

Pregnant Women' Knowledge and Attitudes toward Cord Blood Stem Cell Banking and Donation at Gharbia Governorate, Egypt

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Abstract

Background: In the light of the increase in incidence of immunity diseases, metabolic disorders and blood diseases, the need for cord blood stem cell as therapeutic option has become essential. Parents, especially mothers need to decide if they would like to store their infant's cord blood and donate it. They need to be aware of options exists and information needed. **Aim of the study** was to assess pregnant women knowledge and attitudes toward cord blood stem cell banking and donation at Gharbia Governorate, Egypt. **Setting:** This study was conducted in Antenatal Clinics at the largest ten Central Hospitals and ten Rural Health Units in Gharbia Governorate, Egypt. **Subjects:** A convenient sample of one thousand (1000) pregnant women from the previous settings. **Tools:** Two tools were used: **Tool I:** Structured Interview Schedule: It included three parts: - Socio-demographic data of the pregnant women, obstetric history of the pregnant women and Pregnant Women's knowledge toward cord blood stem cells & its banking and donation. **Tool II:** Pregnant women' attitudes toward donation and banking of cord blood stem cells. **Results:** the majority (78.5%) of the studied pregnant women had low level of knowledge regarding cord blood and stem cell & its banking and donation and nearly the half (49.5%) of them had negative attitudes, with statistically significant relationship between total knowledge and attitudes scores. Education and occupation of the pregnant women have a statistically significant correlation with total knowledge and attitudes scores. **Conclusion and recommendations:** the levels of pregnant women knowledge and attitudes regarding cord blood stem cell banking and donation were very low and need to be improved. Therefore, it is recommended to conduct health education programs and companies through health authorities and the media to increase awareness and support pregnant women's positive attitudes toward cord blood stem cell banking and donation to develop and expand the status of umbilical cord blood banking in Egypt.

Key words: Pregnant women, Knowledge, Attitude, Stem cells, Cord blood banking.

Introduction

Today, one of the main sources of hematopoietic stem cells is cord blood. The placenta and umbilical cord of newborn infants contain umbilical cord blood, commonly known as cord blood⁽¹⁾. The umbilical cord is the cord that connects the baby to the placenta. The placenta grows in the uterus and supplies the baby with food and oxygen through the umbilical cord. After delivery, the umbilical cord is severed and typically thrown away, so the baby will no longer benefit from the blood that is still in this organ. The components of cord blood are the same as those found in other blood that can be found in any organ. It is unique, though, because it has an excess of hematopoietic cells^(2,3)

Hematopoietic stem cells (HSCs) are multi potent primitive cells that can develop into all types of blood cells. HSCs can form mature blood cells, such as red blood cells, platelets, and white blood cells⁽⁴⁾. HSCs are used to restore or rebuild a patient's hematopoietic system in the therapy of numerous malignant (such as leukemia, lymphoma) and non-malignant (such as sickle cell disease) disorders. Performing a bone marrow or stem cell transplant is the medical term for this procedure. Peripheral blood (PB), bone marrow (BM), and umbilical cord blood (UCB) are among the organs that contain HSCs⁽⁵⁾. Similar to bone marrow and peripheral blood, umbilical cord blood is a rich source of stem cells for transplantation. The use of cord blood may be advantageous for some people^(1,6).

Umbilical cord Blood banking is a relatively new technique gaining popularity in the past 30 years. Since the first successful umbilical cord blood stem cell transplant in 1988 in Paris (France),

more than 35,000 similar procedures have been carried out globally on both children and adults for a variety of causes⁽⁷⁾. These comprise hematological malignancies, hereditary blood and immune system abnormalities, inborn metabolic defects, and a number of additional symptoms. All this was possible due to the recognition of the presence of a sizable number of hematopoietic stem cells in the umbilical cord as a valuable biological product. As a result, the umbilical cord was no longer thought of as a wasted tissue after delivery but rather as an alternative and valuable source of stem cells^(8,9).

The American Association of Blood institutions (AABB) has only recognized 76 of the 720 stem cell institutions in the world; Cell Safe Bank is one of them⁽¹⁰⁾. The first stem cell bank in the Middle East and Egypt is called Cell Safe Bank. It is entirely automated and was granted a license by the Ministry of Health in 2009. The American Association of Blood Banks (AABB) accords it recognition on a global basis^(10, 11).

Umbilical cord blood banking is the procedure of gathering and storing umbilical cord blood in the immediate period after delivery for potential future use. Public cord blood banks are present in all developed nations as well as the majority of developing nations. By 2014, the international network of cord blood banks has expanded to approximately 160 public cord blood banks in 36 countries, with over 731,000 umbilical cord blood units being stored there. Three umbilical cord blood banking options are available: public, private and hybrid. Without charging the parents who donated the cord blood, public cord blood banks gather, transport, process, test, and store cord

blood units that have been given voluntarily for allogeneic use^(12,13).

Private or family use cord blood banks are the second category of cord blood banks, where parents pay a fee for the collection, processing, and storage of their child's umbilical cord blood. Only autologous or familial use is permitted with UCB. Nowadays, the public has access to hybrid or alternative cord blood banking options. For instance, hybrid cord blood banks give families the choice of holding their unit privately and donating it for use by others^(12, 13).

The decision to donate must be founded on accurate information and sound guidance, both of which can be provided by the health authorities. It is frequently safe for mothers and young donors to donate UCB. Within ten to fifteen minutes of delivery, UCB is removed from the placenta by inserting a needle into one of the umbilical veins. The UCB is collected and placed in a sterile bag with an anticoagulant to prevent clotting, and this can be done using sterile techniques⁽¹⁴⁾.

Donating cord blood is possible for any healthy mother who had a normal pregnancy. Mothers are not permitted to give cord blood, nevertheless, in some circumstances. Some of these circumstances include twin or multiple pregnancies, premature births, cancer in the mother, father, or siblings of the child, diabetes in the mother, who takes animal product-containing insulin (bovine insulin), organ or tissue transplantation within the previous 12 months, and increased risk of mother contracting a blood-borne illness. These limits are there to safeguard both the recipients of transplants and the donors.^(15, 16).

