

Effectiveness of an Educational Program about Stem Cell Challenges on Knowledge and Attitude of Internship Nursing Students

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Abstract: Responding to recent developments in science, stem cell has demonstrated that it can possibly treat pediatric illnesses, including malignant diseases, cerebrovascular illnesses and immune disorders. The current study aimed at evaluating the effectiveness of an educational program about stem cell challenges on knowledge and attitude of the internship nursing students. A quasi experimental study was used with a sample of 42 nursing students. The present study was carried out at the pediatric and obstetric wards in Port Said general hospitals, Egypt. Two main tools were used in this study; Stem cells knowledge assessment questionnaire and Nurses' attitude scale regarding stem cells. Results showed that the educational program has an effect on the improvement of nursing students' knowledge regarding stem cell therapy, as there were significant differences between the mean scores of student nurses' knowledge before and after an educational program implementation (Immediately and three months later). As well as, 59.5% of the student nurses had a negative attitude toward stem cells before program implementation. Immediately and after three months of implementing the program, 83.3 and 78.6% respectively of student nurses had a positive attitude. It can be concluded that the educational program was effective in improving student nurse's knowledge and their attitude relating stem cell therapy. Further studies are required on a large sample in another clinical setting for generalizing the research findings and, nursing curriculum, including technology challenges topics as stem cell therapy is also required, to update understanding of student nurses and improve their attitude.

Key words: Educational Program • Knowledge • Attitude • Stem Cells • Challenges

INTRODUCTION

Scientific researchers have known for centuries, that some animals have the ability to regenerate missing components of their bodies, as well as, this capacity is shared by humans with these animals. While human bodies cannot replace a missing arm or finger, they are continually regenerating blood, skin and other types of tissues in their bodies. The existence of the potent cells that enables human bodies to replenish certain tissues was firstly discovered in 1950, when trials regarding bone marrow were established, which in turn led to the

development of bone marrow transplantation. This finding created prospects for the regeneration potential in the medical field [1].

More than 200 kinds of mature cells exist in the human body; each has a differentiated and specific function. Stem cells are distinct from human body working cells, they have a terrific capacity to produce new tissues when divided and developed. Stem cells are special cells that repair and regenerate in a variety of different kinds of cells in the human body as the tooth, bone, cartilage, skin, adipose tissue and glands [2].

According to cell maturity, stem cells are classified into two broad types; firstly: embryonic stem cells and secondly: adult stem cells. Embryonic stem cells, which are pluripotent stem cells originating from the internal cell mass of blastocyst in early embryo phase. Adult stem cells, which are synonymic to somatic stem cells are indistinct bodily cells that multiply by dividing cells, regenerating the dead cell and damaged tissues, discovered in the whole body after embryonic development. The ability of hematopoietic stem cells in the umbilical cord blood to grow is higher than the ability of the same cells in the bone marrow or adults blood [3].

All types of stem cells are helpful for medical studies, but there are promises and limitations of each of the various kinds. For example, embryonic stem cells, have the ability to regenerate all cell types of the human body, while adult stem cells, have the ability to produce only specific types of specialized cells. Scientific researchers recently have also recognized type of stem cells in the blood of the umbilical cord and placenta, which lead to different blood cell kinds [1].

Umbilical cord-based stem cells are less susceptible to rejection compared with cells obtained from bone marrow. Blood, in the umbilical cord which includes many hematopoietic stem cells, is utilized to treat a range of pediatric hematological, oncological and genetic conditions, as leukemia, lymphoma, neuroblastoma and retinoblastoma. As well as, many other non-malignant diseases, which include inherited disorders of the blood and immune systems, or genetic diseases affecting metabolism. They are more effective for allogeneic transplantation. This is a possible option when autologous or allogeneic human leukocyte antigen transplants (HLA) are not available for pediatric patients [4-6].

