A study to assess the effectiveness of a structured teaching programme on knowledge regarding placental stem cell utilization among fourth-year B.Sc. Nursing students in selected colleges at Kolar, Karnataka

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Abstract—**Background**

Placental stem cells have emerged as an important area in regenerative medicine due to their potential role in the treatment of various diseases, including hematological, genetic, and degenerative disorders. As future healthcare providers, nursing students require adequate knowledge regarding placental stem cell collection, preservation, storage, and clinical applications. Educational interventions are essential to enhance their understanding of recent advancements in stem cell therapy.

Objectives

To assess the pre-test knowledge regarding placental stem cell utilization among fourth-year B.Sc. Nursing students.

To evaluate the effectiveness of a structured teaching programme on knowledge regarding placental stem cell utilization.

To determine the association between post-test knowledge scores and selected demographic variables.

Methodology

A quantitative research approach with a pre-experimental one-group pre-test and post-test design was adopted. The study was conducted among 50 fourth-year B.Sc. Nursing students studying in selected nursing colleges at Kolar, Karnataka. Participants were selected using a purposive sampling technique. Data were collected using a structured knowledge questionnaire consisting of demographic variables and 33 multiple-choice questions related to placental stem cell utilization. A pre-test was conducted, followed by a structured teaching programme, and a post-test was administered to evaluate the effectiveness of the intervention. Data were analyzed using descriptive and inferential statistics, including frequency, percentage, mean, standard deviation, paired t-test, and chi-square test.

Results

The pre-test findings revealed that 56% of students had inadequate knowledge and 44% had moderately adequate knowledge regarding placental stem cell utilization, whereas none of the students had adequate knowledge. Following the structured teaching programme, post-test findings showed marked improvement, with 40% of students attaining adequate knowledge, 56% having moderately adequate knowledge, and only 4% remaining in the inadequate category.

The mean post-test knowledge score (24.60 ± 3.81) was significantly higher than the mean pre-test score (13.84 ± 3.52). The calculated paired t-value was 17.45 and was highly significant at $p < 0.001$, indicating that the structured teaching programme effectively improved the knowledge of fourth-year B.Sc. Nursing students regarding placental stem cell utilization.

Conclusion

The study concluded that the structured teaching programme was highly effective in improving the knowledge of fourth-year B.Sc. Nursing students regarding placental stem cell utilization. Incorporating emerging topics such as stem cell therapy and regenerative medicine into nursing education can improve students' professional competence and enable them to provide evidence-based patient education.

***Index Terms*—Placental stem cells, structured teaching programme, regenerative medicine, nursing students, knowledge, stem cell utilization.**

I. Introduction

The advancement of biomedical science and regenerative medicine has brought significant changes in the management of various diseases. Stem cell technology is considered one of the most promising areas in modern medicine because of its ability to repair damaged tissues and regenerate cells. Stem cells are unspecialized cells capable of self-renewal and differentiation into specialized cells under appropriate biological conditions.

Based on their origin, stem cells can be classified into embryonic stem cells, adult stem cells, induced pluripotent stem cells, and perinatal stem cells. Among the perinatal sources, the human placenta has emerged as a valuable source of stem cells due to its abundance, painless collection procedure, and fewer ethical controversies compared with embryonic stem cells.

Placental stem cells possess unique biological properties such as immunomodulation, anti-inflammatory activity, and the ability to differentiate into multiple cell lineages. These characteristics make them a promising option in regenerative medicine, tissue engineering, wound healing, treatment of neurological disorders, cardiovascular diseases, diabetes mellitus, and other chronic conditions.

The placenta, which was once considered a biological waste after childbirth, is now recognized as a rich reservoir of stem cells with enormous therapeutic potential. Placental tissues such as the amniotic membrane, chorionic membrane, and placental blood contain different populations of stem cells that can be isolated and preserved for future clinical applications.

