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A Study to Assess the Knowledge on Menstrual Blood Banking Among Graduation Students at Selected Women's College, in Varanasi, Uttar Pradesh, India

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ABSTRACT

Background: Menstrual blood banking is an emerging area of regenerative medicine that utilizes menstrual blood-derived stem cells for potential therapeutic applications in tissue repair and the treatment of various degenerative diseases. Despite increasing scientific advances, awareness regarding menstrual blood banking among young women remains limited, highlighting the need to assess their level of knowledge.

Objectives: To assess the knowledge regarding menstrual blood banking among female undergraduate students and determine its association with selected demographic variables.

Methods: A quantitative, descriptive cross-sectional study was conducted among **100 female undergraduate students** at **Purnodaya Mahila Mahavidyalaya College, Varanasi, Uttar Pradesh**. Participants were selected using a **non-probability convenience sampling technique**. Data were collected using a structured questionnaire consisting of demographic variables and a 15-item knowledge questionnaire on menstrual blood banking. Descriptive and inferential statistics were used for data analysis.

Results: The study revealed that **69%** of participants had **moderate knowledge**, **18%** had **adequate knowledge**, and **13%** had **inadequate knowledge** regarding menstrual blood banking. No statistically significant association was observed between knowledge scores and selected demographic variables ($p > 0.05$).

Conclusion: The findings indicate that most female undergraduate students possess only moderate knowledge regarding menstrual blood banking. Structured educational programmes and awareness initiatives are recommended to improve knowledge and promote informed decision-making regarding menstrual blood stem cell banking.

Keywords: Menstrual blood banking, menstrual blood-derived stem cells, knowledge, female undergraduate students, regenerative medicine, stem cell banking.

INTRODUCTION

Stem cell research has become one of the fastest-growing fields in modern biomedical science because of its potential to regenerate damaged tissues and treat various chronic and degenerative diseases. Stem cells are undifferentiated cells characterized by their ability to self-renew and differentiate into specialized cell types. Based on their origin, stem cells are classified into embryonic stem cells, adult stem cells, induced pluripotent stem cells, and perinatal stem cells. Adult stem cells are widely accepted because they can be obtained from different tissues without major ethical concerns. Common sources include bone marrow, adipose tissue, umbilical cord blood, placenta, dental pulp, and menstrual blood.

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Menstrual blood has recently emerged as a valuable source of mesenchymal stem cells, commonly known as menstrual blood-derived stem cells (MenSCs). These cells can be collected non-invasively during the menstrual cycle and possess excellent proliferative capacity, self-renewal ability, and multilineage differentiation potential. Unlike bone marrow aspiration, menstrual blood collection is painless, inexpensive, repeatable, and free from major procedural risks. These characteristics make menstrual blood-derived stem cells an attractive resource for regenerative medicine and tissue engineering.

Research has demonstrated that menstrual blood-derived stem cells can differentiate into various cell types, including osteogenic, adipogenic, chondrogenic, neural, cardiac, hepatic, and endothelial cells. Experimental studies have shown promising applications in tissue repair and the treatment of neurological disorders, cardiovascular diseases, diabetes mellitus, liver diseases, musculoskeletal conditions, endometrial disorders, and autoimmune diseases. Although many of these applications remain under investigation, the rapid progress in regenerative medicine has highlighted the importance of preserving stem cells for future therapeutic use.

Stem cell banking has become an important component of regenerative healthcare worldwide. While umbilical cord blood banking is well established, menstrual blood banking has emerged as a promising alternative because it provides women with an opportunity to preserve their own stem cells throughout their reproductive years. Researchers across North America, Europe, and Asia continue to investigate the therapeutic potential of menstrual blood-derived stem cells through laboratory and clinical studies. Although routine clinical applications are still evolving, the available evidence indicates considerable promise for future regenerative therapies.