Certainly, at a significant stem cell breakthrough and these cells that were previously anticipated to provide low-cost therapy for pediatric diseases as diabetes mellitus, blindness, heart attack, cerebral stroke, spinal cord problems are lastly on the road to achieving their capability. Healthcare professionals, especially pediatric and obstetric nurses are challenged to understand knowledge regarding stem cell therapy and implement this knowledge in their nursing practices, due to the importance of stem cells in treating pediatric diseases [7, 8]

Significance of the Study: Stem cell research is being undertaken in the hope of achieving major medical breakthroughs. Scientific researchers strive to develop

therapies that regenerate or repair damaged cells with stem cell tissues and provide hope to pediatric patients suffering from cancer, diabetes mellitus, cardiovascular problems, spinal cord damage and many other illnesses. Also, stem cells provide scientific researchers with a precious new technique of drug discovery and testing. They are also strong instruments for research studies that lead to an improved knowledge of the human body. The National Academies have examined the potential of stem cell technologies in the medical sector and discussing the ethical considerations of stem cell therapy. This in turn created an interest in the investigators' minds to conduct an educational program to evaluate the knowledge level of pediatric and obstetric nurses and their attitude regarding stem cell challenges, to improve their effectiveness and their achievement to provide safe ways of initiating nursing care and spreading awareness. Their excellent understanding and positive attitude will provide an in-depth source of data on the use of stem cell therapy as the latest innovations in pediatric treatment, which will enhance hospitalized children and their relatives in decision making regarding stem cell therapy [9].

Aim of Study: The aim of this study was to evaluate the effectiveness of an educational program about stem cell challenges on knowledge and attitude of internship nursing students.

Research Hypothesis: The educational program about stem cells challenges, enhances the improvement in knowledge and attitude of internship nursing students.

MATERIALS AND METHOD

Research Design: A quasi experimental study design.

Setting: The present study was carried out at the Pediatric and Obstetric Wards in Port-Said General Hospitals, Egypt.

Subjects: The study involved all internship nursing students (42 nurses) who work in the previous mentioned hospitals.

Data Collection Tools: Two tools were used in this study.

Tool I: Stem Cells Knowledge Assessment Questionnaire: This questionnaire was developed by Lye *et al.* [1] to assess pediatric and obstetric nurses'

knowledge about stem cell therapy among internship nursing students in Port-Said general hospitals. The questionnaire had two parts as follows:

Part I: Items on the demographic variables like age, sex, education and work experience.

Part II: This part included 15 question items to assess nurses' knowledge pre and post the educational program regarding stem cells as definition, their characteristics, main types, their sources, risks and benefits. The tool is scored using a two choices; "True" and "False" for each of the 15 statements. The total score of the tool is "0" to "15".

Scoring System:

Nurses' Knowledge: One score was given to a correct response and zero to incorrect response for each item of pediatric and obstetric nurses' knowledge. The scores of the items were summed up and the total (15) was divided by numbers of items (15), giving a mean score. These scores were converted into a percentage score. Pediatric and obstetric nurse's knowledge of each subject was considered satisfactory if the nurse's score was equal to or exceed the mean+1 standard deviation, otherwise it was considered unsatisfactory.

The total percent score of nurses' knowledge level was considered as follows:

Excellent = 85% and more, very good = 75% to less than 85%, good = 65% to less than 75%, fair = 60% to less than 65% and poor = less than 60%.

Tool II: Nurses' Attitude Scale Regarding Stem Cells:

This scale was developed by Lye *et al.* [1] to assess pediatric and obstetric nurses' attitudes regarding stem cell therapy. A five point Likert scale "Strongly agree", "Agree", "Unsure", "Disagree" and "Strongly disagree" was used for each of the 10 statements. The total score of the tool is "10" to "50". It consisted of five domains, namely: "Ethical", "Religion", "Culture", "Professional" and "Community".

Scoring System

Nurses' Attitude: The scores of the items were summed up and the total (50) was divided by numbers of items (10), giving a mean score. These scores were converted into a percentage score. Pediatric and obstetric nurse's attitude of each subject was considered positive if the nurse's score was equal to or exceed the mean+1 standard deviation, otherwise it was considered negative.

