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Effect of an Educational Program on Nurses' Knowledge and Attitudes Regarding Umbilical Cord-blood Stem Cells Preservation

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Abstract:
The study aimed to evaluate Effect of an Educational Program on Nurses' Knowledge and Attitudes Regarding Umbilical Cord-blood Stem Cells Preservation. ***Design:*** *A quasi-experimental pre-posttest design was used.* ***Setting:*** *The study was conducted at Obstetrics and Gynecological departments including (antennal, high risk, Labor, operating theater) in Mansoura University Hospital.* ***Sample size:*** *One hundred twenty eight staff nurse.* ***Sample type:*** *Purposive sample technique was used.* ***Results:*** *There was a high statistically significant improvement among staff nurses regarding their level of knowledge about umbilical cord blood collection technique and stem cells post-intervention compared to pre-intervention (P<0.001) as the average score of knowledge was highly significantly improved from 6.59 ± 2.36 pre-intervention to 22.55 ± 2.30 post-intervention. Likewise, the average score of nurses' attitude was 34.43 ± 3.80 pre-intervention compared to 58.83 ± 1.29 post-intervention with highly significant (P<0.001) and their positive attitude had increased from 89.8% to 97.6% in favor to post-intervention. Moreover, the satisfaction of the studied nurses for this program exceeds 70.0%.* ***Conclusion:*** *It was evident that implementation of educational program was effective and had significantly improved the Nurses' knowledge and attitude regarding umbilical cord-blood stem cells collection and preservation.* ***Recommendations****: Continuous in-service training programs about cord blood collection and preservation to develop nurses' knowledge, attitude, and practices in order to fit newly concepts and technological advancement in care.*

Keywords: *Attitudes, Educational Program, Knowledge, Nurses, Umbilical Cord, Stem Cells & Preservation*

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I. Introduction:

The moment of birth not only means the delivery of new life into the world but also provide a onetime chance to save the life of another person **(Amin et al., 2016).** Umbilical cord is the main link and vital attachment, which is always represented as blood and emotional parenthood relationship. **(Kumarasamy and Muthulakshmi, 2010).** At birth, the remaining blood in the placenta and umbilical cord blood (UCB) is called cord blood, the cord blood has several benefits as it consists of several and great hematopoietic stem cells that has the capability to regenerate and be able to differentiate and divide into other specific cell type **(Hend et al., 2015).** Besides to the transplantation benefit due to the contents of cells, it has other benefits, as it doesn't encounter with any microorganisms or viruses and it is reachable with no contact with the fetus during the intrauterine period **(Karadeniz & Yucel, 2013).**

Umbilical cord blood which was deemed to be a medical waste material earlier and get rid of the placenta following delivery as a result of the shortage of knowledge about its uses and benefits. **(Patyal et al., 2018).** However, the cord blood now is considered a valuable thing as it is has an important provenance of hematopoietic stem cells, also it is used for hematopoietic transplant and is life-saving benefit **(Yesikar et al., 2016) & (Samantha et al, 2016).** Nevertheless, the stem cells gained from the cord blood are like those found in the bone marrow therefore it can be utilized as substitution source in transplant of bone marrow. In addition, it is easy to be collected, available and reduce the transmission of diseases **(Philip & Devi, 2017), (Edwinfracis, 2016) & (Mathew et al., 2017).**

The human body contains of more than two hundred types of mature cell, each cell has a distinct and specific function. Stem cells are different to our mature working cells, they have an incredible ability to not make more of themselves, but also to create new tissues when they divide and develop. The discovery of stem cell was one of the greatest achievements of modern medicine. The stem cells found in cord blood has the

ability to differentiate for unspecific times in culture and produce specified cells are the building blocks of the body immune system and more easily reproduce into the blood cells (RBCs, WBCs, and platelets). **(Patyal et al., 2018).**

Current statistics have proved that UCB stem cells can totally treat nearly eighty diseases and more than fifty thousand transplants have been successfully implemented worldwide **(Roura, 2015).** Moreover, UCB as a source of stem cells is being progressively used for treating many diseases including leukemia, myelomas, lymphomas, immune system disease, blood cell and genetic disorders **(Malhotra & Garg, 2015).**

Stem cells that obtained from the cord blood must be preserved under suitable and convenient circumstance for using it in stem cells therapy. Liquid nitrogen tanks are used to store UCB for long duration of time which is known as "Cord Blood Banking". It has been assured that UCB can be preserved in the labs for up to fifteen years **(Uluhan et al., 2009).** The new science advances have proved that UCB is a significant source of stem cells, making it a beneficial tissue resource in the clinical field of transplantation and stem cell therapy. **(Cooper & Severson, 2013)**.

Cord blood collection process of is done within ten unto fifteen minutes of birth. UCB collection is primarily implemented by nurses and obstetricians who have training in this field after cutting the umbilical cord. **(Amin et al., 2016)**. By using a sterile technique, the UCB can be obtained after birth by two methods, either by a syringe or bag method **(Sivakumaran et al., 2018).** The collected blood should be at least 40 mL to ensure that there will be enough cells in the collected amount. In either case, the nurse can collect the blood by venipuncture from the umbilical vein and the gravity will allowed it to drain into a bag supplied by the bank. In both cases container should be pre-coated with anticoagulant (**American College of Obstetricians and Gynecologists, 2019)**.

