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Application of Counseling about Umbilical Cord Stem Cell Collection and Banking among Pregnant Women: Its Effect on Their Knowledge and Attitude

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Abstract The aim of this study was to study the application of counseling about umbilical cord stem cell collection and banking among pregnant women and its effect on their knowledge and attitude. **Design:** A quasi-experimental pre-post test design. **Setting:** The study was carried out at the antenatal clinics in Mansoura University Hospital, Egypt. **Sample size:** Ninety-eight pregnant women. **Sample type:** A purposive sampling. **Tools:** Counseling sheet using gather model, Likert scale, and woman satisfaction scale. **Results:** The study findings had revealed that there was a highly statistically significant improvement of knowledge about the umbilical cord stem cell collection and banking post-intervention compared to pre-intervention. Also, there was improvement among pregnant women concerning their attitude toward the umbilical cord stem cell collection and banking post-intervention compared to pre-intervention. Further, there was a significant, positive correlation between women's total score of knowledge and the total score of attitude pre and post-intervention. **Conclusion:** The present study results concluded that the application of counseling sessions resulted in a significant improvement among the pregnant women concerning their knowledge and attitude toward umbilical cord stem cell collection and banking. Therefore, it was recommended that a guideline and a brochure about umbilical cord blood stem cell collection and banking must be distributed among all pregnant women attending antenatal clinics.

Keywords: *attitude, counseling, knowledge, umbilical cord stem cell collection and banking*

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1. Introduction

Umbilical cord blood (UCB) is the blood which is found in the umbilical cord. Cord blood has the same ingredients as that of the other blood available in any organ. However, it is distinguished from it in being a very rich source of hematopoietic stem cells. Hematopoietic stem cells are still primitive or immature, which still can possibly frame into platelets or red or white blood cells. With some scientific intervention, they may even have the capacity to shape into other cell types that make up the human body [1].

Moreover, stem cells (SC) exist in all multicellular organisms and are characterized by the capacity to regenerate through mitotic cell division and differentiate into a variety of specialized cell types. The two main types of mammalian stem cells are adult stem cells that are found in adult tissues and embryonic stem cells that are isolated from the inner cell mass of blastocysts [2]. Additionally, cord blood stem cells are pluripotent, which is the capability to differentiate into not solely different blood cell types, however, probably into various sorts of tissue, including cartilage, hepatic, skin, pancreatic, muscle, epithelial, neurologic, endothelial, and bone [3].

Furthermore, UCB is increasingly being used as a source of stem cells within the treatment of over eighty diseases, including blood cell disorders, myelomas, leukemia, genetic disorders, immune system deficiencies, and lymphomas [4].

Additionally, a cord blood bank is utilized for storing UCB for future use. In response to the possibility of using cord blood in treating diseases of the blood and immune systems, both private and public cord blood banks have been developed [5]. Likewise, UCB can be collected without danger to the mother or infant donor. The collection of UCB from the placenta is performed within ten to fifteen minutes after the placental delivery through puncturing one of the umbilical veins with a needle. This is done under sterile technique and the UCB is collected into a sterile bag containing an anticoagulant to prevent clotting [6].

In spite of growing evidence of the numerous therapeutic benefits of stem cells derived from the umbilical cord and allogeneic, or autologous use, surveys reveal that the majority of pregnant women had (70 to 80%) inadequate knowledge about stem cells and cord

blood banking and need more information [7]. In fact, most women (80% to 90%) needed to receive information about cord blood banking from their health care professionals and prenatal education. Additionally, counseling is only provided to a minority (15 to 30%) [8].

Moreover, Knowledge about cord blood banking is insufficient among pregnant women. Especially, the majority of women are unaware of public cord blood banking [9]. Also, despite a positive attitude of pregnant women towards UCB banking, they are not sufficiently aware of this service and therefore seldom proceed to donate UCB. A comprehensive and wide-ranging approach must be implemented to enhance necessary information about UCB banking for pregnant women, particularly targeting younger population and those with a lower education [10].

Furthermore, Insufficient awareness among pregnant women about utilization of UCB and banking in general as well as insufficient knowledge regarding its usefulness may be another obstacle for donating UCB due to lack of motivation [11].