In India, regenerative medicine has gained increasing importance over the last decade. The Indian Council of Medical Research (ICMR) and the Department of Biotechnology (DBT) have issued national guidelines to regulate stem cell research and ensure ethical practice. Several medical institutions and research centres are actively conducting stem cell research; however, awareness regarding menstrual blood banking remains limited among the general population. Compared with umbilical cord blood banking, menstrual blood banking is relatively new, and many young women are unfamiliar with its collection process, preservation methods, benefits, and potential therapeutic applications. Most information is obtained through social media, internet sources, or informal discussions, which may not always provide scientifically accurate information.

Young women, particularly undergraduate students, represent an important population for health education because they are future mothers, healthcare consumers, and community influencers. Improving their knowledge regarding menstrual blood banking can encourage informed decision-making, promote reproductive health awareness, and reduce misconceptions related to stem cell preservation. Educational institutions provide an ideal environment for disseminating evidence-based information through lectures, seminars, workshops, and awareness programmes.

Previous studies have consistently reported inadequate to moderate knowledge regarding menstrual blood banking among students and healthcare professionals. Studies conducted among nursing students have demonstrated that structured teaching programmes significantly improve knowledge and awareness regarding menstrual blood stem cell banking. These findings indicate that educational interventions are effective in addressing existing knowledge gaps. However, only limited research has been conducted among female undergraduate students studying outside healthcare disciplines, particularly in northern India. Therefore, information regarding their level of knowledge remains inadequate.

Purnodaya Mahila Mahavidyalaya, Varanasi, is a women's undergraduate college where students have limited opportunities to receive formal education regarding regenerative medicine and menstrual blood banking. Assessing their knowledge is important because it provides baseline information about existing awareness levels and helps identify areas requiring educational intervention. The findings may assist nursing educators, public health professionals, and policymakers in designing awareness programmes

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that improve scientific literacy among young women.

The present study was therefore undertaken to assess the knowledge regarding menstrual blood banking among female undergraduate students at Purnodaya Mahila Mahavidyalaya College, Varanasi, Uttar Pradesh. The study also aimed to determine the association between knowledge and selected demographic variables. The findings are expected to contribute to nursing education, women's health promotion, and regenerative medicine by providing evidence on the current level of awareness among undergraduate students. Furthermore, the results may support the development of educational strategies that promote informed decisions regarding menstrual blood donation and stem cell banking while encouraging greater awareness of future applications of regenerative medicine.