The nurses are the core persons who in direct connection with the women during their pregnancy and during newborn's delivery. Thus, they are the suitable persons who are able to provide awareness to mothers in order to donate or agree for collecting and storing the cord blood in order to protect their child from forthcoming diseases. Nurses have a significant role in collecting the UCB after separation of the cord from the mother and her newborn. Thus, there is a great need to improve the nurse's knowledge about the benefits of UCB, stem cell collection and preservation and to improve their competencies so that they can provide good quality of care in maternity service to the mothers and their babies **(Qureshi, 2019).**

Maternity nurses are integral part of health care providers in all phases of life. Their role in cord blood collection is concentrated in the preparation, collection, tagging and packing of the blood tube. Nurses have a specified role in patient teaching, as they have a reliable source of health information, so they must be aware of the latest trends in medical diagnosis and treatment. On other hand, continuing education for nurses equip them with a running development, preserve their competence and encounter the standards of nursing practices ***(Varghese., 2013)***.

Subsequently, the nurses should be educated in regards to the value of collecting and preserving UCB for future use in curing of diseases and creating appositive attitude to modulate the holistic care of nursing care. Nurses played a vital role in carrying out different functions in stem cell banking, right from understanding the structure of the umbilical cord to defining the sides of obtaining stem cells. However, previous studies conducted in Egypt found that most nurses were unaware of cord blood collection and preservation process as well as its uses in medicine **(Abdella, 2011).**

Significance of the study:

Mansoura University had established a center for stem cells that obtained from UCB as it is a significant source of stem cells and treat many common diseases in Egypt by transplanting stem cells such as Mediterranean anemia, leukemia, diabetes, and liver cirrhosis due to viral hepatitis. Including the process of designing, implementing and testing the validity required to extract and preserve umbilical cord stem cells, and then freezing.

Cord blood stem cells banking and future usage is an inclusive topic. Healthcare team, especially the nurse is supposed to improve educate the pregnant women regarding this issue in order to make an informed decision **(Ozturk et al., 2017& Vijayalakshmi, 2013)**. Nurses especially in maternity field have to be informed about the most modern advances and receive the required training. So that, increase the level of awareness regarding cord blood stem cell therapy among the staff nurses and encourage a positive attitude will help in developing stem cell banking as an essential aspect of Egyptian healthcare team. Hence, the researchers conducted the current study.

Aim of the study:

To evaluate the effect of an educational program on nurses' knowledge and attitudes regarding umbilical cord-blood stem cells preservation.

Hypothesis of the study:
Utilization of educational program was expected to be an effective method for improving nurses' knowledge and attitudes regarding umbilical cord-blood stem cells collection and preservation evidenced by:
H_1: Significant improvement in the level of nurses' knowledge in comparison to pre-intervention.
H_2 Significant difference between the pre & post-test as regard to the nurses' attitude score.

Operational Definitions:
Umbilical cord blood stem cells: the stem cells that obtained from the umbilical cord after birth that be able to produce all of the blood cells in the body (hematopoietic).
Stem cells: Cells have the ability to divide for indefinite time and to give rise to specialized cells.
Cord blood preservation: Storing of the collected umbilical cord blood and placenta for upcoming therapeutic use.

Subjects & Method:

Study Design:
A quasi-experimental pre& post-test research design was used.
Study Setting:
The study was conducted at Obstetrics and Gynecological departments including (antennal, high risk, Labor, operating theater) in Mansoura University Hospital.
Sample Type:
Purposive sample technique was used.
Sample Size:
Calculating sample size for studying nurses knowledge and attitude regarding UCB collection and storing of stem cells through clin calc.com sample size calculator soft ware, at 5% ∞ error (95.0% significance) and 20.0 β error (80.0% power of the study), assuming the percentage of knowledge of nurses towards stem cell and umbilical cord blood banking is (28%) (***Patyal et al., 2018***) and it may expected to be 40.0% in our area. The calculated sample size is 116. We can 10% for better quality of data so; the field sample will be 128 staff nurse.

Inclusion Criteria:
- Nurses who are working maternity departments (antenatal, high risk, Labor, operating theater).
- Willing to participate in the study.
- Available at time of data collection period.
- First time to attend educational program regarding umbilical cord-blood stem cell collection.

Tools of Data Collection:
Tool I: Self-Administered Structured Schedule:
It was developed by the researchers after reviewing the national and international related references. It was classified into parts:
Part I: Used to evaluate the nurses' general characteristics such as (age, qualification, years of experience, Current working job responsibility etc...)
Part II: Used to assess the nurses' knowledge regarding UCB collection and stem cell banking. It was consisted of twenty-five questions divided into two sections:
Section 1: Maternity nurses' knowledge about umbilical cord-blood collection sample
Used to assess the nurses about UCB collection, it consisted of sixteen questions as (definition, anatomy, indications, contraindications, suitable time, etc…).
Section 2: Maternity nurses' Knowledge about the stem cells.
It contained nine questions regarding stem cells, such as concept, characteristics, mechanism of action, nature of cord blood stem cells, sources of stem cells in the body advantages of cord blood stem cells, ethical consideration, sources of stem, diseases can be treated by stem cells.

Scoring system:
Each item of knowledge questionnaire was taken a score of (one) for the correct answer, (zero) for the wrong answer or don't know. The total score for the knowledge was (25) of nurses was calculated by the addition of the total score of all sections. The mean and standard deviation was calculated. Knowledge score had been classified into three categories as follows:
- A scoring of < 50% of the total score indicated poor knowledge.
- A scoring of 50 - 75% of the total score indicated fair knowledge.
- While a score of > 75% of the total score indicated good knowledge.

