, 148 participants remained. The inclusion criteria for the study included fluency in the Persian language, the age range of 20–80 years, no physical limitation for participating in exercises, and willingness to participate in the study.[11] Moreover, patients who didn't participate in the follow-up phase and those were undergoing psychotherapy or drug therapy for psychiatric problems during follow-up period were also eliminated. For this study, at first, the qualified patients were identified by the research team, and after obtaining a written consent and providing necessary guarantees on the confidentiality of their identities, they were entered into the study. A week before the first exercise session, the demographic information (age, gender, education level, occupation, and marital status), clinical information (anxiety and depression), and medical information and records of patients (smoking, drug abuse, and alcohol drinking, hypertension, diabetes, hyperlipidemia, sedentary lifestyle, and family history of CVDs) of the patients was gathered and recorded by the clinical psychologist and cardiologist of the research team. The nutritionist calculated and recorded the patient's body mass index (BMI). At the baseline, the Beck anxiety and depression questionnaires[12,13] were given to individual patients by the psychologist. After obtaining necessary explanations from the psychologist, the participants completed the questionnaires. At the end of the CR period, the number of sessions each patient had participated in the program was extracted from the medical document and recorded in the research forms of the study.

Considering the objectives of the study as well as the fact that a significant number of patients didn't complete the CR program, the information for the end of the CR period was not reported. Moreover, due to a variability of the number of CR sessions for patients (difference in the delivery format and inhomogeneous participation), the follow-up was performed 18 months after the baseline evaluation at the beginning of the CR for outpatients. In the follow-up phase, 18 months after the initial evaluation, the patients' information was gathered and recorded by the psychologist through a phone call. At this stage, 35 participants were eliminated because of unavailability and non-responsiveness, and only the information for 113 participants was analyzed. The information for the follow-up stage was gathered through a number of short standard scales. Somatic symptoms questionnaire,[14] three single standard items for general quality of life, general health, and quality of sleep,[15] the psychological distress scale,[16] the short form of the international questionnaire on physical activity,[17,18] a nutrition questionnaire, and finally an open item about the duration of night sleep were the instruments used for gathering the necessary data. The participants' answers to these questionnaires were elicited by the psychologist and recorded in the study forms during a 15-min phone call. Moreover, the mortality and its cause were recorded based on the information provided by close relatives of the patients.

3. Instruments

3.1. Baseline assessments

The Beck Anxiety Inventory (BAI): The scale is a 21-item test of 3 scores for each item. The total score for this scale is varied from 0 to 63. Cronbach's Alpha of the inventory is 0.92, the retest reliability with one-week interval is 0.75, and the consistency of the items is varied from 0.30 to 0.76. Validity types of the inventory have also been confirmed.[12] Reliability and validity of this tool have been confirmed in the Iranian population.[19]

The Beck Depression Inventory (BDI): The inventory is a 21-item test of 3 scores for each item. The total score for this scale is varied from 0 to 63. Beck et al. (1988) discovered the retest reliability in one-week interval as 0.93.[13] Reliability and validity of this tool have been confirmed in the Iranian population.[20]

3.2. Follow-up assessments

The DSM-5 Level 2—Somatic Symptom—Adult Patient: The scale is an adaptation of the PHQ-15. Each item asks the individual to rate the severity of the individual's somatic symptom during the past 7 days. Each item on the scale is rated on a 3-point scale (0 = not bothered at all to 2 = bothered a lot). The total score is ranged from 0 to 30. The higher scores in the scale indicated greater severity of somatic symptoms.[14] The scale has a good reliability and validity among Iranian samples.[21]

Single-Items for General Quality of Life, General Health, and Sleep Quality: Three single-items, self-report measures are scored on a 9-point response scales (1 = very poor to 9 = very good). General quality of life was measured by the question: "*How would you rate your quality of life?*" General health was measured by the question: "*How satisfied are you with your health?*" Sleep quality was measured by the question: "*How satisfied are you with your sleep?*" The instruments are reliable and valid.[15]

