Dental Environment Stress and The Related Factors in the Iranian Dental Students: A Systematic Review and Meta-Analysis

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Abstract

Background: Stress is an influential factor in mental health; and can lead to psychological disorders. Thus, it has always been a concern for the medical personnel, and particularly dental students. This systematic review aimed to assess the dental environment stress and the related factors in the Iranian dental students.

Methods: In this systematic review, an electronic search of the literature was carried out in the Iranian and international databases, and all possible combinations of relevant keywords were searched using the Boolean operators. Data were analyzed using STATA SE 13.1 meta-analysis software. Heterogeneity of the data was evaluated using the I2 statistics, and the correlation between age and level of stress was analyzed by meta-regression. In the Chi-square (X2) heterogeneity test, P-value < 0.05 was considered significant.

Results: A total of 16 eligible articles (3,521 dental students) out of 821 retrieved studies were reviewed in this systematic review. The mean overall stress level of the Iranian dental students was 2.18 (95% CI:1.87-2.49). The maximum (2.21) and minimum (2.10) mean overall stress values of the Iranian dental students were associated with the dental environment stress (DES) questionnaire and the depression, anxiety and stress scale (DASS-21), respectively (P>0.05). Also, the 4th and 5th year dental students had the maximum (2.24) and minimum (2.01) mean overall stress levels, respectively (P>0.05). Gender had no correlation with the stress level (P=0.520).

Conclusion: The mean stress level of the Iranian dental students is moderate to high. Since stress reduction is directly correlated with the promotion of mental health and function, the authorities are required to revise the educational curricula following consultation with the counselors and implement effective programs to minimize the stress level of dental students. Also, achieving efficient communication between dental students and instructors can greatly improve the quality of clinical education.

Keywords: Dental Stress Analysis, Dental Students, Dentistry; Meta-Analysis, Environment, Psychological Stress

Introduction

Stress is a major psychological disorder affecting different communities and a natural response to events that

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↑What is "already known" in this topic:
Stressful experiences can affect neuroendocrine function, immunity, and physical and psychological health. The most harmful effect of long-term stress is the impairment of effective thinking and learning. Dental students experience a higher level of stress than the general population. There are significant correlations between the stress and educational year, socioeconomic status, lifestyle, and self-efficiency in dental students.

→What this article adds:
Stress is a double-blade sword, which can encourage the students to achieve their maximum educational efficiency or vice versa. The mean stress level of the Iranian dental students is moderate to high. Since stress reduction is directly correlated with the promotion of mental health and function, the authorities are required to revise the educational curricula.

cause fear and anxiety. In medicine, stress can be the trigger of many psychosomatic disorders (1). According to the definition by the World Health Organization, health refers to a state of complete physical, mental and social well-being, and not merely the absence of disease.

If the environmental stressors remain for long, they can lead to serious physical and psychological conditions such as anxiety, depression, fear, cardiovascular symptoms, gastrointestinal problems, insomnia, headache, lymphadenopathy, and excessive sweating of the hands and palms (2-4). The most harmful effect of long-term stress is the impairment of effective thinking and learning (5, 6).

Students are particularly prone to stress, and may show inappropriate responses to stress such as cigarette smoking, alcohol consumption, substance abuse, or suicide (7). The effect of stress on a healthy individual depends on a number of factors such as the severity of stress and its particular impact on the living conditions, physical and psychological status of the individual, and the number of stressors occurring at the same time (8).

Stress is a common concern for medical personnel, and dental students are no exception. According to the literature, dental students experience a higher level of stress than the general population (9, 10). The origin of stress may be personal, academic, or environmental (10, 11). Dental students are at risk of a high level of stress due to their busy schedule and simultaneous instruction of theoretical and practical topics and working on patients. The large volume of the topics taught, the complexity of the topics, the highly technical and heavy workload, and the fear of failing are the main stressors for dental students. Previous studies have reported significant correlations between stress and educational year, socioeconomic status, lifestyle, and self-efficiency (12, 13). Also, dental students often develop musculoskeletal disorders due to clinical work on patients, which can serve as another stressor (14).

Identification of stressors in dental schools and the perspective of dental students towards their educational environment can help find effective strategies to confront stress and its consequences.

Meta-analyses analyze a combination of the existing literature on a particular topic. Their large sample size due to the inclusion of many studies minimizes the differences in the existing parameters and decreases the confidence interval (CI). In fact, meta-analyses are an important link between the research results and clinical decision-making (14-17).

Considering the increased population and diversity of human communities, knowledge about the relative prevalence of stress in Iranian dental students is imperative for the implementation of an efficient program for the prevention and management of stress. Several previous studies have evaluated the stress level of dental students in Iran (18-23). Thus, a systematic review is required to review the available literature on this topic and reach a final conclusion. In systematic reviews and meta-analyses, by evaluation of all the related documentation, a complete image of the problem can be presented, and an overall estimate of the situation can be achieved. Thus, this systematic review aimed to assess the dental environment stress and related factors in the Iranian dental students.

Methods
This systematic review was carried out by electronic searching of the available literature according to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) statement (16).

Inclusion and exclusion criteria
The inclusion criteria were articles regarding the stress level of Iranian dental students published in Persian or English. The exclusion criteria were non-random sample selection, irrelevance to our topic of interest, review articles, case reports, duplicates, and studies on non-Iranian populations.

Search strategy and article selection
The national databases including Magiran, Iranmedex, SID, Medlib, and IranDoc, and the international databases including Scopus, PubMed, Science Direct, Cochrane, Web of Science, and Google Scholar databases were electronically searched using the keywords "psychological stresses", "stresses", "environmental stress", "psychological", "life stress", "life stresses", "stress, life", "stresses, life", "stress, psychologic", "psychologic stress", "psychological stress", "mental suffering", "suffering", "mental", "suffering", "anguish", "emotional stress", and "stress, emotional".

