Effect of Instructional Guidelines on Antenatal Mothers' Knowledge regarding Umbilical Cord Stem Cell Banking

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Abstract

Background: The procedure of collecting and storing umbilical cord blood in the days following a baby's birth is known as umbilical cord blood banking (UCB). It contains potent stem cells, as well as hematopoietic cells. **Aim:** To evaluate the effect of instructional guidelines on antenatal mothers' knowledge regarding umbilical cord stem cell banking. **Subjects and methods: Design:** To achieve the study's aim, a quasi-experimental research design was used. **Setting:** The study was conducted in the Antenatal Outpatient Clinic at Mansoura University Hospital, Egypt. **Subjects**: A total of 200 antenatal mothers were selected from previous setting based on non-probability convenience sampling. **Two tools were used:** (1) a structured interview questionnaire; and (2) a knowledge assessment questionnaire. **Results**: The study's findings demonstrated that post- intervention knowledge of umbilical cord stem cell collecting and banking was statistically significantly higher than pre-intervention knowledge among antenatal mothers. **Conclusion:** The findings of the study concluded that the instructional guidelines were effective in improving knowledge regarding umbilical cord stem cell banking among antenatal mothers and improving critically ill children's life. **Recommendations:** During the third trimester of pregnancy, the community and maternity health nurses should play a role in providing frequent training and workshops to women in antenatal clinics about umbilical cord blood banking and stem cell banking.

Keywords: Antenatal mothers, Knowledge, Umbilical cord stem cell banking.

Introduction:

The umbilical cord connects the mother and the infant and serves as a lifeline. It nourishes the unborn kid while it is still in the womb, and it is joined to the newborn via the belly button later on. During pregnancy, it is linked to the

mother's placenta. Some blood stays in the blood vessels of the placenta and the piece of the umbilical cord that remains linked to it after a baby is delivered and the umbilical cord is severed. The baby no longer requires this extra blood after birth. This blood is referred to as placental blood or umbilical cord blood, and it contains all of the typical components of blood, including red blood cells, white blood cells, platelets, and plasma. However, it contains hematopoietic (blood-forming) stem cells that are comparable to those found in the bone marrow. This is why cord blood can be used instead of bone marrow for transplantation (**Egyptian Cell SafeBank, 2018).**

The procedure of collecting and storing umbilical cord blood in the days following a baby's birth is known as umbilical cord blood banking (UCB). It contains potent stem cells, as well as hematopoietic cells (**Armstrong et al., 2018**). Cord blood can be taken and kept in either a public or private setting. All affluent countries, as well as the majority of developing countries, have public cord blood banks. The international cord blood banking network had grown to over 160 public cord blood banks in 36 countries by 2014, storing over 731,000 umbilical cord blood units (**Davies, et al., 2017 ; Peberdy, et al., 2018** & **Petrini, 2018).**

There are 720 stem cell banks worldwide, only 76 of them are by American Association of Blood Banks (AABB) accredited; Cell Safe Bank is one of them. Cell Safe Bank is the first stem cell bank in Egypt and the Middle East. It acquired its license from the Ministry of Health in 2009 and it is fully automated. Internationally, it accredited by the American Association of Blood Banks (AABB) **(Nietfeld et al., 2018**).

UCB stem cells are one-of-a-kind and have a wide range of potential applications in the future. The method for collecting blood is simple and poses no risk to the donor (mother or baby). The characteristics of umbilical cord blood (UCB) taken from the umbilical cord differ from those of peripheral blood. It contains a large number of hematopoietic stem cells, which can self-renew and specialize in myeloid and lymphoid cell lineages. The telomere length of the DNA in these cells is longer, which aids in long-term hematopoiesis. The cord blood also contains a high concentration of mesenchymal cells, which have been shown to decrease the graft-versus-host disease response (GVHD). Cord blood stem cell transplantation is being done at many places across the world for a variety of genetic, hematologic, immunologic, metabolic, and oncologic problems **(Umbilical Cord Blood Banking, (2020).**

