

Maternity Nurses' Perception regarding Ovarian Rejuvenation as a Novel Approach to Address Premature Ovarian Insufficiency: Effect of an Educational Bundle

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Abstract

Background: Ovarian insufficiency is described as a multifaceted issue typically encountered in the field of assisted reproduction. The three main identified diagnoses of ovarian insufficiency include premature ovarian failure (POF), poor ovarian response (POR), and advanced maternal age (AMA). **Aim:** This research aimed to evaluate effect of an educational bundle on maternity nurses' perception regarding ovarian rejuvenation as a novel approach to address premature ovarian insufficiency. **Design:** A quasi-experimental research design (one group "pre/posttest") was utilized **Study Setting:** The research was conducted at obstetrics and gynecological department at Benha University Hospitals in Qaliobya governorate, Egypt. **Sample:** convenient sample of (86) nurses who are already working in obstetrics and gynecological department were recruited in the study. **Tools:** Two tools were used for data collection **Tool (I):** A structured self-administered questionnaire, **: part one:** Personal characteristics of the studied nurses. **Part two:** Maternity nurses' knowledge questionnaire. **Tool (II):**Maternity nurses' attitudes questionnaire. **Results:** The current study's findings showed that there was a highly statistically significant difference between the results of post -intervention phase compared to pre-intervention phase in relation to all items of studied nurses' knowledge **Conclusion:** significant and remarkable improvement in nurses' perception toward ovarian rejuvenation technology following the implementation of the educational bundle with a highly statistically significant differences between the pre and post-intervention stages, indicating the strong effectiveness of the educational bundle **Conclusion: Recommendations:** Integrate continuous training programs on ovarian rejuvenation technologies into nursing education curricula to ensure sustained knowledge and improved perception among nurses.

Key words: A Novel Approach , Educational Bundle , Insufficiency, Ovarian Rejuvenation , Perception

Introduction

Premature Ovarian Insufficiency (POI) is a disorder characterized by the loss of normal ovarian function before the age of 40, resulting in reduced estrogen production, menstrual irregularities (oligomenorrhea or amenorrhea), and impaired fertility. POI is highly heterogeneous in its causes, including genetic factors (such as monogenic or oligogenic inheritance and chromosomal abnormalities), autoimmune mechanisms, environmental exposures (toxins, smoking), and medical interventions such as chemotherapy or radiation (Guo *et al.*, 2025).

Ovarian rejuvenation refers to emerging regenerative medicine approaches designed to restore or improve ovarian function in women

who have diminished ovarian reserve or premature ovarian insufficiency (POI). POI, often called premature ovarian failure, is characterized by loss of normal ovarian activity before age 40, leading to reduced sex hormone production, menstrual disturbances, and infertility (elevated FSH, low AMH). This innovative therapeutic concept challenges the long-held belief that loss of ovarian follicles is irreversible and offers a paradigm shift in fertility treatment (Hassan *et al.*, 2025).

The primary aim of ovarian rejuvenation techniques is to reactivate quiescent primordial follicles and improve the ovarian microenvironment, thereby restoring hormone production (such as estradiol), increasing antiMüllerian hormone (AMH) levels, and

ultimately enhancing fertility outcomes. Specific goals include increasing antral follicle count, improving oocyte yield in IVF cycles, and potentially enabling spontaneous pregnancy (*Ghafourian et al., 2025*).

Ovarian rejuvenation offers several advantages over conventional fertility treatments. For women with POI or low ovarian reserve who struggle to respond to stimulation, intra- ovarian platelet-rich plasma (PRP) or stem-cell-based therapies is less invasive. Preclinical and early clinical data suggest these approaches can improve endocrine markers (e.g., increased AMH, decreased FSH), a higher follicular count, and, in some cases, lead to spontaneous or assisted pregnancies. Because many of these methods use autologous materials (for example, a patient's own platelets or mesenchymal stem cells), immunologic risks are reduced (*Cui and Jing, 2024*).

Among the most studied techniques is the injection of autologous platelet-rich plasma (PRP) into the ovarian cortex. The procedure typically involves drawing the patient's blood, concentrating platelets via centrifugation, and then injecting the PRP under ultrasound guidance into the ovarian tissue, often using a fine needle. In addition, stem cell-based ovarian rejuvenation approaches, such as intra-ovarian injection of mesenchymal stem cells (e.g., from umbilical cord or menstrual blood) or their extracellular vesicles, are under investigation; these aim to support folliculogenesis by modulating the local microenvironment, secreting growth factors, and reducing inflammation (*Dai et al., 2024*).

Steps ovarian rejuvenation procedure (Dai, F., Liu, H., He, J., et al. (2024).

The ideal candidates for ovarian rejuvenation are women diagnosed with POI (especially those with residual ovarian tissue), diminished ovarian reserve, or poor responders to IVF, who wish to preserve or regain fertility using their own gametes. Some recent clinical cohort studies of mesenchymal stem cell therapy (e.g., umbilical-cord derived MSCs) have shown restoration of ovarian function and improved intermediate IVF/ICSI outcomes in



POI patients, suggesting feasibility in real-world settings (*Huang et al., 2025*).

However, not all women are suitable for ovarian rejuvenation. Potential contraindications may include active pelvic or systemic malignancy (due to risks associated with stem cell growth), pelvic adhesions (which may impede safe injection), bleeding disorders, or anticoagulation therapy that raises bleeding risk. Additionally, because many of these therapies remain experimental, women with virtually no residual ovarian tissue ("burnt-out" ovaries) may not benefit (*Ghafourian et al., 2025*).

