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Ovarian Tissue Cryopreservation Counseling: It's Effect on Knowledge and Attitude of Young Female Cancer Patients

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Abstract:
Background: One of the most important factors affecting the quality of life for cancer patients is fertility, which is also regarded as a foundational element of high-quality cancer care when the disease is discovered early. Ovarian tissue cryopreservation is applied for patients undergoing gonadotoxic radiotherapy or chemotherapy treatment to preserve their fertility and to enable them to have children in the future. **Aim:** To evaluate the effect of ovarian tissue cryopreservation counseling on knowledge and attitude of young female cancer patients. **Design:** A quasi-experimental design (one group pre & posttest). **Study sample**: A non-probability purposive sample of 100 young female cancer patients. **Setting:** This study was conducted at the Oncology Center, Mansoura University Hospitals, Mansoura City, Egypt. **Three tools were used:** A structured interview questionnaire, knowledge of young female cancer patients about ovarian tissue cryopreservation, and young female patients' attitude scale. **Results:** 87% of young females had satisfactory knowledge post counseling also, 92% of them developed a positive attitude, whereas only 8% maintained a negative attitude. In addition, a positive correlation was observed between scores of knowledge, and attitude among young female cancer patients regarding ovarian tissue cryopreservation (p= 0.001). **Conclusion:** Ovarian tissue cryopreservation counseling was effective in improving knowledge and changing attitude of young female cancer patients. **Recommendations:** Integrate protocols to enhance counseling and communication between health care team and young female cancer patients regarding ovarian tissue cryopreservation as a method to preserve their fertility.

Keywords: Attitude, Counseling, Knowledge, Ovarian tissue cryopreservation &Young female cancer patients.

Introduction:
Globally, the number of cancer-related deaths is rising in tandem with the incidence of the disease **(Bray et al., 2021).** United States is expected to have 2,041,910 new cases of cancer and 618,120 cancer-related deaths in 2025 **(Siegel et al., 2025).** A total of 134,632 newly diagnosed cancer cases and 89,042 reported deaths occurred in Egypt in 2020 **(Global Cancer Observatory (Globocan), 2020).** Today, improving patients' quality of life through preserving their fertility is an important issue for those patients not only to ensure survival **(Yinfeng et al., 2020).**

Cancer patients may experience decreased fertility caused by cancer therapy; also, some females experience temporary loss of ovarian function, while others experience permanent loss **(Wright et al., 2018).** According to statistics, cancer treatment affects fertility, about 30-75% in males and 40-80 % of female cancer patients, which typically results in long-lasting fertility issues **(Miok et al., 2019).** Fertility preservation is a cutting-edge, new reproductive health technology area that is gaining popularity worldwide for both non-medical and medical reasons. Both healthy women who wish to postpone marriage and progeny and non-healthy women who have illnesses or medical procedures that may reduce their fertility can become parents **(Al Ghaithi et al., 2023).**

Currently, ovarian tissue cryopreservation, oocyte cryopreservation, and embryo cryopreservation are the three main methods used today to preserve female fertility. The cryopreservation of oocytes and embryos is advised as recognized choices for post-puberty fertility preservation **(Fraison et al., 2023).** but necessitate regulated ovarian stimulation. As a result, these methods work best for patients whose treatments may be delayed by around two weeks **(Cacciottola et al., 2022).**

Ovarian tissue cryopreservation (OTC.) is an innovative approach that can preserve fertility and restore endocrine functions with live births after transplantation **(Fraison et al., 2023 & Rodriguez-Wallberg et al., 2021).** For prepubertal children and women whose gonadotoxic treatments cannot be postponed, ovarian tissue cryopreservation is the only viable alternative that can protect fertility and restore endocrine functions **(Antunes et al., 2023).**

Significant progress is being made in autologous transplantation techniques following ovarian cryopreservation, enhancing the ability to restore endocrine function **(Khattak et al., 2022).** More than 200 infants have been born globally since the first ovarian tissue cryopreservation baby was born in

2004 **(Dolmans et al., 2021 b).** Ovarian tissue collection for transplantation involves removing a tiny sample of ovarian tissue that is taken during a laparoscopic surgery to obtain ovarian tissue for transplantation **(Fabbri et al., 2022).** The excised ovaries are either cryopreserved or implanted after being cut into small pieces. Particularly in storage facilities where samples are closely monitored and preserved, the cryopreserved ovarian tissues can be kept for many years in a liquid nitrogen tank (-196°C) **(Mohammed et al., 2024) Figure 1(Donnez & Dolmans, 2017).**