All possible combinations of the abovementioned terms were also searched using the Boolean operators. Highly sensitive searching was performed by the expert operators. As shown in the PRISMA flowchart (Fig. 1), the retrieved articles were transferred to End Note X9 software. In the primary assessment, the duplicates were removed. Thus, of 821 retrieved articles, 329 were duplicates and excluded. Another 297 articles were excluded by skimming the title since they were irrelevant. As shown in Figure 1, 179 articles were excluded since they did not meet the eligibility criteria. Eventually, two independent researchers selected 16 articles for inclusion in the study. The name of the first author, publication year, location of study, sample size, mean age of participants, study design, the maximum level of stress related to each academic year, gender, mean overall stress, maximum and minimum levels of stress, and factors related to stress were blindly extracted from the eligible articles and tabulated (Table 1). It should be noted that the study by Esfahanizadeh et al. (21) was conducted in two phases, and therefore, is presented as two articles in Table 1. A manual search of the reference list of the articles and an electronic search of dissertations for a doctorate degree in dentistry or a specialty degree in dentistry were also performed in the SID database. After data collection using STATA.SE 13.1 software, meta-regression and meta-analysis were carried out using Metareg and Metan commands.

Quality assessment
In the next step, the researchers independently evaluated the selected articles in terms of methodology and parame-
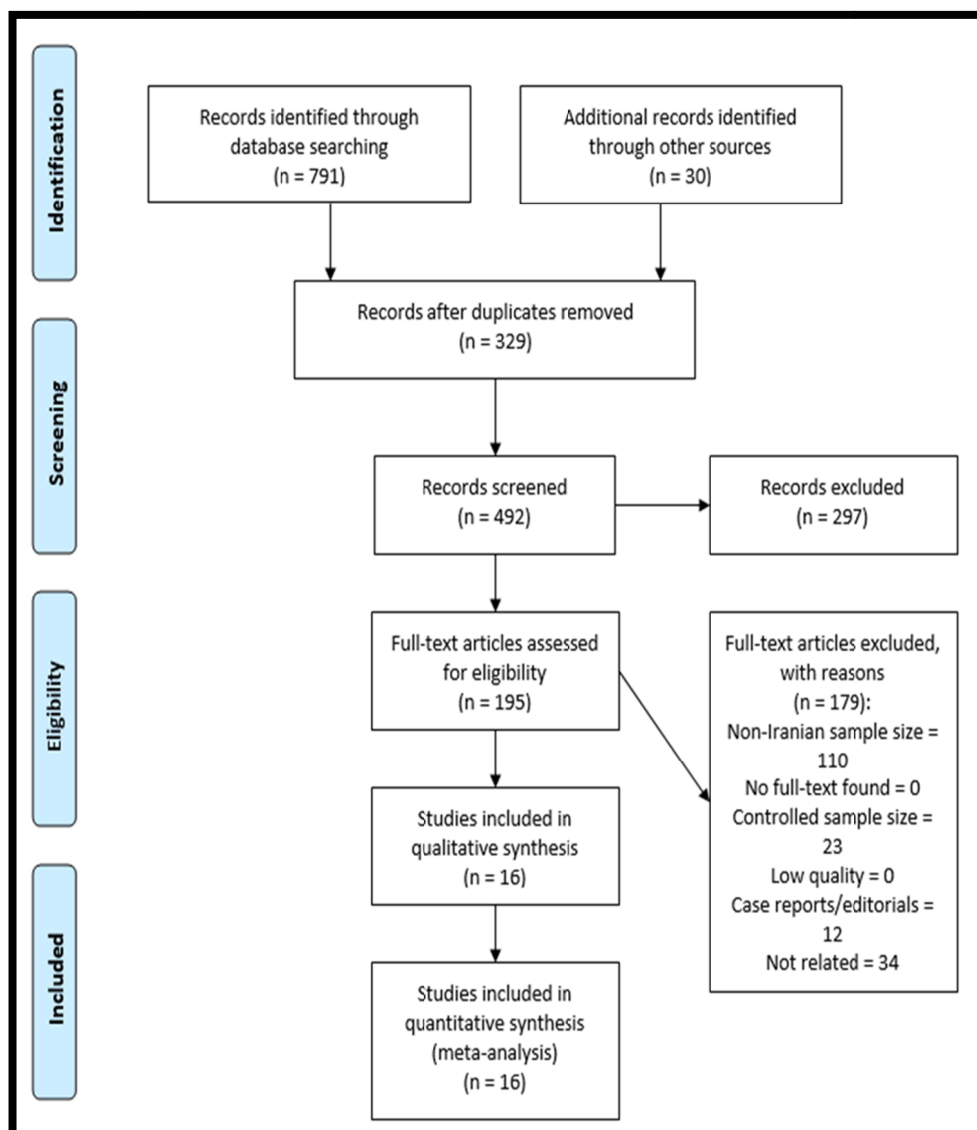
Fig. 1. Flow chart of study selection according to PRISMA (16)

ters such as the method of sampling, measurement of variables, statistical analyses, and study objectives using the STROBE (Strengthening the Reporting of Observational Studies in Epidemiology) standard checklist (24), which has 22 sections. The articles that acquired a minimum score of 16 according to this checklist were selected for meta-analysis. To prevent bias, searching, study selection, quality assessment, and data extraction were performed by two independent researchers. In case of disagreement, a third researcher was consulted until reaching a consensus by discussion (Fig. 1).

