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THE USE OF CADAVERS IN HUMAN ANATOMY CLASSES. TRADITIONAL METHOD, OUTDATED OR INDISPENSABLE?

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Abstract

Introduction: It is known that practical classes with a corpse awaken different feelings among students and it is common to observe behaviors of fear, disgust at the touch, anxiety, euphoria and/or deep respect. Records of corpse manipulations predate the sec. III a. Even so old, the dissected human body is still the most extraordinary, most complete and most complex resource among the tools currently used in teaching anatomy. Despite this, the use of cadavers in practical classes has been gradually replaced by other resources such as artificial models, even in medical graduation courses, raising discussions and calling into question the quality of training for new professionals. Objective: to analyze differences in the perception and quality of use of human anatomy content by students with and without the use of human cadavers in medical curricula. Methods: This study is a descriptive research, of the Integrative Literature Review (RIL) type. The search resulted in 21 articles, of which 10 articles form the corpus of this review. Results and Conclusion: Like a tree that bears sweet fruit, human dissection is always being stoned even by those who delight in its knowledge and secrets. Its importance surpassed fear, taboos, superstitions, dogmas, laws and time. It is indeed the basis of anatomical knowledge, resisting all adversities over time and remaining as the foundation of the training of health professionals from the most different segments.

Keywords: Anatomy. Human dissection. Medical education.

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1 Introduction

Although there are records of anatomical practices for mummification in Egypt that predate 3,000 years BC, human dissection for formal education purposes only began with Herophilus of Chalcedon (335 to 280 BC), who described the pattern of distribution, shape and the size of human organs (PONTINHA, SOEIRO, 2014; ALVES, TUBIMO, 2017). Previously, dissection was only allowed on animal bodies. Not even Hippocrates (460 to 375 BC), father of medicine, or Aristotle (384 to 322 BC), who coined the term "Anatomy", has a record of human dissection.

This delay in the use of human cadavers hampered the advancement of medicine for many centuries by not allowing a concrete experience with relatively simple particularities of body structures such as size and weight of organs; path, shape and number of vessels and nerves; etc. The ban on human dissections was based on superstitions, beliefs, religious issues and intolerances of all orders (ALVES, TUBIMO, 2017).

Although there are records of manipulation of corpses that predate the sec. III a.C., such behaviors were seen as profanations and their acts were punishable. For the Jews, simply touching the corpse was something that should be avoided as it left the person unclean for seven days (Holy Bible - Numbers 19:11 / 19:16) even if the corpse belonged to someone in your family like your father or his mother (HOLY BIBLE - Leviticus 21:11).
Although human dissection is an ancient method, the dissected human body is still the most extraordinary resource and the most complete and complex material among the tools currently used in teaching anatomy. No other resource is capable, so far, of accurately demonstrating texture, coloring, much less the variations found in different body structures.

However, the use of cadavers in practical human anatomy classes has been gradually replaced by other resources such as artificial models. Dissections have long been popular even in undergraduate medical courses, raising discussions and sometimes questioning the quality of training of new professionals (TUBBS et al., 2014; ALI et al., 2015; CRAIG et al., 2010; HERLE, SAXENA, 2011; FAREY et al., 2014; EPPLER et. al., 2018).

It is known that practical classes with a corpse arouse different feelings among students because for many it is the first time they have come across and touched a human corpse. In the first contacts with the corpse, it is common to observe behaviors of fear, disgust at the touch, anxiety, euphoria and/or deep respect (CHIOU, et. al., 2017).

In the beginning, this universe of feelings often interferes with concentration and reduces the quality of learning. Later, with the routine of laboratory studies, the cadaver is seen by many as trivial and some students begin to define practical anatomy classes as monotonous, mechanical and tiring (HOPKINS et al., 2011; SINGH et. al., 2019; BIGGS, 2003).