REVIEW OF LITERATURE

Lakshmi Koos and Marie et al (2024) conducted a study to evaluate the effectiveness of structured teaching program on knowledge regarding menstrual blood banking among nursing student in a selected nursing college at Mangalore. The study surveyed 60 nursing students at New Mangala College of Nursing Mangalore, using a structured teaching program. The data was collected using a structured questionnaire and post-test. The results showed that 70% of students had no prior knowledge about menstrual blood banking, while 85% had average knowledge. The post-test knowledge score was higher than the pre-test score, indicating that the structured teaching program effectively increased nursing students' knowledge on menstrual blood banking. **L Chadha (2024)** This study explored the knowledge, attitudes, and practices of female healthcare workers in India regarding menstrual blood donation for the purpose of extracting mesenchymal stem cells (menstrual blood). Menstrual blood is a rich source of menstrual blood, which have the potential to differentiate into various cell types, similar to stem cells found in umbilical cord blood and bone marrow. The research aimed to understand the perspectives of female healthcare workers on donating menstrual blood for menstrual blood research and therapy**. Siva Sangari D et al (2024)** conducted a study on the utilization of menstrual Blood Banking and healing makes use of Menstrual blood women were regarded as a discard. waste of blood, but most of promising, source of harvest stem cells, secreted from the vaginal and cervix series of value and entry its minimal. The menstrual blood stem cells to deal with lot of disease, especially multiple myeloma and the usage of anti-growing older skin product cream menstrual brood is gathering in door step inside 3- four Hour reached Lab and concern is Want for proper garage of those cells. clinical trial & some menstrual blood clot apply Stash on wound. to heal the wound overnight and bleeding Stopped, in 2009 lisa ray a bolly timber actress and stem mobile beneficiary diagnosed as multiple myeloma and treated. Return to the beginning of her life. **Jasmi Manu et al (2022)** conducted a study to evaluate the effectiveness of the information booklet menstrual blood banking is a process of storing the menstrual blood of a woman to use the stem cells present in it in future. Stem cells which are present in menstrual blood are having multipotency. The present study was conducted to assess the effectiveness of an information booklet on knowledge regarding menstrual blood banking and it’s benefits among adolescent girls studying in selected intermediate schools of Kanpur.” The objectives of the study were to assess the knowledge of adolescent girls regarding menstrual blood banking and its benefits; to evaluate the effectiveness of the information booklet on knowledge regarding menstrual blood banking and it’s benefits among adolescent girls studying in selected intermediate schools of Kanpur, to associate the pre-test and knowledge score with their selected demographic variables. Quasi experimental one group pre-test post-test design was used. 67 adolescent girls were selected from Mariampur Senior Secondary School by using non probability convenient sampling technique. **Bhallam Mounika and Joseph Mary Meena (2021)** conducted a study emphasizing that menstruation is a unique phenomenon in girls and consists of uterine bleeding and discharge between successive ovulations, Women experience menstruation for most of their lives women experience menarche at different ages, The average age at menarche can occur as early as the age of 10 or as early as the age of 16, 14 which varies in length, the average cycle is taken to be 28 days long. These stem cells from Menstrual Blood were first discovered by Australian researcher Carline Garget of Monash University 17, The Menstrual Bank was helpful for women to keep their Menstrual Blood in a preserved condition for the future at a minimal annual fee (Rs. 1500/-) for storage and preservation in -196°C. These Menstrual Blood Banks have brought lifelong benefits to women up to age 60, **Ngente et al (2021)** conducted a study to evaluate the effectiveness of teaching on knowledge Regarding Menstrual Blood Banking among Nursing Students The

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student's changing habits varies depending on their intellectual level. Transition concerns are also present among college students. They are having academic adjustment issues as a result of the new academic pattern, atmosphere, and faculties. Academic transition includes finding inspiration, taking actions to satisfy academic obligations, and dealing with academic frustration. Aim: To evaluate the effectiveness of planned teaching on knowledge regarding Menstrual Blood Banking among nursing students.

Amrapali M Gajbhiye (2019) conducted a study evaluating the impact the knowledge of stem cells in the menstrual blood has given a new meaning to menstruation for women who earlier considered menstruation as nothing but a painful and necessary evil. Stem cells have the unique quality of differentiating into any type of cell. As these cells are immunologically immature in nature, they are able to contribute successfully in the cell survival after a transplant. Stem cells in menstrual blood have similar regenerative capabilities as the stem cells in umbilical cord blood and bone marrow. Cryo-Cell's patent-pending menstrual stem cell service offers women in their reproductive years the ability to store and preserve these cells for potential use by herself or a family member free from ethical or political controversy. Cryo-Cell is the only stem cell bank in the world that can offer women the reassurance and peace of mind that comes with the opportunity, **Lily Podder et al (2018**) conducted a study to assess the knowledge regarding menstrual blood stem cell banking among nursing students studying in nursing colleges of Pune, Maharashtra and to associate the knowledge with selected demographic variables.

A quantitative approach with non-experimental evaluative research design was adopted; 100 samples were selected through non-probability purposive sampling technique from selected nursing education institute of Pune city, Maharashtra. Data were collected by using a valid and reliable tool that consisted of a knowledge questionnaire regarding menstrual blood stem cell banking from the selected student nurses during March 2018 to June 2018. **Marie Rosy et al (2017)** conducted a comparative study to examine the effect of menstrual blood and umbilical cord has always been a subject of study in different researches due to its easy availability. The possibility of isolation of stem cells from the menstrual blood and the umbilical cord blood cells has opened a new channel in stem cell research that can offer future therapeutic benefits to mankind.

