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The effect of computer-based learning on knowledge of oral hygiene among employees in Kerman, Iran

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Original Article

Abstract

BACKGROUND AND AIM: Neglecting the importance of oral health may lead to complications and decrease quality of life (QOL). Regular use of toothbrushes, mouthwash, and flossing is effective in preventing and treating many oral diseases. In this study, we assessed the effect of computer-based learning method on the improvement of oral health knowledge among office employees in Kerman, Iran.

METHODS: In a quasi-experimental study, we selected 80 participants and randomly assigned them to 2 equal arms (intervention and control arms) in 2 governmental offices in Kerman. As a pretest, we measured individuals' level of knowledge using a questionnaire in both arms. After collecting the completed questionnaires, we distributed a recorded CD containing oral health education e-content among the intervention arm participants and after a week, during which the intervention arm had a chance to use the CD, the same questionnaire was given to both arms as a posttest. After completing the second round of the study, the participants in the control arm received the training CD. The CD was prepared in Loheh commercial software and its content was 2 types of slide files and short educational videos.

RESULTS: The comparison of the posttest and pretest showed that the average knowledge score significantly increased in the intervention arm from 9.97 to 12.2 (paired t-test; $P < 0.002$). The knowledge score difference between the intervention arm and the control arm was not affected by age or gender (Student's t-test, Pearson Correlation; $P > 0.050$). However, a positive and significant relationship was observed between educational level and the posttest score (Spearman's correlation; $P < 0.005$).

CONCLUSION: This study showed that the general level of knowledge about oral health is poor. Computer-based learning can positively improve knowledge. This kind of learning approach could be useful and effective enough for enhancing social oral health knowledge and status.

KEYWORDS: Oral Health; Multimedia; Educational Technology; Medical Informatics

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One of the health problems in present day civilized societies is unhealthy lifestyles. Oro-dental health is one of the factors influencing people's lifestyle.[1] Lifestyle plays an important role in personal health, especially in chronic diseases such as obesity and cardiovascular disease (CVD), which are called diseases of civilization.[2] According to the World Health Organization (WHO) technical works on oral health, one of the effective strategies for promoting healthy lifestyles is reducing risk factors related to oral health.[3]

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The Global Burden of Diseases Study 2017 (GBD 2017) estimated that oral diseases affect nearly 3.5 billion people worldwide.[4] Dental caries as the most common chronic disease in children is almost 5 times as common as asthma. The most common cause of tooth loss among adults is untreated periodontal disease. Surprisingly, a quarter of adults who are 65 years and older have lost all of their teeth due to untreated oral diseases.[5]

Despite efforts in developed countries, the problem of tooth decay has not yet been resolved and has increased in some developing countries due to nutritional changes. With the change in urbanization, tooth decay has increased.[6] Many children and adolescents in developing countries have limited access to oral health services and care, and suffer from tooth decay.[7]

Various studies have proven the effectiveness of oral health education programs, and have identified important variables which contribute to the effectiveness of these programs.[8]

In order to promote the use of toothbrushes and floss as two correct hygiene habits, it is necessary to design interventions in the field of health education. Health education is one of the important approaches to the prevention of oral and dental diseases and improvement of the overall health level in society. Most oral health conditions are largely preventable and can be treated in their early stages.[4]

Various methods are used to conduct health education, such as lecturing, small group discussion, role-playing and performance, and printed material. Today, significant advances have been made in educational technology and a wide variety of methods have been developed for teaching. The effectiveness and efficiency of many of these methods are as yet questionable, and multimedia and electronic education have received less attention compared to printed papers and oral lectures.[9]

"Educational media" as a tool for providing education to the learner is part of the educational processes. This teaching agent can be the TV, radio, mobile phone, billboard, or educational CDs. In other words, it refers to all the facilities that can create the conditions of an educational environment in which new information, behaviors, and skills can be acquired by the learners. Evidence shows that computer-aided learning or similar media can also facilitate learning.[10]

Due to the concerning and disturbing reports about the oral health of the Iranian people and the tooth decay of a large percentage of the population, it is necessary to accurately identify and follow the issues of public awareness. The main purpose of this study was to assess the effects of a computer-based learning tool on improvement of knowledge about oral health among employees of 2 offices in Kerman, Iran. The results of this study provide useful information for policymakers to design effective policies for the use of technology in public health, especially dental health education.

