research activities because ignoring ethical issues and analysis of potential ethical problems may not only cause harm to the subjects but also lead to implementation problems and research ineffectiveness. Although ethical commitments are of particular importance in all branches, they require special emphasis in clinical and research fields associated with medical sciences due to the specific nature of medicine, which is related to human life and health [1]. Accordingly, a section is currently dedicated to the requirements of professionalism in all specialized reference books. Nowadays, almost all scientific journals are recently considering ethical approval as the prerequisite for the publication of articles. There have been instances of immoral medical research activities on humans and animals worldwide in history, including infected blood transfusions to 40 individuals at the Robert Koch Institute, typhoid vaccine and the death of thousands in German camps, the death of many twins for genetic investigations, the death of seven thousand Japanese while performing research on the plague, inserting infecting substances into wounds to examine the effects of sulfonamides, and transferring Anopheles mosquitoes from swamps for malaria experiments. Accordingly, the Nuremberg Code was adopted in 1947, after which the Helsinki Code was approved around seventeen years later in 1964, explicitly addressing the issue of research ethics on vulnerable groups. In Iran, the development of codes for the protection of human subjects in medical research began in 1997, and the national codes of ethics in medical research were approved in 26 principles in 2000. Numerous ethics guidelines are now developed and published by the Ministry of Health in different research areas, including clinical trials, stem cells, gametes and embryos, vulnerable groups, laboratory animals, blood and human tissues, genetic research, and many others to provide the researchers with the practical benchmarks [2].

However, some researches indicate that the process of implementation and monitoring of research projects is not desirable in the Middle Eastern countries. which does not seem to be comprehensively considered. However, there is no consensus on how much information should be made available to research volunteers. Observance of individual autonomy and freedom are also of great importance [3].

Considering the above, it seems that conducting this research in terms of investigating the awareness of dental residents and professors of the principles and standards of ethics in research can facilitate serious future planning, along with practical workshops and courses related to this area or other similar measures.

MATERIAL AND METHOD

This is a descriptive cross-sectional study whose population included the dental residents and professors of Shahid Beheshti University of Medical Sciences. The researcher-made questionnaires were prepared by reviewing the available texts and articles and obtaining the opinions of experts. The validity of the questionnaires was assessed based on the opinions of 15 experts, and the content validity ratio (CVR) as well as content validity index (CVI) was used to evaluate the validity of the final questionnaires. The CVR value for each item was more than 80% and 71% in the questionnaires for the professors and residents, respectively. The CVI value based on a 4-item scale (irrelevant, somewhat relevant, relevant, and completely relevant) was more than 85% and 80% for each item in the questionnaires for the professors and residents, respectively. The reliability of the questionnaires was 92% and 86% for the professors and residents, respectively, using Cronbach's alpha coefficient, which indicated acceptable validity and reliability of the questionnaire. The questionnaires consisted of two main parts, the first of which reflected demographic characteristics and the second investigated the participants' awareness of the ethical standards in the research in the form of questions with correct and incorrect answers (34 questions in the residents' questionnaire and 30 questions in the professors' questionnaire). The questionnaires were completed by 53 professors and 74 residents according to the statistics expert and through the census.

Being a full-time faculty member of the School of Dentistry of Shahid Beheshti University of Medical Sciences with at least one year of experience was the inclusion criterion for the professors while starting residency in one of the dentistry specialties was considered as the inclusion criterion for the residents. Some explanations were given to the participants about the research and its necessity at the beginning of the work, while appropriate answers were also provided for their potential questions, along with obtaining their verbal consent to take part in the study.

Descriptive statistical methods such as determining the mean and median, and if necessary, other indicators such as the relationship between variables were used in data analysis. Final data analysis was performed using statistical tests and SPSS 21 software.

Findings

According to the findings of the study, of the total number of 53 professors participating in various specialties, 41.5% were male and 58.5% were female, and most were in the age range of 36 to 45 years. Out of the studied professors, 9.4% had 11 to 15 (minimum), and 32.1% had 1 to 4 years of experience (maximum).

Among the residents, 62.2% were female and 37.8% were male, the majority of whom were in the age range of 20 to 30 years. The highest and lowest number of residents participating in the study were in the first (n=43, 58.5%) and third (n=13, 17.6%) year of residency, respectively. Restorative dentistry had the highest frequency among all participants with 36.5%.