Pregnant women should understand the cord blood alternatives and have access to the data they need to make wise choices. Women's knowledge and understanding of cord blood banking and donation has been reported to be inadequate, and little is known about their informative resources, or the quality of the information given. Many studies on people's understanding, preferences, and attitudes concerning CB banking have been carried out in a number of different countries. Most research results revealed a lack of knowledge among the general population, pregnant mothers, and even healthcare professionals or providers^(14, 17, 18).

Nurses are the main care givers for women during their pregnancies and after the birth of their children. Therefore, they are the most suited to explain to expectant mothers the importance of cord blood donation or to obtain their permission for its collection and storage in order to shield their infants from potential diseases. After the cord has been cut between the mother and the newborn, nurses have crucial role in the process of collecting the UCB.⁽¹⁹⁾

A community health nurse acting 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. Additionally, during an antenatal check-up in a variety of medical settings, nurses must play a crucial part in assessing knowledge and attitudes of expectant mothers and educating them about stem cell and cord blood storage. Maternity nurses are essential members of the medical staff during all stages of life. During cord blood collection, they are primarily in charge of organizing,

gathering, labeling, and packaging the blood tube. They hold a distinct role in patient education since they are reliable sources of health information. Nurses were essential in carrying out a number of stem cell banking-related duties, such as identifying the type of umbilical cord and deciding which sides to collect stem cells from. ^(19,20).

Significance of the study:

Understanding the efficacy and safety of umbilical cord blood stem cells for medicinal purposes is advancing significantly, according to researchers, in addition to their use in treating blood disorders and cancers. Recent research has shown that umbilical cord blood stem cells and embryonic stem cells both have advantages for the advancement of health. Every day, improvements are made to give the patient better safety. Very few researches were done in Egypt regarding banking and donation of cord blood stem cells and covers only small sample.

Even though stem cells extracted from the blood of the umbilical cord have many benefits, they are still seen as medical waste, and the majority of women decide to dispose of their placentas after giving birth. This may be as a result of inaccurate knowledge of its benefits and usage or a negative attitude regarding the use of cord stem cells. This research was done to learn more about pregnant women's attitudes and knowledge regarding cord blood stem cell donation and banking in order to put hands on information level and nature of attitudes among Egyptian pregnant women that may hinder or support the success of cord blood donation and banking in Egypt.

The aim of the study

The aim of the current study was to: -
Assess pregnant women knowledge and

attitudes toward cord blood stem cell banking and donation at Gharbia Governorate, Egypt.

Research questions:

1. How much do pregnant mothers know about banking cord blood stem cells?
2. What is a pregnant woman's attitude of cord blood donation and banking?
3. Is there a relationship between the attitude and knowledge that pregnant women have towards the banking and donation of cord blood stem cells?
4. Is there an effect to socio-demographic characteristics of women on their knowledge and attitude?

Subjects and Method: -

Design: Exploratory descriptive research design was utilized in this study.

Setting:

This research was carried out at Antenatal Clinics in the ten Central Hospitals and ten Rural Health Units in Gharbia Governorate, Egypt. There are ten districts in Gharbia Governorate. The biggest ten central hospitals and the biggest 10 rural health unit from each district were selected to conduct the study.

Subjects: A convenient sample of one thousand (1000) pregnant women from the previous settings was included in the study; 50 pregnant women from each rural health unit and from each central hospital who were recruited in accordance with their planned appointments and who went to the antenatal clinic to obtain standard antenatal treatment. Women of any gestational stage of pregnancy - willing to participate in the study met the inclusion criteria.

Tools of data collection: The following two tools were used to collect data:

Tool I: Structured Interview Schedule: -
It was developed by the researchers to

collect the needed data following a review of relevant literature and prior research with comparable goals ⁽¹⁵⁻²⁰⁾. It included three sub-parts as follow: -

Part one: Socio-demographic data about pregnant women: It was utilized to collect the data about; age, marital status, residence, occupation, level of education, family income, residence, and type of family.

Part two: obstetric history of the pregnant women: It was used to gather information on; parity, pregnancy stage, number of children still alive, previous delivery of baby with congenital anomalies, complications/health problems with current pregnancy and attendance to any antenatal care classes about banking cord blood stem cells.

Part three: Pregnant Women's knowledge regarding the banking and donation of cord blood stem cells: it includes: -

- a- **Pregnant women's knowledge of umbilical cord blood and stem cells:** it contains 9 closed ended questions, such as: function of the umbilical cord, number of arteries and veins in the umbilical cord, suitable time for cord clamping, definition of umbilical blood, blood component formed by cord blood stem cells, definition stem cells, stem cell sources and disorders that cord blood stem cells can treat.
- b- **Knowledge of the pregnant women toward banking and donation of cord blood stem cells:** it contains 13 closed ended questions, such as: time of cord blood collection, cord blood collection and type of delivery, diseases prevent banking and donation, safety of the procedure of cord blood collection for the mother and the baby, length of preservation of cord blood, places for cord blood storage or

donation in Egypt, persons responsible for collection process, cost of cord blood storage and the main reason for UCB banking.

Scoring system: Each question on the knowledge questionnaire received a score of (1) for a right response and (0) for an incorrect response or "do not know." The sum of the scores for all items was used to compute the knowledge score overall.

Total Knowledge score was divided into three categories as follows:

-A scoring of < 50% of the total score indicated **Low level of knowledge**.

-A score between 50% and 75% of the overall score was indicated **Moderate level of knowledge**.

-While a score of > 75% of the overall score stated **High level of knowledge**.

Tool II: Pregnant women' attitudes regarding donation and banking of Stem Cells from Umbilical Cord Blood: This tool was established by Dinc & Sahin (2009) ⁽²¹⁾ and was adapted by the researchers to assess women's attitudes with regard to stem cell donation and banking. It consisted of 10 statements. The women give their responses toward each statement on a three-point Likert Scale: (2) disagree, (1) Neutral, (0) agree for negative items. The score was reversed for positive items (3.4 & 10) to be (0) disagree, (1) Neutral, & (2) agree. The attitude scale's range of possible total scores was 0 to 20.

