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Perceived sources of stress amongst dental students: A multicountry study

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Abstract

Aims: The aim of this study was to explore the perceived sources of stress reported by dental students from fourteen different countries.

Methods: A total of 3568 dental students were recruited from 14 different dental schools. The dental environmental stress (DES) questionnaire was used including 7 domains. Responses to the DES were scored in 4-point Likert scale. Comparison between students was performed according to the study variables. The top 5 stress-provoking questions were identified amongst dental schools. Data were analysed using SPSS software program. Mann-Whitney and Kruskal-Wallis tests were used as appropriate. Logistic regression analysis was also conducted to determine the effect of the studied variables on the stress domains. The level of statistical significance was set at <.05.

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Results: Internal consistency of the scale was excellent (0.927). Female students formed the majority of the total student population. The percentage of married students was 4.8%. Numbers of students in pre-clinical and clinical stages were close together. The most stress-provoking domain was "workload" with a score of 2.05 ± 0.56. Female students scored higher stress than male students did in most of the domains. Significant differences were found between participating countries in all stress-provoking domains. Dental students from Egypt scored the highest level of stress whilst dental students from Jordan scored the lowest level of stress.

Conclusion: The self-reported stress in the dental environment is still high and the stressors seem to be comparable amongst the participating countries. Effective management programmes are needed to minimise dental environment stress.

KEYWORDS

dental education, dental environment, dental students, stress

1 | INTRODUCTION

The term "stress" describes external demands (physical or mental) on an individual's physical and psychological well-being.[1] It is not just a stimulus or response, but rather, it is a process by which we perceive and cope with environmental threats and challenges.[2,3] Personal and environmental events that cause stress are known as stressors. The diagnostic and statistical manual of mental disorder defines a psychosocial stressor as "any life event or life change that may be associated temporally (and perhaps causally) with the onset, occurrence or exacerbation of a mental disorder".[4] Dental students are known to be subjected to considerable levels of stress and anxiety during their training period, and this has been demonstrated in various studies.[5-7] The stressful nature of dentistry starts early as dental students are expected to acquire a wide range of knowledge and a variety of skills to help them succeed in their studies and also in their future career.[8] This stress can result in physical and psychological distress, which in turn can affect the well-being and performance of the student.[9,10]

Although there are conflicting data on the impact of stress on the academic performance of dental students,[11] there is existing evidence in the literature indicating that high levels of perceived stress result in psychological morbidity and emotional exhaustion. This may predispose them to professional burnout and decreased productivity.[12] In the United States, these levels of depression, anxiety and hostility in dental students have been reported as close to the norms for psychiatric outpatients.[13]

Studies conducted on stress amongst dental students of various populations report consistent findings. Main sources of stress include factors relating to the clinical practice, patient management, the need to meet academic and clinical requirements and interactions with clinical instructors, support staff as well as family members.[7,13] This multifactorial stress arising from both academic and socio-cultural environments can be attributed to social support issues, both emotional and financial.[14,15]

Stress and reactions to stress are not specific to medical and dental students; it is a global phenomenon as reported worldwide. Students, during their clinical years of study, are particularly susceptible.[14] In a cross-cultural comparison between Singaporean and American students' perceived sources of stress, Yap et al[16] suggested that stressors were primarily related to different aspects of the curriculum. Humphris et al[12] and Pöhlmann et al[17] presented evidence supporting the association of many aspects of education such as examinations and clinical training with student stress. Investigations by Goldstein[18] and Bradley et al[19] did not relate the observed variance in overall stress scores to demographic variables such as cultural background, pre-professional education and gender; they, instead, identified a limited number of specific stress-provoking factors within the school environment.

A clear understand of what a positive academic environment constitutes and what role the educational/institutional environment has on students' stress perception and provocation is essential.[20,21] To that end, identification of sources of stress is a priority. Hence, our goal in this study was to identify sources of stress amongst dental students from different countries worldwide and to explore the institutional differences in the variation of perceived stressors amongst these diverse student populations. In addition, comparisons of stress levels between genders, different study levels and dental schools from countries partaking in the research were also performed.

2 | MATERIALS AND METHODS

This cross-sectional study was conducted in the academic year 2016/2017. Students were recruited from 13 developing countries (Brazil, Egypt, India, Iraq, Jordan, Kingdom of Saudia Arabia (KSA), Lebanon, Nepal, Pakistan, Peru, South Africa, Sudan and Yemen) and 1 developed country (Croatia) worldwide, and accordingly ranged from low income (Nepal) to high income (KSA). Regarding the

geographical location of the included countries, there were 5 from Middle East, 3 from southern Asia, 1 from northern Africa, 1 from southern Africa, 1 from north-eastern Africa, 1 from eastern South America, 1 from western South America and 1 from south-eastern Europe.

The study was ethically approved by local ethical committees in the included countries. Prior to commencing this study, the purposes of the study were explained to the dental students. Participation was voluntary, and completion of a consent form was compulsory. Data were obtained using a self-administered dental environmental stress (DES) questionnaire which was adopted from a previous study.[22] In addition to the general demographic questions, the DES questionnaire consisted of 41 closed-ended stress-provoking

TABLE 2 Cronbach's α for the tool as a whole and for each domain

	Cronbach's α	No. of items
All	0.927	41
Self-efficacy beliefs	0.813	9
Faculty and administration	0.795	10
Workload	0.792	6
Patient treatment	0.814	4
Clinical training	0.763	4
Performance pressure	0.422	3
Social stressors	0.693	5

TABLE 1 Sample characteristics by institutional, number of students, sample size, response rate and study duration