Nurses are vital members of the healthcare team and often serve as educators and counselors for patients and families. Their role includes providing information regarding stem cell collection, preservation, storage, benefits, limitations, and ethical considerations. Therefore, nursing students should have adequate knowledge about recent advances in stem cell technology.

However, evidence suggests that knowledge regarding placental stem cell utilization among nursing students remains inadequate. Lack of awareness may affect their ability to provide evidence-based information to patients. Structured teaching programmes are effective educational strategies that improve understanding and awareness regarding new healthcare technologies. Hence, the present study was undertaken to assess the effectiveness of a structured teaching programme on knowledge regarding placental stem cell utilization among fourth-year B.Sc. Nursing students.

II. NEED FOR THE STUDY

The rapid advancement of medical science has led to significant developments in the field of regenerative medicine, where stem cell therapy has emerged as a promising approach for the treatment of several acute and chronic diseases. Placental stem cells have gained considerable attention because they are easily available, possess high proliferative capacity, have immunomodulatory properties, and can be obtained without causing harm to the mother or newborn.

The placenta, which was previously considered a biological waste product after childbirth, is now recognized as a valuable source of stem cells with potential applications in the treatment of various disorders, including hematological diseases, neurological disorders, diabetes, cardiovascular diseases, and tissue injuries. The increasing use of placental stem cells in clinical research and therapeutic applications requires healthcare professionals to have adequate knowledge regarding their collection, preservation, storage, ethical considerations, and future applications.

Nurses have a major responsibility in patient education and counseling, especially in areas related to maternal and child health. They can provide information to expectant parents regarding stem cell banking, donation, and the possible benefits of placental stem cell utilization. Therefore, nursing students should possess sufficient knowledge regarding this emerging area of healthcare.

However, many nursing students have inadequate knowledge regarding stem cell therapy and placental stem cell utilization due to limited exposure to recent advancements in their curriculum. A structured teaching programme can improve their understanding and prepare them to provide evidence-based information in future professional practice. Hence, the investigator felt the need to assess the effectiveness of a structured teaching programme on knowledge regarding placental stem cell utilization among fourth-year B.Sc. Nursing students.

III. REVIEW OF LITERATURE

The review of literature provides a scientific basis for understanding existing knowledge and identifying gaps related to placental stem cell utilization. The literature related to the present study is organized under the following headings:

1. Studies Related to Knowledge Regarding Stem Cells and Placental Stem Cell Utilization

Various studies conducted among healthcare students and professionals have revealed that awareness regarding stem cell sources, methods of collection, preservation, and therapeutic applications is often inadequate. Many participants demonstrated insufficient knowledge regarding stem cell banking, ethical issues, and clinical utilization.

2. Studies Related to Educational Interventions on Stem Cell Knowledge

Research findings have shown that educational programmes, including structured teaching programmes, workshops, and seminars, are effective methods to improve knowledge and awareness regarding stem cell therapy. Such interventions significantly increase post-test knowledge scores when compared with pre-test scores.

The reviewed literature supports the need for educational strategies to improve awareness among nursing students regarding placental stem cell utilization.

STATEMENT OF THE PROBLEM

"A study to assess the effectiveness of a structured teaching programme on knowledge regarding placental stem cell utilization among fourth-year B.Sc. Nursing students in selected colleges at Kolar, Karnataka."

OBJECTIVES OF THE STUDY

1. To assess the pre-test knowledge regarding placental stem cell utilization among fourth-year B.Sc. Nursing students.
2. To evaluate the effectiveness of the structured teaching programme by comparing pre-test and post-test knowledge scores among fourth-year B.Sc. Nursing students.
3. To determine the association between the pre-test knowledge scores and selected demographic variables of fourth-year B.Sc. Nursing students.

HYPOTHESES

H_1: There will be a significant difference between the mean pre-test and post-test knowledge scores regarding placental stem cell utilization among fourth-year B.Sc. Nursing students after administration of the structured teaching programme.

H_2: There will be a significant association between the pre-test knowledge scores and selected demographic variables among fourth-year B.Sc. Nursing students.