This adverse feeling towards the cadaver, added to maintenance costs, lack of anatomists and pressures to adopt more modern models of education, has been replacing the cadaver by other learning resources all over the world. In Brazil, in addition to the difficulties already mentioned, the small number of body donations added to the increase in demand with the growth in the number of medical schools in recent years, increased the need for alternative tools in the teaching of human anatomy, since the availability of bodies is much smaller than the demand (COSTA, FEIJÓS. 2009).

The objective of this study was to analyze, through a literature review, the differences in the perception and quality of use of human anatomy content by students with and without the use of human cadavers in the medical curricula.

2 Methodology

In the construction of this study, a descriptive research was carried out, of the Integrative Literature Review (RIL) type, where the essential steps for its development were fulfilled: identification of the theme and selection of the research question; establishment of eligibility criteria; identification of studies in scientific bases; evaluation of selected studies and critical analysis; categorization of studies; evaluation and interpretation of results; and presentation of data in the framework of the integrative review (WHO, 2020).

Considering the methodological rigor for review studies in line with Evidence-Based Practice (EBP), which provides for the identification of evidence contained in investigations carried out and that can be inserted in the practice in question, the use of the PICO strategy is recommended (BERNARDO et al., 2004; WHITTEMORE, 2005), which represents an acronym - Patient or Problem, Intervention, Comparison and Outcomes (outcome), which will make it possible to elaborate the research question and search strategies.

In this context, this integrative review began with the elaboration of the guiding question based on the acronym P (teaching of human anatomy), I (new methodologies), C (different methodologies applied) and O (effectiveness in learning regarding the relationship cost-benefit): what is the scientific evidence on the effectiveness of using a certain teaching-learning process methodology and its practical application, available online, in newspapers with national and international circulation, published between 2010 and 2020.

To compose the research corpus, articles were searched on the internet between the months of August and September 2022. The search in the literature of the primary studies was carried out, via the internet, in the following databases: PubMed, Cumulative Index to Nursing and Allied Health Literature (CINAHL) and Web of Science. To ensure a wide and thorough search, the keywords and descriptors were delimited in the Thesaurus according to the Medical Subject Headings (MeSH) database, as well as the guiding question raised. The Boolean operators AND and OR were used. For search refinement, the qualifier classification (/CL) was used for the descriptor "Anatomy" and the symbol * to truncate the descriptor "Anatomy" and the keywords "Problem-Based Anatomy"*; "Education Medical"; "human corpse", as shown in the table below (Table 1). In order to avoid bias in the search and selection of articles, two researchers acted independently.

To select the sample, the following inclusion criteria were used: primary source articles, indexed in the databases selected for the study, published from September 2010 to August 2020, which addressed the theme in Portuguese, English or Spanish and available in full. The exclusion criteria were: being a review article and not having the keywords in the title or abstract of the selected articles. It is noteworthy that duplicate studies were considered only once.

3 Results and Discussion

The search resulted in 31 articles, of which 2 were excluded due to duplicity within and between the CINAHL, PubMed, Web of Science databases and 10 for not having the descriptors in the title or abstract. After reading the full text of 19 articles, 9 were excluded because they did not fit the objectives proposed in this integrative review. Thus, the corpus of this review consisted of 10 articles, whose potential content was dedicated to investigating the use of new teaching models of human anatomy as alternatives to traditional teaching in the academic training of professionals in the biological and health areas. The search process followed the Preferred Reporting Items for Systematic Reviews and Meta-Analysis (PRISMA) recommendations.

In a study where the effects of a traditional anatomy laboratory were compared with a modern learning system based on a virtual multimedia simulator, the researchers observed different results with a significant disadvantage in the use of the model. The researchers suggested that the results derive from the students' difficulty in transferring the knowledge acquired through a learning model to another, that is, to transfer their knowledge from digital images to real human cadavers (SALTARELLI et. al., 2014; PETERSON; MLYNARCZYK, 2016).