	Dental school name	Institutional	Total No. of students	Sample size	Response rate	Programme duration (y)
Brazil	School of Dentistry of Ribeirão Preto—University of São Paulo	Public	450	236[a]	94% (250 invited)	5
Croatia	School of Dental medicine, University of Zagreb	Public	600	194[b]	32% (All invited)	6
Egypt	Faculty of Dentistry, Pharos University in Alexandria	Private	1500	199[a]	80% (250 invited)	5
India	Faculty of Dentistry, Nitte University	Private	500	250[a]	100% (250 invited)	5
Iraq	Faculty of Dentistry, University of Al-Qadisiyah	Public	354	185[a]	93% (200 invited)	5
Jordan	Faculty of Dentistry, Jordan University of Science and Technology	Public	320	250[a]	100% (250 invited)	5
KSA	College of Dentistry, Jazan University	Public	532	350[b]	66% (All invited)	6
Lebanon	Faculty of Dentistry, Saint-Joseph University of Beirut	Private	248	243[b]	98% (All invited)	5
Nepal	College of Dental Surgery, BP koirala Institute of health sciences	Public	300	224[b]	75% (All invited)	5
Pakistan	University College of Medicine and Dentistry, University of Lahore	Private	316	191[a]	96% (200 invited)	4
Peru	Faculty of Dentistry, University of San Martín de Porres	Private	896	443[b]	49% (All invited)	5
South Africa	Faculty of Dentistry, University of the Western Cape	Public	428	349[b]	82% (All invited)	5
Sudan	Private Dental College	Private	270	109[a]	55% (200 invited)	5
Yemen	Faculty of Dentistry, Thamar University	Public	500	345[b]	69% (All invited)	5

[a]Representative sample.
[b]All respondents.

questions grouped under 7 different domains reflecting all possible stress factors in the dental environment (self-efficacy beliefs (D1), faculty and administration (D2), workload (D3), patient treatment (D4), clinical training (D5), performance pressure (D6) and social stressors (D7)). However, the questions were listed randomly in the questionnaire, and the domains were not displayed. Four possible responses to each item (question) were used (0 = not applicable, 1 = no stress, 2 = moderate stress and 3 = severe stress). The first response was needed because some questions were not applicable for all participants (eg the question "Necessity to postpone having children" is not applicable for single participants). "Slight stress" as an option was omitted from the responses because slight stress is not a problem and is considered manageable. Individual with slight stress can get through the day without any restrictions and can enjoy life and even think positively about the future. Moreover, low levels of stress could be healthy and motivating for better life achievements and maybe needed for better academic performance. However, the higher levels of stress may lead to fatal anxiety, discouragement and

TABLE 3 Sample characteristics by gender and marital status (SD)

	Gender		Marital status	
	Male	Female	Single	Married
All (N = 3568)	1335 (37.4)	2233 (62.6)	3395 (95.2)	173 (4.8)
Brazil (N = 236)	74 (31.4)	162 (68.6)	235 (99.6)	1 (0.4)
Croatia (N = 194)	29 (14.9)	165 (85.1)	191 (98.5)	3 (1.5)
Egypt (N = 199)	126 (63.3)	73 (36.7)	196 (98.5)	3 (1.5)
India (N = 250)	74 (29.6)	176 (70.4)	246 (98.4)	4 (1.6)
Iraq (N = 185)	77 (41.6)	108 (58.4)	179 (96.8)	6 (3.2)
Jordan (N = 250)	99 (39.6)	151 (60.4)	230 (92.0)	20 (8.0)
KSA (N = 350)	147 (42.0)	203 (58.0)	297 (84.9)	53 (15.1)
Lebanon (N = 243)	79 (32.5)	164 (67.5)	241 (99.2)	2 (0.8)
Nepal (N = 224)	114 (50.9)	110 (49.1)	218 (97.3)	6 (2.7)
Pakistan (N = 191)	57 (29.8)	134 (70.2)	179 (93.7)	12 (6.3)
Peru (N = 443)	136 (30.7)	307 (69.3)	432 (97.5)	11 (2.5)
South Africa (N = 349)	103 (29.5)	246 (70.5)	346 (99.1)	3 (0.9)
Sudan (N = 109)	41 (37.6)	68 (62.4)	96 (88.1)	13 (11.9)
Yemen (N = 345)	179 (51.9)	166 (48.1)	309 (89.6)	36 (10.4)

TABLE 4 Sample characteristics by clinical stage and study level (SD)

	Clinical stage		Study level					
	Pre-clinical	Clinical	1st	2nd	3rd	4th	5th	6th
ALL (N = 3568)	1698 (47.6)	1870 (52.4)	619 (17.3)	730 (20.5)	829 (23.2)	756 (21.2)	542 (15.2)	92 (2.6)
Brazil (N = 236)	60 (25.4)	176 (74.6)	30 (12.7)	30 (12.7)	77 (32.6)	69 (29.2)	30 (12.7)	0 (0.0)
Croatia (N = 194)	94 (48.5)	100 (51.5)	30 (15.5)	23 (11.9)	41 (21.1)	30 (15.5)	44 (22.7)	26 (13.4)
Egypt (N = 199)	122 (61.3)	77 (38.7)	43 (21.6)	36 (18.1)	43 (21.6)	39 (19.6)	38 (19.1)	0 (0.0)
India (N = 250)	100 (40.0)	150 (60.0)	50 (20.0)	50 (20.0)	50 (20.0)	50 (20.0)	50 (20.0)	0 (0.0)
Iraq (N = 185)	140 (75.7)	45 (24.3)	45 (24.3)	50 (27.0)	45 (24.3)	45 (24.3)	0 (0.0)	0 (0.0)
Jordan (N = 250)	150 (60.0)	100 (40.0)	50 (20.0)	50 (20.0)	50 (20.0)	50 (20.0)	50 (20.0)	0 (0.0)
KSA (N = 350)	136 (38.9)	214 (61.1)	0 (0.0)	68 (19.4)	68 (19.4)	74 (21.1)	74 (21.1)	66 (18.9)
Lebanon (N = 243)	101 (41.6)	142 (58.4)	50 (20.6)	51 (21.0)	49 (20.2)	46 (18.9)	47 (19.3)	0 (0.0)
Nepal (N = 224)	90 (40.2)	134 (59.8)	38 (17.0)	52 (23.2)	89 (39.7)	28 (12.5)	17 (7.6)	0 (0.0)
Pakistan (N = 191)	82 (42.9)	109 (57.1)	38 (19.9)	44 (23.0)	51 (26.7)	58 (30.4)	0 (0.0)	0 (0.0)
Peru (N = 443)	171 (38.6)	272 (61.4)	70 (15.8)	101 (22.8)	88 (19.9)	118 (26.6)	66 (14.9)	0 (0.0)
South Africa (N = 349)	162 (46.4)	187 (53.6)	83 (23.8)	79 (22.6)	76 (21.8)	68 (19.5)	43 (12.3)	0 (0.0)
Sudan (N = 109)	97 (89.0)	12 (11.0)	25 (22.9)	33 (30.3)	39 (35.8)	12 (11.0)	0 (0.0)	0 (0.0)
Yemen (N = 345)	193 (55.9)	152 (44.1)	67 (19.4)	63 (18.3)	63 (18.3)	69 (20.0)	83 (24.1)	0 (0.0)

