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Meta-analysis of the effectiveness of educational interventions on dental and oral health promotion in Iran

Niloufar Abedi

Abstract:

INTRODUCTION: Dental and oral health is a core component of general health and well-being. Few aspects of health are as accessible to personal control as oral hygiene which can be improved by simple behavioral changes. In recent years, dentists in the field of oral and dental health improvement have been research doing for measurement of validity and efficiency of available educational interventions. In this regard, meta-analysis integrates the results of different studies then determines the effect size of educational interventions. This study seeks to investigate the effective educational interventions on improving oral and dental health improvement in Iran by following the meta-analysis model.

MATERIALS AND METHODS: The present research was a meta-analysis study. This research by using the technique of meta-analysis to integrate the results of different studies, to determine the effect size of an educational intervention on improving oral and dental health improvement in Iran. Seventeen studies accepted in methodology were collected in Iran during 2001–2018, and analyzed through meta-analysis. The research tool was meta-analysis checklist. Effect size for each study was manually calculated.

RESULTS: The study findings showed that the rate of the effect size of educational intervention on Improving Oral and Dental Health Improvement in Iran was 0.62 ($P \leq 0.008$) which according to Cohen's table was intermediate.

CONCLUSION: Findings of this meta-analysis support of the effectiveness of educational interventions on improving oral and dental health improvement in Iran. It seems that the educational interventions on improving dental and oral health can be used as a method for improving oral and dental health in Iran.

Keywords:

Dental and oral health, educational intervention, meta-analysis

Introduction

One of the important development indicators of countries is the level of health and well-being of the population so that the healthy and capable people are the largest national capital of a society.^[1,2] The World Health Organization (WHO) considers oral hygiene as a necessity and part of a general health system throughout life, stating that poor oral health can have an impact on quality of life.^[2,3] Oral hygiene

can also be defined as no chronic pain in the mouth and face, head-and-neck cancers, respiratory failure such as cleft lip and palate, gum diseases, tooth decay, and their loss, and other diseases and defects affecting the oral cavity. A healthy mouth can make talking, eating and feeling well in a community without discomfort. Oral problems are divided into several groups, the most common of which are decay and periodontal diseases. Usually, the human mouth is more likely to develop disease than the other organs and tissues in the body and needs care more than other parts of the body.^[4] Tooth decay is the most

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Department of Dental,
Isfahan Medical Science
University, Isfahan, Iran

Address for correspondence:

Ms. Niloufar Abedi,
Department of Dental,
Isfahan Medical Science
University, Isfahan, Iran.
E-mail: dent.n.abedi@gmail.com

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common human disease that affects more than 99% of humans.^[5] To control tooth decay, mechanical and chemical methods are used. The mechanical methods include the use of dental floss and toothbrushes, and chemical methods consist of using different types of mouthwash and gels.^[6]

Tooth decay (also known as dental caries) is an infectious and multi-functional disease-causing damages to the calcareous tissues of the teeth. It is also the most important factor in tooth loss.^[7] Dental and oral health problems are the most important public health concerns in advanced countries and have recently become worrisome in developing countries. Therefore, the WHO has strategies on the agenda to prevent oral diseases and improve oral hygiene needs to enhance global awareness of dental and oral health.^[8] Nowadays, in all medical and dental schools in the world, prevention is prior to treatment, and it has been concluded that health education can be the best and most convenient way to ensure the health of the community. Oral and oral health is a step that its main elements are as follows: informing, motivating, and helping people to gain and maintain healthy behaviors and lead to healthy lifestyles.^[9] Oral health education can take place in different places, including schools, public places, and homes for the elderly.^[10] The goal of oral education is to increase knowledge in a field that may affect health behaviors that reduce dental and oral disability and diseases.^[11] Nowadays, with the advancement of science and technology, new materials and methods have been developed for replacing the lost lining of the tissue, none of which have normal tissue function. Therefore, prevention for keeping teeth healthy is considered essential. To achieve this goal, there are theories and methods in health education that can be used to create correct hygiene habits and prevent the development and even progression of dental diseases. Prevention is the only way to prevent tooth decay.^[12] Various methods have been proposed in the field of dental and oral health such as brushing using toothpastes-containing fluoride, dental floss, fluoride supplement, and regular referral to dentists.^[13] Maintaining oral health is part of the general health aspect, which is simply achieved by changing behavior and education.^[14] Poor access to services and poor service quality are challenges for the oral health system. Limited capacity and unjust distribution of education by oral health professionals have led to the prevalence of treatment and dental pain control over prevention.^[15] Recent studies in the United States have shown that teaching preventive behaviors such as the use of toothbrushes and dental floss as well as regular examinations, in recent decades in the American community has increased the percentage of people who have been able to maintain their natural teeth at older ages.^[16] Due to the increase in immigration from different countries to the United States, the rate of dental caries