Validity of the Tools: The two tools used in the present study were tested for content validity by jury of seven Pediatric and obstetric nursing specialists, the values of the validity of study tools one and two were 79.4 and 85.6 respectively.

Reliability of the Tools: Reliability was done by using Chronbach Alfa Coefficient for tool one and two of the present study, its values were 0.67 and 0.86 respectively[1].

Pilot Study: A pilot study was carried out with 10% of the whole sample, to check the feasibility of the study, applicability of tools, content validity. Five pediatric and obstetric nurses selected to check the tools of the current study before beginning the data collection phase and were excluded from the complete sample of the research work. The modifications were done accordingly.

Data Collection Procedure: Data was collected in September 2017 till the end of February 2018. Official letters were issued by the college of Nursing, Port-Said University and send to the administrators of all the chosen general hospitals with an evidence of the aim of the study to induce their permission and cooperation. Each pediatric and obstetric nurse in the study sample was requested to fill pre assessment tools (Tool 1 and tool 2) before implement the educational program regarding stem cell therapy.

Developing Phases of an Educational Program: The educational program was developed to improve pediatric and obstetric nurses' knowledge and attitude about stem cell therapy. It was developed by the researchers after reviewing the literatures. It includes: definition of stem cells, importance, sources, characteristics, types, their risks and benefits. The educational program was based on the results of pediatric and obstetric nurses' knowledge and their attitudes before the implementation of the educational program.

Implementation Phase of Educational Program: The educational program was conducted through four sessions. Each session lasted approximately half to an hour. It was presented in clear and concise form, using many teaching strategies such as: brain storming, lectures, discussion, providing examples. Data show, videos, role play and pictures regarding stem cell therapy for pediatric and obstetric nurses. A handout was prepared by the researchers and distributed to the participants.

Evaluation Phase of Educational Program: All pediatric and obstetric nurses were evaluated for their knowledge and their attitudes twice, immediately after implementation of the program and three months later (Follow-up) by applying study tools after program implementation, to assess the level of improvement of pediatrics and obstetric nurses' knowledge and their attitude after implementation of the stem cell program.

Statistical Analysis: Data entry and statistical analysis were done by using SPSS 16.0 statistical software package. Data was presented using descriptive statistics in the form of a percentage, mean and standard deviation to explain demographic variables and compute pretest, post and follow-up test. Student's t test was utilized for two bunches and one ANOVA (F) test was utilized in the present study. The distinction was considered critical at $p \leq 0.000$.

Ethical Considerations: Approval of ethical committee and hospital permission were taken to hold out the study. An oral consent was obtained from pediatric and obstetric nurses to participate within the study. The aim of the study was explained for each participant. Respect for privacy of each participant in the study was followed. In all settings of the study, each participant was assured that the information obtained for the study was confidential and used only for the aim of the present research. Moreover, ensure that all participants have the right to withdraw from the study at any time.

RESULTS

Table (1) revealed that the age of 78.6 % of the studied nurses were ranging from 21 years to less than 23 years old. Regarding gender, 78.6% of nurses were female, all of them (100%) were Muslims. It was found that 50.0 % of the studied nurses had work experience less than one year. All student nurses (100%) did not attain any previous workshops about stem cell therapy.

Table (2) shows distribution of nurses' knowledge items for stem cell throughout the study phases. Among the sample of this study, 90.5% of nursing students had satisfactory knowledge in the post and follow up tests than pretest. Generally, there was marked improvement in all knowledge items than the pretest as definition (100 & 93%), characteristics (95.2 & 83.3%), sources (81 & 95.2%), types (71.4 & 90.5%) finally in the same level the knowledge items of benefits and risks of stem cells. Where as compared with post and follow-up tests. Approximately, all follow up items decrease than post as definition and characteristics.