TABLE 5 Distribution of the respondents and score of stress level according to each domain and the related questions

Domain	Item	Not apply (%)	No stress (%)	Moderate stress (%)	Severe stress (%)	Mean ± SD
D1 Self-efficacy beliefs (Mean ± SD = 1.83 ± 0.56)	Q13—Fear of failing a course or the year	191 (5.4)	575 (16.1)	1134 (31.8)	1668 (46.7)	2.20 ± 0.90
	Q11—Fear of being unable to catch up if behind	214 (6.0)	616 (17.3)	1357 (38.0)	1381 (38.7)	2.09 ± 0.89
	Q23—Lack of confidence to be a successful dental student	333 (9.3)	1090 (30.5)	1544 (43.3)	601 (16.8)	1.68 ± 0.86
	Q14—Fear of not being able to join a postgraduate programme	391 (11.0)	714 (20.0)	1355 (38.0)	1108 (31.1)	1.89 ± 0.97
	Q21—Insecurity concerning professional future	233 (6.5)	738 (20.7)	1654 (46.4)	943 (26.4)	1.93 ± 0.85
	Q20—Insecurity concerning lack of employment positions	344 (9.6)	809 (22.7)	1526 (42.8)	889 (24.9)	1.83 ± 0.91
	Q22—Lack of confidence in own decision making	360 (10.1)	1177 (33.0)	1511 (42.3)	520 (14.6)	1.61 ± 0.85
	Q30—Language barrier	386 (10.8)	1383 (38.8)	1233 (34.6)	566 (15.9)	1.55 ± 0.88
	Q24—Lack of confidence to be a successful dentist	369 (10.3)	1046 (29.3)	1482 (41.5)	671 (18.8)	1.69 ± 0.89
D2 Faculty and administration (Mean ± SD = 1.62 ± 0.56)	Q19—Inconsistency of feedback between different instructors	434 (12.2)	833 (23.3)	1577 (44.2)	724 (20.3)	1.73 ± 0.92
	Q36—Receiving criticism about work	543 (15.2)	780 (21.9)	1563 (43.8)	682 (19.1)	1.67 ± 0.95
	Q4—Being treated as immature and irresponsible by faculty	503 (14.1)	915 (25.6)	1359 (38.1)	791 (22.2)	1.68 ± 0.97
	Q3—Availability of qualified laboratory technicians	465 (13.0)	1079 (30.2)	1507 (42.2)	517 (14.5)	1.58 ± 0.89
	Q27—Lack of input into the decision-making process of school	449 (12.6)	1147 (32.1)	1438 (40.3)	534 (15.0)	1.58 ± 0.89
	Q17—Getting study material	237 (6.6)	1169 (32.8)	1584 (44.4)	578 (16.2)	1.70 ± 0.82
	Q39—Shortage of allocated laboratory time	570 (16.0)	740 (20.7)	1468 (41.1)	790 (22.1)	1.69 ± 0.99
	Q18—Inadequate number of instructors in relation to student	446 (12.5)	960 (26.9)	1459 (40.9)	703 (19.7)	1.68 ± 0.93
	Q38—Shortage of allocated clinical time	1008 (28.3)	477 (13.4)	1273 (35.7)	810 (22.7)	1.53 ± 1.13
	Q2—Amount of cheating in dental school	964 (27.0)	918 (25.7)	1262 (35.4)	424 (11.9)	1.32 ± 1.00
D3 Workload (Mean ± SD = 2.05 ± 0.56)	Q1—Amount of assigned class work	182 (5.1)	547 (15.3)	2056 (57.6)	783 (21.9)	1.96 ± 0.76
	Q9—Difficulty of class work	180 (5.0)	859 (24.1)	1989 (55.7)	540 (15.1)	1.81 ± 0.75
	Q31—Late ending day	170 (4.8)	770 (21.6)	1454 (40.8)	1174 (32.9)	2.02 ± 0.86
	Q28—Lack of time for relaxation	150 (4.2)	466 (13.1)	1483 (41.6)	1469 (41.2)	2.20 ± 0.82
	Q34—Overloaded feeling due to huge syllabus	144 (4.0)	424 (11.9)	1583 (44.4)	1417 (39.7)	2.20 ± 0.80
	Q29—Lack of time to do assigned school work	144 (4.0)	469 (13.1)	1718 (48.2)	1237 (34.7)	2.13 ± 0.79

(Continues)

even illnesses unless addressed properly.[23-26] Study programme amounts for 5 years except for Croatia where it takes 6 years and in Saudi Arabia where the students start their study in the dental school from the second year up to the sixth year. First year for those students is a preparatory year outside the dental school so they were not included in our study. On the other hand, in Pakistan, study programme amounts for 4 years. For the clinical stage, dental students were considered in the clinical stage when they had started with

TABLE 5 (Continued)

