Medical Students' Awareness, Knowledge, and Attitudes toward Basic Life Support at King Faisal University, Saudi Arabia

Ola Mousa[1,2]*, Ghadeer Aqeel Alghafli[1], Kawther Abdullah Alomran[1], Heba Adel Alhawal[1] and Aml Sayed Abdelrahem[1,2]

[1]*College of Applied Medical Sciences, King Faisal University, Saudi Arabia.*

[2]*Faculty of Nursing, Minia University, Egypt.*

*Correspondence:
Ola Mousa, College of Applied Medical Sciences, King Faisal University, Saudi Arabia.

Received: 29 Sep 2022; **Accepted:** 01 Oct 2022; **Published:** 06 Oct 2022

ABSTRACT

Background: Life-threatening emergencies can strike anytime, anywhere, and to anyone. The consequences of cardiopulmonary arrest are devastating, and the mortality rate is very high. Cardiopulmonary resuscitation (CPR) is initiated during cardiac arrest and involves breathing and chest compressions to supply immediate blood to the brain. CPR success rates vary depending on the circumstances of cardiopulmonary arrest (in-hospital as opposed to out-of-hospital, witnessed versus unwitnessed, Etc.) and the knowledge and skills of the health care personnel.

Aim: This study aimed to determine the knowledge of BLS and related skills among undergraduate students from King Faisal University's medical colleges.

Materials and Methods: a descriptive cross-sectional study was conducted between May 11 and July 15, 2022, with King Faisal University Students, Medical Colleges. The sample size of this study was 479. A structured questionnaire was utilized to assess participants' levels of awareness, practical knowledge, and attitudes toward BLS.
Results: The results revealed a low level of students' awareness of BLS. Only 59 (12.8%) of the respondents showed good knowledge of cardiopulmonary resuscitation (CPR) in newborns and adults. only 45 (9.8%) of the respondents had good knowledge about the choking of adults and infants. Only 15 (3.2%) of the participants had a "good" understanding of all BLS items. The study results also indicated that senior students were likelier than junior students to have good BLS knowledge, a statistically significant relationship. Attending BLS training classes and traditional sources of information were significant predictors of having good BLS knowledge.

Conclusion: The study's findings revealed that medical and health college students had just a fair understanding of BLS. This finding indicates the essential need for ongoing refresher courses for this vital subject, particularly in the wake of pandemics like COVID-19.

Keywords

Awareness, Basic Life Support, CPR, Medical Students, Saudi Arabia.

Introduction

There are three broad causes of death, in order of the total deaths: cardiovascular disease and stroke, respiratory disease, and neonatal conditions. Worldwide, 55% of deaths were caused by the top 10 causes [1].

The consequences of cardiopulmonary arrest are devastating, and the mortality rate is very high. During cardiac arrest, cardiopulmonary resuscitation (CPR) involves breathing and chest compressions to supply immediate blood supply to the brain [2]. CPR success rates vary depending on the circumstances of cardiopulmonary arrest (in-hospital as opposed to out-of-hospital, witnessed versus unwitnessed, Etc.) and the knowledge and skills of the health care personnel [3].

As part of basic life support, it is necessary to recognize signs of sudden cardiac arrest, heart attacks, strokes, and foreign bodies obstructing airways [4], and to perform cardiopulmonary resuscitation and automated external defibrillation. During resuscitation, the primary goal is to maintain adequate ventilation and circulation, which is critical to ensuring a patient's survival [5]. Basic life support (BLS) is essential for the public since it significantly increases survival rates for emergency patients, especially those suffering from cardiac arrest, stroke, or foreign body obstruction [6].

Rather than following the airway, breathing, and compressions sequence of the 2005 CPR guidelines, the 2010 CPR guidelines emphasize the importance of high-quality chest compressions, recommending compressions, airway, and breathing sequence to minimize delays in the initiation of compressions and resuscitations [7]. Since 2010, out-of-hospital CPR survival rates have significantly improved, as well as neurologic disability rates [8].

Cardiopulmonary resuscitation (CPR) success is determined mainly by the proficiency level of the individual in basic and advanced life support [9]. In order to save lives in an emergency, BLS should therefore be substantially known by the general public and required of all healthcare professionals [10].