The total attitude score for pregnant women is divided into two categories:

-Positive attitude which accounts for ≥ 60 % of the score.

-Negative attitude which accounts for < 60 % of the score.

Pilot study

A total of 10% of the study sample was used in the pilot study to evaluate the tool's

validity and clarity as well as the amount of time required to complete the questions. According to the results of the pilot study, each woman's structured interview took an average of 15 to 20 minutes to complete. The pilot study's sample was not used in this study.

Validity and Reliability of the tool

The current study tools were evaluated for the face and content validity by a jury of five experts in obstetric and maternity and community health nursing. According to the panel's assessment of the content's appropriateness and the clarity of the sentences, changes were made. The efficacy of the suggested tools was determined by Cronbach's alpha and found to be (0.84) which demonstrated a large strong positive association between the items of tools.

Method

Approvals for the study: Official permission was taken from the Dean of the nursing faculty to the director of Health affairs Directorate in Gharbia Governorate. -participate in the study at the waiting areas in study settings to collect the needed data using study tools. Each pregnant mother got a 20-minute interview.

-Each setting was accessed three times per week, about 8 to 10 women per day until collecting the needed 50 women from each setting.

-Data were collected over a period of five months starting from beginning of March to the end of July 2023.

Statistical analysis:

Statistical Package of Social Science (SPSS) version 22 was used on an IBM personal computer to gather, tabulate, and statistically analyze the data. Descriptive quantitative data that is displayed as numbers and percentages. The following

Then to the directors of selected hospitals and rural health units to facilitate the researchers work.

Ethical & legal aspects

-The Tanta University Faculty of Nursing's Ethical Committee gained approval (**Code 212-2-2023**).

-The researchers introduced themselves and explained the purpose of the study to the women who met the inclusion criteria in order to gain their consent to participate in the study.

-Anonymity, privacy, confidentiality was maintained.

-The entire study caused no harm for the studied subjects.

Procedure

-The researchers created and tested the study tools in an easy-to-understand Arabic language for validity and reliability.

-Pregnant women who satisfied the inclusion criteria provided their informed consent.

-The researcher interviewed the pregnant women who accept to important tests are part of analytical statistics. The association between two qualitative variables is investigated using the Chi-square test (χ^2). The Pearson correlation coefficient (r) was used to assess the correlation between the variables. A significant was adopted at $P < 0.05$. However, a strong significance was adopted at $P < 0.01$.

Results

Table (1): displays socio-demographic characteristics of the studied pregnant women. As regard to women's age, it was observed that more than half (58.1%) of the studied women their age was (25 to 35) and slightly less than one third (30.7%) their age was 15 and less than <25. Around 41.7% of them had a university degree.

Also, more than half (56.7% & 54.2% respectively) of the studied pregnant women were housewives and lived in rural areas. Nearly the half (48.4%) of them had two and more pregnancy and more than one third (40.9%) were in the second trimester. Also, majority (90.8%) of studied women were married and slightly less than two thirds (65%) of them were livings in nuclear family. In addition, slightly more than two thirds (68.3%) of the pregnant women their income was enough.

As regard to source of information about cord blood banking and donation, nearly half (49%) of studied pregnant women did not have any source of knowledge. 17.2% of them reported internet as a source of their knowledge and only 9.4 % of them reported health professionals.

Table (2): shows knowledge regarding blood cord and stem cells among studied pregnant women. It was found that less than three fifth (56.5%) of the pregnant women answered correctly regarding function of the umbilical cord and nearly one fifth (19.9%) gave a correct response related number of veins and arteries in the umbilical cord. less than the half (47%) of the studied women defined umbilical blood correctly and only less than one fifth (17.5%) say no to the discarding of umbilical cord as medical waste. Moreover, less than one quarter (22.4%) who knew sites for obtaining stem cell and slightly more than two fifth (41.6%) of the pregnant women who gave a correct response related to diseases treated by using cord blood stem cells.

Figure (1): shows the attendance to health teaching classes about blood cord stem cell banking and donation among the studied pregnant women by their. It was observed

that, the majority (88.4%) of the studied women did not attend any health teaching classes related to blood cord stem cell banking and donation.

Figure (2): reveals levels of Knowledge regarding blood cord and stem cells among the studied pregnant women. It was observed that more than two third (67.0%) of the studied pregnant women had low level of knowledge regarding blood cord and stem cells and only 11.0% of them had high level of knowledge regarding blood cord and stem cells.

Table (3): reveals knowledge regarding blood cord stem cells' banking and donation among the studied pregnant women. It was showed that more than one quarter (27.2%) of the studied pregnant women gave a correct response regarding time of cord blood collection and about one fifth (20.1%) of women knew that collection of cord blood can be done from only natural births, while nearly one quarter (24.1%) gave a correct response related to any genetic diseases in the baby prevent donation of cord blood stem cells. Also, less than one tenth (7.2%) of the studied pregnant women gave a correct response regarding cord blood banking cost and places in Egypt and only one third of them gave a correct response related to reasons for umbilical cord blood (UCB) banking.

Figure (3): illustrates total levels of knowledge regarding blood cord stem cells' banking and donation among the studied pregnant women. It was observed that the majority (81%) of the studied pregnant women had low knowledge level regarding blood cord banking and donation, 17% had moderate knowledge level and only 2% of them had high

knowledge level regarding blood cord banking and donation.

Figure (4): reveals knowledge levels regarding blood cord stem cells and its banking & donation distribution among the studied pregnant women. It was noticed that more than three quarter (78.5%) the studied pregnant women had low knowledge level regarding blood cord stem cells and its banking & donation and only 2.6% of them had high knowledge level.

