ORIGINAL ARTICLE

Successful experience of using experimental model in the practical training of gastrointestinal physiology in medical students

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Background: The aim of present study was to determine the effect of using the experimental model of induction of structural-functional disorder in the practical training of gastrointestinal (GI) physiology on the level of knowledge and attitude of medical students.

Methods: The present study was a descriptive study conducted on medical students for three consecutive semesters. Initially, students were divided into groups of 15 people and the experimental models of stress and peptic ulcer induction were explained theoretically using PowerPoint software. Then, for each group of students a rat, which was prepared on the same day as the stress ulcer model, was dissected after induction of anesthesia. At the end, students were asked to complete a researcher-made questionnaire consisting of 7 questions in a 5-point Likert scale.

Results: The participants were 187 medical students with mean age of 20.28 ± 1.82 years. Students agreed "high" and "very high" with holding the laboratory for raising knowledge (90.4%), changing their attitude towards GI physiology (68.5%), enhancing their skills (54.5%), being interesting and innovative (89.9%), increasing their interest in learning the topics of GI physiological theory (75.7%), identifying "stress ulcer and peptic ulcer" (79.2%), as well as holding the sessions of the laboratory for the future courses (84.5%).

Conclusion: Findings indicated that experimental work on live animals greatly enhanced students' knowledge and learning. It seems that using animals should not be replaced entirely by virtual experiments; however, the combination of several teaching methods such as blended laboratories is recommended for some concepts and physiological processes including in GI physiology.

Keywords: Laboratory animal, Gastrointestinal, Physiology, Practice, Teaching

تجربة ناجحة في استخدام النموذج التجريبي في التدريب العملي لعلم وظائف الأعضاء المعدية المعوية لدى طلاب الطب

الخلفية: كان الهدف من هذه الدراسة هو تحديد اثر استخدام النموذج التجريبي لتحريض الاضطراب البنيوي الوظيفي في التدريب العملي لفيزيولوجيا الجهاز الهضمي (GI) على مستوى المعرفة و الموقف لدى طلاب الطب.

الطرق: هذه دراسة وصفية أجريت على طلاب الطب لثلاثة فصول دراسية متوالية. في البداية ، تم تقسيم الطلاب إلى مجموعات من ١٥ شخصًا و تم شرح النماذج التجريبية لقرحه الإجهاد و القرحة الهضمية نظريًا باستخدام برنامج باوربوينت .(PowerPoint)لكل مجموعة من الطلاب تم تشريح جثه فأر تم تحضيره في نفس يوم نموذجا لقرحة الإجهاد بعد التخدير. في النهاية ، طُلب من الطلاب إكمال استبيان من إعداد الباحث يتكون من ٧ أسئلة بمقياس ليكرت المكون من ٥ نقاط.

النتائج: كان المشاركون ١٨٧ طالب طب بمتوسط أعمارهم ١/٨٢ ± ٢٠/٢٨ سنة. وافق الطلاب على درجة عالية و عالية جدًا مع عقد هذا المختبر في زيادة المعرفة (٩٠,٤٪) ، تغيير موقفهم تجاه فسيولوجيا الجهاز الهضمي (٦٨,٥٪) ، تعزيز مهاراتهم (٥٤,٥٪) ، مثيرة للاهتمام و مبتكرة (٨٩,٩٪) ، زيادة اهتمامهم بها. تعلم موضوعات النظرية الفسيولوجية للجهاز الهضمي (٧٥,٧٪) ، تحديد "قرحة الإجهاد و القرحة الهضمية" (٧٩,٢٪) و عقد هذه الدورة المعملية للدورات المستقبلية(٨٤,٥٪).

الخلاصة: أشارت النتائج إلى أن العمل التجريبي على الحيوانات الحية عزز بشكل كبير معرفة الطلاب وتعلمهم. يبدو أنه لا ينبغي استبدال استخدام الحيوانات بالكامل بالتجارب الافتراضية و الجمع بين العديد من طرق التدريس حيث يوصى باستخدام المختبرات الممزوجة لبعض المفاهيم و العمليات الفسيولوجية بما في ذلك في فسيولوجيا الجهاز الهضمي.