High education is the source of an advanced workforce in most countries. Hence, reforming educational programs and examining reasons for impacting learners are highly significant for educational institutions and educators [11]. Knowledge and awareness of BLS among Saudis are of prime importance, and this has been tested earlier in different sub-populations in the kingdom [12]. High education is the source of an advanced workforce in most countries. Hence, reforming educational programs and examining reasons for impacting learners are highly significant for education institutions and educators. These outcomes assume that there is still much to be completed to develop further CPR success rates, including explicit methods and quick reaction frameworks, yet better abilities and information on the new generation of medical services suppliers [3]. All employees in the health sector should have BLS training. In addition, proper practice of the techniques and maneuvers is mandatory to effectively resuscitate a victim, which requires adequate knowledge and training during medical and health colleges' education years. Consequently, this study aimed to determine the knowledge of BLS and related skills among undergraduate students from King Faisal University's medical colleges.

Methods
Study Design
We conducted a descriptive cross-sectional study at King Faisal University in Al Ahsa, Saudi Arabia.

Study Area/Setting
The study was conducted between May 11 and July 15, 2022, with King Faisal University Students, Medical colleges.

Study Subjects
The sample size of this study was 479 when the proportion of awareness was taken to be 50%, and the relative precision was 5% with a confidence interval of 98%. All levels of each college in the randomly selected class groups were included in the selection of subjects from all medical colleges.

Ethical Considerations
The Institutional Review Board (IRB) of King Faisal University, "Number: KFU-REC-2022- MAY -EA000631," approved this study on May 10, 2022. A letter of informed participation summarizing the aims and objectives of the project was given, and the administered questionnaire. Participants were given the option to participate or not in this study. An anonymity policy and confidentiality agreement protected participants' privacy.

Data Collection methods, instruments used, measurements
A structured questionnaire was utilized to assess participants' levels of awareness, practical knowledge, and attitudes toward BLS. A review and analysis of previous surveys and studies of basic life support helped build the item pool of the questionnaire. Questions from published studies were formulated into a structured closed-ended questionnaire [10,13]. Aside from the previous BLS experience and training, the skills and attitude toward BLS were also evaluated. Respondents completed a structured and pretested questionnaire administered by an interviewer. Before answering the questionnaire, all participants agreed to participate. A total of 40 students pretested the questionnaires. Two experts also reviewed the questionnaire to ensure its reliability. A validated Arabic-language questionnaire was administered, including 19 items assessing knowledge and attitudes about BLS. The questionnaire consists of two parts. The first part concerns demographic data, including age, college level, gender, Etc. The second part contains questions aimed at assessing knowledge and practices related to BLS with total items of 19 questions. One point is given for the correct answer to each question. The knowledge score is arranged as poor knowledge equal to 0-9 correct answers, proper knowledge equal to 10-15 correct answers, and good knowledge equal to 16-19 correct answers (good (≥80%), fair (50-79%), and poor (<50).

Data Management and Analysis
SPSS version 22 was used to analyze the results. Analysis of variance was used to examine the associations between these variables and awareness of BLS between participants. Results are shown in tables and a P-value less than 0.05 is considered significant.

Results
A total of 461 participants completed the questionnaire, with a response rate of 96.2%. The demographics of the participants are presented in Table (1). The majority of them, 315 (68.3%), were females. Almost half of the participants (238/51.6%) had high monthly family incomes. According to the survey, 217 (47.1%) participants and 110 (23.9%) participants obtained information about basic life support and cardiopulmonary resuscitation (CPR) from university subjects and the internet, respectively. Among the respondents, 268 (58.1%) have first aid training.

Table 1: Demographic Characters of Participants.

Item	Number	Percent
Gender:		
Male	146	31.7
Female	315	68.3
Family Income?		
Less than 5,000 SR	81	17.6
5,000-10,000 SR	142	30.8
More than 10,000 SR	238	51.6
College		
Medical College	160	34.7
CAMS	80	17.4
Dental	60	13
Pharmacy	78	16.9
Veterinary College	83	18
College-level?		
First	140	30.4
Second	103	22.3
Third	86	18.7
more	132	28.6
Source of the reader information about Basic Life Support and Cardiopulmonary resuscitation (CPR)?		
Reading	60	13
TV movies and series or internet	110	23.9
School subject and activities	74	16.1
University subject	217	47.1
Does the reader have a first aid subject in college?		
Yes	302	65.5
No	159	34.5
Did the reader have training in first aid?		
Yes	268	58.1
No	193	41.9
Did the reader experience an emergency in life?		
Yes	199	41.9
No	262	58.1
Does the reader think incorporating a specialized first aid curriculum into the medical colleges helps raise students' awareness?		
Yes	403	87.4
No	58	12.6