Table (4): shows attitude regarding cord blood stem cells banking and donation among the studied pregnant women. It was revealed that more than one quarter (29.7 & 29.5 respectively) agree that if the cost is affordable, they will store cord blood for their babies as a source of stem cells and was in line with everyone should be able to gain advantage from stored stem cells while, slightly more than two fifth (42%) of them accept to donate cord blood stem cells of their babies for research purposes. Also, more than one third (35%) saw that cord blood of their babies should only be used for their family. Nearly two fifth (39.9) worried about their baby's cord blood to be used for different purposes and more than one third (36.7%) prefer to have their baby's stem cells to store in private banks rather than in public banks.

Figure (5): reveals total levels of attitude regarding blood cord stem cells' banking and donation among the studied women. It was observed that about half (49.5%) of the studied pregnant women had negative attitude level regarding blood cord stem cells' banking and donation. However, 50.5% of them had positive attitude.

Table (5): shows correlation between total scores of knowledge and attitude and socio- demographic characteristics of the studied pregnant women. It was observed

that there was highly positive significant correlation between total score of knowledge of the studied pregnant women with their marital status, educational level, family type, monthly income ($p < 0.01$) and positive significant correlation with pregnancy number, gestational age, and pregnancy problems ($p < 0.05$). In addition, there was highly positive significant correlation between total score of attitude of the studied pregnant women with their residence, occupation, educational level, family type, pregnancy number, and gestational age ($p < 0.01$).

Table (6): shows relationship between total levels of knowledge and attitude regarding cord blood stem cells and its banking and donation. It was noticed that there was a statistically significant relationship between total levels of knowledge and attitude regarding cord blood stem cell and its banking and donation where $p = 0.000^{**}$.

Table (7): illustrate relationship between total levels of knowledge and attitude regarding cord blood stem cell banking and donation and attendance of health teaching classes. It was noticed that there was a highly statistically significant relationship between total scores of knowledge and attitude regarding cord blood stem cell and its banking and donation and their attendance to health teaching classes regarding banking and donation of cord blood stem cells where $p = 0.000^{**}$.

Table (1): Socio-demographic characteristics of the studied pregnant women (n=1000)

Socio-demographic characteristics of the studied women	The studied women (n=1000)	
	N	%
Age		
15<25	307	30.7
25-35	581	58.1
>35	112	11.2
Marital Status		
- Married	908	90.8
- Divorced	64	6.4
- Widow	28	2.8
Woman's education		
- Illiterate or read and write.	148	14.8
- Basic education	160	16.0
- Secondary or technical education	275	27.5
- University and post university education.	417	41.7
Woman's occupation		
- Working	433	43.3
- Housewife	567	56.7
Residence		
- Rural	542	54.2
- Urban	458	45.8
Family income		
- Adequate	683	68.3
- Inadequate	218	21.8
- Adequate and save	99	9.9

Continue: Table (1): Socio-demographic characteristics of the studied pregnant women (n=1000)

Socio-demographic characteristics of the studied women	The studied women (n=1000)	
	N	%
Type of family		
- Nuclear family	650	65.0
- Extended family	350	35.0
Number of pregnancies		
- Once	516	51.6
- Two or more	484	48.4
Gestational age		
- 1 st trimester	320	32.0
- 2 nd trimester	409	40.9
- 3 rd trimester	271	27.1
Problems with pregnancy		
- Yes	308	30.8
- No	692	69.2
Number of living children		
- One or more	620	62.0
- No children	380	38.0
Deliver of child with congenital malformation		
- Yes	159	15.9
- No	841	84.1
-Source of Women' Information: -		
Health care providers	94	9.4
Internet	172	17.2
Family\ Friend	114	11.4
T.V \ Radio	26	2.6
Social Media	45	4.5
No source	490	49.0
Others	59	5.9

Table (2): Knowledge regarding blood cord and stem cells among studied pregnant women (n= 1000)

Knowledge statements	Correct Responses	
	N	%
Function of the umbilical cord	565	56.5
Number of veins and arteries in the umbilical cord	199	19.9
Suitable time for cord clamping	410	41.0
Definition of umbilical blood	472	47.2
Types of blood component formed by cord blood stem cells	304	30.4
Discard cord blood as medical waste	175	17.5
Definition of stem cells	312	31.2
Sites for obtaining stem cell	224	22.4
Diseases treated by using cord blood stem cells	416	41.6

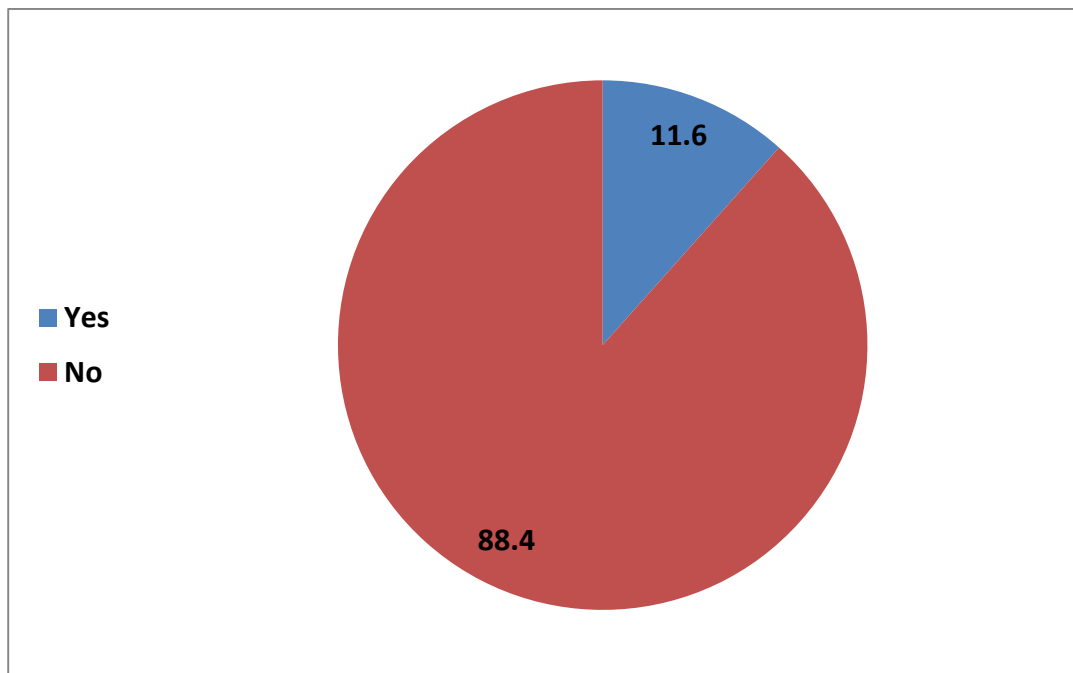


Figure (1): Distribution of the studied pregnant women by their attendance to health teaching classes related to blood cord stem cell banking and donation. (n= 1000)