Counseling is a learning-focused process, which usually happened within an interactive relationship, to help the person learn more about the self, also to utilize such comprehension to empower the person to be an efficient member of the society. Moreover, Counseling is a connection between a concerned person and a person with a need. This relationship is usually person-to-person, although sometimes it may involve more than two people. It is intended to help individuals to comprehend and clear up their perspectives, and learn how to accomplish their self-decided objectives through targeted and informed choices, and by solving emotional or personal problems [12,13].

A nurse as a counselor may be one of the main sources on which a pregnant woman relies to gain more knowledge about cord stem cell collection and banking in order to make an informed decision [14]. In addition, nurses must play a crucial role in educating pregnant woman about stem cell and cord blood banking when performing an antenatal check-up in various health care settings [6].

1.1. Significance of the Study

Despite the many benefits of the stem cell obtained from umbilical cord blood, the umbilical cord was considered a medical waste and a postpartum elimination with the placenta due to lack of knowledge about its benefits and uses and negative attitude of pregnant women about cord stem cell collection. Moreover, previous studies [6,15] recommended utilizing counseling for pregnant women regarding this issue. Thus, pregnant women's knowledge about umbilical cord blood and stem cells need to be enhanced.

Also, in developing countries little is known regarding the effectiveness of public education to raise the number of stem cell donors [16]. Nurses who grant prenatal care should be able to provide counseling to pregnant women about the importance of stem cells that collected from UCB. So this study was conducted to achieve this purpose.

1.2. The aim of the Study

This study aimed to study the application of counseling about umbilical cord stem cell collection and banking among pregnant women and its effect on their knowledge and attitude.

1.3. Study Hypothesis

Counseling pregnant women concerning umbilical cord stem cell collection and banking will expect to enhance their knowledge and attitude.

1.4. Operational Definitions

- **Counseling:** Refers to the process in which the researcher holds face to face talks with pregnant women to help them to improve their knowledge and attitude regarding umbilical cord stem cell collection and banking.
- **Cord blood:** Refers to the blood found in the vessels of the umbilical cord and placenta.
- **Cord blood banking:** Refers to the entire procedure of collecting blood from the umbilical cord after or before the placenta is removed and stored in a special kit.

2. Subjects and Method

2.1. Study Design

A quasi-experimental pre-post test design was utilized to fulfill the aim of this study.

2.2. Study Setting

This study was conducted at the antenatal clinic in Mansoura University Hospital, Egypt.

2.3. Sample Size Calculation

Using DSS research.com calculator, at 3% ∞ error (97.0% significance) and 10.0% β error (90.0% power of the study), assuming 75.0% of pregnant woman have an average knowledge about stem cell and cord blood [17] and its percentage in our locality may be about 60.0%. The calculated sample size is 92 pregnant ladies and we can add 5.0% for better quality of collecting data. So, the study sample will be 98.

2.3.1. Sample Type

A purposive sample was used in this study.

2.3.2. Sample Criteria

Pregnant women in the third trimester (after 28 weeks), who can read and write, with single intrauterine fetus, the first time to attend counseling session regarding cord blood stem cell collection and banking and who did not go to the cord blood bank in previous births.

2.4. Tools of Data Collection (TODC)

2.4.1. Tool I*:* Counseling Sheet Following Gather Model

Based on reviewing the relevant literature, it was designed by researchers; to be filled by the pregnant

women. It consisted of three parts:

Part 1: This part covered the data related to general characteristics of pregnant women such as age, educational level, occupation and residence.

Part 2: This part included obstetrics data, such as number of gravida, numbers of para, the number of abortion and family history of cancer or genetic disorder etc.

Part 3: It was developed to assess women's knowledge concerning umbilical cord stem cell collection and banking. It consisted of 14 questions included 10 multiple choice questions and four true or false questions and the respondents were asked to mark a correct answer for each question.

Scoring System for Knowledge:

Each correct answer took a score (1) and incorrect answer a score (0) respectively. The total score was (14).

2.4.2. Tool II: Likert Scale

It was adapted from Dinc & Sahin [18] to assess pregnant woman's attitude towards umbilical cord stem cell collection and banking. It consisted of a total of 10 statements.

Scoring system for attitude:

The women responded to each of the 10 items using a three-points Likert scale: (0) disagree, (1) Neutral, (2) agree. The total score of the attitude scale ranged from 0 to 20.

2.4.3. Tool III: Woman Satisfaction Sheet

Concerning the implemented counseling session as well as their satisfaction concerning an instructional supportive guideline. It consisted of a total of 6 statements.

Scoring system for satisfaction:

The women responded to each of the 7 items using a five-points Likert-type scale: weak (0), accept (1), good (2), very good (3), excellent (4).

