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Abstract

Academic stressors in a medical educational environment are related to two factors. This study was carried out in order to analyze the correlation between the dental environment and perceived stress among dental students during the COVID-19 pandemic. The respondents were 422 undergraduate dental students and the validated Modified Dental Environmental Stress (DES) and Perceived Stress Scale (PSS) questionnaires were used. Furthermore, the Spearman correlation analysis was used to measure the correlation between DES and PSS score. The result showed that five dental stressors were noted to have the strongest correlations with PSS (p-value >0.40). They include expectation towards dental school (p-value = 0.431), lack of confidence to be a successful dentist (p-value = 0.424), lack of confidence to become a successful dental student (p-value = 0.408), dental school regulations (p-value = 0.401) and criticism of school work (p-value = 0.400). In addition, all six DES categories showed a positive correlation with the PSS. Therefore, the dental students collectively displayed moderate perceived stress scores. The overall discoveries from this study showed a positive correlation between the DES and PSS among dental students during the COVID-19 pandemic.

Keywords: dental environment, dental student, perceived stress scale

Introduction

The data on October 21, 2020 obtained by the Indonesia Medical Council stated that there are only 35,863 dentists in Indonesia. However, this number still remains low and is yet to meet the needs of the Indonesian population.[1] Perceived stress among dental students has become an obstacle towards increasing graduation productivity, especially during the pandemic.[2] This implies that the coronavirus disease 2019 (COVID-19) pandemic has an impact on dental education.[3]

A pandemic is defined as an "epidemic that occurs worldwide or in a very wide region, crossing international borders and typically affecting a large number of individuals".[4] The outbreak that occurred in Wuhan, China, in December 2019, is a newly discovered infectious disease caused by a beta coronavirus called severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), which was later officially known as the COVID-19.[5] The World Health Organization (WHO) stated that the COVID-19 outbreak is a global health emergency on January 30, 2020, and finally declared it as a global pandemic on March 11, 2020, due to its rapid and uncontrollable

transmission.[6] As of October 2020, WHO reported more than 1 million death cases linked to COVID-19 infection worldwide.[7]

Since the beginning of this pandemic, WHO has been publicly recommending several measures to control the spread of SARS-CoV-2 infection. They include the avoidance of crowds and poorly ventilated areas, good hygiene practices such as hand washing and wearing face masks, as well as practicing social distancing.[8] Although, these measures were initially aimed at reducing the global mortality rate, they have somehow significantly altered the world's orders in many aspects, including daily routine, economy, the stock market and even the world's educational system.[8] Consequently, many nations have implemented lockdown (general constraints on the population, including instructions to stay at home and work/learn from home) and this has impacted the lives of employees and students across the globe, ranging from elementary to college students, due to the closedown of public places including offices, companies and educational institutions.[7,9] In the world of dentistry, both in terms of dental practice and education, like other educational majors,

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faced challenges in implementing the new procedures, to protect the health of students and dental faculty staffs, while ensuring the continuity of the quality of dental education.[10] Furthermore, the prevalence of stress and anxiety, especially among dental students, increased with the closure of universities and enforcement of social distancing regulations during this pandemic.[11]

Academic stressors in a medical educational environment are related to several factors, such as large number of difficult materials and the ability of comprehensive examinations to be mastered by students that require a lot of time to study, leaving them with little time to release accumulated stress and anxiety.[2] The health profession has higher stress levels compared to other field of study. It has been observed that 56.4% of health professions have high-stress levels and only 20.6% of non-health-related professions have high-stress levels.[12]

Meanwhile, dental students are more likely to experience high-stress levels compared to other health fields. A study found that dental students have higher stress levels compared to other medical students in academic performance with average scores of 2.56 and 2.37, respectively (p-value <0.1), clinical responsibility towards patients with average scores of 2.39 and 2.21 (p-value <0.1), and faculty relationship with average scores of 2.38 and 1.87, respectively.[13] Furthermore, based on a study by Al-Sowygh, *et al.*,[14] the mean and median score of the Perceived Stress Scale (PSS) among dental students is 22.82 and 23, respectively. This study was performed in Saudi Arabia and stated that dental students in the fourth academic year had the highest stress levels (23.97). Meanwhile, they had the lowest stress levels (22.35) in the third academic year.[14]

The dentistry curriculum requires students to have theoretical knowledge and clinical skills simultaneously. In the preclinical period, they are expected to acknowledge theoretical materials in a short time and be introduced to complex dental equipment. Furthermore, during clinical practice, they are required to perform irreversible procedures on frightened patients. These experiences are new and were never carried out during the pre-clinic study period.[15-17]

