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Evaluation of Pregnant Women's Knowledge and Attitude Toward Banking of Stem Cells from the Umbilical Cord Blood Before and After Counseling

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Abstract
Background: Nowadays the collection of stem cells from the umbilical cord blood is one of the most important topics of health sciences. Pregnant women need to understand or at the very least know about stem cells researches so they can preserve their babies' future health. Purpose: This study was conducted with the purpose of evaluating the pregnant women's knowledge and attitude toward banking of stem cells from the umbilical cord blood before and after counseling. Methods: Research Design: A quasi-experimental design (with pre and post test). Tools: Three instruments were used throughout the course of this study: (I) interviewing questionnaire, (II) women's knowledge assessment sheet and (III) women's attitude scale. Main results: There was a highly statistically significant difference between knowledge and attitude scores at the pre and post test. Conclusion: both study hypotheses were accepted. Pregnant women's score of knowledge about banking of stem cells from the umbilical cord blood was increased after counseling as compared to before. Pregnant women's score of attitude about banking of stem cells from the umbilical cord blood was increased after counseling as compared to before. Recommendations: The current study can be replicated on a larger sample and on a national base in country to serve as a base for antenatal educational program to raise women's awareness about cord blood banking. The current studied topic should be included in the antenatal education at the third trimester of pregnancy. The study booklet can be handed to women during their antenatal visits. In-service training programs about new trends in nursing care and practices must be developed to enhance nurses' knowledge so become able to properly counsel pregnant women.
Keywords: knowledge, attitude, stem cells banking and umbilical cord blood and counseling.

1. Introduction

1.1 Operational Definitions:

Knowledge: Understanding of information about banking stem cells from the umbilical cord blood that pregnant women have before and after series of counseling sessions. In the current study; it was assessed using "knowledge assessment sheet"

Attitude: A predisposition or a tendency to respond positively or negatively towards the idea of banking stem cells from the umbilical cord blood before and after series of counseling sessions. In the current study; it was assessed using "women's attitude scale"

Banking: The process of blood collection from the neonatal umbilical cord either pre or post placental removal and then its storage in a previously prepared kit.

Stem cells: Cells found in the umbilical cord vessels and placenta characterized by the ability to renew through mitotic cell division and differentiate into a diverse range of specialized cell types.

Umbilical Cord blood: Is the blood obtained from the umbilical cord vessels and placenta.

Counseling: Is a series of sessions delivered to small group of pregnant women with the aim of improving their knowledge and modifying their attitude toward blood collection and banking.

Umbilical cord is the first vital bonding between woman and her developing fetus. It is seen to be the relationship of motherhood (Lowdermilk et al., 2012).With delivery of the fetus, the remnant amount of placental blood is referred as cord blood. This blood contains lots of haematopoietic stem cells which are able to form other types of cells and are also able to self-degenerate (Aznar et al., 2011). Stem cells are characterized by their ability to renew and then form different cell types. There are two primary types of such cells: "embryonic stem cells" obtained from the blastocysts, and "adult stem cells" found in adult tissues (American College of Obstetricians and Gynecologists, 2011). Stem cells are able to form hepatic, pancreatic, endothelial, cartilage, epithelial, neurologic, muscle and skin (Gluckman et al., 2011).

Stem cells are much easier to be obtained from the umbilical cord blood (UCB) at the time of delivery than any other source. Similar to cord blood, connective tissue from a section of the umbilical cord can also be collected, preserved, and stored for use in clinical research, or kept in a cord blood bank for future need. Over the cord blood, the connective tissue surrounding the umbilical vein and arteries, Wharton's Jelly, are all important sources of mesenchymal stem cells (Fannin, 2013).

Obstetricians, midwives and nurses are all responsible for umbilical cord blood collection. Those personnel should have previous education and training about their role. Cord blood is obtained through a painless non-

invasive technique after cutting the cord from the newborn (Dinc, H. et al., 2009). There are two techniques of collection: (1) in-utero: in which cord blood is collected after neonatal delivery but before the delivery of placenta and (2) ex-utero method is the widely used one. In the ex-utero method blood is collected after the delivery of the placenta (Waller-Wise, R. 2014).