Public cord blood banks collect, transport, process, test, and store cord blood units that have been altruistically donated for allogeneic use, at no financial cost to the donating parents. The donated cord blood unit is not reserved for the use of the donating family, who relinquish their rights of ownership of the blood to the banking facility (**Yoder, 2019).**

For the collecting, processing, and storage of their infant's cord blood for exclusive autologous or familial use, private cord blood banks charge parents a fee. Parents can choose whether to preserve their infant's cord blood privately for later use, publicly donate it if necessary, and defer cord clipping to

allow their infant to get optimal amounts of cord blood after birth, or to discard the remaining cord blood with the placenta after birth. Parents must be aware of the cord blood options available to their children and have access to the necessary information to make an informed decision. It has been found that parents' knowledge and understanding of cord blood banking and donation is limited (**Perlow, 2016).**

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

Researchers undertook a study to increase expectant mothers' awareness and attitudes towards umbilical cord stem cell banking. A non-probability sampling strategy was used to enroll 60 pregnant women, and data was obtained using a semi-structured questionnaire. The findings demonstrated that most pregnant mothers (75%) had average knowledge before intervention and that most prenatal mothers (65%) had good knowledge after the intervention **(Nisha &Seeta (2017).**

In Egypt, specifically, pregnant women are still unaware of the benefits of umbilical cord blood banking and are unfamiliar with it (**Poomalar & Jayasree, 2016**).

Measuring cord blood banking awareness, the majority of women are unaware of public cord blood banking. Furthermore, despite pregnant women's good attitudes towards UCB banking, they are not adequately attentive to this service and so rarely donate UCB. To reinforce important knowledge on UCB banking for pregnant women, a thorough and wide-ranging approach must be developed, with a focus on the younger demographic and people with lower education (**Matijevic & Erjavec**, **2016**).

Pregnant women should be aware of the cord blood options available to them and have access to the necessary information to make an informed decision. Women's awareness and understanding of cord blood banking and donation have been reported to be limited, and little is known about their sources of information on the subject or the quality of the material offered. Several studies have been carried out in various nations to learn more about people's knowledge, understanding, preferences, and attitudes concerning CB banking. Unfortunately, the majority of findings revealed a lack of awareness among the general public, expectant moms, and even medical professionals or health care providers (**Peberdy et al., 2018**).

Nurses are the primary caregivers for mothers during their pregnancies and the delivery of their newborns. As a result, they are the best people to educate antenatal mothers about the importance of donating cord blood or agreeing to collect and store it to protect their kids from future disorders. After the cord has been separated from the mother and her

newborn, nurses play an important role in collecting the UCB. As a result, there is a pressing need to improve nurses' understanding of the benefits of UCB, stem cell collection, and preservation, as well as their competencies, for them to deliver high-quality maternity care to mothers and babies (**Qureshi, 2019**).

A community health nurse serving as a counselor may be one of the primary sources of information for a pregnant woman seeking to learn more about cord stem cell harvest and banking so that she may make an informed decision. In addition, when providing an antenatal check-up in various health care settings, nurses must play a critical role in teaching pregnant women about stem cell and cord blood banking (**Dinç & Sahin, 2019)**.

Maternity nurses are important members of the healthcare team at all stages of life. They are primarily responsible for the preparation, collection, tagging, and packaging of the blood tube during cord blood collection. Nurses play a unique role in patient education since they are a trusted source of health information, so they must be up to date on medical diagnosis and treatment trends. Continuing education for nurses, on the other hand, provides them with ongoing development, allows them to maintain their competence, and allows them to meet the standards of nursing practice (**Varghese, 2017**).

