

**Identification of stress signs before practical exams in human anatomy**

**Identificação dos sinais do estresse antes da avaliação prática de anatomia humana**

**Identificación de signos de estrés antes de la evaluación práctica de la anatomía humana**

Received: 11/05/2020 | Reviewed: 11/08/2020 | Accept: 12/15/2020 | Published: 12/16/2020

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**Abstract**

The teaching-learning process is challenging in human anatomy. In this process, practical exams are necessary to enable a proper evaluation of the students. Students' performance, on

the other hand, reflects not only their knowledge but also their individual reactions to exams. Objective: This study aimed to identify signs and symptoms of stress in undergraduate students before practical exams in human anatomy. Methods: The sample consisted of 93 students (48 females and 45 males, mean age = 20.33 years) enrolled in medical and dental courses at undergraduate level. Blood rate, heart rate and oxygen saturation were assessed 30 minutes before the practical exams. Lipp's Inventory of Stress Symptoms for Adults (LSSI) was used. Results: Statistically significant differences ( $p < 0.05$ ) was observed for the systolic blood pressure between females (117.76  $\pm$  11.82 mmHg) and males (120.66  $\pm$  10.09 mmHg). Diastolic rate, respiratory rate and oxygen saturation were similar between sex groups ( $p > 0.05$ ). A higher report of signs and symptoms of stress was detected in females ( $p < 0.05$ ) for each of the stress stages described by LSSI, namely alarm, resistance and exhaustion. Medical and dental undergraduate students manifested signs and symptoms of stress before practical exams in human anatomy. The outcomes were more evident in females.

**Keywords:** Anatomy; Psychological stress; Signs and symptoms; Student's health.

### Resumo

O processo de ensino-aprendizagem se apresenta complexo e difícil no que diz respeito ao ensino em Anatomia Humana. O modo como o discente aborda o conteúdo pode repercutir positivamente ou negativamente nesse processo. Fato que reflete diretamente nas avaliações podendo, conforme a metodologia de estudo adotada pelos alunos, desencadear altos índices de estresse no momento da avaliação. Objetivo: Identificar os sinais e a fase do estresse em estudantes do curso de Medicina e Odontologia nas avaliações práticas da disciplina de Anatomia Humana. Metodos: Noventa e três alunos dos participaram da pesquisa sendo a maioria do sexo feminino (42 participantes), com idade média de 20,33 anos. Os participantes foram avaliados 30 minutos antes do início da prova prática sendo aferidos os batimentos cardíacos, frequência respiratória e saturação de oxigênio. Para análise do grau de estresse foi utilizado o Inventário de Sintomas de Stress para adultos de Lipp. Resultados: Quanto aos sinais clínicos avaliados, foram encontradas diferença significativa na média da pressão Sistólica entre os grupos ( $p < 0,05$ ; mulheres: 117,76 ( $\pm$ 11,82) mmhg versus homens:120,66 ( $\pm$ 10,09) mmhg). Quanto ao Inventário de Sintomas de Stress para Adultos de Lipp (ISSL), houve diferença estatísticas quanto aos grupos nas três fases ( $p \leq 0,05$ ) onde o grupo do sexo feminino apresentou maior quantidade de sintomas apresentados. Conclusão: O estudo demonstrou níveis significativos de estresse nos alunos, evidenciou-se também um

predomínio no sexo feminino que se apresentaram em sua maioria na fase de resistência, com predominância de sintomatologia na esfera psicológica.