Methods

This quasi-experimental study was conducted as a survey for a case group with a control group. The aim of the study was to determine the effect of computer-based learning on oral health knowledge. We chose 2 arms to study; one arm was randomly selected as the intervention arm and the other as the control arm. Given that this research had to be performed in government agencies, we randomly selected these 2 arms from 2 separate organizations that were similar in terms of their office environment, types of daily tasks, and the general settings of their workplace; 1 organization was in the intervention arm and the other was in the control arm. In a letter to the department managers, permission was obtained to distribute the questionnaire to the 2 organizations. At the appointed time, the project colleagues referred to each of the 2 organizations and distributed the questionnaires among the individuals.

After distributing the questionnaire among the participants, each of them was given a description of the study, and the questionnaire and how to complete it. However, we did not tell people which group they were assigned to. In fact, no one in the intervention or control arm was aware of the execution plan, and the statistician was not aware of the two-arm codes.

In each arm of the study, there were 40 participants. In the intervention arm, in the first round, we gave them the questionnaire, asking them to complete it and after collecting the completed questionnaires, each person was given a training CD, and the method of using it was clearly explained to all of them. Then, in the second round, after 1 week, the CDs were taken from them, and we redistributed the same questionnaire among them and re-collected the data of the second round of the intervention arm. In the control arm, all of the processes were similar to the intervention arm except for the distribution of the training CD after the first round or any other kinds of education. All participants in the control arm, filled out the same questionnaire 2 times, both in the 1st and 2nd rounds, and after the second round, we gave them the training CD to use by themselves in their own time.

The data collection tool used in this study was a questionnaire. Using information obtained from the articles and materials that we had assessed, and with the supervision and cooperation of the project executives and experts in the field of oral health, we designed a researcher-made questionnaire. The questionnaire consists of 16 questions with 26 knowledge items (9 four-choice questions, 3 three-choice questions (correct/incorrect/I do not know), 3 three-choice questions (yes/no/I do not know), and 1 multi-choice question with 8 different phrases for multiple selecting), and some questions regarding demographic variables like age, sex, and educational level and course. Each of the knowledge questions had 1 point and the maximum total score of the first part of the questionnaire was 26. The content and face validity of the questionnaire was approved by 3 specialists and the reliability analysis for the questionnaire was conducted using Cronbach's Alpha, which was acceptable (0.61)

The study participants were employees of 2 offices in Kerman. The study inclusion criterion was that each employee had a computer system in the working place. This study did not have any clinical consequences and did not cause any harm to the participants, so we did not take informed consent from them. The individuals' acceptance to collaborate with our colleagues in completing the questionnaire was considered sufficient.

The type of intervention in this project was computer-based learning. A training CD with the educational content was delivered to each member of the intervention arm. We used the "Loheh" software that was designed in Persian, in the private sector. Our educational content had 2 parts; 1 part included text files in the form of slides and the other part included educational videos on oral hygiene, all of which were collected via the Internet, and the content quality of which was reviewed and approved by the project consultants. The general content was prepared after several editing, and it was finalized in the form of slides with a similar template, and it was added to the program using the "Loheh" software. For each content, short descriptions and supplementary explanations were added to the training CD so that each participant could see what was explained within each content.

The method of calculating sample size:

Considering that people's knowledge score is measured quantitatively and the aim of the research was to increase the average score by about 5 to 10%, and considering the formula of comparing the average in repeating observations, together with using STATA software (StataCorp, College Station, TX, USA), and taking into account that alpha = 0.05, Power = 90%, and expected

accuracy = 10%, the minimum number of samples required for each group of 39 people was calculated, in which 40 people were selected and questioned in each group. To analyze the hypotheses of the project, we used SPSS software (version 25, IBM Corporation, Armonk, NY, USA). Independent samples t-test, Paired t-test, and Pearson correlation coefficient were used for comparing means of scores between certain groups and the relation between different variables.