in people is progressing well; thus understanding and providing a system with regard to the development of oral hygiene are needed.^[17] Preventing tooth decay depends on changes in behaviors and attitudes as well as access to services.^[17]

Yousefvand *et al.*,^[18] Andarkhora *et al.*,^[19] Shirzad *et al.*,^[20] Papurhaji Aqa *et al.*,^[21] Mohammadzadeh *et al.*,^[22] Amiri *et al.*,^[23] Pakpour Hajiagha *et al.*,^[24] Karami *et al.*,^[25] Heidarnia *et al.*,^[26] Heidari *et al.*,^[27] Moini *et al.*, Amidi Mazaheri *et al.*^[28] and Zaeri^[29] are among the studies have been conducted in the field of oral health improvement in Iran. The above studies have pointed to the effectiveness of educational interventions.

Although educational interventions have had a beneficial effect on dental and oral health, their effects have been reported from low-to-moderate levels. It seems that conducting a meta-analysis will help clarify the real value of the effectiveness of educational interventions on promoting dental and oral health. More straightforwardly, by performing a meta-analysis method, an overview is made on the effectiveness of educational-based interventions on the improvement of oral hygiene and health behaviors in Iran. In fact, this study uses a meta-analysis method to answer the question how is the effectiveness of educational interventions on improving dental and oral health in Iran. Meta-analysis is a statistical technique combining the size of the effects of various researches instead of a particular research hypothesis. Therefore, the present study aims to investigate the effect size of educational interventions on dental and oral health improvement using the meta-analysis research method.

Materials and Methods

In this research, the meta-analysis method was used based on the research type. Using the meta-analysis method, the results of the research can be combined. The research population consisted of articles published in scientific and research journals that were conducted on the effectiveness of educational interventions on the improvement of dental and oral health in Iran from 2007 to 2017. The search resources were research and scientific journals, the Information Resources Database of Jihad Daneshgahi, and the Iran Documentation Center. The key terms used for searching was dental and oral health and educational interventions. Only Persian sources and researches conducted in Iran were studied. Thirteen studies were included in the study, but some studies had two interventions. Hence, a total of 17 pieces of research entered into the meta-analysis.

The studies must had the following inclusion criteria for meta-analysis: the necessary requirements in

terms of methodology (hypothesis, research method, population, sample size, sampling method, measuring instrument, validity and reliability of measurement instruments, statistical hypotheses, statistical analysis, and statistical accuracy); research subjects of educational interventions for dental and oral health improvement; the studies must be conducted in the form of a group research; they must be conducted using the experimental and semi-experimental research designs; and they must report the effect size or the data necessary for its calculation. The exclusion criteria were as follows: not having methodological conditions; case studies, review studies, correlational and descriptive studies, and not reporting the effect size or the data necessary for its calculation.

The data were collected using a content analysis checklist for meta-analysis that included the components such as the research title, the researchers' characteristics, year of publication, place of publication, hypotheses, research instruments, statistical population, sample size, and significance level.^[25] The steps to conduct this meta-analysis are based on comprehensive meta-analysis software, Meta-Analysis V2.0 statistical software, developed by Biosta-Inc-in, USA. Therefore, according to the list of research in the field and referring to them, as well as considering the mentioned criteria, 17 studies were approved. The effect size of each research was calculated by having a mean, variance, and standard deviation values of the groups. The effect size represents the standardized difference between the means of the test and control groups. For calculating the effect size, the ratio of the difference between the mean scores of the test and control groups has to be obtained on the merged variance of total scores.^[27,30]

Descriptive characteristics and results of the studies conducted on the effectiveness of educational interventions on dental and oral health improvement in Iran are presented in Table 1.