Table 1: Distribution of student nurses regarding Socio-demographic characteristics (n=42)

Characteristics	No	%
Age		
21-less than 23	33	78.6
23 and more	9	21.4
Mean ± SD	24.285 ± 4.026	
Sex		
Male	9	21.4
Female	33	78.6
Religion		
Muslim	42	100
Work experience		
Less than 1 year	21	50.0
1- Less than 5	18	42.9
5 or more	3	7.1
Attending workshops		
No	42	100

Table (3) presents the relation of nurse's total knowledge scores for stem cell throughout the study phases. This table shows that there was a noticeable improvement in the level of knowledge. The majority of the studied sample (71.4 %) had poor knowledge before educational program implementation, while 42.9 % and 38.1% respectively of student nurse in post and follow-up had an excellent level of knowledge after implementing the program. There was a statistical significant relationship between pre, post and follow up tests regarding total knowledge of stem cells ($p = 0.000$).

Table (4) indicates the Frequency and percentage scores of nurses' attitude toward stem cell therapy throughout the study phases. This table shows that there was a marked improvement in the level of attitude from the pretest phase to the phases after program implementation.

Distribution of student nurse total attitude levels for stem cell throughout the study phases is shown in Fig. (1). In the pretest, 59.5%, of student nurses reported negative attitude, while in the post-test, 83.3% had a positive attitude. In the follow up test, positive attitude reported by 78.6% of student nurses and 21.4% of them had a negative attitude. The relationship between attitude in the pre and post-tests were statistically significant ($p = 0.000$).

Table (5) displays socio-demographic characteristics of the student nurses and their total knowledge mean scores. There were statistical significant relationships among pre and post tests regarding total knowledge of stem cell and socio-demographic characteristics of student nurse as age, sex and their experience work ($p = .035$, $p = .008$, $p = .038$ and $p = .014$ respectively).

Table 2: Distribution of student nurses' knowledge items for stem cells throughout the study phases (n=42)

Items	Pre		Post		Follow	
	Unsatisfactory No.(%)	Satisfactory No.(%)	Un-satisfactory No.(%)	Satisfactory No.(%)	Un-satisfactory No.(%)	Satisfactory No.(%)
Definition	36(85.7)	6(14.3)	0(0)	42(100)	3(7.1)	39(92.9)
Stem cell Characteristics						
Self-renew	17(40.5)	25(59.5)	2(4.8)	40 (95.2)	6(14.3)	36 (85.7)
Replication	29(69.0)	13 (31.0)	7(16.7)	35(83.3)	13(31.0)	29(69.0)
Stem cell Sources						
Adult stem cell sources	24(57.1)	18 (42.9)	8(19.0)	34 (81.0)	10(23.8)	32 (76.2)
Bone marrow stem cells	18(42.9)	24 (57.1)	2(4.8)	40 (95.2)	2(4.8)	40 (95.2)
Stem cell Types						
Adult /somatic stem cells	23(54.8)	19 (45.2)	12(28.6)	30 (71.4)	13(31.0)	29 (69.0)
Umbilical cord blood cells	20(47.6)	22 (52.4)	4(9.5)	38 (90.5)	5(11.9)	37 (88.1)
Stem cell Risks						
Embryonic stem cell risks	35(83.3)	(16.7)	8(19.0)	34 (81.0)	8(19.0)	34 (81.0)
UCB stem cell risks	30(71.4)	12 (28.6)	11(26.2)	31 (73.8)	12(28.6)	30 (71.4)
Risks to newborn and mother.	30(71.4)	12 (28.6)	21 (50.0)	21 (50.0)	22(52.4)	20 (47.6)
Adult stem cell risks	30(71.4)	12 (28.6)	8(19.0)	34(81.0)	8(19.0)	34 (81.0)
Stem cell benefits						
Test drugs & effect	26(61.9)	16 (38.1)	5(11.9)	37 (88.1)	5(11.9)	37 (88.1)
UCB stem less risky	34(81.0)	8(19.0)	9(21.4)	33(78.6)	9(21.4)	33(78.6)
Induced from normal skin	33(78.6)	9(21.4)	8(19.0)	34(81.0)	8(19.0)	34(81.0)
Forming any cell type	20(47.6)	22(52.4)	8(19.0)	34(81.0)	9(21.4)	33 (78.6)
Total	24(57.1)	18 (42.9)	4(9.5)	38(90.5)	8(19.0)	34 (81.0)

