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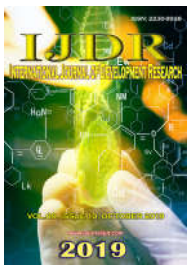

RESEARCH ARTICLE OPEN ACCESS

COMPARISON OF STUDENT ACCEPTANCE LEVEL IN TEACHING HUMAN ANATOMY PRACTICE BY ANATOMIC PARTS TREATED WITH GLYCERIN OR FORMALIN: OBSERVATIONAL STUDY

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ABSTRACT

Introduction: This article deals with a comparison of glycerin and formalin application on the anatomical pieces in the teaching of the practice of human anatomy. It can be noted that formalization is the main form of conservation of anatomical bodies and parts, because of its low cost. Conservation techniques such as formaldehyde and glycerin are the most commonly used in anatomy laboratories. ***Objective:*** The objective of this work is to perform a comparison study of glycerinized and formalized anatomical parts in the teaching of the practice of human anatomy. ***Methods:*** Epidemiologic/observational study, following the rules of STROBE. A total of 88 undergraduate medical students from the Brazil University, Fernandópolis-SP campus were considered. Inclusion criteria included students enrolled in the third to fourth semester of the course, excluding those who refused to participate or did not have contact with the anatomical part in practical class. ***Results:*** As a result, it can be mentioned that having the formaldehyde with a great rejection in terms of smell, the Brazil University students have a high preference for the fixation and preservation in the base of the formaldehyde, which in this case the preference reaches 36% of men and women and Glycerin 64%. It can be concluded that the preparation technique using glycerin has benefited the duration of the anatomical parts, in which it can be observed a prolonged durability effect, being stored for a long period. ***Conclusion:*** Thus, glycerination is a very efficient technique for the conservation of anatomical parts, especially for the purpose of study in practical classes, presenting a better didactic because it does not present health risks.

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INTRODUCTION

Formalin application is the main form of conservation of anatomical bodies and parts, mainly due to its low cost. The technique is based on the use of formaldehyde (5-20%) as a fixative and conservative (Rocha Ferreira *et al.,* 2017). However, there are several negative factors to its use, such as unpleasant odor, darkening, weight gain and stiffness of parts and serious environmental problems when incorrectly disposed of, and is a product classified by the International Cancer Research Agency as highly carcinogenic (Kimura, 2010). Formaldehyde has destructive effects on human body tissues as well as DNA itself, so its use in addition to causing tearing, irritation of the nasal mucosa, burning of the throat and discouraging the study of anatomy, also causes serious health risks to those is close to the chemical (Carvalho *et al.,* 2009). Conservation techniques such as formaldehyde and

glycerination are the most commonly used in anatomy laboratories (Rodrigues, 2010). There are several options for replacing formaldehyde, glycerination, ethyl alcohol, phenol, and plastination. Glycerin acts as an antifungal and bactericidal, and has many advantages over formaldehyde, as it is odor, texture, and color, and is not harmful to health. However, its cost is still high and this explains its low use in anatomy laboratories (Rodrigues, 2001; Viegas, 2010). Glycerin has the capacity of cellular dehydration, acting as fungicide and bactericide. The glycerination technique provides better preservation of anatomical parts with several advantages such as the lightness that they acquire in the preservation process, the morphology is preserved as close to the original form and the coloring, facilitating the identification of various structures difficult to see. In addition, glycerin is an odorless substance, does not irritate mucous membranes, is not carcinogenic and does not have such a high risk of environmental contamination compared to formaldehyde (An *et al.,* 2012; Krug *et al.,* 2011). As a disadvantage this technique shows a considerable cost, being the main factor of not having been standardized in all universities and anatomy laboratories (An *et al.,* 2012). Another factor is that glycerin is an environmentally harmful product when disposed of incorrectly (Carvalho *et al.,* 2013). The use of formaldehyde may or may not be completely discarded since glycerination techniques can be performed on both fresh pieces and 10% already formalized pieces to be dissected before the procedure (Carvalho *et al.,* 2013). The objective of this work was to perform a study of comparison of glycerinated and formalized anatomical parts in the teaching of the practice of human anatomy.