The blood is obtained using a strong sterile technique, draining the blood from the umbilical vein into a collection container, using a closed collection kit. The overall collected blood averages is 110 mL. Sometimes, the blood may be collected into a tube. In both methods, the container and the tube are prepared with anticoagulant drug (Chandran, B. 2012).

"Cell Safe Bank" is the first stem cell bank in Egypt and the Middle East, acquired its license from the Ministry of Health in 2009. The bank is fully automated, Food and Drug Agency (FDA) approved. Internationally accredited by the American Association of Blood Banks (AABB), currently there are 720 stem cell banks worldwide, only 76 of them are AABB accredited, Cell Safe Bank is one of them (Cell Safe Bank, 2018).

Although different therapeutic uses of stem cells obtained from the umbilical cord, researches showed that between 70 to 80% of women had poor knowledge about stem cells and need detailed education and counseling about this point (Katz G, 2011). Needed education and counseling must be delivered from primarily nurses. Available literature revealed that counseling is actually delivered to only 15 to 30% (Poomalar G, 2016). Many pregnant women are unaware of the presence of banks for storing stem cells (Armson, 2015). Although women may have positive attitude towards the idea of banking, they are unaware of the possibility of such services and as a result they never take a step toward banking.

Counseling is the use of an interactive helping process focusing on the needs, problems, or feelings of the person and significant others to enhance or support coping, problem solving, and interpersonal relationships (McLeod, J, 2013 and Shayo, E, 2011). Nurses play a unique and important role in motivating and assisting pregnant women in making health behaviour changes through improving their knowledge, assisting in modifying behaviours and attitude. All can be done within using counselling skills (EdwinFrancis et al., 2016).

1.2 Significance of the Study:

Recent improvement in health science have demonstrated that umbilical blood is a rich source of both types of stem cells, making it a very useful material in the area of stem cells therapy and transplantation (Dinc, H. et al., 2009). According to the recent statistics by (Katz, 2014); nearly 80 diseases can be completely cured by using umbilical cord blood stem cells and over 50000 transplants have been successfully carried out worldwide, which include cancers and blood disorders.

Despite the lots of stem cells benefits, and for many years; the umbilical cord was seen as a waste medical product and disposed of immediately after delivery with the placenta as a result of poor knowledge level and negative attitude of women.

International studies have been conducted exploring pregnant knowledge and perceptions of banking stem cells from cord blood. Many studies showed that most of women need to have information regarding cord blood banking and donation from their antenatal care givers (Jordens et al., 2014). Antenatal care givers have an important role in providing accurate, complete, information about cord blood banking to help parents in their decision making process (Herlihy et al., 2013).

Canadian and European studies revealed that pregnant women have low knowledge level about UCB banking (Fox NS, 2017). A study done by Conrad V Fernandez, (2016) revealed that 70% of studied women showed poor or very poor knowledge about cord blood banking. Majority of the same study participants thought that doctors or nurses should counsel them about banking.

From reviewing available literature and body of knowledge; the researchers found that the issue of studying stem cells is still outcast by nursing field. Few studies discussed Egyptian women knowledge about and attitude toward the issue of UCB banking especially in rural areas. Limited studies were conducted with the aim of examining the effect of counseling about this issue although one of the major nursing roles is counseling. So the researchers conducted this study to evaluate women knowledge and attitude after counseling.

1.3 Purpose of the Study:

This study was conducted with the purpose of evaluating the pregnant women's knowledge and attitude toward banking of stem cells from the umbilical cord blood before and after counseling

1.4 Research Hypotheses

Pregnant women's score of knowledge about banking of stem cells from the umbilical cord blood will increase after counseling as compared to before.

Pregnant women's score of attitude about banking of stem cells from the umbilical cord blood will increase after counseling as compared to before.

