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Designing and manufacturing of educational multimedia software for preventing coronary artery disease and its effects on modifying the risk factors in patients with coronary artery disease

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ABSTRACT

Introduction: Coronary artery disease is one of the most common cardiovascular diseases in adults and is estimated to be responsible for 35% of all deaths in the world. Considering the importance of preventing coronary artery disease and the inadequacy of available e-learning, including educational softwares, this study aimed to determine the effect of educational software program for preventing coronary artery disease risk factors on moderating the risk factors of patients with Coronary artery disease.

Method of the study: This is a semi-experimental study that was performed before and 3 months after the study. The study population consisted of all patients with acute coronary syndrome admitted to the cardiology department of Chamran Hospital in Isfahan. 32 patients were randomly selected from among all patients with acute coronary syndrome who were admitted to the cardiology department of Chamran, Isfahan, Iran. After collecting data, information was analyzed using descriptive and analytical statistics using SPSS statistical software.

Results: According to the results, the minimum age of the studied samples was 28 years and maximum 74 years and the mean age was 57 ± 11.86. .Also, 46.7% of the samples were female and 53.3% of them were male. Paired t-test showed that the mean LDL, HbA1C and FBS significantly decreased after intervention ($p < 0.05$), mean HDL significantly increased, but the mean of other variables had no significant difference before and after the intervention ($p < 0.05$).

Conclusion: According to the results of this study, electronic multimedia programs are an attractive educational method that can increase the motivation of patients to study and understand more about the process of disease, accelerates the recovery of the disease and plays an important role in modulating the risk factors of the disease.

Keywords: coronary artery disease, prevention, risk factors, multimedia software

INTRODUCTION

Coronary artery disease is one of the most common cardiovascular diseases in adults, and it is estimated that it is responsible for 35% of all deaths in the world, and is responsible for 47% of non-communicable diseases (1). Meanwhile, although among cardiovascular disease, coronary artery disease, is one of the most important death causes in the United States, it is estimated that 80 percent of the premature deaths due to this disease can be prevented (2). In Iran, the prevalence of coronary artery disease and its mortality is increasing and in this regard this disease accounting for 46% of the causes of death. The prevalence of coronary artery disease in Isfahan is 19.4% (3). One of the complications of this disease is absence of work, high costs of surgical procedures and medications, and disability of patients. Prevention of coronary artery disease can significantly reduce this loss (4). The results of a cohort study conducted by the US

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Department of Public Health indicate that atherosclerosis is not accidental in people, and high risk individuals can be identified by clinical symptoms. The risk factors identified in this study include male gender, high age, high serum lipids, hypertension, smoking, diabetes mellitus (or even mild glucose intolerance), obesity, low vital capacity, and certain disorders in the ECG. In this order individuals with a combination of risk factors are at a higher risk of coronary artery disease (5). Ideal treatment for coronary artery disease includes the application of multidisciplinary drug interventions, surgical interventions, risk factors adjustment and control, and lifestyle modification. The disease is one of the most preventable non-communicable diseases and the use of primary and secondary prevention methods are key strategies in prevention of coronary heart disease (6). Since, teaching today to the patient is recognized as one of the main duties of nurses, training in heart disease and related care is essential. In this regard, the optimal selection of nurses' educational methods that lead to increased awareness is significant (7). In Iran, in parallel with other countries, the popularity of electronic programs in the form of compact discs is increasing. Computer-assisted learning can accommodate different learning styles and through facilitating active engagement through strong information of the environment and interactive learning environment, will improve the constructivist educational approach (8). On the other hand, using these facilities help education to accomplish some of the aspirations identified as quality education criteria, including pivotal learning, life-long learning, active learning, engagement in learning, and multimedia (9). Also, due to the positive relationship between people's satisfaction and their access to educational methods, e-learning is satisfactory for patients due to the no limitation in time and place and the importance of individual independence in the education process (10). One of the e-learning methods that has recently been taken into consideration is multimedia software, which has received more attention than other educational methods due to its unique advantages, including text, photo, video, sound, and interactive learning. (11). In this regard, various studies have examined this method in different target groups; among them, the results of the research of Lopez-Olivo et al. (2017) showed a significant difference in knowledge of patients with rheumatoid arthritis, osteoporosis and knee osteoarthritis So that the use of multimedia software increased their information about disease and medication and encouraged them to visit a regular doctor (12). The results of the study of FarmihaniFarahani et al. (2016) with aim of determining the effectiveness of an educational multimedia software on self-care knowledge and behaviors in type 2 diabetes patients showed that the use of 30 patients in the experimental group from the educational program resulted in increased knowledge and self-care behaviors of patients two months after the intervention than before (13). The research conducted by Mohammadi Razi et al. (1393) also showed that e-learning can save time and possible costs by raising the level of awareness of mothers of the first pregnancy in postpartum period (14). Also, the study of Aghvami and colleagues (2011) indicated that education through CDs on the quality of life of children with asthma was more effective than group education (7). Considering the importance of preventing coronary artery disease and the inadequacy of available e-learning, including educational softwares, this study aimed to determine the effect of educational software for preventing coronary artery disease risk factors on moderating the risk factors of patients with Coronary artery disease.