Domain	Item	Not apply (%)	No stress (%)	Moderate stress (%)	Severe stress (%)	Mean ± SD
D4 Patient treatment (Mean ± SD = 1.54 ± 0.86)	Q35—Patients being late or not showing for their appointments	1005 (28.2)	493 (13.8)	1286 (36.0)	784 (22.0)	1.52 ± 1.12
	Q25—Lack of cooperation by patients in their home care	875 (24.5)	763 (21.4)	1438 (40.3)	492 (13.8)	1.43 ± 1.01
	Q12—Fear of dealing with patients	702 (19.7)	522 (14.6)	1272 (35.7)	1072 (30.0)	1.76 ± 1.08
	Q41—Working on patients with dirty mouths	884 (24.8)	837 (23.5)	1169 (32.8)	678 (19.0)	1.46 ± 1.06
D5 Clinical training (Mean ± SD = 1.58 ± 0.76)	Q37—Responsibility of getting suitable patients	931 (26.1)	571 (16.0)	1366 (38.3)	700 (19.6)	1.51 ± 1.08
	Q8—Difficulty in learning precision manual skills	483 (13.5)	796 (22.3)	1697 (47.6)	592 (16.6)	1.67 ± 0.91
	Q40—Transition from pre-clinic to clinic work	856 (24.0)	593 (16.6)	1427 (40.0)	692 (19.4)	1.55 ± 1.06
	Q7—Difficulty in learning clinical procedures	640 (17.9)	761 (21.3)	1642 (46.0)	525 (14.7)	1.58 ± 0.95
D6 Performance pressure (Mean ± SD = 1.93 ± 0.60)	Q6—Competition for grades	169 (4.7)	853 (23.9)	1540 (43.2)	1006 (28.2)	1.95 ± 0.84
	Q10—Examinations and quizzes	107 (3.0)	381 (10.7)	1578 (44.2)	1502 (42.1)	2.25 ± 0.76
	Q5—Clinical requirements	728 (20.4)	743 (20.8)	1351 (37.9)	746 (20.9)	1.59 ± 1.03
D7 Social stressors (Mean ± SD = 1.13 ± 0.65)	Q26—Lack of home atmosphere in living quarters	712 (20.0)	1209 (33.9)	1123 (31.5)	524 (14.7)	1.41 ± 0.97
	Q15—Financial responsibilities	341 (9.6)	849 (23.8)	1409 (39.5)	969 (27.2)	1.84 ± 0.93
	Q16—Forced postponement of marriage or engagement	1405 (39.4)	1066 (29.9)	676 (18.9)	421 (11.8)	1.03 ± 1.03
	Q32—Marital adjustment problems	2123 (59.5)	686 (19.2)	523 (14.7)	236 (6.6)	0.68 ± 0.95
	Q33—Necessity to postpone having children	2104 (59.0)	755 (21.2)	464 (13.0)	245 (6.9)	0.68 ± 0.94

even one clinical subject and/or semester because they had already subjected to the clinical training stressors. Of the fourteen included dental schools, there were 8 governmental dental schools whilst the private dental schools were 6. Number of the registered students in the dental schools ranged from 270 (Sudan) to 1500 (Egypt). The aim of this study was to include all dental students, if possible, or a representative sample should at least be obtained. All unfilled and uncompleted questionnaires were excluded.

Statistical analysis was carried out using IBM SPSS for Windows Version 22.0 software program. Normality of response distributions for the 7 DES domains was assessed using the Shapiro-Wilk tests. Frequency distribution, mean and standard deviation were also calculated. In addition, non-parametric Wilcoxon Mann-Whitney and Kruskal-Wallis tests were used as appropriate. Stepwise linear logistic regression analysis was conducted to determine the effect of the studied variables on the stress domains. The level of statistical significance was set at <.05.

3 | RESULTS

Amongst 5104 invited dental students from the 14 participating countries, the total number of questionnaires recruited was 3568 with an overall response rate of 70% varied between the different countries (Table 1). The participants' age ranged from 16 to 45 years with a mean (±SD) of 21.02 ± 2.22 years (median = 21 years). However, the majority of the participants were between 18 and 25 years. The corresponding contributors were contacted to verify the records where students reported their age to be >35 years, and these were then confirmed. The internal consistency (Cronbach's alpha) of the DES was 0.927 for the whole and ranging from 0.877 to 0.976 for countries. However, it ranged from 0.422 to 0.814 for domains. The lowest value was for "performance pressure" domain whilst the highest value was for "Patient treatment" domain (Table 2). Female students (62.6%) formed the majority of the total student population included compared to the males (37.4%). When comparing gender differences per country, the lowest number of female students was in Egypt (36.7%), whilst the highest number of female students comparing to their peers was in Croatia (85.1%). The percentage of married students was 4.8% ranged from 0.4% in Croatia to 15.1% in KSA (Table 3). Numbers of students in pre-clinical and clinical stages were close together (47.6% and 52.4%, respectively). Distribution of the dental students according to the study level for the total sample and for each country is presented in Table 4.

With regard to the total sample, the most stress-provoking domain was "workload" with a score of 2.05 ± 0.56 followed by

TABLE 6 Comparison of means for the 7 domains between genders, different marital status and different clinical stages

		Gender			Marital status			Clinical stage		
	ALL	Male	Female	*P*	Single	Married	*P*	Pre-clinical	Clinical	*P*
Self-efficacy beliefs	1.83 (0.56)	1.74 (0.57)	1.88 (0.56)	<.001	1.84 (0.56)	1.70 (0.58)	.001	1.78 (0.59)	1.88 (0.53)	<.001
Faculty and administration	1.62 (0.56)	1.59 (0.56)	1.63 (0.57)	.022	1.62 (0.56)	1.63 (0.55)	.850	1.41 (0.58)	1.80 (0.47)	<.001
Workload	2.05 (0.56)	1.96 (0.56)	2.11 (0.55)	<.001	2.05 (0.56)	2.10 (0.58)	.127	2.00 (0.58)	2.10 (0.53)	<.001
Patient treatment	1.54 (0.86)	1.53 (0.84)	1.55 (0.86)	.159	1.53 (0.85)	1.71 (0.89)	.005		1.92 (0.59)	
Clinical training	1.58 (0.76)	1.51 (0.73)	1.62 (0.78)	<.001	1.57 (0.76)	1.65 (0.76)	.253		1.90 (0.54)	
Performance pressure	1.93 (0.60)	1.84 (0.62)	1.99 (0.59)	<.001	1.93 (0.60)	1.93 (0.65)	.952	1.80 (0.60)	2.06 (0.58)	<.001
Social stressors	1.13 (0.65)	1.18 (0.65)	1.10 (0.64)	<.001	1.12 (0.64)	1.40 (0.70)	<.001	1.08 (0.67)	1.17 (0.62)	<.001