Several successful researches have shown the use of the stem cells derived from the endometrial blood for the treatments of different fatal diseases. The current breakthrough discovery that the menstrual blood contains stem cells that are proliferative and are capable of differentiating into different types of cells including cardiac cells, neural cells and into almost 9 types of tissues including heart, liver and lung, has opened a new field for therapeutic treatment**. Dr Neelam Hans (2016)** conducted a study focusing on reproductive process the menstrual cycle is a normal process that happens to nearly all women during their childbearing years, from puberty till menopause. Menstrual blood is not just blood it's also made up of tissue from the uterine lining. It also contains the remnants of the egg that travel down the fallopian tube into the uterus during ovulation. Many biochemical and histological events occur unnoticed by the fertile female; however, the monthly menstrual cycle is a repeating reminder that she is capable of conceiving and developing new life.

Mehrabani et al (2016) conducted a study exploring the knowledge stated that one of the readily available sources of mesenchymal stem cells (menstrual blood) is menstrual blood-derived stem cells (Menstrual blood), which exhibit characteristics similar to other types of menstrual blood. This study was performed to determine the growth kinetics, plasticity, and characterization of Menstrual blood in women. (Menstrual blood 15 ml) was obtained from 10 women on their third day of menstruation in 2 age groups of 30 to 40 and 40 to 50 years old. Ficoll was used to separate the mononuclear cell fraction. **Francy Francis et al (2015)** conducted a study to evaluate the effectiveness of the information the electronic databases using which the search done were Cumulative Index to Nursing and Allied Health Literature (CINAHL), Medical Literature Online (Medline), Pub med, EBSCO, Embase, Science Direct. The search terms include Menstruation, Menstrual Blood, Menstrual Blood Stem Cells. Menstrual Blood Banking, Endometrial Stem Cells. Menstrual Regenerative Cells. Though evidences were effectively searched using the keywords, the authors also used the "Bibliographic Mining" method from the available literatures to identify similar studies meeting the objectives. **Padma B, Mamatha N et al (2014)** conducted a study focusing on endometrial regenerative cells (ERC) this study is aimed to educate the public to hold the potential to save themselves from future ailments and understand that menstrual stem cells

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obtained from the menstrual blood offer the best potential to display high concentrations of stem cell growth factors. As investigators we are happy about this new innovation and feel that it is our duty to educate women about the most miraculous thing of contributing medically to save lives through the endometrial regenerative cells (ERC) or stem cells harvested from discarded menstrual fluid.

Paolo et al (2010) This study investigates the knowledge, attitudes, and practices (KAP) of female healthcare professionals in India regarding menstrual blood-derived mesenchymal stem cells (menstrual blood). While menstrual blood are traditionally sourced from bone marrow or umbilical cord blood, menstrual blood has emerged as a potent, highly proliferative source of these pluripotent cells. The research aims to evaluate how familiar healthcare workers are with this source and their willingness to participate in menstrual blood donation. **Patel et al (2008)** conducted a study on established the beneficial properties of menstrual stem cells (menstrual blood) have a great importance for clinical translation of regenerative therapies. The studies demonstrate that these are a unique population of cells that can be safely isolated and can provide us with an expandable source of stem cells from women until they reach menopause. Considering their relevance and importance in treatment of rare diseases including certain neuro disorders, it becomes crucial for women to preserve their menstrual blood in the Menstrual Blood Bank.

METHODOLOGY

Research Approach

The research approach used in the study is quantitative research approach.

Research Design

The research design used in the study is descriptive research design.

Study Setting

The present study was conducted at Purnodaya Mahila Mahavidyalaya, Bachchhaon, Varanasi, Uttar Pradesh, India, a women-only undergraduate college affiliated with Mahatma Gandhi Kashi Vidyapith.

Population of Study

The population comprises all graduation female students in Varanasi, Uttar Pradesh, India.

Target Population

All the graduation female students At Purnodaya Mahila Mahavidyalaya College Bachchhao Varanasi Uttar Pradesh, India.

