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Anatomy Education of Medical Students During the COVID 19 Pandemic

Educación en Anatomía de Estudiantes de Medicina Durante la Pandemia de COVID-19

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SUMMARY: COVID-19 created extraordinary challenges to anatomy education and teaching practices, as the anatomists try to achieve best knowledge delivery level for their discipline, without the use of traditional teaching aids such as the cadavers and microscopic slides. The present study was conducted to collect medical students' response and opinions regarding the pros and cons of online teaching vs traditional teaching. 2263 medical studentswere recruited from the first three academic years. A multiple choice close-ended questionnaire regarding their opinion about virtual teaching mode for the anatomy discipline during COVID-19 pandemic was designed and circulated via emails.The majority (78.12 %) of the students agreed that they missed their traditional anatomy learning mode. Moreover, (92.92 %) of the students missed their campus and the college social life. The students strongly felt there is a gap and difficulty in understanding the topics that required practicing and visual orientation such as dissections, models, microscopic slides which help them in better memorizing and recalling the anatomical terms. The lack of proper devices and the absence of high quality internet were among the top reported issues that negatively affect online learning. These results indicated that, compared with traditional methods of teachings, the online learning in the medical schools had relatively poor planning and required continuous and combined efforts in order to improve the quality of online teaching specially for anatomy discipline, which may be an essential response for any unforeseen situation such as the COVID-19 pandemic. We should look at the current situation as an opportunity to apply modern anatomy education approaches which may be a necessity at the present time, with huge accomplishments achieved in the information and online technology field.

KEY WORDS: Anatomy education; Cadaveric dissection; COVID-19; Students.

INTRODUCTION

In early 2020, the unforeseen COVID-19 pandemic appeared abruptly and spread rapidly across the world, resulting in millions of people being infected globally by this novel coronavirus and thousands of deaths reported daily (World Health Organization, 2020). The COVID-19 pandemic has impacted particularly the education systems all over the world. According to the United Nations Educational, Scientific and Cultural Organization (UNESCO), COVID-19 has affected 85 % of enrolled students worldwide (Nicola *et al*., 2020). In most countries, medical based education whether theoretical or practical classes has changed dramatically from the in person classroom-based teaching to online mode of teaching, carried out using remote digital platforms such as Zoom and Microsoft team (Rose, 2020).

Anatomy is a prerequisite and core course for medical students that enables students to better understand other basic and clinical medical courses. At the same time, cadaveric dissection is perceived as a signature experience for this discipline. However, during the COVID-19 pandemic, an unexpected disruption to anatomy course education took place, as the students' experience lost the opportunity to practice dissection and the access to examine cadavers. Furthermore, other learning modalities like models and microscopic slides have also negatively affected during COVID-19 online teaching. The dissection laboratories were either replaced virtually or postponed until the COVID-19 situation improved.

In recent years, technological progress has greatly impacted the anatomy learning in medical schools (AbouHashem *et al*., 2015). In Jordan, a blended learning model was applied. This hybrid model of teaching combines traditional on campus classes with online lectures. It is widely used to incorporate the advantages of in person and online courses (Dziuban *et al*., 2018; Bonk *et al*., 2008). The hybrid learning model helps to improve the education

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during COVID -19 lockdown time. Although the students' responses to online anatomy teaching were positive, the professors of anatomy department were skeptical, and have concerns about the outcomes of applying this new teaching model on student performance and the quality of knowledge that can be delivered.

The survey was specifically designed to understand the mental and physical outcomes during virtual classes and their impact on students' education level. As the online learning may be applied for unknown period, the feedback from medical students may help in designing and using more accessible and modernized online tools to improve the quality of teaching anatomy courses and other medical based courses.

MATERIAL AND METHOD

Study sample and questionnaire: The study was performed with the approval of the institutional research board at Jordan University of Science and Technology (IRB # 38-125-2020).

The survey instrument was designed to collect information about the online teaching of gross anatomy and histology for clinical medicine during the COVID-19 pandemic, which ranged from February 2020 to end of April 2021 in Jordan, including aspects of online anatomy teaching, such as theoretical sessions, practical sessions, active learning activities, assessments and perceptions of this experience. The survey consisted of 20 individual questions, the first three questions of the survey were focused on general contact information (age, academic year, and institution).

The questionnaire was further subjected to scrutiny after it was initially distributed to a smaller group of medical students as a pilot study to eliminate any discrepancies or duplication of questions; the questionnaire was subsequently revised on the basis of their feedback.