TABLE 7 Comparison of means for the 7 domains between institutional and study levels (SD)

	Institutional			Study level						
	Public	Private	*P*	1st	2nd	3rd	4th	5th	6th	*P*
Self-efficacy beliefs	1.77 (0.59)	1.92 (0.51)	<.001	1.79 (0.61)	1.83 (0.52)	1.82 (0.58)	1.87 (0.52)	1.82 (0.59)	1.91 (0.56)	.240
Faculty and administration	1.54 (0.59)	1.74 (0.51)	<.001	1.32 (0.59)	1.45 (0.54)	1.65 (0.53)	1.82 (0.45)	1.79 (0.55)	1.87 (0.49)	<.001
Workload	2.03 (0.59)	2.09 (0.50)	.492	1.93 (0.59)	2.08 (0.51)	2.03 (0.59)	2.11 (0.48)	2.08 (0.62)	2.20 (0.53)	<.001
Patient treatment	1.47 (0.91)	1.65 (0.56)	<.001			1.53 (0.83)	1.97 (0.54)	1.97 (0.63)	2.00 (0.54)	<.001
Clinical training	1.49 (0.83)	1.71 (0.53)	<.001			1.69 (0.69)	1.90 (0.52)	1.86 (0.61)	1.94 (0.54)	<.001
Performance pressure	1.90 (0.64)	1.97 (0.55)	.034	1.72 (0.60)	1.90 (0.52)	1.88 (0.63)	2.08 (0.56)	2.06 (064)	2.21 (0.53)	<.001
Social stressors	0.99 (0.60)	1.33 (0.56)	<.001	1.07 (0.68)	1.13 (0.66)	1.12 (0.62)	1.16 (0.61)	1.15 (0.65)	1.27 (0.76)	.017

TABLE 8 Comparison of means for the 7 domains between the different participating countries (SD)

	Brazil	Croatia	Egypt	India	Iraq	Jordan
Self-efficacy beliefs	2.04 (0.45)	1.73 (0.45)	1.96 (0.55)	1.85 (0.48)	1.75 (0.56)	1.21 (0.82)
Faculty and administration	1.68 (0.50)	1.45 (0.53)	2.06 (0.41)	1.36 (0.44)	1.63 (0.46)	1.08 (0.77)
Workload	2.24 (0.44)	1.91 (0.43)	2.30 (0.47)	1.85 (0.46)	2.06 (0.51)	1.44 (0.94)
Patient treatment	1.47 (0.82)	1.30 (0.69)	2.06 (0.60)	1.30 (0.91)	1.31 (1.02)	1.11 (0.96)
Clinical training	1.59 (0.78)	1.43 (0.75)	2.03 (0.48)	1.41 (0.58)	1.32 (0.81)	1.04 (0.86)
Performance pressure	1.91 (0.52)	1.86 (0.50)	2.22 (0.58)	1.78 (0.49)	1.83 (0.54)	1.46 (0.94)
Social stressors	0.89 (0.42)	0.95 (0.54)	1.67 (0.70)	0.86 (0.45)	0.79 (0.57)	0.74 (0.62)

"performance pressure" which scored 1.93 ± 0.60, whilst "social stressors" domain was the lowest stressor with a score of 1.13 ± 0.65. More details about distribution of respondents and the score of stress level (presented in mean ± SD) according to each domain and the related questions are shown in Table 5. Female students scored higher stress than male students did in most of the stress-provoking domains (6 of 7 domains) with significant differences except for "patient treatment" domain where the difference was not significant ($P = .159$). Male students scored higher stress than female students did in "Social stressors" domain with a significant difference ($P < .001$). Although the number of married students (4.8%) was much lower than the number of single students, married students scored higher stress than single students in most of the stress-provoking domains (6 of 7 domains). However, significant differences were noted between married and single students in "self-efficacy beliefs," "patient treatment" and "social stressors" domains. According to the clinical stage, clinical dental students scored higher stress than pre-clinical dental students did with significant differences in all stress-provoking domains (Table 6). With regard to study level, it was noted that stress increased significantly with the progressive study levels. No significant difference was found between study levels for "self-efficacy beliefs" domain. Students in private dental schools showed a significantly higher level of stress than did those in public dental schools with regard to all domains except for "workload" domain which was not significant (Table 7).

Comparisons between the participating countries revealed significant differences in all stress-provoking domains. With regard to the first stress-provoking domain "self-efficacy beliefs" (D1), dental students from Brazil and Peru scored the highest level of stress (more than 2 points). With regard to "faculty and administration" (D2), "patient treatment" (D4) and "clinical training" (D5), only dental students from Egypt scored stress level above 2 points. Five countries of 14 scored more than 2 points for "performance pressure" (D6) whilst no country scored ≥2 for "Social stressors" (D7). Generally, amongst all 14 countries, dental students from Egypt scored the highest level of stress scoring more than 2 points for most of the stress-provoking domains whilst dental students from Jordan scored the lowest level of stress. Dental students from Croatia and India also showed low level of stress. More details about levels of stress for all stress-provoking domains for individual countries are presented in Table 8.

In the present study, the top 5 stress-provoking questions were calculated for the total sample as a whole and for each country separately. As shown in Table 9, the top 5 questions for the total sample were "examinations and quizzes" (Q10), "fear of failing a course or the year" (Q13), "lack of time for relaxation" (Q28), "lack of time to do assigned work" (Q29) and "overload feeling due to huge syllabus" (Q34). Each of these questions exceeded 2 in the stress level. One country only (Iraq) matched all top 5 questions of the total sample although with different order. Egypt, in contrary, matched in only 1 question (Q29). Twelve of 14 countries matched the top 5 of the total sample either in 3 or 4 questions. The top 5 questions of the total sample in a descending order were Q10, Q13, Q34, Q28 and Q29. Although Q11 was not amongst the top 5 of the total sample, it was one of the top 5 questions for 9 countries. Q13 was one of the top 5 in 4 countries whilst Q6 was found as one of the top 5 questions in 3 countries. "Amount of assigned class work" (Q1), "fear of not being able to join postgraduate program" (Q14), "financial responsibilities" (Q15), "inadequate number of instructors in relation to students" (Q18), "insecurity concerning professional future" (Q21) and "transition from pre-clinical to clinical work" (Q40) were found separately as one of the top 5 questions in different countries. From this table, it can also be noted that Q10 and Q13 were found to be the first of the top 5 questions in most countries whilst Q1, Q29, "late ending day" (Q31) and Q34 were found separately as the first of the top 5 questions in other different countries. Apart from the top 5 questions of Jordan and Q21 for India (which were <2 points), all the top 5 questions scored ≥2 in the stress level. More details about the top 5 questions are presented in Table 9.