Results

The characteristics of the studies used in the meta-analysis of the effectiveness of educational interventions on the dental and oral health improvement in Iran are reported in Table 1. The results of the meta-analysis of the effectiveness of educational interventions on the dental and oral health improvement in Iran are reported in Table 2.

Table 2 shows the meta-analysis study of educational interventions on the dental and oral health improvement based on 17 pieces of research. The average overall effect size of studies regarding the effectiveness of educational interventions on the dental and oral health improvement

in Iran is 0.31, which is statistically significant at 0.001. This effect size was interpreted in accordance with the interpretation of Cohen's d table.

To investigate the heterogeneity of the studies, the Q index was used [Table 3]. The Q index was calculated as 11.541 for 17 studies with a degree of freedom as 16 and significance level as 0.001. Therefore, the zero hypothesis is confirmed, and we conclude that the studies are heterogeneous. Thus, the studies are common in the true effect size and difference is due to the sampling error. Moreover, the calculations related to the random effect were also significant. Therefore, the heterogeneity of the studies is not due to the statistical method; therefore, the fixed effects model was employed and compared with the search for moderating variables.

The most common and simplest method of detecting the publication bias is the use of a two-dimensional dispersion diagram called the Funnel chart, in which the estimated intervention effect from each study is plotted against the sample size of the study. If there is no publication bias, it is expected that the chart is symmetric and the amount of dispersion around the effect of intervention decreases with increasing sample size. Interpretively, in Funnel charts, studies that have a low standard error and accumulate above the funnel-do not have a publication bias. But as the studies go down the funnel, their standard error goes up and the publication bias increases. Any meta-analysis has some bias due to the criteria for the selection and deletion of studies, which is shown in this paper by the funnel chart. Therefore, according to the Funnel chart of the research is based on the fact that the studies are aggregated above the chart, indicating that there is no publication bias [Chart 1].

Discussion and Conclusion

The findings of this meta-analysis showed that the effect size of educational interventions on dental and oral health improvement is 0.31, which is in accordance with the average interpretation of Cohen's d table. This finding confirms some of the previous researches, including those done by Yousefvand, Andarkhu *et al.*, Mirza *et al.*, Pakpour Hajiagha, Amiri *et al.*, Heidari *et al.*, Moini *et al.*, Mazaheri *et al.*, and Zarei. In explaining these results, it can be said that the meta-analysis or integration of the results of various studies conducted on numerous samples, provides a more comprehensive view of the effect size of the variables. In fact, the results of this meta-analysis indicate that early education of individuals can prevent them from occurring some oral problems. In addition, choosing appropriate teaching methods for learners is a task whose need is always felt. It can also be claimed that training people in different ways, especially via the health belief model, can be effective

Table 1: Characteristics of the studies having been investigated in the meta-analysis