A self-administered and anonymous cross sectional study was conducted through an e-mail and social media, the questionnaire was sent randomly to over 3500 medical students in Jordanian medical facilities in six universities (Yarmouk University, Jordan University of Science and Technology, University of Jordan, Balqa University, Motah University, Al Hussain University). The survey also contained a brief description of the study survey content and its importance, the link send to the student and the clinicians through the admission and registration department in their university.

Only 2263 medical students replied and completed the questionnaire, while the rest were discarded as incomplete or no response. The participants were in the age group of 18 to 24 years. They were representing the first three years in the medical school, there were more responses from the first year (Fig. 1).

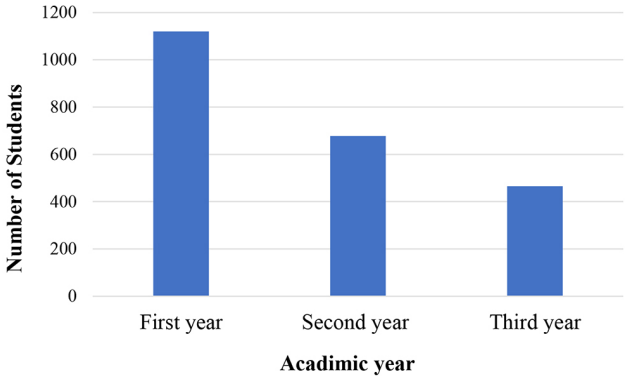

Fig. 1. The number of medical students respondents from each academic year in Jordanian Universities.

Statistical analysis: After collecting the responses and sorting them out, a descriptive, inferential and statistical analysis of data was performed using SPSS software version 20.0. In particular, both the frequency and percentage of each type of reply for the different categories were calculated. A bivariate evaluation was then carried out in order to analyze the relationship between pairs of variables. The Chi square test was especially used for investigating the significant statistical differences between categorical variables; a ? value of less than 0.05 was used to indicate the statistical significance.

RESULTS

Around 88.6 % of the student indicated that they are confident in accessing the online teaching system to attend the classes (Table I). Around 69.9 % were accessing the online classes using their smart phones; 24.5 % of students were using tablets, and only 5.47 % were using laptop/ desktop computers (Table I).

As anatomy classes have been held virtually. Due to demographic and socio-economic issues many medical students cannot own modern communicating devices or computers. In this study around (73.26 %) lack the proper devices and high quality internet connections which is considered an obstacle in attending the online classes. Moreover, 95.13 % felt lack of proper books or study material at their homes (Table I).

The survey showed that most of the students (78.12 %) missed important modalities required to master the anatomy courses including cadavers and dissection. Moreover, the students missed group and team discussion with their classmates (6.62 %) and the in person interaction with mentors and teachers (4.37 %) (Table I).

Anatomy is considered the "basic of the medical sciences", through which medical students acquire basic knowledge and build a solid background about human body structure and organization. It is known that anatomy and histology courses are described as "difficult to get and easy to forget", so we investigated if live-stream dissections

Table I. Close ended questionnaire for medical student's feedback for anatomy education during COVID-19 and the feedback analysis.