Samples

All the graduation course female students in Purnodaya Mahila Mahavidyalaya College Bachchhao, Varanasi, Uttar Pradesh, India.

Size of Sample: total of 100 samples were selected for this study**.**

Sampling Technique

Maximum score	15
Minimum score	0

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A non-probability convenience sampling technique was adopted for selecting the study participants. Female undergraduate students who were present during the data collection period, fulfilled the inclusion criteria, and were willing to participate voluntarily were recruited until the required sample size of 100 participants was achieved. Convenience sampling was considered appropriate because the study aimed to assess the existing knowledge among readily available students within the selected college.

Criteria

Inclusive criteria: Students who are willing to participate in this research study. Students who are not a from a medical professional. Students who can read and write English and Hindi. Students who will be available during data collection

Exclusive criteria: Participants who are not set to receive their degrees. Who are not willing to participate in this study Students who are not attained the menorrhea. Who will not be available at the time of data collection

Instruments

A Structured questionnaire was prepared based on statement of problem. **The Tool Consists of Two Sections:**

Section A

It Include demographic variables such as age, types of family, residence, religion, marital status, father education, mother education, father occupation, occupation of mother, family income, menstrual status, awareness about menstrual blood banking, source of health information, previously participated same kind of program, and willingness to donate menstrual blood.

Section B

It Consist of 15 multiple choice question related to knowledge on menstrual blood banking.

Validity and Reliability

The tool was checked and evaluated by the HODs of Obstetrics and Gynaecological Nursing, Mental Health Nursing, Community Health Nursing, Child Health Nursing, Medical-Surgical Nursing, and Nursing Foundation. reliability, the researcher administered a knowledge questionnaire method to 10 graduation students. **Cronbach's Alpha value** method. was used to calculate the reliability coefficient, yielding a correlation score of **r = 0.745** This result indicates that the tool developed by the researcher demonstrates an acceptable level of reliability.

Procedure for Data Collection

Permissions were obtained from principal, of Purnodaya Mahila Mahavidyalaya College in Bachchhao, Varanasi, UP. All samples were selected following informed written consent. All the samples fulfilling inclusive criteria were selected using convenient sampling technique. They were explained about the purpose of this study. The structured knowledge questionnaire was distributed to all participants after getting informed written consent and their response were collected.

Ethical Consideration

The study was conducted after getting approval from the college's research ethics committee. The nature and purpose of the study were explained to the principal of the Purnodaya Mahila Mahavidyalaya College in Bachchhao, Varanasi, UP. and permission was granted to conduct the study in the college. Written consent was obtained from the participants to ensure full cooperation during the study period. Assurance was given to theparticipants that the confidentiality of each individual would be maintained strictly.

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Plan For Data Analysis

Data was collected, coded and analysed using descriptive and inferential statistics. The data was analysed by using appropriate statistical method and the findings were represented in the form of figures. The present study was designed to the study to assess the knowledge on menstrual blood banking among degree student in Purnodaya Mahila Mahavidyalaya College Bachchhao, At Varanasi, in UP Data analysed according to objectives and organized under the following sections.

Section A: Distribution of the demographic variables.

Section B: Knowledge distribution on menstrual blood banking.

Section C: Association of the demographic variables with the knowledge level.

N=100				
Sl No.	**Demographic variable**	**Options**	**Number**	**Percentage %**
1	Age	18-20 years	28	28%
		21-23 years	40	40%
		24-26 years	18	18%
		27-Above years	14	14%
2	Types of family	Joint family	33	33%
		Nuclear family	59	59%
		Extended family	8	8%
3	Residence	Urban	44	44%
		Rural	49	49%
		Semi urban	7	7%
4	Religion	Hindu	76	76%
		Muslim	16	16%
		Christian	7	7%
		Other	1	1%
5	Marital status	Married	37	37%
		Unmarried	56	56%
		Divorced	4	4%
		Widow	3	3%
6	Father education	Illiterate	21	21%
		Primary education	43	43%
		Secondary education	18	18%
		Under graduate	12	12%
		Post graduate	6	6%
7	Mother education	Illiterate	39	39%
		Primary education	29	29%