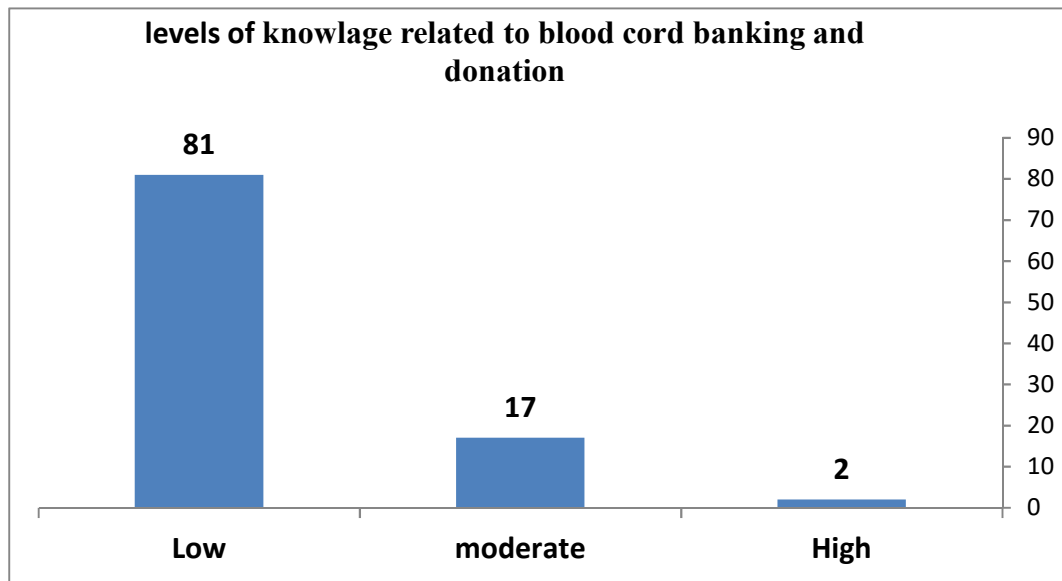


Figure (2): Levels of total Knowledge regarding blood cord and stem cells among studied pregnant women. (n= 1000)

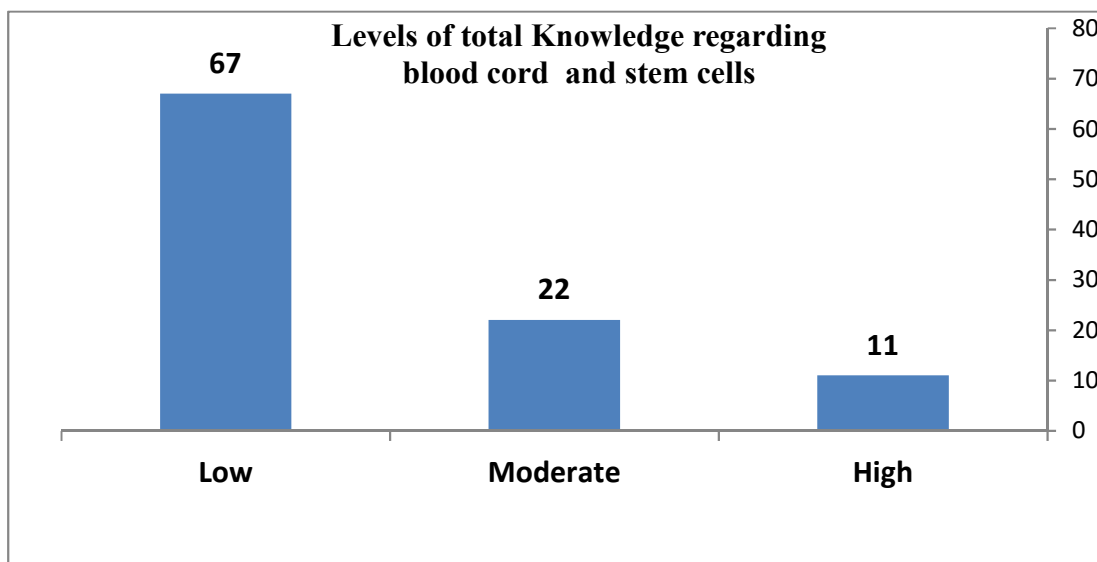


Figure (3): Levels of total knowledge regarding blood cord stem cells' banking and donation among the studied pregnant women. (n= 1000)

Table (3): Knowledge regarding blood cord stem cells' banking and donation among the studied pregnant women (n= 1000)

Knowledge statements	Correct Responses	
	N	%
Time of cord blood collection	272	27.2
Cord blood can be collected from natural births only	201	20.1
Diseases in the baby prevent donation of cord blood stem cells	241	24.1
Cord blood collection procedure	172	17.2
Storage of Cord blood in the cord blood bank.	105	10.5
Places for cord blood storage or donation	88	8.8
Public cord blood bank	198	19.8
Places of banks for cord blood storage in Egypt	72	7.2
Persons responsible for banking & donation	327	32.7
Cost of cord blood banking	72	7.2
Reasons for UCB banking	364	36.4

