Clinical and Experimental Health Sciences

Impact of Education and Text Messages on Cardiovascular Disease Risk Factors Awareness Knowledge and Quality of Life

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ABSTRACT

Objective: This study was conducted to evaluate the effect of health education based on the health belief model and text messages on knowledge, awareness and quality of life regarding cardiovascular disease risk factors in firefighters.

Methods: The research data were collected by the researcher between December 2023 and May 2024 at two different fire stations on the European side of Istanbul. The intervention group received a 3-session Health Belief Model-based health education on prevention of cardiovascular disease risk factors. Following the health education, a total of 39 reminder text messages were sent via WhatsApp three or four times a week for 12 weeks to increase self-efficacy and health motivation. Data were collected using the Introductory Information Form, Cardiovascular Disease Risk Awareness Rating Scale, Cardiovascular Disease Risk Factor Knowledge Level Scale and EQ-5D-5L Quality of Life Scale.

Results: In the post-test, the mean scores of the intervention group on the Cardiovascular Disease Risk Awareness Rating Scale and Cardiovascular Disease Risk Factors Knowledge Level Scale were significantly higher than those of the control group ($p<0.05$).

Conclusions: Health Belief Model-based cardiovascular disease risk factor prevention education and text messages increased firefighters' awareness, knowledge and quality of life in cardiovascular disease risk factor prevention.

Keywords: Cardiovascular Disease, Health Belief Model, Health Education, Firefighter, Occupational Health Nursing.

1. INTRODUCTION

Cardiovascular diseases (CVDs) are the most common, fatal and non-communicable diseases in Turkey as well as in the world (1). The World Heart Federation states that CVDs caused 20.5 million deaths in 2021; approximately one in three deaths worldwide is related to this issue (2).

The prevalence of CVD is predicted to increase with the aging of populations and prolonged life expectancy (3). Although it is known that cardiovascular function decreases with age and age is an important factor in CVD, there are many risk factors that can be controlled to prevent these diseases (4). WHO reports that CVDs can be averted by controlling behavioral risk factors (5). According to the latest data from the Turkish Statistical Institute (TUIK), CVD is the primary cause of death among adults in Turkey (6). The primary goal in interventions to reduce the incidence and mortality rates of CVDs is to create lifestyle changes for risk factors. The lack of information about CVD risk factors hinders the prevention and treatment of these diseases and affects individuals' awareness of risk factors and lifestyle (7). When the studies on CVD prevention and promotion of lifestyle changes are examined in the literature, it is seen that programs to inform the target audience are generally implemented (8, 9, 10). Many studies have shown that the Health Belief Model (HBM) can be used as an acceptable model to predict protective behaviors against various diseases (11, 12). Considering that adults constitute a significant portion of Turkey's population (13), efforts to increase knowledge and raise awareness about CVD risks should be carried out in every environment where individuals can be reached. Workplaces are one of these environments (14). Firefighting is a demanding profession in which firefighters face life-threatening situations and endure enormous physical pressure (15). Existing research has revealed that firefighters have high exposure to CVD risk factors (16,17). Extensive scientific literature shows that firefighters have one of the highest percentages (45%) of

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deaths owing to unexpected cardiac death and the majority are associated with underlying CVD risk factors, while many firefighters often exhibit multiple risk factors associated with CVD or poor overall cardiovascular health, which affects their occupational performance (17, 18, 19, 20). A study has demonstrated that on-duty CVD incidents in the fire service do not occur randomly and occur much more frequently during strenuous tasks (21).

On-duty cardiovascular occurrences have been reported to occur predominantly in firefighters who are predisposed to CVD and have traditional risk factors for CVD (15).

All these findings suggest the consistent and strict application of preventive measures with proven benefits to firefighters (17, 22).