Question	Response
Are you aware of COVID-19 pandemic?	➢ Yes (2263, 100 %) ➢ No (0, 0 %) ➢ Not Sure (0, 0 %)
Do you feel that you have enough knowledge to handle online learning?	➢ Yes (2006, 88.6 %) ➢ No (231, 10.2 %) ➢ Not sure (26, 1.36 %)
Which devise do you use to attend the online classes?	➢ Laptop (110, 4.86 %) ➢ Tablet (556, 24.5 %) ➢ Desktop (14, 0.61 %) ➢ Smart phone (1583, 69.95 %)
Do you feel lack of proper devices, and strong internet connections; a barrier in your current learning process?	➢ Yes (1658, 73.26 %) ➢ No (602, 26.6 %) ➢ Not sure (3, 0.13 %)
Do you feel lack of proper books or study material?	➢ Yes (2153, 95.13 %) ➢ No (110, 4.86 %)
What do you missed the most during the online study?	➢ Cadaveric/histology lab (246, 10.87 %) ➢ Face to face communication with the teacher (99, 4.37 %) ➢ Discussion stations with classmates (150, 6.62 %) ➢ All of them (1768, 78.12 %)
Do live dissections though Zoom help you to make the subject easy to understand?	➢ Yes (1846, 81.57 %) ➢ No (417, 18.42 %)
Is histology tough to understand without spotting slides under microscope?	➢ Yes (1791, 79.145 %) ➢ No (472, 20.85 %)
Do you find it difficult to understand anatomy without models?	➢ Yes (1568, 69.28 %) ➢ No (695, 30,71 %)
Do you find it difficult to understand embryology without models?	➢ Yes (1907, 84.26 %) ➢ No (356, 15.73 %)
Which method of online education you prefer the most?	➢ Video recorded classes (441, 19.48 %) ➢ Online live Zoom classes (1821, 80,46 %) ➢ Theoretical write-ups (1, 0.044 %)
Are you satisfied with current educational system?	➢ Fully satisfied (384, 16.96 %) ➢ Satisfied (689, 30.44 %) ➢ Poorly satisfied (787, 34.77 %) ➢ Not satisfied (403, 17.80 %)
Are you satisfied with current assessment system?	➢ Fully satisfied (273, 12.02 %) ➢ Satisfied (711, 31.41 %) ➢ Poorly satisfied (855, 37.78 %) ➢ Not satisfied (424, 18.73 %)
Do you feel distracted by either home comforts or discomforts during the online classes and studding?	➢ Yes (1499, 66.23 %) ➢ No (764, 33.76 %)
Do you find any difficulty in time management?	➢ Yes (1639, 72.24 %) ➢ No (624, 27.57 %)
Do you feel lack of self-motivation in current scenario?	➢ Yes (1426, 63.01 %) ➢ No (837, 36.98 %)
Do you miss going to your college?	➢ Yes (2103, 92.92 %) ➢ No (160, 7.07 %)

though Zoom help in making the anatomy course easily understood; 81.57 % students accepted that livestreams online dissections helped them to understand and comprehend the topic more easily. On the other hand, (79.14 %) found it difficult to understand histology without spotting slides under microscope. Moreover, most of the participating students found it difficult to understand anatomy (69.28 %) or embryology (84.26 %) without examining laboratory models (Table I).

More than half of the participants (80.46 %) preferred distance learning through live Zoom classes, followed by video recorded classes (19.48 %) and theoretical write-ups (0.04 %). When asked about their satisfaction with the current educational system; only 16.96 % were fully satisfied whereas other 17.8 % were completely dissatisfied to attend online classes. At the same time, the students appeared to be disgruntled with the assessment system as more than half of the participants either poorly satisfied (37.78 %) or malcontent (18.73 %) with being evaluated using online quizzes and exams (Table I).

The majority of students (66.23 %) found it difficult in managing their time and agreed that they were distracted while studying at home. The lack of self-motivation was reported by 63.01 % students. Most of them (92.92 %) accepted that they missed their real on campus social life (Table I).

DISCUSSION

As the global COVID-19 crisis strikes currently many countries, the educational sector was massively impacted. With educational institutions shut down for long period, uncertainty loomed among learners as well as educators. Medical education is critically affected during the unprecedented COVID-19 pandemic. Adapting to new online learning system and the dynamic shift from traditional face-to-face teaching were pronounced in many professional fields, including medical education. Anatomy is a basic discipline in the medical school, which also was taught online without using in person laboratories.

The emergence of innovative e-Learning solutions to satisfy the challenging requirements of the educational sector and these smart learning technologies have transformed the teaching system to online mode and many improvements should be implemented in the future, particularly for courses that require theoretical and practical teaching modalities such as anatomy.

As student feedback is a powerful tool for gauging opinion concerning the content and delivery of virtual anatomy classes. The current study was planned to attain student's reflection regarding digital anatomical education and to recognize various mental and physical problems being faced during this online learning process. This is the first study to discuss student responses regarding the quality of online anatomy teaching in Arab countries including Jordan.

In the current study, the majority of students (88.6 %) have enough knowledge to handle online learning, and this was expected since the students are part of the millennial generation and all are well versed in the use of social media and online technology (Barry *et al*., 2016).

Most of the students who participated in this study preferred Zoom online education, and this maybe for several reasons; the Zoom classes were designed to be interactive classes so that the teacher and the student can communicate in a virtual classroom. Moreover, all classes are recorded, which make it possible for the student to return to the lecture anytime. A previous study reported similar findings: There was a positive correlation between the lecture video review rate and grades (Nieder & Borges, 2012). Moreover, the zoom classes are time and money saving, the students don't need to spend time on the daily commute to the university, and they will save money, if they are attending universities that are in distant areas.