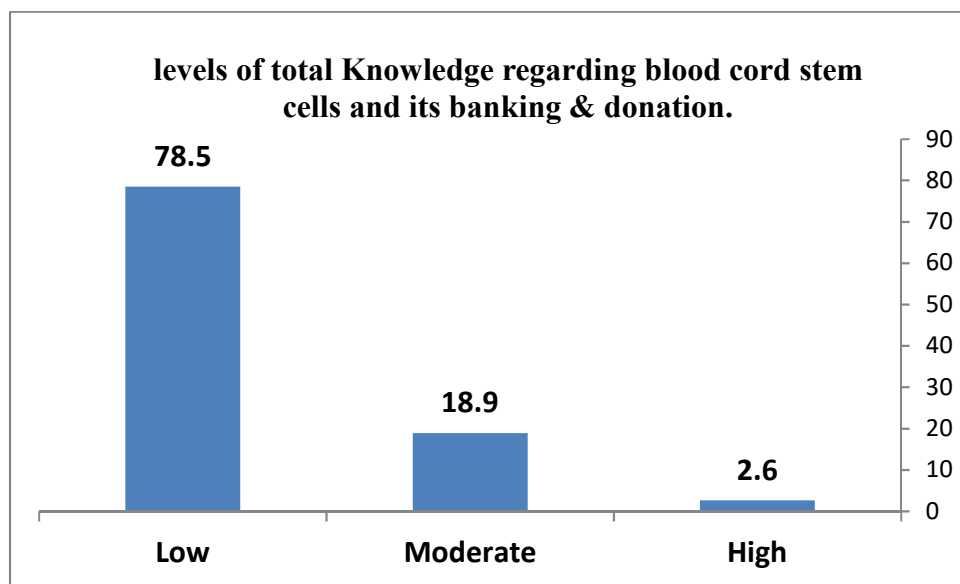


Figure (4): Total levels of Knowledge regarding blood cord stem cells and its banking & donation among the studied pregnant women. (n= 1000)

Table (4): Attitudes regarding cord blood stem cells banking and donation among the studied pregnant women. (n= 1000)

Attitude statements	Pregnant women responses (N= 1000)					
	Agree		Neutral		Disagree	
	n	%	N	%	n	%
1. I think, using my baby's stem cells is more reliable than using stem cells of other people or bone marrow.	453	45.3	242	24.2	305	30.5
2. Cord blood of my baby should only be used for my family.	350	35.0	221	22.1	429	42.9
3. If the cost is affordable and I can save it, I will store cord blood of my baby as a source of stem cells	297	29.7	229	22.9	474	47.4
4. If necessary, everyone should be able to gain advantage from stored stem cells.	295	29.5	237	23.7	468	46.8
5. The process of stem cells collection from cord is dangerous for my baby.	180	18.0	367	36.7	453	45.3
6. Cord blood donation or storage is not important	172	17.2	316	31.6	512	51.2
7. I am concerned that cord blood of my baby can be used for different purposes.	399	39.9	258	25.8	343	34.3
8. I would prefer to have stem cells of my baby to store in private banks rather than in public banks.	367	36.7	240	24.0	393	39.3
9. Only newborns delivered in private hospitals can benefit from collection of stem cells and storage services.	237	23.7	307	30.7	420	42.0
10. I will accept to donate stem cells of my baby from cord blood for research purposes.	420	42.0	277	27.7	303	30.3

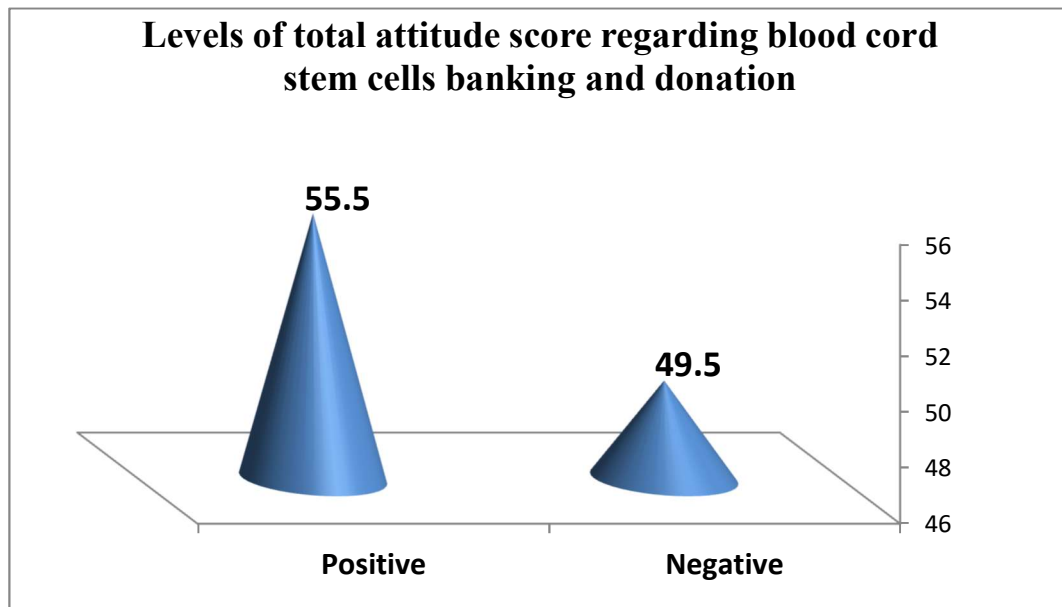
**Figure (5): Levels of total attitude regarding blood cord stem cells' banking and donation among the studied women.**

Table (5): Correlation between total knowledge and attitudes scores and socio-demographic characteristics of the studied pregnant women. (n= 1000)

	Total knowledge score	Total attitude score
Socio- demographic characteristics of the studied women	r P	r P
Woman's age	0.028 0.383	0.024 0.450
Woman's residence	0.018 0.595	0.101** 0.001
Woman's marital status	0.167** 0.000	0.066* 0.038
Woman's education	0.095** 0.003	0.167** 0.000
Woman's occupation	0.022 0.478	0.086** 0.006
Family type	0.128** 0.000	0.093** .003
Family monthly income	0.090** 0.004	0.035 0.259
Pregnancy number	0.078* 0.014	0.114** 0.000
Gestational age	0.065* 0.038	0.159** 0.000
Pregnancy problems	0.090** 0.005	0.060 0.059

*Correlation is significant at the 0.05 level (2-tailed)

**Correlation is significant at the 0.01 level (2-tailed)

Table (6): Relationship between levels of total knowledge and attitude regarding cord blood stem cells and its banking and donation.