2.4.4. The Content Validity of the Tools:

Tools were reviewed by five specialized university professors. According to their comments, modifications were considered.

2.4.5. Reliability

The reliability of tool one and two was (0.721 and 0.912 respectively) as measured by Cronbach's alpha.

2.4.6. Ethical Considerations

Approval to conduct the study was obtained from the head of woman's health and midwifery department, the ethics research committee of the faculty of nursing, Mansoura University and the director of Mansoura University Hospital (MUH). The informed consent was obtained from each pregnant woman. The pregnant women were informed about their rights to withdraw at any time. The data collection tools did not address religious, moral or cultural issues in a manner that did not undermine the dignity of women.

2.4.7. Pilot Study

It was conducted with 10 pregnant women other than the sample of the main study to assess the applicability and content validity of the study tools and the expected time needed for responding to them. The modification included reducing the number of questions and simplifying the language of statements.

2.4.8. Field Work

- This study was carried out at the above-mentioned setting from November 2017 to February 2018.
- The study was conducted through three phases:

- Phase one: Preparatory phase:

The researchers reviewed the relevant literature related to the study, then prepared and designed tools for data collection and counseling sessions. Official permission was obtained from the director of Mansoura university hospitals, head of woman's health and midwifery nursing department and from the faculty of nursing ethical committee to conduct the study. The final pilot study was conducted among 10 pregnant women**.**

- Phase two: Implementation phase:

- The researchers had visited the previously mentioned study setting 3 days/week from 9:00 am – 12:00 pm. The researchers started by introducing themselves to each woman in the study, greet the women, making them feel comfortable, then explained the aim of the study and obtain written consent from them.
- Women were told about the study, and the pre-test that assess the women's knowledge and attitude about umbilical cord stem cell collection and banking was applied.
- Then, the implementation of the counseling sessions started. The researcher conducted a counseling session. Each session duration lasted 20 minutes and a number of women were four in each session. The method of teaching in the session included lectures and group discussion. The educational material included laptop, power point presentations that include pictures, questions and model for mother and baby. The sessions were provided in Arabic language. The number of sessions was four sessions.
- **First session**: It covered knowledge related to definition of umbilical cord blood, knowledge about the person that give cord blood, purposes of umbilical cord blood collection and contraindications of cord blood collection,
- **Second session**: It covered knowledge about the appropriate time for collecting cord blood, maximum duration of cord blood storage, diseases that can be treated by cord blood and definition of stem cells.
- **Third session**: It aimed at increasing knowledge about the definition of umbilical cord blood banking, the main reason for umbilical cord blood banking, knowing about cord blood banking in our country.
- **Fourth session**: Revision about all contents presented in previous sessions and answer all questions.
- An instructional supportive guideline was distributed among pregnant women at the end of last session.

- Evaluation phase: During this phase, post-test was distributed among women by using the same tools to assess their gained knowledge. The pregnant woman was interviewed two weeks post-intervention. Finally, their

attitude was assessed using Likert scale, and their satisfaction was assessed using satisfaction scale.

- The average time needed to complete the questionnaire in the pre and the post-test ranged from 25 to 30 minutes.

2.4.9. Statistical Analysis

Using SPSS version 20 to encode, process and analyze data. Data were presented using descriptive statistics in the form of frequencies, percentages and mean ± SD. Chi square ($\chi 2$) was used to compare categorical variables, paired t test and Anova test used to compare continuous quantitative variables. The Pearson (r) correlation coefficient was calculated between two large continuous variables. The difference was significant at $P \leq 0.05$.

3. Results

Table 1. Frequency distribution among studied sample according to their general characteristics

Characteristics	Items	no (98)	%
Age (years)	18-25	24	24.5
	24-30	36	36.7
	31-35	21	21.4
	Above 35	17	17.3
Educational level	Read and write	14	14.3
	Basic education	22	22.4
	Diploma	35	35.7
	University level	25	25.5
	Post university	2	2
Occupation	Housewife	62	63.3
	Working	36	36.7
Residence	Urban	36	36.7
	Rural	62	63.3
Family income	Sufficient	52	53.1
	Insufficient	46	46.9

Table 1 presents the general characteristics of the studied sample. It was found that about 36.7% of pregnant women had aged 24-30 years old and 35.7% had a diploma level. Around two-thirds (63.3%) of them were housewife and from the rural area.

