Original Article

DOI: 10.7860/JCDR/2021/51396.15547

Knowledge and Attitude about Stem Cells and their Potential Applications in Field of Medicine among Medical Students of Arar, Saudi Arabia

Physiology Section

TEHREEM AFTAB[1], EHTISHAM KHYZER[2]

ABSTRACT

Introduction: The use of stem cell has opened new avenues in the management and cure of diseases in modern era. They have enabled us to achieve remissions and cure in malignancies. They have enormous ability of stimulating the repair process in diseased and damaged tissue. As the medical specialists are a reliable source of information, so their knowledge and approach are vital in counselling the patients regarding the use of stem cells as an advanced treatment option.

Aim: To assess the knowledge and attitude level about stem cells and their therapeutic applications among medical undergraduates.

Materials and Methods: This cross-sectional study was carried out for a period of six months from January 2021 to June 2021. It included 150 MBBS students (2nd to final year) of Northern Border University (NBU), Arar, Saudi Arabia. A well-structured questionnaire was used to collect data after obtaining informed consent. It included 15 statements to assess knowledge and 10 statements about attitude. The total knowledge and attitude scores were calculated for each student and classified as poor, moderate or high score. The knowledge and attitude scores were correlated using Pearson's correlation.

Results: Majority of the participating students were males (63.3%) with mean age of 23.62±1.5. Adequate knowledge about stem cells was observed in 65.3% of students while 10% had excellent knowledge. An overall positive attitude was reported with a mean score of 36.9±3.71. There was a low positive relationship between knowledge and attitude scores with p-value <0.001 and Pearson's score(r) of 0.396.

Conclusion: The study indicates an overall good knowledge and positive approach towards stem cell use in medicine among medical undergraduates. It is suggested to organise comprehensive training sessions and update the curriculum regarding recent developments in stem cell research to further enhance students' awareness and attitude.

Keywords: Awareness, Embryonic stem cells, Medical undergraduates, Positive approach

INTRODUCTION

Stem cells play a vital role in repair of the body. They help to maintain and regenerate organs and tissues. They replace dead cells and renew injured tissues [1]. They have tremendous capability to repair and develop into specialised cells [2]. They are found both in embryos and adults. They can be unipotent, pluripotent or totipotent. Unipotent cells develop into single adult cell type while pluripotent can mature to many different cell types. Totipotent stem cells can develop to all kinds of cells present in fetus [3]. The sources of stem cells are blood in the umbilical cord and placenta (umbilical cord stem cells), foetal tissue (embryonal stem cells) and blood, tissue or bone marrow (adult stem cells) [4].

The stem cells collected from embryo are non specific and can develop into any type of cell in human body [5]. Therefore, they can be utilised to provide various tissue types needed in treating Parkinson's, Alzheimer's, spinal cord injuries and cardiac disease. However, use of embryonic stem cells is associated with ethical, social and legal concerns because it includes destruction of embryos for collection of cells [6]. Collecting cells from blood of umbilical cord and adults doesn't involve damage and are therefore preferred. The cells collected from blood of umbilical cord are highly proliferative and have tremendous capacity of self-renewal. They are safe to collect and have no ethical concerns [7]. The adult type of stem cells can be obtained from any organ of human body and are best for autologous transplantation. Cardiac stem cells have been used to repair injury caused by heart attacks [8].

It is essential to recognise the importance of recent developments in stem cell therapy which are needed to promote regenerative medicine [9,10]. An increased incidence of fatal degenerative diseases of the nervous system, heart, liver, pancreas, and other organs has been reported in recent years [11]. In these circumstances, use of stem cells can provide big relief to patients with chronic diseases like diabetes, Parkinson's, and Huntington's diseases [12]. The prospects of stem cell-based treatment are bright so it is essential for medical practitioners to keep up-to-date information of progress in stem cell therapy.

Research related to stem cells is currently being done in many Arab countries. In Saudi Arabia, many Institutions are doing research on stem cells [13]. King Abdullah International Medical Research Centre has developed a stem cell registry showing more than 10,000 donors and the Cord Blood Bank [14].