Tool II: Likert Scale (Nurses attitudes towards application of the stem cells and cord-blood collection)
It was adopted according to **(Patyal et al., 2018)** it used to assess the attitude towards the stem cells and cord blood collection sample, it was consisted of twenty statements categorized as (11 items as positive attitude) & (9 items as a negative attitude).
The items were scored according to a three-point Likert scale continuum from agree (3), neutral (2), and disagree (1). Summing up the scores of the items then the overall score gave total attitude score. Nurses' total attitude score was graded as the following; negative when total score was (< 33%), neutral when total score was (34-48%) and positive when total score was (>49%).

Tool III: Maternity Nurses Satisfaction Sheet:
The scale was used to assess the nurse's satisfaction regarding the teaching program, it was consisted of seven items. Each nurse response was classified as weak (0), accept (1), good (2), very good (3), excellent (4).

Validity & Reliability of Research Tools:
Content validity of the tool was established after it revised by a jury of 3 experts specialized in related nursing field. Pre-testing of the tools revealed that the tool was clear, feasible and there was no ambiguity in the language. Modifications were done accordingly based on their comments and remarks. Internal consistency and a reliability coefficient (Cronbach's alpha) the components of the questionnaire tested by SPSS soft ware version 21.And it is 0.72 for knowledge assessment part, 0.74 for attitude assessment questionnaire and 0.81 for satisfaction scale and this means good reliability of the tools.

Pilot Study:
An eleven nurses were included in the pilot study to test the clarity and applicability of the study tools. It was done to estimate the period required to fill the questionnaire. Some questions such as (ethical considerations of obtaining stem cells from umbilical cord . . . etc.) were added and the required modifications were done. Nurses involved in the pilot were excluded from the study.

Ethical Considerations:
An official approval was attained from the directors of the head of woman's health and midwifery nursing department and the director of obstetrics and gynecology department in Mansoura university hospital. Each nurse was informed about the study aim and before starting the data collection a written consent was obtained from the study sample. Confidentiality was ensured throughout the study process, and the nurses were confident that all data was used only for research purpose. Each nurse involved in the study informed that the participation is voluntary and able to withdraw from the study at any time.

II. Method:

The study was carried out from August 2019 till December 2019. To fulfill the aim of the study the researchers had followed the following phases:

Assessment phase:
- An official written approval was obtained from the director of woman's health and midwifery nursing department and the director of obstetrics and gynecology department in Mansoura university hospital after reviewing the relevant published literatures and designing the tools of data collection. Then the pilot study was conducted on an eleven staff nurse.
- The researchers had introduced themselves, greeted each nurse and explain the aim of the study for obtaining the written approval. Then the researchers interviewed the nurses for 30 minutes and collect the baseline data. Pre-test was carried out to evaluate nurses' knowledge and attitude regarding the UCB collection and preservation for further comparison to evaluate the effect of the conducted program.

Planning phase:
Based on the data that has collected from pre-test assessment, the educational program sessions were conducted. Four sessions were provided in Arabic and English language to suit to different educational levels of nurses. The teaching methods used were included (
(Visual aids as posters, PowerPoint presentation, lectures and group discussion, brainstorming, cord blood collection set, real umbilical cord, and model of fetus with umbilical cord). The number of sessions was four sessions. Each session last 20 minutes by the researchers.

Implementation phase:
- The researchers visited the pre-mentioned setting during the (morning and afternoon shifts) three days each week alternately for twenty weeks for conducting the program.
- The program encompassed four planned sessions and were implemented according to job load, nurses' shifts and their intellectual and physical willingness. The sessions were repeated to each subgroup included (4-5

nurses). Each session continued for 30-40 minutes including time for discussion and differ according to the nurses' recognition, comments and feedback.

1st session: An orientation about the program and its aims were clarified at the beginning of the first session. It covered information about the cord blood such as definition, anatomy, indications, contraindications, suitable time for collection, the appropriate time for collecting cord blood, maximum duration of storage, diseases that can be cured by using it.

2nd session: It covered knowledge about regarding stem cells, such as concept, characteristics, mechanism of action, nature of cord blood stem cells, sources of stem cells in the body advantages of stem cells that collected from the cord blood, ethical consideration, sources of stem and its medical uses.

3rd session: It aimed for increasing knowledge about UCB collection and preservation.

4th session: session was applied for revising all data provided at the previous sessions and discuss the answers of all questions. Handouts were disseminated at the end of the sessions.

- At the beginning of each session, feedback was given about the previous one.

Evaluation phase:

At this phase, the researchers had distributed the post-test to evaluate the knowledge and attitude of the nursing staff by using the same pre-designed tools to compare the difference between pre-and post-test results and evaluate the effect of the implemented program and compare. Also, evaluate their satisfaction level regarding the awareness program.

Limitation of the study

Occasionally, the sessions were extended because of the workload, shortage of nursing staff and interference that required extra time that is devoted and effort.

Statistical analysis:

The data were coded, computed and statistically analyzed using version 21 SPSS program (statistical package of social sciences). Data were presented as frequency and percentages (qualitative variables) and mean ± SD (quantitative continuous variables). Chi square (χ^2) was used for comparison of categorical variables, and was replaced by Fisher exact test (FET) if the expected value of any cell was less than 5. Paired t test was used for comparison of continuous quantitative variables before and after training, the difference was considered significant at $P \leq 0.05$.