Following that, nurses should be trained on the need to collect and store UCB for future use in illness cures, as well as develop a positive attitude to modify holistic nursing care. Nurses were essential in carrying out several responsibilities in stem cell banking, from identifying the nature of the umbilical cord to determining the sides of stem cell collection. Previous research in Egypt indicated that the majority of nurses were uninformed of the cord blood collection and preservation process, as well as its medical applications **(Abdella, 2019).**

Significance of the study:

Cord stem cell preservation is still a relatively new notion, and many people are unaware of it. Many people miss out on a once-in-a-lifetime opportunity to bio-insure their child's future because they are ignorant (**Umbilical Cord Blood Banking, 2020**). The bone marrow or blood of matched siblings or appropriately matched unrelated volunteers can be utilized to make stem cells, however many patients do not have a suitable donor. Alternative stem cell sources such as umbilical cord blood have been successful. It has the advantage of being able to tolerate a level of human leukocyte antigen incompatibility that adult bone marrow cannot, resulting in a higher possibility of finding a suitable match **(Brien et al., 2016).**

Mohammed and EL Sayed (2015) conducted a study in Egypt to analyze maternity nurses' knowledge and attitudes regarding cord blood collection and stem cells. They suggested that counseling for pregnant women on this subject is extremely important. Cord blood stem cells are currently being studied in the field of regenerative medicine, where stem cells may be used to induce healing or regenerate cells to restore tissues. Clinical trials employing cord blood in experimental therapies to treat cerebral palsy, brain injury, and juvenile diabetes have been conducted as a result of this

fascinating new field of medicine **(Nietfeld et al., 2018).**

Despite growing evidence of the therapeutic benefits of umbilical cord-derived stem cells and media promotion of umbilical cord blood collection for allogeneic, family-directed, or autologous use, surveys show that the majority of pregnant women (70 to 80 percent) are unaware of stem cells and cord blood banking and want to learn more (**Fernandez et al., 2018**). In addition, little is known about the effectiveness of public education in increasing the number of stem cell donors in developing countries (**Bapat et al., 2017**). Therefore, the researchers conducted this study to evaluate the effect of instructional guidelines on antenatal mothers' knowledge regarding umbilical cord stem cell banking.

Operational Definitions:

Stem cells: The ability to renew through mitotic cell division and differentiate into a varied spectrum of specialized cell types distinguishes stem cells, which are located in the umbilical cord vessels and placenta.

Umbilical Cord blood: Blood derived from the umbilical cord vessels and placenta is known as umbilical cord blood.

Aim of the study

To evaluate the effect of instructional guidelines on antenatal mothers' knowledge regarding umbilical cord stem cell banking through:

- Assessing antenatal mothers' knowledge level regarding umbilical cord stem cell banking.
- Designing and implementing instructional guidelines based on the antenatal mothers' needs.
- Investigating the association between demographic characteristics of antenatal mothers and their knowledge regarding umbilical cord stem cell banking**.**
- Assessing the effect of instructional guidelines on knowledge regarding umbilical cord stem cell banking among antenatal mothers.

Research hypothesis:

H1 There will be a significantly higher level of knowledge in post-test scores than pretest on knowledge regarding umbilical cord stem cell banking among antenatal mothers.

H2 There will be a significant association between post-test knowledge regarding umbilical cord stem cell banking among antenatal mothers with their selected demographic variables.

Subjects and Method:

Research design:

A quasi-experimental research design was utilized to accomplish the study's aim. This design is important to the nature of the study issue, having one or more group subjects observed on pre and post manipulations (**Creswell, 2012)**.

Setting:

The study was conducted in the Antenatal Outpatient Clinic at Mansoura University Hospital. This setting was chosen because of the high attendance

rate of antenatal mothers attending for follow up .

Subjects:

Sample size calculation:

The sample size was a total of (200) antenatal mothers were selected according to the following statistical formula n = Z2p (1-p) /d2, where z = level of confidence according to the standard normal distribution (for a level of confidence of 95%, z = 1.96). p = the estimated proportion of the population that presents the characteristic (when unknown, we use p = 0.5), d = (d is considered 0.05) (**Joshi et al., 2012)**

It included 200 antenatal mothers who were selected from previous setting based on non-probability convenience sampling that had met the inclusion criteria within six months and had received education from the previously mentioned setting. The inclusion criteria were mothers whose ages ranged from18-40 years old, and who were available at the previously mentioned setting at the time of data collection and were willing to participate in this study. Exclusion criteria included antenatal mothers who are not willing to participate in the study.