Row	Research title	Researcher	Sample size	Treatment method	Instrument	Statistic	Significant
1	Comparison of the Efficacy of Electronic and Moulage Dental Training Models on Adolescents	Yousefvand (2006)	Moulage group: 60 Electronic group: 6	Moulage method Electronic method	Self-report questionnaire and checkup	χ^2 Wilcoxon signed-rank test	0.151 0.001
2	Comparison of the Effect of Lecture and Multimedia Screening on Oral Health Behavior of Students in Tehran	Andarkhora <i>et al.</i> (2007)	Experimental Group 1: 30 Experimental Group 2: 30 Control group: 30	Lecture method Multimedia screening method -	Researcher-made questionnaire	Independent <i>t</i> -test	0.05 0.05
3	The Effect of Educational Intervention in Changing Mothers' Attitudes, Perceived Self-Efficacy and Perceived Barriers Regarding Oral Health of Preschool Children	Shirzad <i>et al.</i> (2010)	Experimental group: 60 Control group: 60	Attitude and self-efficacy training	Researcher-made questionnaire	Independent <i>t</i> -test	0.001
4	Effect of educational intervention on oral health self-care behaviors in diabetic patients	Pakpour Hajiagha <i>et al.</i> (2006)	Experimental group: 65 Control group: 65	Intervention Based on the Modification Process Model	Researcher-made questionnaire and checkup	<i>t</i> -test and Mann-Whitney U-test	0.001
5	Effect of an Educational Intervention Based on the Trans-Theoretical Model on Oral Health Behaviors in Pregnant Women	Mohammadzadeh <i>et al.</i> (2004)	Experimental group: 68 Control group: 68	educational program based on the theory of planned behavior	Raven IQ test Questionnaire	<i>t</i> -test and Mann-Whitney U-test	0.05
6	Effects of Oral Health Training on Dental Plaque Index	Amiri <i>et al.</i> (2010)	Breath odor group: 48 Traditional education group: 57 Control group: 56	Bad breath education Dental decay education	Questionnaire and checkup	χ^2 <i>t</i> -test and Mann-Whitney U-test	0.002 0.003
7	Investigating education on dental and oral health behaviors in diabetic patients	Pakpour Hajiagha <i>et al.</i> (2010)	Experimental group: 75 Control group: 75	Education of dental and oral health behaviors	Questionnaire	χ^2 <i>t</i> -test and Mann-Whitney U-test	0.001
8	Effect of education based on health belief model on the alteration of oral health behaviors among students	Karami <i>et al.</i> (2008)	Experimental group: 75 Control group: 75	Education Based on Health Belief Model	Questionnaire	Independent <i>t</i> -test	0.05
9	The effect of educational program based on health belief model on adopting preventive behaviors of tooth decay in pregnant women in Arak City	Heidarnia <i>et al.</i> (2010)	Experimental group: 65 Control group: 65	Education Based on Health Belief Model	Questionnaire	Independent <i>t</i> -test	0.05
10	Comparison of two rolling and scrubbing brushing methods on dental plaque control in children aged 11-8 years	Heidari <i>et al.</i> (2008)	Rolling brushing group: 110 Scrubbing brushing group: 105	Education of rolling and scrubbing brushing methods	Observation and checkup	Independent <i>t</i> -test ANCOVA	0.001
11	A Comparative Study of Peer Education and Trainer Education on the Basis of HBM in Improving Oral Health in Sanandaj Boys' Elementary Schools	Moini <i>et al.</i> (2012)	Child-to-child group: 30 Trainer-to-child group: 30 Control group: 30	Child-to-child and trainer-to-child education methods	Questionnaire	Independent <i>t</i> -test	0.007

Contd...

Table 1: Contd...

Row	Research title	Researcher	Sample size	Treatment method	Instrument	Statistic	Significant
12	The effect of educational posters on knowledge and attitude of selective apartment residents in Isfahan about oro-dental health	Amidi Mazaheri <i>et al.</i> (2011)	Experimental group: 36 Control group: 31	Poster-based education	Questionnaire	Mann-Whitney U-test Wilcoxon signed-rank test	0.653
13	Effect of health education on oral health through role playing and painting on awareness and function of children	Zarei (2008)	80 participants	Role playing and painting	Questionnaire	t-test	0.05

HBM: Health Belief Model

Table 2: The results of the meta-analysis of the effectiveness of educational interventions on the dental and oral health improvement in Iran

