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Comparison of the effect of *in vitro* and *in vivo* exposure on cadaveric anxiety among first year medical and nursing students

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Abstract:

BACKGROUND: Human anatomy instruction is mostly focused on cadaver dissection and prosected specimen examination. Exposure to cadaver dissection can be a stressful experience that may cause a wide variety of symptoms among students of health sciences. To compare and evaluate the effect of *in-vitro* and *in-vivo* exposure on cadaveric anxiety, disgust propensity and sensitivity, and attitude toward death and dying among 1st-year medical and nursing students.

MATERIALS AND METHODS: An open-label randomized trial (matched-control experimental design) was conducted among 127 1st-year Medical and Nursing students from a selected Institute of National Importance, Bhopal, India during 2015. The participants were divided into an experimental and control group based on matched trait anxiety scores using the Trait Anxiety Inventory. Followed by preassessment, video demonstration with cadaver dissection (*in vitro* exposure) was then administered to the experimental group, while the control group had direct exposure to cadaver dissection (*in vivo* exposure).

RESULTS: The study showed that there was a statistically significant difference in state anxiety related to cadaver dissection in the experimental group ($P = 0.01$). However, video-demonstration of cadaver dissection did not have any effect on disgust propensity and sensitivity and attitude toward death and dying.

CONCLUSION: The findings provided evidence that video-demonstration of cadaver dissection reduced anxiety, although it did not have any effect on disgust and attitudes of death. The dissection hall experience may evoke feelings of anxiety and disgust that need to be addressed through advanced preparedness and coping strategies, especially among medical and nursing students.

Keywords:

Anatomy, anxiety, attitude to death, disgust, dissection, undergraduate

Introduction

Anatomical knowledge remains a cornerstone of medicine and healthcare professions despite reductions in the importance, time committed to, and status of anatomical education in modern curricula. Dissection reinforces and elaborates knowledge that is acquired in lectures and tutorials. It brings the students to the closest

and most comprehensive encounter with human mortality. It helps in developing a spatial and tactile appreciation for the fabric of the human body that cannot be achieved by pro-section or computerized learning aids alone.^[1]

First-year medical and nursing students normally experience a variety of emotional reactions and mixed feelings, when they

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encounter human cadavers for the first time. For these students, dissection of a human body during an anatomy course raises questions about invasion of privacy, cadaver sources, dying, and death. There are varying responses as regards their attitudes and views towards cadaver dissection.^[2]

Sándor *et al.* have reported that dissection hall experience had an emotional impact on half of the Hungarian medical students.^[3] The emotional impact can be described in terms of somatic symptoms such as nausea, conjunctival irritation, and subjective affective states like anxiety, stress, and sadness.^[4,5] Attitudes towards cadaver dissection are also linked to human body representation, death, and dying. Studies have reported that students suffering from stress reactions significantly impair anatomy learning as well as professionalism.^[6]

Anxiety is described as a subjective feeling of fear, nervousness, or restlessness about something with an unknown result. Anxiety to cadaveric dissection usually tends to be repressed after a few dissection room experiences, typically within a few weeks, often resulting in a “mechanical” attitude devoid of empathy toward cadavers and patients in general. Therefore, this emotional arousal during the initial experience of dissection is important to be addressed in the budding clinician as it may have a long-term impact on subsequent doctor-patient relationships. Studies have implicated the use of *in-vitro* exposure methods for preparing students for dissection room experience and in reducing anxiety to cadaveric dissection.^[4,5]

Disgust is one of the primary emotions and the construct of disgust is construed of two sub-components – disgust sensitivity and disgust propensity. Disgust propensity is defined as the frequency of experiencing disgust whereas disgust sensitivity is defined as the perceived harmful consequences of experiencing disgust.^[7] Disgust is an emotion evolved as a way to protect oneself from illness and is more resistant to habituation compared to fear and anxiety.^[8] Disgust and anxiety have a negative influence on students’ motivation and learning. There is the paucity of literature available on disgust propensity and sensitivity in the context of cadaver dissection. The effect of cadaver dissection on disgust sensitivity might be useful in understanding how this primary emotion is regulated during exposure to cadavers including olfactory provocation.

Only a few studies have examined the attitudes of 1st year preclinical students towards cadaver dissection in anatomy learning. These studies do not exactly describe, what was the attitude and emotional outcome of the 1st-year preclinical students in the dissection hall when they enter first.