Due to the detrimental association between CVD risk factors, poor physical fitness, and firefighter line-of-duty mortality, health professionals need to establish health promotion programs to reduce CVD risk and improve firefighter physical fitness (21). It has been reported that workplace wellness programs are effective in reducing modifiable CVD risk factors in healthy individuals and people with CVD (23). It is important to create health education programs for firefighters, who are at elevated risk for CVD, and to establish conditions that promote health in the workplace to prevent risk factors and encourage healthy lifestyle behaviors. In the literature, it is stated that firefighters' knowledge of CVD is low despite their high CVD risk, but with a short and simple educational intervention, firefighters' awareness of these risk factors can be increased in the short term (24, 25). However, these studies are not sufficient and there is no interventional study on CVD risk factors for firefighters in Turkey. The aim of this study was to analyze the effect of HBM-based training program and text messages on information level, awareness and quality of life concerning CVD risk factors in firefighters.

2. METHODS

2.1. Ethical Considerations

Ethics Committee Permission was obtained from the clinical research ethics committee of the medical faculty of a state university (14.07.2023; Protocol No: 09.2023.931), and institutional permission was obtained from the authorized institution to which the fire departments are affiliated (28.11.2023; BK No: 4298). Scale use permissions were obtained by the scale authors. Written informed consent was obtained from all participants.

2.2. Study Design And Sample Selection

The universe of the study consisted of firefighters working in fire stations located in two different districts on the European side of Istanbul province in Turkey (N = 160). The sample size was determined by power analysis performed on the G-Power 3.1 program. Power analysis was applied at 5% significance level, two-way, based on 80% power requirement. As a result of the analysis, the minimum sample size required for each group in the study was calculated as 67 people. Considering the risk of data loss, the sample size was increased by approximately 10% and was determined as 148 people in total, with at least 74 people in each group. As a result, the study sample consisted of a total of 160 firefighters, 84 in the intervention group and 76 in the control group. The study data were collected by the researcher between December 2023 and May 2024 using a questionnaire method. In order to prevent interactions between groups and to ensure randomization, stations were determined as intervention and control groups by drawing lots. During the study, 3 participants in the intervention group and 2 participants in the control group were excluded due to CVD. After the pre-tests were applied, 2 participants in the intervention group were excluded from the study because they could not attend the training, and 1 participant in the control group left the study voluntarily (Figure 1).

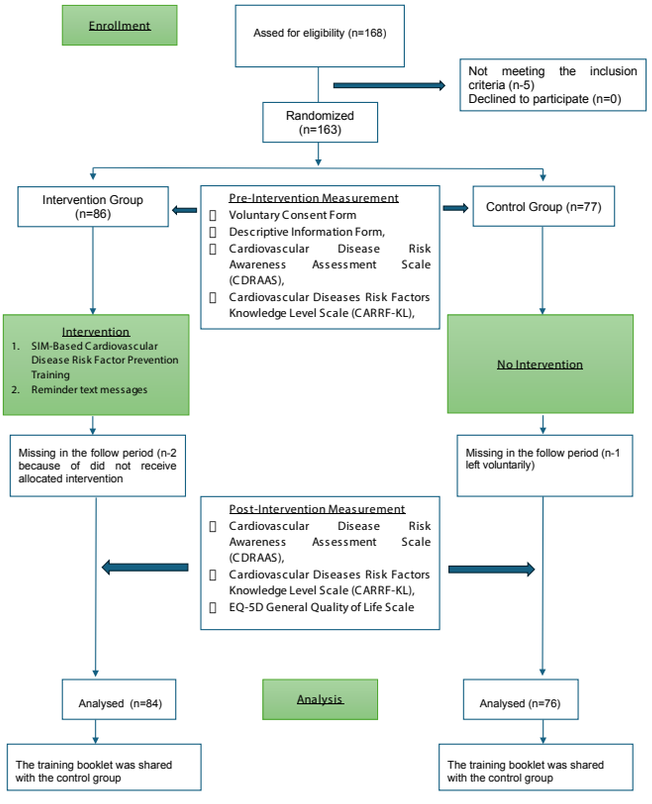

Figure 1. *Consort Flow Diagram*

Sample selection criteria

- Not having any cardiovascular disease
- To be working in the institution where the research is carried out
- Not having any a disease or disability that would prevent working
- Not having any training in preventing cardiovascular disease.