Some of the students who participate in this study belong to rural area and internet network was a potential barrier for their effective online learning. Unfortunately, in the current situation, education in general depends on online education. The majority of students (95.13 %) feel the lack of proper books or study material, specially that students like textbooks more that the teacher PowerPoint slides. Lack of proper textbooks was mainly because of the lockdown; moreover, the students who are from rural areas did not manage to get all books even though the majority of books were available online.

Most of the students (69.95 %) were using smart phone in for their digital education. Smart phone is not considering a propitiate tool in anatomy education, the small screen may hinder the proper understanding of the subject. Moreover, it may hinder the correct view of some anatomical pictures that require view of the structure in three dimensional view instead of two dimensional.

There has been a debate over the educational implications of cadaver dissection. With regard to the acquisition of anatomy learning, previous studies have suggested various methods to assist or replace cadaver-based learning (Sugand *et al*., 2010; Hu *et al*., 2018; Iwanaga *et al*., 2021).In contrast, other studies asserted that the experience

and knowledge acquired by hands-on cadaver dissection in anatomy laboratories are invaluable (Franchi, 2020; Jeyakumar *et al*., 2020). In the current study, only 10.87 % missed cadaver dissection. The students appear to miss everything that related to anatomy education, not only the cadaver dissection, but also the communication between instructors and students, and the communication between classmates. Our results indicate that face to face learning methods with cadaver dissection has a positive impact on student achievement.

Despite the overall positive outcomes of online anatomy classes, the students were unsatisfied with either online education or the online assessments. One of the challenges that face the anatomy faculty members is how to ensure appropriate method of assessment (Oti, 2002). In our facility department, formative assessments are given to the students in order to evaluate their knowledge. Moreover, anatomy laboratory assessment continued to be the practical examination.However, practical examinations were delivered purely online in a remote medium, using primarily two-dimensional images. The students were supposed to submit their answers in the limited timeframe. The students might feel that some of them were attempting the assignments honestly on their own and some may be obtaining help from study material or other senior students, which may affect their comparative score.

The majority of students got distracted while studying at home, beside the difficulty in time management, and lack of self-motivation due to the absence of on campus social life and group discussion with their fellow students. Few students were comfortable studying at home.

This study gave feedback about the anatomy education during COVID-19 in Jordan. The conversion to online anatomy education during COVID-19 pandemic should be taken as an opportunity to extend anatomy education beyond traditional face to face lectures by applying various modern online tools that are necessary nowadays with revolutionized information and online technology.

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RESUMEN: La pandemia de COVID-19 creó desafíos extraordinarios para la educación y las prácticas de enseñanza de la anatomía, debido al objetivo del anatomista de lograr el mejor nivel de educación para su disciplina sin el uso materiales didácticos tradicionales, tal como los cadáveres y las láminas microscópicas. En este studio se analizó la respuesta y las opiniones de los estudiantes sobre los pros y los contras de la enseñanza en línea frente a la enseñanza tradicional. Se reclutaron 2263 estudiantes de medicina de los tres primeros años académicos. Se diseñó un cuestionario cerrado de opción múltiple con respecto a su opinión sobre el método de enseñanza virtual para la disciplina de anatomía durante la pandemia de COVID-19 y se distribuyó por correo electrónico. Además, (92,92 %) de los estudiantes dejaron de participar en la vida social universitaria y se ausentaron del campus. Los estudiantes sintieron fuertemente que hay una brecha y dificultad para comprender los temas que requieren práctica y orientación visual, como disecciones, modelos, diapositivas microscópicas que les ayudan a memorizar y recordar mejor los términos anatómicos. La falta de internet de calidad, y de dispositivos adecuados se encuentran entre los principales problemas reportados que afectan negativamente el aprendizaje en línea. Estos resultados indicaron que, en comparación con los métodos tradicionales de enseñanza, el aprendizaje en línea en las escuelas de medicina tenía una planificación relativamente deficiente y requería una planificación continua, además de esfuerzos para mejorar la calidad de la enseñanza en línea de anatomía, lo que que podría ser de apoyo fundamental ante cualquier situación imprevista como la pandemia de COVID-19. Actualmente, se debe considerar esta situación como una oportunidad para aplicar enfoques modernos de educación en anatomía con importantes logros en el campo de la tecnología informática y en línea.

PALABRAS CLAVE: Educación en anatomía; Disección cadavérica; COVID-19: Estudiantes.

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