METHODS

Study design: Epidemiologic/observational study, following the rules of STROBE (Strengthening the Reporting of Observational studies in Epidemiology), https://www.strobe-statement.org/index.php?id=strobe-home.

Participants and eligibility criteria: A total of 88 undergraduate medical students from the Brazil University, Fernandópolis-SP campus were considered. Inclusion criteria included students enrolled in the third to fourth semester of the course, excluding those who refused to participate or did not have contact with the anatomical part in practical class.

Applications and eligibility analysis: A validated questionnaire consisting of 15 items was applied. Variables considered were grade series, age, gender, previous college degree, marital status, perception of anatomical smell (formaldehyde and glycerin), tearing, intoxication and skin lesion by (formaldehyde and glycerine), conservation solution preference parts (formaldehyde and glycerin) and associated details (better identification of the anatomical parts (formaldehyde and glycerin), matching atlas images in contact with formaldehyde and glycerin, symptoms caused by formaldehyde and glycerin, early search for clarification and risk awareness the health).

Statistical analysis: Data analysis was performed by Tukey test adopting 95% confidence interval ($p < 0.05$).

RESULTS

After analyzing the research, it was observed that 44 participants were from the third semester and 44 from the fourth semester. Looking at Figure 1, we have formaldehyde with a great rejection in terms of smell, the students of the Brazil University have a high preference for fixation and conservation in the base of formaldehyde, in which case the preference reaches 36% of men and women and Glycerin 64%. For the results, we have the Formal considered more unpleasant than Glycerin, but most students prefer formaldehyde to identify fixations in anatomical parts reaching a preference of 56% of respondents at the University Brazil, being 22 women and 27 men. After analysis, the formaldehyde was pointed with great rejection in terms of smell, the students of the University Brazil have a high preference for the fixation

Table1. Frequency of symptoms involving formaldehyde solution

	FemALE	Fem(%)	MALE	MaLE(%)	Total	T(%)
Third semester	23	53%	21	47%	44	50%
Headache	0	0%	3	7%	3	3%
Irrized eyes	1	2%	0	0%	1	1%
Angry eyes headache	5	12%	1	2%	6	7%
Angry-eyed head-headache	2	5%	1	2%	3	3%
Headache-Cough-lack of irritated eyes	0	0%	2	4%	2	2%
Headache-Cough-Missing-irritated-eye-dry Mucosa	1	2%	1	2%	2	2%
Headache - he was angry eyes	0	0%	2	4%	2	2%
Headache - cough - eyes angry - dry music	1	2%	0	0%	1	1%
Lack of angry-eye-rated eyes	1	2%	0	0%	1	1%
Dried Mucosas		0%	1	2%	1	1%
AT	4	9%	4	9%	8	9%
Angry Eyes	7	16%	6	13%	13	15%
Coughed Angry Eyes	1	2%	0	0%	1	1%
Fourth semester	20	47%	24	53%	44	50%
Headache	1	2%	1	2%	2	2%
Irrized eyes	1	2%	0	0%	1	1%
Angry eyes headache	3	7%	0	0%	3	3%
Angry-eyed head-headache	1	2%	1	2%	2	2%
Headache - cough - lack of irried eyes - Muscle-spotted skin	2	5%	0	0%	2	2%
Headache - he was angry eyes	1	2%	1	2%	2	2%
Headache - cough - eyes angry - Dry music	0	0%	1	2%	1	1%
Headache - coughing - angry eyes - muscle - Dropled skin	1	2%	0	0%	1	1%
Angry eye pain	0	0%	1	2%	1	1%
At	1	2%	5	11%	6	7%
Angry eyes	5	12%	8	18%	13	15%
Angry eyes-dry mucosa	2	5%	2	4%	4	5%
Coughed Angry Eyes	1	2%	4	9%	5	6%
Cough-angry eyes-mucosa dry	1	2%	0	0%	1	1%
Total	43	100%	45	100%	88	100%