		Total attitude level		X ² P
		Negative	Positive	
Total Knowledge level	Low	382	403	1729.525** 0.000
	Moderate	100	89	
	High	13	13	

****Highly significant P –value <0.001**

Table (7): Relationship between levels of total knowledge and attitude regarding cord blood stem cell banking and donation and attendance of health teaching class.

		Attendance health teaching class		X ² P
		Yes (n=116)	No (n=884)	
Total Knowledge levels	Low	20	573	242.933** 0.000
	Moderate	64	226	
	High	32	85	
Total attitude levels	Positive	68	395	57.586** 0.000
	Negative	48	489	

****Highly significant P –value <0.001**

Discussion:

This is the first widely survey in Egypt that cover large segment of pregnant women to explore their knowledge and attitudes toward cord blood stem cells & its banking and donation after developing blood cord banks in Egypt to help in managing chronic and immune system illnesses. Cord blood is a source of hematopoietic stem cells which can be utilized to create immune system and blood cells that can be used to treat immune system diseases including leukemia and other diseases like cancer ⁽²²⁾. However, the knowledge and attitudes of expectant mothers concerning blood cord stem cell donation and banking is a detrimental factor.

More than half of the pregnant women included in this study their ages ranged from 25 to 35 years, were from rural areas and were housewives. More than one third of them had university education and more than on quarter had secondary education **(Table 1)**. This result is corresponds with **AL-Shammary A et al. (2023)** ⁽⁷⁾ who study inconsistencies in pregnant mothers' attitudes and willingness to donate umbilical cord stem cells and found that more than one half of women aged between 19 and 31 years old and the had university education and nearly two-thirds of them were housewife.

Regarding obstetric history, in the present study slightly more than half of the studied mothers had the first pregnancy. More than one third of them were in second trimester and about one third were in the third trimester **(Table 1)**. This finding is in line with **Jawdat, et al. (2018)** ⁽²³⁾ who study

awareness of public in Saudi Arabia regarding cord blood banking and reported that two-thirds of the study sample was primipara and half of them was in their third trimester.

Regarding total levels of knowledge, Low levels of knowledge were found among the pregnant women in the present study that two thirds and most of them have low knowledge levels regarding cord blood and stem cell and their collection procedure, storage, banking and donation respectively **(Figure 2, 3)**. Only minority of them knew about presence of cord blood banks and its places in Egypt **(Table 3)**. This result is in agreement with that of **Subramaniam et al. (2021)** ⁽²⁴⁾ who study knowledge and attitude of pregnant women towards cord blood banking in Hospital Kuala Lumpu and revealed that only 11.5% of the participants had fundamental knowledge of CBB, only 18% knew the primary use of UCB and more than 90% didn't know about the cord blood collection process and storage. About 80% of them didn't know the concept of public cord blood bank (CBB).

The present study also reveals that, the total knowledge level regarding cord blood stem cell and its banking and donation was low among more than three quarters of the participants, moderate among one fifth and high among only 2.6% of them **(Figure 4)**. This may be due to that more than half of the studied sample did not completes their university education and about one third of them their pregnancy was the first and have not knowledge and experience. This is also may be due to that only 11.6% of studied

mother reported attendance of health teaching regarding cord blood cell banking and donation (**Figure1**). Besides the cord blood stem cell collection and banking among Egyptian population is still uncommon task.

This result is in line with **Reda et al (2021)**⁽²⁵⁾ who revealed that above half of the studied participants had poor knowledge level, less than quarter of them had a good knowledge level toward umbilical cord banking and stem cell. These results were supported also by **Habib et al., (2017)**⁽²⁶⁾ who study " knowledge and attitude of Saudi women toward UCB' and revealed that half of the sample had poor knowledge level and only 18% had good knowledge level. Moreover, a lack of knowledge about UCB banking was observed among most participants of studies conducted in various countries^(27- 29).

On the other hand, the result of the present study is contradicting with **Ibrahim et al, (2018)**⁽³⁰⁾ who evaluate attitude, knowledge, and effect on future practice among expectant mothers about cord blood banking in UAE and reported that 66% of studied pregnant women had cord blood banking basic knowledge regarding. However, 77% of them did not know the diseases or conditions that can be treated by cord blood stem cells.

Regarding the sources of mothers' information, about half of studied pregnant women in the present study reported that they have no source of information regarding cord blood stem cell and its banking and donation while less than one fifth reported internet as a source followed

by minority of them reported health professionals as a source of their information (**Table 1**). From the researchers' point of view, the reason may be deficit of their knowledge. This result arousing the importance of health education role that community and maternity health nurses should provide to pregnant women when contacting them during antenatal visits to increase their awareness regarding cord blood stem cells banking and donation and its importance. Therefore, they need to be trained and acknowledged enough to give clear, accurate, complete, and evidenced based information to the women.

This result is in agreement with **Subramaniam P et al (2021)**⁽²⁴⁾ and **Ozturk et al. (2017)**⁽³¹⁾ who found that, the internet is a primary source of information for their studied mothers and reported healthcare professionals as a secondary source. **Reda et al (2021)**⁽²⁵⁾ reported again that social media as first sources of information followed by nurses/ midwifery. The result of the present study and the other studies could be due to the fact that the internet and social media have become an important aspect of women's live nowadays. Moreover, time constraints and insufficient knowledge of the medical staff themselves.

However, these results are contradicting with **Saleh FA et al. (2019)**⁽²⁸⁾ and **Elemam et al (2021)**⁽¹¹⁾ who reported that the main source of their participants was their doctor. This difference may be due to the high level of education among most of their samples which facilitate discussion of

such topics with their doctors and also may be due to the difference in sample size.