Preclinical and animal studies suggest that hormonal responses to intra-ovarian PRP or MSC therapies can begin relatively early: for example, in rodent models treated with PRP, improvements in FSH, AMH, and estradiol levels have been detected within weeks, along with increased expression of germ-cell markers and follicular survival. Over subsequent weeks to months, follicle counts often rise and lead to restored fertility.

Although early data are promising, safety concerns remain. In animal models, intra-ovarian PRP treatment has been linked to bleeding, inflammation, and potential tissue injury, especially if injection is not properly guided. The long-term risks of stem-cell-based interventions are even less well understood and may include ectopic tissue formation, fibrosis, or tumorigenicity (*Guo et al., 2025*).

Nurses and midwives have a critical role in the context of ovarian rejuvenation. Nurses must educate and counsel women on the experimental nature of these therapies, explain

potential benefits and risks, and help patients make informed decisions. Nurses also coordinate care by managing pre-procedure workups, follow-up hormonal monitoring, and ultrasound assessments. After the procedure, nurses monitor for complications (e.g., bleeding, infection), provide emotional and psychological support, ensure adherence to follow-up, and facilitate data collection for research registries. Their role is key in implementing these novel therapies safely and ethically (*Saleh Khudhur, 2025*).

Significance of the research:

Primary ovarian insufficiency (POI) is a significant but under recognized health issue worldwide. Recent guidelines estimate a prevalence of about 3.5% globally, higher than previous assumptions. In fact, a systematic review and meta-analysis reported a pooled prevalence of 3.5%, while subgroup analyses revealed much higher rates in certain etiological categories (e.g., 11.2% in iatrogenic POI, 10.5% in autoimmune cases) (*Li et al., 2022*). In Egypt, a recent nationally representative survey found that 1.9% of women experience early menopause (before age 45), which may include POI cases (*Soliman and Tawfik, 2025*).

The health consequences of POI extend far beyond infertility: women with POI face an elevated risk of osteoporosis (due to estrogen deficiency), cardiovascular disease, cognitive impairment, and psychological distress, including anxiety and depression. So, many evidence-based guideline provides numerous recommendations addressing not only hormone management and fertility preservation, but also long-term monitoring for bone, cardiovascular, and neurological health (*Anderson et al., 2024*).

Ovarian rejuvenation represents a groundbreaking regenerative approach for treating premature ovarian insufficiency (POI), offering significant advantages over conventional therapies. Unlike hormone replacement therapy (HRT) or assisted reproductive technologies, which primarily manage symptoms, regenerative strategies aim to restore the ovary's endocrine and reproductive functions. This technique holds promise not only for fertility restoration but

also for improving hormonal balance and long-term systemic health. Also, ovarian rejuvenation is safe, less invasive and less risk (*Cui and Jing, 2024*).

Moreover, the effectiveness of such advanced therapies critically depends on well-informed nursing staff: implementing comprehensive educational programs for nurses can enhance their awareness and understanding of ovarian rejuvenation technology, enabling them to better counsel POI patients, support informed decision-making, and ensure safe and ethical integration of these therapies into clinical care (*Zhang et al., 2025*).

Purpose:

This research aimed to evaluate effect of an educational bundle on maternity nurses' perception regarding ovarian rejuvenation as a novel approach to address premature ovarian insufficiency.

Research hypothesis:

H1: Maternity nurses will demonstrate a significantly higher level of knowledge regarding ovarian rejuvenation as a novel approach to address premature ovarian insufficiency after implementation of the educational bundle compared to before its implementation.

H2: Maternity nurses will demonstrate a more positive attitudes toward ovarian rejuvenation as a novel approach to address premature ovarian insufficiency after implementation of the educational bundle compared to before its implementation.

Operational definitions:

▪ **Maternity nurses' perception** regarding ovarian rejuvenation refers to the beliefs, understanding, attitudes, and professional judgments held by maternity nurses about the concept, safety, effectiveness, ethical implications, and clinical relevance of ovarian rejuvenation techniques.

▪ **An educational bundle** about ovarian rejuvenation is a structured, evidence-based set of learning materials and teaching strategies

designed to provide maternity nurses with comprehensive knowledge and positive attitude about ovarian rejuvenation procedures. This bundle integrates multiple educational components such as lectures, visual aids, written guidelines, case examples to enhance understanding and support informed decision-making. Key Dimensions of the Educational Bundle are: Cognitive, Affective, Behavioral/Skill and Instructional.

Subjects and method

Research Design:

A quasi-experimental research design (one group "pre/posttest") was utilized to achieve the aim this research.

Research Setting:

This research was performed at obstetrics and gynecological department at Benha University Hospitals in Qaliobyah governorate, Egypt. This department composed of: internal department, emergency department, labour unit, outpatient clinic and major operation rooms. This hospital was chosen because it is the main hospital in Benha city, which provide medical care to all women from Benha, its suburbs and villages, and from various cultural backgrounds, regardless of their social characteristics.

Sampling:

Sample type and size: A convenient sample of (86) nurses who are already working in obstetrics and gynecological department were recruited in the study.

Tools of data collection:

Two tools were used for data collection:

Tool I: A structured self-administered questionnaire: It was constructed by researchers after reviewing a related literature and translated into Arabic language. It is divided into two parts:

Part (1): Personal characteristics of studied nurses: It comprised of 5 items which were (age, residence, educational qualification,

years of experience and attending any educational courses regarding new approaches in treatment of premature ovarian failure).