Methods: This is a semi-experimental study that was performed 3 months before and after the study. The research community consisted of patients with acute coronary syndrome admitted to the cardiovascular department of the Chamran Hospital in Isfahan. Sampling was done randomly from among all patients with acute coronary syndrome admitted to the cardiovascular department of Chamran Hospital in Isfahan who were eligible to enter the study. The number of samples according to the formula $n = \frac{2S^2(Z_1+Z_2)^2}{d} = \frac{2S^2(1.96+0.84)^2}{0.49S^2}$ and considering 95% (1.96) confidence coefficient, the test power factor was 80% (0.84) and the minimum difference between the two groups (0.7s) was 32 persons, which according to the probability of the loss of specimens 35 people were included in the study. The inclusion criteria for the study were acute coronary syndrome (acute myocardial infarction with ST elevation, myocardial infarction without ST elevation and unstable angina), approved by a cardiologist, having a home computer, willingness to participate in the study, knowledge of their illness, Being alert, being familiar with Farsi, lack of mental retardation, motion impairment, blindness, deafness and active psychosocial illness, non-thyroid disease, gastrointestinal disorders, non-acute complications of acute coronary syndrome, and acute myocardial infarction (15). Criteria on the exclusion from study also included the patient's unwillingness to participate in the study and the lack of completion of the questionnaire.

Data gathering tools in this study included multimedia softwares in compact discs, personal information questionnaire (age, level of education, marital status, occupation, history of cardiovascular risk factors (high blood sugar, high blood pressure and high blood lipids), smoking, duration of diagnosis of heart disease, history of hospitalization and condition of heart muscle damage), a mercury pressure gauge, a stethoscope,, a glucometer, a blood biochemical measurement device, a scale and a meter.

Content validation was used for multimedia software (compact disc). The materials were collected using the library study method and the collection of valid and new sources (last 5 years) in the field of anatomy, physiology, risk factors and their prevention, diagnosis, medication, surgery and nursing process of coronary artery disease. Then it was approved by faculty members affiliated with the cardiovascular system at the Faculty of Nursing and Midwifery and several cardiologists from Isfahan University of Medical Sciences.

In order to determine the reliability of the blood pressure measurement device, blood pressure of 5 healthy people was measured twice in 3 minutes, and then Pearson correlation coefficient was calculated between the values obtained, which was 0.85. For validity, the blood pressure measurement by the researcher was approved by the faculty members of the Faculty of Nursing and Midwifery.

For glucometer reliability, non-fasting blood glucose of 5 healthy subjects was measured at a time interval of 1 minute. Then, the Pearson correlation coefficient was calculated to be 0.88.