Hence, the present study was aimed at evaluating the effectiveness of *in vitro* and *in vivo* exposure in anxiety to cadaveric dissection and to assess the mediating role of disgust sensitivity and propensity and attitude toward death in cadaveric dissection.

Materials and Methods

Study design and setting

An open-label randomized trial (matched-control experimental design) was used to observe the efficacy of intervention at two different points of time. The research study was conducted on a matched-control group of students of a selected tertiary health care institute, Bhopal, India with current student strength of 100 Undergraduate Medical and 60 Nursing students. This trial was conducted from September 2015 to October 2015.

Study participants and sampling

Students who were enrolled in 1st-year MBBS and BSc (Hons) Nursing students were included in the study. Any students with significant chronic illness or students who did not consent for the study were excluded. The present study was time-bound and exploratory in nature. Nonprobability convenience sampling technique was used to prevent intervention contamination.

A total of 140 students (male = 56, female = 84) of 1st-year MBBS and BSc (Hons) Nursing were included for the study and they were divided into experimental (65) and control groups (62) based on matched trait anxiety scores by Trait-Strait Anxiety Inventory (STAI) by Spielberger, 1983^[9] by random lottery method. Investigators did not take part in the creation of the randomization list and were not aware of its contents. Sequentially numbered opaque sealed envelopes were used for the allocation concealment of students to the experimental and control groups. Envelopes were opened after obtaining written informed consent from participants and assigned to either intervention or control groups.

About 140 students were assessed for eligibility, and all the participants met the inclusion criteria, about 10 students who were absent on the day of intervention were excluded. The students were randomly allocated to either control or intervention by lottery method. During the study period, 3 students in the control group did not complete the posttest questionnaires. Hence, the study’s final sample size estimated for analysis is 127 [Figure 1].

Data collection tools and techniques

Variables

- Independent variable: *In-vitro* exposure - Intervention consisting of video-assisted *in-vitro* exposure and *in-vivo* exposure, i.e., real cadaver dissection