The benefits and possible future use of stem cells are, however, not commonly known by the general population in Saudi Arabia. Thus professional healthcare provider's doctors and paramedical staff must educate and guide patients to ethically implement stem cell based therapy. The information being provided to patient should be precise which help them in making unbiased decision. The knowledge and attitude of medical graduates can influence patient's decision regarding use of stem cells. The current study was, therefore, planned to measure and correlate the knowledge and attitude scores of medical students about stem cell and its applications.

MATERIALS AND METHODS

This cross-sectional study was conducted for a period of six months (January 2021 to June 2021) among 2nd to final year MBBS students of Northern Border University (NBU), Arar, Saudi

Arabia. The study was carried out after obtaining Ethical approval from Local Committee for Bioethics (LCBE) at NBU (Approval no: 03/42/H). Written consent was obtained from all participants after explaining the study protocol, its voluntary nature and the secrecy of the responses.

Sample size calculation: The sample size was estimated using Cochrane's sample size formula ($n=z^2pq/e^2$), where,

n=minimum sample size

z=confidence interval (95%)

p=proportion (50%)

q=1-p

e=level of precision (5%).

The population proportion (p) was taken as 50%. With a finite population of 245, the estimated sample size was calculated as 150. Random convenient sampling was done to obtain 150 respondents.

Inclusion and Exclusion criteria: Any student from 2nd to final year MBBS who wanted to participate was included in the study. Students who were reluctant to participate were excluded.

The data was obtained from the students by using a self-administered questionnaire. It was prepared in English language by the investigators after reviewing the pertinent literature related to stem cells and their use in medicine. A pilot study was done among 30 medical students of NBU using this questionnaire. The Cronbach Alpha coefficient was calculated to be 0.8 in order to assess the internal consistency of questionnaire. The students enrolled in pilot phase of study were not included in the main part of study.

Questionnaire

Each participant was given an envelope containing a questionnaire, participants information, and information related to study. Thirty minutes were given to each student to fill the questionnaire. The questionnaire had three sections:

- Section 1: Collected information about gender, age and education years.
- Section 2: Contained 15 questions related to knowledge about stem cells. The possible answers were: "Yes", "No" or "Don't Know". The students were instructed to choose only one answer for each statement. The correct answer was given 2 points and the wrong answer was given 1 point. The answer "don't know" was not given any point. As there were a total of 15 questions, knowledge score range was 0-30, making 30 as the highest score, if the student answered all the questions correctly and 0 as the lowest score if the student selected "don't know" option for all questions. The total knowledge score was calculated for each student by adding the responses to 15 statements. The score was divided into three categories: poor (less than 20), moderate (21-25), and excellent (26-30).
- Section 3: Assessed the attitude of students towards stem cell application in medicine. Each question was scored using 5-point Likert scale. It consisted of 10 statements. The students were instructed to select only one response for each question. A score of 1 was given for strongly negative response and a score of 5 for strongly positive response. The range of score was from 10-50 points. Thus high attitude score indicated positive approach of students towards stem cell therapy. The attitude score was classified into three groups based on the total score of each participant: poor (10-29), good (30-39), excellent (40-50) [15].

STATISTICAL ANALYSIS

The data was analysed using Statistical Package for the Social Sciences (SPSS) version 22.0. Results were presented as the mean±SD or percentage where relevant. The correlation between knowledge and attitude was calculated using Pearson's correlation test.

RESULTS

The survey was completed by 150 MBBS students. Majority of the students were males (63.3%) and belong to 6th year MBBS (35.3%). The mean age of students was 23.62±1.5. Descriptive statistics are shown in [Table/Fig-1].

Variable	N		Percentage (%)
Age (mean±SD) (years)	23.62±1.5		
Gender	Male	95	63.3
	Female	55	36.7
Level of education	2nd year	10	6.7
	3rd year	12	8
	4th year	30	20
	5th year	45	30
	6th year	53	35.3
Religion	Islam	150	100

[Table/Fig-1]: Demoghraphic characteristics of study population.