2. Methods:

2.1 Research design:

A quasi-experimental design (with pre and post evaluation of knowledge and attitude).

2.2 Setting:

The study activities were all done at the antenatal clinic of maternal and child health center (MCH), Shebin El Koom Qebly. This center was purposively selected because it is known to present services to large sector of the governorate population thus having a high flow rate of pregnant women.

Participants of the current study were purposively recruited according to the following inclusion criteria: pregnant women in their last trimester of pregnancy, willing to participate in the study, at least with basic education, never received counseling about the current study topic.

The sample size was determined through the following procedure:

Based on results reported in Philip N & Devi S. (2017); the sample size was calculated to be 100 pregnant women considering CI=95% and power=90% (10% dropout).

2.3 The filed work:

The data collection was conducted from January 2017 to June 2017. Maneuver of Intervention: The current study was conducted through three main phases: preparatory, implementation and evaluation phases.

Preparatory Phase: A detailed reviewing of electronic data related to umbilical cord banking and stem cells extraction, banking, counseling in nursing, attitude and knowledge measurement was done. A review of literature to collect relevant knowledge pertinent to study was also used in developing and adapting data collection instruments. The counseling sessions' contents were collected, adequately formulated and translated into Arabic. The counseling contents were prepared in many forms: PowerPoint presentations, video explaining the technique of collection and a guiding booklet. Finally; the data collection instruments and the booklet were submitted for revision by a jury of expertise.

Implementation Phase:

Participants were selected according to the previously mentioned inclusion criteria.

The researchers recruited 20 pregnant women per month and visited the MCH center 2 days per week for 3 hours.

Participants were divided into subgroups of (3-5) women to receive the counseling sessions. Each session lasted for 20 minutes. The sessions sequence was as follows:

Session 1: was devoted to explain the purpose of the study, its methods, obtaining an oral informed consent, sitting time for other sessions and identifying methods of contacting with the researchers. Using instruments I, II and III the pre-test of knowledge and attitude was done. (It took 20-30 minutes). At the end of the session the guiding booklet was handed to women.

Session 2: deals with women knowledge (part 1).

Session 3: deals with women knowledge (part 2).

Session 4: deals with women attitude.

Session 5: Egyptian stem cells bank and its services.

The intended learning outcomes of the counseling sessions were:

Knowledge and understanding:

- Define stem cells and cord blood banking
- List the importance of banking the umbilical cord blood.
- Memorize diseases treated by stem cells
- State indications and contraindications for the procedure

Intellectual skills:

- Recognize services provided by the Egyptian stem cells bank

General and transferable skills:

- Value the importance of banking umbilical cord blood as a source for stem cells.

Attitude:

- Communicate effectively with the researchers later on to bank the umbilical cord blood

Sessions outline:

Session 2: knowledge (part 1).

- Definition of umbilical cord blood
- Definition of stem cells from umbilical blood
- Umbilical cord components
- Who can give cord blood for banking?
- Aim of collecting umbilical cord blood

Session 3: knowledge (part 2).

- Contraindications for collection
- Suitable timing of collection
- Duration of banking for the cord blood
- Which conditions can be managed by stem cells?
- Stem cells sources other than umbilical cord blood

Session 4: attitude.

- Using women newborn's stem cells is more reliable than using other people's stem cells
- The newborn's cord blood can only be used for his family
- Everyone should be able to take advantage of the stored cells
- The process of collecting cells did not harm my newborn
- Newborn's stem cells from cord blood can be used for different purposes
- Are public banks better than private ones?
- Only newborns delivered in private centers can benefit from stem cells collection and storage services

Session 5: Egyptian stem cells bank and its services

- Location and contact information of the bank
- Services of the bank (umbilical cord blood banking- tissues banking and dental pulb banking)
- Financial cost of umbilical cord blood banking

Teaching Materials: PowerPoint presentation using lab top computer, video and printed copy of the sessions' contents

Evaluation Phase: At the last session, the researchers conducted the post-test using instruments II and III.

