Effect of Designed Educational Program on Pregnant Women' Knowledge and Attitude towards Stem Cells and Cord Blood Banking

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Abstract

Background: Stem cells and cord blood banking is important for biologic insurance and treating diseases of pregnant women's families. So, knowledge and attitude of the pregnant women regarding collection and banking of cord blood stem cells are essential. **Aim:** The current study aimed to investigate the effect of designed educational program on the pregnant women' knowledge and attitude toward stem cells and cord blood banking. **Design:** Quasi- experimental design was followed to accomplish the aim of the current study. **Setting:** obstetric and gynecological out-patient clinic in Benha University Hospital at Benha city. **Sample**: A Purposive sample of (80) pregnant women was selected for data collection according to inclusion criteria. **Tools:** Two main tools were used; tool (I); a structured interviewing questionnaire that consisted of three parts: (1): general characteristics of the studied sample, (2): obstetric history, (3): assessment of pregnant women`s knowledge about stem cells and cord blood banking. Tool (II) consisted of pregnant women`s attitude towards stem cells and cord blood banking. **Results:** The majority of the pregnant women had adequate knowledge and more than three fourth of the pregnant women had positive attitude towards stem cells and cord blood banking immediately post program and follow up compered to preprogram with a highly statistically significant throughout program phases ($P \leq 0.001$). There was a positive correlation between the total knowledge and attitude scores of the studied pregnant women throughout program phases ($P \leq 0.001$). **Conclusion**: The designed educational program has a positive effect in improving pregnant women' knowledge and attitude toward stem cells and cord blood banking. **Recommendation**: provide ongoing health educational programs about stem cells and cord blood banking to pregnant women as a part of antenatal care and provided at all the delivery department.

Keyword: Attitude, Cord blood banking, educational program, knowledge, stem cells.

Introduction:

The umbilical cord is the vital connection between the fetus and the placenta and considered biological waste, and typically discarded along with the placenta after a baby is born **(Fisher and Frey., 2021).** Umbilical blood is a rich source of both types of stem cells, making a very useful material around stem cells therapy and transplantation. Umbilical cord blood contains hematopoietic stem cells that have potential life-saving benefit **(Ghasrodashti et al., 2021).**

Stem cells are special human cells that can develop into many different cell types which can both reproduce itself and generate offspring of different functional cell types. Stem cells can build every tissue in the human body and can range from muscle cells to brain cells. In some cases, these cells can also fix damaged tissues. Stem cells can be used for the routine treatment of more than 80 diseases especially hematopoietic and oncological diseases. Advanced applications in stem cell may be hopeful for many diseases in the future **(Slack, 2021).**

There are several sources of stem cells with varying potencies. Each type of stem cells (embryonic, cord blood, adult) has its advantages and drawbacks when considered for potential clinical applications. Umbilical cord blood offers an alternative source of stem

cells with both research and clinical advantages over other sources of stem cells. Stem cells play an important role in tissue development, tissue homeostasis, and wound repair throughout life (**Liu et al., 2022).**

Umbilical cord blood stem cells processing, and collection is much easier and simpler. Indeed, the cord blood harvesting is quick and easy, and the processing takes days to weeks. Moreover, over 50000 transplants have been successfully carried out worldwide, which include cancers and blood disorders. Also, due to revolutionary development in the stem cell industry, there are several life-threatening diseases like thalassemia, leukemia etc. can now be treated completely **(Wang and Metheny, 2023).**

Cord blood banking includes the collection, processing, and storage of umbilical cord blood for future needs that are related to the treatment of family or others. Cord blood banking is once in a lifetime opportunity to save babies cord blood stem cells for potential medical uses. Which a lifesaving for baby or other family members and immediately available if ever needed **(Waller-Wise, 2022).**

There are three types of banks, public, private and hybrid. The public banks allow storage of altruistic units from donors, sponsored, and funded nationally or locally to process, and store donated umbilical cord blood units. Private cord blood banks store processed umbilical cord blood units for the private use of the family. The family of the newborn pays a fee to process and store the cord blood units, and the mother is typically named the legal custodian of the banked cord blood units **(Pentakota et al., 2022).**

Hybrid banking is a general term for banking practices that combine elements of public and private storage. The common denominator is the aim to make otherwise privately stored umbilical cord blood units available to the public, thus increasing the diversity and quantity of cord blood for donation. Different models of hybrid banking exist around the world, which will be explained in Public–private integration and the active promotion and collaboration with transplantation centers and various stakeholders through the public sector (**Laue et al., 2023).**

In addition, Egypt's Ministry of Health and Population developed an extensive policy on cord blood banking using guidelines and codes of ethics from the United States and Europe as a template. Before a cord blood bank can operate in Egypt, that would receive approval from Al-Azhar University in Cairo. Egypt permits both private and public banking in the country if certain regulations are fulfilled to minimize the potential of commercial exploitation **(Mohammed et al., 2020).**

On the other hand, insufficient information and a low education level are commonly cited as factors linked to poor knowledge levels, leading to pregnant women often being unwilling to consider donating or storing stem cells and cord blood. Additionally, educational programs are designed for assessing knowledge about stem cells and cord blood banking, playing a significant role in influencing pregnant women's understanding and attitude towards stem cells and cord blood banking **(Chaudhary et al., 2023).**