Knowledge score: The knowledge of students about stem cells was assessed by analysing correct responses to 15 knowledge questions. About 71.3% of students were aware that stem cell is not a specialised cell of body. However, the information about function and origin of embryonic stem cells (Q5 and Q6) was 50.6% and 50%. Majority of students have adequate knowledge about stem cell utilisation in various medical conditions. The number and percentages of correct and incorrect responses to knowledge statements are shown in [Table/Fig-2].

S. No.	Question	Incorrect responses n (%)	Correct responses n (%)	Don't know
1	Stem cells are specialised cells	42 (28)	107 (71.3)	1 (0.66)
2	Stem can divide and renew for long periods	47 (31.3)	102 (68)	1 (0.66)
3	Adult stem cells can be obtained from sperm and eggs	42 (28)	87 (58)	21 (14)
4	Stem cells can treat neurological diseases such as Alzheimer's and Parkinson's	60 (40)	82 (54.7)	8 (5.3)
5	Embryonic stem cells can form any cell type in the body including placenta	71 (47.3)	76 (50.6)	3 (2)
6	Stem cells obtained from umbilical cord are embryonic	66 (44)	75 (50)	9 (6)
7	Collection of umbilical cord blood stem cells can cause pain and may be harmful to the newborn and mother	43 (28.7)	79 (52.7)	28 (18.7)
8	There is lower risk for graft vs host disease with umbilical cord stem cell transplantation	75 (50)	64 (42.7)	11 (7.3)
9	Bone marrow stem cells are obtained from the spine	30 (20%)	102 (68)	18 (12)
10	Embryonic stem cell transplantation can lead to the formation of tumour	75 (50%)	70 (46.7)	5 (3.3)
11	Stem cells can treat the diabetes mellitus	52 (34.7%)	75 (50)	23 (15.3)
12	Stem cells can treat spinal cord injuries and paralysis	19 (12.7)	113 (75.3)	18 (12)
13	Stem cells can treat infertility	33 (22)	102 (68)	15 (10)
14	Stem cell banks are available in Saudi Arabia	62 (41.3)	83 (55.3)	5 (3.3)
15	In order to donate umbilical cord blood, the delivery has to take place in big public hospital	18 (12)	132 (88)	-

[Table/Fig-2]: Number and percentage of student responses to knowledge statements (n=150).

Attitude score: Regarding the utilisation of stem cells from embryos and aborted foetuses 30.7% of the students have no clear idea while 19.3% thought it should be restricted. Similarly damaging embryo for obtaining stem cells was considered immoral and illegal by more than half of students as shown in [Table/Fig-3]. Majority of students were interested in organisation of training programs and education activities related to stem cells and its potential uses. The percentage and number of students in each category of knowledge and attitude are shown in [Table/Fig-4]. The overall mean knowledge score was 22.42±2.74 as shown in [Table/Fig-4].