Results

In this study, 80 office employees of 2 organizations in Kerman were examined and their level of knowledge about oral health was assessed. Among these individuals, 51 were women (63.8%) and 29 were men (36.3%). Their age range was 23 to 59 years and the mean age of the subjects was 35.54 ± 7.78 years. Given that the 2 arms were randomly selected, the mean age of the employees in the intervention arm was 39.8 ± 7.9 years and slightly higher than the control arm (31.3 ± 4.7) with a significant difference (t = 5.89, P < 0.001). The frequency of the age group under 35 and over 35 differed between the 2 arms (Table 1). There was no significant difference between the 2 arms in terms of gender and level of education (P = 0.200).

There were 16 questions in the questionnaire with a sum of 26 available points for all of the phrases and items. Assessing the answers from the first and second round showed that the scores varied from 2 to 17 and, and 2 to 20, respectively. The highest score change between the first and second round was an 11-point increase in one of the members of the intervention arm and a 9-point decrease in one of the members in control arm.

To determine the effect of educational tools, the difference between the scores obtained in the 2 rounds of the survey was examined for the individuals. The frequency of responses in both arms showed that 35 people (43.7%) scored 1-11 points higher in the second round than in the first round. Of these, 29 were in the intervention arm and only 6 were in the control arm. The mean score difference between these individuals was compared using independent t-test, which showed an average increase of 3.83 points in the intervention arm and 3.33 points in the control arm; the difference between them was not statistically significant (P = 0.600).

Among the 20 other participants, the second score decreased about 1-4 points compared to the first score. Moreover, out of a total of 80 people, 19 people (23.7%) did not have a difference in points between the first and second rounds, and their scores were exactly the same. Of these, only 3 belonged to the intervention arm, whose education was diploma, associate degree, and master's degree, and the remaining 16 belonged to the control arm, which in fact did not receive any additional training from the research team between the 2 sessions.

Furthermore, in the 2 arms, 23 people (28.7%) out of 80 obtained lower scores on the second round, 8 of whom were in the intervention arm and 15 in the control arm.

Table 1. Descriptive data of the demographic variables between the intervention and control arms

Variables	Values	Intervention arm [n (%)]	Control arm [n (%)]	P
Age group (year)	≤ 35	15 (37.5)	32 (80.0)	< 0.001*
	> 35	25 (62.5)	8 (20.0)	
Gender	Female	23 (57.5)	28 (70.0)	0.200
	Male	17 (42.5)	12 (30.0)	
Level of education	Diploma	7 (17.5)	2 (5.0)	0.200
	Associate degree	5 (12.5)	3 (7.5)	
	Bachelor's degree	12 (30.0)	20 (50.0)	
	Master's degree	12 (30.0)	12 (30.0)	
	Doctorate	4 (10.0)	3 (7.5)	

*Statistically significant

Of these, 2 from the control arm had a decrease of 9 and 7 points, and 1 person from the intervention arm had a decrease of 8 points and the most errors in the second round. Pearson linear correlation analysis was performed to investigate the similarity of 2 response rounds separately in the intervention and control arm.

In each study arm, 40 people were examined and the questions were entered one by one as a score of 1 and 0 in the correlation model. The results showed that there was no significant correlation between the first and second round answers in any of the 26 items of the questionnaire in either study arm, and in fact the similarity of the answers was not statistically significant (P = 0.059). Nevertheless, the same analysis in the control arm showed that in all 26 questions, Pearson's linear correlation coefficients ranged between 0.452 and 0.912 and the similarity of responses were significant in all individuals (P < 0.005).

The results of statistical analysis of scores in both arms were evaluated using paired t-test. The mean score of the intervention arm increased from 9.97 ± 3.07 to 12.20 ± 3.70 (P = 0.002), but in the control arm the mean score changed from 8.12 ± 3.6 to 7.65 ± 3.5, which is not statistically significant (P = 0.200) (Table 2).

Comparison of the difference between the first and second scores between the intervention and control arms showed that in the intervention arm, the average raw score of individuals increased by 3.70 ± 2.22 points, while in the control arm, it decreased about -0.47 ± 2.60 points, which is statistically significant (P < 0.001).

Spearman's rank correlation analysis for examining the effect of education level on the level of knowledge of the intervention and control arms showed that there is a positive and significant relationship between the level of education of respondents and their second round scores, which was observed in both intervention and control arms (P < 0.050). One-way analysis of variance (ANOVA) to compare the mean of the 2 scores or the difference between 2 scores at different levels of education did not show a significant difference in either the intervention arm or the control arm. It seems that the score of the respondents with a master's degree was slightly higher than that of others in the intervention arm in the second round.