The binominal test was used to examine research questions based on the nature of the tools. The results of investigating the dental professors' awareness of ethical standards in medical research (Table 1).

Written consent is required in intervention research.	Incorrect	0	0	0.5	.000a
	Correct	74	1		
Sometimes, the authority of the person under study can be limited depending on the subject of the research.	Incorrect	31	0.42	0.5	.201a
	Correct	43	0.58		
When the researcher has a higher position than the person under study, the consent must be obtained from a trusted third party.	Incorrect	37	0.5	0.5	1.000a
	Correct	37	0.5		
In a clinical trial, it is not necessary to inform the subjects whether they are in the experimental or control group.	Incorrect	13	0.18	0.5	.000a
	Correct	61	0.82		
The researcher has the main responsibility regarding confidentiality of the subjects' secrets.	Incorrect	3	0.04	0.5	.000a
	Correct	71	0.96		
Written consent must be obtained from parents in examining a new drug to control pediatric dental infection.	Incorrect	5	0.07	0.5	.000a
	Correct	69	0.93		
There are no special executive regulations called subject protection codes in research in our country.	Incorrect	59	0.8	0.5	.000a
	Correct	15	0.2		
Both the researcher and the subject must be insured when conducting research.	Incorrect	21	0.28	0.5	.000a
	Correct	53	0.72		
Since the duration of the research, the way it is performed, and the type of intervention in clinical trials is a specialized matter, there is no requirement to inform the subject of such cases, while strictly observing the scientific standards and professional ethics.	Incorrect	52	0.7	0.5	.001a
	Correct	22	0.3		
The researcher is responsible to plan properly for the safety of the research.	Incorrect	10	0.14	0.5	.000a
	Correct	64	0.86		
The Strasbourg Codes are one of the oldest codes of ethics in research	Incorrect	48	0.65	0.5	.014a
	Correct	26	0.35		
Total	Incorrect	11	0.15	0.5	.000a
	Correct	63	0.85		

Table2: The results of binominal test in investigating the dental residents' awareness of the ethical standards in medical research.

Since the significance criterion obtained in the output (0.001) is less than 0.05, the null hypothesis can be rejected. Therefore, it can be said that the awareness of dental residents of the ethical standards in medical research is desirable, and the difference observed is not due to chance or accident.Regarding the items of the studied component, since the test is significant at the level of 0.05, it can be claimed that the awareness of dental residents of the ethical standards in medical research is high (given the cumulative frequency of the correct answers).

In items such as "According to the Nuremberg Code, research on vulnerable groups is possible with considerations", "One of the tasks of the Research Ethics Review Committee is to review the research proposals from a scientific point of view", "In obtaining the consent, providing basic information is sufficient and there is no

need to provide all the information", "In vulnerable groups, therapeutic research is usually more ethically accepted than non-therapeutic research", "If it is not possible to obtain consent due to the nature of the research, the research can be carried out with the approval of the Research Ethics Review Committee", "There are no ethical problems if the treating physician and the researcher are one person", "Sometimes, the authority of the person under study can be limited depending on the subject of the research", and "When the researcher has a higher position than the person under study, the consent must be obtained from a trusted third party", since the test is not significant at the level of 0.05, it can be claimed that the awareness of dental residents of the ethical standards in medical research (given the relatively equal cumulative frequencies of the Correct and Incorrect answers) is moderate.

Independent t-test was used to investigate the differences in the awareness of professors and dental residents of the ethical standards in medical research.

		Number	Mean	SD
Awareness	Professors	53	0.5906	0.1623
	Residents	74	0.6542	0.17693

Table3: Variable descriptive indicators comparing the awareness of professors and dental residents of the ethical standards in medical research.

Based on the results obtained from independent t-test, since t is significant in the studied variable with the value of 2.068 at the significance level of 0.05 (p = 0.041), the null hypothesis (no difference between two independent means) is rejected and the research hypothesis (the difference between two independent means) is confirmed. Therefore, there is a difference between the awareness of professors and dental residents of ethical standards in medical research. Comparison of the mean of the two groups shows that dental residents had a higher awareness of ethical standards in medical research (0.65) than professors (0.59).

Multivariate analysis of variance was used to investigate the difference in awareness of dental residents of the ethical standards in medical research by demographic components.