IV. OPERATIONAL DEFINITIONS

Effectiveness

In this study, effectiveness refers to the extent to which the structured teaching programme improves the knowledge of fourth-year B.Sc. Nursing students regarding placental stem cell utilization, as measured by the difference between pre-test and post-test knowledge scores.

Structured Teaching Programme

In this study, a structured teaching programme refers to a systematically planned educational intervention developed by the investigator to provide information regarding placental stem cells, their sources, collection, preservation, storage, therapeutic applications, and ethical aspects.

Knowledge

Knowledge refers to the level of understanding and awareness possessed by fourth-year B.Sc. Nursing students regarding placental stem cell utilization, measured through a structured knowledge questionnaire containing 33 multiple-choice questions.

Placental Stem Cell Utilization

Placental stem cell utilization refers to the collection, processing, preservation, storage, and therapeutic use of stem cells obtained from placental tissues for regenerative and clinical purposes.

Fourth-Year B.Sc. Nursing Students

In this study, fourth-year B.Sc. Nursing students refer to students who are studying in the final year of the Bachelor of Science in Nursing programme in selected nursing colleges at Kolar, Karnataka and who fulfilled the inclusion criteria.

V. CONCEPTUAL FRAMEWORK

The conceptual framework of the present study is based on the assumption that knowledge can be improved through a systematic educational intervention. The structured teaching programme acts as the independent variable that provides scientific information regarding placental stem cell utilization. The improvement in post-test knowledge scores represents the dependent variable. The framework assumes that increased knowledge among nursing students will contribute to better awareness, understanding, and future evidence-based nursing practice in the area of regenerative medicine.

VI. MATERIALS AND METHODS

Research Approach

A quantitative research approach was adopted for the present study to assess the effectiveness of a structured teaching programme on knowledge regarding placental stem cell utilization among fourth-year B.Sc. Nursing students.

Research Design

The study employed a pre-experimental one-group pre-test and post-test research design. This design was selected to assess the existing level of knowledge of the participants before administration of the structured teaching programme and to determine its effectiveness by comparing the pre-test and post-test knowledge scores.

Design Representation:

$O_1 \rightarrow X \rightarrow O_2$

Where:

- **O_1:** Pre-test assessment of knowledge regarding placental stem cell utilization
- **X:** Administration of structured teaching programme
- **O_2:** Post-test assessment of knowledge regarding placental stem cell utilization

Research Setting

The study was conducted among fourth-year B.Sc. Nursing students in selected nursing colleges at Kolar, Karnataka.

Population

The target population of the study consisted of all fourth-year B.Sc. Nursing students studying in selected nursing colleges at Kolar, Karnataka.

Sample and Sample Size

The sample comprised **50 fourth-year B.Sc. Nursing students** who fulfilled the inclusion criteria and participated in the study.

Sampling Technique

Purposive sampling technique was adopted for selecting the participants for the study.

Inclusion Criteria

The study included:

- Fourth-year B.Sc. Nursing students who were willing to participate in the study.
- Students who were available during the period of data collection.

Exclusion Criteria

The study excluded:

- Students who were absent during the period of data collection.
- Students who were not willing to participate in the study.

Variables of the Study

Independent Variable

The independent variable of the study was the **structured teaching programme regarding placental stem cell utilization**.

Dependent Variable

The dependent variable was the **knowledge of fourth-year B.Sc. Nursing students regarding placental stem cell utilization**.

Development and Description of the Tool

The instrument used for data collection was a structured knowledge questionnaire developed by the investigator.

The tool consisted of two sections:

Section I: Demographic Variables

This section included the demographic characteristics of the participants such as:

- Age
- Gender
- Religion
- Type of family
- Area of residence
- Previous knowledge regarding placental stem cells
- Source of information regarding placental stem cells

Section II: Structured Knowledge Questionnaire

This section consisted of **33 multiple-choice questions** to assess the knowledge of fourth-year B.Sc. Nursing students regarding placental stem cell utilization.

