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Effect of nursing intervention program on pregnant woman's knowledge about umbilical cord stem cell banking

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Abstract---The procedure of collecting and storing umbilical cord blood in the days following a baby's birth is known as umbilical cord blood banking. It contains potent stem cells, as well as hematopoietic cells. Aim: To determine the effect of the nursing intervention program on pregnant woman's knowledge about umbilical cord stem cell banking. Design: A quasi-experimental research design was used to achieve the study's aim. Setting: The study was applied in the Antenatal Outpatient Clinic at Minia University Hospital. Subjects: A total of 100 pregnant women were selected from previous settings based on non-probability convenience sampling. Two tools were used: (1) a structured interview questionnaire; which included two parts (1) personal data, (2) obstetric history, and (2) a knowledge assessment questionnaire. Results: The study's findings demonstrated that post-nursing intervention program knowledge of umbilical cord stem cell collecting and banking was statistically significantly higher than pre-nursing intervention program knowledge among the studied pregnant woman. Conclusion: The findings of the study concluded that the nursing intervention program was effective in improving pregnant woman's knowledge regarding umbilical cord stem cell banking. Recommendations: During the third trimester of pregnancy, maternity health nurses should play a role in providing frequent training and workshops to pregnant women during antenatal care about umbilical cord blood banking and stem cell banking.

Keywords---Pregnant woman, Knowledge, Nursing intervention program, Umbilical cord stem cell banking.

Introduction

The umbilical cord, which joins the mother to the child, is a lifeline. In the womb, it feeds the developing child, and afterward, it is connected to the baby via the belly button. It is connected to the mother's placenta during pregnancy. After a baby is delivered and the umbilical cord is cut, some blood remains in the placenta's blood vessels as well as the portion of the chord that is still attached to it (Armstrong et al., 2018). After birth, this additional blood is no longer needed by the newborn. 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 Safe Bank, 2018).

Umbilical cord blood banking is the process of obtaining and preserving umbilical cord blood in the days immediately following a baby's birth. It includes hematopoietic cells as well as powerful stem cells (Petrini, 2018). It is possible to collect and store cord blood in a public or private location. Public cord blood banks exist in every developed nation as well as most underdeveloped nations. By 2014, the network of public cord blood banks throughout the world has expanded to over 160, with over 731,000 umbilical cord blood units being stored there (Davies, et al., 2017).

There are 720 stem cell banks around the globe, but only 76 of them have received accreditation from the American Association of Blood Banks (AABB); Cell Safe Bank is one of them. The first stem cell bank in the Middle East and Egypt is called Cell Safe Bank. In 2009, the Ministry of Health granted it a license, and it is entirely automated. It holds American Association of Blood Banks (AABB) accreditation internationally (Nietfeld et al., 2018).

Because they are unique and have so many potential uses in the future, umbilical cord blood stem cells. Simple and without risk to the donor, the blood collection procedure (mother or baby). Peripheral blood has features that are different from those of umbilical cord blood. It has a lot of hematopoietic stem cells that can self-renew and have a preference for myeloid and lymphoid cell lineages (Umbilical Cord Blood Banking (2020)). Long-term hematopoiesis is facilitated by the extended telomere length of the DNA in these cells. The mesenchymal cells, which are abundant in cord blood and have been demonstrated to reduce the graft-versus-host disease response, are also thought to play a role in this (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 (Peberdy, et al., 2018).

Free of charge to the giving parents, public cord blood banks gather, transport, process, test, and store cord blood units that have been generously donated for

allogeneic use. The donating family forfeits their ownership of the blood to the banking facility, therefore the given cord blood unit is not kept for their use (Yoder, 2019).

Parents must pay private cord blood banks for the collection, processing, and storage of their infant's cord blood for only autologous or family usage. Parents can decide whether to privately store their child's cord blood for future use, publicly donate it if necessary, and postpone cord cutting so that their child receives the maximum amount of cord blood after birth, or dispose of the remaining cord blood along with the placenta (Nisha & Seeta, 2017). To make an informed choice, parents must be aware of the cord blood options available to their children and have access to the essential data. Parents' comprehension of cord blood donation and banking has been proven to be poor (Perlow, 2016).