Finally; women were thanked for their participation and time.

2.4 Data Collection Instruments:

Three instruments were used throughout the course of this study: (I) interviewing questionnaire, (II) women's knowledge assessment sheet and (III) women's attitude scale.

(I) Interviewing questionnaire {*}: It consisted of the following parts: A. Assessment of socio-demographic data (age, educational level, occupation, residence and income), B. Obstetric history (as data about current pregnancy, previous pregnancies and deliveries, number of live births, having abortion).

{*} Instrument was developed by the researchers and revised by a jury of qualified experts, then tested for validity and reliability.

Validity of the interviewing questionnaire was ascertained by a group of qualified subject area experts, medical and nursing staff who reviewed the tool for content validity. They were asked also to judge the items for completeness and clarity. Suggestions were incorporated into the instrument.

Test-retest reliability was applied by the researchers for testing the internal consistency of the interviewing questionnaire. It is the administration of the same instrument to the same participant under similar conditions on two or more occasions.

(II) Women's knowledge assessment sheet: It was used to evaluate knowledge about banking of stem cells from the UCB. It was adapted from (Habib F, ALFozan H, Prince J, Albylwi A M, AlQadoom B N & Almutairi M S. (2017). It consisted of fifteen closed ended questions. The instrument was scored as: correct answer = 2, do not know = 1 and wrong answer = 0. The total knowledge score ranged from 0 to 30. Poor knowledge score ranged from 0 – 10, average knowledge score ranged from 11 – 20, and good knowledge score ranged from 21 to 30.

(III) Women's attitude scale: the instrument was adapted from Dinc, H. & Sahin, N. (2009), translated into Arabic by the researchers and revised by the previously mentioned jury. It composed of ten statements assessing pregnant women attitude toward banking of stem cells from the umbilical cord blood. Answers were on three-point Likert scale: (0) for disagree, (1) for neutral and (2) for agree. The overall scale score was between 0 and 20. A total score more than 50% indicated positive attitude and a score less than 50% indicated negative attitude. Validity and Reliability of the scale were ascertained by Dinc, H. & Sahin, N. (2009).

2.5 Ethical Consideration: Official steps were taken to obtain a permission to conduct the study from Faculty of Nursing, Menofyia University, with explanation of the aim and the importance of the study to the MCH center authorities. A verbal consent was obtained from all women before participation in the study. Women were assured that their information were confidential and only used for study process.

2.6 Piloting the Instruments: A Piloting was conducted on ten women to test the applicability of the instruments and to estimate the time needed for data collection. On the basis of the piloting results the researchers determined the feasibility of data collection procedures, developed the sessions schedule. The results of the piloting help in refining the interview questionnaire.

2.7 Statistical Data Analysis: The current collected data were tabulated and analyzed using statistical package for the social science (SPSS) software version 20 on IBM compatible computer. Quantitative data were expressed as mean & standard deviation (X±SD). Categorical variables comparison was done using Chi square ($\chi 2$) test. Continuous quantitative variables were compared using paired t test. For two large continuous variables, Pearson (r) correlation coefficient was calculated. P-value at 0.05 was used to determine significance regarding: P-value > 0.05 to be statistically insignificant (NS), P-value ≤ 0.05 to be statistically significant (S) and P-value ≤ 0.001 to be high statistically significant (HS).

3. Results:

Table 1: Sociodemographic characteristics of the studied women

Variable	N =100	
	No	%
Age		
Mean ± SD	26.09±4.56	
Level of education		
Illiterate	-	-
Basic	2	2
Secondary	45	45
University	53	53
Residence		
Urban	15	15
Rural	85	85
Accommodation		
With husband family	13	13
Alone	87	87
Monthly income		
Enough	17	17
Not-enough	83	83

Table 1 shows the distribution of the pregnant women according to their socio-demographic characteristics. It can be observed that, the mean age of was 26 years. Nearly half of women (53%) were highly educated. More than three quarters of them (85%) were rural residents. Most of the women (87%) lived alone and their monthly income was not enough.