Table 2. Frequency of symptoms involving glycerine solution

	FemALE	Fem(%)	MaLE	MaLE(%)	Total	T(%)
Third semester	23	53%	21	47%	44	50%
Headache	1	2%	3	7%	4	5%
Angry Eyes Headache	1	2%	0	0%	1	1%
Headache-Cough-Missing-irritated-eye-dry Mucosa	1	2%	0	0%	1	1%
AT	16	37%	16	36%	32	36%
Angry Eyes	4	9%	2	4%	6	7%
Fourth semester	20	47%	24	53%	44	50%
Headache	0	0%	2	4%	2	2%
Missing head pain	1	2%	0	0%	1	1%
Angry eyes headache	1	2%	0	0%	1	1%
At	16	37%	21	47%	37	42%
Angry eyes	1	2%	0	0%	1	1%
Spotted skin	0	0%	1	2%	1	1%
Cough-angry eyes-mucosa dry	1	2%	0	0%	1	1%
Total	43	100%	45	100%	88	100%

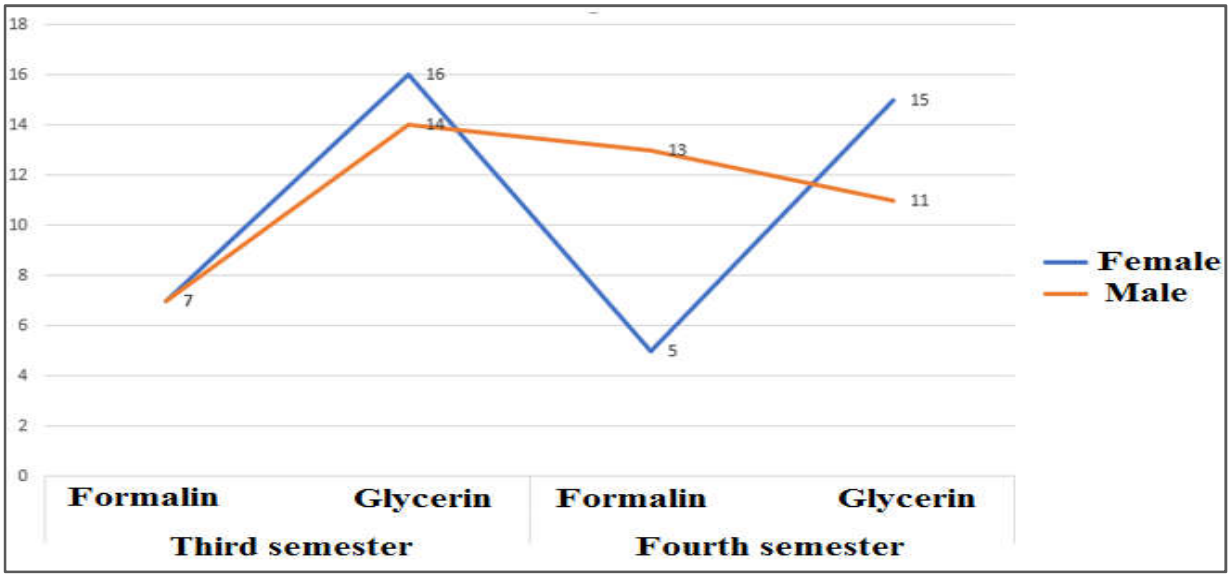

Figure 1. Frequency of the preference between formaldehyde and glycerin in the fixation and conservation of the anatomical specimen at Brazil University

and preservation in the base of formaldehyde, in which case the preference reaches 36% of men and women and the Glycerin 64%. For the results, we have the Formal considered more unpleasant than Glycerin (Tables 1 and 2), but most students prefer formaldehyde to identify fixations in anatomical parts reaching a preference of 56% of respondents at the University Brazil, being 22 women and 27 men. From Table 1, it is clear that formaldehyde causes a lot of headaches and irritates the eyes, within the female responses, had a variance of 9.54 and male had a variance of 13.08. Having an average of 2.38 for females and an average of 2.5 for males with an average error of 0.78. Glycerin causes fewer symptoms than formaldehyde reaching a 78% non-irritability rate, but still has some cases of headache and irritated eyes, according to Table 2.