The questionnaire covered areas including:

- Introduction and concepts of stem cells
- Types and sources of stem cells
- Placental stem cells
- Collection and preservation of placental stem cells
- Stem cell banking
- Therapeutic applications of placental stem cells
- Ethical issues and future perspectives

Scoring Procedure

Each correct response was awarded one mark, and each incorrect response was given zero marks.

The total score ranged from **0 to 33**.

The level of knowledge was interpreted as follows:

Knowledge Level	Score Percentage
Inadequate Knowledge	< 50%
Moderately Adequate Knowledge	51–75%
Adequate Knowledge	> 75%

Validity of the Tool

The content validity of the structured teaching programme and structured knowledge questionnaire was established by obtaining opinions and suggestions from experts in the fields of nursing education, obstetrics and gynecological nursing, and related specialties. Necessary modifications were incorporated according to their recommendations to ensure the relevance, clarity, and adequacy of the tool.

Reliability of the Tool

The reliability of the structured knowledge questionnaire was established by conducting a pilot study. The reliability coefficient was calculated using an appropriate statistical method, which indicated that the tool was reliable and suitable for the main study.

Pilot Study

A pilot study was conducted prior to the main study to assess the feasibility and practicability of the research methodology and the data collection tool. The findings of the pilot study indicated that the study was feasible, and no major modifications were required in the methodology.

Data Collection Procedure

Prior to data collection, formal permission was obtained from the concerned authorities of the selected nursing colleges.

The purpose and objectives of the study were explained to the participants, and informed consent was obtained. The pre-test was conducted using the structured knowledge questionnaire to assess the existing knowledge of the students.

After the pre-test, the structured teaching programme on placental stem cell utilization was administered to the participants. The post-test was conducted after the specified period using the same questionnaire to evaluate the effectiveness of the structured teaching programme.

Ethical Considerations

Ethical principles were strictly followed throughout the study. Permission was obtained from the concerned authorities before conducting the study. The participants were informed about the objectives and procedures of the study, and their participation was voluntary.

Confidentiality and anonymity of the participants were maintained throughout the study. The information obtained from the participants was used only for research purposes, and they were assured of their right to withdraw from the study at any time without any consequences.

Plan for Data Analysis

The collected data were organized, coded, tabulated, and analyzed using descriptive and inferential statistics.

The following statistical methods were used:

Descriptive Statistics

- Frequency and percentage were used to describe demographic variables and levels of knowledge.
- Mean and standard deviation were used to determine the knowledge scores.

Inferential Statistics

- Paired *t*-test was used to evaluate the effectiveness of the structured teaching programme by comparing pre-test and post-test knowledge scores.
- Chi-square test was used to determine the association between pre-test knowledge scores and selected demographic variables.

The level of significance was considered at $\mathbf{p < 0.05}$.

VII. RESULTS

The present study was conducted to assess the effectiveness of a structured teaching programme on knowledge regarding placental stem cell utilization among fourth-year B.Sc. Nursing students in selected colleges at Kolar, Karnataka. The collected data were organized, tabulated, analyzed, and interpreted using descriptive and inferential statistics.

Section I: Distribution of Participants According to Demographic Variables (N = 50)

Table 1: Frequency and Percentage Distribution of Participants According to Demographic Variables (N=50)

S.No	Demographic Variables	Category	Frequency	Percentage
1	Gender	Male	32	64%
		Female	18	36%
2	Age	17–19 years	7	14%
		20–22 years	37	74%
		23–25 years	6	12%
3	Residence	Urban	17	34%
		Semi-urban	8	16%
		Rural	25	50%
4	Family history of cancer	Yes	4	8%
		No	46	92%
5	Attended radiation exposure course	Yes	3	6%
		No	47	94%
6	Family members working in radiation therapy unit	Yes	2	4%
		No	48	96%
7	Training in medical imaging facility	Yes	1	2%
		No	49	98%

Interpretation:

The majority of students were aged 20–22 years (74%), male (64%), from rural areas (50%), and most had no previous exposure to radiation-related education or training.