Therefore, this academic demand requires dental students to be competitive and encourages them to study hard in order to obtain a good education. However, for some students, this stressor causes high-stress levels.[18] One of the undesirable effects of stress on dental students is intellectual dysfunction and failure to learn. They become ineffective in fulfilling the requirements in the dentistry curriculum due to high-stress levels, with or without physical symptoms. The stress levels also put them in conflicting situations where they have to choose between spending time studying, relaxing, or doing other things outside the scope of dentistry.[19]

A study stated that identifying the stress-causing factors and the levels of stress among dental students may be of assistance in building a strategy to reduce stress levels.[20] Appropriate strategies contribute to increasing the number of graduates and quality of dental education. This solution is expected to address the ratio of dentists to the population in some countries. Consequently, the stress-causing factors and stress levels among dental students need to be studied in order to formulate an appropriate strategy.[21] A study of stress levels among dental students at the Faculty of Dentistry Trisakti University has never been carried out. Therefore, this study aims to acknowledge the relation of the stress-causing factors and perceived stress among dental students at the Faculty of Dentistry Trisakti University, primarily during the COVID-19 pandemic.

Method

This study was based on analytic observation, using cross-sectional study methods. The subjects were undergraduate students at the Faculty of Dentistry Trisakti University, representing the class of 2017-2019. Using the random sampling method, the minimal sample was calculated and the minimal size obtained was 212 (N = 1,500). The respondents were 422 undergraduate dental students. This study was approved by the Ethics Commission of Faculty of Dentistry Trisakti University with approval number 267/S1/KEPK/FKG/2/2020. Furthermore, all questionnaires were developed and confirmed after expert review.

The data used was collected from completed questionnaires. The questionnaires were divided into the Perceived Stress Scale (PSS) and Modified Dental Environment Stress (DES) questionnaire. Perceived Stress Scale questionnaire measured the perceived stress level of the student using Likert scale from 0-4 as follows: 0: never, 1: almost never, 2: sometimes, 3: almost often, 4: often. Subsequently, total scores were calculated by changing the scores for questions number 4, 5, 6, 7 and 8 into 0 = 4, 1 = 3, 2 = 3, 3 = 1, 4 = 0. The total score of the PSS questionnaire analysis was divided into three scales, namely low-stress level (0-13), middle-stress level (14-26) and high-stress level (27-40).[14,22]

Meanwhile, Dental Environment Stress was measured by events, experiences or stimuli originating from the environments that are able to cause stress. This study modified the DES questionnaires with excluding patient care category. The questions were divided into six categories, namely: self-efficacy, lecturers, workload, clinical training, academic performance pressure and personal/others and scaled with Likert from 1-5 as follows: 1: no stress, 2: less stressful, 3: simply stressful, 4: very stressful, 5: not applicable.[14,23] Data from the DES questionnaire was categorized with a calculated mean and standard de-

viation.

The validity of the DES and PSS questionnaires was tested, but due to the modification of questionnaires in this study, the validity was re-tested. The modified DES questionnaires consisted of 29 questions which had an r count more than r table (0.428-0.800). Meanwhile, the PSS questionnaires consisted of 10 questions which had an r count more than r table (0.420-0.867). Therefore, all the questions from both questionnaires were valid.

Reliability tests for both questionnaires were carried out using the Chronbach coefficient alpha, which was also used to determine the reliability of the measuring instrument. According to Bernstein, the minimum coefficient for measuring an instrument is 0.7 and is said to be reliable.[24] The result of the reliability test for both questionnaires are shown in Table 1. It was concluded that questionnaires are usable since both the DES and PSS were classified as having very high and high reliability respectively.

Data between genders were compared using an Independent Sample T-test. Furthermore, Spearman correlation analysis was used to measure the correlation between the DES and PSS score. Data analysis was carried out using IBM SPSS Statistic Version 24 (IBM Corp., New York, USA).

Results

A total of 422 responses were recorded in Table 2, among which 87.7% were female and 12.3% were male. Furthermore, the mean PSS score for the study population was 20.5 (±5.644) with a range of 5-38. The male students showed a mean PSS score of 19.3 (±5.090), while that of the female students was 20.6 (±5.712). From all the DES factors in Table 3, five factors with the highest mean were selected (Table 4). The factor with the highest mean among the stress-causing factors was 'Fear of failing a module,' which was included in the 'Academic performing pressure category. The DES factor

categories of 'academic performance pressure', 'workload' and 'clinical training', predominated with the mean score of each category being 2.86, 2.69 and 2.85 respectively. The result of the Spearman correlation test indicated that there was a positive correlation between all DES factors and PSS scores (p-value <0.01) (Table 5). Among all DES items, the 5-items with the strongest positive correlations (p-value >0.4) were noted in Table 6.