Part (2): Maternity nurses' knowledge questionnaire: It was developed by researchers after reading the relevant literatures (*Hassan et al., 2025; Zhang, 2025 and Serdarogullari et al., 2024*) to assess nurses' knowledge about premature ovarian insufficiency and ovarian rejuvenation. It included 28 multiple choice questions (MCQs) under 2 parts as follows:

- Knowledge about premature ovarian insufficiency (11 Qs) as (definition of premature ovarian insufficiency, causes, risk factors ...etc.).
- Knowledge about ovarian rejuvenation (17 Qs) as (definition of ovarian rejuvenation therapy, main goal of ovarian rejuvenation therapy, potential benefits of ovarian rejuvenation ...etc.).

Scoring system:

For each question, the correct answer was scored as "1" and the incorrect or I don't know answer was scored as "0". The total knowledge score was ranged from 0- 28 and calculated by adding up of the scores of all questions. The higher scores reflected the higher knowledge. *The total knowledge score was classified as the following:*

- Good knowledge: 75% to 100% = 21-28 score
- Average knowledge: 50% to <75% = 14-20 score
- Poor knowledge: < 50% = 0-13 score

Tool II: Maternity nurses' attitudes questionnaire: It was designed by the researchers after reviewing the literature (*Mohamed & El-Badry,2025; Nouh et al., 2025 and Saleh Khudhur, 2025*) to assess nurses' attitude regarding ovarian rejuvenation. It included 13 statements such as (ovarian rejuvenation is a relatively simple, minimally invasive and process, ovarian rejuvenation is a safe procedure when performed under proper medical guidelines, ovarian rejuvenation has the potential to improve fertility outcomes ...etc.).

Scoring system:

Each item was scored on 3-points Likert scale as follow: 2 for "agree", 1 for "uncertain" and 0 for "disagree". The overall obtained score was ranged between 0 and 26, with higher scores indicating better attitude. *The total attitude score was classified as the following:*

- Positive level: 75% to 100% = 39-52 score
- Negative level: < 75% = 0-38 score

Tools validity:

A panel of three jury experts in the field of obstetrics and gynecological nursing at Benha University evaluated the validity of questionnaires to ensure the clarity, relevance, comprehensiveness, and applicability of tools. Minor modifications were required in formulating sentences. From the experts' perspective, the tools were considered valid.

Tools reliability:

The reliability of tools was done by Cronbach's Alpha coefficient test, which revealed that the internal consistency of research tools as following:

Tools	Cronbach's alpha value
Tool I: Maternity nurses' knowledge questionnaire.	Internal consistency ($\alpha=0.91$).
Tool III: Maternity nurses' attitudes questionnaire.	Internal consistency ($\alpha=0.89$).

Ethical consideration:

Ethical aspects were considered before starting the study as the following: The study approval obtained from scientific research ethical committee of the faculty of nursing at Benha University for fulfillment of the research with code REC-OBSN-P123. An official permission from the selected study settings was obtained for the fulfillment of the study. Before applying the tools, the researchers explained the aim and importance of the study to gain nurses' confidence and trust. The researchers

obtained signed consent from nurses to participate in the study and confidentiality was assured. The study didn't have any physical, social or psychological risks on the nurses. All tools of data collection were burned after statistically analysis to promote confidentiality of the participating nurses. The study tools didn't include any immoral statements and respect human rights. The nurses were free to withdraw from study at any time.

Pilot study:

The pilot study was conducted on 10% of the total sample size (9 nurses) to test the clarity, objectivity, feasibility and applicability of the tools and to find out the possible obstacles and problems that might face the researcher and interfere with data collection and to detect any problems peculiar to the statements as sequence of questions and clarity. It also helped to estimate the time needed for data collection. No modifications were done according to the pilot results. So, the pilot sample was included in the research.

Field work:

The research was carried out from the beginning of March, 2025 and completed at the end of August 2025 covering six months. The researchers visited the previously mentioned setting until completion of the predetermined sample size, two times/ week (Sundays and Mondays) from 9.00 a.m. to 2 p.m. Current research was implemented through the following eight phases; preparatory phase, interviewing and assessment phase, planning phase, implementation phase and evaluation phase.

Preparatory phase:

The preparatory phase is the first phase of the research; through which the researchers reviewed the local and international related literature about the research problem. This helped the researchers to be acquainted with magnitude and seriousness of the problem, and guided the researchers to prepare the required data collection tools. The tools were distributed to three experts in the field of obstetrics &

gynecological nursing at Benha University and the jury results were done.

Interviewing phase:

It is the second phase. During this phase, the nurses were interviewed to be assessed in the lecture hall in obstetric and gynecological department. At the beginning of the interview the researchers welcomed the nurses, introduced themselves, stated the purpose and requirements of the research, provided the nurses with all information about number and frequency of educational sessions to assure their adherence to interventions and took signed consent to participate in the research.

Needs assessment phase:

The needs assessment phase focuses on identifying existing knowledge gaps and perceptions among nurses regarding ovarian rejuvenation. During this stage, baseline data were collected through questionnaire, interviews, or focus groups to evaluate nurses' understanding, attitudes, and confidence related to this emerging reproductive technology. Current evidence, clinical protocols, and educational standards were reviewed to determine the essential content areas that must be addressed. The findings from this phase guided the design of the educational bundle and ensure that it targets the most relevant learning needs.