Table 3: Relation of nurses' total knowledge scores for stem cell throughout the study phases (n=42)

Knowledge level	Pre		Post		Follow		Pre & Post	Pre & Follow	Post & Follow
	No	%	No	%	No	%			
Excellent (≥85%)	0	0	18	42.9	16	38.1	0.000*	0.000*	0.000*
Very good (75%-<85%)	5	11.9	16	38.1	12	28.6			
Good (65%-<75%)	3	7.1	4	9.5	8	19.0			
Fair (60%-<65%)	4	9.5	4	9.5	1	2.4			
Poor (<60%)	30	71.4	0	0	5	11.9			

*Correlation is significant at 0.05

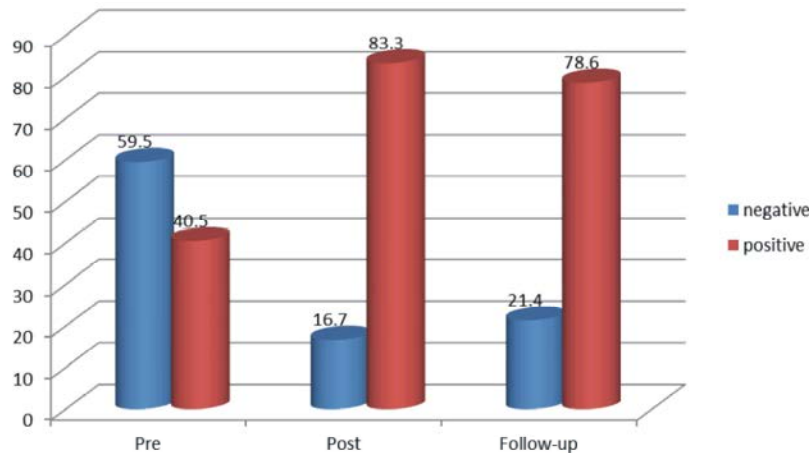


Fig. 1: Distribution of nurses total attitude levels for stem cell throughout the study phases (n=42)

Table 4: Frequency & percentage of attitude toward stem cell therapy (n=42)

Items	Strongly disagree		Disagree		Unsure		Agree		Strongly agree	
	No	%	No	%	No	%	No	%	No	%
1-worried human being killed										
Pre	15	35.7	14	33.3	0	0	2	4.8	11	26.2
Post	5	11.9	0	0	7	16.7	4	9.5	26	61.9
Follow	6	14.3	0	0	6	14.4	5	11.9	25	59.5
2-Government prohibit stem cell from abortion										
Pre	14	33.3	1	2.4	15	35.7	5	11.9	7	16.7
Post	7	16.7	0	0	2	4.8	6	14.3	27	64.3
Follow	2	4.8	7	16.7	4	9.5	6	14.3	23	54.8
3-Embryo Destruction is illegal										
Pre	15	35.7	1	2.4	12	28.6	3	7.1	11	26.2
Post	0	0	6	14.8	7	16.7	4	9.5	25	59.5
Follow	0	0	3	7.1	12	28.6	4	9.5	23	54.8
4- Respect of blastocyst										
Pre	17	40.5	15	35.7	6	14.3	3	7.1	1	2.4
Post	0	0	4	9.5	13	31.0	4	9.5	21	50.0
Follow	9	21.4	0	0	10	23.8	3	7.1	18	42.9
5-Stem cells widely practiced.										
Pre	13	31.0	2	4.8	15	35.7	4	9.5	8	19.0
Post	0	0	3	7.1	17	40.5	2	4.8	20	47.6
Follow	0	0	0	0	15	35.7	5	11.9	22	52.4
6-advise pregnant to store stem cells for future										
Pre	15	35.7	3	7.1	15	35.7	3	7.1	6	18.3
Post	7	16.7	3	7.1	8	19.0	9	19.0	16	38.1
Follow	6	14.3	5	11.9	8	19.0	7	16.7	16	38.1
7-knowledge important as a care provider										
Pre	15	35.7	0	0	15	35.7	2	4.8	10	23.8
Post	8	19.0	0	0	5	11.9	8	19.0	21	50.0
Follow	8	19.0	0	0	5	11.9	8	19.0	21	50.0
8-Aware of benefits, uses, & harms										
Pre	14	33.3	1	2.4	19	45.2	3	7.1	5	11.9
Post	0	0	6	14.3	14	33.3	5	11.9	17	40.5
Follow	0	0	6	14.3	15	35.7	4	9.5	17	40.5
9-Should be more awareness program										
Pre	14	33.3	3	7.1	17	40.5	3	7.1	5	11.9
Post	2	4.8	9	21.4	7	16.7	6	14.3	18	42.9
Follow	1	2.4	9	21.4	7	16.7	7	16.7	18	42.9
10-Future research successfully conducted										
Pre	13	31.0	0	0	17	40.5	2	4.8	10	23.8
Post	4	9.5	1	2.4	12	28.6	5	11.9	20	47.6
Follow	3	7.1	1	2.4	12	28.6	5	11.9	21	50.0