Discussion

During the COVID-19 pandemic, many faculties all over the world, including dentistry greatly transformed the traditional face-to-face form of the educational system into online learning in order to pass the educational substances between tutors and students. Despite the adoption of new approaches that are capable of suppressing the spread of COVID-19, the uncertainty about how and when the pandemic will end could significantly im-

Table 1. Chronbach Coefficient Alpha of Dental Environment Stress and Perceived Stress Scale Questionnaires

Questionnaire	Cronbach Coefficient α
Dental environment stress	0.957
Perceived stress scale	0.773

Table 2. Comparison of Mean Scores, Data Range and Perceived Stress Scale Score between Gender

Participant	n (%)	Mean (SD)	Data Range	PSS Category
All	422	20.5 (5.644)	5-38	Moderate stress
Male	52 (12.3%)	19.3 (5.090)	6-38	Moderate stress
Female	370 (87.7%)	20.6 (5.712)	5-38	Moderate stress

Notes: PSS: Perceived Stress Scale, SD: Standard Deviation

Table 3. Dental Environment Stress Factors

Variable	Mean	SD
Self-efficacy	2.53	0.763
Lack of confidence to be a successful dental student	2.60	0.891
Lack of confidence to be a successful dentist	2.71	0.918
Insecure feeling towards the future	2.91	0.906
Consider changing to another major	1.76	0.930
Lecturers	2.03	0.714
Faculty environment	2.11	0.940
Number of dishonest faculty in dentistry	2.27	1.027
Rules and regulations for faculty of dentistry	2.12	0.930
Respondent expectation towards faculty of dentistry vs. reality	2.28	0.913
Lack of input in decision making by faculty of dentistry	2.140	0.950
Gestures of faculty of dentistry towards female students	1.531	0.860
Race discrimination, class status and ethnic group	1.581	0.875
Inconsistency of feedback on respondent work by different lecturers	2.100	0.965
Workload	2.69	0.834
Number of assignments	2.50	0.926
Less time for relaxation	2.97	0.925
Less time to carry out assignments	2.58	0.950
Clinical training	2.85	0.857
Difficulty in studying clinical procedure	2.94	0.981
Difficulty in learning the skills needed in pre-clinic and lab work (skills lab)	2.74	0.911
Academic performance pressure	2.86	0.720
Difficulties in assignments	2.52	0.926
Competition among academic peers	2.46	1.019
Examinations and grades	3.17	0.849
Fear of failing a module	3.31	0.823
Requirements for graduation (Bachelor's degree)	2.88	0.958
Fear of not being able to catch up if sitting at the back of the class	2.47	0.997
Criticism of the work	3.03	0.720
Personal/Others	1.91	0.760
Financial issue	2.53	1.068
Forced postponement of marriage/engagement	1.43	0.842
Personal physical health	1.96	0.944
Away from home/homesick	1.78	0.983
Problems with family/spouse regarding the choice to become a dentist	1.45	0.856

Note: SD: Standard Deviation

Table 4. The Stress-Causing Factor with the Highest Means in Dentistry

DES Factor	Category	Mean	SD
Fear of failing a module	Academic performance pressure	3.31	0.825
Examinations and grades	Academic performance pressure	3.17	0.850
Fear of not being able to catch up if sitting at the back of the class	Academic performance pressure	3.03	0.936
Less time for relaxation	Workload	2.97	0.925
Difficulty in studying clinical procedure	Clinical training	2.94	0.981

Notes: DES: Dental Environment Stress, SD = Standard Deviation

Table 5. Correlation between Scores of Dental Environment Stress Categories and Perceived Stress Scale

DES Category	ρ*	p-value
Self-efficacy	0.426	<0.001
Lecturers	0.424	<0.001
Workload	0.299	<0.001
Clinical training	0.358	<0.001
Academic performance pressure	0.429	<0.001
Personal/others	0.361	<0.001

Notes: DES: Dental Environment Stress, * Spearman's correlation coefficient rho

Table 6. Strongest Positive Correlations between Scores of Dental Environment Stress Items and Perceived Stress Scale

DES Item	ρ*	p-value
Respondent expectation towards faculty of dentistry vs. reality	0.431	<0.001
Lack of confidence to be a successful dentist	0.424	<0.001
Lack of confidence to be a successful dental student	0.408	<0.001
Rules and regulations for faculty of dentistry	0.401	<0.001
Criticism of the work	0.400	<0.001