Researchers found that even though umbilical cord stem cells can be used for a variety of therapeutic purposes, between 70 and 80 percent of women had limited awareness of stem cells and required in-depth education and counseling on this subject. The primary providers of the necessary instruction and counseling must be nurses. Only 15 to 30% of people receive counseling, according to the information currently available (Poomalar, 2016). Many expectant women are not aware that there exist stem cell banks. Although women may be open to the notion of banking, many are unaware of the available services, hence they never actually engage in banking (Armson, 2015).

According to a survey on cord blood banking awareness, most women are not aware that public cord blood banking exists. Additionally, despite their positive sentiments toward UCB banking, pregnant women are not sufficiently attentive to this service and hence infrequently give UCB. A full and comprehensive strategy must be created, focusing on the younger generation and persons with lesser education levels, to reinforce crucial information about UCB banking for pregnant women (Matijevic & Erjavec, 2016).

Pregnant women should be aware of their cord blood alternatives and have access to the facts they need to make an educated choice. Little is known about women's sources of information on the topic or the caliber of the information provided, and it has been claimed that women's awareness and understanding of cord blood banking and donation are limited. To find out more about people's knowledge, comprehension, preferences, and attitudes regarding CB banking, several researches have been conducted in various countries. Unfortunately, the bulk of data demonstrated a lack of knowledge among the general public, pregnant mothers, and even medical experts or healthcare providers (Peberdy et al., 2018).

The majority of the mothers' care during their pregnancies and the delivery of their newborns are provided by nurses. They are therefore the most qualified to inform expectant mothers about the significance of cord blood donation or their consent to its collection and storage to shield their children from potential illnesses. Nurses are essential in the process of collecting the UCB after the cord has been cut from the mother and the newborn. Therefore, it is imperative to raise nurses' competencies and understanding of the advantages of UCB, stem cell

collection, and preservation for them to provide women and babies with high-quality maternity care (Qureshi, 2019).

At all stages of life, maternity nurses are crucial members of the medical team. They are largely in charge of setting up, gathering, labeling and packaging the blood tube during cord blood collection. Since they are a dependable source of health information, nurses have a special responsibility in patient education, so they need to be knowledgeable about current medical diagnoses and treatment trends (Petrini, 2018). On the other hand, continuing education for nurses enables them to meet the standards of nursing practice, provides them with continued development, and helps them to keep their competence (Varghese, 2017).

Then, nurses should receive training on the significance of gathering and storing UCB for potential use in the treatment of illnesses as well as cultivate a positive outlook to alter holistic nursing care. Nurses were crucial in performing several tasks related to stem cell banking, including determining the type of umbilical cord and choosing which sides to collect stem cells from. The majority of nurses in Egypt, according to earlier studies, were unaware of how cord blood is collected, preserved, and used medically (Abdella, 2019).

Significance of the study

Many people are unaware of cord stem cell preservation, which is still a fairly new concept. Because they are unaware, a lot of individuals miss out on a once-in-a-lifetime chance to bio-insure their child's future (Umbilical Cord Blood Banking, 2020). To create stem cells, matched siblings or adequately matched unrelated volunteers can donate their bone marrow or blood, however many patients lack a qualified donor. Umbilical cord blood is an alternative stem cell source that has shown promise. In comparison to adult bone marrow, it has the benefit of being able to tolerate a level of human leukocyte antigen incompatibility, increasing the likelihood of finding a compatible donor (Brien et al., 2016).

Cord blood stem cells are currently being researched in the field of regenerative medicine, where stem cells may be employed to induce healing or regenerate cells to restore tissues. This interesting new area of medicine has led to clinical trials using cord blood in experimental therapies for the treatment of cerebral palsy, brain injury, and juvenile diabetes (Nietfeld et al., 2018).

Surveys reveal that the majority of pregnant women (70 to 80 %) are unaware of stem cells and cord blood banking and desire to learn more despite mounting evidence of the therapeutic advantages of umbilical cord-derived stem cells and media promotion of umbilical cord blood collection for allogeneic, family-directed, or autologous use (Fernandez et al., 2018). Furthermore, nothing is known about how well public education works to increase the number of stem cell donors in developing nations (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 umbilical cord vessels and placenta are home to stem cells, which are characterized by their capacity to replenish through mitotic cell division and differentiate into a wide range of specialized cell types.