2.3. Data Collection Procedure And Tools

The pre-test of the study was conducted between December 4-15, 2023 and the post-test between April 30-May 5, 2024. Health education was given on February 1-6, 2024 and the post-test was administered 12 weeks after the education. During the 3-month follow-up period after the training, text messages were sent by phone.

2.3.1. Descriptive Form

It was prepared by the researcher in line with the literature to determine the sociodemographic characteristics of firefighters (22, 26). The form includes 24 questions about the characteristics of firefighters such as age, education level, marital status, smoking status, regular exercise and salt consumption.

2.3.2. Cardiovascular Disease Risk Awareness Assessment Scale (CDRAAS)

The scale was adapted into Turkish by Birgül Vural Doğru et al. in 2021. The scale consists of three sub-dimensions: perceived heart attack/stroke risk, perceived benefits and intentions to change, and healthy eating intentions. The Cronbach's alpha value of the scale was α=0.80 (43) whereas it was found to be α=0.66 in this study. The scale, which consists of 22 items in total, is a 4-point Likert scale and is scored between 1 (strongly disagree) and 4 (strongly agree). Increased scale and subscale scores indicate increased awareness of CVDs (27).

2.3.3. The Cardiovascular Disease Risk Factors Knowledge Level (CARRF-KL) Scale

CARRF-KL is a 28-item scale measuring the level of knowledge about cardiovascular disease risk factors. While the first four items in the scale are related to the characteristics of CVDs, preventability and age factor, 15 items question risk factors and nine items question the outcome of change in risk behaviors Each correct answer is evaluated as 1 point. Scores that can be obtained from the scale are between 0 and 28. The higher the score, the higher the level of knowledge (28). The Cronbach's alpha value of the scale was α=0.76 (28), whereas it was found to be α=0.82 in this study.

2.3.4. EuroQoL Quality of Life Scale (EQ-5D-5L)

It is a quality of life scale that measures how individuals perceive and evaluate their own health status. The scale consists of two parts: EQ-5D index and EQ-5D VAS. EQ-5D index: It consists of 5 dimensions: movement, pain, general activities, self-care, anxiety/depression. The answers to each dimension have 5 options: no problem, mild problem, moderate problem, severe problem and extreme problem. EQ-5D VAS: It is a visual analog scale in which individuals give values between 0 and 100 about their current health status and mark it on a thermometer-like scale. An increase in the scale score indicates a positive perception of health.

2.4. Data Analysis

Statistical Package for Social Sciences (SPSS) v27 statistical program and Microsoft Excel 2016 program were used for data analysis. The frequencies (f) and percentages (%) of the responses to the descriptive information form were determined. Chi-Square analysis was applied to determine whether the intervention and control groups were homogeneous. The internal consistency levels of the data were checked by examining the Cronbach's Alpha values to test whether they were reliable and the skewness and kurtosis values to test whether they were normally distributed. Dependent group t test was used for intra-group mean score comparisons and independent group t test was used for inter-group mean score comparisons. As significance level, p≤.05 and p≤.01, 95% and 99% confidence intervals were used.

2.5. Interventions

2.5.1. Health Education

One of the fire stations in Istanbul constituted our intervention group. In line with the literature review, "HBM-Based CVD Prevention Training" was created in order to increase the level of knowledge of firefighters regarding CVD risk factors, improve their awareness and positively affect their quality of life. This training was given in 3 different sessions by meeting face-to-face with firefighters in the training hall of fire stations. Each session lasted 40 minutes. Answers were given to the questions asked at the end of the session. **The training was created under the following main headings in line with the Health Belief Model:**

Perceived Responsiveness: Messages about the individual's perceived risk of developing CVD.

Perceived Seriousness: It includes messages that identify the individual's perceived threat, including harmful consequences based on the risk of CVD occurrence.

Benefit Perception: Messages about the individual's perceived benefits of eating well, exercising and quitting smoking to prevent CVD.

Perceived Barriers: Messages about the individual's perceived barriers to eating well, exercising and quitting smoking to prevent CVD.

Perceived Self-Efficacy: Messages that include the degree of confidence that the individual perceives about doing behaviors to prevent CVDs.