**Palavras-chave:** Anatomia; Estresse psicológico; Sinais e sintomas; Saúde do estudante.

### **Resumen**

El proceso de enseñanza-aprendizaje es complejo y difícil cuando se trata de enseñar en Anatomía Humana. La forma en que el alumno se acerca al contenido puede tener un impacto positivo o negativo en este proceso. Hecho que se refleja directamente en las evaluaciones y que, según la metodología de estudio adoptada por los estudiantes, puede desencadenar altos niveles de estrés en el momento de la evaluación. Objetivo: Identificar los signos y la fase de estrés en estudiantes de medicina y odontología en evaluaciones prácticas de la disciplina de Anatomía Humana. Métodos: En la investigación participaron 93 de los estudiantes, la mayoría mujeres (42 participantes), con una edad promedio de 20,33 años. Los participantes fueron evaluados 30 minutos antes del inicio de la prueba práctica, midiéndose la frecuencia cardíaca, la frecuencia respiratoria y la saturación de oxígeno. Se utilizó el Inventario de Síntomas de Estrés de Lipp para adultos para analizar el grado de estrés. Resultados: En cuanto a los signos clínicos evaluados, se encontró diferencia significativa en la presión sistólica media entre los grupos ( $p < 0.05$ ; mujeres: 117.76 ( $\pm$  11.82) mmhg versus hombres: 120.66 ( $\pm$  10.09) mmhg). En cuanto al Inventario de Síntomas de Estrés de Lipp para Adultos (ISSL), hubo diferencia estadística con respecto a los grupos en las tres fases ( $p < 0.05$ ) donde el grupo femenino mostró un mayor número de síntomas presentados. Conclusión: El estudio mostró niveles significativos de estrés en los estudiantes, también se evidenció un predominio en el sexo femenino que se presentó mayoritariamente en la fase de resistencia, con predominio de los síntomas en la esfera psicológica.

**Palabras clave:** Anatomía; Estrés psicológico; Signos y síntomas; Salud del estudiante.

### **1. Introduction**

Knowledge of human anatomy is essential in undergraduate courses of health sciences (Davis, Bates, Ellis, & Roberts, 2014; Houser & Kondrashov, 2018; Sbayeh et al., 2016). In most curricula worldwide, the discipline is taught early in order to prepare students for the clinical practice. In short, developing anatomical skills will enable an optimal approach to the human body during diagnostic and therapeutic performances (Gole, Meshram, & Hattangdi, 2015; Rokade & Shinde, 2020). Challenge, on the other hand, emerge because students in the

first and second years of undergraduate courses are not used with the terminology inherent to human anatomy. Additional difficulties include I) the minimum level of memorization required during the learning process, II) the exposure to cadavers during the teaching process, and III) the practical exams that readily test students' knowledge during the evaluation process. The combination of challenging events that move students out of their comfort zone lead to stressful experiences (Banyard & Cantor, 2004; Cabib, Campus, Conversi, Orsini, & Puglisi-Allegra, 2020).

From an educational perspective, stress could influence on students' performance. While well-succeeded exposure to controlled stimulus could promote a rich repertoire of adaptive coping responses (Cabib et al., 2020; dos Santos Boni et al., 2018), abrupt and uncontrolled stimuli could affecting cognitive and memory functioning. In this context, professors have a positive or negative impact on how students will cope (Chia, Oyeniran, Ajagbe, Onigbinde, & Oraebosi, 2020). Ideally, tutors should be able to identify signs and symptoms of stress in order to establish strategies to minimize negative effects. Predicting specific moments in which students would manifest stress in the academic routine, such as before exams, would allow a better understanding of their experience and would enable the identification, quantification and qualification of the signs and symptoms of stress.

This study aimed to assess the signs and symptoms of stress in medical and dental undergraduate students before practical exams in human anatomy.

## **2. Material and methods**

### ***Study design and ethical aspects***

An observational and quantitative (Pereira et al., 2018) study was designed. Reporting guidelines of the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) were followed (Von Elm, 2008). Ethical standards followed the Declaration of Helsinki, 2013. The study was approved by the institutional committee of ethics in human research (protocol: 66460917.3.0000.5374). Participants volunteered and manifested their consent through a signed informed consent form.