Row	Studies	Year of publication	r	Fisher's z'	SE	P
1	Yousefvand	2006	0.18	0.190	0.132	0.151
2	Yousefvand	2006	0.41	0.441	0.132	0.001
3	Andarkhora <i>et al.</i>	2007	0.36	0.378	0.192	0.05
4	Andarkhora <i>et al.</i>	2007	0.36	0.378	0.192	0.05
5	Shirzad <i>et al.</i>	2010	0.41	0.441	0.132	0.001
6	Pakpour Hajiagha	2006	0.39	0.422	0.127	0.001
7	Mohammadzadeh <i>et al.</i>	2006	0.33	0.350	0.124	0.005
8	Amiri <i>et al.</i>	2010	0.43	0.446	0.149	0.002
9	Amiri <i>et al.</i>	2010	0.38	0.407	0.136	0.003
10	Pakpour Hajiagha <i>et al.</i>	2010	0.37	0.391	0.118	0.001
11	Karami <i>et al.</i>	2008	0.22	0.231	0.118	0.050
12	Heidarnia <i>et al.</i>	2010	0.24	0.249	0.127	0.050
13	Heidari <i>et al.</i>	2008	0.31	0.320	0.097	0.001
14	Heidari <i>et al.</i>	2008	0.19	0.194	0.099	0.007
15	Moini <i>et al.</i>	2012	0.48	0.526	0.192	0.653
16	Mazarei <i>et al.</i>	2011	0.07	0.078	0.174	0.05
17	Zarei	2008	0.22	0.224	0.114	0.05

SE: Standard error

in promoting dental and oral health. In other words, when the cognitive, attitude, and behavioral aspects are considered in educational programs, the effectiveness of education can be enhanced.

The research results also illustrated that among the researches that were analyzed, the largest size of the calculated effect (0.48) was the research done by Moini *et al.* This research shows that child-to-child education based on the health belief model (behavior is a function of knowledge and attitudes of an individual), and according to the components that it is based on this idea that it makes people perceive a health threat and pushes their behaviors to health. In this way, it can raise the perceived sensitivity and severity of individuals to dental caries and direct them to oral health with regard to perceived benefits and barriers, it can lead

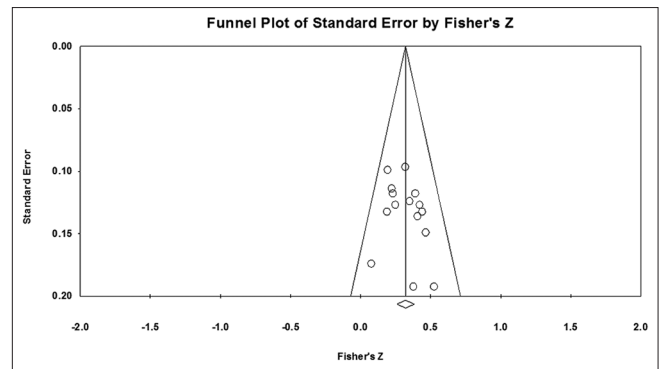


Chart 1: Funnel chart of meta-analysis studies conducted on the effectiveness of educational interventions on dental and oral health improvement in Iran (Fisher's standard error based on Fisher's z)

to students' dental and oral health improvement, and be used in schools. Moreover, in the research of Moini *et al.*, the perception of tooth decay and its problems were raised, which shows that the examined participants more seriously understood the risk of tooth decay. The results of Moini *et al.* also indicate an increase in the perceived severity of the child-to-child group, which indicates a positive effect. Children are more successful than the coach in terms of the familiarity of the world of each other and the greater commonality of each other in describing the dimension of deterioration and severity of the problem.

Generally speaking, considering the effect size of this meta-analysis (0.31), it can be said that educational interventions were used to improve dental and oral health at a moderate level. Therefore, in addition to these methods and models for training individuals, others methods have also used for dental and oral health.

It is recommended that the health belief model be used for training children and students in schools. Experts also need to test game practices and models, including the use of multimedia, theatres, performing arts, storytelling, and training on modeling and game apps appropriate to individuals' ages. Finally, it is suggested that special

Table 3: Investigating the heterogeneity of educational interventions on the of dental and oral health improvement in Iran

Q	df	P	Z	Lower limit of size	Upper limit of size	Effect size	Number of studies
11.541	16	0.001	10.158	0.253	0.365	0.301	17

attention should be paid to improving the education of oral health and increasing the effect on behavior change in the design of the training program in addition to selecting the appropriate educational method for the cultural, economic, and environmental issues of each region.

Limitations of research include the lack of a coherent database in Iran and little access to resources and research in this field.

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Conflicts of interest

There are no conflicts of interest.

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