Table 2: Obstetric history of the studied women

Variable	N =100	
	No	%
Gravidity		
Primigravida	39	39%
Multigravida	61	61%
Live children		
None	42	42%
One/ more	58	58%
Abortions		
None	75	75%
One/ more	25	25%
Still Births		
None	80	80%
One/ more	20	20%
Current pregnancy complications		
Yes	14	14%
No	86	86%

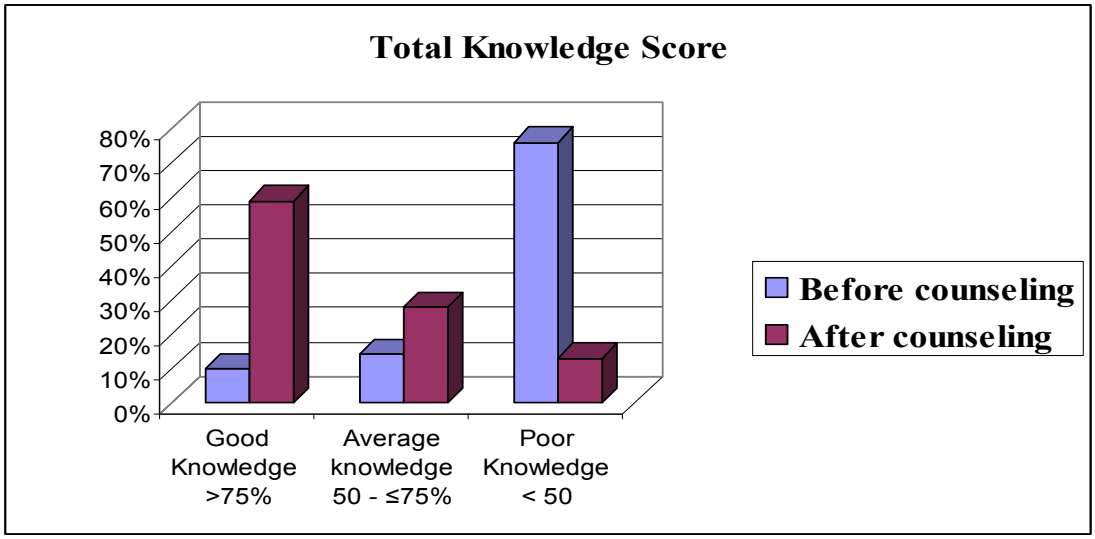
Table 2 displays that; multi gravida women represent about two third of the sample (61%). As for number of living children; 58% of women had one and more. 86% of women were not having any medical condition associated with pregnancy.

Table 3: Knowledge about banking of stem cells from the umbilical cord blood before and after counseling

Variable	Before Counseling			After Counseling			$\chi 2$ test	P value
	Correct %	Wrong %	Don't know %	Correct %	Wrong %	Don't know %		
Number of arteries and veins in the umbilical cord	12	45	43	78	16	6	36.37	<0.001*
Function of the umbilical cord	68	32	0	98	2	0	79.13	<0.001*
Suitable time for cord clamping	22	56	22	69	12	19	89.11	<0.001*
Definition umbilical blood	13	77	10	63	21	16	83.10	<0.001*
Benefits of collection	20	78	2	83	9	8	65.26	<0.001*
Women suitable for donation	6	36	58	57	24	19	79.04	<0.001*
Women not suitable donation	4	49	47	53	27	20	79.10	<0.001*
Obtained blood storage places	2	82	16	63	23	14	76.00	<0.001*
Duration for cord blood storage	1	73	26	92	2	6	62.10	<0.001*
Persons responsible for collection process	11	81	8	98	0	2	83.01	<0.001*
Methods of blood collection	2	89	9	52	45	3	69.03	<0.001*
Definition of stem cells	17	35	48	89	1	10	74.03	<0.001*
Sources of obtaining stem cells	6	23	71	73	21	6	71.67	<0.001*
Importance of obtaining stem cells from umbilical cord	5	34	61	91	4	5	82.03	<0.001*
Uses of stem cells	31	56	13	63	31	6	64.14	<0.001*
Mean and SD of total knowledge score	4.23±2.56			23.23±1.77			22.3**	<0.001*