Planning and Design Phase:

Based on results obtained during need assessment phase, the researchers established clear objectives and determined the most appropriate components to include in the educational bundle. This includes selecting evidence-based content, such as lectures, visual aids, practical demonstrations and printed booklet, that collectively enhance understanding of ovarian rejuvenation. Careful planning at this stage ensures that the intervention is well-structured and aligns with the identified needs. Sessions number and its contents, different methods of teaching, and instructional media were determined.

The education time sessions was planned and arranged with the nurses during

their free times from duties or after finishing their shift, as nature of the work in this department is consuming large time and effort from nurses during the shift, so we arranged together the time suitable for educational sessions at the lecture hall in the department.

Development phase:

The development phase involves creating or refining the educational materials based on the planned content. This includes preparing presentations, videos, info graphics, and quick-reference guides that deliver information clearly and accurately. Subject-matter experts review the materials to ensure scientific accuracy and clinical relevance. A pilot test was conducted with a small group of nurses to evaluate the clarity, usability, and effectiveness of the materials. Feedback from this testing is used to make necessary revisions, ensuring that the final educational bundle is polished and effective.

Implementation phase:

The implementation of educational bundle was carried out over the course of three scheduled sessions throughout three consecutive weeks (one session per week) started immediately after completion of the need assessment phase., each session lasting 30–45 minutes according to their achievement and feedback. The researchers divided the nurses into small groups (10 groups) of "8-9 nurses" for each group.

During this phase, the educational bundle is delivered to the target group of nurses through structured learning sessions. These may include in-person workshops, online courses, or hybrid formats that combine multiple methods of instruction. Nurses engage with the material through lectures, demonstrations, case discussions, and interactive activities that encourage participation and critical thinking. Educational resources, both digital and printed, were made available to support ongoing learning. This phase aimed to translate the prepared content into meaningful educational experiences for participants.

At the beginning of the first session, nurses were oriented with the session contents. The subsequent session started by feedback about the previous session and the objectives of the new session. At the end of each session, few minutes were devoted to permit nurses to ask questions to clarify the session contents and to correct any misunderstanding. Each nurse informed about the time of the next session.

Various educational methods and materials were used, including modified lecture, group discussion, problem solving, brainstorming, role-playing, demonstration and re-demonstration, PowerPoint presentation, video film, and a designed booklet was distributed to all recruited nurses from the first session to achieve its objectives.

- **1st session** "the introductory session" was **overview about** ovarian anatomy and functions.

- **2nd session** was about premature ovarian insufficiency.

- **3rd session** was about ovarian rejuvenation as a novel approach to address premature ovarian insufficiency.

Evaluation phase:

The effect of the educational bundle was evaluated through: using the same format of pretest (Tool I & II). Post-test was conducted two weeks after last educational session. This phase ensured that the educational intervention achieves its intended outcomes.

Reinforcement Phase:

In the reinforcement phase, additional strategies were used to support long-term retention of the acquired knowledge. Nurses received refresher materials, brief review modules, or updated guidelines. Reinforcement Phase conducted weeks or months after implementation helped determine whether knowledge and positive attitude had been sustained. This stage aimed to reinforce learning, prevent knowledge decay, and promote continuous professional development in the area of ovarian rejuvenation.

Statistical analysis:

Data were verified prior to computerized entry. The data collected was organized, coded, computerized and analyzed by using appropriate statistical methods and tests. The Statistical Package for Social Sciences (SPSS version 25.0) was used. Descriptive statistics included frequencies and percentages, means, and standard deviations. Inferential statistics as the (Chi-square test) was used to test the research hypothesis. The correlation coefficient was used to investigate the relationship between total scores of study variables. For all of the statistical tests done, $p\text{-value} > 0.05$ indicated no statistically significant difference, $p\text{-value} \leq 0.05$ indicated a statistically significant difference, and $p\text{-value} P \leq 0.001$ indicated a highly statistically significant difference.

Limitations:

There are limited data and very few studies available about maternity nurses' perception regarding ovarian rejuvenation.

Results:

Table (1): shows that (40.7%) of studied nurses were in age group 35 - < 45 years old with a mean age of 35.44 ± 7.74 years. In relation to educational qualifications (61.1%) of them graduated from nursing technical institute and (58.1%) of them lived in rural areas. As well as, (53.4%) of them had 5 - 10 years of experience in obstetrics and gynecology nursing. Also, (100.0%) of them didn't attend any educational courses regarding new approaches in treatment of premature ovarian failure.

Table (2): demonstrates that there was a highly statistically significant difference between the results of post -intervention phase compared to pre-intervention phase in relation to all items of studied nurses' knowledge about premature ovarian insufficiency ($p \leq 0.001$).

Table (3): illustrates that there was a highly statistically significant difference between the results of post -intervention phase compared to pre-intervention phase in relation

to all items of studied nurses' knowledge about ovarian rejuvenation ($p \leq 0.001$).

Figure (1): displays that, (19.8%) and (82.6%) of studied nurses had good knowledge regarding premature ovarian insufficiency and ovarian rejuvenation at pre- and post-intervention phases respectively

Table (4): clarifies that, there is a marked positive change in attitude of studied nurses toward premature ovarian failure and ovarian rejuvenation after implementation of the educational bundle with a highly

statistically significant difference between pre and post-intervention phases ($p < 0.001$).

Figure (2): shows that, (25.6%) and (81.4%) of studied nurses had positive attitude toward ovarian rejuvenation at pre and post-intervention phases respectively

Table (5): clarifies that there was a highly significant statistical positive correlation between total knowledge and attitude scores of the studied nurses at pre-intervention and post-intervention phases ($P \leq 0.001$)

Table (1): Frequency of the studied nurses according to personal characteristics (n.=86).