Data extraction
The required information was extracted from the selected articles using a checklist. This information included the name of the first author, year of study, location of study, sample size, mean age of participants, study design, maximum stress related to the academic year, gender, mean overall stress, maximum and minimum stress levels, and the factors related to stress.

Statistical analysis
After data extraction, a meta-analysis of the data was carried out using STATA.SE (13.1) software. For data analysis, the pooled ES of the extracted data and Metan and Metareg commands of the software were used. The Chi-square test was used to assess the heterogeneity of the studies. The rate of heterogeneity was determined using the I^2 statistics. P<0.05 was considered significant.

Results
Descriptive findings: A total of 3,521 dental students from different academic levels and from 10 provinces of Iran were evaluated in this study; out of which, 1,512 (42.94%) were males and 2,009 (57.05%) were females.

A total of 16 articles were systematically reviewed, out of which, 5 were in English, and 11 were in Persian.

Table 1. Systematic review of the articles on stress and its related factors in the Iranian dental students

Reference number	Author	Year	Location (city)	Questionnaire	Sample size	Mean age	Study design	Academic year	Gender of students	Other	Mean total	Maximum	Minimum
(20)	Dalband & Farhadi Nasab	P:2007	Hamedan	DES	154 (M=66, F=88)	NM	C.S	4th year	Females (2.73)	-	2.6±0.55 (Out of 4)	Stress due to theoretical courses [Q1] (3.18±0.83)	Stress due to clinical and preclinical courses [Q5] (1.96±1)
(25)	Shahravan et al.	P:2016	Kerman	DES	165 (M=77, F=88)	23.63±2.94	C.S	NM	Females (86.61±14.02) (p<0.001)	Correlation of stress with selection of the desired field of study (p=0.09)	82.60±14.53 (out of 128)	Self-efficiency in university setting (passing the exams) [Q1]	Fear of unemployment or not being recruited in the future [Q3]
(26)	Amini et al.	P:2014	Kerman	DASS-21	141 (M=74, F=67)	23.28±4.21	C.S	3rd year	NM	Low 63.1% Moderate 32.6% High 4.2% Significant correlation between marital status and stress was found.	40.19±12.70 (out of 84)	Stress related to university activities	Stress related to emotional issues

P=Published; DES=Dental environment stress; NM=Not mentioned; DS=Dental student; CS=Cross-sectional; DASS-21=Depression, anxiety, and tress scale 21
Q1: Self-efficiency in the university setting; Q2: Treatment of patients, Q3: Personal beliefs, Q4: Academic activities, Q5: Clinical instruction

Table 1. Ctd

Reference number	Author	Year	Location (city)	Questionnaire	Sample size	Mean age	Study design	Academic year	Gender of students	Other	Mean total	Maximum	Minimum
(27)	Shahbazi-MOghadam et al.	P:2010	Tehran	DES	187 (M=66, F=121)	NM	C.S	6th year	Females (p=0.02)	Low 39% Moderate 16% High 8% No Stress 37% (CI95%: 57-71%)	-	Completing the requirements [Q5]	Relationship with the opposite sex
(28)	MahdiZadeh et al.	P:2014	Babol	DES	199 (M=86, F=113)	NM	C.S	4th year	Females (p<0.005)	Prosthesis, radiology, and endodontics were the most stressful departments.	2.058±0.398 (out of 4)	More than one exam in one day [Q1]	Inappropriate behavior of the personnel [Q1]
(29)	SharifiRad et al.	P:2012	Isfahan	Kessler -10 Q	387 (DS= 40) (M=217, F=170)	21.86±2.20	C.S	-	-	OR Physicians to dentists: OR=1.44, P=0.33 Mild 10(25%) Moderate 11(27%) Severe 4(10%) No Stress 15(37.5%)	-	-	-
(30)	Ramezani & Nazari	P:2013	Zahedan	Modified DES	177 (M=106, F=77)	25.01±7.65	C.S	3rd year	Females	Age and marital status had significant correlations with stress. Self-efficiency in the university, and clinical instruction were the main stressors.	2.38±0.44 (out of 4)	Passing the exams [Q1] (3.07±0.90)	Stress due to lack of self-confidence and concerns regarding becoming a successful dentist in the future [Q3] (2.21±1.10)

Table 1. Ctd

Reference number	Author	Year Location (city)	Questionnaire	Sample size	Mean age	Study design	Academic year	Gender of students	Other	Mean total	Maximum	Minimum
(22)	Kazemizadeh & Bakhshi	P:2011 Rafsanjan	DES	125 (M=42, F=83)	NM	C.S	3rd year	NM	According to the Coudron stress test, 84.8% of students had stress; 86.7% of females and 81% of males had stressful personality.	1.89±0.54 (out of 4)	Completing the requirement [Q_5] (2.39±0.83)	Personal factors [Q_6] (1.06±0.53)
(31)	OmidKhodah et al.	P:2016 Mashhad	Researcher-designed	139 (M=63, F=76)	22.54±2.96	C.S	3rd year	Females	Academic activities and clinical instructions had a significant correlation with stress (p<0.05)	2.37±0.46 (out of 4)	Stress due to passing the exams [Q_1]	Peer competition [Q_1]
(32)	Hamissi et al.	P:2016 Qazvin	Modified DES	150 (M=78, F=72)	NM	C.S	4th year	Females (p<0.05)	Exams with a mean stress score of 30.7 caused the highest level of stress in students in clinical courses.	-	Stress due to academic factors [Q_1]	Stress due to pre-clinical factors [Q_5]
(33)	NafarZadeh et al.	P:2014 Babol	DASS-21	217 (M=96, F=121)	NM	C.S	4th year	Males	Students with abnormal stress: 74.2%, n=16	21.53±9.59 (out of 28)	Stress due to failing the theoretical or clinical exams [Q_1]	Not acquiring the necessary skills in preclinical courses [Q_5]
(34)	MirSeyfi et al.	P:2015 Yazd	DES	150 (M=66, F=84)	22.00±1.0	C.S	5th year	Females (p=0.04)	-	1.4±0.6 (out of 4)	Academic activities [Q_1] (1.8±0.8)	Personal factors [Q_6] (1.07±0.7)