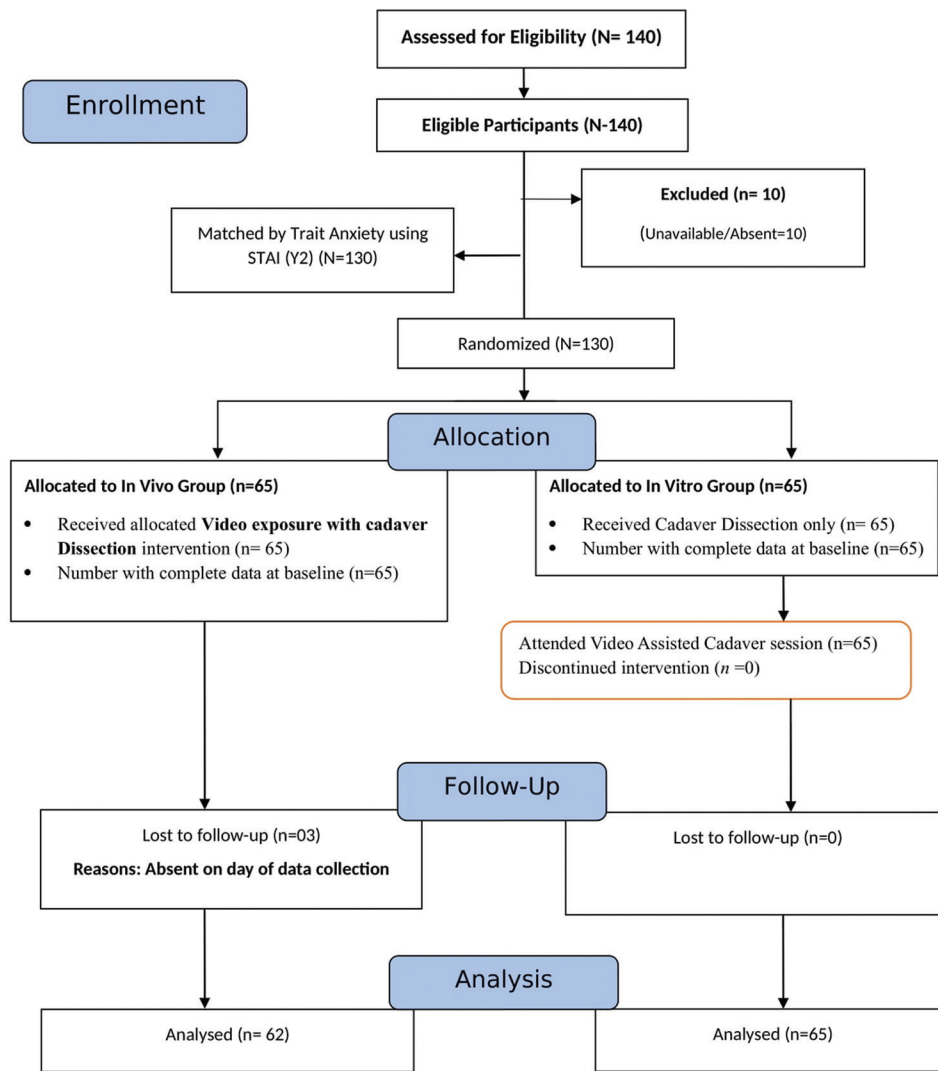


Figure 1: Consolidated standards of Reporting Trails 2010 flow chart

- Dependent variables: Anxiety to cadaveric dissection as measured on State Anxiety subscale of the STAI^[9] and Disgust Propensity and Sensitivity on the Disgust Propensity and Sensitivity Scale-Revised (DPSS-R)^[10]
- Moderating variable: Attitude towards death and dying^[11]
- Extraneous variables: Trait anxiety as measured on the Trait Anxiety subscale of the STAI.^[9] This was systematically controlled by using as a matching variable for the present study.

Intervention video-demonstration of cadaver dissection (*in-vitro* group)

Following the initial evaluation, video-demonstration of cadaver dissection (*in-vitro* exposure) was administered to the experimental group, while the control group had direct experience with cadaver (*in-vivo* exposure). The students were shown a video demonstration of cadaveric dissection of the thorax and abdomen, lasting for 30 min. After the video, they were allowed to address any of

their queries and concerns to the teachers. The posttest assessment was done immediately after the completion of real cadaver dissection (after 2 h) in both groups.

Control (*in vivo* exposure) group

Control group students were exposed directly to cadaver dissection which was supervised by an anatomist. Students' doubts were clarified during dissection.

Measures

Standardized tools were used to carry out the assessment and evaluation with permission from respective authors. Sociodemographic profile sheet was self-structured. A tryout for translated tools was conducted to check their feasibility in the selected setting. The current study used reliable, valid, and standardized research instruments to measure the baseline assessment of cadaver dissection related anxiety, (STAI Y1 and Y2 by Spielberg, 1983), disgust propensity and sensitivity by Olatunji *et al.* and attitudes of death and dying

(Death Attitude Profile – Revised by Wong *et al.* of the participants.^[9-11]

Sociodemographic questionnaire

The student background data were gathered included age, gender, occupation, family income, religion, family type, and residence type, previous exposure to cadaver dissection, witnessed any accidents involving human death, etc.

State-Trait Anxiety Inventory^[9]

It is a 40 item self-report scale that evaluates state anxiety and trait anxiety. Form Y is the most widely used version of STAI, which has 2 subscales. Each of the two subscales has 20 items and is rated on a 4-point scale from “Almost Never” through “Almost Always.” The tool has good internal consistency ranging between 0.86 and 0.95 with test-retest reliability coefficients have ranged between 0.65 and 0.75 over 2 months’ interval.^[12] Spielberger STAI is culturally appropriate and the Hindi version is also available. However, pretesting of the tools was done in the current population using split-half method of reliability and found to be highly reliable 0.94. The tool was also validated by 06 experts.

Disgust Propensity and Sensitivity Scale-Revised^[10]

It is a 12-item self-report measure, on a scale of “Never” through “Always” that provides two indices for Disgust Propensity and Disgust Sensitivity that underlies the experience of disgust. The DPSS-R showed excellent internal consistency with $\alpha = 0.90$.^[10]

Death attitude profile – revised^[11]

The death attitude profile is a 32-items measure, 7-point rating scale ranging from strongly agree through strongly disagree. The DAP-R assesses fear of death, death avoidance, neutral acceptance, approach acceptance, and escape acceptance. Alpha coefficient of internal consistency ranged from 0.65 to 0.95. Overall, the tool is highly reliable.

Ethical considerations

Ethical permission was obtained from the Institutional Ethical Committee (IHEC-LOP/2015/IM0060). Informed written consent was obtained from the participants before initiating the data collection process. Anonymity and confidentiality of information were maintained and informed about their freedom of choice.