Health Motivation/Activators: Messages that identify different degrees of willingness to engage in CVD-preventive behaviors to prevent CVD from occurring.

2.5.2. Text Messages

After the HBM-based health education, 39 text messages were sent via WhatsApp application 3-4 times a week for 3 months to increase the effectiveness of the education and the motivation of firefighters in CVD prevention. The messages were created in line with the literature (29, 30, 31) by taking the suggestions of 10 academicians who are experts in their field. A pilot study was conducted before the text messages were sent. According to expert opinions, the Content Validity Index (CVI) value of the messages was found to be above 0.80 (CVI>0.80). Example of Short Messages:

- Losing excess weight is important in reducing cardiovascular mortality and morbidity.
- Refined foods (canned foods, acidic drinks, white sugar, etc.) and saturated fats increase the risk of cardiovascular diseases.
- Smoking causes deterioration of the vascular structure.

3. RESULTS

3.1. Participant Characteristics

Firefighters in the intervention and control groups had average ages of 36.61±7.87 and 38.25±8.09 years, respectively. Male firefighters constituted 98.8% of the intervention group and 92.1% of the control group. The mean weights of the intervention and control groups were 84.99±12.05 and 83.09±11.26 kilograms, respectively, and the mean heights of the intervention and control groups were 176.69±5.88 and 175.88±5.78 centimeters, respectively. There was no meaningful difference (p>.05) between the two groups concerning the independent variables of the study (age, gender, education, marital status, smoking and alcohol use, daily vegetable and fruit consumption, etc.) (Table 1). The pre-intervention mean scores for the intervention and control group firefighters on the CDRAAS and its sub-dimensions, CARRF-KL and EQ-5D-5L Quality of Life Scale, revealed no statistically meaningful difference (p>.05).

Table 1. *Comparison of individual characteristics according to firefighters*

Variable	Group	Control Group (n=76)		Intervention group (n=84)		Chi-squared	
		f	%	f	%	χ2	p
Age	23-34	25	32.9	38	45.2	2.77	.250
	35-44	39	51.3	37	44.0		
	45-55	12	15.8	9	10.7		
	Mean±SD/Min.-Max.	38.25±8.09	25-55	36.61±7.87	23-55		
Gender	Woman	6	7.9	1	1.2		.054*
	Male	70	92.1	83	98.8		
Marital Status	Married	56	73.7	62	73.8	0.00	.986
	Single	20	26.3	22	26.2		
Education Level	High school	18	23.7	22	26.2	0.83	.661
	Universty	54	71.1	55	65.5		
	Master / PhD	4	5.3	7	8.3		
Weight (kg)	58-75 kg	21	27.6	20	23.8	1.72	.424
	76-95 kg	49	64.5	52	61.9		
	96 kg and above	6	7.9	12	14.3		
	Mean±SD / Min.-Max.	83.09±11.26	58-110	84.99±12.05	62-130		
Height (cm)	162-174 cm	32	42.1	31	36.9	1.36	.506
	175-184 cm	35	46.1	46	54.8		
	185-193 cm	9	11.8	7	8.3		
	Mean±SD / Min.-Max.	175.88±5.78	162-193	176.69±5.88	165-190		
Body Mass Index	Normal	17	22.4	21	25.0	1.45	.484
	Overweight	49	64.5	47	56.0		
	Obese	10	13.2	16	19.0		
Working time	0-5 years	21	27.6	27	32.1	1.06	.590
	5-10 years	5	6.6	8	9.5		
	11 Years and above	50	65.8	49	58.3		
Daily Computer Usage Time	0-3 Hours	73	96.1	74	88.1	3.38	.066
	4-7 Hours	3	3.9	10	11.9		
Blood Pressure	Hypotension	3	3.9	3	3.6	3.85	.278
	Normal	48	63.2	41	48.8		
	Prehypertension	23	30.3	38	45.2		
	Hypertension	2	2.6	2	2.4		
Family history of CVD	Yes	21	27.6	20	23.8	0.31	.580
	Hayır	55	72.4	64	76.2		