III. Results

Table (1): Frequency distribution among the studied nurses according to the general characteristics.

Characters	No=128	%
Age (years)		
20-25	36	28.1
26-30	34	26.6
31-35	58	45.3
	Mean ± SD = 28.13 ± 4.52 years	
Qualifications		
Diploma	58	45.3
Technical Institute	44	34.4
BSc. Nursing	26	20.3
Experience years		
1-5 years	38	29.7
6-10 years	51	39.8
11-15 years	39	30.5
	Mean ± SD = 8.73 ± 2.81 years	
Current working job responsibility		
Head nurse	49	38.3
Staff nurse	31	24.2
Practice nurse	48	37.5
Residence		
Urban	36	28.1
Rural	92	71.9
Religion		
Muslim	105	82.0
Others	23	18.0
Have you ever taken assisted cord blood or stem cell sampling?		
Yes	0	0.0
No	128	100.0

Table (1) shows the characteristics of the studied nurses. Among 128 studied nurses, 45.3% aged 31 to 35 years and 54.7% aged 20-30 years with average 8.73 ± 2.81 years. Qualifications are diploma (45.3%), technical institute (34.4%) and nursing with BSc. (20.3%). Their experience years ranged from ten to fifteen years; most of them (69.5%) had experience up to 10 years with average 8.73 ± 2.81 years. As regard the current job; 38.3% works as a head nurse, 24.4 as staff nurse and 37.5 were practice nurse. Most of them were from rural areas (71.9%) and Muslims (82.0%). There no one of them was assisting in cord blood or stem cell sampling.

Table (2): Comparison of pre& post-intervention knowledge among the studied sample about the UCB & stem cells.

Items	Correct answer pre-intervention		Correct answer post-intervention		Significance test
	No.	%	No.	%	
1st Section: Knowledge Regarding UCB collection technique					
1- Definition of umbilical cord?	51	39.8	101	78.9	χ^2=40.49,P<0.001
2- Anatomy of umbilical cord?	86	67.2	115	89.8	χ^2=19.47,P<0.001
3- What is cord blood stem cell banking?	14	10.9	119	93.0	χ^2=172.53,P<0.001
4- Benefits of Umbilical Cord blood?	19	14.8	110	85.9	χ^2=129.44,P<0.001
5- Indications of cord blood collection?	25	19.5	116	90.6	χ^2=130.49,P<0.001
6- Contraindications of cord blood collection?	27	21.1	122	95.3	χ^2=144.92,P<0.001
7- Advantages of umbilical cord blood banking?	26	20.3	116	90.6	χ^2=128.09,P<0.001
8- Proper time of clamping umbilical cord?	45	35.2	115	89.8	χ^2=81.67,P<0.001
9- Purpose for cord blood storage?	24	18.8	117	91.4	χ^2=136.55,P<0.001
10- Which time is Suitable for collect umbilical cord blood?	51	39.8	115	89.8	χ^2=70.19,P<0.001
11- Methods of umbilical cord blood collection?	26	20.3	112	87.5	χ^2=116.27,P<0.001
12- Amount of blood needed?	24	18.8	118	92.2	χ^2=139.73,P<0.001
13- Places for cord blood storage?	40	31.2	113	88.3	χ^2=86.57,P<0.001
14- Preparations of umbilical cord blood collection?	22	17.2	128	100.0	χ^2=180.91,P<0.001
15- Recommended procedures related to cord blood banking	51	67.2	122	95.3	χ^2=89.87,P<0.001
16- Length of time for cord blood storage	31	24.2	89	69.5	χ^2=52.50,P<0.001
2nd Section: knowledge about stem cells					
1- Definition of stem cells?	42	32.8	115	89.8	χ^2=87.77,P<0.001
2- Characteristics of stem cells?	25	19.5	115	89.8	χ^2=127.80,P<0.001
3- Sources of stem cells in the body?	18	14.1	128	100.0	χ^2=192.88,P<0.001
4- Advantages of cord blood stem cells?	26	20.3	118	92.2	χ^2=134.35,P<0.001
5- Sites of obtaining stem cells?	10	7.8	109	85.2	χ^2=153.90,P<0.001
6- Mechanism of action of stem cells?	31	24.2	113	88.3	χ^2=106.73,P<0.001
7- Types of stem cells?	13	10.2	109	85.2	χ^2=144.32,P<0.001
8- Ethical considerations of obtaining stem cells from umbilical cord?	90	70.3	124	96.9	χ^2=32.93,P<0.001
9- What diseases are currently treated by cord blood stem cells?	27	21.1	128	100.0	χ^2=166.81, P<0.001

Table (2) shows that there was highly significant increase in the percentage of correct answers about both knowledge sections regarding umbilical cord-blood collection technique and stem cells post-intervention (P<0.001).

Table (3): Average knowledge score among the Studied Nurses pre& post-intervention.

Items	Pre- Intervention	Pre- Intervention	Significance test
	Mean ± SD	Mean ± SD	
1st Knowledge Section	4.39 ±1.87	14.28 ± 1.85	t=42.644,P<0.001
2nd knowledge Section	2.20 ±1.24	8.27 ± 0.94	t=48.338,P<0.001
Total knowledge	6.59 ± 2.36	22.55 ± 2.30	t=55.575,P<0.001

Table (3) shows that the average score of knowledge was highly significant improved from 6.59 ± 2.36 pre-intervention to 22.55 ± 2.30 post-intervention with highly significant difference (P<0.001).