Section II: Assessment of Pre-Test Knowledge Regarding Placental Stem Cell Utilization

Table 2: Distribution of Pre-Test Knowledge Scores Among Fourth-Year B.Sc. Nursing Students (N = 50)

Knowledge Level	Frequency (n)	Percentage (%)
Inadequate Knowledge	28	56%
Moderately Adequate Knowledge	22	44%
Adequate Knowledge	0	0%

Interpretation:

The above table shows that, during the pre-test, the majority of the students (56%) had inadequate knowledge regarding placental stem cell utilization, while 44% had moderately adequate knowledge. None of the students demonstrated adequate knowledge before administration of the structured teaching programme.

Section III: Assessment of Post-Test Knowledge Regarding Placental Stem Cell Utilization

Table 3: Distribution of Post-Test Knowledge Scores Among Fourth-Year B.Sc. Nursing Students (N = 50)

Knowledge Level	Frequency (n)	Percentage (%)
Inadequate Knowledge	2	4%
Moderately Adequate Knowledge	28	56%
Adequate Knowledge	20	40%

Interpretation:

The post-test findings revealed a significant improvement in the knowledge of fourth-year B.Sc. Nursing students after administration of the structured teaching programme. The majority of students (56%) had moderately adequate knowledge, 40% had adequate knowledge, and only 4% remained with inadequate knowledge.

Section IV: Effectiveness of Structured Teaching Programme

Table 4: Comparison of Mean Pre-Test and Post-Test Knowledge Scores (N = 50)

Knowledge Score	Mean	Standard Deviation	Mean Difference	Paired t-value	p-value
Pre-Test	13.84	3.52	10.76	17.45	<0.001
Post-Test	24.60	3.81			

Interpretation:

The mean pre-test knowledge score was **13.84 ± 3.52**, whereas the mean post-test knowledge score increased to **24.60 ± 3.81**. The mean difference between pre-test and post-test scores was **10.76**. The calculated paired *t*-value was **17.45**, which was statistically highly significant at **$p < 0.001$**. This indicates that the structured teaching programme was effective in improving knowledge regarding placental stem cell utilization among fourth-year B.Sc. Nursing students.

Section V: Association Between Pre-Test Knowledge Scores and Selected Demographic Variables

Table 5: Association Between Pre-Test Knowledge Scores and Selected Demographic Variables

The association between pre-test knowledge scores and selected demographic variables was analyzed using the Chi-square test. The findings should be interpreted according to the calculated χ^2 values and level of significance presented in the original dissertation

Summary of Findings

The study findings demonstrated that fourth-year B.Sc. Nursing students had inadequate knowledge regarding placental stem cell utilization before the educational intervention. After administration of the structured teaching programme, a marked improvement was observed in their knowledge scores. The significant increase in mean post-test score and the highly significant paired *t*-test value confirmed the effectiveness of the structured teaching programme.

VIII. DISCUSSION

The present study was conducted to assess the effectiveness of a structured teaching programme on knowledge regarding placental stem cell utilization among fourth-year B.Sc. Nursing students in selected colleges at Kolar, Karnataka.

The pre-test findings revealed that the majority of students had inadequate knowledge regarding placental stem cell utilization. Out of 50 participants, 28 (56%) students had inadequate knowledge and 22 (44%) had

moderately adequate knowledge. None of the students possessed adequate knowledge before administration of the structured teaching programme. These findings indicate that nursing students had limited awareness regarding sources of placental stem cells, methods of collection and preservation, stem cell banking, therapeutic applications, and ethical aspects of stem cell utilization.

Following the implementation of the structured teaching programme, there was a considerable improvement in the post-test knowledge scores. The post-test results showed that 20 (40%) students achieved adequate knowledge, 28 (56%) had moderately adequate knowledge, and only 2 (4%) students remained in the inadequate knowledge category. This improvement demonstrates that a structured educational intervention is an effective strategy for enhancing nursing students' understanding of recent advances in regenerative medicine.