(Table 2) shows participants' knowledge of infants' and adults' cardiopulmonary resuscitation (CPR). Most 371 (80.5%) participants were familiar with the BLS acronym. Approximately 325 (70.5%) reported that they knew the emergency medical service number. 163 (35.4%) recognize the recommended Basic life support (BLS) sequence for 2020, according to the International Liaison Committee on Resuscitation (ILCOR) guidelines. Nearly half of respondents, 255 (55.3%), indicated that commencing chest compressions within 10 seconds of realizing cardiac arrest, pushing hard and quickly, and minimizing interruptions are all proper CPR techniques in response to the question concerning the essential elements of CPR. According to the survey, only one-third of 182 respondents (39.5%) replied that they would activate emergency medical services (EMS) or call for help as first step in case of loss of consciousness. Nearly half of respondents, 256 (55.5%), said that a head tilt chin lift was the best method for opening the airway. 202 (43.8%) respondents were able to answer the question about opening an airway in a head trauma victim by using jaw thrust. 301 (65.3%) of respondents answered 100-120 beats/minute as the correct chest compression rate for adults and children. When asked about adults' correct chest compression depth, 201 (43.6%) replied between 1 1/2 and 2 inches. Nearly half

the respondents, 223 (48.8%), answered correctly when asked how to use an automated external defibrillator (AED). In response to the question about the correct chest compression depth for children, nearly one-third 156 (33.8%) answered one-half to one-third. In response to the question about the compression area, nearly two-thirds 292 (63.4%) answered the middle of the chest below the sternum. In the question about whether the victim responds to chest compression, the majority, 287 (62.3%), chose to place him on the side-lying position "recovery position. Cardiopulmonary resuscitation (CPR) is initiated when the patient is unresponsive, and without a pulse, 291 (63.1%) respondents answered. A total of 277 (60.1%) answered about the chest compression/ventilation ratio in adults and children with 30 compressions /2 breaths. In general, only 59 (12.8%) of the respondents showed good knowledge of cardiopulmonary resuscitation (CPR) in newborns and adults.

Table 2: Responses to Questions Regarding Awareness about Cardiopulmonary Resuscitation (CPR) In Infants and Adults.

Item	Number	Percent
1. What does the abbreviation BLS stand for?		
a. Best Life Support	42	9.1
b. Basic Life Support	371	80.5
c. Basic Lung Support	25	5.4
d. Basic Life Services	23	5
2. What is the emergency medical service number?		
a/999	32	6.9
b/998	57	12.4
c/997	325	70.5
d/ I do not know	47	10.2
3. What is the recommended Basic life support (BLS) sequence for 2020 the International Liaison Committee on Resuscitation (ILCOR) guidelines?		
a. Chest compressions, Airway, Breathing	163	35.4
b. Airway, Breathing, Check pulse	151	32.8
c. Airway, Breathing, Chest compressions	147	31.9
4. What are the vital characteristics of Cardiopulmonary resuscitation (CPR)		
a . Starting chest compressions within10 seconds of recognition of cardiac arrest	135	29.3
b . Pushing hard and fast	45	9.8
c . Minimizing interruptions	26	5.6
d . All the above	255	55.3
5. What should the reader's immediate action be in the case of confirming somebody is not responding after shaking and shouting at him?		
a . Start Cardiopulmonary resuscitation (CPR)	190	41.2
b . Activate Emergency medical services (EMS)	182	39.5
c . Put him in a recovery position	64	13.9
d . Observe the victim	25	5.4
6. How to open the airway of a victim without any trauma?		
a . Head tilt chin left	256	55.5
b . Jaw thrust	105	22.8
c . Side-lying position	100	21.7
7. How to open the airway in a head trauma victim?		
a. Jaw thrust	202	43.8
b. Head tilt chin left	150	32.5
c. Side-lying position	109	23.6
8. What is the correct rate of chest compression for adults and children?		
a. 100-120 b / min	301	65.3
b. 150 / min	49	10.6
c. 80 / min	70	15.2
d. 70 / min	41	8.9