Discussion

In this project, one of the most important issues of personal and social health, namely knowledge of oral health, was analyzed. The main purpose of this study was to determine the effect of computer-based learning using an educational software on the level of knowledge of adult oral health. Those surveyed were employees of 2 offices in Kerman, and the analysis of the results showed that the use of training software has a positive effect on increasing knowledge of oral health. This method of education has nothing to do with age or gender. Howe0ver, the factor of education level had a greater impact on the use of this method, and people who had a higher level of education used the tools a little better than others. Moreover, the difference between the 2 scores of the questionnaire showed that not receiving correct training does not automatically increase people's knowledge.

Table 2. Comparison of raw scores and differences between the two rounds of the study in the intervention and control arms

Variables	Values	Intervention arm		Control arm		P
		n	Mean ± SD	n	Mean ± SD	
Raw score	1st round	40	9.97 ± 3.07	40	8.12 ± 3.67	< 0.001**
	2nd round	40	12.20 ± 3.69	40	7.65 ± 3.51	0.250#
Difference of scores	2nd-1st	40	2.22 ± 3.72	40	-0.47 ± 2.61	< 0.001
Difference of scores	Female	23	1.34 ± 4.04	28	-0.85 ± 2.63	< 0.050
	Male	17	3.41 ± 2.95	12	0.41 ± 2.42	< 0.010

**Intervention arm; #Control arm
SD: Standard deviation

The simplest and, of course, most unfortunate result of this research is the very low level of knowledge of people about basic issues in the field of oral health. As mentioned in the results section, the average score obtained by individuals in the first round and out of 26 simple phrases was less than 10, which indicates their poor knowledge of oral health.

Various studies in this regard have been conducted in Iran, the results of which indicate the unfavorable oral health status in the country, and that many Iranians do not have the conditions for a high oral health status.[11] According to the results of the systematic review by Rabiei et al. on the dental condition of the elderly in Iran, approximately 50% of the elderly are in very bad conditions and should be trained to improve dental care education, and should be provided with dental care services in the public sector and dental insurance coverage in an effort to improve the dental status of Iranian seniors.[12] The results of a systematic review by Ghaffari et al. are in line with the present study results, and support the effectiveness of oral health education in promoting oral health status and the implementation of continuous interventions for educating the general population.[13] Furthermore, the results of a meta-analysis study by Abedi show the effectiveness of educational interventions on improving oral health in Iran.[14] It seems that educational interventions can be used as a way to improve oral health in Iran. However, the impact of these interventions varies from low to high. The results of this study also emphasized that educating people in different ways, especially through the pattern of health belief, can increase the effectiveness of education.[14]

In a similar study, the researcher compared the effect of multimedia teaching methods and speech methods on oral health knowledge and consequent behaviors of students in Tehran, Iran.[15] Comparison of the results of the 2 arms showed that people's knowledge increased significantly immediately after the intervention in the multimedia arm.[15]

The results of similar studies that looked at the effect of education on knowledge of oral and dental care in different groups in different communities were also consistent with the results of this study. An example is the study by Wu et al., in which 80 employees were trained through 3 training methods, including providing information with the help of multimedia tools.[16] The effectiveness of the training program was measured using a structured questionnaire that was completed before and after the training program. The results of this study show that oral health education has been effective in improving health knowledge and staff skills, and statistical analysis indicates that the results are significant.[16]

The results of the study by In-Young et al. on 106 workers who participated in an oral health education program once a week also confirmed the results of the present study.[17] The findings showed that the score of the participants in the study improved significantly.[17] In a systematic review conducted, the researcher collected information on the effectiveness of oral health education programs and announced that all studies were effective in improving the level of knowledge.[8]

Numerous articles have been published on oral hygiene in children aged 9-12 years. This age range is a special period in terms of the growth of permanent teeth, and for children of this age, suitable hygiene is very important. Some reports indicate that the percentage of tooth decay in Iranian school children is close to 89%, and in fact, 9 out of 10 Iranian school children suffer from tooth decay.[18]