Table 1. Ctd

Reference number	Author	Year	Location (city)	Questionnaire	Sample size	Mean age	Study design	Academic year	Gender of students	Other	Mean total	Maximum	Minimum
(18)	Akbari et al.	P:2011	Mashhad	DASS-21 & self-administrated	173 (M=79, F=94)	NM	C.S	4th year	Females (p=0.67)	Students with abnormal stress level (mean>15)=90(52%) Male=15.72±10.48 (out of 30) Female=16.64±9.73 (out of 30)	16.22±10.064 (out of 28)	Concerns about not completing the requirements (2.63) [Q5]	Dissatisfaction with the field of study (0.67)
(35)	Sayedmoallemi and Naseri	P:2013	Isfahan	Self-Administrated	294 (M=125, F=169)	23.50±1.59	C.S	-	Females	All factors related to place of residence caused significantly higher level of stress in students living in dormitories.	0.98±0.93 (out of 4)	Stress due to working on a patient with a contagious disease [Q2] (1.66±1.0)	Stress due to working and employment while studying [Q5]
(36)	Rabiei and Safarpour	P:2017	Rasht	DES	167 (M=74, F=93)	23.70±2.40	C.S	5th year	Females (Odds Ratio=2.3, 95%CI)	Stress scores of patients living with their parents were significantly higher than others. Odds ratio= ٢٫٦٧, 95%CI OR:1.1-6.4 Stress score decreased with age (p=0.009).	2.27±0.50 (out of 4)	Passing the exams [Q1] (2.95)	Fear of unemployment or not being recruited in the future (1.50)
(21)	Esfahanizadeh et al.	P:2013 (first phase)	Tehran	DES	301 (M=92, F=209)	23.60±1.90	C.S	NM	Females (p<0.05)	-	-	Stress related to the school authorities and mentors [Q4] (76.4%)	Stress due to family problems [Q3] (4.7%)
(21)	Esfahanizadeh et al.	P:2013 (second phase)	Tehran	DES	395 (M=105, F=290)	24.20±2.20	C.S	NM	Females (p<0.05)	-	-	Stress due to heavy workload and difficult topics [Q1] (66.5%)	Relationship with the opposite sex (11%)

Four studies had been conducted in 2011 and before 2011, and 12 studies had been conducted after the year 2011.

The study by Esfahanizadeh et al. (21) conducted in 2013 (second phase of the study) had the largest sample size (n=395); while the study by Kazemizadeh et al. (22) conducted in 2011 had the smallest sample size (n=125). Most studies had been conducted in Tehran (n=3) and Kerman (n=3) provinces. One study had been conducted in each of the Hamadan, Zahedan, Qazvin, Yazd, and Guilan provinces. In general, 10 studies (58.82%) reported that concern about self-efficiency in the university setting was the main reason for the stress of dental students. Half of the studies (50%) reported that concern about passing the exams was the main cause of stress for dental students. After self-efficiency in the university setting, "clinical education and learning" ranked second, since it was mentioned as the main cause of stress by 3 studies (17.64%). Among factors with a small effect on the level of stress of dental students, the personal belief was reported to have the least effect on stress in 6 studies (35.29%).

Four articles reported that difficult understanding of the taught topics (stress due to theoretical courses), which was a subdomain of the self-efficiency in the university setting, was the most common stressor for dental students. The most important stressor was passing the exams, which was another subdomain of the self-efficiency in the university, in 5 studies. However, 3 studies reported that completing the requirements, which was a subdomain of clinical instruction, was the most common stressor.

Three studies reported that difficult learning of fine hand skills for clinical practice and lab work (stress due to clinical and preclinical courses), which was a subdomain of clinical instruction, was the least common stressor. However, the least common stressor in the 3 studies was fear of unemployment or not getting recruited in the future, which was a subdomain of personal beliefs. Relationship with the opposite sex was the least important stressor in the two studies.

As shown in Table 2, significant correlations were noted between the demographic factors and the level of stress in the reviewed studies. Shahravan et al., (25) (P=0.09) and Ramezani et al. (30) (P<0.05) found a significant correlation between the interest in the selected field of study and stress level, such that higher interest in the selected field of study decreased the stress level. In studies by Esfahanizadeh et al., (21) (P<0.05), Rabiei et al., (36) (P=0.003), Mirseifi et al., (34) (P=0.04), Hamisi et al., (32) (P<0.05), Mahdizadeh et al., (28) (P<0.005), Shahravan et al., (25) (P<0.001), Ramezani et al., (30) (P<0.05), and Shahbazi Moghadam et al., (27) (P=0.02) female students had significantly higher level of stress than male students.

Dalband et al., (20) Mahdizadeh et al., (28), Nafarzadeh et al., (33) and Akbari et al. (18) found a significant correlation between the 4th academic year and level of stress of students (P<0.05), since the 4th year dental students experienced a higher level of stress compared with other students. However, Mirseyfi et al., (34) and Rabiei et al. (36) reported that the 5th year, and Shahbazi Moghadam et al. (27) reported that the 6th year was the most stressful academic year for their dental students.