Stepwise multiple regression analyses revealed varied independent determinants for each domain. Much of the effect was due to clinical stage, and institutional and gender variables, whilst country revealed small, although statistically significant effect. Marital status on the other hand showed effect on D1 and D7 only. The lowest number of determinants was found for D2 and D4—3 independent determinants each—whilst the highest number of determinants was found for D1 and D7—5 independent determinants each. Married students scored lower stress than single did in D1 domain, and female students did so in D7 domain (Table 10).

KSA	Lebanon	Nepal	Pakistan	Peru	South Africa	Sudan	Yemen	*P*
1.80 (0.56)	1.80 (0.54)	1.90 (0.42)	1.97 (0.51)	2.04 (0.43)	1.92 (0.40)	1.71 (0.62)	1.77 (0.58)	<.001
1.54 (0.55)	1.57 (0.47)	1.85 (0.35)	1.80 (0.47)	1.92 (0.39)	1.47 (0.52)	1.48 (0.60)	1.62 (0.59)	<.001
2.22 (0.46)	2.27 (0.49)	1.89 (0.44)	2.05 (0.53)	2.04 (0.39)	2.10 (0.45)	2.07 (0.64)	2.19 (0.51)	<.001
1.62 (0.94)	1.41 (0.81)	1.85 (0.55)	1.79 (0.71)	1.75 (0.55)	1.46 (0.81)	1.54 (0.82)	1.54 (1.08)	<.001
1.64 (0.80)	1.61 (0.63)	1.91 (0.53)	1.87 (0.56)	1.78 (0.61)	1.59 (0.88)	1.41 (0.68)	1.35 (0.85)	<.001
2.08 (0.60)	2.06 (0.56)	1.95 (0.57)	2.10 (0.54)	1.91 (0.46)	2.04 (0.51)	1.78 (0.69)	1.95 (0.59)	<.001
0.85 (0.61)	1.09 (0.57)	1.67 (0.56)	1.41 (0.68)	1.56 (0.54)	0.96 (0.48)	1.24 (0.73)	1.13 (0.53)	<.001

4 | DISCUSSION

Sustained stress, psychological morbidity and/or emotional exhaustion may lead ultimately to professional burnout.[27,28] It is more problematic when it occurs early during the education stage. Dental education in particular is one of the most stressful educational environments; it is challenging and demanding as it entails diverse competencies by the students including academic and clinical competencies, as well as important communication skills.[19,29,30] It is essential therefore to assess the level of such stress and its sources in order to address them through appropriate actions and programmes.

The current study is the largest multicountry study that recruited 3568 dental students from 14 countries with a reasonable response rate ranging from 32% to 100% to assess the perceived DES. The overall response rate was 70% which can be considered good. Typically, the overall perceived stress was substantial in all countries although different by domains from country to country. In line with that, a previous study conducted by Humphris et al[12] in 2002 included 331 first-year dental students recruited from 7 European dental schools with a response rate of 97% revealed high level of emotional exhaustion. Seven years later, Polychronopoulou and Divaris[8] performed another multinational study in 2009 recruited 1492 dental students from 6 countries with a response rate of 81%; they revealed high level of stress and similar variability by domains between countries. Our study came 7 years after Polychronopoulou's study and revealed substantial stress amongst all the included countries. This indicates the international trend of DES despite the variability of the provoking stressors. Moreover, these results support the findings of Alzahem's systematic review[31] in which he found comparable results of stress and stressors during the period from 1990-2010. It should be noted here that our result is out of 3 (the scale ranged from 0 to 3) whilst the results of the abovementioned studies were out of 4 (the scale ranged from 0 to 4 or from 1 to 4). This means that stress amongst dental students is still at a high level despite the considerable amount of research conducted in this regard and it may indicate the failure of the currently applied stress-reducing programmes, if any.

Although the included participants were dental students exposed to the dental education environment, there are huge variabilities in the perceived stress in different countries which indicates different dental environmental circumstances from country to country and even from school to school within the same country.[8,32] The variability in the surrounding environmental circumstances, the degree of family/governmental support and the extent of the competition in different countries must not be overlooked. All curricula for the selected dental schools were the same in all countries, which have pre-clinical and clinical components except that the duration of the programme differed between countries ranging from 4 to 6 years. All curricula adopt conventional method of teaching that includes lectures, tutorials and practical sessions. The internal consistency of the DES for the total sample was excellent whilst it was poor for the "performance pressure" which might be related to the few numbers of questions included in this domain. For the total sample, the "workload" was the highest stress-inducing domain followed by "performance pressure" domain. These domains have been reported as the most stressors in many of the previous studies.[7,8,33-37] On the other hand, the self-efficacy belief represented the lowest stress-inducing domain as perceived by Jordanian students, although perceived the highest in Brazil and Peru (2.04 each). It is difficult to explain such a difference, but it may be related to the personality, social background, religious beliefs and economical and political stability. Stress due to shortage in faculty and administration was lowest in Jordan and highest in Egypt. This could be a direct result of the total number of enrolled students (1500 students in Egypt); the student to faculty staff ratio is much better in Jordan due to fewer enrolled students. In the education process, this scenario allows for a better feedback system from faculty side and at the same time, substantial contribution from students related to decision making. Despite stress levels being high in most of the included countries, stress due to workload was highest in Egypt and lowest in Jordan. The above explanation would probably be the reason for this. The other fields of stress followed the same direction, being highest amongst Egyptian and lowest amongst Jordanians students.