The Screening Tool for Psychological Distress (STOP-D): The STOP-D is a 5-item measure; with one item assessing psychosocial components include depression, anxiety, stress, anger, and social support. Each item is considered to be a stand-alone item with no summation score to reflect overall distress. Reliability and validity of the STOP-D have been confirmed in the outpatient cardiac setting.[16]

Short Last* 7 Days *Telephone Format of International Physical Activity Questionnaires (IPAQ): The international measure was designed in Geneva in 1998. The short form (2 items) version is available for use by either telephone or self-administered methods. The studies suggest that these measures have acceptable measurement properties for use in many settings and in different languages, and are suitable for national population-based prevalence studies of participation in physical activity.[17,18]

Nutrition Questionnaire: The dietary screener is adapted from California Health Interview Survey (CHIS). The interviewer-administered questionnaire includes 9 items about food intake last month. The items are evaluated as follows: fruits, vegetables and green salads, brown and white potatoes, beans, cucurbits and tomatoes, sugar drinks, and natural and non-natural juices. Answers are recorded as the food intake one to several times a day, week, and month. Meanwhile, here's an option "I do not know" or "I am not sure" for each item (**Error! Hyperlink reference not valid.**).

3.3. Interventions

Outpatient CR Protocol: The CR program in OOO hospital of OOO city is provided to the patients in 10–12 weeks. All high-risk patients participated in the CR under the full supervision of the medical team three times a week for 26–40 sessions. Low-medium risk patients living near the CR center also participated in the full delivery format. Conversely, Low-medium risk patients living in neighboring towns and remote areas participated in the CR once a week for 10–12 sessions (short delivery format). In the full delivery format, patients participated in; 1-h training session and 1-h exercise session (including a warm-up session for 10 min, the dynamic exercise for 45 min, and recovery for 5 min). Otherwise, the short delivery format included a 2-h training session and 1-h exercise session. The dynamic exercise included strenuous movements and running on a treadmill. The CR training sessions were focused on management of risk factors, healthy nutrition and weight control, learning to measure blood glucose and blood pressure, and stress management. One of the family members of illiterate patients was asked to participate in training sessions.[11] The short delivery format patients were encouraged to the off-center exercise especially walking at least 3 times a week.

The exercise protocol: The American College of Sports Medicine (ACSM) guidelines used as a principle for aerobic exercise prescription

for the samples. Bruce protocol was used to calculate the intensity of exercise. At baseline, the exercise intensity was calculated and registered based on heart rate reserve obtained during the graded exercise test and the rating of perceived exertion. Then, target heart rate range using the Karvonen formula was used to prescribe exercise intensity. Graded aerobic exercise training was mainly treadmill walk three times per week (once a week for the short delivery format), with an intensity of 40–70% of target heart rate range obtained in the exercise test and rating of perceived exertion of 11–14 for a duration of 20–45 min.[11]

3.4. Statistical analysis

Data related to continuous variables are reported as the mean and standard deviation and data related to categorical variables is reported as value and percentage. Hierarchical cluster analysis with agglomerative method used for the cluster integration. In the cluster analysis, at first, the hierarchical density method using squared Euclidean distance is used for identification of the number of clusters. In order to prevent propagation effect among completely related multiple variables (anxiety and depression), the centroid clustering method was used. Models having two to five clusters were evaluated separately and we found that the resolution of the three-cluster model is better than other recommended models. At the next stage, the k-means clustering method was used to determine the three clusters suggested by the initial model. Finally, in order to evaluate the structural stability of the clusters and determine the agreement among the solutions, Cramer's V test was used. The clustering components among the clusters were compared using analysis of variance (ANOVA). Furthermore, demographic information and medical history of participants at the baseline were reported based on individual clusters.

At the next stage, the clusters were compared using ANOVA with regards to physical activity, nutrition, quality of life, general health, duration and quality of sleep, and psychological distress components[18] after evaluating the baseline. Here, cluster 1 was selected as the reference cluster due to weak adherence to CR. The analysis was repeated once more after controlling the differences between the groups at the baseline (smoking and sedentary lifestyle). In order to compare each cluster with the reference cluster, the Tukey post-hoc test was used. All the statistical analyses were performed using SPSS20 (IBM Corp., Armonk, NY, USA) software application. All the tests had two-tailed and statistical significance was defined as P-value < 0.05.