Umbilical cord blood: This is the blood that comes from the placenta and the vessels of the umbilical cord.

Aim of the study

To determine the effect of a nursing intervention program on pregnant woman's knowledge about umbilical cord stem cell banking through:

- Assessing pregnant woman's knowledge level regarding umbilical cord stem cell banking.
- Designing and implementing nursing intervention program based on the pregnant woman's needs.
- Assessing the effect of a nursing intervention program on knowledge regarding umbilical cord stem cell banking among pregnant women.

Research hypothesis

H1 There will be a considerably higher level of knowledge about umbilical cord stem cell banking among pregnant women in post-test results compared to pretest results.

H2 Pregnant women's post-test knowledge of umbilical cord stem cell banking will significantly correlate with their chosen demographic factors.

Subjects and Method

Research design:

To accomplish the goal of the study, a quasi-experimental research design was adopted. Having one or more group subjects observed on pre and post-manipulations as part of this design is crucial given the nature of the study problem (Creswell, 2012).

Setting:

The study was used in the Minia University Hospital's Antenatal Outpatient Clinic. These locations were picked because they serve the most populated region of the nation and have a high attendance rate of pregnant women who come in for follow-up care.

Subjects:

A total of 100 pregnant women were selected from previous settings based on non-probability convenience sampling

Data collection tools:

Two tools were used to collect the data for 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: Created to gather data on the demographics of the study sample, including age, educational attainment, employment status, and place of residence (4 items).

Part II: Aiming to gather data on obstetric history (such as a week of gestation, consanguineous marriage, history of abortion, and previous abnormal baby), (6 items).

Knowledge evaluation questionnaire is a tool (II)

Following a review of the relevant literature (Matijevic, & Erjavec, 2016; Didilescu et al., 2018), the researchers created it. It contained 13 questions (multiple choice questions). It was designed to gather data on women's knowledge of umbilical cord stem cell banking, including definitions of umbilical cord blood, stem cells from umbilical blood, umbilical cord components, who can give cord blood for banking, why umbilical cord blood is collected, and the Egyptian stem cell program.

Scoring system

The tool received a score of 2 for accurate responses and 0 for unanswered questions. 0 was the lowest and 28 was the highest on a scale of 0 to 26, with 0 representing general knowledge. In terms of knowledge, individuals who scored between 14 and 26 were deemed to have satisfactory knowledge (50%), whereas those who scored between 0 and 13 were deemed to have unsatisfactory knowledge (50%).

Validity of the tools

A nursing intervention program's clarity, comprehensiveness, appropriateness, and relevance were all examined by five academics, along with the tools' content validity. The tools' content validity as well as the nursing intervention program was examined by five specialists in obstetric and gynecological nursing. The content validity Index (CVI), which measures how well the content is valid, was 0.99 after revisions were made to guarantee sentence clarity and appropriateness.

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 was gathered between January and April of 2021. Three phases make up the current research study: planning, carrying out, and evaluating. The study included 100 pregnant women in total. For four months, the researchers interviewed pregnant women two days a week from 9 a.m. to 12 p.m. on the morning shift (Sunday and Monday). It took about 25 to 35 minutes to complete each interview question.

A-Preparatory phase:

The data collection tools were distributed to the pregnant women twice: (1) as a pre-test to assess their knowledge before adopting the nursing intervention program, and (2) as a post-test to assess their knowledge after the nursing intervention program was implemented. The simplified booklet was utilized as a support tool and distributed to pregnant women in the Arabic language to cover all topics about the knowledge regarding umbilical cord stem cell banking after studying the pertinent literature and evaluating the real needs of the investigated pregnant women. As means of instruction, we used lectures, dialogues, pictures, and posters.

A pilot study

A pilot study was conducted on 10% (20 pregnant women) 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. Women who were in the pilot were included in the research study.