Workload domain was the highest stress-inducing source in 9 of the 14 countries. In Peru and India, self-efficacy belief and workload domains contributed equally in inducing high stress. In Jordan, Nepal and Pakistan, however, performance pressure was the highest stress-inducing source. Indeed, performance pressure was the second highest source of stress in most of the other countries. This reflects the keenness of the students in gaining excellence rather than merely fulfilling their obligations. Again, such variabilities in the rank of the stress-inducing domains indicate either different dental

TABLE 9 Means for the top 5 questions between the different participating countries (SD)

	Q10	Q13	Q34	Q28	Q29	Q11	Q31	Q6	Q1	Q18	Q21	Q14	Q40	Q15
All	2.25 (0.76) **1**	2.20 (0.90) **2**	2.20 (0.80) **3**	2.20 (0.82) **4**	2.13 (0.79) **5**									
Brazil	2.63 (0.53) **1**	2.44 (0.71) **4**	2.48 (0.66) **3**	2.58 (1.61) **2**		2.44 (0.70) **5**								
Croatia	2.34 (0.74) **1**	2.23 (0.83) **2**	2.10 (0.75) **5**	2.14 (0.72) **4**			2.22 (0.60) **3**							
Egypt					2.34 (0.64) **3**	2.36 (0.79) **2**	2.31 (0.71) **4**		2.46 (0.69) **1**	2.31 (0.71) **5**				
India	2.03 (0.75) **3**	2.12 (0.87) **1**	2.02 (0.80) **4**			2.05 (0.78) **2**					1.95 (0.88) **5**			
Iraq	2.34 (0.70) **1**	2.21 (0.90) **5**	2.26 (0.68) **3**	2.29 (0.79) **2**	2.24 (0.74) **4**									
Jordan	1.74 (1.08) **1**		1.55 (1.11) **3**	1.58 (1.14) **2**		1.54 (1.10) **4**		1.50 (1.09) **5**						
KSA	2.52 (0.62) **1**		2.27 (0.72) **5**	2.41 (0.72) **2**	2.30 (0.68) **4**		2.30 (0.84) **3**							
Lebanon	2.39 (0.67) **3**		2.29 (0.77) **4**	2.49 (0.71) **2**			2.49 (0.74) **1**					2.28 (0.82) **5**		
Nepal	2.02 (0.79) **3**	2.05 (0.82) **1**	2.04 (0.73) **2**			2.00 (0.82) **5**							2.01 (0.78) **4**	
Pakistan	2.18 (0.77) **4**	2.38 (0.86) **1**	2.24 (0.85) **2**			2.23 (0.79) **3**		2.17 (0.81) **5**						
Peru		2.66 (0.58) **1**		2.16 (0.70) **5**	2.19 (0.60) **4**	2.23 (0.71) **3**								2.25 (0.83) **2**
South Africa	2.43 (0.59) **3**	2.58 (0.65) **1**	2.37 (0.69) **4**	2.16 (0.68) **5**		2.50 (0.63) **2**								
Sudan	2.12 (0.97) **4**		2.28 (0.96) **1**	2.14 (1.04) **3**	2.12 (1.02) **5**	2.17 (0.95) **2**								
Yemen	2.27 (0.83) **5**		2.48 (0.77) **2**	2.40 (0.77) **3**	2.54 (0.71) **1**			2.28 (0.80) **4**						

Numbers with bold refer to the ranking questions.

TABLE 10 Stepwise multiple regression analyses for the association between the 7 domains and the study variables

				95% CI			
		B	SE	Lower	Upper	Adjusted R^2	P
Self-efficacy beliefs	Institutional	0.137	0.019	0.099	0.174	0.041	.000
	Gender	0.140	0.019	0.102	0.177		.000
	Clinical stage	0.099	0.019	0.062	0.135		.000
	Marital status	−0.148	0.043	−0.233	−0.063		.001
	Country	0.006	0.002	0.001	0.010		.019
Faculty and administration	Clinical stage	0.389	0.017	0.354	0.423	0.150	.000
	Institutional	0.191	0.018	0.156	0.226		.000
	Country	0.009	0.002	0.005	0.013		.000
Workload	Gender	0.152	0.019	0.115	0.190	0.028	.000
	Clinical stage	0.089	0.018	0.053	0.126		.000
	Country	0.007	0.002	0.003	0.012		.002
	Institutional	0.046	0.019	0.009	0.083		.014
Patient treatment	Clinical stage	0.799	0.025	0.750	0.849	0.230	.000
	Institutional	0.159	0.026	0.108	0.209		.000
	Country	0.017	0.003	0.011	0.024		.000
Clinical training	Clinical stage	0.675	0.023	0.631	0.720	0.216	.000
	Institutional	0.204	0.023	0.159	0.250		.000
	Gender	0.063	0.023	0.017	0.109		.008
	Country	0.006	0.003	0.000	0.012		.034
Performance pressure	Clinical stage	0.256	0.020	0.217	0.294	0.063	.000
	Gender	0.137	0.020	0.098	0.177		.000
	Country	0.008	0.002	0.004	0.013		.001
	Institutional	0.058	0.020	0.019	0.097		.004
Social stressors	Institutional	0.335	0.021	0.294	0.376	0.105	.000
	Country	0.023	0.003	0.018	0.028		.000
	Marital status	0.306	0.048	0.212	0.400		.000
	Gender	−0.102	0.021	−0.144	−0.060		.000
	Clinical stage	0.088	0.021	0.048	0.129		.000

environments to which these students were exposed or different coping abilities in handling these stressors or both. Emphasising on the importance of proper and well-planned pre-clinical training and on the quality of the required clinical cases rather than the quantity is essential to reduce DES whose highest fraction comes from the "workload" and "performance pressure" domains.