Table (4): Knowledge level of the Studied Nurse's regarding the UCB collection technique & stem cells pre& post-intervention.

Items	pre-intervention		post-intervention		Significance test
	No.	%	No.	%	
1st Section: Knowledge Regarding UCB collection technique					
Poor knowledge (<50.0%)	119	92.0	1	0.8	χ^2=227.70, P<0.001
Fair knowledge (50.0 - <75.0%)	8	6.2	14	10.9	
Good knowledge (≥75.0%)	1	0.8	113	88.3	
2nd Section: knowledge about stem cells					
Poor knowledge (<50.0%)	123	96.1	1	0.8	χ^2=240.06, P<0.001
Fair knowledge (50.0 - <75.0%)	4	3.1	4	3.1	
Good knowledge (≥75.0%)	1	0.8	123	96.1	
Total knowledge					
Poor knowledge (<50.0%)	121	94.5	2	1.6	χ^2=227.96, P<0.001
Fair knowledge (50.0 - <75.0%)	5	3.9	8	6.2	
Good knowledge (≥75.0%)	2	1.6	118	92.2	

(Table 4 & figure 1) shows that the level of nurses' knowledge was significantly improved post-intervention (P<0.001) and the level of good knowledge had increased from 1.6% pre-intervention to become 92.2% post-intervention.

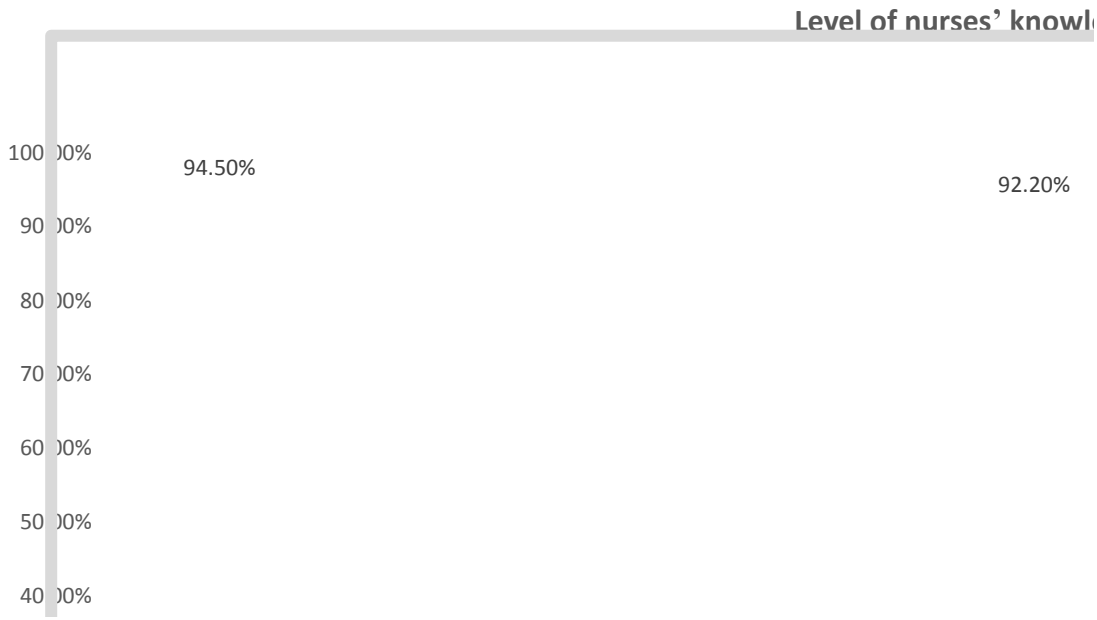

Figure (1): Knowledge level of the studied nurses about cord blood sampling & stem cells

Table (5): Average Attitudes score of the Studied Nurses pre& post-intervention.

Variable	Pre-intervention	Post-intervention	Paired t test
Attitude Score (Mean ± SD)	34.43 ± 3.80	58.83 ± 1.29	t=64.997,P<0.001

Table (5) presents the average score of nurses' attitude was highly significant (P<0.001) increased to 58.83 ± 1.29 post-intervention in comparison to 34.43 ± 3.80 pre-intervention.

Table (6): Nurses' attitudes towards application of the stem cells and cord blood collection.