Furthermore, maternity nurses are central members of the health care team throughout all life stages. In the process of stem cells and cord blood banking, that mainly responsible for coordinating, collecting, labeling, and packaging the blood samples. So, maternity nurses play a unique role in women education as trustworthy providers of health information also an exclusive role in caring for women during pregnancy and postpartum, and greatly impacts women decisions to donate or store umbilical cord blood specially making women the most appropriate women to educate on the significance of cord blood banking to protect the women`s newborns from potential illnesses **(Sanchez-Petitto et al., 2023).**

Significance of the study:

Stem cells from cord blood act as repair units in the body, replenishing dying cells, regenerating damaged tissues, and offering potential cures for diseases such as cancer as well as in replacement therapy. Beyond cell-based therapies, also utilized in screening new drugs and toxins, understanding birth defects, and treating a range of hematologic and non-hematologic diseases in both children and adults. Worldwide, there have been over 40,000 successful umbilical cord transplants, showcasing the effectiveness of these applications. Furthermore, public banks are currently releasing approximately 30 times more umbilical cord blood units than before **(Hastings et al., 2022).**

To the best our knowledge there were previous Egyptian studies showed variable levels of stem cell and cord blood banking knowledge and attitude over different regions in Egypt. In Gharbia governorate, the researchers showed that (78.5%) of the pregnant women had low level of knowledge and (49.5%.) had negative attitude towards stem cells and cord blood banking **(Khaton et al., 2023)**. Also, in Beni-Suef governorate (42.5%) of the studied pregnant women had average level of knowledge and (67%) had negative attitude **(Arafat et al., 2021).**

In addition, pregnant women should be educated about the benefits of stem cells, cord blood banking, and the importance of storing stem cells for the women`s families and provide health insurance for women's newborn. For improving knowledge and change the attitude towards stem cell and cord blood banking. Therefore, the study was conducted to investigate the effect of designed educational program on pregnant women's knowledge and attitude towards stem cell and cord blood banking.

Aim of the Study:

The present study aimed to investigate the effect of designed educational program on the pregnant women' knowledge and attitude towards stem cells and cord blood banking. This aim was achieved through:

- Assessing the pregnant women`s level of knowledge and attitude towards stem cells and cord blood banking.
- Designing and implementing the educational program about stem cells and cord blood banking.
- Evaluating the effectiveness of a designed educational program on pregnant women's knowledge and attitude towards stem cells and cord blood banking.

Research Hypotheses:

H 1- The pregnant women who received a designed educational program would expect to have improved level of knowledge regarding stem cells and cord blood banking than before.

H 2- The pregnant women who received a designed educational program would have positive attitude towards stem cells and cord blood banking than before.

Subjects and Methods:

Research design:

Quasi- experimental design was utilized to accomplish the aim of the study.

Setting:

The study was conducted at obstetric and gynecological out-patient clinic in Benha University Hospital at Benha city. This setting serves the Qalyubia Governorate and the surrounding governorates; this clinic located on the ground floor of the hospital where women attend to the outpatient clinic for obstetric and gynecological checkups, family planning counseling, and antenatal care.

Sample type:

A purposive sample was selected from the previous mentioned study setting.

Sample size:

A total of (80) pregnant women who were attended to the previous mentioned setting at the period of six months according to the following

Inclusion criteria: -

- Pregnant women at 28-32 weeks.
- Never received counseling about stem cells and cord blood banking.
- Pregnant women have at least with basic education.

Tools of data collection:

Two tools were used for data collection.

Tool (I): A structured interviewing questionnaire.

This tool was designed by researchers after reviewing literature (**Sahoo, 2021; Gupta et al., 2019).** It included the following three parts:

Part (1): General characteristics of the studied pregnant women included (age, level of education, occupation, place of residence, and family income).

Part (2): Obstetric history of the studied pregnant women included (number of gravidity, number of parity, number of abortions and gestational age).

Part (3): Assessment of pregnant women`s knowledge about stem cells and cord blood banking, it consisted of (21) items which divided into three sections: -

Section (a) knowledge about stem cells, included (7) items (meaning, benefits, sources of collection, types, advantages, disadvantages, harms of stem cells).

Section (b) knowledge about umbilical cord blood, included (3) items (meaning, benefits and contraindications to use the umbilical cord blood).

Section (c) knowledge about stem cells and umbilical cord blood banking, included (11) items (meaning of stem cells and umbilical cord blood banking, meaning of the umbilical cord blood bank, the types of stem cell and umbilical cord blood banks, stem cells and umbilical cord blood banks in Egypt, methods of umbilical cord blood and stem cells collecting. persons that responsible for collecting umbilical cord blood, time to inform the pregnant woman about stem cell and umbilical cord blood banking, tests before using stem cells from umbilical cord blood, costs of stem cell and umbilical cord blood banking, period for stem cells and umbilical cord blood banking, and view of Islam about banking and donating of stem cells and umbilical cord blood).

The Scoring system:

Each item was graded as (2) for correct answer, and (1) for incorrect and unknown answer. Total knowledge ranged from 21 to 42 scores, then converted into inadequate knowledge (< 60%) if the total score less than (25) degrees and adequate knowledge (≥ 60%) if the total score more than (25) degrees.

Tool II: Pregnant women's attitude toward stem cells and cord blood banking.

This tool was designed by the researchers after reviewing of the related literature **(Subramaniam et al., 2021; Sumerlin et al., 2019)** to assess pregnant women attitude toward stem cells and cord blood banking which included (15) items; positive items as (stem cells and cord blood banking in a special blood bank is useful, utilizing stem cells to treat some immune and blood diseases more effective,…etc). And include negative items such as (stem cells banking harmful for the newborn, using umbilical cord blood only for the newborn's family, ……. etc).