4. Results

4.1. Identified clusters

Table 1 presents the profile obtained from hierarchical cluster analysis and k-means algorithm. After eighteen stages, the combination of the clustering was stop and at this stage, changes rate in the distance coefficients was from 0.000 to 0.422. The results of Cramer's V test ($V = 0.541$, $P < 0.0005$) show that the solution structures of clusters in both models have acceptable stability and there is an agreement between the solutions. This model proposed three clusters for selected components and as can be seen from the table, there is a significant difference between the clusters with regards to all the components ($P < 0.002$). The proposed clusters include (i) patients with medium distress and weak participation, (ii) patients with mild distress and average participation, and (iii) patients with medium distress and good participation.

4.2. Demographics and clinical characteristics of participants at the baseline separated by the clusters

The results show that 106 participants were CABG, 5 participants were VHD, and 2 participants were PCI. Table 2 presents the demographic information and medical history of participants in each of the clusters. The data in this table shows that there is a significant statistical difference between the clusters with regards to only smoking ($P = 0.010$) and sedentary lifestyle ($P = 0.029$). There is no significant difference with regards to other variables.

4.3. 18-Month comparison of clusters with regards to psychological health and healthy behaviors

The results depicted in Table 3 include information on psychological health and healthy behaviors. The results in this table show that there is no significant difference between clusters 2 and 3 and the reference cluster with regards to healthy behaviors. However, the participants in cluster 2 have a higher level of psychological health included somatic symptoms ($P = 0.010$), quality of life ($P = 0.004$), sleep quality ($P < 0.001$), sleep duration ($P = 0.003$), psychological distress ($P < 0.001$), depression ($P < 0.001$), anxiety ($P = 0.010$), stress ($P < 0.001$), and anger ($P = 0.004$) compared to the reference cluster. In other words, the participants in the reference cluster suffer from higher psychological distress and somatic symptoms along with lower quality of life and sleep quality. Compared to the reference cluster, the patients in cluster 3 are enjoying the better social support ($P = 0.035$) and sleep quality ($P = 0.033$). Moreover, the mortality rate related to the disease is slightly higher (but not significant) in the cluster with medium distress and weak participation.

5. Discussion

5.1. Main findings

- We identified three clusters based on anxiety, depression, and rate of participation in outpatient CR sessions: two clusters including patients with medium distress and weak/good participation and one cluster including patients with mild distress and medium participation in CR.
- 81.4% of the participants are suffering from significant anxiety and depression. On the other hand, a little more than one-third of the participants (36.3%) had an acceptable rate of participation in CR.
- In the 18-month follow-up, there was no significant difference between the clusters with regards to adopting healthy behaviors in areas of physical activity and nutrition.

Table 1
The profile derived from a cluster analysis (n = 113).

Variable (M ± SD)	Total (n = 113)	Cluster 1 Reference (n = 51; 45.1%)	Cluster 2 (n = 21; 18.6%)	Cluster 3 (n = 41; 36.3%)	P-value[a]
		Patients with a moderate distress and poor participation	Patients with a mild distress and moderate participation	Patients with a moderate distress and good participation	
Depression	16.18 ± 3.10	16.57 ± 3.25	14.05 ± 2.99	16.78 ± 2.49	0.002
Anxiety	33.96 ± 8.38	36.90 ± 5.21	19.71 ± 3.58	37.61 ± 5.01	0.001
Sessions	16.04 ± 10.11	7.31 ± 4.04	18.28 ± 9.83	25.76 ± 4.56	0.001

All values are as mean ± standard deviation.
a = P value of ANOVA. Statistically significant is = $P < 0.05$ between the non-healthy clusters and reference category.

Table 2
The baseline demographics and medical histories separated by the clusters.