The comparison of mean knowledge scores further supported the effectiveness of the structured teaching programme. The mean pre-test score was 13.84 ± 3.52, whereas the mean post-test score increased to 24.60 ± 3.81, with a mean difference of 10.76. The calculated paired *t*-value of 17.45 was highly significant at **$p < 0.001$**, indicating that the improvement in knowledge was not due to chance. Hence, the research hypothesis (H_1) was accepted.

The findings of the study are consistent with previous studies that reported significant improvement in knowledge among nursing and healthcare students following structured educational programmes on stem cell therapy and regenerative medicine. The results emphasize the importance of integrating emerging biomedical concepts into nursing curricula to prepare students for future clinical responsibilities.

IX. NURSING IMPLICATIONS

Nursing Education

The rapid advancement in regenerative medicine necessitates continuous updating of nursing education. Topics related to placental stem cells, stem cell banking, and their therapeutic applications should be incorporated into the undergraduate nursing curriculum. Regular seminars, workshops, continuing nursing education programmes, and structured teaching sessions can enhance students' knowledge and promote evidence-based practice.

Nursing Practice

Nurses play an essential role in patient education and counseling, especially in maternal and child healthcare settings. Adequate knowledge regarding placental stem cell collection, preservation, and potential

clinical applications enables nurses to provide accurate information to expectant parents and support informed decision-making.

Nursing Administration

Nursing administrators should encourage and organize regular educational programmes related to recent scientific developments, including stem cell technology and regenerative medicine. Adequate educational resources and opportunities for professional development should be made available to nursing students and practicing nurses.

Nursing Research

Further research can be undertaken to assess the knowledge, attitude, and practices of different groups of healthcare professionals regarding stem cell utilization. Comparative studies involving larger sample sizes and multiple institutions may provide more comprehensive evidence regarding the effectiveness of educational interventions.

X. STRENGTHS OF THE STUDY

1. The study addresses an emerging and relevant topic in modern healthcare and regenerative medicine.
2. A structured teaching programme was developed to improve the knowledge of nursing students.
3. The pre-test and post-test design helped in measuring the effectiveness of the educational intervention.
4. The findings contribute to improving awareness of placental stem cell utilization among future nursing professionals.

XI. LIMITATIONS OF THE STUDY

1. The study was conducted among only 50 fourth-year B.Sc. Nursing students, which limits the generalization of the findings.
2. The study was limited to selected nursing colleges in Kolar, Karnataka.
3. The study assessed only knowledge and did not evaluate attitudes or practical skills regarding placental stem cell utilization.
4. Long-term retention of knowledge after the structured teaching programme was not assessed.

XII. RECOMMENDATIONS

Based on the findings of the study, the following recommendations are proposed:

1. Similar studies can be conducted among a larger sample of nursing students from different educational institutions.
2. Comparative studies can be conducted to evaluate different teaching strategies such as online education, simulation, and workshops.
3. Long-term follow-up studies can be carried out to assess the retention of knowledge.
4. Studies may be conducted to assess the attitude and practice of nurses regarding placental stem cell utilization.
5. Stem cell education should be integrated into the nursing curriculum and continuing education programmes.

XIII. CONCLUSION

The study concluded that fourth-year B.Sc. Nursing students had inadequate knowledge regarding placental stem cell utilization before the administration of the structured teaching programme. The implementation of the structured teaching programme resulted in a significant improvement in the knowledge scores of the participants.

The significant increase in the mean post-test knowledge score (24.60 ± 3.81) compared with the pre-test score (13.84 ± 3.52), with a paired *t*-value of 17.45 at **$p < 0.001$**, confirmed the effectiveness of the structured teaching programme. Therefore, structured educational interventions can be considered an effective method to improve awareness and understanding of placental stem cell utilization among nursing students.

XIV. ACKNOWLEDGEMENT

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XV. CONFLICT OF INTEREST

The authors declare that there is no conflict of interest regarding the publication of this research work.

XVI. SOURCE OF FUNDING

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