Personal characteristics M82KV	No	%
Age in (years)		
< 25	11	12.8
25 - < 35	25	29.1
35 - < 45	35	40.7
≥ 45	15	17.4
Mean ± SD = 35.44±7.74		
Residence		
Rural	50	58.1
Urban	36	41.9
Educational qualifications		
Nursing technical institute	53	61.6
Bachelor of science in nursing	28	32.6
Postgraduate studies	5	5.8
Years of experience in obstetrics and gynecology nursing		
< 5	20	23.3
5 - 10	46	53.4
> 10	20	23.3
Mean ± SD = 8.45±4.51		
Attending any educational courses regarding new approaches in treatment of premature ovarian failure		
No	86	100.0
Yes	0	0.0

Table (2): Frequency of the studied nurses according to knowledge regarding premature ovarian insufficiency at pre and post -intervention phases (n.=86).

Knowledge items	Pre-intervention				Post-intervention				X ²	(P-value)
	Correct answer		Incorrect answer		Correct answer		Incorrect answer			
	No	%	No	%	No	%	No	%		
Definition of premature ovarian insufficiency	62	72.1	24	27.9	86	100.0	0	0.0	27.89	0.000**
Causes of premature ovarian insufficiency	42	48.8	44	51.2	74	86.0	12	14.0	27.11	0.000**
Risk factors for premature ovarian insufficiency	29	33.7	57	66.3	80	93.0	6	7.0	65.14	0.000**
Symptoms premature ovarian insufficiency	50	58.1	36	41.9	82	95.3	4	4.7	33.35	0.001**
Diagnosis of premature ovarian insufficiency	20	23.3	66	76.7	65	75.6	21	24.4	47.09	0.000**
Complications of premature ovarian insufficiency	22	25.6	64	74.4	78	90.7	8	9.3	74.91	0.000**
Long-Term Health effect of premature ovarian insufficiency	18	20.9	68	79.1	71	82.6	15	17.4	60.69	0.000**
Effect of premature ovarian insufficiency on quality of life	25	29.1	61	70.9	70	81.4	16	18.6	47.61	0.000**
Prevention of complications of premature ovarian insufficiency	15	17.4	71	82.6	68	79.1	18	20.9	65.40	0.000**
Treatment of premature ovarian insufficiency	27	31.4	59	68.6	80	93.0	6	7.0	69.46	0.000**
Prognosis of premature ovarian insufficiency	30	34.9	56	65.1	72	83.7	14	16.3	42.49	0.000**

** Highly statistically significance P-value ≤ 0.001 .

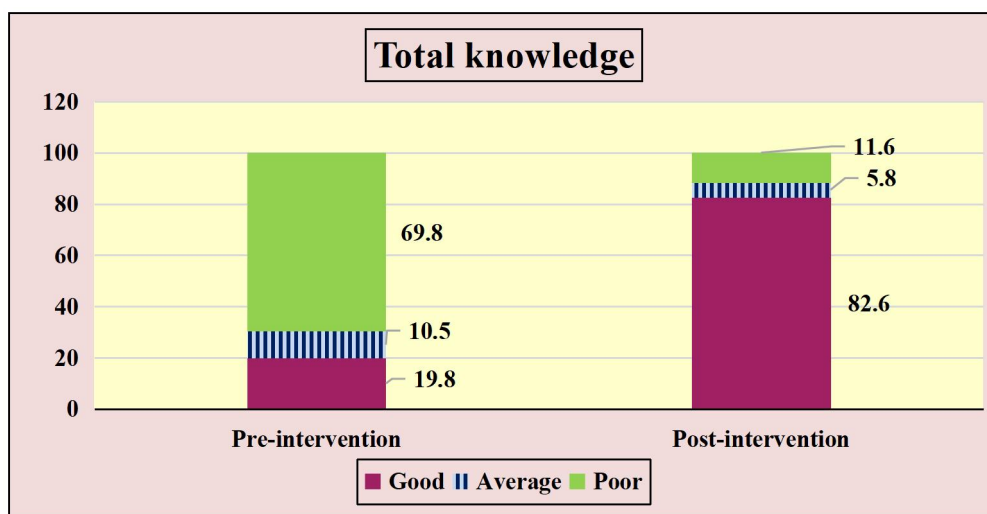
**Figure (1): Frequency of studied nurses according to total knowledge score regarding premature ovarian insufficiency and ovarian rejuvenation at pre and post-intervention phases (n=86).**

Table (3): Frequency of the studied nurses according to knowledge regarding ovarian rejuvenation at pre and post -intervention phases (n.=86).