Ethical considerations

The Dean of the Nursing Faculty at Minia University issued a letter granting official approval for the study's conduct. The researchers met with the facility's medical and nursing directors to discuss the study's objectives and get their approval. Oral consent was obtained to win the women's cooperation. The goal of the study and the anticipated results from its execution was mentioned to obtain permission for data gathering. The pregnant women were informed of the study's objectives. Women who are pregnant have the right to withdraw from the study at any time and without explanation. Women who were expecting were informed that their data would be kept private and solely used for research.

B-Implementation phase

100 pregnant woman participated in the study. Women who attended previously chosen locations were surveyed by the researchers. Women were approached individually in the waiting area at the previously chosen locations, and after introducing themselves, the researchers described the purpose of the study.

The researchers developed and put into practice a theoretically-based nurse intervention program for umbilical cord stem cell banking. The theoretical part included pregnant women's understanding of umbilical cord stem cell banking. Lectures, posters, educational movies, scenarios, and role-playing games were used to implement it. An informational pamphlet on umbilical cord stem cell banking was distributed to expectant mothers in easy Arabic and with accompanying images from the researchers.

Two sessions, each lasting around 20 to 30 minutes, were used to cover the topic material for the theoretical phase. Each of them took an hour to finish. A description of the nursing intervention program for umbilical cord stem cell

banking was given at the start of the first session, and a review of the input from the previous session was given at the start of each succeeding session.

The nursing intervention program covered information on umbilical cord stem cell banking, including the definitions of umbilical cord blood, stem cells from umbilical blood, umbilical cord components, who can donate cord blood for banking, the purpose of collecting cord blood, contraindications for collection, suitable timing of collection, duration of banking for the cord blood, which conditions can be managed by stem cells, and stem cells sources other than umbilical cord blood.

- The bank's address and phone number
- The services offered by the bank (umbilical cord blood banking, tissues banking, and dental pulp banking)
- The expense associated with storing umbilical cord blood

Evaluation

A post-program evaluation of the nurse intervention program was conducted. For pregnant women, a post-test was administered to assess their knowledge using the same pre-test instruments and scoring methodology that was done before the implementation of the nursing intervention program (tool II).

Administrative design

Administrative permission was obtained through an issued letter from the Dean of the Faculties of Nursing, Minia University to the Director of the Outpatient Clinic.

Statistical analysis

Using SPSS, the data was examined (version 19). The demographic characteristics of the participants and the information sources were analyzed, and the findings were presented as frequencies and percentages. To examine the homogeneity of demographic characteristics, the Chi-square and Two-Sample Kolmogorov-Smirnov tests were utilized. The U test and analysis of covariance were used to compare the knowledge subscales (ANCOVA). With these presumptions in mind, an ANCOVA was performed, with pre-test scores corrected as a covariate variable, and the adjusted means of the two groups were compared. The significance threshold was set at P 0.05.

Results

Table (1): showed that 78% of the pregnant women's age ranged between 18 < and 30 years, with a mean SD of 24.64 ± 6.78 , (44%) of them had secondary education, and also, it is pointed out that 65% of them were housewives. Finally (70%) of the studied women were living in rural areas.

Table 2 represented the medical and obstetric history of the studied pregnant mothers, it was noticed that 63% of them were between 28 and < 32 weeks of gestation. 61% of them reported that they were consanguineous in marriage, (4%) of them had a history of abortion, and only (2%) had a previous baby anomaly.

Figure (2): Illustrated that 83% of the studied pregnant women reported that their main source of information regarding umbilical cord stem cell banking was their doctors.

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

Figure (3): Most of the studied antenatal mothers (90%) had unsatisfactory total knowledge scores pre-nursing intervention program' implementation, while 85 % of them had total satisfactory knowledge scores after the nursing intervention program's implementation.