Table 2. Frequency distribution among the studied sample according to their obstetric history

Characteristics	Items	no (98)	%
Gravida	Primi gravida	22	22.4
	Multi gravida	76	77.6
Number of still births	None	79	80.6
	One and More	19	19.4
Number of abortions	None	74	75.5
	One and More	24	24.5
Number of living children	None	33	33.7
	One and More	65	66.3
Previous anomalous baby	Yes	8	8.2
	No	90	91.8
Family history of cancer / genetic disorder	Yes	26	26.5
	No	72	73.5
Present of medical complications in current pregnancy	None	84	85.7
	Maternal	12	12.2
	Fetal	2	2

Table 2 shows that about three-quarters of studied sample (77.6%) were multi gravida. Also 66.3% of them had one and more children. Most of them (91.8%) had no previous anomalous baby. The majority of them (85.7%) had no medical complications in the current pregnancy.

Table 3 presents that there was a highly statistically significant improvement of all items of knowledge about the umbilical cord stem cell collection and banking post-intervention compared to pre-intervention (P<0.001). pre-intervention the total mean of the women's knowledge about the umbilical cord stems cell collection and banking was poor (3.44±3.30), while post-intervention there was improvement in the total mean of knowledge among pregnant women (11.18±1.94).

Table 3. Comparison of pre and post intervention knowledge about the umbilical cord stem cell collection and banking among studied sample

Items	Pre intervention	Post intervention	Significance test
1. Definition of umbilical cord blood	38 (38.8%)	80 (81.6%)	χ^2= 37.57 P <0.001
2. Knowledge about the person/s that give cord blood	28 (28.6%)	88 (89.8%)	χ^2= 76.03 P <0.001
3. Purposes of umbilical cord blood collection	18 (18.4%)	83 (84.7%)	χ^2= 86.31 P <0.001
4. Contraindications of cord blood collection	20 (20.4%)	80 (81.6%)	χ^2= 73.50 P <0.001
5. Appropriate time for collecting cord blood	38 (38.8%)	88 (89.8%)	χ^2= 55.56 P <0.001
6. Maximum duration of cord blood storage	22 (22.4%)	66 (67.3%)	χ^2= 39.93 P <0.001
7. Diseases that can be treated by cord blood	18 (18.4%)	84 (85.7%)	χ^2= 89.05 P <0.001
8. Definition of stem cells	17 (17.3%)	74 (75.5%)	χ^2=66.65 P <0.001
9. Umbilical cord textile consists of supernatural tissue or nerve or skin cells	22 (22.4%)	70 (71.4%)	χ^2=47.20 P <0.001
10.Umbilical cord blood can be taken during the birth of a normal or caesarean section	22 (22.4%)	81 (82,7%)	χ^2=71.23 P <0.001
11.Umbilical cord blood should be used for the same child only	24 (24.5%)	62 (63.3%)	χ^2=29.92 P <0.001
12.Cord umbilical textile is a source of stem cells	24 (24.5%)	94 (95.9%)	χ^2=104.35 P <0.001
13. Main reason for umbilical cord blood banking	29(29.6%)	68 (69.4%)	χ^2=31.04 P <0.001
14.Knowing about cord blood banking in our country	22 (22.4%)	90 (91.8%)	χ^2=96.33 P <0.001
Total mean of knowledge (paired t- test)	3.44±3.30	11.18±1.94	t=21.08 P<0.001

Significant at P≤0.05 & highly significant at P≤0.01.