The Scoring system: -

Each item was rated on a three-point Likert scale: (3) for agree, (2) for neutral, and (1) for disagree. The score was reversed for the negative items. Total attitude scores ranged from 15 to 45. The total score was less than 27 scores (< 60%), it was considered a negative

attitude; if the total score was between 27 and 45 scores (≥ 60%), it was considered a positive attitude.

Validity and Reliability of the Tools:

The tools were revised by a jury of three experts of Obstetric and Gynecology Nursing professors at the Faculty of Nursing, Benha University to test content validity of tools and modifications were done for paraphrasing some words to give the appropriate meaning for clarifying of all statements and comprehensiveness of the tools. Reliability for the internal consistency of the tools assessed by Cronbach's alpha test and internal consistency was (0.88) for the part (3) of tool (I) and internal consistency was (0.85) for tool (II).

Ethical Considerations:

The ethical research considerations in this study were as follows:

- Approval from the Ethical Committee at the Faculty of Nursing, Benha University.
- The researchers explained the study objectives and process to the pregnant women involved and obtained oral consent from each participant.
- Pregnant women had the right to withdraw from the study at any time without facing any consequences.
- The study did not have any physical and psychological risks on the pregnant women.
- The researchers were ensured the fullest respect, dignity, anonymity, confidentiality and privacy.

Pilot study:

The pilot study was conducted on 10% of the total study period about three weeks involved (10 pregnant women) to evaluate the feasibility, clarity, and applicability of the study`s tools. As well as to estimate the time needed for data collection. Modifications were done related to appropriateness of the content and the sequence of the items of the tools as modify some words for clear meaning of the sentences such as (change the diseases that treated with umbilical cord blood as well as the advantage of the umbilical cord blood to the benefits of the umbilical cord blood. Thus, the pregnant women involved in the pilot study were excluded from the main study sample.

Field work:

The current study was conducted through the following phases: interviewing and assessment, planning, implementation, and evaluation. These phases spanned from October 2021 to September 2022, covering a period of 12 months. The researchers visited the prementioned setting two days per week from 9:00 am to 12 pm.

Interviewing and assessment phase:

At the beginning of the interview the researchers greeted each pregnant woman, introduced herself, explained the aim of the current study and provided the pregnant women with all information about the current study objectives, duration, and activities. Then took oral consent from each pregnant woman to participate in the current study. The researchers distributed the pretest tool to each pregnant woman which included a structured interviewing questionnaire. The average time required for the completion of tool (I) was around 15-20 minutes and tool (II) were around 10-15 minutes. So, the total time for finishing of tools was 25-35 minutes. The researchers interviewed about 4-5 pregnant women weekly.

Planning phase:

Based on the data obtained from the pretests in the interviewing and assessment phase of the current study the researchers determined the deficit and needs of the pregnant women's knowledge and attitude towards stem cells and cord blood banking. Accordingly, the researchers designed the educational program and booklet in clear and simple Arabic language appropriate to the level of education of the studied pregnant

women. This booklet was supported with colored pictures. In addition, the researchers determined the educational sessions number and every session content. Similarly, the researchers selected the methods of teaching as group discussion and instructional media as posters and video.

Implementation phase:

The researchers visited the outpatient clinic two days a week, from 9:00 am to 12:00 pm. The studied pregnant women were divided into 16 subgroups, each consisting of 4-5 pregnant women. The educational program comprised three sessions, each one lasting 30-40 minutes. Each subgroup attended these sessions, and contact information was collected for future communication. The sequence of educational sessions was as follows: -

First session: at the starting of the session the researchers gave the pregnant women the overview about the outline of the educational program's sessions. Also, the researchers took pregnant women's feedback about the stem cells. Then the researchers explained the general and specific objectives of this session. The researchers helped the pregnant women to change the false knowledge and attitude toward the stem cells Upon completion of the research session, the researchers provided pregnant women opportunity to share the opinions on the session, discuss the acquired information's benefits, and assess the session's impact on the knowledge. The researchers distributed the printed Arabic educational booklet with colored pictures to each woman.

Second session: At the beginning of this session, the researchers quickly reviewed the previous session with the pregnant women. Following this, the researchers sought feedback from the pregnant women regarding umbilical cord blood. In addition, the researchers allowed the chance to the pregnant women to say the view about this session and evaluate the information clarified in this session.

Third session: At the start of this session, the researchers engaged the pregnant women by swiftly reviewing the previous session. The researchers identified the pregnant women the meaning of the stem cells and cord blood banking, the types and sites of these banks in Egypt. After the end of this session the researchers allowed to the pregnant women to ask any questions also permitted to all pregnant women to give any comments and gave the opportunity to say the pregnant women's opinions and attitude about the current session.

Evaluation phase:

Immediately and after one month of the implementation of the designed educational program, the researchers distributed posttests format of tool I part (3) and Tool II to assess the effect of program on pregnant women`s knowledge and attitude towards stem cells and cord blood banking.