Knowledge items	Pre-intervention				Post-intervention				X ²	(P-value)
	Correct answer		Incorrect answer		Correct answer		Incorrect answer			
	No	%	No	%	No	%	No	%		
Definition of ovarian rejuvenation therapy	34	39.5	52	60.5	86	100.0	0	0.0	74.53	0.000**
Main goal of ovarian rejuvenation therapy	28	32.6	58	67.4	77	89.5	9	10.5	58.70	0.000**
Potential benefits of ovarian rejuvenation	22	25.6	64	74.4	75	87.2	11	12.8	66.41	0.000**
Women to which ovarian rejuvenation is mainly recommended	25	29.1	61	70.9	72	83.7	14	16.3	52.22	0.000**
Ovarian rejuvenation is NOT recommended for	10	11.6	76	88.4	60	69.8	26	30.2	60.22	0.000**
Person responsible for performing the ovarian rejuvenation procedure	30	34.9	56	65.1	86	100.0	0	0.0	83.03	0.000**
Commonly used technique in ovarian rejuvenation	9	10.5	77	89.5	72	83.7	14	16.3	92.61	0.000**
Steps of ovarian rejuvenation	5	5.8	81	94.2	70	81.4	16	18.6	99.89	0.000**
Platelet-Rich Plasma (PRP) used in ovarian rejuvenation is derived from	42	48.8	44	51.2	86	100.0	0	0.0	59.12	0.000**
Route is commonly used for PRP injection	31	36.0	55	64.0	82	95.3	4	4.7	67.10	0.000**
Hormone are commonly monitored after ovarian rejuvenation	12	14.0	74	86.0	45	52.3	41	47.7	28.57	0.000**
Risks of Ovarian Rejuvenation	11	12.8	75	87.2	49	57.0	37	43.0	36.96	0.000**
Advantages of ovarian rejuvenation over other techniques	7	8.1	79	91.9	55	64.0	31	36.0	58.10	0.000**
Safety of ovarian rejuvenation	20	23.3	66	76.7	68	79.1	18	20.9	53.61	0.000**
Effectiveness of ovarian rejuvenation	26	30.2	60	69.8	76	88.4	10	11.6	60.22	0.000**
Factors on which success of ovarian rejuvenation depending on	28	32.6	58	67.4	85	98.8	1	1.2	83.82	0.000**
Duration expected usually to see improvement after ovarian rejuvenation	29	33.7	57	66.3	80	93.0	6	7.0	65.14	0.000**

** Highly statistically significance P-value ≤ 0.001 .

Table (4): Frequency of studied nurses regarding attitudes toward ovarian rejuvenation at pre and post-intervention phases (n.=86).

Attitude items	Pre-intervention						Post-intervention						X ²	P-value
	Agree		Uncertain		Disagree		Agree		Uncertain		Disagree			
	No	%	No	%	No	%	No	%	No	%	No	%		
Ovarian rejuvenation (PRP) is a relatively simple, minimally invasive and process	14	16.3	10	11.6	62	72.1	50	58.1	20	23.3	16	18.6	50.71	0.000**
Ovarian rejuvenation is a safe procedure when performed under proper medical guidelines.	9	10.5	26	30.2	51	59.3	44	51.2	20	23.3	22	25.6	35.41	0.000**
Ovarian rejuvenation has the potential to improve fertility outcomes.	19	22.1	38	44.2	29	33.7	66	76.7	10	11.6	10	11.6	51.57	0.000**
Ovarian rejuvenation may offer hope for women with diminished ovarian reserve.	25	29.1	25	29.1	36	41.9	66	76.7	10	11.6	10	11.6	39.59	0.000**
I feel confident in my competence when explaining the basics of ovarian rejuvenation to patients.	0	0.0	20	23.3	66	76.7	30	34.9	35	40.7	21	24.4	57.36	0.000**
Nurses should receive training about ovarian rejuvenation as part of reproductive health education.	30	34.9	56	65.1	0	0.0	80	93.0	6	7.0	0	0.0	63.05	0.000**
More research is needed before ovarian rejuvenation becomes a routine practice.	50	58.1	20	23.3	16	18.6	86	100.0	0	0.0	0	0.0	45.52	0.000**
I support offering ovarian rejuvenation as an option for eligible patients.	20	23.3	60	69.8	6	7.0	55	64.0	15	17.4	16	18.6	47.87	0.000**
Cost of ovarian rejuvenation may restrict its accessibility for many women.	25	29.1	61	70.9	0	0.0	45	52.3	41	47.7	0	0.0	9.63	0.002*
Ethical concerns surrounding ovarian rejuvenation may limit its clinical acceptance.	18	20.9	40	46.5	28	32.6	56	65.1	30	34.9	0	0.0	48.94	0.000**
Role of nurses is essential in guiding patients considering ovarian rejuvenation.	31	36.0	39	45.3	16	18.6	60	69.8	15	17.4	11	12.8	20.83	0.000**
The potential side effects of ovarian rejuvenation are much lower than with other treatment methods.	0	0.0	30	34.9	56	65.1	44	51.2	20	23.3	22	25.6	60.82	0.001**
Ovarian rejuvenation aligns with advancements in reproductive medicine.	13	15.1	36	41.9	37	43.0	52	60.5	34	39.5	0	0.0	60.45	0.000**