In 2018, at the University of Oxford, a symposium under the title "Do we really need more cadavers to learn anatomy in undergraduate medical courses?" two teams of specialists, one opposed to its use and the other in favor of it, discussed the importance or not of using cadavers in teaching anatomy. The opposing team defended the use of resources such as portable ultrasound, body painting and physical examination in pairs. However, in postgraduate surgery classes, they suggested the use of dissection (MCMENAMIN et.al., 2018), making it clear that even for those who resist the use of the cadaver, the value of this tool for the formation of a body is still recognized. health professionals in more advanced courses that require more accurate knowledge. In a study carried out with more than 500 students from different health courses at the Federal University of Pernambuco – Brazil, almost 90% of the students stated that the use of cadavers in practical anatomy classes was essential, even though they also used other didactic resources.

When asked if the corpse should be used only for research purposes, more than 95% of the students disagreed and reaffirmed the importance of the human corpse for teaching purposes. In addition, 90% of students disagreed with replacing the corpse with some technological tool and 98% disagreed with replacing the corpse with carcasses of other animals in anatomy courses (COSTA, LINS, 2012).

In a study in Australia, Eppler et. al., (2018) analyzed the performance of two groups of undergraduate medical students, where one group voluntarily participated in a dissection program and the other did not. The results showed that students who desiccated performed significantly better both in the integrated system (anatomy, biochemistry, physiology) seen in the 1st year of the course, and in the normal system (systemic anatomy) seen in the 2nd year of the course. The authors, however, suggest caution in approaching these results, inferring that perhaps the group that participated in the voluntary dissection program would have greater affinity and pleasure with the contents of anatomy, which could influence the final results.

Data base	search strategy	Publications identified
Web of Science	*Anatomy * AND* (*dissection **) *AND* (*Education, Medical*) AND (*human corpse*) [*keyword and MeSH*]	14
CINAHL	*Anatomy* (*dissection **) *AND* (*Education, Medical*) AND (*human corpse*) [*keyword and MeSH*]	9
PubMed	*Anatomy /CL* (*dissection **) *AND* (*Education, Medical*) AND (*human corpse*) [*keyword and MeSH*]	17