Table 5: Socio-demographic characteristics of the nurses and their knowledge mean scores (n=42)

Characteristics	Total knowledge								
	Pre			Post			Follow		
	M	SD		M	SD		M	SD	Significant
Age (years)									
21-less than 23	6.0303	3.695	t=2.187	12.303	2.068	t=.038-	11.9091	2.28259	t=0.411
23 and more	2.8889	4.284	P=.035*	12.333	2.236	P=.970	11.5556	2.29734	P=.683
Sex									
Male	11.142	1.511	t=-2.77	10.642	1.598	t=-2.57	4.7143	3.49568	t=-734
Female	12.892	2.096	P=.008*	12.428	2.332	P=.014*	5.6786	4.24311	P=.467
Experience									
Less than 5 years	6.1905	4.178		12.714	2.261		12.142	2.555	
5-less than 10	5.2778	3.460	F=3.555	12.055	1.862	F=1.136	11.611	2.004	F=474
10years or more	.0000	.000	P=.038*	11.000	1.732	P=.331	11.000	1.732	P=.626

*Correlation is significant at 0.05

DISCUSSION

Stem cells are unique type of cells having specialized ability to differentiate into a variety of cells as smooth muscle cells and neurons. Bone marrow, neural tissue, skin, retina, deciduous and wisdom teeth can be a source for stem cells [10].

Stem cells are superior cells that have the ability to regenerate any human body tissue. To this end, studies into stem cells is one of today's most significant and contentious subjects [11].

On the side of assessing knowledge of the studied sample regarding stem cells, the results of the current study presented, that 71.4% of student nurses had poor knowledge relating stem cells prior the implementation of an educational program. This may refer to that stem cells are new recent trend and the nursing curriculum, is still deficient in this concern. Results from this study are also consistent with Lye *et al.* [1] who found that only 7% of participants in their study had good knowledge about stem cells. Further, the same results are also reported by Varghese [12] who revealed that the sample had poor knowledge regarding various aspects of stem cell transplantation.

On the same line, both studies of Mohammed and El Sayed [8] and Moustafa and Youness [13] concluded that most of the studied nurses had a low knowledge level regarding stem cell therapy. Furthermore, the study of Khalil and Sharshor [14] stressing that 69% of student nurses in Tanta, Egypt, had insufficient understanding regarding stem cells in their pediatric intensive-care unit (PICU) and their Department of pediatric hematology.

Meanwhile, in the present study, more than two fifths of student nurses had excellent knowledge scores regarding stem cells with a statistically significance, immediately and three months after the educational program implementation. This could be clarified by the reality that student nurses have an interest in learning and acquiring knowledge about this matter. In addition to, the educational program booklet distributed to the student nurses was considered a helpful reference for acquiring this knowledge about stem cell therapy.