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		Secondary education	26	26%
		Under graduate	6	6%

Section-A

Table.4.1 DISTRIBUTION OF DEMOGRAPHIC VARIABLES

Table:4.2 Distribution of knowledge on menstrual blood banking

			N=100
SL no.	**Knowledge level**	**Number**	**Percentage**
1	Adequate (11-15)	18	18%
2	Moderately adequate (6-10)	69	69%
3	Inadequate (0-5)	13	13%

Table:4.2 and Fig 4.1: On assessing the knowledge of the samples on menstrual blood banking the researchers understood that 13% of the samples had inadequate knowledge, 69% had moderately adequate knowledge and 18% sample had adequate knowledge.

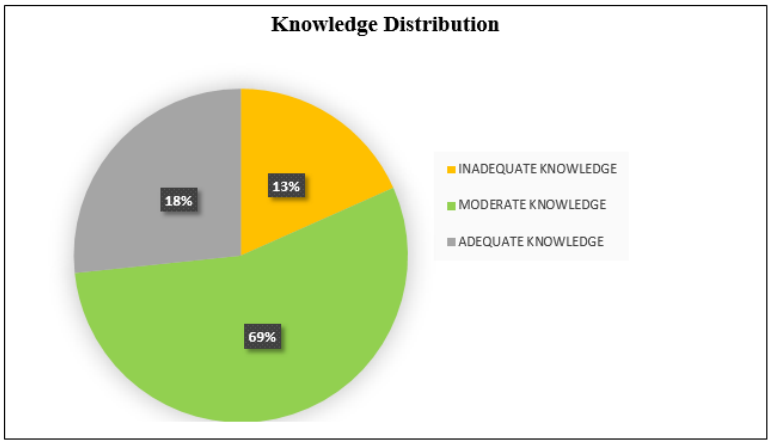


Fig: 4:1 Level of knowledge on menstrual blood banking.

Section-C

Sl	**Demogr**	**Options**	**In**	**Mo**	**Ad**	**X_2 va.**	**Result**
1	Age	18-20 years	4	9	5	X^2 =0.7379 p=.993637	**Not Significant at P<0.05**
		21-23 years	8	17	9		
		24-26 years	5	11	8		
		27-Above years	4	13	7		
2	Types of family	Joint family	7	18	9	X^2=0.1209 P= 998246	**Not Significant at P<0.05**
		Nuclear family	9	28	13		

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		Extended family	3	9	4		
3	Residence	Urban	7	18	11	X^2=0.2784 P= .991165	**Not Significant at P<0.05**
		Rural	9	24	12		
		Semi urban	4	9	6		
4	Religion	Hindu	11	28	17	X^2=0.5033 P= 997799	**Not Significant at P<0.05**
		Muslim	6	14	10		
		Christian	2	4	3		
		Other	1	3	1		
5	Marital status	Married	9	29	11	X^2=3.8378 P= .698616	**Not Significant at P<0.05**
		Unmarried	8	22	9		
		Divorced	3	2	2		
		Widow	2	2	1		
6	Father education	Illiterate	7	12	8	X^2=1.5858 P=.99119	**Not Significant at P<0.05**
		Primary education	8	18	9		
		Secondary education	4	9	7		
		Under graduate	2	5	4		
		Post graduate	1	3	3		
7	Mother education	Illiterate	9	16	13	X^2=1.7179 P= .943731	**Not Significant at P<0.05**
		Primary education	8	13	10		
		Secondary education	6	9	8		
		Under graduate	3	4	1		

Table:4.3 Association of Demographic Variables and Knowledge on Menstural Blood Banking

On associating the age, types of family, residence, religion, marital status, father education, mother education, occupation of father, occupation of mother, family income, menstrual status, awareness of menstrual blood banking, source of health information, previously participated same kind of programme, willingness to donate menstrual blood the study participant and the knowledge level on menstrual blood banking, there was **no significant relationship** found at $p<0.05$.