Statistical analysis:

The current collected data tabulated and analyzed using the Statistical Package for the Social Science (SPSS version 25.0). Descriptive statistics were applied by mean, standard deviation, Frequency, Percentages**.** Inferential statistics as chi-square or Fisher's exact test were used to compare the qualitative variables, repeated measures ANOVA was used to compare the quantitative variables. Pearson's correlation coefficient test was used to assess the degree of association between quantitative variables. A statistically significant difference was considered at a p-value ≤ 0.05, a highly statistically significant difference was considered at a value $\leq 0{,}001$.

Limitations of the study:

Sometimes the sessions were protracted due to noise and other women' interruption.

Results:

Table (1) shows that 67.5% of the studied pregnant women age was ranged from 20-30 years and the mean age of the pregnant women was 25.36± 3.49 years. In relation to educational level 47.4% of the studied pregnant women had secondary education. As well as many of the studied pregnant women were housewives which represented 63.7%. Moreover, most of the studied pregnant women were lived in rural regions and represented 56.3%. Furthermore, 72.5% of the studied pregnant women had inadequate monthly income.

Table (2) clarifies that 43.7% of the studied pregnant women had pregnancy for one time. While 41.2% of the studied pregnant women delivered once. Also, 97.5% of the studied pregnant women had no abortion. In addition, the mean gestational age of the studied pregnant women was 30.17±1.28 weeks.

Table (3) clarifies that there was increased in the mean score of knowledge immediately post program compared to preprogram. While during follow up phase there were slightly decline than immediately post program. Moreover, there was a highly statistically significant difference between the studied pregnant women`s mean of total knowledge scores regarding stem cells and umbilical cord blood banking through pre-program, immediately post program and follow-up phase ($P \leq 0.001$).

Figure (1) shows that 85% of the studied pregnant women had inadequate level of total knowledge regarding stem cells and cord blood banking preprogram. On the other hand, 90% of the studied pregnant women had adequate level of total knowledge regarding stem cells and cord blood banking immediately post program. While 81.2% of the studied pregnant women had adequate level of knowledge regarding stem cells and cord blood banking during follow up phase.

Table (4) indicates that there was a highly statistically significant difference between the studied pregnant women`s attitude towards stem cells and cord blood banking preprogram, immediately post program and follow up phases ($P \leq 0.001$).

Figure (2) shows that 77.5% of the studied pregnant women had negative level of total attitude toward stem cells and cord blood banking preprogram. on the other hand, 83.7% of the studied pregnant women had positive level of total attitude towards stem cells and cord blood banking immediately post program. While, 75.0% of the studied pregnant women had positive level of total attitude towards stem cells, and cord blood banking in follow up phase.

Table (5) illustrates that there was a highly statistically positive correlation between total knowledge and total attitude scores of the studied pregnant women regarding stem cells and cord blood banking preprogram, immediately post program and follow up phases ($P \leq 0.001$).

Table (1): Distribution of the studied pregnant women according to general characteristics (n= 80).

Variables	No.	%
Age (years)		
≤ 20	6	7.5
20 < 30	54	67.5
30 < 40	20	25.0
Mean ± SD	25.36 ± 3.49	
Educational level		
Basic education	15	18.8
Secondary education	38	47.4
University education	27	33.8
Occupation		
working	29	36.3
Housewife	51	63.7
Residence		
Urban	35	43.7
Rural	45	56.3
Monthly income		
Adequate	22	27.5
Inadequate	58	72.5

Table (2): Distribution of the studied pregnant women according to obstetric history (n= 80).

Obstetric History	No.	%
Gravidity		
Once	35	43.7
Twice	26	32.5
Three and more	19	23.8
Parity		
Once	33	41.2
Twice	28	35.0
Three and more	19	23.8
Number of abortions		
None	78	97.5
One	2	2.5
Gestational age (weeks)		
Mean ± SD	30.17± 1.28	

Table (3) Comparison of mean knowledge scores of the studied pregnant women regarding stem cells and cord blood banking throughout program phases (n=80).

Phases / Knowledge about	Preprogram	Immediately post program	Follow up	F test	P-value
	Mean ± SD	Mean ± SD	Mean ± SD		
Stem cells	7.46 ± 0.99	12.85 ± 1.16	10.78 ± 1.21	567.11	0.001**
Umbilical cord blood	3.19 ± 0.28	5.46 ± 0.79	4.94 ± 0.85	302.83	0.001**
Stem cells and cord blood banking	11.41 ± 0.84	19.16 ± 2.18	17.16 ± 1.82	586.84	0.001**
Total	22.14± 1.92	38.32 ± 5.75	34.73 ± 6.38	270.64	0.001**

F: repeated measures ANOVA **A highly statistically significant difference (P ≤ 0.001)

