

Learning anatomy through dissection: emotional influence on the first-year medical student: a systematic review

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SUMMARY

The traditional study of anatomy is based on cadaveric dissection. However, in recent years new teaching methodologies have been introduced with the aim of increasing the ability of students to learn about the structures of the human body using computerized representations. Despite the increasing implementation of these new methodologies, universities around the world continue to base the practical teaching of anatomy on dissections. However, biomedical students begin to study dissections without having been exposed to a corpse previously, which poses a risk of generating stress. Using a systematic review process, we have observed that a large majority of students feel psychologically affected by this experience, leading to physiological consequences derived from anxiety and fear, although these decrease throughout the year due to a process of habituation. Therefore, it is necessary to reduce the amount of stress factors that can be found in

the anatomy laboratory to increase the transfer of knowledge between professor and student.

Key words: Medical students – Anatomy – Dissection – Emotions

INTRODUCTION

For several centuries, the practical learning of anatomy has depended primarily on the use of dissection techniques in human corpses, an educational method widely used in universities around the world (Getachew et al., 2014). For years, different educational methods have been compared with the intention of elucidating which ones optimize anatomy learning. Several approaches have been carried out, including the use of small groups of students or computerized representations of anatomy, and even the debate between dissection and prosection has been raised. Despite all this, anatomy still needs

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to be taught based on learning about the human body, this being fundamental for adequate professional development. Normally, anatomy teaching takes place during the first semesters of training of biomedical students, since it is a cornerstone for the subsequent development of more in-depth knowledge (Bernhardt et al., 2012).

However, there is one issue that may go unnoticed in our education system: how can we prepare young students of health science degrees to confront the study of anatomy using an anatomical subject? It should be noted that, at this early stage of their academic degree, most students have not had any prior contact with a corpse. The first exposure to a dead body can trigger various emotional reactions (Criado-Álvarez et al., 2017). In addition, stress is presented as a complex interaction between the student and his environment, generating around him events that can be positive, neutral, or negative. The most important manifestations of stress in the student are anxiety and depression, although the presence of low stress levels can lead to a lack of concentration and a decrease in motivation, and thus may influence their study habits and desire to work. It is important to note that stress has been shown to have a high impact in first-year students, who are focused on the exam stage due to a highly competitive environment and the absence of a well-defined study strategy. Conversely, students in higher clinical years show more concern for their professional future (Nechita et al., 2014).

The prosection of corpses is presented as an event that produces high levels of stress in students, generating physiological alterations such as palpitations, dizziness, or insomnia. Accordingly, generating a relaxed and favorable environment becomes essential to reduce the number of physiological alterations related to dissection in students (Anyanwu, 2015). Some studies have focused on trying to reduce the anxiety levels of students using different methods. One of them is based on an educational film about body donors; the students demonstrated increased levels of empathy and respect towards donors as a result, in addition to experiencing a reduction in anxiety levels, especially in those who were beginning to study anatomy (Iaconisi et al., 2019). Other stud-

ies have tried to improve anatomy learning using small tasks that students must perform in groups in each period, showing considerable acceptance by students, and improving the learning of the anatomical area being studied. This extra motivation could reduce stress in students (Kang et al., 2012). In addition to these techniques, some studies have focused on the use of background music in the dissection room to try to reduce the stress to which students are subjected when they are in front of the corpse, this methodology being capable of producing this fact and, in addition, increasing the grades obtained by the groups subjected to the experiment (Anyanwu, 2015; Bellier et al., 2020).

Considering this background, over the last few years there has been a lot of interest in studying the traumatic effects of dissection on students, in addition to the psychological implications that can undermine their education. A study conducted at Hawassa University on second- and third-year medical students found that approximately 20% and 30% of these students, respectively, had no symptoms when entering the dissection room. The most common symptoms observed in the rest of students were loss of appetite, dizziness, and nausea. Other less common symptoms included eye redness, shortness of breath, or skin irritations. The main cause of this symptomatology was the smell of the dissection room, followed by the feeling of touching the corpse and the fear triggered by being exposed to it (Getachew et al., 2014).

Our goal is to analyze the psychological and physiological impact of the educational method of human anatomy dissection in first-year medical students using a systematic review process.

MATERIALS AND METHODS

Study eligibility

The objective of this systematic review was to determine the psychological effects of exposure to cadavers on first-year medical students. For the implementation of this systematic review, we followed the guidelines of the *PRISMA (Preferred Reporting Items for Systematic reviews and Meta-Analyses)* declaration (Page et al., 2020).