Table 1 - Search strategies in the Web of Science, CINAHL and PubMed databases

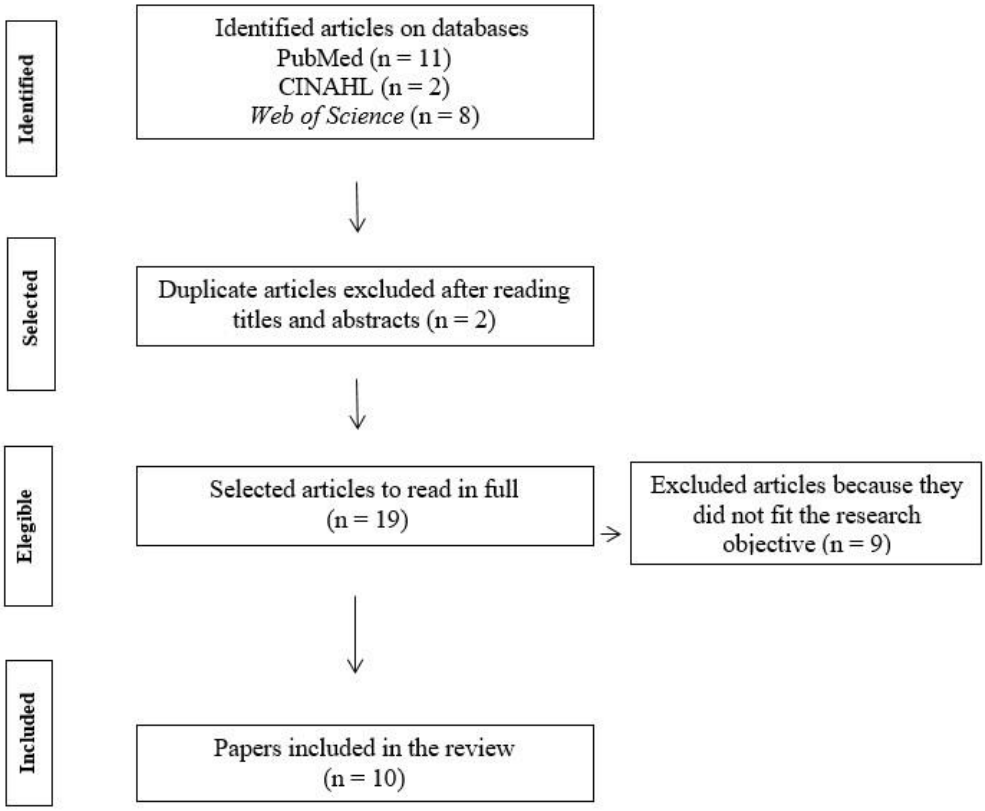

Figure 1 - Article search and selection flowchart adapted from PRISMA

Similar results were found by Rae et. al (2016), who compared short-term and long-term effects on neuroanatomy knowledge retention between two groups of medical students where one group used a brain dissection protocol and the other did not.

Wright (2012), when analyzing a teaching program that used only anatomical models and anatomy software, although he reported a good level of learning and a percentage of approval above 90% in the student's perception, pointed out as a disadvantage in the use of such features the relatively small number of structures that can be visualized when compared to structures present in a cadaver, low accuracy on the surfaces of structures and lack of a minimum sample of anatomical variations. However, the author considers that these shortcomings, or simplicity in the presentation of structures, can help students to understand anatomy content.

Dissection, or at least the use of an already dissected cadaver, should not be thought of only for the study of pure human anatomy. Learning the body with bodies is the cornerstone of preclinical education, advanced clinical training, and scientific progress in medicine.

For the study of injuries caused by pathology commonly found in cadavers, Geldenhuys et. al., (2016) used human dissection in a medical class to observe and analyze the pattern of lesions diagnosed and routinely treated in the clinic.

The incorporation of the cadaver for use in content addressed in other disciplines, such as physiology, pathology, surgery, semiology, evolution, etc., tends to enrich the content of these sciences by placing them in a practical, everyday context and thus, more relevant and coherent, in addition to providing the student with a more holistic view of biological processes and their illnesses.

If the use of cadavers seems to be beneficial for everyone involved in the medical training process, why does its use face so much resistance? Among the points listed to justify the replacement of the corpse by other didactic resources, there are the number of body donations insufficient to meet the demand of health courses; the costs for the preparation and maintenance of the cadaveric collection; the annoyance of the strong odor and irritability of the mucous membranes by formaldehyde; the emotional stress caused in some students by the presence and direct contact with the corpse; and the construction of some form of dehumanization on the part of students when faced with the figure of death and suffering of an unknown individual.

In a slightly more accurate analysis of these negative points, it is noted that their practical effects are not very significant or even falsely real. The use of cadavers only as research material is almost utopian since the research would require a statistically significant number of new cadavers and a continuous flow for evaluations, especially when dealing with analysis of clinical patterns or anatomical variations.

Furthermore, after the end of the study, the cadaver or the specific structure worked on could no longer be useful for another study and would become unusable. With the great demand for human corpses by health faculties, and with the number of donations well below the necessary, the new research would probably stimulate the clandestine acquisition of anatomical pieces. As a resource in the three pillars of education, teaching, research and extension, the cadaver can be used for more than a decade, offering knowledge, an abundant source of questions, discussions, curiosity and attraction of an audience eager for the unknown or for the desire to work in the field. health field.

The strong smell of formaldehyde, the fixative substance most used as a preservative in human corpses, is striking and uncomfortable for everyone who enters the anatomy laboratory for the first time. For most students, this discomfort disappears after a short period of time, but for a few, this feeling persists and is pointed out by some education professionals as an insurmountable barrier to learning and suggests the use of other teaching materials or pedagogical tools. to replace the human corpse.

Pointing out the physical discomfort caused by formaldehyde as a negative point for learning is to disqualify the Personal Protective Equipment (PPE) required in the laboratory environment. The dissection or at least the manipulation of cadaveric parts allows a complete anatomical knowledge and probably influences surgical skills (ANSCHUETZ et al., 2018).