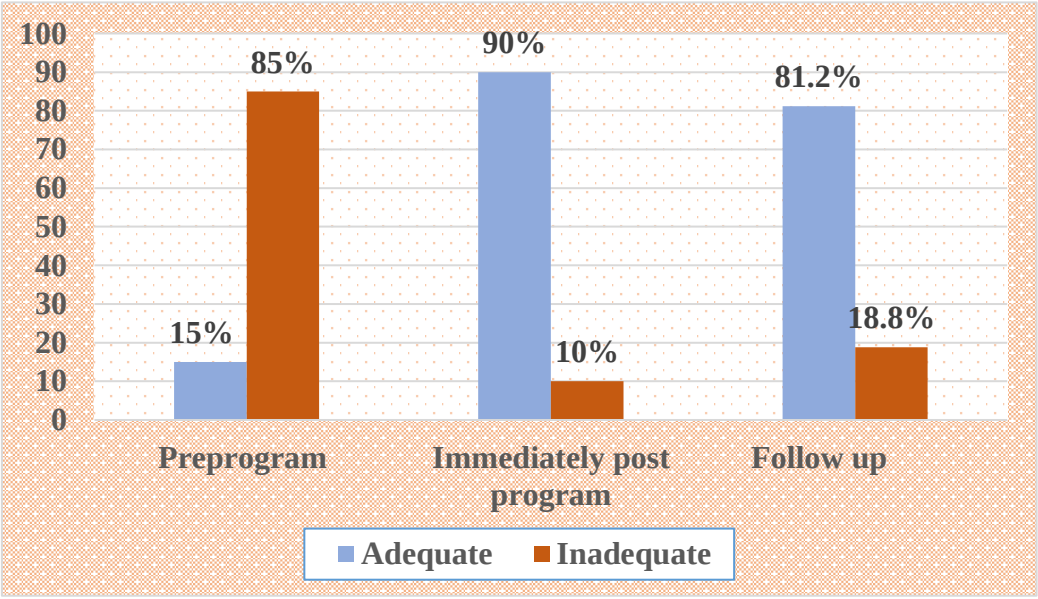

Figure (1): Percentages distribution of the studied pregnant women according to level of total knowledge regarding stem cells and cord blood banking throughout program phases (n=80).

Table (4): Distribution of the studied pregnant women according to attitude toward stem cells and cord blood banking throughout program phases (n=80).

Phases / Attitude Items		Preprogram		Immediately post program		Follow up		^{2}/ FETX (P_1-value)	^{2}/ FETX (P_2 -value)
		No.	%	No.	%	No	%		
Stem cells and cord blood banking in a special blood bank is useful.	Agree	9	11.3	68	85.0	59	73.7	71.19 (0.001**)	67.78£ (0.001**)
	Neutral	38	47.5	7	8.7	19	23.8		
	Disagree	33	41.2	5	6.3	2	2.5		
Utilizing stem cells to treat some immune and blood diseases more effective.	Agree	12	15.0	72	90.0	62	77.5	76.23£ (0.001**)	68.32£ (0.001**)
	Neutral	35	43.7	5	6.2	16	20.0		
	Disagree	33	41.3	3	3.8	2	2.5		
Using of cord blood stem cells to treat various diseases such as autism, burns, spinal cord injuries and birth defects.	Agree	6	7.5	70	87.4	65	81.2	92.36£ (0.001**)	89.87 (0.001**)
	Neutral	31	38.7	7	8.8	10	12.5		
	Disagree	43	53.8	3	3.8	5	6.3		
Using of cord blood stem cells to treat regeneration and repair damaged organs in the body.	Agree	5	6.2	67	83.7	54	67.4	89.58£ (0.001**)	70.93 (0.001**)
	Neutral	30	37.5	9	11.3	19	23.8		
	Disagree	45	56.3	4	5.0	7	8.8		
Stem cells banking harmful for the newborn.	Agree	35	43.7	6	7.5	0	0.0	70.57 (0.001**)	69.58£ (0.001**)
	Neutral	29	36.3	5	6.2	14	17.5		
	Disagree	16	20.0	69	86.3	66	82.5		
Profiting from stem cell collection is vital.	Agree	5	6.3	60	75.0	47	58.7	78.42£ (0.001**)	51.32£ (0.001**)
	Neutral	39	48.7	11	13.7	21	26.3		
	Disagree	36	45.0	9	11.3	12	15.0		
Using umbilical cord blood only for the newborn's family.	Agree	10	12.5	0	0.0	3	3.8	16.14£ (0.001**)	17.58£ (0.001**)
	Neutral	25	31.3	15	18.8	8	10.0		
	Disagree	45	56.3	65	81.2	69	86.2		
Using banked cord blood for treatment through donation.	Agree	12	15.0	67	83.7	57	71.2	76.73 (0.001**)	53.99£ (0.001**)
	Neutral	50	62.5	7	8.8	21	26.3		
	Disagree	18	22.5	6	7.5	2	2.5		
Collecting umbilical cord blood hurts the newborn and the mother during labor.	Agree	27	33.8	0	0.0	0	0.0	82.22£ (0.001**)	69.32£ (0.001**)
	Neutral	34	42.4	0	0.0	10	12.5		
	Disagree	19	23.8	80	100.0	70	87.5		
Umbilical cord blood isn`t important for donation.	Agree	48	60.0	7	8.8	13	16.3	71.38 (0.001**)	63.94 (0.001**)
	Neutral	26	32.5	18	22.5	5	6.2		
	Disagree	6	7.5	55	68.7	62	77.5		
The public banks are better than private banks for stem cells and cord blood banking.	Agree	7	8.8	59	73.7	47	58.7	69.85 (0.001**)	55.73 (0.001**)
	Neutral	35	43.7	9	11.3	28	35.0		
	Disagree	38	47.5	12	15.0	5	6.3		
Storing newborn cord blood as a source of stem cells, if the banking costs are affordable.	Agree	5	6.3	69	86.2	61	76.2	85.14£ (0.001**)	83.52£ (0.001**)
	Neutral	40	50.0	7	8.8	18	22.5		
	Disagree	35	43.7	4	5.0	1	1.3		
Donating umbilical cord blood to a public bank to utilize for treating medical diseases and to use by other people.	Agree	6	7.5	70	87.5	61	76.2	95.95£ (0.001**)	80.75 (0.001**)
	Neutral	30	37.5	8	10.0	13	16.3		
	Disagree	44	55.0	2	2.5	6	7.5		
Donation stem cells and cord blood for purposes of research in the future to treat incurable diseases.	Agree	7	8.7	57	71.2	45	56.2	73.88 (0.001**)	53.57 (0.001**)
	Neutral	24	30.0	17	21.3	25	31.3		
	Disagree	49	61.3	6	7.5	10	12.5		
Profiting from stem cells and umbilical cord blood banking and donation is prohibited by Sharia.	Agree	35	43.7	8	10.0	11	13.7	33.07 (0.001**)	42.06 (0.001**)
	Neutral	26	32.5	20	25.0	9	11.3		
	Disagree	19	23.8	52	65.0	60	75.0		