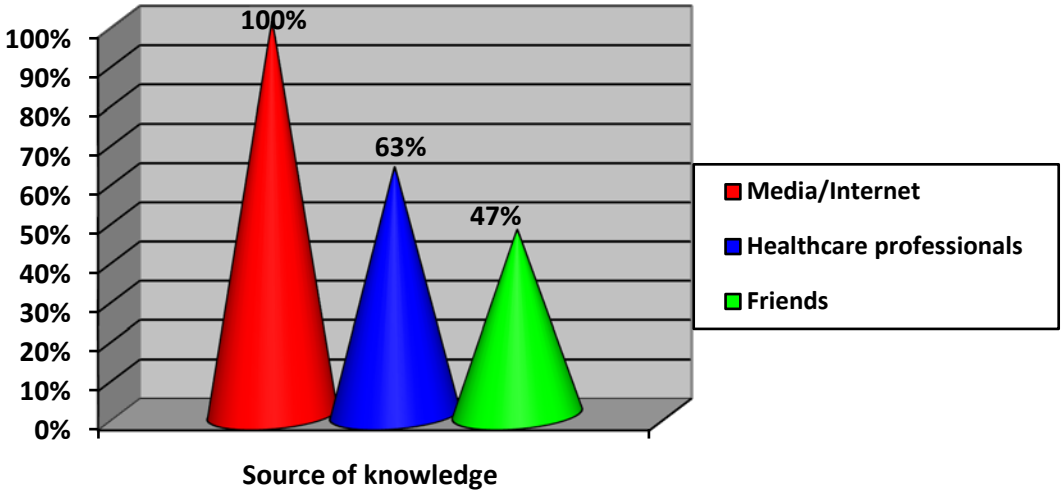

Figure 1. Source of knowledge regarding umbilical cord stem cell collection and banking among the studied sample

Figure 1 shows that from (38.6%) of pregnant women who heard about umbilical cord stem cell collection and banking (100%) of them reported that they had information about umbilical cord stem cell collection and banking from the internet and media followed (63%) by health care professionals then (47%) from friends.

Table 4 shows that pre-intervention the mean score of the women's attitude about the umbilical cord blood stem cell collection and banking was (8.06±2.46). While post-intervention there was improvement in the mean score of attitude (14.28±2.09). Also, there was a statistically significant improvement in all items of attitude post-intervention.

Table 4. Comparison between pre and post intervention attitudes about the umbilical cord stem cell collection and banking among studied sample

Items	Pre intervention			Post intervention			Significance test
	Agree	Natural	Disagree	Agree	Natural	Disagree	
1. Using my baby's own cord blood is more reliable than using other people's cord blood.	23 (23.5%)	55 (56.1%)	20 (20.4%)	52 (53.1%)	39 (39.8%)	7 (7.1%)	X^2= 20.20 P 0.000
2. My baby's cord blood should only be used for my own family.	25 (25.5%)	47 (48%)	26 (26.5%)	56 (57.1%)	19 (19.4%)	23 (23.5%)	X^2= 23.93 P0.000
3. If the cost is reasonable and I can afford it, I will store umbilical cord blood for my baby.	20 (20.4%)	18 (18.4%)	60 (61.2%)	65 (66.3%)	28 (28.6%)	5 (5.1%)	X^2= 72.54 P 0.000
4. If necessary, everyone should be able to take advantage of the stored umbilical cord blood.	24 (24.5%)	14 (14.3%)	60(61.3%)	73 (74.5%)	19 (19.4%)	6 (6.1%)	X^2= 69.70 P0.000
5. The cord blood collection did not harm my baby.	20 (20.4%)	22(22.4%)	56 (57.1%)	73(74.5%)	19 (19.4%)	6 (6.1%)	X^2= 70.75 P0.000
6. Cord blood sample is not important to be donated.	24 (24.5%)	40 (40.8%)	34 (34.7%)	7 (7.1%)	64 (65.3%)	27 (27.6%)	X^2=15.66 P 0.000
7. Baby's cord blood can be used for different purposes.	16 (16.3%)	18 (18.4%)	64 (65.3%)	65 (66.3%)	19 (19.4%)	14 (14.3%)	X^2=61.72 P 0.000
8.I Prefer to store my baby's cord blood in public banks rather than in private banks.	32 (32.7%)	15 (15.3%)	51 (52.0%)	68 (69.4%)	13 (13.3%)	17 (17.3%)	X^2=30.10 P 0.000
9. Only babies born in private hospitals can benefit from cord blood storage services.	50 (51.0%)	32 (32.7%)	16 (16.3%)	25 (25.5%)	42 (42.9%)	31 (31.6%)	X^2=14.47 P 0.001
10. I would accept to donate my baby cord blood.	16 (16.3%)	26 (26.5%)	56 (57.1%)	87 (88.8%)	7 (7.1%)	4 (4.1%)	X^2=104.95 p0.0001
Total mean scores of attitude (paired t-test)	8.06±2.46			14.28±2.09			*t*=18.97 P<0.001

Significant at P≤0.05 & highly significant at P≤0.01.