Statistical analysis

The sociodemographic profile of both groups was compared. The homogeneity of both groups was assessed using the Chi-square test and paired *t*-test. Data were analyzed using Statistical Product and Service Solutions (SPSS) version 20 developed by International Businesses

Machines Corporation (IBM), New York, USA, including descriptive (frequency, percentage, mean, and mean percentage) and inferential statistics (paired *t*-test and MannWhitney).

Results

Preintervention comparison

Comparison of student characteristics is presented in Table 1. Groups were compared using the Chi-square test for categorical variables and *t*-test for continuous variables. No statistically significant differences between age, religion, education, occupation, marital status, residence, monthly income, history of suicide, age at onset of illness, the total duration of illness, family history of mental illness, and the number of previous attempts [Table 1]. Both the groups were comparable in trait anxiety scores also.

Intervention effects

Figure 2 compares the change in the level of anxiety before and after the cadaver exposure. In the experimental group, about 48% of the students reported no or low anxiety while only 1% of them had severe anxiety after the intervention compared to their counterparts. Participants in experimental (*in vitro*) group reported a significant reduction in cadaveric anxiety ($P = 0.019$) while there was no statistical difference found in disgust propensity ($P = 0.442$) and sensitivity ($P = 0.682$) and attitudes of death and dying [$P = 0.280$ and Table 2].

Discussion

The use of cadaver dissection and prosected specimens is commonly used in the teaching of human anatomy.

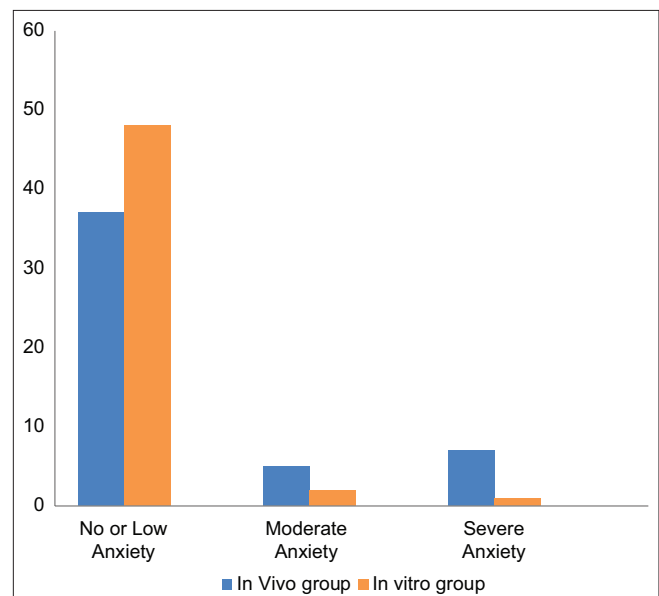


Figure 2: Postintervention comparison of anxiety scores (N=127)

Table 1: Preintervention comparison of student characteristics (n=127)

Sociodemographic characteristics	Group, frequency (%)		χ^2	P
	Control (<i>in vivo</i>) group (n=62)	Experimental (<i>in vitro</i>) group (n=65)		
Age (years), mean±SD	17.98±0.930	18.18±1.184		
Gender				
Male	30 (24)	26 (20)	2.868	0.41
Female	31 (24)	40 (32)		
Stream				
MBBS	39 (31)	42 (33)	2.376	0.498
Nursing	22 (17)	24 (19)		
Type of family				
Nuclear	41 (32)	52 (41)	2.938	0.401
Nonnuclear	19 (15)	13 (10)		
Father's education				
No formal education	2 (1)	1 (1)	9.518	0.658
Primary education	8 (6)	11 (9)		
Secondary education	7 (6)	18 (14)		
Graduation	27 (21)	21 (17)		
Postgraduation	16 (13)	14 (11)		
Mother's education				
No formal education	4 (3)	5 (4)	9.219	0.684
Primary education	15 (12)	19 (15)		
Secondary education	13 (10)	13 (10)		
Graduation	19 (15)	24 (19)		
Postgraduation	8 (6)	5 (4)		
Religion				
Hindu	48 (38)	53 (42)	3.368	0.948
Christian	3 (2)	7 (6)		
Muslim	6 (5)	3 (2)		
Others	4 (3)	3 (2)		
Place of residence				
Rural	14 (11)	15 (12)	5.771	0.449
Urban/town	36 (28)	41 (32)		
Metropolitan city	11 (9)	10 (8)		
Annual family income (Rs.), mean±SD	348151.79±278826.598	426370±536931.193		
Previous experience of dissection				
Yes	41 (32)	45 (35)	1.684	0.996
No	19 (15)	20 (16)		
History of physical illness				
Yes	50 (39)	49 (39)	2.512	0.867
No	12 (9)	15 (12)		
Death of a family member/friend in recent past				
Yes	22 (17)	22 (17)	1.187	0.756
No	39 (31)	44 (35)		
Participation in death rituals and ceremonies				
Yes	40 (31)	40 (31)	3.811	0.283
No	21 (17)	26 (20)		
Uneasy in visiting death places				
Yes	26 (20)	20 (16)	3.935	0.269
No	35 (28)	46 (36)		
Caregiver for ill and dying				
Yes	14 (11)	9 (7)	0.602	0.896
No	47 (37)	51 (40)		
Witnessed accidents involving human death				
Yes	13 (10)	9 (7)	1.758	0.624
No	48 (38)	57 (45)		
Direct exposure to natural calamity				