Data collection tools:

Two tools were used to collect the data of the study as the following:

Tool (I): A structured interview questionnaire was developed by the researchers after reviewing the related literature and research studies: **Umbilical Cord Blood Banking (2020);** it consists of 9 items categorized into two parts.

Part I: Designed to collect information on the study sample's demographic characteristics (age, educational level, occupation, and residence) (4 items).

Part II: Designed to collect information on obstetric history (such as week of gestation, consanguineous marriage, history of abortion, previous anomalous baby, and genetic disorder and cancer history) (6 items).

Tool (II): Knowledge assessment questionnaire

It was developed by the researchers after reviewing the related literature (**Matijevic, &Erjavec, 2016; Didilescu et al., 2018**): and included 14 questions (multiple choice questions). It was created to gather information about mothers' knowledge about umbilical cord stem cell banking such as definition of umbilical cord blood, the definition of stem cells from umbilical blood, umbilical cord components, who can give cord blood for banking, aim of collecting umbilical cord blood, and the Egyptian stem cell bank and its services.

❖ **Scoring system:**

The tool was given a score of 2 for correct answers and 0 for incorrect answers and didn't know. The overall knowledge score ranged from 0 to 28, with 0 being the lowest and 28 being the highest. The knowledge score went from 0 to 13, was considered to have unsatisfactory knowledge (< 50%), and those who scored from14 to 28 were considered to have satisfactory knowledge (≥50%).

Validity of the tools:

Five professors reviewed the content validity of the tools and the instructional guideline, as well as its clarity, comprehensiveness, appropriateness, and relevance. Three experts in obstetric and gynecological nursing and two experts in community health nursing reviewed the content validity of the tools and the instructional guideline. To ensure sentence clarity and content appropriateness, changes were made based on the panel's assessment and the content validity Index (CVI) was 0.99.

Reliability of the tools:

The Cronbach's test was performed to determine tool one's reliability, which was 0. 88, while tool two's reliability was 0.87.

Methods of data collection:

Filed work:

The data collection was conducted from January 2021 to June 2021. The current research study was divided into three stages: preparatory, implementation, and evaluation. A total of 200 antenatal mothers were enrolled in the study. The researchers gathered information from antenatal mothers two days a week from 9 a.m. to 1 p.m. during the morning shift (Sunday and Monday) for six months. Each interview question took approximately 25-35 minutes to complete tools.

A-Preparatory phase:

The data collection tools were distributed to the antenatal mothers twice: (1) as a pre-test to assess their knowledge before adopting instructional guidelines, and (2) was as a post-test to assess their knowledge after the instructional guidelines were implemented.

After reviewing the related literature and assessing the actual needs of the studied antenatal mothers, the simplified booklet was used as a supportive material and given to antenatal mothers in the Arabic language to cover all items regarding the knowledge regarding umbilical cord stem cell banking. Lectures, discussions, photographs, and posters were all employed as instructional methods.

A pilot study

A pilot study was conducted on 10% (20 antenatal mothers) of the total sample to test the clarity and feasibility of the research process. No modifications were carried out to develop the final form of the tools. Mothers who were in the pilot were excluded from the research study.

Ethical considerations:

Before beginning the study, the Ethical Research Committee of the Faculty of Nursing gave their approval. An Official approval was obtained through an issued letter from the Dean of the Faculty of Nursing, Mansoura University, to conduct this study. The researchers visited the medical and nursing directors of the chosen facility to explain the study's aim and obtain their agreement. To gain antenatal mothers' cooperation, oral consent was acquired. To secure authorization for datacollection, the purpose of the study was stated, as well as the expected outcomes

from its implementation. The study's aim was explained to the antenatal mothers. The mothers were advised that participation in the study was entirely optional, and they were free to decline. Mothers have the right to drop out of the study at any time and for no reason. Mothers were told that their information would be kept private and only utilized for research.

B-Implementation phase:

The study included 200 antenatal mothers. The researchers collected data from the mothers who attended previously selected setting. The researchers met mothers individually at the waiting area present at previously selected setting and explained the aim of the study after introducing themselves to mothers.