الكلمات المفتاحية: حيوان المختبر ، الهضم ، علم وظائف الأعضاء(فيزيولوجيا)، الممارسة ، التدريب

طب کے طلبا کو نظام ہاضمہ کی فیزیالوجیکل کلینیکل تعلیم دینے میں تجرباتی ماڈل کا کامیاب تجربہ

بیک گراونڈ : اس تحقیق کا ھدف میڈیکل طلبا کو نظام ہاضمہ میں فزیالوجیکل لحاظ سے پیدا ہونے والی بیماریوں کے بارے میں کلینیکل تعلیم دینے میں نئے ماڈل کے کامیاب تجربے کا جائزہ لینا ہے۔ اس تجربے میں یہ دیکھا گیا ہے کہ نیا تعلیمی ماڈل طلبا کی آگہی اور نقطہ نظر پر کیا اثر رکھتا ہے۔

روش : تین سمسٹر کے طلبا کو مسلسل اس تحقیق میں شامل کیا گیا تھا۔ طلبا کوپندرہ افراد کے گروہوں میں تقسیم کیا گیا اور نئے ماڈل کے ذریعہ ، اسٹرس السر اور پیپٹک السر کی وضاحت کی گئي ، اس وضاحت کے لئے پاور پوائنٹ سافٹ ویر کا استعمال کیا گیا۔ اس کے بعد طلبا کے ہر گروہ کو ایک جنگلی چوہا دیا گیا جس کو پہلے ہی سے اسٹرس السر کا ماڈل بنالیا گیا تھا ۔ چوہے کو بے ہوش کرنے کے بعد اس کا آپریشن کیا گیا ۔ اس کے بعد طلبا سے کہا گیا کہ وہ سات سوالوں کا ایک سوالنامہ بنائیں جو لائیکرٹ اسکیل کے پانچ جوابوں کے مطابق ہو ۔

نتیجے : اس تحقیق میں ایک سو اٹھہتر۱۸۷ طلبا نے شرکت کی ۔ تحقیق میں شریک طلباء نے ان کی علمی صلاحیتوں میں نکھار لانے ، نظام ھاضمہ کی فیزیالوجی کے تعل سے ان کے نقطہ ہائے نظر میں تبدیلی ، ان کی مہارتوں میں اضافہ اور نئی روش کے دلچسپ اور مفید ہونے نیز نظام ھاضمہ کی فزیالوجیکل لحاظ سے بہتر تعلیم حاصل کرنے، اس نئے ماڈل کے اسٹر السر اور پیپٹک السر کی بہتر تشخیص کی وجہ سے اس ماڈل کے اپنائے جانے پر خاصی تاکید کی ہے۔

سفارشات : اس تحقیق سے پتہ چلا ہے کہ جانوروں تشریح بدن سے طلبا کے علم میں اضافہ ہوتا ہے لیکن میڈیکل تعلیم کو محض جانوروں کی تشریح بدن پر ہی منحصر نہیں رکھنا چاہیے بلکہ انٹرنیٹ سے حاصل ہونے والی مدد نیز دیگر روشوں کو ملا کر فزیالوجیکل مسائل بالخصوص نظام ھاضمہ کے مسائل کی وضاحت کرنی چاہیے۔

کلیدی الفاظ : فزیالوجیکل، جانور کا ماڈل ، نظام ھاضمہ

تجربه موفق استفاده از مدل تجربی در آموزش عملی فیزیولوژی گوارش در دانشجویان پزشکی

زمینه و هدف : هدف از مطالعه حاضر تعیین اثر استفاده از مدل تجربی القاء اختلال ساختاری- عملکردی در آموزش عملی فیزیولوژی گوارش بر سطح آگاهی و نگرش دانشجویان پزشکی بود.