****A highly statistically significant difference (P ≤ 0.001)** **£=Fisher Exact Test**

$X1^2$ and P1-value = Pre and Immediately post program

$X2^2$ and P2 – value = Preprogram and follow up

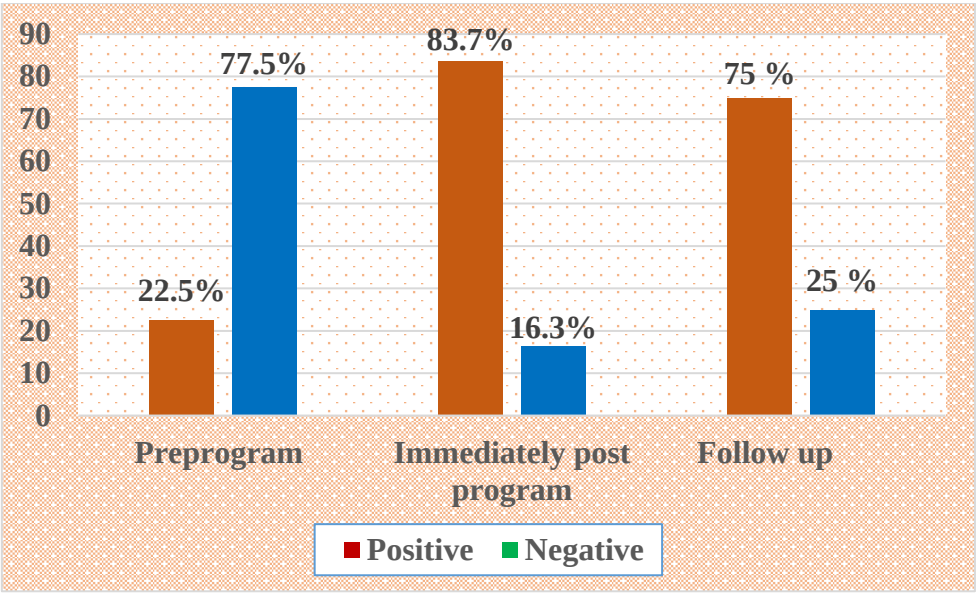

Figure (2): Percentage distribution of the studied pregnant women according to level of total attitude toward stem cells and cord blood banking throughout program phases (n=80).

Table (5) Correlation coefficient between total knowledge and attitude of the studied pregnant women towards stem cells and cord blood banking throughout program phases (n=80).

Variables	Total knowledge score					
	Preprogram		Immediately post program		Follow up	
	r	p	r	p	r	p
Total attitude score	0.458	0.001**	0.625	0.001**	0.793	0.001**

****A highly statistically significant difference (P ≤ 0.001)**

Discussion

Umbilical cord blood post birth used to be deemed medical waste. Which the stem cells isolated from this blood are called umbilical cord blood stem cells. Which characterized by the ability to self-renew and differentiate into different mature cell types have been isolated from various tissues and have significant potential for treating numerous life-threatening malignant and non-malignant diseases **(Alrehaili et al., 2023; Marskole et al., 2021).**

Stem cell and cord blood banking with future applications is a significant health topic which health care team particularly nurses should educate pregnant women for making informed decisions regarding banking. Increasing knowledge of stem cell and cord blood banking process, options and resource available for pregnant women and encourage a positive attitude which suggest to establishing stem cell and cord blood banking as a vital component of the healthcare system and should be included in educational program of current study from a health care provide **(Waller-Wise, 2022).**

The current study aimed to investigate the effect of designed educational program on the pregnant women` s the knowledge and attitude towards stem cells and cord blood banking. The findings of the study will be discussed in the following sections: general characteristics of the studied pregnant women,

assessment of the pregnant women`s knowledge, assessment of the pregnant women`s attitude towards stem cells and cord blood banking throughout educational program phases. As well as correlation between the studied variables.

Concerning general characteristics of the studied pregnant women; the current study results revealed that more than half of the studied pregnant women`s age was ranged from 20-30 years with mean age 25.36±3.49 years, less than half of the studied pregnant women had secondary education, more than half of the studied pregnant women were housewives and lived in rural area, and less than three quarters of the pregnant women had inadequate monthly income.

The current study results in accordance with the study of **Aboushady et al., (2021),** who reported that more than half of the study sample` age was 20-30 years and more than two third of the study sample was a housewife.

As well as the study finding in the same line with **Ibrahim et al., (2021)** who showed that nearly to half of the sample had secondary education and nearly to three quarters of the sample were housewives.

On the other hand, the study findings were disagreed with **Subramaniam et al., (2021)** who found that one third of the sample was unemployed. Also, the current study result was disagreed with **Khaton et al., (2023)** who mentioned that more than two thirds of the study sample 'family income was enough.