Smoking	Yes	41	53.9	47	56.0	0.41	.815
	No	31	40.8	31	36.9		
	Drop	4	5.3	6	7.1		
Alcohol	Yes	5	6.6	10	11.9	1.33	.248
	No	71	93.4	74	88.1		
Exercising Regularly	Yes	42	55.3	38	45.2	1.60	.205
	No	34	44.7	46	54.8		
Chronic Illness	No	76	100.0	84	100.0	-	
Regular Medication Use	Yes	2	2.6	5	6.0		.447*
	No	74	97.4	79	94.0		
Salt Consumption	Unsalted	2	2.6	6	7.1	1.78	.411
	Low Salt	61	80.3	63	75.0		
	Salty	13	17.1	15	17.9		
Daily Fruit Consumption	Yes	55	72.4	50	59.5	2.92	.088
	No	21	27.6	34	40.5		
Daily Vegetable Consumption	Yes	56	73.7	51	60.7	3.03	.082
	No	20	26.3	33	39.3		
Low-Fat Diet	Yes	50	65.8	44	52.4	2.96	.085
	No	26	34.2	40	47.6		
Oil Preference	Vegetable Oil	38	50.0	44	52.4	0.30	.862
	Butter	18	23.7	21	25.0		
	Olive oil	20	26.3	19	22.6		
Cooking Method	Baking	25	32.9	24	28.6	1.07	.785
	Boiled	17	22.4	16	19.0		
	Grill	3	3.9	5	6.0		
	Frying in Oil	31	40.8	39	46.4		
Source of health news	Doctor / Nurse	10	13.2	14	16.7	2.72	.436
	TV News	33	43.4	30	35.7		
	Other	23	30.3	22	26.2		
	Unfollow	10	13.2	18	21.4		

*χ2: Chi-Square test value. *Fisher correction.*

3.2. CDRAAS, CARRF-KL VE EQ-5D-5L Quality of Life Scale

According to the independent sample t-test results, no substantial difference was observed between the pre-test scores of the intervention and control groups on the CDRAAS total (t=1.65; p=.102) and Perceived Heart Attack/Stroke Risk (t=0.53; p=.594), Healthy Eating Intentions (t=0.32; p=.323), Perceived Benefits and Intentions to Change (t=1.85; p=.066) sub-dimensions (Table 2). No substantial difference was observed between the CARRF-KL (t=1.79; p=.075), EQ-5D-5L Index (t=1.06; p=.290) and EQ-5D-5L VAS (t=1.51; p=.133) pre-test scores of the intervention and control groups (Table 2). There was no meaningful difference between the pre-test and post-test mean scores of the control group in the CDRAAS total (t=-0.48; p=0.628) and Perceived Heart Attack/ Stroke Risk (t=-0.22; p=.823), Healthy Eating Intentions (t=-1.72; p=.090), Perceived Benefits and Intentions to Change (t=0.75; p=.457) sub-dimensions (Table 3). There was no meaningful difference between the mean CARRF-KL pre-test and post-test scores of the control group (t=1.83; p=.072) (Table 3). There was no meaningful difference between the pre-test and post-test mean scores of the EQ-5D-5L Quality of Life Scale of the control group (t=-0.84; p=.405) (Table 3). According to the independent sample t-test results, a meaningful difference was found between the CARRF-KL post-test mean scores of the intervention and control groups (t=-5.60; p=.000) (Table 4). The outcomes of the independent sample t-test revealed that a meaningful difference was found between the CDRAAS total (t =-4.72; p=.000) and Perceived Heart Attack/Stroke Risk sub-dimension post-test scores (t=-2.49; p=.014) of the intervention and control groups (Table 4). However, no meaningful difference was found between the mean scores of CDRAAS Healthy Eating Intentions (t=-1.84; p=.068), Perceived Benefits and Intentions to Change (t=-1.62; p=.107) sub-dimensions (Table 4). According to the results of the independent samples t-test performed to examine the comparison of the mean quality of life scores between the groups, no meaningful difference was found between the EQ-5D-5L index (t=-0.06; p=.950) and EQ-5D-5L VAS (t=-1.36; p=.177) post-test mean scores of the intervention and control groups (Table 4). A meaningful difference was found between the pre-test and post-test mean scores of the intervention group on CDRAAS total (t=-8.50; p=.000) and Perceived Heart Attack/Stroke Risk (t=-4.15; p=.000), Healthy Eating Intentions (t=-5.56; p=.000), Perceived Benefits and Intentions to Change (t=-3.82; p=.000) sub-dimensions (Table 5). A meaningful difference was found between the mean CARRF-KL pre-test