The researchers created and implemented educational guidelines for umbilical cord stem cell banking that included a theoretical component. Antenatal mothers' knowledge of umbilical cord stem cell banking was incorporated into the theoretical portion. It was implemented through lectures, posters, educational films, scenarios, and role-plays. Antenatal mothers were given an educational booklet written in simple Arabic with illustrative photos provided by the researchers regarding umbilical cord stem cell banking.

For the theoretical section, the subject information was divided into two sessions, each lasting roughly 20-30 minutes. Each one took one hour to complete. The first session began with an introduction to the educational guidelines for umbilical cord stem cell banking, and each subsequent session began with a summary of the previous session's feedback.

The instructional guidelines included knowledge regarding umbilical cord stem cell banking as follow:

- 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
- 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,
- Egyptian stem cell bank and its services as:
  - Location and contact information of the bank
  - Services of the bank (umbilical cord blood banking, tissues banking, and dental pulp banking)
  - The financial cost of umbilical cord blood banking

Evaluation:

Evaluation of the educational guidelines was done after one month. A post-test was applied for the mothers to evaluate their knowledge using the same pre-test tools that were evaluated according to the same method of scoring that was used before the application of the educational guidelines (tool II).

Administrative design:

An administrative permission was obtained through an issued letter from the

Dean of the Faculty of Nursing, Mansoura University to the Director of the outpatient clinic.

Statistical analysis:

The data was analyzed using SPSS (version 19). The individuals' demographic traits and information sources were examined, and the results were expressed as frequencies and percentages. The Chi-square and Two-Sample Kolmogorov-Smirnov tests were used to look at the homogeneity of demographic characteristics. The subscales of knowledge were compared using the U test and analysis of covariance (ANCOVA). The ANCOVA was run with the assumptions in mind, correcting the influence of pre-test scores as a covariate variable, and then comparing the adjusted means. $P < 0.05$ was considered as the level of significance.

Results:

Table (1): showed that 80% of the antenatal mothers' age ranged between 18 < 30 years, with a mean SD of 23.46 ± 6.34. (40%) of them had secondary education, and also, it is pointed out that 73% of the antenatal mothers were housewives.

Figure (1): Demonstrated that (75%) of the antenatal mothers were living in rural areas and 25% of them were from urban areas.

Table (2): represented the medical and obstetric history of the studied antenatal mothers, It was noticed that 60% of them were between 28<32weeks of gestation. 30% of the antenatal mothers reported that they were consanguineous marriage, (5%) of them had a history of abortion, and only (1%) had a previous baby anomaly. Concerning the presence of genetic disorders and cancer history, 7% of them had genetic disorders.

Figure (2): Illustrated that 85% of the studied antenatal mothers reported that their main source of information regarding umbilical cord stem cell banking was their doctors.

Table (3) demonstrated frequency and percentage distribution of the studied antenatal mothers' knowledge regarding umbilical cord stem cell banking. It was observed that there was an improvement with a highly statistically significant difference between antenatal mothers' knowledge regarding umbilical cord stem cell banking pre/post one month of instructional guidelines implementation (P<0.001).

Figure (3): Most of the studied antenatal mothers (94%) had unsatisfactory total knowledge scores pre instructional guidelines implementation, while 82 % of them had total satisfactory knowledge scores after instructional guidelines implementation

Table (4): portrayed that (86%) of the antenatal mothers had satisfactory knowledge regarding umbilical cord stem cell banking post guidelines implementation than pre-implementation with statistically significant difference.

Concerning table (5), the analysis using chi- square illustrated that there was a statistically significant association between age, education, occupation, residence, and knowledge.

Table (1): Distribution of the studied antenatal mothers regarding their demographic characteristics (n=200).

Demographic characteristics	No.	%
Age in years		
18 < 30	160	80
30 – 40	40	20
Mean ±Stander deviation	23.46 ± 6.34	
Educational level		
- Read and write	50	25
-Secondary education	80	40
-University education	70	35
Occupation		
- Working	54	27
- Housewives	146	73

Figure (1): Distribution of the studied antenatal mothers according to their residence (n=200).