The researcher point of view suggested the reason of the highest frequency of housewives of the studied pregnant women and the monthly income was inadequate may be due to the highest frequencies of low and secondary educational status and rural residence which found low percentage of different work fields comparing with urban residence which influence on the family income.

Regarding the obstetric history, the current study results illustrated that less than half of the pregnant women had once pregnancy and was one para respectively. Also, the majority of the studied pregnant women had no abortion, and the mean gestational age of the studied pregnant women was 30.17±1.28 weeks.

The current study results were similar to the study of **Tomar et al., (2022**) who reported that nearly to half of the sample were primigravida and supported with the study of **Arafat et al., (2021)** who showed that more than half of the study sample were primiparous. Additionally, the present study findings were corresponded to **AbdElaziem et al., (2021)** who found the majority of the sample had no abortion and in the third trimester from 28-32 weeks of gestation.

While the current study findings in the contrast with **Mazlan et al., (2021)** who mentioned that nearly three fourth of the study sample were multigravidas.

Regarding level of total knowledge regarding stem cells and cord blood banking throughout program phases; the present study findings showed that more than three quarters of the studied pregnant women had inadequate knowledge regarding stem cells and cord blood banking preprogram. While the majority of the studied pregnant women had adequate knowledge regarding stem cells and cord blood banking immediately post program but declined to more than three quarters of the studied pregnant women had adequate knowledge regarding stem cells and cord blood banking within follow up phase.

In addition, the comparison of mean knowledge scores of the studied pregnant women towards stem cells and cord blood banking throughout program phases, the

present study results showed that there was increased in the mean score of knowledge immediately post program compared to preprogram. While during follow up phase there were slightly decline than immediately post program. Moreover, there was a highly statistically significant difference between the studied pregnant women`s mean of total knowledge scores regarding stem cells and umbilical cord blood banking through pre-program, immediately post program and follow-up phase.

Also, theses current findings were supported the study hypothesis (I) which stated that the pregnant women who received a designed educational program would expect to have improve level of knowledge regarding stem cells and cord blood banking than before. So, the researcher's perspective on the decline in pregnant women's knowledge levels is that more than half of the studied pregnant women lived in rural country and had inadequate information on stem cells and cord blood banking prior to the educational program and this a new topic for the studied pregnant women who heard before. This led to the significant improvement immediately post program and follow up phases. Also, may be due to the pregnant women were interested to the research topics and effective educational sessions.

The present study findings agree with **Ali et al., (2021)** who reported that more than three fourth of the study sample had unsatisfactory knowledge pre-instructional guidelines phases. On the other hand, more than two thirds of the study sample had satisfactory knowledge post instructional guidelines phases.

The present study findings are in agreement with **Ibrahim et al., (2021)** who revealed that more than three quarters of the antenatal mothers had satisfactory total knowledge score regarding umbilical cord stem cell banking guidelines post implementation than pre-implementation with increasing statistically significant difference.

Also, the current study results supported by **Shehata and Rashe., (2018)** Who showed that more than three quarters of study sample had poor level of total knowledge score before counseling. And after counseling more than two thirds of women had good level of total knowledge score about banking of stem cells from the umbilical cord blood with increasing in significant after counseling as compared to before.

Although the current findings disagreed with **Roshdi et al., (2021)** who revealed less than half of the study sample had good knowledge about umbilical cord banking and stem cell after the assessment of knowledge. This difference may be due to high level of education of one third of the study sample.

Regarding level of total attitude regarding stem cells and cord blood banking throughout program phases; the current study results displayed that more than three quarters of the studied pregnant women had negative attitude towards stem cells and cord blood banking preprogram. On the other hand, most of the studied pregnant women had positive attitude regarding stem cells and cord blood banking immediately post program. While in follow up phase decline to three quarters of the studied pregnant women had positive attitude regarding stem cells and cord blood banking. Also, theses current findings were supported the study hypothesis (II) which stated that the pregnant women who received a designed educational program would have positive attitude towards stem cells and cord blood banking.

The researcher point of view that the negative attitudes of the studied pregnant

women due to over two-thirds being housewives and nearly three-quarters having inadequate monthly incomes and living in rural areas which hindered their access to knowledge to this new topic about stem cells storage and cord blood banking before the educational program sessions. In addition, the positive attitude of the studied pregnant women due to the improvement of the effective streamlining of the educational program sessions and providing the Arabic educational booklet for all the studied pregnant women by the researcher.

The present study findings agree with **EL-Said et al., (2023)** who reported that nearly to half of the study sample had negative attitude toward cord blood stem cell banking and donation. On the other hand, more than half of the study sample had positive attitude towards cord blood stem cell banking and donation.

As well as the present study findings corresponding with **Velikonja et al., (2021)** who found the majority of respondents had a positive attitude toward umbilical cord blood banking after assessing awareness.

On the other hand, the current study results on the opposite side of **Al-Shammary and Hassan., (2023)** who reported that more than three quarters of the pregnant mothers has positive attitude towards stem cells donation pre intervention.

Regarding the studied pregnant women's attitude towards stem cells storage and cord blood banking throughout program phases, the present study findings showed that there was a highly statistically significant difference in all items of the studied pregnant women`s attitude towards stem cells and cord blood banking preprogram, immediately post program and follow up phases.