Another questionable point refers to the repulsion of some students to visualize and manipulate bodies. Chiou, et. al., (2017), observed that initiation activities such as ceremonies of respect and homage to the corpse, debates and conversations about the relationship between life and death before the formal start of practical classes, decrease students' tension, reduce negative sensations and images. in relation to the corpse and death itself. They also found that these activities increase the degree of responsibility with the course, in addition to contributing to the learning process, promoting and strengthening the bonds of respect for others and solidarity, which are so important in the training of health professionals.

In one study, 186 medical students at Otto-von-Guericke-University Magdeburg, Germany, were assessed for emotional stress prior to first contact with a cadaver. It was found that 50% of the students had some degree of anxiety before the first contact with the corpse, with 12% presenting a high level. As for the dissection of individual regions of the body, lower levels of anxiety were observed for limbs and internal organs and greater anxiety for the head, neck and genitals regions. After the anatomy course, 90% of the participating students said they were in favor of offering the human anatomy discipline at the beginning of the course (BERNHARDT et. al., 2012).

In Brazil, almost all health courses, including medicine, do not offer the dissection of human cadavers in their curricula. In general, students work with pieces already prepared for practical classes. Generally these pieces are organized by systems and more commonly by topographical regions. Thus, stress levels are probably even lower than those presented by Bernhardt et. al., (2012) since it works initially with individualized systems (systemic anatomy) starting with the bone system.

Entire regions are covered only in the final two-thirds of anatomy, or more commonly, in a second discipline, topographic anatomy, and for a few health courses such as medicine, dentistry, and physiotherapy.

Although the cadaver is used daily in the laboratory and is almost always seen by many as a simple piece of study, ethically the cadaver is worthy of respect and always deserves to be remembered as someone who was born, grew up, lived through good and bad experiences and established affective bonds with others. (COHEN, GOBBETTI, 2003; COSTA, LINS, 2012). Thus, the use of the cadaver must always be based on ethical standards and legal restrictions.

The view of the cadaver as an object by the health student can be explained by the interest in focusing their studies only on obtaining practical skills that will be useful in their professional life (CHIOU, et. al., 2017), attributing to the unknown cadaver only the part figure or study tool.

Ethical precepts must always be very clear to everyone involved in the process of using the cadaver and must also be used to encourage in students and future professionals a feeling of empathy, respect and care for others, starting with those who do not he doesn't even know the name or the origin. Thus, the use of the cadaver in practical anatomy classes is useful in discussions about the meaning of life and death and our role in this process as human beings who seek to harmonize the individual with the environment in which they live, in order to promote physical and mental health in its primary approach.

The contact and management of the lifeless body of a stranger makes us think about our own body, our life habits, our family members and other people we live with. This reflection, especially if guided by a psychologist or other qualified professional, can awaken more human behaviors, of generosity, respect and compassion for others, even if they are strangers.

A study that analyzed the effectiveness of dissection in students' knowledge gain did not show significant short-term differences between students who dissected and those who did not. According to their analyses, there are no immediate benefits in implementing dissection in relation to other modalities.

However, these authors found that students prefer to work with dissection and that this resource is linked to the students' greater level of confidence in clinical environments and raises a question, which pedagogical resource maximizes the confidence of future professionals and their ability to solve problems. clinical problems? The authors also suggest that the dissection activity may be linked to the ability to unconsciously convey dispositions typical of the daily life of health professionals, such as teamwork and surgical skills (ADAM et. al., 2018).

In a three-year prospective study, between 2012 and 2015, researchers from Lisbon found that students who participated in optional dissection courses had higher final scores and lower rates than those who did not participate in the courses. Such results were attributed to increased motivation to study anatomy among students who dissected. Additionally, students who dissected showed better three-dimensional orientation, dexterity, and teamwork skills (PAIS et. al., 2017).