Table (2): Distribution of the studied antenatal mothers regarding their medical, family history, and obstetrical history (n=200).

Medical obstetrical history	No.	%
Week of gestation		
- 28<32	120	60
- 32-36	80	40
Consanguineous marriage		
- Yes	60	30
- No	140	70
History of abortion		
- Yes	10	5
- No	190	95
Previous anomalous baby		
- Yes	2	1
- No	198	99
Presence of genetic disorder and cancer history		
- Yes	14	7
- No	186	93

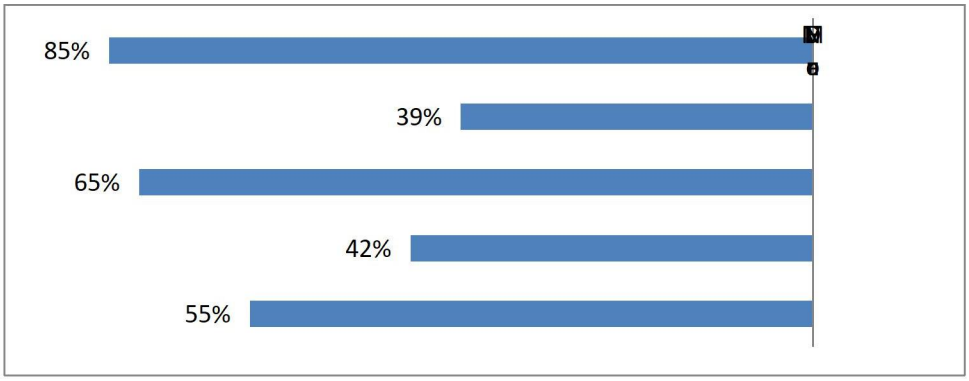

Figure (2): Distribution of the studied antenatal mother according to their source of knowledge regarding umbilical cord stem cell banking (n=200).

Table (3): Distribution of the studied antenatal mothers' knowledge regarding umbilical cord stem cell banking pre and post instructional guidelines' implementation(n=200).

Antenatal mothers 'knowledge	No =(200)		P-value
	Pre (No/%)	Post (No/%)	
Definition of umbilical cord blood	40 (20)	168 (84)	<0.001*
Definition of stem cells from umbilical blood	30 (15)	164 (82)	<0.001*
Umbilical cord components	38 (19)	178 (89)	<0.001*
Who can give cord blood for banking	26 (13)	172 (86)	<0.001*
Aim of collecting umbilical cord blood	20 (10)	180 (90)	<0.001*
Egyptian stem cells bank and its services	40 (20)	170 (85)	<0.001*

*highly significance at 0.001 levels -Chi-square test

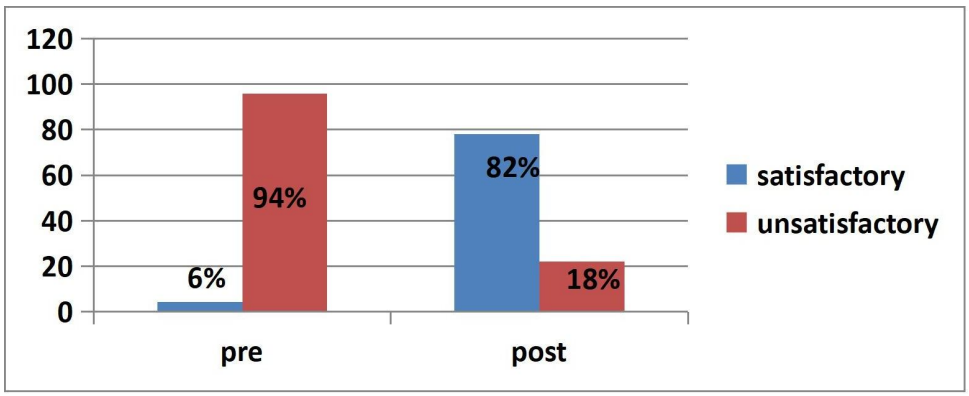

Figure (3): Total knowledge scores of the studied antenatal mothers through pre/post instructional guidelines phases (n=200).