(*) Statistically significant at p≤0.001, (**) Paired t- test

Table 3 clarifies that all items of knowledge were statistically significant improved at the after counseling as compared to before (P<0.001). Before counseling, the mean and standard deviation of total score of knowledge was poor (3.23±2.56), while at the post-intervention; there was an improvement (12.23±1.77).



Paired t- test 29.94 P=0.000

Figure 1: Comparison between total knowledge score before and after counseling

Figure 1 displayed that, most of the women (88.7%) had poor knowledge level before counseling. However, after counseling the majority of women (68.6%) had good knowledge level.

By observing table 3 and figure 1, the first study hypothesis "Pregnant women's score of attitude about banking of stem cells from the umbilical cord blood will increase after counseling as compared to before." was

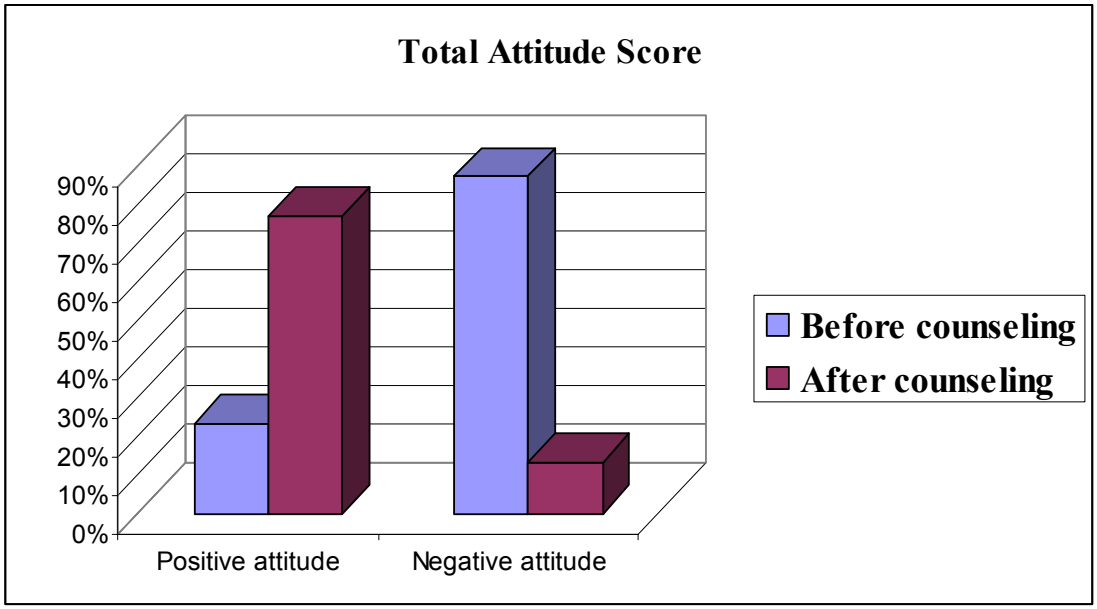
accepted.