and post-test scores of the intervention group (t=-9.74 13.643, p=.000) (Table 5). A meaningful difference was found between the pre-test and post-test mean scores of EQ-5D-5L Index (t=-2.69; p=.009) and EQ-5D VAS (t=-4.56; p=.000) of the intervention group (Table 5).

Table 2. *Comparison of pre-intervention CDRAAS. CARRF-KL. EQ-5D Quality of Life Scale mean scores according to intervention and control groups*

Scale / Sub-Scale	Group	n	Mean	SD	t	p
CDRAAS	Control Group	76	42.17	5.04	1.65	.102
	Intervention Group	84	40.76	5.71		
Perceived Risk of Heart Attack/Stroke	Control Group	76	17.88	2.98	0.53	.594
	Intervention Group	84	17.61	3.47		
Healthy Eating Intentions	Control Group	76	12.26	2.74	0.32	.323
	Intervention Group	84	11.82	2.88		
Perceived Benefits and Intentions to Changec	Control Group	76	6.37	1.24	1.85	.066
	Intervention Group	84	5.96	1.49		
Knowledge	Control Group	76	5.43	1.78	0.23	.819
	Intervention Group	84	5.37	1.81		
CARRF-KL	Control Group	76	17.42	4.54	1.79	.075
	Intervention Group	84	16.12	4.63		
EQ5D5L Index	Control Group	76	0.97	0.06	1.06	.290
	Intervention Group	84	0.96	0.07		
EQ5D5L VAS	Control Group	76	87.29	10.99	1.51	.133
	Intervention Group	84	84.46	12.51		

**Independent groups t-test was applied.*

Table 3. *Comparison of the mean scores of the control group's pre-test CDRAAS. CARRF-KL. EQ-5D Quality of Life Scale with the post-test mean scores*

Scale / Sub-Scale	Test	n	Mean	SD	t	p
CDRAAS	Pre-Test	76	42.17	5.04	-0.48	.628
	Post-Test	76	42.38	6.08		
Perceived Risk of Heart Attack/Stroke	Pre-Test	76	17.88	2.98	-0.22	.823
	Post-Test	76	17.95	3.35		
Healthy Eating Intentions	Pre-Test	76	12.36	2.82	-1.72	.090
	Post-Test	76	12.64	2.83		
Perceived Benefits and Intentions to Change	Pre-Test	76	6.37	1.24	0.75	.457
	Post-Test	76	6.29	1.38		
Knowledge	Pre-Test	76	5.43	1.78	-0.22	.827
	Post-Test	76	5.46	1.84		
CARRF-KL	Pre-Test	76	17.42	4.54	1.83	.072
	Post-Test	76	16.67	5.33		
EQ5D5L Index	Pre-Test	76	0.97	0.06	-0.84	.405
	Post-Test	76	0.97	0.05		
EQ5D5L VAS	Pre-Test	76	87.29	10.99	0.43	.672
	Post-Test	76	86.84	11.70		

**Dependent (Paired) groups t-test was applied.*

Table 4. *Comparison of post-intervention CDRAAS. CARRF-KL. EQ-5D Quality of Life Scale mean scores according to intervention and ve control groups*