روش: این یک مطالعه توصیفی است که بر روی دانشجویان پزشکی برای سه نیمسال تحصیلی متوالی انجام شده است. در ابتدا دانشجویان در گروههای ۱۵ نفره تقسیم شدند و مدل های تجربی استرس اولسر و پپتیک اولسر به صورت تئوری با استفاده از نرم افزار پاورپوینت توضیح داده شد. سپس برای هر گروه از دانشجویان یک موش صحرایی که همان روز به صورت مدل استرس اولسر آماده شده بود بعد از القاء بیهوشی تشریح شد. در پایان از دانشجویان خواسته شد تا یک پرسشنامه محقق ساخته شامل ۷ سئوال با معیار لیکرت ۵ گزینه ای را تکمیل کنند.

یافته ها: تعداد ۱۸۷ نفر دانشجو با میانگین سنی ۱/۸۲ ± ۲۰/۲۸ سال در این مطالعه شرکت کردند. دانشجویان به صورت زیاد و خیلی زیاد با برگزاری این آزمایشگاه در بالا بردن آگاهی(۹۰/۴٪)، تغییر نگرش در مورد فیزیولوژی گوارش(۶۸/۵٪)، افزایش مهارت ها(۵۴/۵٪) ، جالب و نوآورانه بودن آن(۸۹/۹٪)، افزایش علاقه آنان برای یادگیری دروس تئوری فیزیولوژی گوارش(۷۵/۷٪) ، تشخیص استرس اولسر و پپتیک اولسر (۷۹/۲٪) و برگزاری این جلسه آزمایشگاه برای دوره های بعدی (۸۴/۵ ٪) موافق بودند.

نتیجه گیری: یافته ها نشان داد که کار تجربی بر روی حیوان زنده بطور زیادی آگاهی و یادگیری دانشجویان را افزایش داد. به نظر می رسد که استفاده از حیوان نباید بطور کامل با تجربیات مجازی جایگزین شود و ترکیب چندین روش آموزشی به صورت آزمایشگاه ترکیبی برای برخی مفهوم ها و فرآیندهای فیزیولوژیک از جمله در فیزیولوژی گوارش توصیه می شود.

واژه های کلیدی: مدل حیوانی، گوارش، فیزیولوژی، عملکرد، آموزش

INTRODUCTION

Physiology as one of the basic sciences is taught by direct experience and observation of scientific phenomena in practical classes (1); therefore, physiology teaching for medical curriculum includes both lectures and practical classes (2). Hence, lack of understanding the underlying theoretical concepts due to inappropriate experimental techniques limits the value of such classes (1).

Laboratory experiences relating to work with animals in laboratory environment can reinforce research skills such as experimental design, data analysis, experimental techniques and methodologies, and report writing (1,3). Also, it promotes communication skills and raises pedagogy of problem-based learning (PBL), problem solving, and team working (4). On the contrary, virtual experiments (computer-based simulation) which is particularly used for longer term experiments and is normally run by several practical classes, can also drastically reduce the costs associated with traditional laboratory class such as animals, equipment, staff and faculty time (5,6). However, there are not collaboration and hand-on technical skills in computer-based simulation experienced in laboratory classes (7).

Using non-human primates to understand physiological concepts as well as learning enforcement was considered as a common approach in practical classes over the last 20 years. During this time due to ethics and moral considerations and also quality of education laboratory, the experiences with living preparations can be replaced by virtual technologies such as slides, videos, computer-assisted instructions and computer simulations; moreover, there has been a progressive decline in animal use for laboratory experiences in recent years as well (8,9).

Similar to the present study, a recent cross-sectional study by Durand et al. in Brazil demonstrated that the majority of 350 students, 108 of whom participated only in virtual classes, 120 only in practical animal laboratory classes, and 122 in both approaches, agreed with both methods to reinforce tutorial goals and acquired skills by using animal in education and learning. There was no difference in the final grades among groups for virtual or practical animal laboratory classes or both, respectively (8).