Positive statements	Groups	Agree (3)		Neutral (2)		Disagree (1)		Significance test
		No	%	No	%	No	%	
1. Collection of umbilical cord blood immediately after delivery is necessary	Before After	55 2	43.0 1.6	46 6	25.9 4.7	27 120	21.1 93.8	χ^2=138.8, P<0.001
3. Cord blood is useful for life	Before After	62 0	48.4 0.0	42 0	32.8 0.0	24 128	18.8 100.	χ2=175.1, P<0.001
5. Baby's cord blood collection should be used for different purposes	Before After	51 2	38.8 1.6	45 7	35.2 5.5	32 119	25.0 93.0	χ^2=123.2, P<0.001
7. Baby's cord blood should be used for different purposes	Before After	56 0	43.8 0.0	50 0	39.1 0.0	22 128	17.2 100.	χ2=180.91, P<0.001
9. Experience is required for cord blood collection	Before After	52 1	40.6 0.8	43 6	33.6 4.7	33 121	25.8 94.5	χ^2=127.30, P<0.001
11. Stem cells across matching are necessary before use	Before After	54 2	42.2 1.6	42 4	32.8 3.1	32 122	25.0 95.3	χ2=132.27, P<0.001
13. Storage of cord blood is necessary	Before After	51 0	39.8 0.0	44 0	34.4 0.0	33 128	25.8 100.	χ^2=151.06, P<0.001
15. It is necessary to introduce regarding cord blood collection and stem cells in nurses	Before After	62 4	48.4 3.1	36 4	28.1 3.1	30 120	23.4 93.8	χ2=130.57, P<0.001
17. Like to attend workshops regarding cord blood collection and stem cells in nurses	Before After	55 0	43.0 0.0	46 0	35.9 0.0	27 128	21.1 100.	χ^2=166.81, P<0.001
19. Collecting umbilical cord blood and stem cells is approved?	Before After	64 12	50.0 9.4	41 10	32.0 7.8	23 106	18.0 82.8	χ2=107.83, P<0.001
20. I am aware of the potential benefits, uses &possible harms of stem cells research	Before After	56 0	43.8 0.0	50 15	39.1 11.7	22 113	17.2 88.3	χ^2=136.1, P<0.001
Negative statements								
2. Cord blood is useful only for baby and his own family only	Before After	66 5	51.6 3.9	41 4	32.0 3.1	21 119	16.4 93.0	χ^2=151.4, P<0.001
4. During cord blood collection, baby is harmed	Before After	52 0	40.6 0.0	49 0	38.3 0.0	27 128	21.1 100.	χ2=166.8, P<0.001
6. Cord blood collection is wasting of time.	Before After	58 0	45.3 0.0	49 9	38.3 7.0	21 119	16.4 93.0	χ^2=154.1, P<0.001
8. Care of mother and baby is affected by collection on cord blood.	Before After	60 0	46.9 0.0	45 0	35.2 0.0	23 128	18.0 100.	χ2=178.01 P<0.001
10. Stem cells transplantation should be widely practiced.	Before After	67 4	52.3 3.1	41 6	32.0 4.7	20 118	15.6 92.2	χ^2=151.56, P<0.001
12. Competency in stem cell knowledge is important for me as a health care provider.	Before After	57 5	44.5 3.9	49 5	38.3 3.9	22 118	17.2 92.2	χ2=145.2, P<0.001
14. There should be no more awareness program regarding stem cell	Before After	63 0	49.2 0.0	40 0	31.2 0.0	25 128	19.5 100.	χ^2=172.3, P<0.001
16. The government should prohibit researches regarding stem cells from embryo or aborted fetus	Before After	67 0	53.3 0.0	33 0	25.8 0.0	28 128	21.9 100.	χ2=164.1, P<0.001
18. The future of mankind is bright if stem cell research could be successfully conducted	Before After	54 0	42.2 0.0	53 0	41.4 0.0	21 128	16.4 100.	χ^2=178.13, P<0.001

Table (6) shows the nurses' attitudes towards application of the stem cells and cord blood collection. There was a highly significant improvement in the all items of nurses' attitude after intervention.

Table (7): Comparison of the Attitude pattern among the Studied Nurse's pre & post the intervention.

Attitude Pattern	Value	Pre-intervention		Post-intervention		Significance test
		No	%	No	%	
Negative attitude	<33.0%	2	1.6	1	0.8	χ^2=6.98, P 0.030
Neutral attitude	33.0-48.0%	11	8.6	2	1.6	
Positive attitude	≥49.0%	115	89.8	125	97.6	

Table (7): shows the pattern of nurses' attitude was statistically significant changed post-intervention (P 0.030) and the positive attitude increased from 89.8% pre-intervention to 97.6% post-intervention (figure 2).

Figure (2): Attitude pattern of the studied nurses about cord blood sampling & stem cells

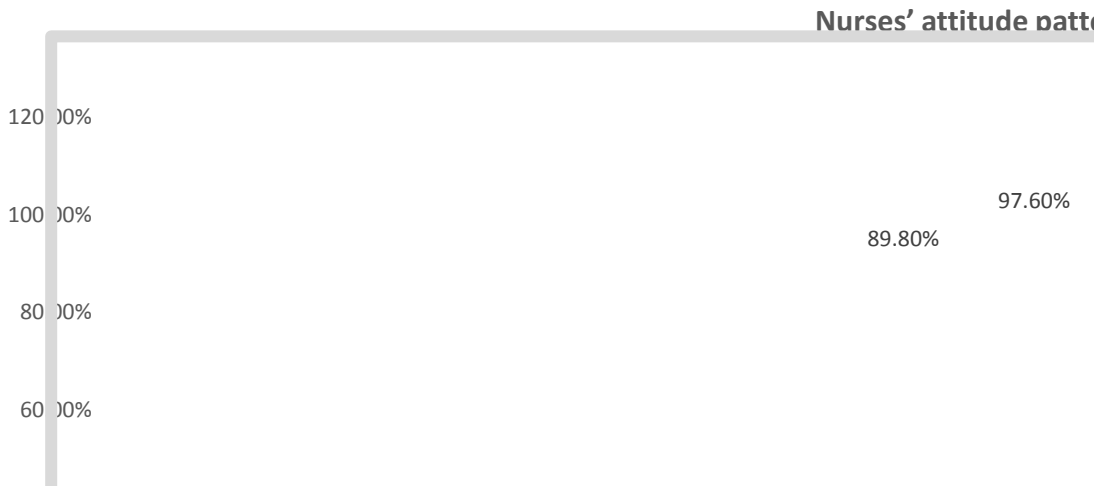

Table (8): Frequency distribution among the studied sample according to their satisfaction about the implemented educational program.