As shown in Figure 2, the mean overall stress level of the Iranian dental students was 2.18 (95% confidence interval:1.87-2.49). The maximum (3.07) and minimum (0.98) mean overall stress values were recorded in the studies by Nafarzadeh et al., (33) (2014) and Sayedmoallemi et al. (35) (2013), respectively.

The maximum (15.94%) and minimum (1.23%) weighted stress values were noted in the studies by Mahdizadeh et al., (28) and Akbari et al., (18), respectively.

The heterogeneity index indicated very low heterogeneity among the studies, such that the X2 statistic was not significant (0=893), and the I^2 statistic was 0.0%, indicating very low heterogeneity, which was excellent.

Figure 3 shows the forest plot of the study according to the type of questionnaire. Of 16 reviewed studies, 7 (43.75%) had calculated the mean stress score according to the dental environment stress (DES) questionnaire. The mean stress score in these studies was 2.20 (95% CI:1.84-2.56). As shown in Figure 3, according to the DES questionnaire, the maximum mean overall stress value was reported by Dalband et al., (20), which was 2.60 (95% CI:1.52-3.67), and the minimum mean overall stress value was reported by Mirseyfi et al., (34), which was 1.40 (95% CI: 0.22-2.57). No significant correlation was noted between the use of the DES questionnaire and the mean stress score (P=0.722). Two studies calculated the mean stress score using the dental anxiety and stress scale (DASS-21). They reported the mean stress value to be 2.09 (95% CI:1.01-3.17). As shown in Figure 3, according to DASS-21, the maximum mean overall stress value was reported by Nafarzadeh et al., (33) which was 3.07 (95% CI:0.38-5.75) while the minimum value was reported by Amini et al., (26), which was 1.91 (95% CI:0.73-3.08). Three studies (18.75%) used research-designed self-administered questionnaires to assess the mean stress level of students and reported the mean value to be 2.11 (95% CI: 1.33-2.89) (P=403).

In this study, the maximum mean overall stress value of the Iranian dental students was calculated using the DES questionnaire (2.21; 95% CI: 1.85-2.57), while the minimum value was measured using the DASS-21 (2.10; 95% CI: 1.02-3.17). This difference was not significant (P=0.863). The maximum weighted stress was calculated using the DES questionnaire (75.56%), while the mini-

Table 2. Correlation of demographic factors with the stress level of dental students

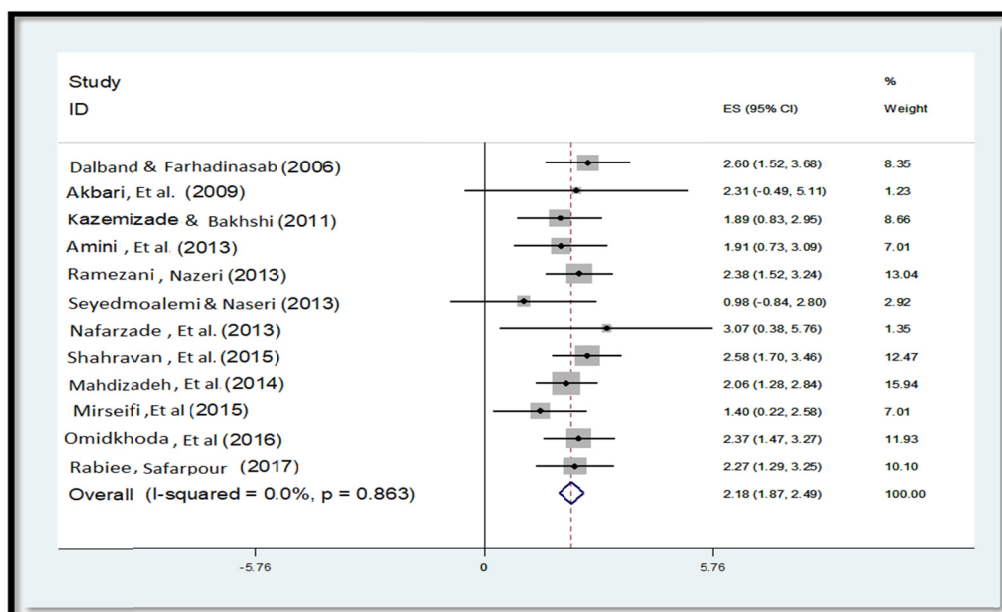| Demographic factors	Reference number
Selection of the desired field of study	(25, 30)
Female gender	(20, 21, 25, 27, 28, 30, 32, 36, 37)
Academic year of education	(18, 20, 22, 27, 28, 31, 36-38)

Fig. 2. Forest plot of the mean overall stress level of Iranian dental students
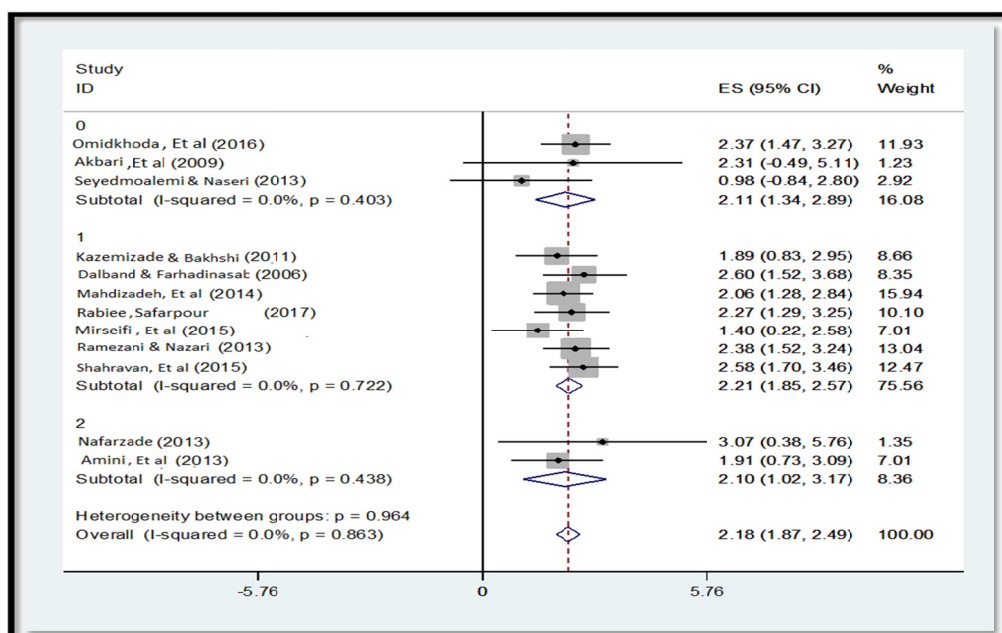