In the present study, the results of statistical analysis of all participants' scores by arms before and after the educational intervention showed that, in the intervention arm, people's knowledge scores increased by about 22%, which is statistically significant in the group. In the control arm, the average score decreased by about 6%, which was not

statistically significant. This decrease in the control arm may be due to the fact that, in the second round of answering the questionnaire, people felt that they had answered some of the questions incorrectly or had chosen another option after discussing the question with their colleagues. This is despite the fact that the research team did not provide any special training to the members of the control arm, and they did not expect to receive a similar questionnaire again in the second round. This reduction is not statistically significant and seems random. People cannot increase their knowledge about this issue during 1 week without receiving oral health education and with the usual social interactions they have, unless they have become somewhat sensitive to the issue and obtain some information from a specific source that is searched and studied.

There is no statistically significant difference between the ratios of individuals in the study of the level of education of the people in the study, but a positive and significant relationship was found between the knowledge score of the two arms studied and their level of education. We expected that the level of education of individuals would affect their level of knowledge. Spearman's correlation coefficient showed that individuals' knowledge scores in the second round of the study had significant results in both the intervention arm and the control arm.

A comparative study of the mean score of the 2 scores or the difference between the 2 scores at different levels of education did not show a significant difference in either the intervention arm or the control arm. The educational status of the individuals in the intervention and control arms was almost similar in terms of the level of education, and about 40% of the people had a master's and doctoral degree, which could be the cause of people's higher knowledge scores. Previous studies have also emphasized the effect of education level on people's knowledge in the field of health and dentistry. The results of the study by Ahmadi et al., which was conducted to determine the relationship between oral health and the elderly, also confirmed this finding.[19] The results of the study by Kim et al. in Korea also confirm this conclusion.[20]

Comparing the difference between the scores of the 2 sexes in the 2 arms shows different results. In fact, the difference in the scores of people before and after the study was not related to their gender and depended only on the study group. Of course, the difference in knowledge score of the second round compared to the first round in the men is slightly higher than the women, but this difference is not statistically significant in either the intervention arm or the control arm. Therefore, the effectiveness of computer-based oral health education does not depend on gender. This finding has also been confirmed by the results of other studies.[21,22]

The correlation analysis between the answers to each question in the questionnaire showed that, in the intervention arm, there was no correlation between the first and second round of the answers to any question. In other words, the participants responded differently to questions in the second round of the study in the intervention arm between the two shifts, according to the training they received with CDs or other personal actions, and which may have increased their knowledge.

However, in the control arm, who did not receive any training between the 2 sessions of the survey from the researchers, a high similarity was seen in their answers to all of the questions; this means that the knowledge of this group has not changed in this short period and they have answered the questions almost as they did in the first round.[23,24]

In the intervention period, increased score of the second round answers compared to the first round can indicate the positive effect of computer-based education in improving people's knowledge of oral health. In contrast, those who scored lower on the second round or did not gain a different score had probably not used the educational CDs. However, it is noteworthy that the percentage of people with equal or reduced scores in the control group is

much higher than the intervention group, which shows that if people do not receive the necessary training, not only will there be no change in their knowledge, but also in their probability. They have changed some of their answers in terms of prestige and even reduced their scores.

From all the above results and points, and considering the similarities mentioned in other articles, it can be concluded that computer-based learning, due to the ease and special features of multimedia in transferring knowledge and influencing the learning process, may be great for adults. This method is effective enough to significantly improve their awareness. The limitation of this study was the insufficient budget for working in a bigger community, and thus, we studied a small group.

In this study, the executive team considered it necessary to pay attention to the educational needs of society regarding oral health. They also recommend the efficient use of existing computer-based tools as an effective and inexpensive method and the attention of other researchers to similar projects.

Conclusion

This study was performed based on a hypothesis about the lack of knowledge of oral health in the general community. Participants in this survey were from a relatively moderate to high socio-economic state, and all of them were employees in academic and educational offices, but their overall knowledge about simple issues regarding oral and dental hygiene was not good. Providing them information on oral health through an educational CD slightly increased their awareness scores. Therefore, we conclude that academics' and educational organizations' attention to providing individuals with useful information on oral and dental health and a better lifestyle is necessary.

Conflict of Interests

Authors have no conflict of interest.

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