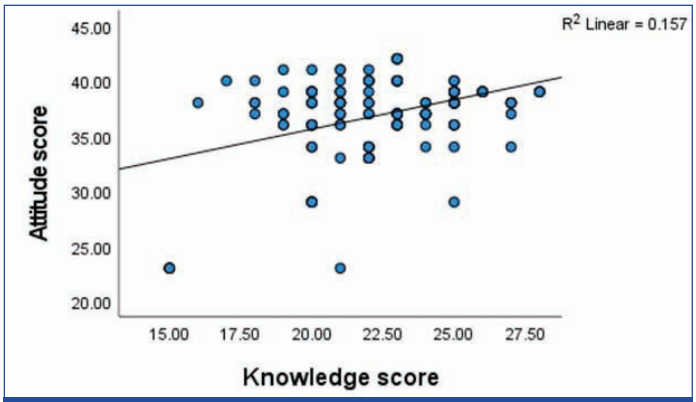
S. No.	Question	Strongly disagree n (%)	Disagree n (%)	Not sure n (%)	Agree n (%)	Strongly agree n (%)
1	Stem cells transplantation can open doors to human being killed for the benefit of others	35 (23.3)	63 (42.0)	52 (34.7)	-	-
2	Research involving use of embryonic stem cells from embryo or aborted fetus should be restricted	38 (25.3)	37 (24.7)	46 (30.7)	29 (19.3)	-
3	Embryonic stem cells research involving destruction of embryo is immoral and illegal	9 (6)	10 (6.6)	54 (36)	61 (40.7)	16 (10.7)
4	Stem cells transplantation should be widely done	4 (2.7)	33 (22)	41 (27.3)	40 (26.7)	32 (21.3)
5	Pregnant mothers should be counselled to store their umbilical cord blood stem cells for future purposes	-	11 (7.3)	26 (17.3)	85 (56.7)	28 (18.7)
6	Health care provider should have sound knowledge about stem cells	0	15 (10)	5 (3.3)	78 (52)	52 (34.7)
7	More awareness program should be organised regarding stem cells	0	0	25 (16.6)	76 (50.6)	49 (32.7)
8	The future of mankind is bright if stem cells research could be successfully conducted	0	0	17 (11.3)	73 (48.7)	60 (40)
9	Privacy of donor should be maintained	0	0	16 (10.7)	38 (25.3)	96 (64)
10	Informed consent should be taken for collection, storage and use of cord blood before delivery	0	0	-	69 (46)	81 (54)

[Table/Fig-3]: Number and Percentage of student responses to attitude statements (n=150).

Category	n	%
Knowledge		
Poor knowledge	37	24.7
Moderate knowledge	98	65.3
Excellent knowledge	15	10
Overall knowledge score (mean±SD)	22.42±2.74	
Attitude		
Poor attitude	11	7.3
Good attitude	114	76
Excellent attitude	25	16.7
Overall attitude score (mean±SD)	36.9±3.71	

[Table/Fig-4]: Categories of knowledge and attitude score.

Correlation between knowledge and attitude score: The mean knowledge and attitude scores are shown in [Table/Fig-4]. The knowledge and attitude scores were correlated using Pearson's correlation test. It showed a low positive linear correlation with p-value <0.05 as shown in [Table/Fig-5].



[Table/Fig-5]: Correlation between knowledge and attitude scores (r=0.396 and p-value <0.001).

DISCUSSION

Stem cells can give rise to any tissue of body thus showing a tremendous ability to cure and treat diseases. However, their use has ethical, legal, and social issues which needs to be addressed [16,17]. The controversy can be minimised by providing sound and up-to-date knowledge to medical professionals. It can help patients in making right decisions related to use of stem cells as a new treatment modality.

The results of present study show that 65.3% of the medical undergraduates have sufficient knowledge related to stem cells while 10% have excellent knowledge. The results are consistent with a study done in Qassim (Saudi Arabia) reporting adequate knowledge in 56% of participants [18]. However, study done in Al Jouf region of Saudi Arabia among dental graduates has shown poor knowledge (55.7%) but positive approach towards stem cells [19]. The study done on nursing staff has also shown inadequate knowledge indicating the lack information regarding stem cells and its therapeutic applications [20]. Similar results have been reported by a study from Egypt showing 69% of the nursing staff had insufficient knowledge [21]. This disagreement with the current study can be attributed to the differences in settings and participants of the study.

The students believed that health professionals should have sound information regarding stem cells (86.7%) and more training programs should be organised for their training. Similar findings were reported in Egypt where 92% nursing staff were in favour to receive comprehensive education regarding stem cells [21]. Although most of the students were interested in obtaining awareness about embryonic stem cells but almost half of students considered it unethical. The students showed concerns about the unethical use of human embryos for research purpose. Similar allegations have been made worldwide [22] that human embryos have been exploited for commercial and research purposes. The students believed that causing harm to foetus at any stage is a serious offence. The blastocyst was considered a living human by more than 50% of participants in a study done in Malaysia [23].