Sig.	F	Mean of squares	Df.	Sum of Squares	Indicator
					Source of Changes
0	350.127	8.695	1	8.695	Covariate effect
0.385	0.765	0.019	1	0.019	Age
0.175	1.885	0.047	1	0.047	Gender
0.233	1.372	0.034	7	0.239	Specialty
0	12.393	0.308	2	0.616	Residency year
		0.025	62	1.54	Error
			74	34.341	Total

Table4: Summary of the results of multivariate analysis of variance comparing awareness of dental residents of the ethical standards in medical research by their demographic components.

According to above data, given that the value of F with (different) degrees of freedom is not significant in the components of age, gender, and specialty at the level of α = 0.05, it can be concluded that there is no significant difference between the awareness of dental residents of the ethical standards in medical research by age, gender, and specialty.

Also, since the value of F with degrees of freedom (2 and 62) is significant in the components of the residency year at the level of α = 0.05, it can be concluded that there is a significant difference between the awareness of dental residents of the ethics in medical research by year of their residency. The results of the post hoc test showed that the second- and third-year residents had a higher level of awareness compared to the first-year residents, but there was no significant difference between the second- and third-year residents.

Multivariate analysis of variance was used to investigate the difference in awareness of dental professors of the ethical standards in medical research by demographic components.

The hypothesis of homogeneity of variance of within-group scores was investigated using Levene's test. Considering that the value of F was not significant at the level of α=0.05, the hypothesis of homogeneity of data variance and regression slope was inferred.

Sig.	F	Mean of squares	Df.	Sum of Squares	Indicator
					Source of Changes
0	145.67	2.776	1	2.776	Covariate effect
0.526	0.761	0.014	3	0.043	Age
0.795	0.069	0.001	1	0.001	Gender
0.083	2.48	0.047	3	0.142	Years of service
0.086	1.967	0.037	9	0.337	Specialty
0.186	1.677	0.032	4	0.128	Project participation
		0.019	26	0.496	Error
			47	17.894	Total

Table5: Summary of the results of multivariate analysis of variance comparing awareness of dental professors of the ethical standards in medical research by their demographic components.

According to Table 5, given that the value of F with (different) degrees of freedom is not significant in the components of age, gender, specialty, years of service, and project participation at the level of $\alpha = 0.05$, it can be concluded that there is no significant difference between the awareness of dental professors of the ethical standards in medical research by age, gender, specialty, years of service, and participation in the research project or dissertation.

DISCUSSION

Sickle cell disease is an inherited autosomal recessive disorder which is common in Sub-Saharan Africa, the Mediterranean areas, Arabian Peninsula, South Asia, and Southeast Asia. According to the World Health Organization, African population has the highest prevalence of the disease that ranges from 10-40%, and in countries where the trait prevalence is over 20%, the disease affects about 2% of the people. Generally, it is estimated that 7% of the overall populations in the world are carriers of hemoglobinopathies.

The phytotherapy is recently used as an alternative medicine that can provide relief for SCD patients. The review of the literature indicated that various plants have been tested and shown to have anti-sickling potential effects, of which was *Curcuma longa*. It was reported that the extracts of rhizomes of C. longa have several pharmacological effects such as anti-inflammatory, anti-cancer, healing, cholesterol-lowering, hypoglycaemic, anti-Alzheimer, anti-plasmodial, antioxidant, anti-venom, antibacterial, antifungal, antipyretic, and analgesic properties. It also has protective potential against diabetic retinopathy and other pathologies.

In this study, 49 fresh whole blood samples of confirmed sickle cell disease patients were collected. Majority 57.1% of cases were males (M: F=1: 0.75). Average (±SD) age of cases was 28.2 (± 9.97) years. Average percentage of sickled RBC before adding the extracts was 23.5 ± 4.2% and, after adding Fenugreek seed extract the mean percentage of sickled cells was significantly decreased to 9.1 ± 3.3 (p value<0.001), and when adding Turmeric rhizome extract the mean percentage of sickled RBC was significantly decreased to 7.8 ± 3.5 (p value<0.001). Between the two products, Turmeric rhizome extract had shown to be more active when compared with Fenugreek seed extract but the difference is not significant (p-value=0.025). Turmeric rhizome extract was found to be effective agent with 66.81% anti-sickling activity and Fenugreek seed extract with 61.28% reversal anti-sickling effect.