Regarding the present study participants' attitude toward donating and banking cord blood stem cells, our results unexpectedly reveals that about half of studied pregnant women had total positive attitude. While, the other half have negative attitude score (**Figure 5**). This result is agreement with **Reda et al (2021)** ⁽²⁵⁾ who found that 67% of their participant had negative attitude and 33% of them had positive attitude. **Again, Key Value Pair (2018)** ⁽³²⁾ who studied pregnant women knowledge and attitude about the storage of cord blood and reported also a negative attitude toward the stem cell and blood banking among the majority of the sample. Besides, **Jawdat et al. (2018)** ⁽²³⁾ in Saudi Arabia revealed that about two-thirds of participants had negative attitude and inadequate knowledge. From the researchers' point of view, the result of the present study supports occurrence of positive effect of future health teaching companies about donating and banking of cord blood stem cell among Egyptian pregnant women to improve their awareness and attitudes as there is a considerable percentage of them had positive attitude and they need only to be acknowledge well.

The present study results reveals that 42% of the studied pregnant women agree to donate their babies cord stem cell and 27.7% of them were uncertain while 30.3% refuse that (**Table 4**). This result may be due to that a considerable percentage (41%) of studied women oriented by the diseases that can be treated with stem cells.

The results of similar studies report different percentages. **Subramaniam P et al (2021)** ⁽²⁴⁾ decelerated that only 23% of his participants had a positive attitude about UCB storage, while 22.4% refused and a large percentage (54.6%) undecided for UCB storage. Also, **Pandey et al (2016)** ⁽³³⁾ who assess potential donors' attitudes from one of India's largest UCB repositories reported that only 15% of their participants were supportive. A significant percentage (55%) was uncertain whether to bank UCB.

Moreover, **Ibrahim et al, (2018)** ⁽³⁰⁾ found that 84% of the study participants said that they didn't want to store cord blood of their babies and only 16% choose to store it. There could be for many reasons such as religious, social, monetary beliefs, or lack of knowledge about the stem cells uses. Also, awareness was a relevant factor, and the results signify that increasing awareness in target populations is essential to enhance the intention probability to donate blood cord stem cells. This is supported by **AL-Shammary A et al, (2023)** ⁽⁷⁾ who demonstrated that awareness significantly predicted willingness to donate.

The present study' result shows that more than one third of the participant women prefer to store their babies cord blood stem cell in private banks than in public banks and use that of their babies only for their families (**Table 4**). This result is supported by **Subramaniam P et al (2021)** ⁽²⁴⁾ whose participants prefer a private cord blood bank and think that their own cord blood is safer than that of others. These results

show that they are inadequately informed by misleading information about public banks that needs to be changed. Similar observations about private cord blood bank preference have also reported by **Pandey et al (2016)** ⁽³³⁾.

Regarding the correlation between total knowledge and attitude of the studied pregnant women and their socio-demographic characteristics, the present study reveals a highly significant positive correlation between educational level and family type with knowledge and attitude; between family income and knowledge; between residence and occupation of the participants and their attitude (**Table 5**). A possible explanation for this might be that women with higher education backgrounds likely to read more about cord blood banking and hear or discuss Cord Blood Banking (CBB) with healthcare professionals. Also, a better income and having an occupation may be associated with getting a lot of information sources and employees may trust in policy and practice of public cord blood banking. This is supported by **Subramaniam P et al (2021)** ⁽²⁴⁾ and **Pandey et al (2016)** ⁽³³⁾ who proved also that participants with higher educational level and who are employee have better knowledge and **Lu H et al (2015)** ⁽³⁴⁾ in China, who showed a more positive attitude among mothers who were employed.

This result is in the same line with that of **El-Sayed H et al., (2018)** ⁽³⁵⁾ who proved a relation between the education, occupation, residence of the study sample and their knowledge score. **Reda et al (2021)** ⁽²⁵⁾

also reported a statistically significant association between knowledge, attitude and age and educational level. While, there was not a statistically significant association with residence and occupation. Moreover, **Matijević, & Erjavec (2016)** ⁽²⁹⁾ found a significant correlation of knowledge and attitude and educational level. All these findings emphasize the importance of raising awareness among pregnant women so that they are more inclined to support CBB.

The present study decelerates a positive correlation between total scores of knowledge and attitudes (**Table 6**). This result ascertains that existing of knowledge and awareness about banking and storing of UCB stem cell evokes a positive attitude. Our result agrees with that of **El-Sayed H et al (2018)** ⁽³⁵⁾ who found also a positive significant correlation between the total scores of knowledge and attitudes pre and post intervention. **Habib et al (2017)** ⁽²⁶⁾ reported also a strong, statistically significant positive relationship between participant sample' total knowledge and attitude scores. In the same line, studies by **Kaur & Garg et al, (2017)** ⁽³⁶⁾ and **Subramaniam P et al (2021)** ⁽²⁴⁾ demonstrated also a positive correlation between knowledge and attitude. These results might have a good insight that better understanding of the benefit and clinical significance of UCB will increase the agreement toward UCB storage. This supported by other previous studies which indicated a substantial number of participants showed a poor attitude towards

CBB, mainly due to inadequate information^(37, 38).

Conclusion and recommendations

Based on the findings of the current study, it was concluded that, most of the studied pregnant women had low level of knowledge regarding cord blood stem cell banking and donation and nearly the half of them had negative total attitude level with statistically significant relationship between total knowledge and attitude scores. Education, occupation, family type, family income and gestational age had a statistically significant correlation with total knowledge and attitude scores.

Based on the finding of the current study, the following recommendations were suggested: -

1. Health education programs to raise awareness of pregnant women about cord blood banking and donation during their antenatal visits to develop and expand the status of UCB banking in Egypt.
2. Mass media approaching should be used for spreading awareness regarding UCB's advantages and benefits of its storage in UCB banks.
3. Health care professionals, in particular nurses and midwives, should have a sufficient level of education to assist pregnant women to make an informed choice around cord blood banking.
4. A pre-experimental study could be conducted to evaluate the effectiveness of structured teaching program regarding umbilical cord blood banking.
5. Further research needs to be conducted to identify the barriers to health professionals

providing evidence-based information on cord blood use and banking options.

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