**A Highly statistically significant $p \leq 0.001$

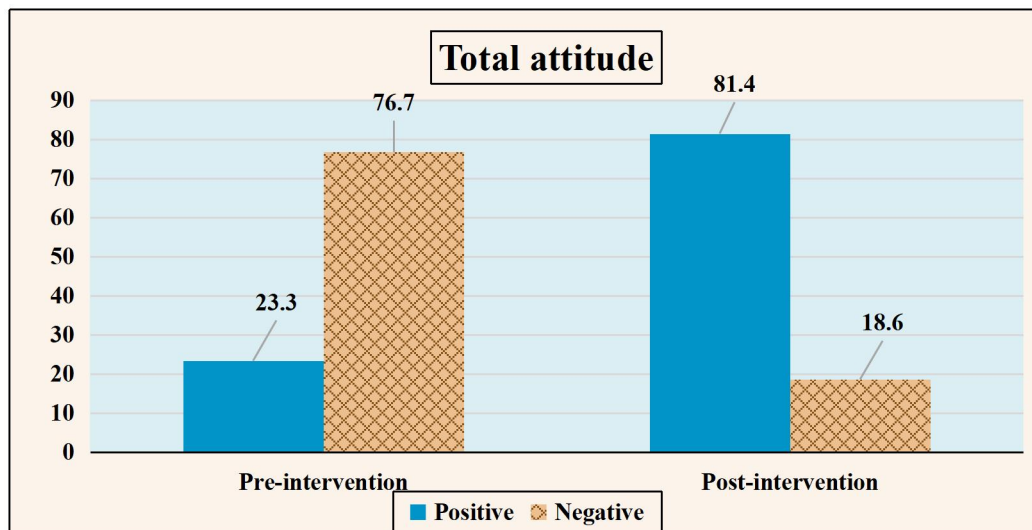


Figure (2): Frequency of studied nurses regarding total attitude score toward ovarian rejuvenation at pre and post-intervention phases (n=86)..

Table (5): Correlation between total knowledge and attitude scores of the studied nurses at pre and post-intervention phases (n.=86).

Variables	Total knowledge score			
	Pre-intervention		Post-intervention	
	r	P-value	r	P-value
Total attitude score	0.625	0.000**	0.691	0.000**

**A Highly statistically significant $p \leq 0.001$

Discussion

Ovarian rejuvenation is an emerging regenerative strategy that aims to restore ovarian function through techniques such as intra-ovarian platelet-rich plasma (PRP) injections and stem cell therapy. Recent studies suggest that PRP may “reactivate” quiescent follicles, although improving embryo quality remains unproven (*Barrenetxea, 2025*). Given these rapid advances, it is vital for nurses – as front-line patient educators – to stay abreast of the latest evidence. By doing so, they can provide accurate, balanced counselling on benefits, limitations, and risks, thereby helping patients make well-informed decisions. Their role in conveying realistic expectations and discussing ethical and experimental aspects is essential in this evolving field (*Anitua, 2025*).

In relation to *personal characteristics*, the finding of current research showed that more than two-fifths of studied nurses were in age group 35 - < 45 years old with a mean age of 35.44 ± 7.74 years. In relation to educational qualifications less than two-thirds of them

graduated from nursing technical institute and more than half of them lived in rural areas. As well as, more than half of them had 5-10 years of experience in obstetrics and gynecology nursing. Also, all of them didn't attend any educational courses regarding new approaches in treatment of premature ovarian failure.

Pertaining to *knowledge*, the results of current research demonstrated that there was a highly statistically significant difference between the results of post -intervention phase compared to pre-intervention phase in relation to all items of studied nurses' knowledge about premature ovarian failure and ovarian rejuvenation. It was displayed that, less than one-fifth and the majority of studied nurses had good knowledge regarding premature ovarian failure and ovarian rejuvenation at pre- and post-intervention phases respectively.

The researchers attribute these results to that in recent years, research has indicated that while direct studies on nurses' attitudes toward ovarian rejuvenation (e.g., platelet-rich plasma for ovarian regeneration) are scarce, there is

significant evidence of gaps in knowledge, confidence, and practice among nurses regarding ovarian rejuvenation techniques. Studies on fertility preservation consistently highlight that nurse often lack sufficient awareness, feel unprepared to counsel patients, and face barriers in clinical implementation.

Current research findings were supported by *Osman, El-Kest, and Alanazi (2025)* who conducted a qualitative study exploring the lived experiences of Egyptian women diagnosed with premature or precocious menopause. Although the study focused on women rather than nurses, the findings highlighted the essential role of nurses in providing emotional support, information, and guidance about reproductive health changes. Several women reported that the information they received from nurses was inconsistent or insufficient, which contributed to anxiety and confusion about their condition. These results underscore the broader need for improving nurses' knowledge about reproductive endocrine disorders, including premature ovarian insufficiency (POI), to ensure better patient support and counseling.

Moreover, *Alqersh and Ahmed (2022)* - although the intervention targeted patients rather than nurses-, the study demonstrated that professional education and structured instructional materials significantly improved women's understanding and management of their condition. This implies that nurses, as primary educators, must be adequately trained to guide POI women. The authors emphasized that many women initially lacked accurate information about POI, suggesting an educational gap that could be addressed by enhancing nurses' knowledge.

As also noted by *Alqersh and Nada (2025)* who their study revealed that women had very limited baseline knowledge about regenerative ovarian therapies, including stem cell applications, and their awareness improved significantly after the educational intervention. Although nurses were not the population under study, the findings strongly highlight the necessity of healthcare professionals—including nurses—to possess updated knowledge about novel regenerative treatments

such as ovarian PRP and stem-cell therapy to provide accurate information and counseling.

The results of previous researches were in agreement with *Satılmış et al. (2024)* who showed that nurses commonly lacked adequate knowledge about fertility-related interventions and felt unprepared to counsel patients. These findings align with the broader theme that nurses' knowledge about reproductive technologies—including regenerative ovarian therapies—needs improvement through structured educational programs.

The researchers concluded that all the cited results align closely with our theoretical framework by showing a persistent knowledge deficit among nurses regarding new reproductive technologies, thereby reinforcing the need for targeted educational programs on advanced reproductive innovations such as ovarian regeneration with stem cells or PRP.

Concerning *attitude*, our research findings indicated that clarified that, there is a marked positive change in attitude of studied nurses toward premature ovarian failure and ovarian rejuvenation after implementation of the educational bundle with a highly statistically significant difference between pre and post-intervention phases. It was indicated that, nearly more than one-quarter and the majority of studied nurses had positive attitude toward ovarian rejuvenation at pre and post-intervention phases respectively.