Table (4): portrayed that (88%) of the studied women had satisfactory knowledge regarding umbilical cord stem cell banking post-nursing intervention program implementation than pre-implementation with a 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 pregnant women regarding their demographic characteristics (n=100)

| Demographic characteristics | No. | % |
|------------------------------|------------------|------|
| Age in years | | |
| 18 < 30 | 78 | 78.0 |
| 30 - 40 | 22 | 22.0 |
| Mean \pm Stander deviation | 24.64 \pm 6.78 | |
| Educational level | | |
| - Read and write | 22 | 22.0 |
| -Secondary education | 44 | 44.0 |
| -University education | 34 | 34.0 |
| Occupation | | |
| - Working | 35 | 35.0 |
| - Housewives | 65 | 65.0 |
| Residence | | |
| - Urban | 30 | 30.0 |
| - Rural | 70 | 70.0 |

Table (2): Distribution of the studied pregnant women regarding their medical, family history, and obstetrical history (n=100)

| Medical obstetrical history | No. | % |
|-----------------------------|-----|------|
| Week of gestation | | |
| - 28<32 | 63 | 63.0 |
| - 32-36 | 37 | 37.0 |
| Consanguineous marriage | | |
| - Yes | 39 | 39.0 |
| - No | 61 | 61.0 |
| History of abortion | | |
| - Yes | 4 | 4.0 |
| - No | 96 | 96.0 |
| Previous anomalous baby | | |
| - Yes | 2 | 2.0 |
| - No | 98 | 98.0 |

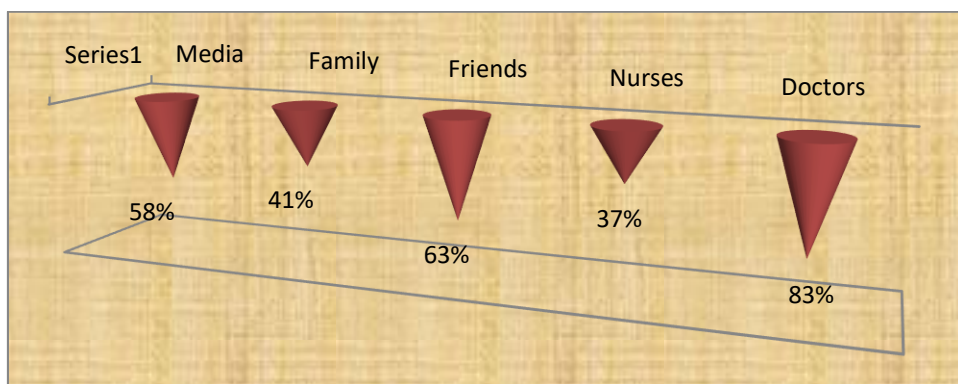


Figure (2): Distribution of the studied pregnant women according to their source of knowledge regarding umbilical cord stem cell banking (n=100)

Table (3): Distribution of the studied pregnant women's knowledge regarding umbilical cord stem cell banking pre and post-nursing intervention program implementation (n=100)

| Antenatal mothers' knowledge | No =(100) | | P-value |
|---|------------|-------------|---------|
| | Pre (No/%) | Post (No/%) | |
| Definition of umbilical cord blood | 42 (42.0) | 58 (85.0) | <0.001* |
| Definition of stem cells from umbilical blood | 33 (33.0) | 89 (89.0) | <0.001* |
| Umbilical cord components | 39 (39.0) | 87 (87.0) | <0.001* |
| Who can give cord blood for banking | 27 (27.0) | 84 (84.0) | <0.001* |
| Aim of collecting umbilical cord blood | 20.0) (20 | 90.0) (90 | <0.001* |
| Egyptian stem cells bank and its services | 34 (34.0) | 87 (87.0) | <0.001* |