### ***Sampling and participants***

The inclusion criteria consisted of undergraduate students regularly enrolled in the

first year of medical and dental courses. The exclusion criteria were: students with previous knowledge of human anatomy, students that previously failed the discipline of human anatomy and students with history of psychological treatment with anxiolytic drugs. Based on the eligibility criteria, eighty students were sampled – 48 (51.6%) females and 45 males (48.4%) (mean age =  $20.33 \pm 3.55$  years).

### ***Data extraction and variables***

Two examiners performed the data extraction. Thirty minutes before the time scheduled for the practical exams, the participants answered a questionnaire designed to retrieve social, demographic, and academic information. Next, the participants were requested to sit (not crossed legs) and the blood rate was individually measured from the right arm. The arm was extended at chest level and the measurement was performed with the aid of a sphygmomanometer and a stethoscope. Systolic and diastolic rates were registered. In the same position, heart rate was assessed by counting the number of heart beatings over the course of one minute (bpm). Finally, oxygen saturation was assessed with the aid of a digital oximeter (Digimed™, São Paulo, SP, Brazil).

Lipp's Inventory of Stress Symptoms for Adults (LSSI) was used to verify if the students were manifesting symptoms of stress (Lipp 2000). The tool is specific for detecting stages of stress and the stress manifestation as physical or psychological symptoms. More specifically, LSSI has 34 items to investigate the manifestation of physical stress and 19 items for psychological stress. The answer to the items may allocate the participant within specific stages (phases) of stress, namely alarm, resistance and exhaustion. According to LSSI guidelines, it can be applied by professionals lacking experience with psychology unless the outcomes are interpreted by psychologists.

### ***Data analysis***

Data was analyzed with descriptive statistics of central tendency and dispersion. Students t-test and Wilcoxon-Mann-Whitney tests were used for inferential statistics, more specifically to test difference of means between and within females and males. Data analysis was performed with SPSS software (IBM Corp.™, Armonk, NY, USA) with significance level set at 5% and confidence interval of 95%.

### 3. Results

According to the academic answers given by the participants to the preliminary questionnaire, sixty-nine students (74.2%) were enrolled in the Medicine course, while the remaining (25.8%) were enrolled in the Dentistry course. Most of the students (n = 80, 86%) revealed that they like the discipline of Human Anatomy, but they feel unprepared (n = 50, 53.8%) and scared (n = 67, 72%) of practical exams. Nearly 80% of the students followed extra-class activities to have additional learning. Seventy-six percent of the students revealed that they prefer cadaver study compared to studying from artificial anatomic parts (Table 1).

**Table 1** – Social, demographic and academic characteristics of the sample

	n	%
Sex		
Female	48	51.6
Male	45	48.4
Mean age (years)		
Female	19.51	± 2.38*
Male	20	± 1.91*
Course		
Medicine	69	74.2
Dentistry	24	25.8
Do you like the discipline of human anatomy?		
Yes	80	86.0
No	13	14.0
Do you feel prepared for the exams?		
Yes	43	46.2
No	50	53.8
Did you take extra classes of human anatomy?		
Sim	75	80.6
Não	18	19.4
Are you insecure or afraid of the practical exams?		
Yes	67	72.0
No	26	28.0
Do you prefer practical exams with artificial body parts or cadavers?		
Artificial	19	20.4
Cadaver	74	79.6

n: absolute frequency; %: relative frequency; \*Standard deviation.

Source: Authors, study outcomes.