The improvement in knowledge scores is supported by the work of Zuhre *et al.* [15] who studied the knowledge and attitude of university students about stem cells. Their results showed good knowledge after the program. In addition, Mohamed and Sayed [8] concluded that nurses in their study conveyed poor knowledge

about cord blood stem cells before the educational program, with statistically significant improvement in knowledge scores after the program implementation (Immediately and after three months later).

The improvement of Knowledge scores in the present study is also similar to Lovis [16], who discovered that the majority of student nurses in the pre-test have poor understanding, compared with their knowledge in the post-test, most of them had good knowledge regarding stem cells. As well as, Kumaraswamy and Muthulakshmi [17] who concluded that the knowledge score after implementation of educational program was greater than the knowledge score before it. They, also concluded that training of pediatric and obstetric nurses, wrong concepts can be eliminated and the trend in stem cell therapy can increase their understanding and attitude.

Concerning student nurses' attitude regarding stem cell therapy, the result findings of the present study showed that approximately two thirds of the studied nurses had a negative attitude toward stem cells before program implementation. This finding is in disagreement with a study done in Malaysia by Lye *et al.* [1] who concluded that among the 10 questions that evaluate the attitude level in their study, the majority of the undergraduate nursing student showed a good attitude

On the other hand, the attitude percentage increased immediately and after three months of program implementation. They had a positive attitude to stem cell therapy with a statistically significant difference. This may be due to obtaining knowledge of the educational program and getting highly involved in the educational program sessions, their active involvement and the maturation of learners in the fifth year who thus have gained more data that leads to favorable attitudes.

Such findings are similar to, Azzazy and Mohamed [18] in Egypt, who study "The effect of educational intervention on knowledge and attitude of nursing students regarding stem cell therapy", they found that 56% of their students had a positive attitude toward stem cell therapy before the program implementation which changed to 94% after the program. Similarly, Mohamed and Sayed [8] stressed that nearly two thirds of their studied nurses had negative attitudes toward stem cells before the program while more than two thirds of student nurses had positive attitude immediately and after 3 months of implementing the program.

Muslims tend to accept new medical innovations that would provide a treatment for human diseases, such belief affects positively on the view of students regarding stem cell therapy. This might also explained the marked improvement in attitude as 100% of the studied sample are Muslim in the current study. Similarly, results of Leng *et al.* [19] who carried out a study in Malaysia found that 86.6% of their nursing students showed good attitudes toward stem cell therapy. The results of study were congruent with Mohammed and Sayed [8] who mentioned that approximately two thirds of the sample had a negative attitude regarding stem cells in the three phases of the program. This percentage changed to more than two thirds of the student nurses had positive attitude regarding stem cells. Adversely, Bombas *et al.* [20] concluded that the attitudes of the sample in their study showed few improvements due to difficulties in changing their attitudes.

Generally, the nursing students showed low understanding with a highly negative attitude in the current research. Developing and improving student nurses understanding and attitudes by implementing educational programs that was effective in meeting their requirements and thus accept hypotheses of the present study. In line with the outcomes of a systematic review of Chen and Lou [21] that showed that these educational programs are useful, since they include multi-dimensional learning approaches. The effectivity of the educational program and its beneficial influence on the understanding of and attitudes of nurses towards stem cells were evident [12].

CONCLUSIONS

The current research found that the implementation of an educational program has improved understanding and attitude of student nurses regarding stem cell therapy.

Recommendations:

- Adequately planned educational programs related to stem cells must be established to develop nursing student knowledge and attitude to adapt new ideas into nursing care.
- To update understanding of student nurses, on technology challenges such as stem cell therapy, the nursing program or curriculum must include the existing techniques for teaching.

- Program booklets regarding stem cells should be available with easy access for nurses at pediatric and obstetric units in Port-Said hospitals.
- Further studies are required on a larger sample in another clinical setting for generalizing the research findings.

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