Scale / Sub-Scale	Group	n	Mean	SD	t	p
CDRAAS	Control Group	76	42.38	6.08	**-4.72**	**.000**
	Intervention Group	84	46.68	5.44		
Perceived Risk of Heart Attack/Stroke	Control Group	76	17.95	3.35	**-2.49**	**.014**
	Intervention Group	84	19.23	3.14		
Healthy Eating Intentions	Control Group	76	12.64	2.83	-1.84	.068
	Intervention Group	84	13.44	2.65		
Perceived Benefits and Intentions to Change	Control Group	76	6.29	1.38	-1.62	.107
	Intervention Group	84	6.61	1.09		
Knowledge	Control Group	76	5.46	1.84	**-6.37**	**.000**
	Intervention Group	84	7.11	1.36		
CARRF-KL	Control Group	76	16.67	5.33	**-5.60**	**.000**
	Intervention Group	84	20.39	2.40		
EQ5D5L Index	Control Group	76	0.97	0.05	-0.06	.950
	Intervention Group	84	0.97	0.05		
EQ5D5L VAS	Control Group	76	86.84	11.70	-1.36	.177
	Intervention Group	84	89.11	9.07		

**Independent groups t-test was applied.*

Table 5. *Comparison of the mean scores of the intervention group's pre-test CDRAAS. CARRF-KL. EQ-5D Quality of Life Scale with the post-test mean scores*

Scale / Sub-Scale	Test	n	Mean	SD	t	p
CDRAAS	Pre-Test	84	40.76	5.71	**-8.50**	**.000**
	Post-Test	84	46.68	5.44		
Perceived Risk of Heart Attack/Stroke	Pre-Test	84	17.61	3.47	**-4.15**	**.000**
	Post-Test	84	19.23	3.14		
Healthy Eating Intentions	Pre-Test	84	11.82	2.88	**-5.56**	**.000**
	Post-Test	84	13.44	2.65		
Perceived Benefits and Intentions to Change	Pre-Test	84	5.96	1.49	**-3.82**	**.000**
	Post-Test	84	6.61	1.09		
Knowledge	Pre-Test	84	5.37	1.81	**-10.26**	**.000**
	Post-Test	84	7.11	1.36		
CARRF-KL	Pre-Test	84	16.12	4.63	**-9.74**	**.000**
	Post-Test	84	20.39	2.40		
EQ5D5L Index	Pre-Test	84	0.96	0.07	**-2.69**	**.009**
	Post-Test	84	0.97	0.05		
EQ-5D5L VAS	Pre-Test	84	84.46	12.51	**-4.56**	**.000**
	Post-Test	84	89.11	9.07		

**Dependent (Paired) groups t-test was applied.*

4. DISCUSSION

This original study provides important evidence on the effect of HBM-based planned health education program and subsequent text messages sent to firefighters via WhatsApp on knowledge, awareness and quality of life of firefighters in

the prevention of CVD risk factors. As far as we are aware, there is no interventional study on the effect of education on CVD risk factor knowledge, awareness levels and quality of life of firefighters in Turkey; our study is the first to address this field.

According to the results of this study, the HBM-based health education and brief messages program in the prevention of CVD risk factors was effective in increasing awareness, knowledge and quality of life concerning CVD risk factors. While there was no notable disparity between the quality of life scores of the control and intervention groups after the intervention, there was a notable disparity between the pre-test and post-test mean scores of the intervention group. It is thought that this may be due to the fact that the quality of life scores of the control and intervention groups were close to each other before the intervention. Similarly, many a variety of studeies have revealed that HBM-based health education programs are effective in improving health knowledge, awareness of CVD diseases and quality of life (32, 33, 34). After the HBM-based intervention, it was revealed that there was a statistically noteworthy increase in the CDRAAS and perceptions of heart attack/stroke risk, healthy eating intentions, perceived benefits and intentions to change and knowledge sub-dimensions of the firefighters in the intervention group. Similarly, it was revealed that the post-test scores of the CARRF-KL and EQ-5D-5L Quality of Life Scale of the firefighters who took part in the intervention scheme were considerably higher than the pre-test scores.