Dissection can be seen as an expensive resource because it requires a large number of cadavers to be available, usually one cadaver for every 10 students, which demands time and money for the acquisition, transport, preparation of the material and the room, disposal of the material and cadaver maintenance after dissection. However, the corpse, in addition to being a didactic resource, also exerts a strong power of attraction and curiosity on the part of students. Fairs and extension projects that exhibit cadaveric pieces tend to attract a large public that is often naturally and passively persuaded to enroll in health courses.

This spontaneous persuasion tool, along with other available tools such as clinical images (radiographs, CT scans, ultrasound, tomography, etc.), 3D images, body painting, digital platforms, etc., can be used by educational institutions as a differential, improving its methodology and enhancing its commercial marketing.

This set of features is likely to help you grow your clientele by reducing the cost of maintaining your holdings. This technique, however, must comply with and guarantee the application of all ethical precepts and values of life.

Virtual resources certainly have their importance and should be seen as tools that will be part of everyday life for all individuals in this century, with no chance of return and always in the certainty of new technological advances. However, the cadaver not only offers a perfect anatomical reality, with its patterns, variations, malformations and mechanical, accidental or pathological wear and tear, but it also offers a real and complex experience.

4 Conclusions

Dissection is indeed the basis of anatomical knowledge, withstanding all adversities over time and remaining as the foundation of the training of health professionals from the most different segments. His importance has overcome fear, taboos, superstitions, dogmas, laws and time, remaining as a silent master who only has to add to us when the subject refers to the morphological complexity of the human organism. Like a tree that bears sweet fruit, it is always being stoned even by those who delight in its knowledge and secrets. Therefore, it is always necessary to defend what is most precious as a tool for the study of human anatomy, the eternal Corpse.

CREDIT AUTHORSHIP CONTRIBUTION STATEMENT

MAJC and SEJC conceived the idea for this review. FESS and CMAFM designed the review protocol, and AOO, MAJC, and SEJC conducted the search, all authors read and screened citations, abstracts, and full texts. MAJC, performed the data extraction, as well as the consultation with CMAFM, conducted the data analysis. SEJC, FESS and GDF contributed substantially to the final construction of the review, MAJC and GDF prepared the manuscript. All authors reviewed and provided their feedback and approved the manuscript in its final version.

DECLARATION OF INTEREST

The authors have no conflicts of interest.

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REFERENCES

ADAM, B., WILSON, A. B., MILLER, C. H., KLEIN, B. A., MELISSA A., TAYLOR, M. A., GOODWIN, M., BOYLE, E. K., BROWN, K., HOPPE, C., MICHELLE LAZARUS, M. A. Meta-Analysis of Anatomy Laboratory Pedagogies. **Clinical Anatomy** 31:122–133. 2018. Available from: https://doi.org/10.1002/ca.22934

ALI, A., KHAN, Z., KONCZALIK, W., COUGHLIN, P., & EL SAYED, S. The perception of anatomy teaching among UK medical students. **The Bulletin of the Royal College of Surgeons of England**, 97(9). 2015. Available from: https://doi.org/10.1308/rcsbull.2015.397.

ALVES, E. M. O., TUBINO, P. Proibição das dissecções anatômicas: Fato ou mito? **Jornal Brasileiro de História da Medicina**. 2017. ISSN 1516-0386. Access on: https://issuu.com/jornalbrasileirodehistoriadamedicin/docs/jbhmedicina-1.

ANSCHUETZ, L., PRESUTTI, L., MARCHIONI, D., BONALI, M., WIMMER, W., VILLARI, D., CAVERSACCIO, M. Discovering middle ear anatomy by transcanal endoscopic ear surgery: A dissection manual. **Journal of Visualized Experiments**, (131). 2018. Available from: https://doi.org/10.3791/56390.

BERNARDO, W. M., NOBRE, M. R., JATENE, F. B. Evidence-based clinical practice. Part II—Searching evidence databases. **Revista da Associação Médica Brasileira**. 2004. ISSN: 0104-4230. Access on: https://www.scielo.br/j/rbr/a/p3kYDSB6g3xW8jVYTdG9CQP/?format=pdf&lang=pt.