The analysis of signs of stress showed mean systolic blood rate of  $117.76 \pm 11.82$  mmHg in the total sample. In females, the mean rate decreased to  $114.58 \pm 7.13$  mmHg, while in males it increased to  $120.66 \pm 10.09$  mmHg in males. The difference between males and

females was statistically significant ( $p < 0.05$ ). The mean diastolic blood rate was  $73.48 \pm 6.33$  mmHg in the total sample. Analyses separately performed for females and males showed mean rates of  $73.75 \pm 6.39$  mmHg and  $74 \pm 6.53$  mmHg, respectively. The mean heart rate for the total sample was  $82.10 \pm 12.51$  bpm. For females and males the mean heart rates were  $84.41 \pm 11.24$  bpm and  $79.48 \pm 11.50$  bpm, respectively. The mean Oxygen saturation was  $95.62 \pm 2.99$  % combining females and males. The mean of Oxygen saturation for females was  $95.62 \pm 3.75$  % for females and  $95.53 \pm 4.3$  % for males (Table 2).

**Table 2** – Signs of stress assessed in the present study.

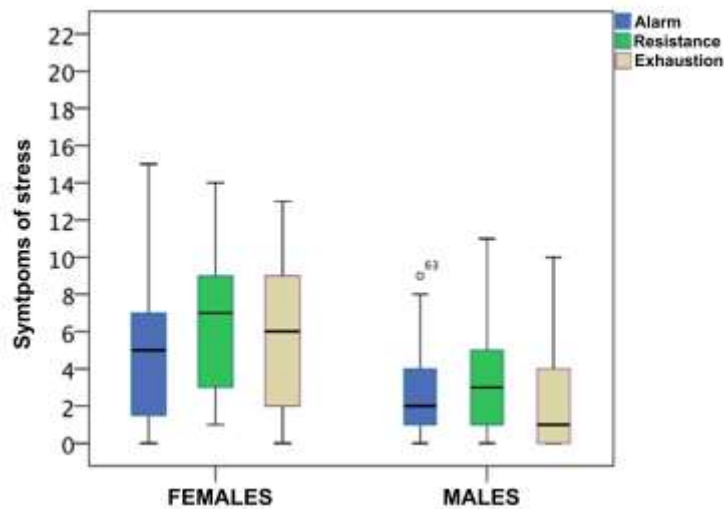
	Sex	Mean	SD	EP	F	Sig.
Systolic blood rate <sup>1</sup>	Female	114.58	7.13	1.02	11.382	.001
	Male	120.66	10.09	1.50		
Diastolic blood rate <sup>1</sup>	Female	73.75	6.39	.92	.035	.853
	Male	74.00	6.53	.97		
Heart rate <sup>2</sup>	Female	84.41	11.24	1.62	4.360	0.40
	Masculin o	79.48	11.50	1.71		
Oxygen saturation <sup>3</sup>	Female	95.62	3.75	.54	.012	.913
	Male	95.53	4.30	.64		

1: Blood rate expressed in mmHg; 2: Heart rate expressed in beating per minute (bpm); 3: Oxygen (O<sub>2</sub>) saturation expressed in percentage (%); SD: standard deviation; Sig.: significance rate considering the threshold of 0.05.

Source: Authors, study outcomes.

Data analysis of the outcomes of LSSI tool revealed statistically significant differences between males and females for the three stages of stress: alarm, resistance and exhaustion ( $p \pm 0.05$ ). Females presented more symptoms of stress compared to males. In the first phase (alarm), 35.5% of the female students and 6.6% of males presented seven or more symptoms of stress. In the second phase (resistance), 73.1% of the females and 31.2% of the males presented four or more symptoms. In the third phase (exhaustion), 41.7% of the females and 8.8% of the males presented nine or more symptoms (Figure 1).

**Figure 1** – Distribution of male and female students per stage of stress (alarm, resistance and exhaustion) according to LSSI tool.



Source: Authors, study outcomes.

#### 4. Discussion

The first year of undergraduate courses represent new social and academic experiences that may be stressful for young students (Bailey & Phillips, 2016). In the practice of health science courses, stress may have a negative impact on students' performances at academic level. Considering the hypothesis that students experience stress prior to practical exams of human anatomy, this study assessed the signs and symptoms of stress in undergraduate females and males properly enrolled in medical and dental courses.