Table 5. Frequency distribution among the studied sample according to their satisfaction about the implemented counseling session as well as an instructional supportive guideline

Items	Excellent	Very good	Good	Accepted	Weak
The subject was interesting	93 (94.9%)	5 (5.1%)	0 (0%)	0 (0%)	0 (0%)
The subject presented in a logical sequence	80 (81.6%)	10 (10.2%)	6 (6.1%)	2 (2%)	0 (0%)
The scientific content was new and added to enhance my knowledge	90 (91.8%)	5 (5.1%)	3 (3.1%)	0 (0%)	0 (0%)
The scientific material included in the guideline had been clear and easy to understand	94 (95.9%)	3 (3.1%)	1 (1%)	0 (0%)	0 (0%)
Your assessment of the shape, organization and quality of printing material	91 (92.9%)	5 (5.1%)	2 (2%)	0 (0%)	0 (0%)
The guideline language written in easy and easy to understand	90 (91.8%)	8 (8.2%)	0 (0%)	0 (0%)	0 (0%)
I will use it for future pregnancy and encouraged my friend to use it.	80 (81.6%)	10 (10.2%)	8 (8.2%)	0 (0%)	0 (0%)

Table 6. Correlation between the total score of knowledge and total score of attitude pre and post intervention

	Total knowledge scores pre intervention	Total knowledge scores post intervention
Total attitude scores pre intervention	**r= 0.362, p = 0.000****	
Total attitude scores post intervention		**r= 0.309, p =0.002****

Correlation is significant at the 0.05 level.

Table 7. Relation between demographic data and knowledge score of the studied sample

Characters	Items	No	Total knowledge	
			Pre-intervention (Mean ± S.D)	Post-intervention (Mean ± S.D)
Educational level	Read and write	14	2.86±2.66	9.43±1.34
	Basic education	22	3.54±3.28	11.68±1.64
	Diploma	35	3.77±3.66	11.31±2.13
	University	25	3.50±3.29	11.96±1.54
	Post university	2	2.00±000	12.00±2.83
Significant test			F=0.374 P=0.826	F=4.99 P=0.001
Residence	Urban	36	4.17±3.55	11.89±1.77
	Rural	62	3.10±3.08	10.97±1.96
Significant test			t=1.57 P=0.121	t=2.32 P=0.022
Occupation	Housewife	62	3.94±3.29	10.97±1.91
	Working	36	3.23±3.28	11.89±1.86
Significant test			t=1.05 P=0.299	t=2.32 P=0.022

Table 5 shows that the majority of the studied sample were satisfied with counseling session as well as an instructional supportive guideline and reported that it was excellent in all items like clear and easy to understand, interesting, shape and organization (95.9%, 94.9%, 92.9% respectively).

Table 6 shows a significant, positive correlation between the total score of knowledge and total score of attitude pre and post intervention (r=0.362 p = 0.000, r=0.309, p =0.002 respectively).

Table 7 shows that, there was a relation between the education, occupation, residence of the study sample and knowledge score about the umbilical cord blood stem cell collection and banking in post-intervention.

4. Discussion

The aim of the study was to study the application of counseling about umbilical cord blood stem cell collection and banking among pregnant women and its effect on their knowledge and attitude was attained within the framework of the present study hypothesis (counseling pregnant women concerning umbilical cord blood stem cell collection and banking will expect to enhance their knowledge and attitude). The present study had revealed that there was a highly statistically significant improvement in knowledge and attitude among studied sample about umbilical cord blood stem cell collection and banking. So the research hypothesis was approved. This is may be due to the proper method of teaching and educational materials used, clarity and simple language of the session.

The current study results were supported by Philip & Devi [17] who assess the effect of information booklets on improving the knowledge and attitude of antenatal mothers regarding umbilical cord stem cell banking and reported that there was a significant improvement of knowledge and attitude of mother after receiving information. In the same line Edwin Francis et al. [6] study about the effectiveness of structured teaching program on knowledge regarding stem cells and cord blood banking among antenatal mothers found that about three quarters of participants had adequate knowledge after receiving educational intervention and there was a significant difference between the level of knowledge in the pretest and post-test.

Concerning to the source of information regarding umbilical cord stem cell collection and banking, the present study results revealed that the main source was media and internet followed by the health team. These findings showed that women mainly depend on the internet and the media to learn about UCB. In the same line, Ozturk et al. [19] study about knowledge and attitudes about UCB and cord blood banking revealed that the primary source of information for mothers were the media and the internet and the secondary source was healthcare professionals. In another study Dinc & Sahin [18] concluded that the source of information was the internet and media and the secondary source was the obstetricians.