Inclusion and exclusion criteria

Publications related to the psychological and physiological consequences of the use of anatomy teaching techniques in first-year medical students were included. Articles on repercussions caused by any educational method other than dissection were excluded. In addition, publications had to be focused on medical students. For this reason, publications focused on degrees other than Medicine (e.g., Dentistry, Occupational Therapy, Pharmacy, Physics, or Speech and Language Therapy) were excluded. Moreover, all publications that were not journal articles and outdated articles not available through database access were excluded. On the other hand, only articles published in English were included. There were no geographical restrictions.

Databases

The literature search was performed using various databases, including PubMed, SCOPUS, Web of Science (WOS) and ERIC, to locate education manuscripts. The keywords used in the search, which were adapted to each database, included “medical students”, “anatomy”, “dissection” and “emo-

tions”. Accordingly, the following search formula was used in PubMed: (“students, medical”[MeSH Terms] OR (“students”[Title/Abstract] AND “medical”[Title/Abstract]) OR “medical students”[Title/Abstract] OR (“medical”[Title/Abstract] AND “students”[Title/Abstract])) AND (“anatomy”[Title/Abstract] OR “anatomy”[MeSH Terms]) AND (“dissection”[MeSH Terms] OR “dissection”[Title/Abstract] OR “dissections”[Title/Abstract] AND (“emotions”[MeSH Terms] OR “emotions”[Title/Abstract] OR “emotion”[Title/Abstract] OR “emotional”[Title/Abstract])). The search formula used in SCOPUS was: (TITLE-ABS-KEY (medical AND students) AND TITLE-ABS-KEY (emotions) AND TITLE-ABS-KEY (anatomy) AND TITLE-ABS-KEY (dissection)). Furthermore, the formula used for WOS was: TS= anatomy AND TS= dissection AND TS=medical students AND TS=emotions. Finally, the search formula used in ERIC was: “anatomy AND dissection AND emotions AND medical students”. Bibliographic citations between 1990 and 2023 were included.

Study selection

Two of the authors (F.Q. and C.M.) carried out the literature research, the review of the abstracts

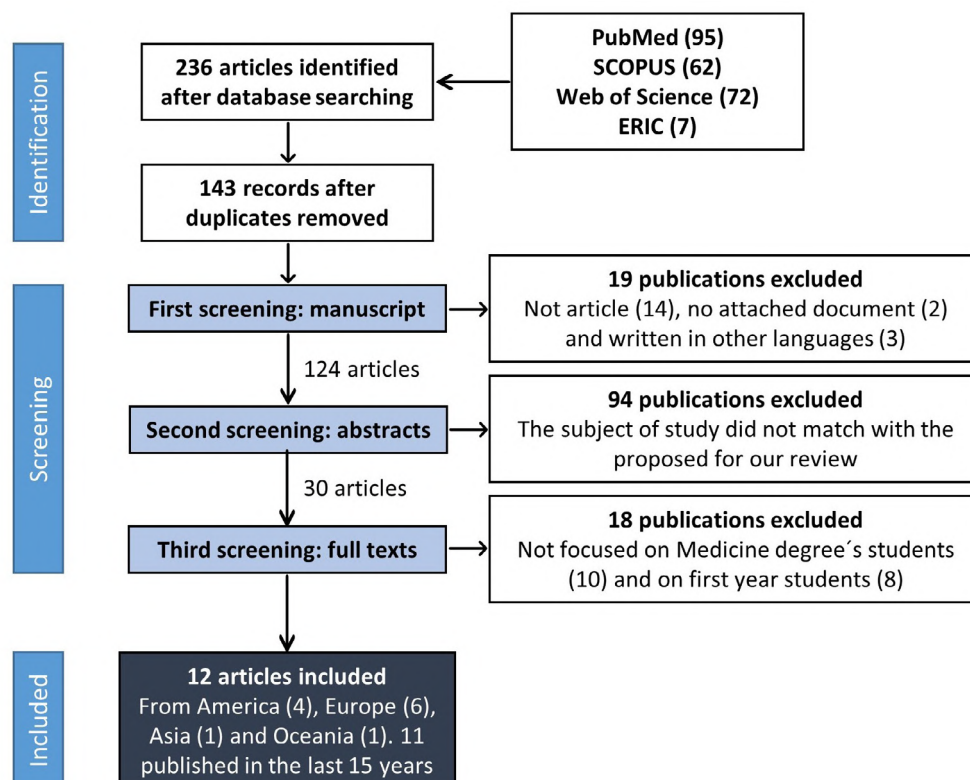


Fig. 1.- Flow diagram of the studies included in the review.

and the selection of the appropriate ones for full-text examination. After searching the databases described above, duplicated publications were eliminated. Following the application of the exclusion criteria, initial peer-reviewed screening was performed, considering the analysis of the publication title and summary. Finally, the screened articles were read in full, and those which met any exclusion criteria were discarded. In the event of a disparity between the two reviewers over inclusion, a third researcher was consulted to decide on its possible incorporation into the review.