Blood and heart rates and oxygen saturation were the signs of (response to) stress analyzed in this study. These are possibly the main biological expressions investigated in neurophysiological studies (Prokofieva, Kostromina, Polevaia, & Fenouillet, 2019). The present study found especial outcomes in the systolic blood rate and oxygen saturation – that were statistically significantly different between females and males. The clinical implication of these findings, however, might not be evident because the obtained outcomes fit within the interval of normality for healthy individuals.

The most pertinent outcome of this study was the combination of signs and symptoms of stress observed in medical and dental students before practical exams of human anatomy. These findings corroborate the existing scientific literature (Aramayo et al., 2005) by showing that students are susceptible to experiences that can influence their academic performance. A reasonable explanation for this phenomenon is the moment in life in which young students



start their academic training. In the early adulthood, undergraduate students experience a transition of lifestyle that require personal and social adaption (Furtado, Falcone and Clark, 2003). Despite the converging opinion of authors regarding the increase of stress prior to exams, the specific expression of stress between females and males is uncertain. Some authors detected more signs and symptoms of stress in males (Saxena, Shrivastava, & Singh, 2014), others found in females (Backović, Ilić Živojinović, Maksimović, & Maksimović, 2012), and some authors found no difference based on sex (Heinen, Bullinger, & Kocalevent, 2017).

In the present study, females were the students with the highest number of signs and symptoms of stress. In particular, most of the female students were allocated in the “resistance” stage of stress. This stage includes fatigue, attention and memory issues, insomnia, hypersensitivity and higher susceptibility to infectious disease (Lipp, 2000). The outcomes of LSSI tool confirmed the study of Collazo et al. (2005) that found 90% of the females with moderate and high levels of stress. The difference between studies, however, relies on the fact that Collazo’s research did not established the assessment of stress before exams. Possibly, the application of LSSI tool before exams would increase the authors’ rate of moderate and high level of stress in females. Interestingly, the authors found an existing high rate of stress in females without even exposing them to a clear stressful agent (i.e. practical exams). Aguilar et al. (2009) also found a higher prevalence of stress in females (66.7%) compared to males, and a predominance of females in the resistance stage. Although some level of stress might be positive in the learning process, severe stress may trigger negative effects on physical and mental health, such as lack of focus (Almojali, Almalki, Alothman, Masuadi, & Alaqeel, 2017).

When it comes to the answers given by the students to the learning process using cadaver models, most of the participants preferred cadaveric studies instead of artificial body parts (e.g. 3D printed). In the study of Bastos and Proença (2000), students that underwent human anatomy classes with cadaver models reported higher rates of disgust to visualizing cadavers and eating meat. Complaints of formaldehyde odor also built a barrier to the learning process. Chia et al. (2020), on the other hand, suggest that student progressively develop resilience to face cadaver learning – which gradually becomes an important educational tool. The rationale behind the preference of students for the cadaver models (observed in the present study), is illustrated by the study of Araújo Junior et al. (2014). The authors indicate that cadaver training might enable moral maturation and prepare the student to future humanitarian practice with patients.

The scientific literature on students' stress before exams is scarce. To the best of our knowledge, this is the first study established to assess students' signs and symptoms of stress induced by practical exams of human anatomy. This study contributes to the field dedicated to understand students' behavior and performance at academic level. More investigations are encouraged to design strategies that minimize potentially stressful situations and enable students to perform with their best. Examples of research include longitudinal analyses; signs and symptoms assessed in disciplines other than anatomy, and moments other than pre-exams; and students sampled from other undergraduation courses. More importantly, professors must balance situations that promote stress in order to maintain it at a level that benefits the student during the learning process.

## 5. Conclusion

Signs and symptoms compatible with stress were detected in medical and dental undergraduate students before practical exams of human anatomy. The evidences of stress were predominant in female students. Most of female students were allocated in the stage of resistance, which depicted mainly psychological effects of stress.

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