Considering previous studies that have shown working with live animals in laboratory environment reinforce tutorial goals, the physiology of the gastrointestinal tract is complex and specific. This doubles the importance of effective training, although it is often overlooked (10,11). Therefore, the aim of designing the present study was to determine the effect of using the experimental model of induction of structural-functional disorder in the practical training of gastrointestinal (GI) physiology on the level of awareness and attitude of medical students.

METHODS

This study was conducted in the Medical Physiology Lab of Birjand University of Medical Sciences in collaboration with the Research Center of Experimental Medicine on medical students in basic sciences degree according to new curriculum for three consecutive semesters in 2018-2019. This study was approved by Birjand University Medical Ethics committee with Ethical approval registration number IR.BUMS.REC.1399.125. In order to hold the initial laboratory session, the informed consent was provided by all participants based on the criteria of the Ethics Committee of the Faculty of Medicine of Birjand University of Medical Sciences.

At the end of the theoretical sessions on gastrointestinal physiology, students were divided into two groups of 15 people to participate in a practical laboratory. Concepts of stress ulcer and peptic ulcer as well as their experimental models of induction were explained theoretically using PowerPoint software additionally, and its film was shown for students how to induce stress ulcer. Then for each group of students, an animal model (rat), which was prepared on the same day as the stress ulcer model of cold-water immersion stress (CWIS) (12), was dissected after induction of anesthesia. At the end of each laboratory session, students were asked to complete a researcher-made questionnaire consisting of 7 questions with 5-point Likert scale from very low to very high in order to determine their level of knowledge (3 items), attitude (3 items), and skill (1 item). To ensure face and content validity, the initial questionnaire was presented in the physiology department and after applying the opinions of the faculty members of the physiology department, it was modified and approved in terms of face and content validity. The reliability of the questionnaire was also calculated and confirmed by the Cronbach's alpha coefficient 0.81.

The data was analyzed by a Statistical Package for the Social Sciences (SPSS) version 16.0 (SPSS Inc, Chicago, Illinois). Descriptive analyses were used to summarize the data on the variables.

RESULTS

This study was performed on 187 medical students. The mean age of students was 20.28 ± 1.82 years, and 47.6% of them (89 individuals) were males. 90.4% of the students considered the holding of this laboratory “high” and “very high” effective in raising awareness and information about GI physiology and related diseases. 68.5% of the students assigned the holding of this laboratory “high” and “very high” effective in changing their attitude towards studying GI physiology as much as possible. 54.5% of the students mentioned the holding of this laboratory “high” and “very high” effective in enhancing their skills in diagnosing and identifying GI diseases. 89.9% of the students described the experiment on the laboratory animal as interesting and innovative, as well as 75.7% of them believed that the holding of the laboratory using the experimental model was “high” and “very high” effective in increasing their interest in learning the topics of GI physiological theory. 79.2% of the students agreed “high” and “very high” that observation of this experiment on a laboratory animal is effective in identifying "stress ulcer and peptic ulcer" and the differences between them in humans. Also, 84.5% agreed this session of the laboratory as “high” and “very high” for the future courses. The frequency distribution of students' answers to questions is presented in Table 1.

Table 1. Topics of 5-point Likert questions checklist and frequency distribution of students' answers