*highly significance at 0.001 levels

-Chi-square test

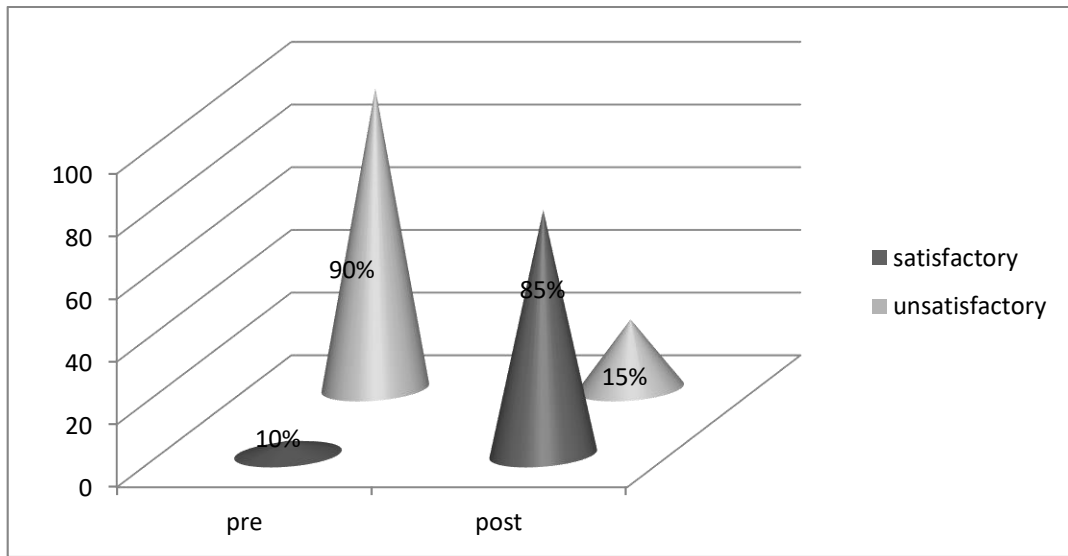


Figure 3; Total knowledge scores of the studied pregnant women through pre/post nursing intervention phases (n=100)

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 | 33 | 33.0 | 88 | 88.0 | 15.022 | <0.001* |
| Unsatisfactory | 67 | 67.0 | 12 | 12.0 | | |

*highly significance at 0.001 levels

-Chi-square test

Table 5: Correlation between the studied women's demographic characteristics and knowledge

| Variables | Co-relation (r) | P-Value |
|-----------------------|-----------------|---------|
| Age -Knowledge | -0.239 | 0.000 |
| Education -Knowledge | -0.605 | 0.000 |
| Occupation- knowledge | -0.228 | 0.000 |
| Residence- knowledge | -0.636 | 0.000 |

Discussion

Blood-forming stem cells that can be genetically related to the infant are abundant in umbilical cord blood that is collected shortly after delivery. The immune system cells produced from this blood are used to treat immune system diseases like leukemia since the cells from cord blood are identical to those found in adult bone marrow (Shaban, 2018).

According to the study's findings, most pregnant women were between the ages of 18 and 30; their mean age was 24.64, the standard deviation was 6.78, and most of them resided in rural areas. The presence in rural areas, in the researchers' opinion, may be the cause of the knowledge gap.

The results of this study are comparable to those of Rashed and Shehata (2018), who conducted a study titled "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 26.094.56, nearly all of the study participants had completed secondary and university education and nearly all of the participants lived in rural areas.

According to the findings of the current study, more than 35% of the pregnant women were between 28 and 32 weeks along. These results concur with a study conducted in Saudi Arabia by Jawdat, et al. (2018) regarding "Public awareness on cord blood banking," which also came to the same conclusions. The result of the current study revealed that the majority of the studied pregnant women reported that their main source of information regarding umbilical cord stem cell banking was their doctors.

This outcome is comparable to that of Poomalar & Jayasree (2016), who investigated "Awareness of cord blood banking among pregnant women in semi-urban areas" and discovered that physicians served as the main source of information for the general public about the storage of umbilical cord blood. This result conflicts with a study by Tufekci et al. (2017) titled "To assess knowledge and attitudes about umbilical cord blood banking," which discovered that the primary sources of information for pregnant women were the media and the internet, with healthcare providers serving as a secondary source. Since the internet has grown to be a significant part of women's lives, this may have something to do with the media.

The current study's findings revealed an improvement in prenatal women's awareness of umbilical cord stem cell banking, with a highly statistically significant difference between the implementation of the program before and after nursing intervention ($P < 0.001$). According to the researchers, one positive result of the execution of the nursing intervention program may be seen in the growth of knowledge on this subject. The lack of knowledge before the nursing intervention program can be attributed to the fact that the collection of cord blood and stem cells is a new, advanced trend and the nursing curricula are still lacking in this area, as well as to the nurses' limited familiarity with the collection and use of cord blood and stem cells.