DISCUSSION

Formaldehyde has been prominent in the preservation of biological tissues since the nineteenth century in order primarily to preserve tissues or parts of humans. Despite being known to be harmful to health and the environment, it is still widely used. Formaldehyde has been replaced by solutions of alcohol and glycerol in preserving cadavers (Rocha Ferreira, 2017). In this context, formalin fixation as a fundamental step in the conservation process of cadavers (Rocha Ferreira, 2017). It is based on permanently maintaining the cytological and histological structures of cells and tissues, that is, it avoids the degradation of the material due to autolytic phenomena and allows the performance of numerous cytological and histopathological techniques, as well as the conservation process. of corpses (Kimura *et al.,* 2010). However, formic aldehyde acts as a fixative by interacting with the amino acids lysine and arginine (Kimura *et al.,* 2010). Such a fixative does not cause protein precipitation, does not preserve free fat, but fixes complex lipids, causes slight precipitation of other cellular constituents and is not the carbohydrate fixative of choice (Carvalho, 2009). Preservation in formaldehyde requires maintenance, which occurs every fifteen days, where the corpses are placed in the same tanks, being exposed during the following weekends and / or holidays, so that the reagent can be fixed again (Rodrigues, 2010). After this period, the corpses are removed from these tanks and placed in fixed and / or mobile stretchers, and should then be wetted three times a day with water to prevent drying of the anatomical structures. The process of glycerin maintenance occurs after a time of preservation of corpses in formaldehyde, but this process occurs only once when the corpse is placed in a glycerine tank (Rodrigues and Franco, 2001). For this, the body needs to be kept dry, ending the use of water, a few days earlier for the glycerin application process to be done correctly. Among the advantages of formaldehyde can be cited the conservation of the pieces, maintaining the color and texture of the structures, facilitating the visualization to the teacher and academic at the

time of studies, respectively (Viegas *et al.,* 2010). Formaldehyde is a substance characterized as a relatively strong odor, which causes a variance of discomfort when the public is exposed to the product, such as eye, airway and throat irritation, headaches and nausea, and always needs maintenance. wetting the corpses with water three times a day so that the structures do not dry out, making the process costly (An *et al.,* 2012). Glycerin application acts as an opposite to the process using formaldehyde since the smell is softer compared to formaldehyde and keeps the corps comparatively more conserved because they do not need maintenance (Krug *et al.,* 2011). They are not placed in the tanks, being considered a more economical method. Its disadvantage focuses on the impossibility of using water, as glycerin is hydrophilic and contact with water could deteriorate laboratory structures (Carvalho *et al.,* 2013). Maintenance of stretchers is done daily, becoming very dirty when changing the body of a stretcher or turning a body on the stretcher (IARC, 1995). For the safety of the fellows and employees, the use of PPE (personal safety equipment) should be made such as long pants, long sleeve coat, closed shoes, impervious procedure gloves, respiratory panoramic mask, with filter. Thus, it is logically concluded that the use of glycerin is the most economical method (Veronez *et al.,* 2010).

Conclusion

The technique of preparation using glycerin, based on the descriptions and methods used in various contexts, has benefited the duration of the anatomical parts, in which an effect of prolonged durability can be observed, being stored for a long period. With this brief study, it can be concluded that glycerin application is a very efficient technique for the conservation of anatomical parts, especially for the purpose of study in practical classes, presenting a better didactic because it does not present health risks. None of the problems caused by the use of formaldehyde were observed with the use of glycerin.

Declaration of conflicts of interest: The authors declare nothing.

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