Fig. 3. Forest plot of the mean stress level of the Iranian dental students according to self-administered (0) and DES (1) questionnaires and DASS-21 (2)

mum weighted stress was measured using the DASS-21 (8.36%). The heterogeneity index indicated very low heterogeneity of the studies such that the X2 statistic was not significant (0.893) and I² was 0.0%, indicating very low heterogeneity, which was excellent.

No significant correlation was noted between the type of questionnaire and academic year with the mean overall stress level of the Iranian dental students (P=863) (Fig. 4). However, maximum and minimum mean overall stress values were noted in the 4th year (2.24; 95% CI: 1.61-2.88) and 5th year (2.01; 95% CI: 1.32-2.72) dental students. The maximum weighted stress was 35.44%, which was noted in studies that did not assess this factor. The weighted stress values of the 4th (24.28), 3rd (20.59), and

5th (19.69) year dental students ranked next. The heterogeneity index indicated very low heterogeneity such that the X2 statistic was not significant (0.863) and the I² was 0.0%, indicating very low heterogeneity, which was excellent.

In addition, we analyzed a Meta-regression model between the percentage of females in each study and stress level. As indicated in Table 3, no significant relationship between these two variables was found so the heterogeneity between the studies was not related to the number of males or females in the studies (P=0.520). The I² was 0.0%, which indicated no heterogeneity between the studies in this respect.

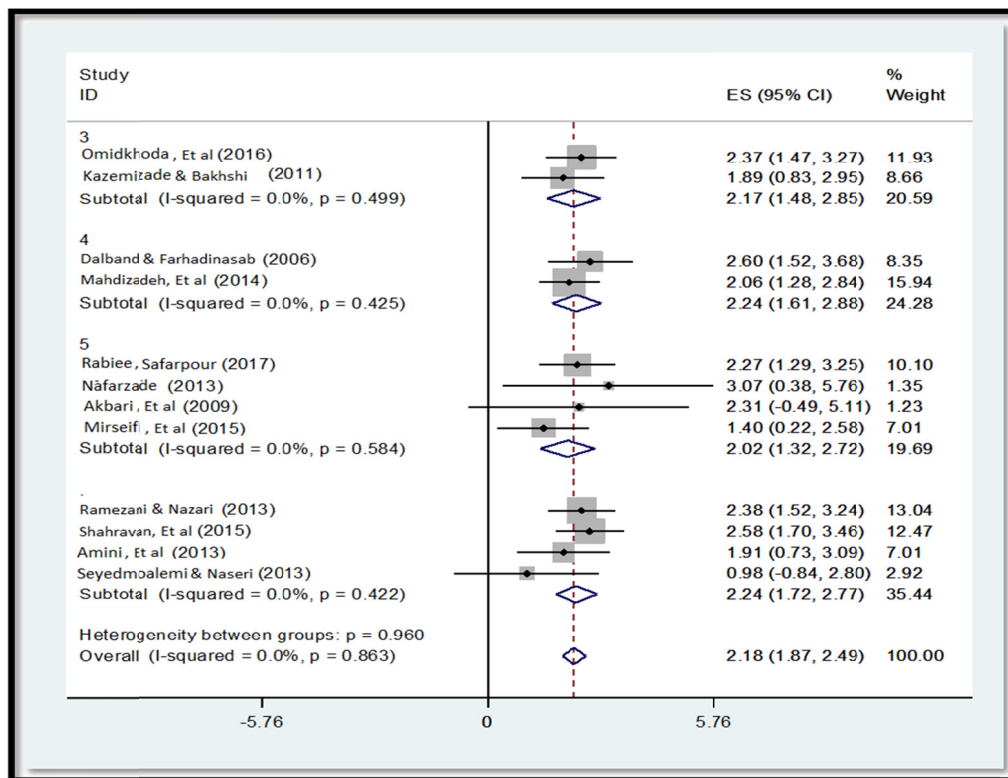The meta-regression of the mean stress level of the Ira-

Fig. 4. Forest plot of the mean stress level of the Iranian dental students according to their academic educational year