BERNHARDT, V., ROTHKÖTTER H. J., KASTEN, E. Psychological stress in first year medical students in response to the dissection of a human corpse. **GMS Zeitschrift fur medizinische Ausbildung**. 29 (1). 2012. Available from: https://doi.org/ 10.3205/zma000782.

BÍBLIA SAGRADA. Levítico 21:11. Português. In**: A Bíblia sagrada**: antigo e novo testamento. Tradução de João Ferreira de Almeida. Brasília: Nostrum Editora, 2014. p. 3424p.

BÍBLIA SAGRADA. Números 19:11 / 19:16. Português. In: **A Bíblia sagrada**: antigo e novo testamento. Tradução de João Ferreira de Almeida. Brasília: Nostrum Editora, 2014. p. 3424p.

BIGGS J. Constructing learning by aligning teaching: constructive alignment. Teaching for quality learning at university: what the student does. Buckingham. **SRHE and open University Press**. 2 ed. 2003. Access on: https://www.tru.ca/__shared/assets/Constructive_Alignment36087.pdf.

CHIOU, R. J., TSAI, P. F., & HAN, D. Y. Effects of a "silent mentor" initiation ceremony and dissection on medical students' humanity and learning. **BMC Research Notes**, 10(1). 2017. Available from: https://doi.org/10.1186/s13104-017-2809-0.

COHEN C, GOBBETTI, G. Bioética e morte: respeito aos cadáveres. **Revista da Associação Médica Brasileira**. 49(2). 2003. Access on: https://www.scielo.br/j/ramb/a/PC9dwGggBsbgKqqLCCxpJ5b/?format=pdf&lang=pt.

COSTA L. F., FEIJÓS, A. G. S. Doação de corpos: estudo comparativo luso-brasileiro sobre a utilização do corpo humano para ensino e pesquisa. **Anais do 5º Salão de Iniciação Científica**; 2009. Porto Alegre: EDIPUCRS. ISSN 1983-7011. Access on: https://periodicos.uff.br/ensinosaudeambiente/article/download/44296/28386/166960.

COSTA, G. B. F., COSTA, G. B. F., LINS, C. C. S. A. O cadáver no ensino da anatomia humana: uma visão metodológica e bioética**. Revista Brasileira de Educação Médica**, 36(3). 2012. Available from: https://doi.org/10.1590/s0100-55022012000500011.

CRAIG, S., TAIT, N., BOERS, D., MCANDREW, D. Review of anatomy education in Australian and New Zealand medical schools. **ANZ Journal of Surgery**, 80(4). 2010. Available from: https://doi.org/10.1111/j.1445-2197.2010.05241.x.

EPPLER, E., SEROWY, S., LINK, K., & FILGUEIRA, L. Experience from an optional dissection course in a clinically-orientated concept to complement system-based anatomy in a reformed curriculum. **Anatomical Sciences Education**, 11(1). 2018. Available from: https://doi.org/10.1002/ase.1707.

FAREY, J. E., SANDEFORD, J. C., & EVANS-MCKENDRY, G. D. Medical students call for national standards in anatomical education. **ANZ Journal of Surgery**, 84(11). 2014. Available from: https://doi.org/10.1111/ans.12557.

GELDENHUYS, E. M., BURGER, E. H., VAN HELDEN, P. D., MOLE C. G., KOTZ S. H. Optimizing the Use of Cadavers by Integrating Pathology During Anatomy Dissection. **Anatomical Sciences Education**. 2016. Access on: https://doi.org/10.1002/ase.1617.

HERLE, P., SAXENA, A. Contemporary teaching of anatomy in Australian medical schools. Are we doing enough? **ANZ Journal of Surgery**. 81:662 - 663. 2011. Available from: https://doi.org/10.1111/j.1445-2197.2011.05849.x.

HOPKINS, R., REGEHR, G., & WILSON, T. D. Exploring the changing learning environment of the gross anatomy lab. **Academic Medicine**, 86(7). 2011. Available from: https://doi.org/10.1097/ACM.0b013e31821de30f.