The database search yielded 236 results, of which 93 were redundant, resulting in total of 143 articles being screened. Of these, 14 were excluded because they were not original research man-

uscripts, two because there was no attached document and 3 because they were written in other languages. In addition, 94 articles were excluded after reading the abstract, because they did not match the topic under study in our review. After full reading of the articles, 18 more were excluded (10 because they were not focused on medical students and 8 because they were not focused on first-year students). The final number of articles included in the review was 12 (Fig. 1).

RESULTS

Characteristics of the included studies

Studies carried out on Universities of Vermont, Minnesota, Oakland, Zulia (America), Castilla la

Table 1. Summary of features and results of articles included in the systematic review.

Reference	Year	University	Psychological and physiological consequences
Greene and Rosen	2020	Vermont University, USA	Nervousness, reflection on life, death, the donor and his family, concern for the body. They are altered by the smell of the dissection room.
Romo- Barrientos et al.	2019	University of Castilla la Mancha, Spain	Students show stress, anxiety, and fear. They are frightened by the observation of the corpse and report a strong smell in the practice room.
Chang et al.		Korea University, South Korea	Gratitude, intimate emotions after looking at corpses and respect for their altruism, responsibility, shock, apprehension, anxiety, and fear of death.
Wisenden et al.	2018	University of Minnesota, USA	Anxiety, mostly expressed in women compared to men.
Araujo-Cuauro		University of Zulia, Venezuela	Curiosity, fear, anguish, disgust, stress, sickness, and respect for the corpse. They manifest reactions of sweating, instability, tremor, paleness, and tachycardia.
Sandor et al.	2015	Universities of Bucharest, Debrecen, Pécs and Szeged, Hungary	Stress, post-practice thoughts about dead bodies, flashbacks, dreams about dead bodies, and fear of loneliness.
Hussein et al.		Oakland University	Sickness, fear, anxiety and depression, symptoms that decrease throughout the course.
Bob et al.	2014	Iuliu Hatieganu University, Romania	Fainting, dizziness, palpitations, tremors, sickness, sweating, loss of appetite, insomnia, recurrent images of corpses. They are altered by stimuli such as smell, vision and touch to corpses and are apprehensive.
Quince et al.	2011	University of Cambridge, United Kingdom	Apprehension, confusion, anxiety, sadness, enthusiasm, interest, and excitement. They get upset when they look at the corpse, coming to think of it afterwards.
Arráez-Aybar et al.	2008	Complutense University of Madrid, Spain	Curiosity, interest, anxiety, fear, pleasure, satisfaction, happiness, aversion, horror. Students develop arousal, nausea, palpitations, tremors, disturbed breathing, dry mouth, nausea, and dizziness.
Dempster et al.	2006	University of Northern Ireland, Ireland	Anxiety, sickness, appearance of nightmares, loss of appetite, increased thoughts about death and presence of recurrent images of corpses. Some students considered quitting the race.
Horne et al.	1990	University of Melbourne, Australia	Anxiety, dizziness depression, eye pain and sickness. In addition, the students reported a horrible smell of corpses.

Mancha, Complutense of Madrid, Iuliu Hatieganu, Cambridge, Northern Ireland, and several from Hungary (Europe), Korea (Asia) and Melbourne (Oceania) were included. Of the 12 articles selected, 11 had been published in the last 15 years, while the other one was published in 1990 (Table 1).

Psychological and physiological effects of the teaching of cadaveric dissection-based anatomy in first-year medical students

Initially, most students are emotionally prepared to attend the dissection room for the first time, a percentage that increases throughout the hands-on sessions. However, other studies reported that, although most students did not exhibit explicit “fear”, 1/3 stated that they felt “several degrees of fear”. In addition, half of the students had not witnessed any corpse before (Arráez-Aybar et al., 2008; David et al., 1990; Bob et al., 2014).

Studies indicated that, during the year, students’ emotions and negative responses to exposure to the corpse decreased, especially anxiety and fear (Arráez-Aybar et al., 2008; Romo-Barriendos et al., 2019; Chang et al., 2018; Horne et al., 1990; Hussein et al., 2015; Dempster et al., 2006; Wisenden et al., 2018) and its consequences (nausea and nervous arousal, palpitations, tremors, tachycardia, paleness, nightmares, sweats and even shortness of breath) (Arráez-Aybar et al., 2008; David et al., 1990; Chang et al., 2018; Dempster et al., 2006; Araujo-Cuauro, 2018). This mixture of sensations disappears as the course progresses because they

become accustomed to the dissection laboratory. However, certain negative emotions such as those derived from the smell of the dissection room increase throughout the year (Arráez-Aybar et al., 2008; Romo-Barriendos, et al., 2019; Araujo-Cuauro, 2018). In addition, several studies showed a decrease in positive emotions due to excessive workload and frequent examinations, difficulties in concentrating on the study, concerns about the future and financial problems, as well as personal problems such as partner relationships, family members and diseases (Sándor et al., 2015). Conversely, other studies found that these emotions remain unchanged or even increase (Chang et al., 2018; Greene and Rosen, 2021). Moreover, some authors observed that students express emotions of gratitude in relation to the donation process by appreciating the altruism of people and society (Chang et al., 2018) (Table 2).