The anti-sickling potential of extracts from different organs (rhizomes, roots, leaves, petals, and sepals) of *Curcuma longa* was described by the researchers.18 The most recent study of this plant for SCD management has also reported that the anti-sickling potential of different parts of *Curcuma longa*. Their results revealed that extracts of *Curcuma longa* leaves, which are rich in anthocyanin, have a prominent anti-sickling activity.

According to several studies, the anti-sickling effect of plants is mainly due to the presence of anthocyanins and organic acids. Anthocyanins interact with HbS, competing with the polymerization process and preventing RBC sickling. The total aqueous extracts as well as the total methanol extracts of different organs of *Curcuma longa* have shown considerable anti-sickling properties. Several studies found that extracts of *Curcuma longa*, including from the flowers, contain large amounts of total polyphenols which have characteristic antioxidant and scavenging properties.

Discussion and Conclusion

The observance of ethical standards in medical research in Iran has been seriously studied for many years, given the specific religious and cultural background of the country. Numerous studies on this issue have been published at the national level, including articles on ethical principles in research related to surgery. There are also articles on the need for researchers to consider ethical principles while conducting medical research. In an Iranian article, ethical issues have been mentioned in research related to organ and tissue transplantation [4].

Based on the research findings, it is clear that the awareness of dental residents of Shahid Beheshti University of Medical Sciences of the ethical standards in medical research was at a high and acceptable level. It is probably associated with the effects of professors' behavior and practice on students, attractiveness and correct understanding of medical ethics and forensic dentistry in the general course, and students' experiences regarding ethical challenges with patients in different wards. However, the professors had lower scores.

In a similar study on professors and students of Gonabad University of Medical Sciences in 2013, student-related and managerial-environmental domains were reported as the most important reasons for ethical deficiencies in research, which was contrary to our report. In a similar study in Isfahan between 2001 and 2015, it was reported that the observance of ethical scientific principles in humanities research has a long way to go to reach the desired level in general student studies. However, the process of observing the principles showed improvement in Medical ethics during the research, especially comparing 5-year courses.

Also, in a study on knowledge, awareness, and attitudes towards research ethics in Middle Eastern dental schools, it was found that a 3-day workshop on research ethics for physicians and scientists at the University of Nigeria improved knowledge and application of research ethics, and international guidelines, rules, and regulations.

In another article on research ethics among dentists in India in 2014, participants had desirable attitudes towards research ethics, but their knowledge and behavior required significant improvement.

However, it seems that consideration of ethical issues while conducting medical research has not yet become a requirement for all researchers. Accordingly, in a 5-year research project in Iran, which reviewed all research projects, the following results were obtained: There was a section for the ethical considerations in 85.5% of the total plans, and 96.6% of the clinical trials. Subjects were informed about participating in the study in 68.4% of cases, and the prediction of informed consent was only in 66.8% of cases, of which 50.9% consents were in written form. Informed consent was obtained in 80% of clinical trials, of which 85.5% were in written form, and out of 60 clinical trials, 63.3% had referred to research ethics committees and obtained the approval of the ethics committee [5].

According to the research findings, 66% of professors and 85% of residents selected the correct answers regarding the level of awareness of medical ethics, and there was a statistically significant difference between the awareness of professors and students; however, there was no significant relationship between the awareness of the professors and residents by demographic characteristics.

According to the findings of the study, the level of awareness of dental professors was lower than that of residents. It is probably because professors are not directly involved in the research work in many cases, and more research is carried out by residents with the support and guidance of professors, which requires consideration. It also indicates the importance of workshops related to ethical standards in research and the need for active participation of professors in these workshops, because they play a fundamental role in educating students who are the future doctors and dentists.

Given the importance of the subject and the need to consider ethical issues in conducting research, and also according to the findings of this research project, it seems that professors and faculty members of various specialties are somewhat unfamiliar with the ethical principles in research. Therefore, it is necessary to take steps to eliminate this shortcoming through effective workshops and training courses.

According to McGoldrick, the problem should not be probably in mere theoretical training, which has short-term effectiveness even for residents. In other words, training that is primarily based on mere lectures and theoretical explanations is no longer effective [6]. On the other hand, the professional involvement of professors and focused dental courses for students can be another important factor in the lack of opportunities to learn ethical principles in research.

Therefore, it may be better to use the same training opportunities available in the faculty for professors and students because most research is carried out in academic environments. The development of such research for the accurate evaluation of national medical schools seems necessary to make accurate planning possible.

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