Maternity nurses' satisfaction statements	Excellent 4		Very good 3		Good 2		Accepted 1		Weak 0	
	No	%	No	%	No	%	No	%	No	%
1. The subject was interesting	11	8.6	36	27.3	33	25.8	49	38.3	0	0.0
2. The subject presented in a logical sequence	25	19.5	85	66.4	14	10.9	4	3.1	0	0.0
3. The scientific content was new and added to enhance my knowledge	9	7.0	118	92.2	1	0.8	0	0.0	0	0.0
4. The scientific material included in the guideline had been clear & easy to understand	117	91.4	7	5.5	4	3.1	0	0.0	0	0.0
5. Your assessment of the shape, organization and quality of printing material	0	0.0	0	0.0	128	100.	0	0.0	0	0.0
6. The guideline language written in easy and easy to understand	7	5.5	7	5.5	114	89.1	0	0.0	0	0.0
7. I will encourage pregnant women to use it.	13	10.2	68	53.1	24	18.8	23	18.0	0	0.0

Table (8) shows that the response of nurses varies from excellent to good about most of the satisfaction assessment items and the average satisfaction score was 19.75 ± 1.76, while average percent score of satisfaction was 70.53 ± 6.29. This means that the satisfaction of the studied nurses for this program exceeds 70.0% (table 9).

Table (9): Satisfaction raw score and satisfaction percent score.

Items	Satisfaction raw score	satisfaction percent score
Range	13.0 – 23.0	46.43 – 82.14
Mean ±SD	19.75 ± 1.76	70.53 ± 6.29
Median	20.0	71.43

Figure (3): Satisfaction level among the studied nurses

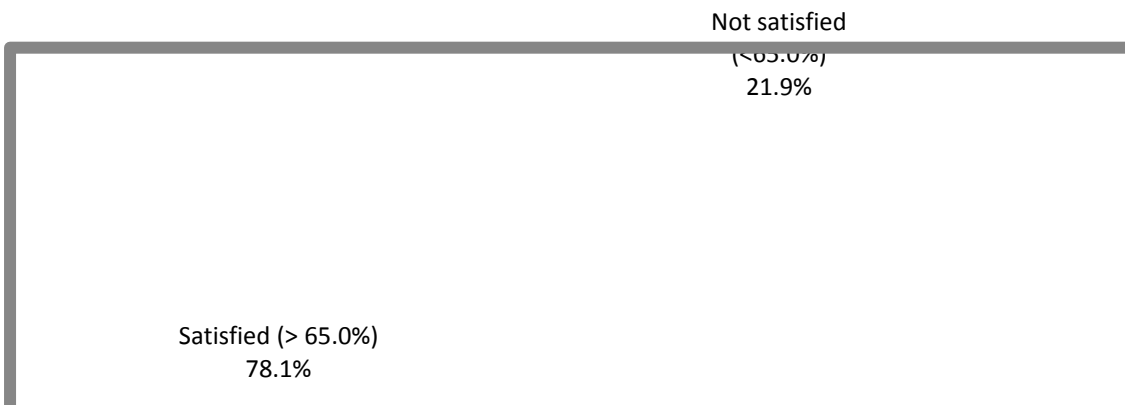

Figure (3) Shows that the majority of nurses were satisfied with the educational program and their satisfaction level reach 78.1%

IV. Discussion:

Blood from umbilical cord which collected immediately after birth is rich in blood forming stem cells that genetically identified to the newborn. This collected blood generates the cells of blood and cells of the immune system which presently used to cure the immune system diseases like leukaemia, where cells from cord blood are similar to those of adult bone marrow ***(Shaban, 2018)***.

Concerning demographic characteristics of studied nurses, the current study showed that their age ranged from 20 to 35 years with a mean age of 28.13 ± 4.52 years. Regarding qualification, the current study result found that more than half of the participants had nursing diplomas. Regarding experience years of the studied nurses half of them had 6 to ten years of experience with mean of 8.73 ± 2.81 years.

This finding came in partial agreement of ***Mohammed & El-Sayed, (2015)*** who studied "Knowledge and attitude of maternity nurses about cord blood collection and stem cells" who revealed that more than 1/2 of nurses aged 20-25 years, mean 25.34 ± 4.51, had nursing diplomas, and nearly two thirds of nurses had a mean of 6.36 ± 2.75 years of experience in the delivery room.

Regarding evaluation of sample's knowledge in cord blood and stem cell collection the recent study found that only 14.8% of participants received training sessions about UCB sampling & stem cells and there was no practicing for assisting the cord blood sampling. This finding is correspondent to ***Shaban, (2018)*** who studied "Effect of Educational Intervention on Nursing Students' Performance Regarding UCB Collection for Stem Cells" and found that the majority of the studied subjects' didn't have any previous information and more than tenth had information about collection of cord blood. Also this finding is in congruence with that of ***Amin et al, (2016)*** who found that 89% of their studied sample had no previous information regarding umbilical cord stem cell therapy.

Similarly study performed by ***Khalil & Sharshor., (2016)*** who supported this findings in the study conducted to assess nurses' knowledge and attitude regarding application of stem cells therapy and reported that the nurses have lacked and inadequate knowledge regarding umbilical cord blood banking. Also these results are in congruence with ***Mohammed & El-Sayed., (2015)*** who studied maternity nurses' Knowledge and attitude about UCB & stem cells and reported that their low knowledge can be attributed to the fact that cord blood collection and stem cells are new advanced trends and the nursing curricula are still in deficient in this topic, as well as their low level of knowledge about how to collect the cord blood and stem cells uses before the intervention. Also after graduation, care workers ignore reading and lack of motivation in upgrading their professional knowledge.