Table (4): The total knowledge score levels of the studied antenatal mothers regarding umbilical cord stem cell banking pre and post instructional guidelines' implementation.

Total knowledge	Pre instructional guidelines implementation		Post instructional guidelines implementation		T	P-value
	No	%	No	%		
Satisfactory	54	27	172	86	15.022	<0.001*
Unsatisfactory	146	73	28	14		

*highly significance at 0.001 levels -Chi-square test

Table (5): Correlation between antenatal mother's demographic characteristics and knowledge.

Variables	Co-relation (r)	P-Value
Age –Knowledge	-0.238	0.000
Education -knowledge	-0.603	0.000
Occupation- knowledge	-0.227	0.000
Residence- knowledge	-0.635	0.000

Discussion:

Blood taken from the umbilical cord shortly after delivery is high in blood-forming stem cells that can be genetically linked to the newborn. This blood is utilised to manufacture blood and immune system cells, which are being employed to treat immune system illnesses such as leukemia, where cells from cord blood are identical to those found in adult bone marrow **(Shaban, 2018).**

It is a source of hematopoietic stem cells that are utilised to treat cancer and other disorders **(Armstrong et al., 2018).** The goal of this study was to see how instructional guidelines affected antenatal mothers' knowledge of umbilical cord stem cell banking. The findings of this study support the premise that mothers' knowledge of umbilical cord stem cell banking has increased statistically significantly.

The results of the present study indicated that the majority of the antenatal mothers' age ranged between 18 < 30 years with a mean ± SD 23.46 ± 6.34 and the majority of them were living in rural areas. From the researchers' point of view, the presence in rural areas may be the reason for knowledge deficit.

The findings of this study are similar to those of **Rashed & Shehata, (2018**), who conducted a study about " Evaluation of Pregnant Women's Knowledge and Attitude Toward Banking of Stem Cells from the Umbilical Cord Blood Before and After Counseling" and reported that the average age of the study sample was 26.09 4.56, and nearly all of the study participants had completed secondary and university education and resided in rural areas.

The present study results highlighted that three fifth of the studied antenatal mothers were between 28<32 weeks of gestation. These findings are in line with a study in Saudi Arabia done by **Jawdat, et al., (2018)** about "Public awareness on cord blood banking" and found the same results.

The result of the current study revealed that the majority of the studied antenatal mothers reported that their main source of information regarding umbilical cord stem cell banking was their doctors.

This result is comparable to that of **Poomalar & Jayasree (2016),** who studied" Awareness of cord blood banking among pregnant women in semi urban areas" and found that doctors were the primary source of information about umbilical cord blood storage for the general public. This finding contradicts a study conducted by **Tufekci et al., (2017)** entitled "To assess knowledge and attitudes about umbilical cord blood banking," which found that the primary source of information for mothers was the media and the internet, with healthcare professionals serving as a secondary source. This could be tied to the media, as the internet has become an important aspect of women's lives.

The current study result found an improvement in prenatal women's knowledge of umbilical cord stem cell banking, with a highly statistically significant difference between pre/post one month of instructional guidelines implementation (P0.001). From the researchers' point of view, it noticed the good effect of instructional guidelines implementation may be shown in the improvement in knowledge about this topic. Knowledge deficit pre instructional guidelines can be attributed to the fact that cord blood collection and stem cells are new advanced trends and the nursing curricula are still deficient in this topic, as well as their low level of knowledge about how to collect and use the cord blood and stem cells before the intervention.

This could be because the majority of the women in the study didn't finish their education and didn't realize what they didn't know. A study by **Habib et al., (2017)** on "Saudi Women knowledge and Attitude regarding cord blood donation" found that half of the sample had low awareness and only 18 percent had high knowledge. Furthermore, **Rashed, & Shehata, (2018**), who conducted "Evaluation of Pregnant Women's Knowledge and Attitude regarding Banking of Stem Cells from the Umbilical Cord Blood Before and After Counseling," concurred with the current finding. They came to the conclusion that the studied sample's general awareness of the UCB was relatively low before counseling.