MCMENAMIN, P. G., MCLACHLAN, J., WILSON, A., MCBRIDE, J. M., PICKERING, J., EVANS, D. J. R., WINKELMANN, A. Do we really need cadavers anymore to learn anatomy in undergraduate medicine? **Medical Teacher**, 40(10). 2018. Available from: https://doi.org/10.1080/0142159X.2018.1485884.

MOHER, D., LIBERATI, A., TETZLAFF, J., ALTMAN, D. G., ALTMAN, D., ANTES, G., ATKINS, D., BARBOUR, V., BARROWMAN, N., BERLIN, J. A., CLARK, J., CLARKE, M., COOK, D., D'AMICO, R., DEEKS, J. J., DEVEREAUX, P. J., DICKERSIN, K., EGGER, M., ERNST, E., TUGWELL, P. Preferred reporting items for systematic reviews and meta-analyses: The PRISMA statement. In **PLoS Medicine** (Vol. 6, Issue 7). 2009. Available from: https://doi.org/10.1371/journal.pmed.1000097.

PAIS, D., CASAL, D., MASCARENHAS-LEMOS, L., BARATA, P., MOXHAM, B. J., GOYRI-O'NEILL, J. Outcomes and satisfaction of two optional cadaveric dissection courses: A 3-year prospective study. **Anatomical Sciences Education**, 10(2). 2017. Available from: https://doi.org/10.1002/ase.1638.

PETERSON, D. C., MLYNARCZYK, G. S. A. Analysis of Traditional Versus Three-Dimensional Augmented Curriculum on Anatomical Learning Outcome Measures. **Anatomical Sciences Education**. 9:529 – 536. 2016. Available from: https://doi.org/10.1002/ase.1612.

PONTINHA, C. M., SOEIRO, C. A dissecação como ferramenta pedagógica no ensino da anatomia em Portugal. **Interface: Communication, Health, Education**, 18(48). 2014. Available from: https://doi.org/10.1590/1807-57622013.0558

RAE, G., CORK, R. J., KARPINSKI, A. C., SWARTZ, W. J. The Integration of Brain Dissection Within the Medical Neuroscience Laboratory Enhances Learning. **Anatomical Sciences Education**. 9:565–574. 2016. Available from: https://doi.org/10.1002/ase.1611.

SALTARELLI, A. J., ROSETH, C. J., SALTARELLI, W. A. Human cadavers Vs. multimedia simulation: A study of student learning in anatomy. **Anatomical Sciences Education**, 7(5). 2014. Available from: https://doi.org/10.1002/ase.1429.

SINGH, K., BHARATHA, A., SA, B., ADAMS, O. P., MAJUMDER, M. A. A. Teaching anatomy using an active and engaging learning strategy. **BMC Medical Education**, 19(1). 2019. Available from: https://doi.org/10.1186/s12909-019-1590-2.

TUBBS, R. S., SORENSON, E. P., SHARMA, A., BENNINGER, B., NORTON, N., LOUKAS, M., MOXHAM, B. J. The development of a core syllabus for the teaching of head and neck anatomy to medical students. **Clinical Anatomy**, 27(3). 2014. Available from: https: https://doi.org/10.1002/ca.22353.

WHITTEMORE, R. Combining in nursing research: methods and implications. **Nursing Research**, 54(1): p 56-62. 2005. Access on: https://pubmed.ncbi.nlm.nih.gov/15695940// ISSN : 00296562

WHO. Infection prevention and control during health care when novel coronavirus (nCoV) infection is suspected: interim guidance, 25 January 2020. **World Health Organization**, January. Access on:: https://www.who.int/publications-detail/infectionprevention-and-control-during-health-care-whennovel-coronavirus-(ncov)-infection-is-suspected.

WRIGHT, S. J. Student perceptions of an upper-level, undergraduate human anatomy laboratory course without cadavers. **Anatomical Sciences Education**. 2012. Available from: https://doi.org/10.1002/ase.1265.