Table 4: Attitude toward banking of stem cells from the umbilical cord blood before and after counseling

Variable	Before counseling			After counseling			$\chi 2$ test P value
	Agree	Neutral	Disagree	Agree	Neutral	Disagree	
Using my newborn's stem cells is more reliable than using other people's stem cells	25 25%	55 55%	20 20%	53 53%	40 40%	7 7%	$\chi 2$=26.21 P=0.000*
My newborn's cord blood can only be used for my family.	26 26%	47 47%	27 27%	58 58%	19 19%	23 23%	$\chi 2$=28.33 P=0.000*
If the cost is reasonable and I can save it, I will store umbilical cord blood for my baby as a source of stem cells.	21 21%	19 19%	60 60%	80 80%	9 9%	11 11%	$\chi 2$=62.84 P=0.000*
If necessary, everyone should be able to take advantage of the stored stem cells from umbilical cord blood.	22 22%	16 16%	62 62%	75 75%	15 15%	10 10%	$\chi 2$=78.72 P=0.000*
The process of collecting stem cells from cord blood did not harm my newborn.	23 23%	27 27%	50 50%	76 76%	20 20%	4 4%	$\chi 2$=80.15 P=0.000*
Cord blood is not important to be donated.	39 39%	52 52%	9 9%	3 3%	84 84%	13 13%	$\chi 2$=45.06 P=0.000*
Newborn's stem cells from cord blood can be used for different purposes.	19 19%	79 79%	2 2%	81 81%	12 12%	7 7%	$\chi 2$=72.52 P=0.000*
I Prefer to store my newborn's stem cells in public banks rather than in private banks.	21 21%	72 72%	7 7%	29 29%	39 39%	32 32%	$\chi 2$=39.90 P=0.000*
Only newborns delivered in private centers can benefit from stem cells collection and storage services.	18 18%	72 72%	10 10%	3 3%	16 16%	81 81%	$\chi 2$=23.67 P=0.001*
I would accept to donate my newborn's stem cells from cord blood.	41 41%	34 34%	25 25%	83 83%	9 9%	8 8%	$\chi 2$=27.55 P=0.001*
Mean and SD of attitude score	9.19±2.06			15.21±3.05			t=21.07** P<0.001

(*) Statistically significant at p≤0.001, (**) Paired t- test

All items of attitude were statistically significant improved after counseling as compared to before (P<0.001). The mean and standard deviation of total attitude score was (9.19±2.06) before counseling and improved to (15.21±3.05).



Paired t- test 29.94 P=0.000

Figure 2: Comparison between total attitude score before and after counseling

Figure 2 displayed that, only 28% of women had positive attitude toward stem cells collection and banking before counseling. Meanwhile after counseling, the percentage of positive attitude increased to 81%.

By observing table 4 and figure 2, the second study hypothesis "Pregnant women's score of attitude about banking of stem cells from the umbilical cord blood will increase after counseling as compared to before." was accepted.

Table 5: Pearson's correlation between total knowledge and total attitude scores before and after counseling

Variable		Total knowledge score	
		before counseling	after counseling
Total attitude score	before counseling	r=0.45 p = 0.000 *	-
	after counseling	-	r= 0.79 p =0.002 *

(*) Statistically significant at p≤0.001

This table showed a significant, positive correlation between knowledge and attitude before and after counseling (r=0.45, r=0.79 respectively). The more increased in knowledge score, the more positive attitude a pregnant woman had.

4. Discussion

Umbilical cord blood is used as a source of hematopoietic stem cells used for the treatment of malignant and non malignant disease. The current study was intended to examine pregnant women's knowledge and attitude toward cord blood banking after application of counseling sessions, as women support is crucial to the success of blood banking programs.

The currents studied women were all pregnant at their last trimester. This trimester was purposively selected as the study topic seen to be vital for women near birth. Many studies were published indicating a different sample nature. Tuteja M, Agarwal M, &Phadke SR (2016) conducted an Indian study about "Knowledge of cord blood banking in general population". The aforementioned study reported that the idea of banking was not attractive to the studied sample. The contradiction is seen to be due to selecting a sample of general population including all age groups and not only pregnant women.