Contd...

Table 1: Contd...

Sociodemographic characteristics	Group, frequency (%)		χ^2	P
	Control (<i>in vivo</i>) group (n=62)	Experimental (<i>in vitro</i>) group (n=65)		
Yes	7 (6)	5 (4)	0.788	0.852
No	54 (46)	61 (48)		
Trait anxiety score				
Trait anxiety			3.486	0.746
No or low anxiety	23 (18)	26 (20)		
Moderate anxiety	18 (14)	21 (17)		
Severe anxiety	20 (16)	19 (15)		

SD=Standard deviation

Table 2: Comparison of the effect of *in-vitro* and *in-vivo* exposure on outcome variables (N=127)

Variables and time of assessment	Control (<i>in vivo</i>) group (n=62)		Experimental (<i>in vitro</i>) group (n=65)		P (Mann-Whitney test)
	Mean±SD	Median	Mean±SD	Median	
Anxiety					
Trait anxiety (STAI-Y2)	42.00±9.50	41.00	40.80±7.60	40.00	0.700
State anxiety (STAI-Y1)	34.00±11.50	31.00	29.90±7.50	30.00	0.019a
Disgust propensity					
Pretest	16.60±4.00	16.00	16.00±3.20	16.00	0.368
Posttest	13.10±3.90	13.50	12.60±4.00	13.00	0.442
Disgust sensitivity					
Pretest	13.50±4.40	13.00	12.90±4.30	13.00	0.586
Posttest	13.10±3.90	10.00	10.30±3.30	9.50	0.682
Death attitude profile - Revised Total					
Pretest - Total	133.60±23.00	135.50	134.50±24.90	137.00	0.788
Posttest - Total	128.50±25.70	130.00	123.80±24.10	126.00	0.280
Death attitude profile - Revised - Domain wise					
Fear of death - Pretest	25.70±8.00	26.00	25.70±9.90	26.00	0.881
Fear of death - Posttest	23.30±8.60	21.00	22.80±9.30	23.00	0.870
Death avoidance - Pretest	22.10±7.60	23.00	22.60±7.20	25.00	0.777
Death avoidance - Posttest	21.80±8.10	23.00	20.60±8.60	23.00	0.449
Neutral acceptance - Pretest	30.00±3.80	30.00	30.70±3.20	31.00	0.370
Neutral acceptance - Posttest	30.20±3.90	31.00	30.70±3.70	31.00	0.394
Approach acceptance - Pretest	40.40±11.60	42.50	40.90±13.20	41.00	0.935
Approach acceptance - Posttest	38.70±13.50	40.50	36.60±13.20	35.00	0.288
Escape acceptance - Pretest	15.20±7.60	13.00	14.60±7.10	14.00	0.698
Escape acceptance - Posttest	14.60±7.30	13.00	13.20±7.10	11.00	0.241

*Paired t-test. SD=Standard deviation

However, students may experience tension and anxiety as a result of their exposure to human cadavers. The present study compared and evaluated the effect of *in-vitro* and *in-vivo* exposure on cadaveric anxiety, disgust propensity and sensitivity, and attitude toward death and dying among 1st-year medical and nursing students.

Cadaver-based learning involves the actual dissection of bodies by medical or nursing students under the guidance of trained teachers and the study of prosected specimens in which individual human body structures are dissected and exhibited by professional dissectors.