		Frequency	Percent
9. What is the correct depth of chest compression for adults?			
a. 1½ – 2 inches		201	43.6
b. 2½ – 3 inches		154	33.4
c. 1 – 1½ inches		68	14.8
d. ½ – 1 inch		38	8.2
10. When operating an automated external defibrillator (AED), what are the correct steps to follow?			
a. Power on the AED, attach electrode pads, shock the individual, and analyze the rhythm		126	27.3
b. Power on the AED, attach electrode pads, analyze the rhythm, clear the individual, and deliver shock		223	48.4
c. Attach electrode pads, check pulse, shock individual, and analyze rhythm		61	13.2
d. Check pulse, attach electrode pads, analyze rhythm, shock patient		51	11.1
11. What is the correct depth of compression for children?			
a. 1½ – 2 inches		129	28
b. 2½ – 3 inches		71	15.4
c. One-half to a one-third depth of chest		156	33.8
d. ½ – 1 CM		105	22.4
12. Where will give the compression? ("area" of compressions)			
a/ on the middle of the chest, on the lower part of the sternum		292	63.3
b/ on the right side		49	10.6
c/ on the left side		63	13.7
d/ the reader does not know		57	12.4
13. What will you do if the victim shows a response after chest compression?			
a/ let him/her lie down		78	16.9
b/ put him on the side-lying position "recovery position"		287	62.3
c/ try to let him/her stand up		51	11.1
d/ nothing just talking to the victim		45	9.8
14. When to start Cardiopulmonary resuscitation (CPR)?			
A/ when someone collapses on the ground		83	18
B/ when someone with no breathing and no pulse		291	63.1
C/ with someone falling to the ground		37	8
D/ the reader does not know		50	10.8
15. What will be the ratio of chest compression and ventilation in adults and children?			
a. 1 compression /20 breath		21	4.6
b. 30compression /2 breath		277	60.1
c. 10compression /1 breath		81	17.6
d. 40compression /3 breath		82	17.8
The mean score of knowledge regarding awareness about Cardiopulmonary resuscitation (CPR) of infants and adults	8.1909		
		Frequency	Percent
Good		59	12.8
Fair		226	49.0
Poor		176	38.2
Total		461	100.0

Table 3 shows the responses to questions about choking in adults and infants. Nearly a third (171) (37.1%) of respondents to the question concerning the standard indication for choking responded by placing their hands over their necks. 218 (47.3%) people responded that their initial action when they see someone showing indications of choking is to encourage them to cough. 214 (46.4%) people say they will give five back strikes and five chest thrusts to a choking baby. When asked how the hands move when making an abdominal fist, 241 (52.3%) people responded quickly and upwards. In general, only 45 (9.8%) of the respondents had good knowledge about the choking of adults and infants.

Table 3: Responses to Questions Regarding Awareness about Choking of Adults and Infants.

Item	Number	Percent
1. What is the universal sign that appears when choking happens?		
a. Coughing	187	40.6
b. Shouting	48	10.4
c. Nervousness	55	11.9
d. Putting a hand over the neck	171	37.1
2. What will be your first response when you see someone "adult" choking?		
1- Give him/her a cup of water.	76	16.5
2-encourage him to cough.	218	47.3
3-Slap his/her back	123	26.7
4. I do not know	44	9.5
3. For a choking infant what will you give?		
a. 5 Abdominal thrust	88	19.1
b. 5 Chest thrust.	90	19.5
c. 5 Back blows and 5 chests thrust	214	46.4
d. 10 Back blows	69	15
4. The movement of the fist during abdominal fist is:		
a. Quick, upward	241	52.3
b. Quick, inward	117	25.4
c. Slow, inward	54	11.7
d. Slow, upward	49	10.6
Mean score	1.8308	
Good	45	9.8
Fair	83	18.0
Poor	333	72.2
Total	461	100.0

Table 4 illustrates the knowledge score of the participants. The scores of all knowledge-related items in the questionnaire were combined based on correct and incorrect answers to determine the level of knowledge of BLS. For each question, the correct response received a score of 1, while the wrong response received a 0. Therefore, a participant's highest knowledge score for the BLS knowledge section was 19, and the lowest score was 0. Our study population's mean overall knowledge score was found to be 9.5401 ± 3.2. Only 15 (3.2%) of the participants had a "good" understanding of BLS.

Table 4: Total Knowledge Score.