Notes: DES: Dental Environment Stress, * Spearman's correlation coefficient rho

pact the mental health of educational staff members and dental students due to increased stress and anxiety.[3,25] The educational process of a profession can be an experience with full psychological stress and pressure, which is a psychological response to various demands in mental, emotional, or physical forms. Stress is a normal response and acts as a protective-adaptive process in the life of an individual, but stress is also capable of causing an individual to experience certain conditions such as anxiety, depression and exhaustion, which have a negative impact on the quality of life.[26,27]

The impact of stress on each individual varies. Sometimes it serves as a source of motivation for students to gain achievement. However, with stressful stimulations and excessive stress, it is possible for them to experience negative impacts in terms of academic performance. This is due to differences in each individual in terms of stress tolerance and motivation.[28] The consequences of high and intolerable stress levels do not always have a direct impact on student academic performance, but it might have psychological impacts. Therefore, such student feels incapable of continuing his or her education and decides to quit being a dentistry major.[29] It has been observed that this is one of the reasons for the decline in the number of dentistry graduates. The low number of dentistry graduates leads to a reduction in number of dentists in an area, resulting in an imbalanced dentists-to-patients ratio.[30] This imbalanced ratio shows that the population in the area will not receive ideal den-

tal treatments.[31]

Studies in the past three decades showed that dental students experience high-stress levels.[14] However, this study indicated that the stress level of dental students at the Faculty of Dentistry Trisakti University was categorized into moderate stress level (20.5±5.64). Furthermore, the mean score comparison between genders indicated that female students have higher perceived stress levels compared to males. This result was in accordance with the studies carried out in Canada, Saudi Arabia and Russia, which stated that female students have higher perceived stress levels compared to males.[32,33] The collected data ranged from 6, which was in the 'low-stress level' category or 'low stress,' to 38, which was in the 'high-stress level' category or 'high perceived stress'.

The stress-causing factor in dental education needs to be identified in order for the objectives of this study to be fulfilled. Therefore, an analysis was performed on six categories of stress-causing factors. The stressor category with the highest mean score was 'academic performance pressure' (2.86±0.720). This implies that the academic performance pressure put on students, has a had a high potential of increasing students' stress levels due to expectations and goals that are self-imposed, family or society and also, the general thought that academic performance plays a crucial role in shaping one's career. Dental students were faced with the demanding nature of the dental curriculum in order to reach the goal. Therefore, this was one of the many factors contributing to the higher level of stress among them compared to other health-related students.[13,34]

The second dental environmental stressor category with the second highest mean score was the 'clinical training' (2.85±0.857), followed by the 'workload' category (2.69±0.834). The lowest mean score came from the 'personal/others' category (1.91±0.760). Although, studies on dental students from various countries showed different causes of stress, majority discovered that the top stress-causing factors originated from the categories of 'academic performance pressure', 'clinical training'

and 'workload'. Furthermore, the results of this study were consistent with previously published studies.[35,36]

In addition correlations between dental environments and stress levels in this study showed positive correlations between all DES factors and perceived stress (p-value <0.01). However, a study in Saudi Arabia showed different results, as there were positive correlations between only five DES factors (clinical training, workload, self-efficacy, lecturers and education personnel and academic performance pressure) and perceived stress.[14]

Conclusion

The stress level of dental students at the Faculty of Dentistry Trisakti University was categorized into moderate stress level. This study showed there is a significant correlation between the dental environment and perceived stress levels among dental students at the Faculty of Dentistry Trisakti University during the COVID-19 pandemic. However, future studies are needed to investigate proper stress management for students. Moreover, the stress-causing factor in dental education needs to be analysed further. This is because, proper stress management techniques are capable of motivating students to measure and overcome stress in order to increase their academic and clinical performance.

Abbreviations
DES: Dental Environment Stress; PSS: Perceived Stress Scale; COVID-19: Coronavirus Disease 2019; SARS-CoV-2: Severe Acute Respiratory Syndrome Coronavirus 2; WHO: World Health Organization.

Ethics Approval and Consent to Participate
This study has been ethically reviewed and approved by the Ethics Commission of Faculty of Dentistry Trisakti University with approval number 267/S1/KEPK/FKG/2/2020.

Competing Interest
The author declares that there are no significant competing financial, professional, or personal interests that might have affected the performance or presentation of the work described in this manuscript.

Availability of Data and Materials
All data that support the results of this study are with the corresponding author [TEA] and will be made available upon reasonable request.

Authors' Contribution
TEA and HJ conceptualized and designed this study. HJ carried out data collection, while WS carried out data analysis and interpretation. Furthermore, TEA, ASW, and HJ analyzed the data and edited the manuscript. All authors discussed the study and contributed to the manuscript preparation and review.

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