Variable	Total	Cluster 1 Reference (n = 51; 45.1%)	Cluster 2 (n = 21; 18.6%)	Cluster 3 (n = 41; 36.3%)	*P*-value
		Patients with a moderate distress and poor participation	Patients with a mild distress and moderate participation	Patients with a moderate distress and good participation	
Sex, male (%)	79 (69.9)	32 (62.7)	17 (81)	30 (73.2)	0.263[a]
Education (%)					0.520[a]
Under diploma	62 (54.8)	30 (58.8)	13 (61.9)	19 (46.3)	
Diploma	23 (20.4)	11 (21.6)	4 (19)	8 (19.5)	
Academic level	28 (24.8)	10 (19.6)	4 (19)	14 (34.1)	
Job (%)					0.089[a]
Employed	18 (15.9)	8 (15.7)	2 (9.5)	8 (19.5)	
Self-employed	28 (24.8)	16 (31.5)	8 (38.1)	4 (9.8)	
Housekeeper	28 (24.8)	16 (31.4)	4 (19)	8 (19.5)	
Retired	39 (34.5)	11 (21.6)	7 (33.3)	21 (51.2)	
Marital status (%)					0.387[a]
Merited	103 (91.2)	46 (90.2)	20 (95.2)	37 (90.2)	
Widow/separated	10 (8.8)	5 (9.8)	1 (4.8)	4 (9.8)	
Medical history (%)					
Smoking	48 (42.5)	21 (41.2)	15 (71.4)	12 (29.3)	**0.010**[a]
Addiction	11 (9.7)	7 (13.7)	4 (19)	0 (0)	0.090[a]
Drinking	9 (8)	3 (5.9)	4 (19)	2 (4.9)	0.146[a]
CVDs in family	70 (61.9)	31 (60.8)	12 (57.1)	27 (65.9)	0.779[a]
Hypertension	42 (37.2)	23 (45.1)	6 (28.6)	13 (31.7)	0.278[a]
Diabetes mellitus	23 (20.4)	8 (15.7)	7 (33.3)	8 (19.5)	0.236[a]
Hyperlipidemia	34 (30.1)	17 (33.3)	7 (33.3)	10 (24.4)	0.609[a]
Sedentary lifestyle	52 (46)	22 (43.1)	15 (71.4)	15 (36.6)	**0.029** [a]
Age (M ± SD)	59.3 ± 9.1	58.9 ± 8.4	59.8 ± 12.1	59.5 ± 8.4	0.907 [b]
BMI (M ± SD)	25.7 ± 3.9	25.9 ± 4.2	25.3 ± 3.2	25.6 ± 4.0	0.808 [b]

a = P-value of chi-square test, b = P-value of ANOVA.

- In the 18-month follow-up, patients with mild anxiety and depression at the baseline showed higher levels of psychological health even for medium levels of participation in CR program.
- In the 18-month follow-up, patients suffering from clinical anxiety and depression at the baseline and weak participation in CR generally had weaker mental and psychological health.
- The mortality rate related to the disease is higher in the cluster with medium distress and weak participation; however, it is not significant.

In line with previous studies on the classification of cardiovascular patients using psychological components,[22,23] in the current study, the cluster analysis provides valuable insights with regards to partitioning CR patients based on levels of anxiety and depression. Previous studies have paid little attention to partitioning patients using both psychological distress and rate of participation in CR. However, in the current study, the rate of participation in CR played an important role in clustering the population.

In line with previous studies,[24,25] our results show that a large number of CR patients suffer from significant levels of anxiety and depression. Moreover, the rate of participation in sessions is weak for all participants. This finding may have been caused by a number of psychosocial factors, which is in line with a recent study in Iran.[8] The opinions of Iranian physicians with regards to the participation rate of lower than 15% in CR patients confirm this finding.[26]