As expected, the perceived stress by female students was higher than that perceived by males except for the social stressors field where the contrary was observed. This is in agreement with many previous studies[29,35,38-41] whilst it contradicts some other studies.[12,32,42] It might be that certain cultural values and the nature of a patriarchal society expect males to be less expressive of their worries and show more responsibility in dealing with difficulties. This is supported by the difference in the social stressors field in favour of females due to the fact that the social responsibilities, specifically the financial ones, rest with men in many of these societies. In line with that, no gender difference was found regarding patient treatment field. Shortage in dental patients, or patients not being cooperative, is stress-inducing for dental students irrespective of their gender.

The perceived stresses were higher in the senior levels of study. It has been well documented that with the commencing of clinical training, the perceived stress by dental students increased substantially.[5,13,36,43-46] However, this finding is in contrast with that of Newton et al[47] and Sugiura et al[48] who reported lower level of stress in senior students than their younger peers. They related this result to the ability of senior students to adapt to the dental curriculum and to cope with some difficulties. This is not the case in our sample because the difference was increasingly apparent in all fields related to the academic process. However, there were no differences in perceived self-efficacy beliefs stress between the different levels. This applies to the social stressors to some extent. These 2 fields are not directly related to the academic process. When the levels were dichotomised into "pre-clinical" and "clinical," the differences

were increasingly apparent in all fields including self-efficacy beliefs and social stressors. Apart from the other fields which indicate real differences, the differences in the latter 2 fields might be due to the large sample size rather than it being real.

Despite the small number of married students compared to singles, the differences between them in relation to DES domains were significant for "social stressors," "self-efficacy beliefs" and "patient treatments". This difference could be explained by the fact that married students have more responsibilities than singles. Family responsibilities, additional financial responsibilities, having children, and residing away from their parent's home and extended families are some factors that may create more stress amongst this group.[12,13,39,49]

Except for "workload" domain which was not significant, all other domains had significant differences in favour of students from private dental schools compared to students from public dental schools. This might be related to the additional annual fees besides the conventional costs. Henzi et al[50] found that the educational cost was the source of most stress amongst dental students in the United States.

"Examinations and quizzes" (Q10), "fear of failing a course or the year" (Q13), "lack of time for relaxation" (Q28), "lack of time to do assigned work" (Q29) and "overload feeling due to huge syllabus" (Q34) were the top 5 stress-provoking questions for the whole sample. However, many variations were found regarding stressor questions with regard to the individual countries. In Egypt, "amount of assigned class work" (Q1) and "inadequate number of instructors in relation to students" (Q18) were found within the top 5 stress-provoking questions. This might be attributed to the huge number of registered students (1500 students). On the other hand, there were only 199 students included in this study which may not represent the actual response in real. In India, "insecurity concerning professional future" (Q21) was one of the top 5 stressors, indicating high level of competition due to the huge number of graduating dentists. In addition, the admission for postgraduate study is difficult as the students have to go for highly demanding competition. With regard to gender, female students are uncertain of their future plan as they might have to shift to other places or stop dental working, once married. In Lebanon, "late ending day" (Q31) was the first ranking stressor and "fear of not being able to join postgraduate program" (Q14) was the fifth ranking stressor. For the former, the working day in this dental school takes long time (more than 10 hours) with a very short time as a break in the day. In addition, during break time, the students are busy preparing for the next sessions. This contributed greatly to the level of students stress. For the latter, postgraduate study in this dental school is expensive and requires the students to have the skills and ability to pass the entrance examination. In Nepal, "transition from preclinical to clinical work" (Q40) was the fourth ranking stressor. This may be attributed to the curriculum in this dental school where the students have to learn some medical knowledge in the pre-clinical stage where they had encountered with medical patients early before they go for clinical stage and dealing with dental patients. In Peru, "financial responsibilities" (Q15) was the second stressor. This may be attributed, to some extent, to the annual fees as this dental school is a private institution and the students have to pay annually for dental education, in addition, payment of the learning materials, instruments, equipments and the fees of the dental treatment are necessary to achieve the assigned requirements. Moreover, the students come from low economic backgrounds. In Yemen, "lack of time to do assigned work" (Q29) was the first ranking stressor. This might be due to the shortage in dental facilities including dental chairs. In addition, the country has serious problems with a continuous electricity supply; this is due to the political conflicts and war of the past 3 years. The dental school, therefore, depends totally on its emergency generator which entails decreasing the time assigned for the clinical sessions. Despite the above-mentioned disparities of the top 5 stressors, all those stressors have been mentioned in the literature as considerable stress-provoking factors.[31,43,51,52]

It can be noted form the regression analysis that the country plays significant role as independent variable amongst all domains, that is the stress varies significantly from country to country. The Jordanian students, for example, scored the lowest level of stress which might be related to the learning programme, number of registered students or number of the academic staff. Most of the fractions in dental stress can be attributed to "clinical training," "patient treatment," and "faculty and administration" domains. Typically, DES appears to increase upon transition into clinical training. In a matter of fact, the assigned clinical requirements, dealing with patients, and acquiring special skills are some factors that expose dental students to further stress. Positive and productive coping with the encountered stress can enhance students' performance. Also, strict adherence to the quality control and academic accreditation which emphasises the importance of availability of different ideal conditions will ensure excellent environment for both students and staff and will help in reducing the stress from different sources.

Some limitations of the current study should be acknowledged. First, the study design is cross-sectional and hence a sound conclusion regarding the effect of study level and clinical stage cannot be drawn. Second, no data were collected regarding ethnicity of the participants. Third, the effect of age on the perceived stress was not examined. However, apart from study level which also reflects the role of age, we confirm here that the vast majority of the participants were between 18 and 25 years. Fourth, the details of the non-respondents had not been collected in all selected countries. We considered this as a limitation of this study. Finally, the study system in our study was almost the same whilst different study systems might play a pivotal role and hence future research should evaluate such a hypothesis.

5 | CONCLUSION

Within the limitations of the current study, it can be concluded that the perceived stress in the dental environment is still high and the stressors seem to be internationally comparable. Effective management programmes, curricula reviews and redesign alongside with longitudinal studies should be performed to ease and minimise dental environment stress.

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SUPPORTING INFORMATION

Additional Supporting Information may be found online in the supporting information tab for this article.

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