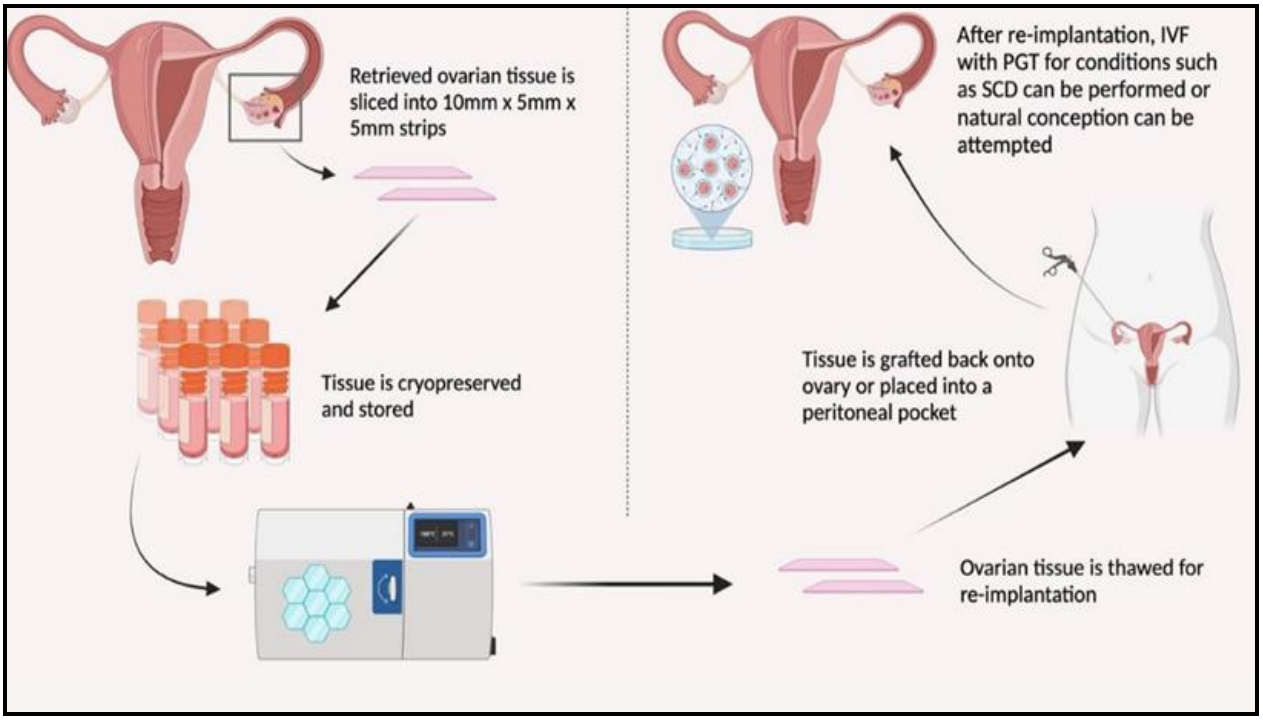

Figure (1): Process of ovarian tissue cryopreservation

Note. The process of retrieval and cryopreservation of ovarian tissue (left), followed by reimplantation of thawed tissue into the patient (right). **Adopted from (Donnez & Dolmans, 2017).**

Following illness remission, cryopreserved ovarian tissue may be thawed for orthotopic transplantation to restore appropriate ovarian endocrine function and offer the chance of becoming pregnant. Women whose tissue was cryopreserved at a younger age have shown the greatest effectiveness with this technique **(Andersen et al., 2019).** After cryopreserved and thawed ovarian tissue was transplanted, more than 130 live babies were documented **(Donnez & Dolmans, 2021).** In Europe, a network of five centers reported a pregnancy rate of 29% and a live birth rate of 23%, while another study reported a pregnancy rate of 33% and a live birth rate of 25% **(Donnez et al., 2015 & Van der Ven et al., 2016).**

Fertility-related information regarding the effects of a planned treatment and information on fertility preservation should be provided in oncological and hematological care programs, as well as in cases of gonadotoxic treatments for benign illnesses that may also affect fertility. Due to the delayed initiation of childbearing and the increased risk of cancer with aging, these women need quick and effective management techniques **(Dolmans et al., 2021a).**