The findings of the current study show that in the 18-month follow-up, there is no significant difference between the clusters with regards to adopting healthy behaviors in areas of physical activity and nutrition. It was expected that patients with higher participation rate in CR had higher physical activity and healthier diets. However, in the long run, patients had similar inclinations. This issue may be related to the imbalance between the CR team and patients after the exercise program. Moreover, failure to design a long-term self-monitoring program can explain these results. Accordingly, the results of a study show that routine CR programs, compared to self-monitoring, generally have a weaker influence on adherence to regular physical activity among cardiovascular patients in the long run.[27] In programs which include self-monitoring, the patients may participate in a group exercise program a number of times in a year under the supervision of a physician after CR and record the duration of their daily physical activities.[27] On the other hand, the delivery of such services in the format of the current study lacks any plans for lifestyle correction after CR program. Providing a self-regulated lifestyle plan including motivational interviews and homework can play an important role in adopting healthy behaviors after CR.[28] Meanwhile, supportive interaction and participation of the spouse can help improve the physical activity and nutrition of the patient after CR.[29]

Another finding shows that mild anxiety and depression at the baseline, without considering the level of participation in the program, is considered a positive prognosis for 18-month psychological health. However, clinical distress at the baseline and weak participation in CR are considered as a negative prognosis for psychological health. In their study, Yohannes et al.[30] found out that initial depression in CR patients had a reverse significant relationship with 12-month quality of life. Moreover, the results of this study show that anxiety and depression at the baseline can predict the energy consumption of patients 12 months after CR.[30] On the other hand, in line with the results of the current study, the findings of two review studies show that higher participation in exercises and CR sessions can lead to increasing improvement in depression and anxiety.[31,32] Other studies show that higher participation in exercises can reduce somatic symptoms and pain, improve quality of life and sleep quality.[11,33,34] Besides the direct impact of exercise on reducing psychological distress in CR, training sessions for mental health management can play a significant role in mitigating the symptoms of patients.[6,30] Reducing psychological distress can, in turn, lead to improvement in sleep quality and quality of life.

Despite the insignificance of the mortality rate among the clusters of the current study, the only cases of mortality occurred in the unhealthy cluster (the reference cluster). Besides the clinical distress at the baseline, the samples in this cluster had a very weak rate of participation in CR (about seven sessions). The higher mortality rate in this cluster can be explained by the significant impact of CR on fatal cardiovascular consequences. Indeed, the results of a study show that initial anxiety and depression in CR are related to 161-month mortality.[35] Furthermore, the results of another study show that attending 36 sessions of CR, compared to 12 sessions, can reduce the risk of myocardial infarction up to 31% and the risk of death within four years up to 47%.[36]

Table 3
The psychological health separated by the clusters.