An overall positive approach related to stem cell applications has been observed among medical undergraduates in current study. Majority of students had good attitude (76%) while 16.7% had excellent attitude. This positive approach can be due to adequate knowledge of students about stem cell therapy. The findings are consistent with study done in Qassim showing that 76% of the medical professionals have positive attitude [18]. Similarly study done among the health science students in Jouf University of Saudi Arabia showed high attitude scores in 70% of students [24].

The knowledge and attitude scores showed low positive correlation calculated by Pearson's coefficient (0.396). The study carried out

in Jouf University showed a similar positive correlation (r=0.334, p-value <0.001) [24]. The positive association was also reported by a study conducted on nursing staff in labour room (r=0.532, p-value <0.01) [25]. However, a poor correlation was reported by a study done in Malaysia. They reported that although the awareness about stem cell is an important factor in shaping the approach of students related to stem cell, the religious, cultural and social beliefs seems to modify it [23].

Limitation(s)

The main limitation of study was that it was questionnaire based and has self-reported data which can lead to bias or an exaggerated response. The research was done only among medical students of NBU, so the results cannot be generalised.

CONCLUSION(S)

An adequate knowledge and positive approach was reported regarding stem cells in current study. This can be further improved by organising training courses about stem cell research which should be designed in accordance with the religious and cultural norms of the country. It should be considered an important topic in medical curriculum to further enhance the awareness among students. This will empower the future doctors and help in ethical use of stem cells.

Acknowledgement

The authors gratefully acknowledge the approval and the support of this research study under the grant no. MED-2019-1-10-F-8245 from the Deanship of Scientific Research at Northern Border University, Arar, Kingdom of Saudi Arabia.