These results may be due to that the educational interventions have been shown to significantly improve nurses' knowledge, attitudes, and readiness to engage in fertility counseling. These findings support the urgent need for tailored educational and awareness programs to empower nurses to adopt positive attitude and to take a more active, informed role in fertility preservation discussions, and potentially in future technologies like ovarian rejuvenation

In accordance with the same context, *Magdy et al., (2024)* reported that educational programs tailored for nurses working in maternal and reproductive health settings are crucial to build their foundational knowledge and to adopt positive attitude about ovarian

rejuvenation techniques. This not only enhances their competence but also contributes to safer clinical practice. Without targeted training, misconceptions or lack of awareness may limit the integration of such innovative treatments into routine maternal care.

As well as, *ElAdham and Shaban, (2023)* expressed that, educational interventions play a critical role in shaping attitudes and beliefs among nurses about fertility preservation and ovarian rejuvenation. By offering structured guidelines, workshops, and awareness sessions, such programs can counteract resistance, reduce ethical concerns, and foster a more positive outlook toward patients seeking fertility restoration leading to support patients, advocate for the use of cutting-edge therapies, and engage confidently in counseling about these options.

In addition, all the previous results were consistent with *Hussain et al., (2025)* who indicated that sustained and continuous educational programming is especially important in the context of rapidly evolving reproductive medicine especially in innovative techniques for ovarian rejuvenation emerge. Ongoing training ensures that they are not left behind by the latest scientific developments, enabling them to provide evidence-based care, maintain professional credibility, and contribute to high-quality patient outcomes; which end with having positive attitude.

In the same harmony, *Nouh et al., (2025)* demonstrated that educational initiatives also help to empower nurses to become health educators themselves. When they receive up-to-date training about ovarian rejuvenation, they will have positive attitude and can confidently educate their patients, dispel myths, and guide informed decision-making. This multiplier effect means that well-educated nurses can play a pivotal role in community outreach, counseling sessions, and patient advocacy, thereby amplifying the impact of the original training program.

Increasingly, *Serdarogullari et al., (2024)* summarized that maintaining and scaling educational programs is vital for long-term integration of modern ovarian rejuvenation techniques into maternal health

services. Health systems that invest in continued professional development for nurses can better institutionalize innovative attitude, ensure standardized care protocols, and build a culture of lifelong learning, fostering trust with patients and improving the overall quality of fertility care.

Correlation :As regard correlation between study variables, the present research result stated that there was a highly significant statistical positive correlation between total knowledge and attitude scores of the studied nurses at pre-intervention and post-intervention phases. In line with our results, *Abdalla and Hassan, (2024)* concluded that research consistently shows a positive correlation between nurses' knowledge of ovarian rejuvenation techniques and their attitudes toward these procedures. As nurses gain more accurate and comprehensive information about fertility preservation and ovarian technologies, they tend to adopt a more favorable perspective. Knowledge enhances nurses' ability to discuss advanced reproductive options with patients, and reduces misconceptions. In essence, well-informed nurses are more likely to support and advocate for innovative ovarian treatments.

In same context, *El-Sayed and Farag, (2023)* mentioned that educational interventions further reinforce this positive relationship. The significant improvement in nurses' knowledge about ovarian rejuvenation, in turn translates into more positive attitudes. This shows that knowledge is not merely associated with attitude, but actively shapes it: the more nurses understand the science, benefits, and patient eligibility criteria, the more likely they are to adopt constructive views toward these advanced therapies. Also, *Mohamed and El-Badry, (2025)* indicated that the positive correlation between knowledge and attitude has practical implications for patient care. Nurses with higher knowledge levels and favorable attitudes toward ovarian rejuvenation are more proactive in counseling patients, explaining the procedures, and supporting informed decision-making.

Conclusion

The findings of the research demonstrated a significant and remarkable improvement in nurses' perception toward ovarian rejuvenation technology following the implementation of the educational bundle with a highly statistically significant differences between the pre and post-intervention stages, indicating the strong effectiveness of the educational bundle. Furthermore, a strong positive correlation was observed between knowledge and attitudes in both the pre- and post-intervention phases, with highly significant statistical differences. This suggests that as nurses' knowledge about ovarian rejuvenation technology increased, their attitudes became more favorable. Therefore, the aim of the research was successfully achieved, and research hypothesis was clearly supported

Recommendations:

Based on the research findings it was recommended that:

- Integrate continuous training programs on ovarian rejuvenation technologies into nursing education curricula to ensure sustained knowledge and improved perception among nurses.
- Develop standardized clinical guidelines for nurses regarding the principles, indications, benefits, and limitations of ovarian rejuvenation as a management option for premature ovarian insufficiency.
- Encourage periodic competency assessments to evaluate nurses' understanding and readiness to support patients undergoing ovarian rejuvenation procedures.
- Promote interdisciplinary collaboration between nurses, gynecologists, and reproductive specialists to enhance communication and strengthen the implementation of innovative reproductive technologies.

Further researches:

- Conduct further large-scale studies to explore long-term effects of educational interventions on nurses' knowledge, attitudes, and clinical practices related to ovarian rejuvenation.
- Investigate whether improved perception and knowledge translate into enhanced clinical practice and decision-making when caring for patients with premature ovarian failure.
- Compare the effectiveness of different teaching methods (e-learning, workshops, simulation-based training) in improving nurses' understanding of ovarian rejuvenation technology.

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