Variable	Total	Cluster 1, Reference (n = 51; 45.1%)	Cluster 2 (n = 21; 18.6%)		Cluster 3 (n = 41; 36.3%)	
		Patients with a moderate distress and poor participation	*Patients with a mild distress and moderate participation*		*Patients with a moderate distress and good participation*	
	M ± SD	M ± SD	M ± SD	P value	M ± SD	P value
Psychological health[a]						
Somatic symptoms	4.98 ± 3.96	5.85 ± 4.09	**2.86 ± 2.71**	0.010	5.05 ± 4.03	0.588
Quality of life	6.24 ± 1.56	5.77 ± 1.69	**7.05 ± 1.24**	0.004	6.36 ± 1.37	0.154
General health	6.60 ± 1.66	6.39 ± 1.76	7.14 ± 1.15	0.202	6.56 ± 1.75	0.886
Sleep quality	6.44 ± 2.13	5.67 ± 2.34	**7.57 ± 1.25**	0.001	**6.76 ± 1.91**	0.033
Sleep duration	6.73 ± 1.61	6.29 ± 1.67	**7.66 ± 1.28**	0.003	6.76 ± 1.51	0.339
Psychological distress	15.06 ± 7.95	17.92 ± 7.90	**9.38 ± 6.05**	0.001	14.63 ± 7.33	0.096
Depression	2.98 ± 2.11	3.58 ± 1.98	**1.33 ± 1.32**	0.001	3.12 ± 2.20	0.513
Anxiety	3.17 ± 2.02	3.62 ± 2.00	**2.09 ± 1.79**	0.010	3.19 ± 1.99	0.559
Stress	3.74 ± 2.18	4.40 ± 2.11	**2.09 ± 1.70**	0.001	3.80 ± 2.09	0.361
Anger	3.65 ± 2.12	4.33 ± 2.14	**2.57 ± 1.99**	0.004	3.41 ± 1.92	0.089
Social support	1.52 ± 1.68	1.98 ± 2.07	1.28 ± 1.38	0.245	**1.10 ± 1.11**	0.035
Healthy behaviors[a]						
Physical activity, pre-week	3.21 ± 2.62	3.35 ± 2.46	3.19 ± 2.66	0.970	3.05 ± 2.83	0.850
Day, minuet	35.14 ± 30.82	33.85 ± 26.84	27.38 ± 21.48	0.701	40.61 ± 38.05	0.557
Nutrition, pre-month						
Fruits	7.53 ± 4.93	6.96 ± 5.07	8.05 ± 4.19	0.679	7.93 ± 5.16	0.629
Vegetables/green salads	2.57 ± 2.33	2.40 ± 2.24	2.62 ± 1.99	0.933	2.76 ± 2.62	0.758
Brown potatoes	0.62 ± 0.86	0.67 ± 0.87	0.64 ± 1.01	0.991	0.57 ± 0.79	0.838
White potatoes	0.01 ± 0.09	0.00 ± 0.00	0.00 ± 0.00	0.999	0.02 ± 0.16	0.455
Beans	1.22 ± 0.83	1.22 ± 0.87	1.42 ± 0.87	0.653	1.13 ± 0.78	0.852
Cucurbits/tomatoes	2.38 ± 1.65	2.04 ± 1.47	2.81 ± 1.69	0.175	2.56 ± 1.77	0.297
Sugar drinks	0.38 ± 1.03	0.63 ± 1.41	0.23 ± 0.51	0.284	0.18 ± 0.53	0.094
Natural juices	0.61 ± 0.99	0.65 ± 1.20	0.93 ± 1.06	0.528	0.41 ± 0.55	0.496
Non-natural juices	0.15 ± 0.75	0.29 ± 1.10	0.10 ± 0.30	0.589	0.02 ± 0.16	0.226
Mortality (%)[b]						
Cardiovascular event	1 (0.9)	1 (2)	0 (0)	0.999	0 (0)	0.999
Cerebrovascular event	1 (0.9)	1 (2)	0 (0)	0.999	0 (0)	0.999
Kermanshah earthquake, 2017	1 (0.9)	1 (2)	0 (0)	0.999	0 (0)	0.999

Boldface indicates statistically significant ($P < 0.05$) between each group and the reference category.
The differences are persistent after adjustment for smoking and sedentary lifestyle.
[a] = P value of ANOVA and Tukey test.
[b] = P value of chi-square test.

5.2. Limitations and recommendations

Anxiety and depression at the baseline were measured using Beck's scales.[12,13] Due to the fact that these scales are too long, a short scale of psychological distress was used for phone follow-up.[16] It is recommended that future studies use a single measuring instrument so that bias can be minimized. Due to the inhomogeneous participation of patients in the CR program, our study lacks an evaluation at the end of the CR program (12 weeks). In order to compare the clusters in the short run, it is recommended that at the end of the schedule of each patient (even if they didn't fully adhere to the program), a phone evaluation is performed. Finally, small number of samples in some clusters is one of the study limitations. Thus, selecting a larger sample, particularly a national one, can contribute to a more accurate clustering.

6. Conclusion

Initial anxiety and depression and weak participation of outpatients in CR have more severe long-term somatic and psychological consequences. Screening of increased psychological distress and identification of candidates for failure to adhere to CR at the baseline are considered among the most important responsibilities of the CR team. Accordingly, providing timely interventions for managing mental health and improving adherence to CR can possibly lead to long-term positive outcomes.

Conflicts of interest

None of the authors have conflicts of interest to report.

Authors' contributions

All authors participated in the design of the study and drafted the manuscript and read and approved the final manuscript.

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