	Frequency	Percent
Good (80% and above)	15	3.2
Fair (50 to less than 80%)	223	48.4
Poor (less than 50%)	223	48.4
Mean	9.5401±3.2	

Table 5 shows the correlations between the demographic characteristics of the participants and knowledge scores. The relationships between students' knowledge scores and the contributing factors are shown in Table 5. It was shown that there is no relationship between a student's gender and their knowledge levels, while there is a slight propensity for female students to know more. It was discovered that there is a considerable correlation between family income and knowledge scores, with high knowledge scores attained by considerably more high-income students. There was no significant difference between students from various health colleges. In order to determine the effects of the academic year, the information source, and attending

the BLS training course, a correlation analysis was also carried out. Senior students were likelier than junior students to have good BLS knowledge, a statistically significant relationship. Attending BLS training classes and traditional sources of information were significant predictors of having good BLS knowledge.

Table 5: Correlation between the Score of BLS Knowledge and Its Associated Factors.

		Sum
Gender	Pearson Correlation	-0.043
	Sig. (2-tailed)	0.360
Family Income?	Pearson Correlation	.104[*]
	Sig. (2-tailed)	.025
College?	Pearson Correlation	-.040-
	Sig. (2-tailed)	.386
College-level?	Pearson Correlation	-.092-[*]
	Sig. (2-tailed)	.048
Source of your information about Basic Life Support and Cardiopulmonary resuscitation (CPR)?	Pearson Correlation	.220[**]
	Sig. (2-tailed)	.000
Did you have training in first aid?	Pearson Correlation	.230[**]
	Sig. (2-tailed)	.000

. Correlation is significant at the 0.01 level (2-tailed).

Discussion

Health care professionals should possess sound knowledge and adequate skills to perform BLS [14]. This is because life-threatening emergencies can strike anytime, anywhere, and to anyone [15]. Thus, understanding the cycle of survival helps increase one's chances of surviving and recovering from emergencies like heart attacks, strokes, and other emergencies. This chain entails prompt detection of cardiac arrest, activation of the emergency response system, prompt defibrillation, and efficient advanced life support with cardiac arrest management [16].

In our study, 51.6% of the participants received greater than 50% knowledge scores. This results in line with many studies in which medical students and interns showed adequate knowledge about BLS [14,17]. This result contradicts other research on medical students published in the literature, which revealed marginally lower knowledge levels of only 5% in Egypt, 17% in Pakistan, and 19% in the Netherlands, respectively [4,18,19]. The current BLS importance following COVID-19 may affect these results.

Our study found that nearly 42% of participants had not been trained in first aid. In contrast to Adewale BA's study, 29.7% of his subjects had undergone CPR training [20]. The results may be affected by the world changes after COVID-19 pandemic.

In the current study, there was a slight but not statistically significant difference in the mean knowledge score between males and females (mean score 9.1986 ± 2.89261 vs. 9.6984 ± 3.66267). This result is consistent with Al-Shamiri HM, 2017, who found that males (45.31%) and females (45.41%) both exhibited strong BLS knowledge [21]. This finding is consistent with past research that found that women had higher mean scores than men overall [22,23]. This result might be explained by the fact that female

students are more studying than male students, thus earning more marks [24,25].

Conclusion

It is an art to resuscitate a patient. Practice, training, reading, and experience are required to improve their performance. The study's findings revealed that medical and health college students had just a fair understanding of BLS. This finding indicates the essential need for ongoing refresher courses for this vital subject, particularly in the wake of pandemics like COVID-19. The consequences of insufficient knowledge can include failing to rescue the victim, injuring the victim, and being exposed to the victim's secretions. Therefore, BLS and other resuscitation skills should be included in the undergraduate curriculum in the first year, and students must be able to master these skills.

Data Availability

The entire data set is available without restriction.

References

1. World Health Organization. (2020). The top 10 causes of death. https://www.who.int/news-room/fact-sheets/detail/the-top-10-causes-of-death

2. Fowler R, Chang MP, Idris AH. Evolution and revolution in cardiopulmonary resuscitation. Curr Opin Crit Care. 2017; 23: 183-187.

3. Park IY, Ju YS, Lee SY, et al. Survival after in-hospital cardiopulmonary resuscitation from 2003 to 2013 An observational study before legislation on the life-sustaining treatment decision-making act of Korean patients. Medicine Baltimore. 2020; 24: 21274.