Questions	Animal Laboratory, Students' Views				
	Very low	Below Average	Average	High	Very high
	N (%)	N (%)	N (%)	N (%)	N (%)
To what extent has holding a laboratory been effective in raising your knowledge and information about gastrointestinal physiology and related diseases?	1 (0.5)	1 (0.5)	16 (8.6)	92 (49.2)	77 (41.2)
To what extent has the holding of a laboratory changed your attitude towards studying gastrointestinal physiology as much as possible?	4 (2.1)	8 (4.3)	47 (25.1)	71 (38)	57 (30.5)
To what extent has the laboratory been able to enhance your skills in diagnosing and identifying of common gastrointestinal diseases?	4 (2.1)	18 (9.7)	63 (33.7)	58 (31)	44 (23.5)
How interesting and innovative has this experiment been on a laboratory animal?	4 (2.1)	2 (1.1)	13 (6.9)	39 (20.9)	129 (69)
To what extent can observing this experiment in a laboratory animal help you identify "stress ulcer and peptic ulcer" and the difference between them in humans?	2 (1.1)	8 (4.3)	28 (15.4)	68 (36.4)	80 (42.8)
To what extent was holding this laboratory session effective in increasing your interest in learning the topics of gastrointestinal physiological theory?	1 (0.5)	7 (3.9)	37 (19.9)	63 (33.9)	78 (41.8)
How much do you agree with this experiment and holding a laboratory on gastrointestinal physiology for future courses?	5 (2.7)	5 (2.7)	19 (10.1)	38 (20.3)	120 (64.2)

DISCUSSION

In physiology teaching as one of the basic sciences for the medical curriculum, the use of animals in laboratory is considered as a foundation for enforcing learning in medical education and hands-on experiences, since working with animals in laboratory promotes practicing skills required for future physicians (13).

This study is in accordance with Rochelle et al. done in 2016 in University of São Paulo on undergraduate students in the Dentistry (n = 100) and Pharmacy (n = 100) that demonstrated the majority of dentistry students agreed with animal use in physiology and pharmacology learning while most pharmacy students disagreed with (11).

Also, the present study is in contrast with Quiroga et al. in 2019 in Australia. The study conducted on second year students in their 3-year degree program as virtual experiment for a practical laboratory class including the "Neuronal Control of Gastrointestinal Smooth Muscle" on 421 students (subject: BMS2031, Body Systems), 83 students (subject: NUT2103, Integrated Science Systems), and 376 students (subject: PHY2032, Endocrine Control Systems). The results showed the improvement of understanding physiological concepts, as well as experimental design and research skills in students (1).

Previous studies have shown that although animal experiments are illustrated by using videos and virtual technologies, live observations are exciting and can lead to significant emotional experience due to their influence on neural circuitry. This facilitate consolidation of concepts (9,13), as in the present study 89.9% "high" and "very high" students described the experiment on the laboratory animal as interesting and innovative. In this regard 84.5% agreed holding this session of the laboratory "high" and "very high" for the future courses.

Some studies have demonstrated that virtual activities are not as effective as animal use in aspects of perceptions including knowledge acquisition and reinforcing PBL learning goals (14, 8). Also, students who had experienced virtual laboratory may lack hands-on skills regarding physiology concept learning (8). As the present results showed, 90.4% and 54.5% of students considered the holding of this laboratory "high" and "very high" effective in raising awareness and information on GI physiology, enhancing their skills in diagnosing, and identifying GI diseases respectively.

Additionally, present study showed that 68% of students agreed "high" and "very high" with holding of a laboratory in changing their attitude towards studying GI physiology, and 25% agreed medium. Although live animals are important in physiology teaching and ethic considerations; however, some students had contradictory attitudes and were uncomfortable with animal use and live experiment observation. Such concerns can be as a barrier for teaching (15,16). It seems that combination of several teaching methods as blended laboratories can be more attractive for students, particularly with widespread use of computers and computer-based resources in medical teaching.

This study had some limitations. It was impossible to access to the comparison of the educational effectiveness of holding this session of laboratory with the previous ones as well as with virtual practical training.

In conclusion, the present findings indicated that experimental work on live animals enhanced greatly the students' knowledge and learning; therefore, animal use should not be replaced entirely by virtual experiments such as video and computer simulations for learning some concepts and physiological processes in GI physiology

because of its complex and specialized function.

Ethical considerations: Ethical issues (Including plagiarism, informed consent, misconduct, data fabrication and/or falsification, double publication and/or submission, redundancy, etc.) have been completely observed by the authors.

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