DISCUSSION

The present study was undertaken to assess the knowledge regarding menstrual blood banking among female undergraduate students of Purnodaya Mahila Mahavidyalaya College, Varanasi, Uttar Pradesh. Menstrual blood banking is an emerging area in regenerative medicine, as menstrual blood-derived stem cells have shown promising therapeutic potential in tissue regeneration and the management of various chronic and degenerative diseases. Despite increasing scientific evidence supporting the clinical applications of menstrual blood stem cells, awareness among the general population, particularly young women, remains limited. Assessing the level of knowledge among undergraduate students is therefore important to identify educational gaps and develop appropriate awareness programmes that promote informed decision-making regarding menstrual blood banking.

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The demographic characteristics of the study participants revealed that the majority (40%) belonged to the age group of 21–23 years, 59% lived in nuclear families, and 49% were from rural areas. Most participants were Hindu (76%) and unmarried (56%). Regarding educational background, 43% of fathers had completed primary education, whereas 39% of mothers were illiterate. Private employment was reported by 37% of fathers and 44% of mothers, while 37% of participants belonged to families with a monthly income between ₹10,001 and ₹20,000. Most participants (91%) reported having regular menstrual cycles, 88% had heard about menstrual blood banking, 33% identified healthcare professionals as their primary source of information, 96% had never attended any educational programme related to menstrual blood banking, and 78% expressed willingness to donate menstrual blood. These findings suggest that although participants had some awareness of menstrual blood banking, opportunities for structured education and scientific learning on the subject were limited.

The present study demonstrated that **69% of participants had moderate knowledge**, **18% had adequate knowledge**, and **13% had inadequate knowledge** regarding menstrual blood banking. These findings indicate that while the majority possessed a basic understanding of the concept, detailed knowledge regarding stem cell collection, processing, cryopreservation, eligibility criteria, storage procedures, and future therapeutic applications was insufficient. The predominance of moderate knowledge emphasizes the need for systematic educational interventions to improve awareness and promote evidence-based understanding among young women.

The findings of the present study are consistent with those reported by **Lakshmi Koos et al. (2024)**, who evaluated the effectiveness of a structured teaching programme on menstrual blood banking among nursing students in Mangalore. Their study reported that most students had poor baseline knowledge before the intervention, whereas knowledge scores improved significantly after the structured teaching programme. Both studies demonstrate that although students may have heard about menstrual blood banking, comprehensive scientific knowledge remains inadequate. These findings support the importance of incorporating structured educational programmes into undergraduate curricula to improve students' understanding of menstrual blood stem cell banking and its clinical significance.

The present findings are also comparable with those of **Ngente et al. (2021)**, who assessed the effectiveness of planned teaching on knowledge regarding menstrual blood banking among nursing students. Their study concluded that educational interventions significantly enhanced students' knowledge, highlighting the importance of continuous academic exposure to recent developments in regenerative medicine. Similar to the present study, they observed that students possessed only limited baseline knowledge before receiving formal instruction. This similarity suggests that menstrual blood banking continues to receive inadequate emphasis in routine undergraduate education despite its growing clinical relevance.

The findings further agree with the study conducted by **Podder et al. (2018)** among nursing students in Maharashtra, which reported that the majority of participants demonstrated moderate knowledge regarding menstrual blood stem cell banking. Podder and colleagues recommended regular educational sessions and awareness programmes to improve students' knowledge and acceptance of menstrual blood banking. The consistency between the present findings and previous studies indicates that limited knowledge regarding menstrual blood banking is a common observation across different educational institutions and geographical regions of India. Together, these studies reinforce the need for integrating regenerative medicine concepts into undergraduate health education.