For the reliability of the balance, the weight of a person was measured five times in a minute, and then, between the values obtained, the Pearson correlation coefficient was calculated to be 0.86. To reduce the error, for all of the research samples in both of the research phases, a calibrated mercury pressure gauge (Richter, Germany), a glucometer (bionime), a balance (jupiter and Hitachi 902) were used.

The researcher started constructing the program after receiving the license from the research departments of Isfahan University of Medical Sciences and the code of ethics at IR.MUI.REC.1394.1.265. In the first stage, considering that the software was provided for patients, its design was extremely simple and attractive.

This multimedia software was designed and developed by Flash. This software includes parts such as anatomy and physiology of cardiovascular system, physiology and anatomy of coronary artery with diagnostic methods (angiography, echocardiography, diagnostic tests, risk factors (modifiable and irreversible), various therapies (pharmaceuticals, surgeries) and nursing care for preventing the symptoms of the disease. Different parts of the software were designed as animated pages with audio guides, videos, photos and related clips. . In addition, a timer was designed for software to determine at the end of the study how long the user spent using this software.

In the second stage, the researcher, after entering the research environment by introducing himself and explaining the purpose of the study, selected the eligible subjects for the study randomly and then entered the study after obtaining written informed consent. A two-part tool consisting of a demographic and disease-related data questionnaire was provided by a research associate who had no information about the goals of the research, completed by questionnaires from the research units, and one day before the intervention, all of the research samples were evaluated by the cardiologist at Chamran Hospital and then a blood sample was taken from the patient.

Blood pressure, height, weight and body mass index were measured by observing the established standards. Before the intervention was started, the researcher provided three training sessions on the use of software to patients and one of their family members. The researcher also besides giving patients a telephone number tracked them by the phone and ensured that patients correctly use the software every day for one hour, three times a week. After three months, all tests performed before the intervention, were repeated in accordance with the standard. After collecting data, it was analyzed using descriptive statistics and analytical tests such as t-test using SPSS software.

RESULTS

According to the results, the minimum age of the samples was 28 years and maximum 74 years and mean age was 57 ± 11.86 years. Also, 46.7 percent of the samples were female and 53.3 percent were male (**Table 1**).

Table 1: *The minimum age of the samples was 28 years and maximum 74 years and mean age was 57 ± 11.86 years*

Variable	Number (percentage)
Level of education	
illiterate	6(20)
School dropout	10(3.33)
High school diploma	8(7.26)
Academic	6(20)
Marital status	
Single	1(3.3)
Married	23(76.7)
Divorced	4(13.3)
Widow	2(6.7)
Occupation	
Employee	4(13.3)
Self employment	10(33.3)
Retired	4(13.3)
manual worker	4(13.3)
housewife	6(20)
Unemployed	1(3.3)
Others	1(3.3)
History of risk factors	
High blood sugar	19 (63.3)
High blood pressure	10(33.3)
High blood lipids	21(70)
smoking	11(36.7)
Duration of diagnosis	
4 weeks to 3 months	13(43.3)
3 to 6 months	1(3.3)
6 to 12 months	3(10)
1 to 2 years	4(13.3)
2 to 5 years	2(6.7)
5 to 10 years	2(6.7)
10 to 15 years	2(6.7)
15 to 20 years	2(6.7)
Previous hospital record	
Yes	20(66.7)
No	10(33.3)
Number of admissions to the hospital Mean (SD)	2(2.07)
Duration of admission	8 (8.17) days
The condition of heart muscle damage	
Heart ischemia	6 (20)
Angina	13(30)
heart attack	4(13.3)
Angioplasty	4(13.3)

Table 2. *Comparison of risk factors for coronary artery disease patients before and after intervention*