Moreover, a fifth of the antenatal mothers had heard about stem cells. In a research undertaken by **Fernandez et al., (2018)** who studied" Knowledge and attitudes of pregnant women with regard to collection, testing and banking of cord blood stem cells" however, less than three-quarters of pregnant women had little or no knowledge. Similar findings were found in a study conducted by **Vijayalakshmi, (2019),** studied" Knowledge on collection and storage of cord blood banking", which found that the majority of pregnant women had insufficient awareness about stem cell harvest, storage, and banking. Also, **Suen et al. (2018)** confirmed these findings in their study "Maternal understanding of commercial cord blood storage for their

offspring – A survey among pregnant women in Hong Kong. The results of this investigation demonstrated that most pregnant women had little or no understanding about stem cell banking and its uses.

More than a quarter of the women had heard about stem cells. In a study by **Fernandez et al. (2018**), who studied" Knowledge of pregnant women with relation to cord blood stem cell collection, testing, and banking," less than three-quarters of pregnant women had little or no knowledge. Similar findings were obtained in a study conducted by **Vijayalakshmi et al., (2019**), which investigated "Knowledge on collection and storage of cord blood banking," which discovered that the majority of pregnant women were unaware of stem cell harvest, storage, and banking. **Suen et al.,(2018),** for example, looked into "Maternal awareness of cord blood storage for their children.

The current study showed that there was a statistically significant association between age, education, occupation, residence, and knowledge. This finding is in line with that of **Matijevic, &Erjavec, (2016)** studied "Knowledge and attitudes among pregnant women and maternity staff about umbilical cord blood banking" and reported the same results. From the researchers' point of view, the results of the current study convey the success of the implementation of instructional guidelines for antenatal mothers which met their needs in terms of enhancing and improving their knowledge, resulting in acceptance of the research hypothesis and objectives.

According to a previous study, after becoming aware of the umbilical cord blood collection technique and stem cells, there is a considerable improvement in the percentage of right responses to questions. After awareness, the average knowledge score is quite significant. Furthermore, following awareness, the degree of nurses' knowledge grew dramatically, and good knowledge climbed from less than two percent before awareness to the majority after it. The current findings are consistent with those of **Shaban, (2018**), who found a significant improvement in knowledge scores among the participant students in the areas of umbilical cord, stem cells, and cord blood collection that were found at the immediate after-test and after 3 months of intervention, where the majority of them had a good level of knowledge.

Similarly, **Mohamed and Sayed (2015)** reported that the maternity of nurses in their study prior to the instructional guidelines intervention had insufficient knowledge about umbilical cord blood collection and banking, which resulted in statistically significant improvement at post and after three months of intervention.

Similarly, **Akshatha (2017)** studied and reported a significant difference in knowledge levels between the pre- and post-tests among the examined subjects, concluding that the structured education program was helpful in boosting the knowledge of their staff nurses. In a similar vein, **Lovis, (2020)** studied and discovered that the majority of their participants had low awareness of the cord blood collection method and stem cell usage in the pre-test compared to the good knowledge gained in the post-

test. These findings are also consistent with **Kumaraswamy & Muthulakshmi's (2018**) findings, which concluded that the developed educational program was effective.

Conclusion:

Based on the study results, the current study findings highlighted that the majority of the participants had inadequate knowledge about stem cells and its banking pre instructional guidelines. The instructional guidelines were effective in improving knowledge regarding umbilical cord stem cell banking among antenatal mothers.

Recommendations:

- Every pregnant woman who visits an antenatal clinic should receive a guide and a leaflet on umbilical cord blood stem cell harvesting and banking.
- Continuous in-service cord blood collection and preservation training program to improve mothers' awareness of new concepts and technological advancements in care.
- It is recommended that similar studies be conducted on a large sample of people in multicenter settings in order to generalize the findings.
- During the third trimester of pregnancy, community and maternity health nurses should play a role in providing frequent training and workshops to women in antenatal clinics about umbilical cord blood banking and stem cell banking.
- Umbilical cord blood banking and stem cell banking should be promoted in the media to increase public awareness of the advantages and benefits of these procedures.

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