4. Chandrasekaran S, Kumar S, Bhat SA. Awareness of basic life support among medical dental nursing students and doctors. Indian J Anaesth. 2010; 54: 121-126.

5. Sasson C, Rogers MA, Dahl J, et al. Predictors of survival from out-of-hospital cardiac arrest a systematic review and metaanalysis. Circulation Cardiovasc Qual Outcomes. 2010; 3: 63-81.

6. American Heart Association Guidelines for Cardiopulmonary Resuscitation and Emergency Cardiovascular Care. Part 1: Introduction. Circulation. 2005; 112.

7. Hazinski MF, Nolan JP, Billi JE, et al. Part 1: Executive Summary: 2015 International Consensus on Cardiopulmonary Resuscitation and Emergency Cardiovascular Care Science With Treatment Recommendations. 2015; 2: 250-275.

8. Larribau R, Deham H, Niquille M, et al. Improvement of out-of-hospital cardiac arrest survival rate after implementation of the 2010 resuscitation guidelines. PLoS One. 2018; 13: 0204169.

9. Aroor AR, Saya RP, Attar NR, et al. Awareness about basic

life support and emergency medical services and its associated factors among students in a tertiary care hospital in South India. J Emerg Trauma Shock. 2014; 7: 166-169.

10. Forouzan A, Verki MM, Khabazipour A, et al. Basic life support awareness among resident doctors medical students nursing experts health care providers and their assistants in Southwest Iran. Med Stud. 2018; 1: 203-210.

11. Ahmad A, Akhter N. Knowledge of basic life support among the students of Jazan University Saudi Arabia Is it adequate to save a life. 2018; 54: 555-559.

12. Mousa O, Al Atiyah M, Al Hussain A, et al. Basic life support awareness among non-medical students at King Faisal University Al Ahsa Saudi Arabia. Journal of Nursing Education and Practice. 2023; 13: 1.

13. Narayan DP, Biradar SV, Reddy MT, et al. Assessment of knowledge and attitude about basic life support among dental interns and postgraduate students in Bangalore city India. World J Emerg Med. 2015; 6: 118-122.

14. Dixit S, Dahal S, Dixit PB, et al. Awareness of Adult Basic Life Support among Graduates in a Medical College of Kathmandu. J Nepal Soc Perio Oral Implantol. 2020; 4: 73-77.

15. Businger A, Rinderknecht S, Blank R, et al. Students' knowledge of symptoms and risk factors of potential life-threatening medical conditions. Swiss Med Wkly. 2010; 140: 78-84.

16. Khader K, Al-Ghamdi AN, Youssef HAM, et al. Awareness and knowledge of health-college students of cardiopulmonary resuscitation at Taif university Saudi Arabia. Int J Multidisciplin Curr Res. 2016; 348-351.

17. Al-Werdani MM, Mokhtar AM, Ebead AK, et al. Basic Life Support Knowledge of Medical Students A Single Faculty Study in Egypt. Arch Emerg Med Crit Care. 2018; 3: 1044.

18. Tan ECTH, Severien I, Metz JCM, et al. First aid and basic life support of junior doctors A prospective study in Nijmegen the Netherlands. Med Teach. 2006; 28: 189-192.

19. Adewale BA, Aigbonoga DE, Akintayo AD, et al. Awareness and attitude of final year students towards the learning and practice of cardiopulmonary resuscitation at the University of Ibadan in Nigeria. African J Emergency Med. 2021; 11: 182-187.

20. Al-Shamiri HM, Al-Maweri SA, Shugaa-Addin B, et al. Awareness of basic life support among Saudi dental students and interns. Eur J Dent. 2017; 11: 521-525.

21. Reddy S, Doshi D, Reddy P, et al. Awareness of basic life support among staff and students in a dental school. J Contemp Dent Pract. 2013; 14: 511-517.

22. Chew KS, Yazid MN. The willingness of final year medical and dental students to perform bystander cardiopulmonary resuscitation in an Asian community. Int J Emerg Med. 2008; 1: 301-309.

23. Hassan N, Hassan T. Female Students get More Marks as Compared to Male Students A Statistical Study. J Bus Fin Aff. 2016; 5: 226.

24. O'Dea RE, Lagisz M, Jennions MD, et al. Gender differences in individual variation in academic grades fail to fit expected patterns for STEM. Nat Commun. 2018; 25: 3777.