Variable	Before intervention		After intervention		Paired-t test	
	Mean	SD	Mean	SD	t	p-value
Systolic blood pressure	117.3	15.2	118.3	11.76	0.45	0.65
Diastolic blood pressure	74	13.47	74	1.7	0.01	0.99
Weight	75.8	12.36	75.7	11.7	0.1	0.91
BMI	27.04	4.2	26.95	3.92	0.41	0.68
Cholesterol	160.76	45.56	159.36	40.29	0.36	0.72
LDL	108.8	46.88	98.4	31.73	2.01	0.04
HDL	36.53	10.6	43.33	15.62	3.84	0.001
HbA1C	13.06	3.44	9.15	3.22	6.181	0.000
FBS	120.16	60.16	109	28.73	1.99	0.045

Paired t-test showed that the mean of LDL, HbA1C and FBS decreased significantly after intervention ($p < 0.05$), mean HDL significantly increased, but the mean of the other variables was not significantly different before and after the intervention ($p < 0.05$) (**Table 2**).

DISCUSSION AND CONCLUSION

The purpose of this study was to design and manufacture multimedia software for preventing coronary artery disease and its effect on moderating risk factors. The results showed that the intervention significantly reduced LDL and fasting blood glucose levels and significantly increased HDL and glycosilated hemoglobin (HbA1C) three months after the intervention. In this regard, the results of the study by Noahi et al. (2011), showed that e-learning improved the knowledge, attitude and practice of self-care and also the mean fasting blood glucose and glycosilated hemoglobin in diabetic patients after the training (3). Also, Moattari et al. (2012) showed that the e-learning program reduces LDL and glycosylated hemoglobin and improves metabolic control in patients with diabetes (16). Also, the results of the study of FarmihaniFarahani et al (2016) with the aim of determining the effectiveness of a multimedia software program on knowledge and self-care behaviors in type 2 diabetic patients showed that the use of 30 patients in the test group of the supportive educational program using multimedia software has increased the knowledge and self-care behaviors of patients 2 months after the intervention than before (13).

The results of Stromberg et al. (2006) also showed that computer-aided and CD-ROM education increased the knowledge of patients about heart failure compared to traditional education alone (17). The research of Khodadadi et al. (2013) also showed that education by CD was more effective in increasing the performance of the samples than in the group training method (8). The results of Aghvami et al. (2013) aimed at determining the effectiveness of group education by CD on the quality of life of children aged 8-12 years with asthma showed that the mean scores of quality of life and the rankings obtained before and after a month of intensive group training with CD resulted to improvement of the quality of life of the studied units (7). In explaining the reason for the results, we can say that this educational method lacks age-related limitations related to the cognitive, visual and motor status that are considered in the design of a program, and thus, despite on average of about 60 years of participation In the study, there were changes in the moderation of certain symptoms of disease risk. . On the other hand, this method of training has made it possible for learners to refer to it at various and needed times with no time concerns and receive appropriate answers to questions in their mind.

But the results of this study showed that the use of this multimedia software did not significantly differ in other variables such as blood pressure, height and weight, BMI and blood cholesterol levels before and after three months after the intervention. In this regard, the results of Björck Linné and Liedholm (2006) showed that patient education through CD did not affect the rate of readmission or death within 6 months after discharge (18). The results of Vaghee and colleagues (2017) also showed that multimedia and face to face education were effective in decreasing anxiety of electroshock therapy in patients with mood disorders, but this reduction in anxiety was higher in face-to-face education (19). Also, the results of Feizalahzadeh et al. (2016) showed that education based on multimedia educational software "hemodialysis and care" and the traditional method both improved the quality of life of patients undergoing hemodialysis at a same rate (11).

CONCLUSION

According to the results of this study, electronic multimedia programming is an attractive teaching method that can motivate patients to study and understand more about the disease process, accelerates their self-efficacy in the recovery from illness and plays an important role in moderating the risk factors of the disease. On the other hand, considering the importance of training the patients and time limitations of the health care provider personnel, the use of this method as a cost-effective and efficient method in different groups of patients is necessary.

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