On the contrary a study done by ***Patyal et al., (2018)*** revealed that most of the nurses had average knowledge and the majority of them had moderate attitude regarding UCB collection and stem cells preservation.

The results of the current study revealed that the level of knowledge of the entrants was very poor with extremely negative attitudes and poor practices. The implementation of educational intervention has proven to meet their needs in enhancing their knowledge, improving their attitudes and maintaining good practices, which led to acceptance of the research hypothesis and its objectives. The existing study indicated that there is a high significant increase in the percentage of correct respond to questions after awareness for both knowledge regarding UCB collection technique and stem cells. The average score of knowledge is highly significant after awareness. Also, the level of nurses' knowledge is significantly increased after awareness and good knowledge increased from 1.6% before awareness to become 92.2% after it.

The current findings are in congruence with those of ***Shaban, (2018)*** who demonstrated that concerning umbilical cord, stem cells and cord blood collection there is a significant improvements for knowledge scores among the participant students that were found at the immediate after-test and after 3 months of intervention, where the majority of them had a good level of knowledge. Also, ***Mohamed & Sayed, (2015)***, who stated that the maternity of nurses in their study before the educational intervention had poor knowledge about UCB collection and banking which conveyed to statistically significant improvement at post and after three month of intervention.

Similarly, ***Akshatha, (2012)***, who documented a significant variation between the pre and post-tests level of knowledge among the studied subjects and concluded that the structured teaching program was effective for improving the knowledge of their staff nurses. On the same line, these findings are supported by ***Lovis, (2010)*** which revealed that the majority of their participants had poor knowledge regarding the collection process of cord blood and the stem cells uses in the pre-test in comparison to the good knowledge gained in the post-test.

As well, these results are correspondent to those of ***Kumaraswamy & Muthulakshmi,(2010)*** who stated that the constructed educational program was effective for improving the knowledge of health professionals, in particular those of the nurses concerned with the collection and preservation of umbilical blood

cord stem cells, in which the mean post-test score is higher (39,6±2,57) than the pre-test score (13,23±3,88); By training health care practitioners, particularly nurses, it is possible to remove misconceptions and provide them with sufficient knowledge.

As regard to the nurse' attitudes towards the stem cells and cord blood collection, the outcomes of the present study shows that the average score of nurses' attitude was highly significant increased from 34.43 ± 3.80 to become 58.83 ± 1.29 after the intervention. Also, the pattern of nurses' attitude is significantly changed after the program and positive attitude had increased from 89.8% before the program to become 97.6% after it. This higher change in attitudes may be due to the effect of information received from the educational intervention with high adherence with the educational sessions which results in a better attitude.

These results are correspondent to those of ***Shaban., (2018)*** who found that about nearly one quarter of the studied students had positive attitudes toward the current study topic before intervention, which changed to the majority in posttest and more than three quarter after three month of intervention and the differences observed were statistically significant. On the same line, these findings are supported by ***Azzazy & Mohamed, (2016)*** who assess the effect of educational intervention on nursing students' knowledge and attitude regarding stem cell therapy and reported that 56% of their subjects had positive attitude toward stem cell therapy before the intervention which changed to 94% post intervention.

Similarly, these results are in congruence with ***Mohamed & Sayed, (2015)*** showed that nearly 2⁄3 of the studied subject's attitudes was changed from negative to positive attitude about the stem cells and cord blood collection post-intervention in comparison to pre-intervention. Muslims are willing to accept new medical innovations that would create a cure for diseases or provide promises to human being; such belief affects positively on the view of students regarding stem cells therapy.

On the contrary of the present study results ***Leng et al, (2016)*** who carried out a study in Malaysia found that 86.6% of their nursing students showed good attitudes toward stem cells therapy. Additionally, ***Bombas et al, (2011)*** reported a least significant improvement in their nurses' attitudes and issues in changing attitudes were also added.

Concerning maternity nurses' satisfaction about the educational program about cord blood collection & stem cells, it was clear that the respond of nurses varies from excellent to good about most of the satisfaction assessment items. And the average satisfaction score is 19.75 ± 1.76, while average percent score of satisfaction is 70.53 ± 6.29. This means that the satisfaction of the studied nurses for this program exceeds 70.0% and satisfaction level reach 78.1%.

V. Conclusion:

Overall the results, the current study findings highlighted that implementation of educational program was effective and had significantly improve the Nurses' knowledge and change their attitude regarding umbilical cord-blood stem cells collection and preservation.

VI. Recommendations:

- Continuous in-service training programs about cord blood collection and preservation to develop nurses' knowledge, attitude, and practices in order to fit newly concepts and technological advancement in care.
- Integrate the umbilical cord blood stem cells preservation as a new technological advancement in the nursing curriculums.
- Provide guidelines regarding collection of cord blood and stem cells preservation should be accessible to all nursing staff as well as women pre-natal and labor units.
- Conducting similar studies on a wide range of sample in multicenter settings for generalizing the findings.
- Conducting regular training programs and workshops for women in antenatal clinics regarding the umbilical cord blood banking and stem cells banking.

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CONFLICTS OF INTEREST DISCLOSURE

The authors have no conflict of interest to declare.

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