Table 3. Meta-regression between gender and stress level

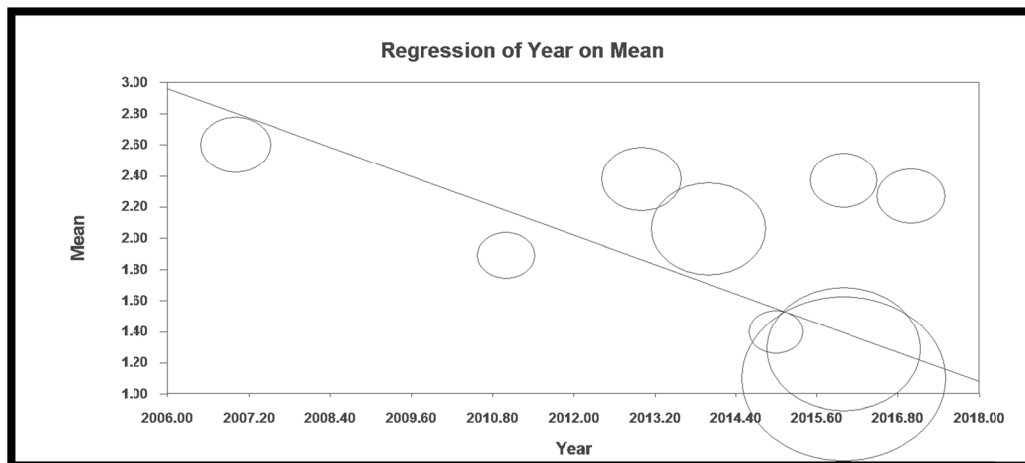| average	Coefficient	Standard error	t	P>|t|	95% confidence interval	
Fem	-1.587225	2.380795	-0.67	0.520	-6.891967	3.717516
_cons	3.03946	1.294274	2.35	0.041	.1556386	5.923282

I-squared_res = 0.00%

Fig. 5. Meta-regression of the mean stress level of the Iranian dental students according to the year of article publication

nian dental students according to the year of article publication (Fig. 5) indicated a reduction in the level of stress in recent years.

The funnel plot of the heterogeneity of studies on the stress level of Iranian dental students and risk of bias (Fig. 6) indicated that most studies, except two, were within the pyramid. Thus, the risk of bias was low.

Discussion

Stress is a double-blade sword, which can encourage the students to achieve their maximum educational efficiency or vice versa. The high stress of dental students can be due to depression, anxiety or burnout (39). Determining the stress level of students is imperative to determine their wellbeing and provide the authorities with this information to take measures and implement strategies to decrease the stressors. Changing the dental curricula and
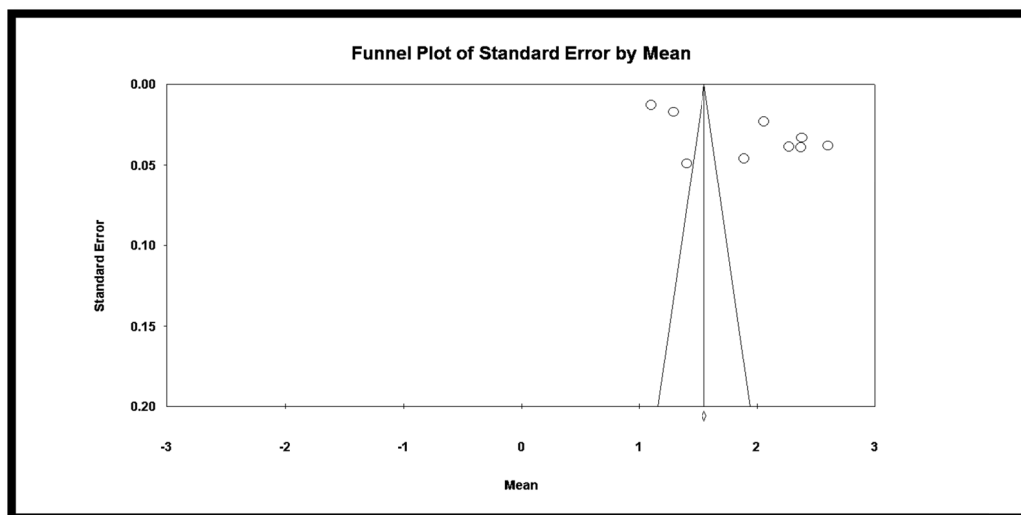
Fig. 6. Funnel plot of the heterogeneity of the studies on the stress level of Iranian dental students

educational improvement may be required to minimize the perceived level of stress (40). Dental education is a challenging learning experience. Dental students need to learn theoretical and technical skills and also learn how to communicate with patients (41). This systematic review aimed to assess the stress level of Iranian dental students and the related factors. A meta-analysis was also carried out on 15 descriptive, cross-sectional studies.

A total of 3,521 dental students from different academic levels and from 10 provinces of Iran were evaluated in this study. The mean overall stress level of the Iranian dental students was 2.18 (95% CI:1.87-2.49). The maximum (3.07) and minimum (0.98) mean overall stress values of the Iranian dental students were reported by Nafarzadeh et al., (33) (2014) and Sayedmoallemi and Naseri (35) (2013). The mean values indicated moderate to high levels of stress in the Iranian dental students, which was

moderate in comparison with other countries (Table 4). As shown in Table 4, the mean stress value in the United States (4, 42), and India (57) was almost the same as that in this study. However, higher stress values were reported in South Africa (43), Singapore (49), Malaysia (51), Turkey (56), Greece (10), Croatia (9), and Saudi Arabia (40); while, Jordan (46), Japan (39), and Netherlands (54) showed lower mean stress values.

Higher stress levels of dental students in other countries may be due to their more organized educational curricula and educational system. On the other hand, difficult living conditions in some countries are responsible for higher stress levels of students.