HBM emphasizes that increasing individuals' perceived health risks plays a critical role in changing health behaviors (35, 36). Increased awareness and perceived risk, especially for serious health events such as heart attack and stroke, may lead individuals to make more informed decisions regarding cardiovascular health. Studies emphasize that educational programs can make significant changes in individuals' perception of health risks and that these changes can improve health outcomes in the long term (37). In one study, it was emphasized that individuals' perception of the seriousness of health threats may increase their motivation to change their behavior (38). In this study, HBM-based intervention was found to increase risk perception in firefighters. The outcomes of the study are consistent with similar studies in the literature (11, 39).

There is abundant evidence in the literature that education and constant reminders are crucial in the improvement and maintenance of healthy eating habits (40, 41, 42, 43). As seen in this study, training and text message interventions for firefighters were effective in increasing their healthy eating intentions.

HBM emphasizes that perceived benefits are an important source of motivation for individuals to adopt healthy behaviors (35, 36). The findings of the study reveal that individuals started to see the benefits of CVD risk factor avoidance behaviors more clearly after the intervention and tended to participate in change processes more willingly and decisively. Participants had a clearer understanding of the benefits of CVD preventive behaviors such as healthy nutrition, regular physical activity, quitting smoking and stress avoidance, and accepted these behaviors as necessary for a healthy life.

The elevate in the CARRF-KL post-test score of the intervention group reveals that the education and text message intervention led to a significant improvement in CVD risk factor knowledge. This study's findings support the conclusions of other research in the field that interventions such as education and reminder text messages are effective in increasing the knowledge level of CVD risk factors in individuals (24, 25, 44, 45, 46). Many studies have included multiple interventions similar to this study and mostly applied educational interventions to develop behavior change (47, 48). In this study, a planned health education and informative and motivational text messages were used to promote behavior change.

In order to develop healthy lifestyle behaviors and to be protected from risk factors, information should be obtained. Having information about the possible negative consequences of diseases is considerable importance, especially in the establisment of healthy lifestyle behaviors (36). Some studies have indicated that healthy lifestyle behaviors increase with increasing knowledge of risk factors for CVD (10, 26, 46, 49). Increased comprehension and awareness of CVD risk factors may lead individuals to feel more competent to take steps to reduce these risks. This study shows that workplace health education and motivational text messages played an important role in increasing knowledge of CVD risk factors among firefighters. The intervention program resulted in a significant increase in knowledge among firefighters, demonstrating the feasibility and effectiveness of such programs in the workplace, particularly for critical-risk occupational groups.

In the post-test, the overall health status of the firefighters was positively affected according to the EQ-5D-5L. Firefighters already reported their overall quality of life as good before the intervention. After the intervention, the perceived improvement in their quality of life increased minimally. This is a valuable finding in that regular and planned interventions can significantly affect quality of life and improve health. Taking these results into account, interventions can be tailored to effectively address the specific needs of firefighters and ultimately can aim to effectively improve the quality of life of firefighters. Considering the high exposure of firefighters to CVD risk factors, it is important to take measures to prevent CVD and improve cardiovascular health in firefighters in order to reduce or prevent these diseases and the problems they will bring with them. It is thought that nurses are in a strong position in this regard and have important roles in health protection and promotion. Occupational health nurses can motivate firefighters to take measures to inform them about the seriousness of CVDs and encourage better lifestyle behaviors. The outcomes of the study clearly show the impact of HBM-based training and text messages by improving firefighters' quality of life, knowledge and awareness. It is

believed that such programs can elevate the awareness and comprehension level of employees at workplaces about CVD, improve their quality of life, improve their general health status and create healthier environments at workplaces.

The data for this study were collected through self-reporting. The findings are particular to the specific fire brigade group involved in the research and cannot be extrapolated to other fire brigade units.

5. CONCLUSIONS

The results showed that HBM-based CVD risk factor prevention training and text messages increased awareness and knowledge of CVD risk factors in firefighters and positively affected their quality of life. According to the results obtained from the study, we recommend that studies should be conducted to elevate awareness and knowledge levels to prevent CVDs in firefighters who are at great risk for CVDs, occupational health nurses should plan HBM-based health education and reminder interventions in workplaces, and models that improve quality of life and promote behavioral change in firefighters should be transformed into effective programs. The study can serve as an example for the planning and implementation of health protection and promotion programs in workplaces.

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