This might be the result of the majority of the study's women participants not completing their education and failing to recognize their ignorance. According to a study by Habib et al. (2017) on "Saudi Women's knowledge and attitude on cord blood donation," just 18% of the sample had good awareness while the other half had low awareness. Furthermore, the current finding was supported by Rashed, & Shehata's (2018) "Evaluation of Pregnant Women's Knowledge and Attitude Regarding Banking of Stem Cells from the Umbilical Cord Blood Before and After

Counseling" study. They got to the conclusion that before counseling, the investigated sample's general knowledge of the UCB was somewhat low.

Umbilical cord stem cell banking was the subject of a study to better understand pregnant women's opinions and awareness of it. Data were collected using a semi-structured questionnaire after 60 pregnant women were enrolled using a non-probability sampling approach (Nisha & Seeta, 2017). The data showed that most expectant mothers (65%) had strong knowledge after the intervention while most pregnant mothers (75%) had average knowledge before it. Pregnant women, in particular in Egypt, still do not understand the advantages of umbilical cord blood banking (Poomalar & Jayasree, 2016). The knowledge and attitudes of maternity nurses on cord blood collection and stem cells were examined in a study by Mohammed and EL Sayed, (2015) that was carried out in Egypt. They said that prenatal counseling on this topic is crucial and should be provided to all pregnant mothers.

Less than three-quarters of pregnant women in a study by Fernandez et al. (2018) who looked at "Knowledge and attitudes of pregnant women with relation to the collection, testing, and banking of cord blood stem cells" had little to no knowledge. Similar conclusions were drawn from a study by Vijayalakshmi, (2019), titled "Knowledge on collection and storage of cord blood banking," which discovered that the majority of pregnant women were underinformed regarding the collection, storage, and banking of stem cells. The results of Suen et al., (2018) study, "Maternal comprehension of commercial cord blood storage for their offspring - A survey among pregnant women in Hong Kong," also supported similar conclusions. The findings of this study showed that the majority of pregnant women understood very little to nothing about stem cell banking and its uses.

The results of the current study revealed a statistically significant relationship between age, education, occupation, place of residence, and knowledge. The results of Matijevec, & Erjavec's (2016) study on "Knowledge and Attitudes among Pregnant Women and Maternity Staff about Umbilical Cord Blood Banking" are consistent with the findings of this study. The current study's findings, in the researchers' opinion, demonstrate the success of the nursing intervention program for expectant women, which satisfied their demands in terms of enhancing and refining their knowledge, leading to approval of the research premise and objectives.

A prior study revealed a significant increase in the percentage of correct answers when participants learned about the method for obtaining stem cells and umbilical cord blood. The average knowledge score comes in second after awareness and is very important. In addition, after becoming aware, the level of knowledge among nurses increased significantly, and the proportion of nurses with good knowledge increased from less than 2% to the majority. The current findings are in line with those of Shaban, (2018), who discovered 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 to this, according to Mohamed and Sayed (2015), the maternity of nurses in their study before the nursing intervention program had insufficient knowledge about the collection and banking of umbilical cord blood, which led to a statistically significant improvement at the post and after three months of intervention.

Similar to this study, Akshatha (2017) assessed the participants and reported a significant difference in knowledge levels between the pre-and post-tests, concluding that the organized education program was beneficial in enhancing the knowledge of their staff nurses. In a similar vein, Lovis (2020) conducted research and found that the majority of participants had limited knowledge of the stem cell and cord blood collecting methods in the pre-test compared to the high knowledge attained in the post-test. These results support Kumaraswamy & Muthulakshmi's (2018) findings, which found that the created educational program was successful.

Conclusion

According to the study's findings, the majority of participants knew little to nothing about stem cells and their banking before the introduction of the nurse intervention program. The nursing intervention program was effective in improving pregnant woman's knowledge regarding umbilical cord stem cell banking.

Recommendations

- During the third trimester of pregnancy, maternity health nurses should play a role in providing frequent training and workshops to pregnant women during antenatal care about umbilical cord blood banking and stem cell banking.
- Ongoing in-service cord blood collection and preservation training program to increase moms' knowledge of new ideas and medical technology.
- To generalize the results, it is advised that similar studies be carried out on sizable populations in multicenter settings.
- To raise public awareness of the advantages and benefits of these procedures, umbilical cord blood banking, and stem cell banking should be promoted in the media.

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