As for women's knowledge about banking of stem cells, the current finding revealed a statistically significant improvement in women knowledge at the post intervention phase as compared to the pre one. This finding was supported by a descriptive Saudi study by Habib et al., (2017) about "Saudi Women knowledge and Attitude of toward UCB". Habib et al.,'s study reported that half of the sample had poor knowledge score and only 18% had good knowledge score. Moreover; the current finding was also agreed upon by Tiwari, et al., (2016) who studied "Perception of UCB Banking amongst Youth in India". Tiwari, et al., concluded that the overall awareness about the UCB was very poor among the studied population and out of the total population only half of people were aware of UCB. The reported poor knowledge level in different studies is seen to be due to the idea that UCB is still a new trend and still not widely known.

Concerning women's attitude towards banking of stem cells from the cord blood, the findings of the current study showed a notable attitude improvement after counseling as compared to before. This could be due to the fact that, receiving information through counseling and high adherence to counseling sessions and women's active participation helps in modifying attitude. This finding was in agreement with a study done at USA by Philip & Devi, (2017) and reported that majority of studied antenatal mothers (65%) had good attitude toward umbilical cord stem cell banking at the post test. In addition to, Pandey D, Kaur Ss & Kamath S. (2016) who studied "Banking of UCB" and found that counseling sessions application resulted in an improvement in the pregnant women attitude toward the studied point.

The current study assured the presence of significant positive correlation between knowledge and attitude total scores before compared to after counseling. This means that the more increased in total knowledge score, the more positive attitude a pregnant woman had and vise versa. Knowledge is seen to be the denominator of attitude and with poor knowledge, there will be negative attitude. Habib et al., (2017) in a study among Saudi women reported a statistically positive correlation between total knowledge and attitude scores. On the same line, Kaur & Garg (2017) who conducted a study among pregnant women attending antenatal outpatient clinic to evaluate their knowledge and attitude about UCB reported a similar positive correlation between score of knowledge and attitude. The current findings were contradicted by the results of Katz et al. (2011) who studied attitude and knowledge of Indian pregnant women. In this study, there was a weak correlation between knowledge and attitude. The contradiction in results can be rationalized by the difference in sample nature as Katz et al., studied women from a different ethnic background who considered banking of cord blood a big fault and so their attitude was negative although they had good knowledge.

Improved knowledge and attitude total scores were though to be a direct result of counseling sessions. Philip & Devi, (2017) studied "improve knowledge and attitude of antenatal mothers regarding umbilical cord stem cell banking". The aforementioned study used educational intervention and after the application (75%) of the antenatal mothers had good knowledge and positive attitude toward study topic. Azadpour et al., (2018) used structured teaching programme and tested its effectiveness on knowledge regarding stem cells and cord blood banking among antenatal mothers at Mogappair, Channel. Azadpour et al., reported an improved knowledge level after intervention. The similarity of results highlighted the idea that the role of the nurse as an educator and counselor is very important in improving population knowledge and modifying attitude toward new treatment modalities.

Pregnant women should be provided with unbiased information about umbilical cord stem cell banking options including their benefits and limitations. Health care providers, especially nurses, should pay close attention to this topic in planning for antenatal counseling sessions. Professionals should be aware of current recommendations for education, counseling, obtaining informed consent, collection, and storage of umbilical cord blood. This is primarily important as health care personnel are a major source of disseminating information about newly advanced topics.

6. Study Limitations

Reported bias as some of women might want to give socially accepted responses to the questions of instruments after sessions.

This study was limited to Egyptian female population from one city and who can read and write.

7. Conclusion

Based on the findings of the current study; it can be concluded that both study hypotheses were accepted. Pregnant women's score of knowledge about banking of stem cells from the umbilical cord blood was increased after counseling as compared to before. Pregnant women's score of attitude about banking of stem cells from the umbilical cord blood was increased after counseling as compared to before.

8. Recommendations

The current study can be replicated on a larger sample and on a national base in country to serve as a base for antenatal educational program to raise women's awareness about cord blood banking.

The current studied topic should be included in the antenatal education at the third trimester of pregnancy.

The study booklet can be handed to women during their antenatal visits.

In-service training programs about new trends in nursing care and practices must be developed to enhance nurses' knowledge so become able to properly counsel pregnant women.

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