An important finding of the present study was that **none of the selected demographic variables showed a statistically significant association with knowledge regarding menstrual blood banking ($p > 0.05$)**. Variables including age, type of family, residence, religion, marital status, parental education, parental occupation, family income, menstrual status, awareness, source of information, previous participation in educational programmes, and willingness to donate menstrual blood were not significantly associated with knowledge scores. Several factors may explain these findings. First, all participants belonged to the same women's college and shared a similar educational environment, curriculum, and learning opportunities, resulting in relatively homogeneous knowledge levels. Second, menstrual blood banking is a relatively new and

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specialized concept that has not yet been widely incorporated into undergraduate academic curricula or community health education programmes. Consequently, students from different demographic backgrounds may have had comparable exposure to information regardless of age, socioeconomic status, or educational background. Third, the use of a convenience sampling technique and the sample size of 100 participants may have limited the statistical power to detect small differences between demographic groups. Therefore, the absence of statistically significant associations should not be interpreted as evidence that demographic characteristics have no influence on knowledge; rather, it may reflect the relatively uniform educational exposure of the study population.

The findings of this study have important implications for nursing education and public health practice. Undergraduate curricula should include recent advances in stem cell therapy, regenerative medicine, and menstrual blood banking to improve scientific literacy among young women. Educational strategies such as structured teaching programmes, workshops, seminars, awareness campaigns, and digital learning modules may enhance students' knowledge and encourage informed decisions regarding menstrual blood donation and future stem cell preservation. Healthcare professionals should also play an active role in disseminating accurate information, addressing misconceptions, and promoting evidence-based awareness regarding menstrual blood banking.

Overall, the present study demonstrates that the majority of female undergraduate students possessed **moderate knowledge** regarding menstrual blood banking, while only a small proportion demonstrated adequate knowledge. The findings highlight the need for structured educational interventions to strengthen awareness, improve understanding of regenerative medicine, and prepare young women to make informed decisions regarding menstrual blood banking and its potential future applications.

Summary

The researcher conducted A study to assess the knowledge on menstrual blood banking among graduation students at selected college, Varanasi, Uttar Pradesh. with the objectives of

1. To assess the level of knowledge on menstrual blood banking among graduation students at selected college.
2. To find out the association between the level of knowledge with their selected demographic variables.

The study was conducted among 100 conveniently selected graduation students in purnodaya mahila mahavidyalay college in bachchhao Varanasi, who were fulfilling the inclusive criteria of the study. After obtaining the permission from the college Principal, purnodaya mahila Mahavidyalaya college and a structured questionnaire was administered to the participants to evaluate their understanding of menstrual blood banking. The study participants a structured tool was used to assess knowledge of menstrual blood banking of study participants. After organizing and analyzing the study according to the set objectives the result of the study showed that 18% (18) of the samples had adequate knowledge, 69% (69) had moderate knowledge,13% (13) had inadequate knowledge. level of menstrual blood banking (Not significant $P<0.05$) The findings indicate that most student passes moderate knowledge of menstrual blood banking, with only a small percentage demonstrating adequate knowledge.

CONCLUSION

The present study revealed that the majority of **female undergraduate students** possessed **moderate knowledge** regarding menstrual blood banking, while only **18%** demonstrated **adequate knowledge** and **13%** had **inadequate knowledge**. These findings indicate that although participants had a basic understanding of menstrual blood banking, their knowledge of its collection, preservation, and potential therapeutic applications remains insufficient. No statistically significant association was found between knowledge levels and the selected demographic variables, including age ($p > 0.05$), suggesting that knowledge was relatively similar across the study population. The findings highlight the need for structured educational programmes, seminars, workshops, and awareness campaigns to enhance knowledge regarding menstrual blood banking among female undergraduate students. Incorporating emerging concepts of stem cell banking and regenerative medicine into

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undergraduate education may further improve awareness and promote informed decision-making regarding menstrual blood donation and future therapeutic applications.

Recommendations

- This study may be replicated on larger number of samples.
- Similar study can be done using experimental design.
- Similar study can be conducted for longer duration.Similar study can be done on different population.

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