Theses present findings agreed with **Bakr et al., (2022)** who reported that a highly statistically significant difference between the wives' attitude toward cord blood banking and stem cells pre-intervention and post-interventions. Alike the present findings are relatively in accordance with **Fernandes et al., (2022)** who revealed positive attitude and highly significant toward forming the intention to donate umbilical cord blood after conducting the study. As well as the present findings in agreement with **Al Shammary et al., (2023)** who found high statistically significant post interventions. Alike, these recent study findings were supported by **El-Sayed et al., (2018)** who reported there was a statistically significant improvement in all items of attitude post-intervention than pre-interventions. Also, the present study findings were consistent with **Shehata and Rashed., (2018)** who revealed the study sample` attitude was statistically significant improved after counseling about banking of stem cells from the umbilical cord blood as compared to before.

Concerning the correlation between total knowledge and attitude of the studied pregnant women towards stem cells and cord blood banking throughout program phases, the current study results illustrated that there was a highly statistically positive correlation between total knowledge and attitude scores of the studied pregnant women regarding stem cells and cord blood banking preprogram, immediately post program and follow up phase. This may be related to the effects of the educational sessions in improving of the studied pregnant women` knowledge and change attitude towards stem cells and cord blood banking.

These current study results corresponding to **Khaton et al., (2023)** that found there was a highly statistically positive correlation between total scores of knowledges and attitude towards cord blood stem cell, banking,

donation after intervention. Also, the current study results agreed with **Aboud et al., (2018)** who reported that a significant, positive correlation between the total score of knowledge and total score of attitudes pre and post intervention.

On the other hand, the current study results on the contrary with **Roshdi et al., (2021)** that mentioned there was not statistically correlation between total knowledge level and attitude level among women regarding blood banking and stem cell. Also, the present study findings disagreed with the study of **Catherine et al., (2020)** who examined "knowledge and attitude towards umbilical cord blood banking among antenatal mothers,, who showed there was no significant association between knowledge and attitude towards umbilical cord blood banking among antenatal mothers.

Additionally, the researcher point of view this improvement is attributed to the effective streamlining of the educational program. Also, pregnant women have become aware of stem cell banking through the Arabic educational booklet provided by the researcher to all the participants.

Conclusion:

Based on the current study results which concluded that the designed educational program has a positive effect in improving pregnant women` knowledge and attitude toward stem cells and cord blood banking with statistically significant difference throughout pre, immediately post and follow up phases. In addition, there was a highly significant positive correlation between the total knowledge and total attitude scores of the studied pregnant women regarding stem cells and cord blood banking through the educational program phases. Therefore, the study aim was achieved, and the study's hypotheses were supported.

Recommendations:

- Provide ongoing health educational programs about stem cells and cord blood banking to pregnant women as apart of antenatal care and provided at all the delivery department.
- Educational booklets regarding umbilical cord blood collection and banking should be available in obstetrics and gynecological departments in hospitals.

Further Studies:

- Provide in-service training program to maternity nurses about cord blood collection and blood banking.
- Replicate this study on large probability sample in different settings for generalization of the findings.
- Study of the wide usage of banked stem cells and umbilical cord blood in the treatment of the chronic diseases and any fetal defects through intrauterine life.
- Track long term impact on decision making and satisfaction with choices related to cord blood banking.

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تأثير برنامج تعليمي مصمم على معلومات وإتجاهات السيدات الحوامل تجاه الخلايا الجذعية وبنك دم الحبل السري

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تعتبر الخلايا الجذعية وبنك دم الحبل السري مهمة لضمان الحياة ومعالجة الأمراض في عائلات السيدات الحوامل. لذلك، فإن معرفة واتجاه السيدات الحوامل بشأن جمع الخلايا الجذعية وبنك دم الحبل السري أمر ضروري. لذا هدفت الدراسة إلى تأثير البرنامج التعليمي المصمم على معرفة واتجاه السيدات الحوامل نحو الخلايا الجذعية وبنك دم الحبل السري. وتم اتباع تصميم شبه تجريبي لتحقيق هدف الدراسة الحالية. وقد أجريت الدراسة في عيادة النساء والتوليد الخارجية في مستشفى جامعة بنها في مدينة بنها على عينة هادفة مكونة من (٨٠) سيدة حامل. واظهرت النتائج ان الغالبية العظمى من للسيدات الحوامل تمتلك نسبة كبيرة من المعلومات، وأكثر من ثلاثة أرباع السيدات الحوامل كان لديهن موقف إيجابي تجاه الخلايا الجذعية وبنك دم الحبل السري بعد البرنامج مباشرا، وكانت النتائج ذات دلالة إحصائية عالية خلال مراحل ما قبل البرنامج، وبعد البرنامج مباشرة، وأثناء المتابعة. وكان البرنامج التعليمي المصمم له تأثير إيجابي على تحسين معلومات السيدات الحوامل وموقفهم تجاه الخلايا الجذعية وبنك دم الحبل السري. وبالمثل، كان في فيه علاقة إيجابية بين درجات المعلومات والموقف الكلي لدى السيدات الحوامل المشاركة خلال فترة ما بعد البرنامج مباشرة وأيضًا خلال المتابعة. وأوصت الدراسة بتقديم برامج تعليمية صحية مستمرة عن الخلايا الجذعية وبنك دم الحبل السري للسيدات الحوامل كجزء من رعاية ما قبل الولادة، وتكون متاحة في جميع أقسام التوليد.