No significant correlation was noted between the type of questionnaire and the mean overall stress level of Iranian dental students. The maximum and minimum mean overall stress values of the Iranian dental students were related

Table 4. Mean stress level of students in different countries using the DES questionnaire

Reference number	Country	Average stress based on DES
(10)	Greece	2.6
(4)	USA	2.12
(42)	USA	2.19
(43)	South Africa	2.87
(44)	Australia	2.30
(45)	UK	2.38
(46)	Jordan	2.50
(47)	West Indies	2.11
(48)	India	2.27
(49)	Singapore	2.53
(50)	Jordan	1.91
(51)	Malaysia	2.63
(39)	Japan	1.98
(52)	Fiji	2.52
(53)	Canada	2.38
(54)	Netherlands, Ireland, Finland, UK	2
(9)	Greece, Croatia, Spain, Slovenia, Sweden, Ireland	2.46
(55)	USA	2
(56)	Turkey	2.78
(57)	India	2.09
(58)	Nigeria	2.46
(40)	KSA	2.23

to the DES questionnaire and DASS-with scores of 2.21 (95% CI: 1.85-2.57) and 2.10 (95% CI: 1.02-3.17), respectively (P>0.05). Since the DES questionnaire has a standard design, future studies are recommended to use standard questionnaires.

No significant association was noted between the academic year of education and the mean overall stress level of the Iranian dental students (P=863). However, the maximum and minimum stress values were rerecorded in the 4th year (2.24, 95% CI:1.61-2.88) and 5th year (2.01, 95% CI:1.32-2.72) dental students, respectively. In this regard, Sugiura et al., (39) and Bamidele et al. (58) reported results in line with our findings. However, Morse et al. (52) reported that the 3rd year was the most stressful academic year for dental students while Alharbi et al. (59) reported the 4th year, Gonter et al., (54) and Sofola et al. (60) reported the 5th year, and Halboub et al. (40) reported the 6th year to be the most stressful. Higher mean stress levels of students in the 4th academic year can be due to the initiation of learning practical and clinical skills simultaneous with theoretical topics and the existing concerns regarding clinical decision making. The lower level of stress in higher academic years can be due to acquiring the required expertise and skills after working on different cases. Also, completion of the 6-year dental education period and entering the job market can cause some concerns for students and increase their stress levels (18, 25, 27, 31, 36).

Gender had no significant correlation with stress level (P=0.520). Several studies reported higher irritability and stress score of female students in all domains, such as the studies by Dalband et al., (20) Esfahanizadeh et al., (21) Shahravan et al., (25) Polychronopoulou et al., (10) Shahbazi Moghadam et al., (27) Sugiura et al., (39) and Halboub et al. (40). However, some studies reported higher levels of stress in male students such as the studies by Tangade et al., (61) Acharya et al., (62) and Peker et al. (56). Nonetheless, the current meta-analysis revealed no significant correlation between gender and stress levels of students. Controversy in the results on this topic can be due to the differences in supporting male and female students, not expressing the concerns, and difference in the assessment of actual stress and reaction to stress (57, 62).

In this systematic review, over half of the students (58.82%) reported that efficiency in the university setting was their main cause of stress; of which, 50% reported that passing the exams was their main concern. Similarly, in the study by Halboub et al., (40) passing the exams was among the most prominent stressors. However, several other factors have been reported by other studies. For instance, in the study by Alharbi et al., (59) concerns regarding not completing the requirement were the main stressor of dental students. Our findings in Iran can be due to the fact that dental students are the top students that pass the university entrance exam with the highest score. Thus, failing an exam is considered a failure to them (18). It seems that assessing the performance of students during a semester, instead of at the end of a semester by a final exam, can decrease their stress level (22).

Funnel plots are used for the assessment of the homoge-

neity of studies and their risk of bias. In this study, the majority of reviewed studies, except two, were within the pyramid, and thus, were homogeneous, which confirms the reliability of the results of this meta-analysis.

However, this study had some limitations, which should be taken into account when interpreting the results. Most reviewed studies were descriptive cross-sectional studies, which provide relatively weak evidence. Also, tools used for quality assessment have not been exclusively designed for quantitative studies. As mentioned earlier, most reviewed studies used the DES questionnaire to measure the stress level, while the DES questionnaire was originally designed to assess the sources of stress and not the overall stress level. However, it is wrongfully used for the latter purpose by many studies on dental stress (63). Another limitation of this study is the lack of separation of how students enter the university and its effect on student stress in most studies. Considering that entering the university through the national entrance exam, Islamic Azad exam, postgraduate students abroad (difference in educational and cultural system), oral hygienists who will become dentists in the future, etc., this seems to be a bias factor for this study.

The mean level of stress in the Iranian dental students was moderate to high. Since stress reduction has a direct correlation with psychological and mental health, and improves performance, some authoritative decisions need to be taken by the authorities in dental education to revise the educational curricula following consultation with experts and minimize the stress level of dental students. Also, achieving an acceptable level of instructor-student communication can promote the quality of clinical instruction and decrease the stress level of students.

The stress level of dental students in many provinces of Iran has not yet been evaluated. Thus, it was not possible to compare the stress level of students based on their geographical region. Therefore, further studies are warranted on this topic. Moreover, some measures need to be taken to minimize the stress level of dental students, such as revision of educational curricula, changing the method of assessment of the performance of dental students, instruction of relaxation techniques to students, quantitative and qualitative promotion of counseling programs for students, encouraging the students to participate in sports activities, and providing them with the necessary living accommodations and entertainment. The concerns regarding the transmission of infectious diseases can be minimized by comprehensive instruction of the standard principles and guidelines of infection control to students. By doing so, the students can be reassured about their health and safety in case of adherence to the protocols and guidelines.

Conclusion

The mean stress level of the Iranian dental students is moderate to high. Since stress reduction is directly correlated with the promotion of mental health and function, the authorities are required to revise the educational curricula following consultation with the counselors, and implement effective programs to minimize the stress level of dental students. Also, achieving efficient communica-

tion between dental students and instructors can greatly improve the quality of clinical education.

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Conflict of Interests
The authors declare that they have no competing interests.

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