Students also develop a perception of curiosity about dissection which remains invariable during the year. By the end of the year, almost all students indicated that they would “relive the experience”, and that dissection-based teaching helped them reinforce the knowledge imparted in the theoretical classes. Students showed high satisfaction rates with practices, which remain unchanged throughout the year. However, a high percentage of students reflected on death after the first few months of internships due to their experience (Romo-Barriendos et al., 2019; Hussein et al., 2015). Upon completion of the anatomy course, students reported having a better understanding of anat-

Table 2. Consequences detected in the first expositions to the corpse in medical students.

Consequences	Number of studies (percentage)
Anxiety	8/12 (66%)
Sickness	6/12 (50%)
Fear	5/12 (42%)
Curiosity	4/12 (33%)
Concern for the body	4/12 (33%)
Reflection on life	4/12 (33%)
Stress	3/12 (25%)
Depression or sadness	3/12 (25%)
Respect for the corpse	2/12 (17%)
Nervousness	1/12 (8,5%)

omy, improved the development of psychomotor skills for clinical work, and were encouraged to further appreciate the human body and the spirit of organ donation (Hussein et al., 2015).

Students generally described the experience in the anatomy room as interesting, informative, challenging, exciting, enjoyable, and stimulating (Arráez-Aybar et al., 2008; Hussein et al., 2015) with the vast majority agreeing that cadaveric dissection is indispensable for the learning of anatomy (Bob et al, 2014; Araujo-Cuauro, 2018; Quince et al., 2011).

Modification of student behavior by prior exposure to the dissection laboratory

Prior exposure (PE) to laboratory practices by students did not increase positive responses. However, differences in negative emotions were found; these were significantly higher in students who had not previously been exposed to the laboratory (NE). During the year, NE students showed an increase in positive responses, while these did not vary significantly in PE pupils. Meanwhile, negative emotions decreased over time in NE students, but did not vary in PE students. At the end of the year, both groups expressed similar emotions in relation to the dissection process (Greene and Rosen, 2021).

DISCUSSION

The well-being of the student in his environment is essential for the correct process of education. Thus, it has been shown that the motivation of anatomy students is essential for optimizing the learning process (Abdel-Meguid and Khalil, 2017). The first contact with the corpse in the anatomical field can be frustrating for students who have just started their medical training. As shown in our review, lack of prior contact with a corpse leads to stress and fear in medical students through different mechanisms. The most frequent feelings described by students in these studies are anxiety (in 66% of the studies), sickness (50%) and fear (42%). One of the most interesting aspects is that, throughout the practical sessions in the anatomy laboratory, the students adapt, and their negative physiological and psychological feelings decrease, a factor that contributes to their learning.

Although this learning curve is difficult for new students, most studies conclude that, by the end of the year, they enjoy the experience of learning about the body and that this type of education reinforces their theoretical knowledge on anatomy. Therefore, the experience of the anatomy student is positive after this training, endorsing its educational value. In addition, students who have previously been exposed to a dissection laboratory experience show fewer negative responses, which indicates that adaptation to these conditions reduces the stress caused by dissection and improves their learning experience. These results support those observed in other studies, in which implementation of training through prosection improves the theoretical and practical knowledge of students (Thompson et al., 2020).

The low number of articles obtained in our search may indicate that few anatomy professors have been interested in the consequences of exposure to a corpse for the first time in the novice student. However, the fact that most of the articles retrieved date from the last 15 years reveals an increasing interest in this topic. Therefore, it is essential to investigate new anatomy teaching methodologies capable of improving the environment in the dissection room, reducing the stress produced in the student, and increasing the knowledge acquired during the learning process. In our opinion, keeping dissection as a practical teaching method for human anatomy allows medical students to learn the structures in a real body, which makes it invaluable from an educational point of view.

CONCLUSION

Although students may think that they are prepared for dissection practices before they begin, exposure to corpses may affect them both psychologically and physiologically. Common symptoms during first exposures to a corpse include anxiety and fear reactions such as sweat, the presence of fainting or nausea, among others. However, habituation causes these reactions to decline over time, and reduces the percentage of students who show them at the end of the course. We stress the need for a greater number of studies in this field, since the physical and mental well-being of the student

is essential to allow for an optimal transfer of knowledge between the teacher and the trainee.

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