REFERENCES

[1] Fujimaki S, Machida M, Hidaka R, Asashima M, Takemasa T, Kuwabara T. Intrinsic ability of adult stem cell in skeletal muscle: An effective and replenishable resource to the establishment of pluripotent stem cells. Stem Cells Int. 2013;2013:42016.
[2] Ray P, De A, Yaghoubi S, Khanna A. Application of adult stem cells in medicine. Stem Cells Int. 2015;2015:258313.
[3] Mitalipov S, Wolf D. Totipotency, pluripotency and nuclear reprogramming. Adv Biochem Eng Biotechnol. 2009;114:185-99.
[4] Can A. A concise review on the classification and nomenclature of stem cells. Turk J Haematol. 2008;25:57-59.
[5] Bodnar MS, Meneses JJ, Rodriguez RT, Firpo MT. Propagation and maintenance of undifferentiated human embryonic stem cells. Stem Cells Dev. 2004;13:243-53.
[6] Jawdat D, AlTwijri S, AlSemari H, Saade M, Alaskar A. Public awareness on cord blood banking in Saudi Arabia. Stem Cells Stem Cells Int. 2018;2018:8037965.
[7] Peberdy L, Young J, Kearney L. Health care professionals' knowledge, attitudes and practices relating to umbilical cord blood banking and donation: An integrative review. BMC Pregnancy Childbirth. 2016;16:81.
[8] Carr CA, Stuckey DJ, Tan JJ, Tan SC, Gomes RS, Camelliti P, et al. Cardiosphere-derived cells improve function in the infarcted rat heart for at least 16 weeks: An MRI study. PLoS One. 2011;6(10):e25669.
[9] Muraro PA, Pasquini M, Atkins HL, Bowen JD, Farge D, Fassas A, et al. Long-term outcomes after autologous hematopoietic stem cell transplantation for multiple sclerosis. JAMA Neurol. 2017;74:459-69.
[10] Lo B, Parham L. Ethical issues in stem cell research. Endocr Rev. 2009;30:204-13.
[11] Alahmad G, Aljohani S, Najjar MF. Ethical challenges regarding the use of stem cells: Interviews with researchers from Saudi Arabia. BMC Med Ethics. 2020;21:35.
[12] Almashori MM, Alaradi BI, Altoairqi LM, Swead FA, Altemani MF, Elbeltagy M, et al. Knowledge, attitude and practice of doctors and medical students towards stem cell use in the management of diabetes mellitus. Egypt J Hosp Med. 2018;71:3308-13.
[13] Hazzazi AA, Ageeli MH, Alfaqih AM, Zakri AK, Elmakki EE. Knowledge and attitude towards hematopoietic stem cell transplantation among medical students at Jazan University, Saudi Arabia. Saudi Med J. 2019;40(10):1045-51.
[14] Fakhoury HA, Alaskar AS, Hajeer AH. A novel HLA-DQ allele, HLA-DQB1* 05: 48, found in the Saudi stem cells donor registry. Tissue Antigens. 2015;86(3):218-19.
[15] Sullivan GM, Artino AR. Analysing and interpreting data from Likert-type scales. J Grad Med Educ. 2013;5:541-42.
[16] MacPherson A, Kimmelman J. Ethical development of stem-cell-based interventions. Nat Med. 2019;25:1037-44.
[17] Robertson JA. Embryo stem cell research: Ten years of controversy. J Law Med Ethics. 2010;38(2):191-203.
[18] Tork H, Alraffaa S, Almutairi KJ, Alshammari NE, Alharbi AA, Alonzi AM. Stem cells: Knowledge and attitude among health care providers in Qassim region, KSA. International Journal of Advanced Nursing Studies. 2018;7(1):01-07.
[19] Alhadlaq A, Al-Maflehi N, Alzahrani S, AlAssiri A. Assessment of knowledge and attitude toward stem cells and their implications in dentistry among recent graduates of dental schools in Saudi Arabia. Saudi Dent J. 2019;31(1):66-75.
[20] Moustafa MF, Youness EM. Nurses, knowledge about umbilical cord blood banking and its barriers. IOSR J Nurs Health Sci. 2015;4(2):44-53.
[21] Mohammed HS, EL Sayed HA. Knowledge and attitude of maternity nurses regarding cord blood collection and stem cells: An educational intervention. J Nurs Educ Pract. 2015;5(4):58-69.
[22] Beeson D, Lippman A. Egg harvesting for stem cell research: Medical risks and ethical problems. Reprod Biomed Online. 2006;13(4):573-79.
[23] Lye JL, Soon LK, Wan Ahmad WA, Tan SC. Knowledge and attitude about stem cells and their application in medicine among nursing students in Universiti Sains Malaysia, Malaysia. Malays J Med Sci. 2015;22(4):23-31.
[24] Almaeen A, Wani FA, Thirunavukkarasu A. Knowledge and attitudes towards stem cells and the significance of their medical application among healthcare sciences students of Jouf University. Peer J. 2021;9:e10661.
[25] Ambili V, Poonam J, Dipika D, Tulika S. Knowledge and attitude of nurses regarding stem cells and umbilical cord blood banking in a selected tertiary care facility. Asian J Nur Edu Res. 2016;6:240-44.

PARTICULARS OF CONTRIBUTORS:
1. Assistant Professor, Department of Physiology, Northern Border University, Arar, Northern Border, Saudi Arabia.
2. Assistant Professor, Department of Medicine, Northern Border University, Arar, Northern Border, Saudi Arabia.

NAME, ADDRESS, E-MAIL ID OF THE CORRESPONDING AUTHOR:
Dr. Tehreem Aftab,
Assistant Professor, Department of Physiology, Northern Border University,
P.O. Box; 1321 Arar 91431, Northern Border, Saudi Arabia.
E-mail: tehreem_aftab@yahoo.com

PLAGIARISM CHECKING METHODS: [Jain H et al.]
- Plagiarism X-checker: Jul 22, 2021
- Manual Googling: Sep 23, 2021
- iThenticate Software: Sep 29, 2021 (10%)

ETYMOLOGY: Author Origin

AUTHOR DECLARATION:
- Financial or Other Competing Interests: None
- Was Ethics Committee Approval obtained for this study? Yes
- Was informed consent obtained from the subjects involved in the study? Yes
- For any images presented appropriate consent has been obtained from the subjects. NA

Date of Submission: **Jul 14, 2021**
Date of Peer Review: **Sep 01, 2021**
Date of Acceptance: **Sep 30, 2021**
Date of Publishing: **Oct 01, 2021**