In contrast, Poomalar & Jayasree [9] revealed that television, doctors and nurses form the main source to provide information to the public regarding umbilical cord blood storage and the internet constituted only 5%. Also, Karagiorgou et al. [11]; Screnci et al. [20] founded that women received information primarily from their gynecologists and obstetricians; which was not in compliance with our research.

Regarding the level of pregnant women's knowledge about the umbilical cord stem cell collection and banking pre-intervention, the present study results showed that pregnant women had poor knowledge about the umbilical cord stem cell collection and banking. The lack of knowledge about this issue may be due to the fact that it is a quite new phenomenon and there was an impaired of health policies on this issue.

The current study results were in the same line with Azadpour et al. [21] study about the knowledge and attitude of pregnant women about the preservation of umbilical cord blood who reported that the most of the sample had a low level of knowledge. Also, Jawdat et al. [22] in their study about public awareness of cord blood banking in Saudi Arabia found that around two-thirds of subjects had inadequate knowledge.

Moreover, another study done by Matijevic and Erjavec [10] about knowledge and attitudes among pregnant women about umbilical cord blood banking concluded that pregnant women were insufficiently informed about UCB banking. Similar study results of Poomalar & Jayasree [9] about awareness of cord blood banking among pregnant women reported that lacking of knowledge among pregnant women. This lack of knowledge was consistent with other studies such as the one conducted by Karagiorgou et al. [11] among Greek citizens which assess knowledge about umbilical cord blood banking and another study among Israeli women [23].

The current study confirmed that there was a significant positive correlation between the total score of knowledge and the total score of attitude pre and post-intervention. In agreement with Habib et al. [24] as there was a strong, statistically significant positive relationship between total knowledge score and the total attitude score of the sample. In the same line, Kaur & Garg [25] study reported that there was a positive correlation between knowledge and attitude. While the results of the present study were in disagreement with a study conducted by Katz et al. [8] on knowledge and attitude of pregnant women regarding the banking of cord blood stem cells in five European countries. In this study, the knowledge and attitude weakly correlated with each other.

The current study confirmed that there was a relationship between the pregnant woman's level of knowledge and education and residence during post-intervention. The present study results were in agreement with Ozturk et al. [19] who reported that mothers' knowledge level about UCB and cord blood banking increased with increase their educational status. Moreover, Poomalar & Jayasree [9] reported that there was a statistically significant influence of the educational status among Greek citizens on Greek citizens' knowledge towards cord blood banking.

Furthermore, Pandey et al. [26] who study banking UCB stem cells: Awareness, attitude and expectations of potential donors from one of the largest potential repositories (India) showed that overall awareness of cord blood banking showed a high reliance on the level of education. A Similar pattern was found among the Chinese population by Tuteja et al. [27]. Dinç& Sahin [18] who assess pregnant women's knowledge and attitudes about stem cells and cord blood banking showed that the pregnant women with higher levels of education had a statistically significant level of knowledge about stem cells and cord blood. Although the results of the present study disagreed with the study by Kaur and Garg [25] who revealed that variables like education and residence had no impact on knowledge regarding stem cells and UCB banking.

As concerning the satisfaction about the counseling sessions and the instructional supportive guideline among pregnant women, The present study findings illustrated that the majority of studied women were satisfied and reported that it was excellent. This may be due to the effectiveness of the counseling, which had taken into account the basic principles of effective communication, and which involved active listening and systematic delivery of information with an empathetic attitude. This stressed the importance of applying the guideline at all maternal health services and indicating its importance.

5. Conclusion

Application of counseling sessions showed a significant improvement among the pregnant women concerning the knowledge and attitude about umbilical cord stem cell collection and banking in the post-intervention compared to pre-intervention.

6. Recommendations

1. Guidance guideline about umbilical cord blood stem cell collection and banking must be distributed among all pregnant women attending antenatal clinics.
2. Integrate umbilical cord stem cell collection and banking in the undergraduate curriculum in the Faculty of Nursing, Mansoura University.
3. Nursing protocol and guidance, including the importance of technique for umbilical cord stem cell collection and banking in antenatal, postnatal clinics, and delivery room at Mansoura university hospitals.

4. Disseminate the present study, research findings to all maternity governmental and non-governmental hospitals.

7. Future Research

Educational program among nurses to enhance their knowledge and attitude regarding umbilical cord blood stem cell collection and banking

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Conflicts of Interest Disclosure

The authors declare that there is no conflict of interest.

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