Studies have documented that students of health sciences show several feelings (ambivalent emotions), such as anxiety, fear, excitement, and tension before their first cadaver dissection.^[13] Majority of the students seem to

consider the dissection room as slightly or highly stressful and have reported fear and nausea during initial exposure while their interest and excitement have increased on subsequent exposure to dissection ($P < 0.05$).^[14] Another study has mentioned that 34.7% of students experienced different levels of fear on exposure to the dissection room practical sessions. Many students experienced anxiety in reaction to dissection.^[15-17]

The present study revealed that more than half of (control and experimental group) the students had moderate-to-severe traits as well as state anxiety [Table 1 and Figure 2]. Similar findings were noted in a study that reported medium level of anxiety was detected in the students in their first encounter with the cadaver. The mean state anxiety score of students was 42.6 ± 5.60 and the mean trait anxiety score was 46.6 ± 5.0 .^[18] Besides, Bernhardt *et al.* carried out a study

to distinguish between concerns related to dissection and individual experiences and anxiety because of deceasing or death among 1st-year students. It was found that about 50% of the students started the course with emotional stress and about one-tenth of them were very worried about the confrontation with corpses.^[19]

The present study showed that majority (62%) of the participants from both the groups had been involved in death rituals and ceremonies in the past, as well as 34% of them, had experienced the death of a family member/friend in the recent past. Similar results were found in another study which mentioned that majority of the control and experimental group students had an experience in seeing a dead body or bereavement before the entrance to dissecting room. It may be assumed that as part of normal human experience, 62% have been exposed to death before encountering cadaver dissection.^[6,20]

The current study evaluated the effect of *in vitro* exposure, i.e., video demonstration of cadaver dissection and found that there was a statistically significant difference in mean scores of cadaveric anxiety measured via the construct of state anxiety between the experimental group ($P = 0.019$). This finding is in concurrence with other studies which revealed that the influence of video demonstration of cadaver dissection had reduced the anxiety of students of health sciences.^[13-16]

However, another study has revealed that there was no difference between an orientation lesson (Group A) group and students without an orientation lesson (Group B) in the state and trait anxiety levels, belief in life after death.^[21] Similarly, counseling for psychological and physical problems related to cadaver dissection was not beneficial.^[20] Despite all emotional issues, the students of health sciences still prefer dissection over plastic models and other audio-visual aids.^[22]

Furthermore, in our study, there was a reduction in total mean scores of attitudes of death and dying in the experimental group compared with pretest mean scores. Likewise, Mc Garvey *et al.* examined and compared the impact of anatomy learning in the lab using plastic anatomical specimens on death and dying among nursing students. The students using cadavers felt significantly more stressed and reported significantly more symptoms than those using plastic specimens after their first lesson. While a large proportion of the students using both cadavers (97%) and plastic specimens (88%) found their learning experiences positive, 43% of the respondents using cadavers stated that as a result of this experience they felt more prepared to deal with death in a hospital and that they were happy to see death in a stress-free

environment. The responses from the group using plastic specimens were positive as essentially, they had found the theory easier to learn.^[22] It is essential to understand the nature of anxiety reaction as it helps in controlling it. This control can be exercised directly by the Anatomy instructor by using simple, quick, and cheap methods such as showing a dissection video the student would perform in a similar setting.^[23]

The present study revealed that the total mean scores of disgust propensity and sensitivity reduced after the video exposure of cadaver dissection among medical and nursing students but it was not significant.

Limitations and recommendation

The current study is limited to a single center and used a single session of video intervention before exposing students to dissection. Anxiety is also one of the reasons given to remove or minimize the dissection of cadavers from medical education. Despite its limitations, indeed, our research confirms that showing students dissection videos that they will encounter for the first time decreases their level of uncertainty and hence their reaction to their first experiment with anxiety. The present study is one of its kind that measured the disgust propensity and sensitivity and attitudes of death and dying among students of health sciences. Future studies might include a virtual simulation of cadaver dissection to overcome the emotional problems of students of health sciences. Further, qualitative data from interviews and observations should be added to complement the self-report questionnaires.

Conclusion

The present study highlighted that there was a reduction in mean scores of anxiety, disgust propensity and sensitivity, and attitudes of death and dying among medical and nursing students. The dissection video has more benefits for all students of health sciences as it prepares the students psychologically. A preparatory session such as video dissection would be of great help for students from low- or middle-income countries to overcome the anxiety related to the cadaver, attitudes of death, and dying. Educational assistance by video dissection and hands-on workshops can be effective in defining their professional identity, making the experience of the anatomy room positive and also challenging.

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Conflicts of interest

There are no conflicts of interest.

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