Counseling and educating the young females cancer patients have been regarded as one of the most successful ways to change females' knowledge and attitude about cryopreservation. Without proper supervision, young female patients could not be adequately informed about the potential of freezing tissues of ovary to preserve fertility. Lack of guidance may lead to loss of the opportunity to maintain fertility. Healthcare workers, especially nurses who treat cancer patients, need to stay up to date on the newest developments in fertility preservation technology to provide the best treatment services **(Fahmy & Mohamed, 2021).**

Significance of the study:

Preserving fertility in female cancer patients has received a lot of attention in recent years. According to a comprehensive systematic analysis, between 66% and 100% of cancer patients indicated that they needed information about fertility, especially those

who were young, childless, and had plans to have children. However, due to a serious lack of information support services related to fertility, a lack of understanding about fertility, and a lack of awareness about fertility preservation **(Mahey et al., 2020 & Villarreal- Garza et al., 2021).**

Ovarian tissue cryopreservation has become a widely adopted and significant method developed from being an experimental procedure to being a standard method of fertility preservation since the late 1990s for fertility preservation as an increasing number of women become aware of its benefits **(Macklon, 2020; Dolmans et al., 2021 & Schallmoser et al., 2023).** The only way to maintain fertility in women receiving cancer treatment that cannot be postponed or in prepubertal girls for whom mature germ cells are unavailable is through ovarian tissue cryopreservation, as opposed to oocyte cryopreservation **(Duffin et al., 2023).** Fifty percent of the women had ovarian tissue transplantation achieved pregnancies and 28.4-42.0% of them delivered an infant **(Shapira et al., 2020).**

Counseling possible hazards to fertility is a component of holistic treatment for cancer patients in a flexible, efficient, and multidisciplinary decision-making process **(Panagiotopoulou et al., 2018).** It is important to discuss possible fertility preservation methods such as ovarian tissue cryopreservation, a counseling approach, and a risk-benefit analysis of the various treatments. Therefore, counseling and fertility preservation could improve the lives of thousands of people worldwide **(Ranniger et al., 2024).** There are limited studies regarding the effect of ovarian tissue cryopreservation counseling on knowledge and attitude representing a gap. The current study tries to fill such gap by evaluating the effect of ovarian tissue cryopreservation counseling on knowledge and attitude of young female cancer patients.

Aim of the study:

This study aimed to evaluate the effect of ovarian tissue cryopreservation counseling on knowledge and attitude of young female cancer patients.

Hypotheses of the study:

Counseling is anticipated to be an effective method for improving the young female cancer patients' knowledge and attitude regarding ovarian tissue cryopreservation as evidenced by:

Hypothesis (I): Counseling significantly improves the knowledge of young female cancer patients regarding ovarian tissue cryopreservation.

Hypothesis (II): Counseling significantly changes the attitude of young female cancer patients regarding ovarian tissue cryopreservation.

Hypothesis (III): Significant positive correlation between the young female cancer patients' knowledge and their attitude regarding ovarian tissue cryopreservation.

Operational definitions:

Ovarian tissue cryopreservation: Is the technique of slowly freezing ovarian tissue at -196 °C and keeping it in liquid nitrogen, normal conception can be achieved after implanting these tissues. This technique is used to preserve female's fertility **(Mohammed et al., 2024).**

Counseling: In the current study it means prearranged educating sessions aimed at providing the young female cancer patients with necessary information about ovarian tissue cryopreservation to improve patients' knowledge and changing their attitude regarding this topic.

Knowledge: In the current study it means knowledge of young female cancer patients about ovarian tissue cryopreservation it was assessed before and after counseling using young female cancer patients' knowledge assessment tool.

Attitude: In the current study females react positively or negatively to the technique of ovarian tissue cryopreservation as a method to preserve their fertility before and after counseling, it can be assessed using the young female cancer patients' attitude scale.

Subjects and Method

Study design:

A quasi-experimental research design (pre, & posttest) was used in this study. The effect of the independent variable (i.e., ovarian tissue cryopreservation counseling) on the dependent variables (i.e., knowledge and attitude of young female cancer patients) were assessed in this study.

Study setting:

The study was carried out at Medical Outpatient and Hematology Clinics at the Oncology Center, Mansoura University Hospitals, Egypt during the period from the beginning of January 2024 to the end of December 2024. This center has a high flow rate of cancer patients and provides health care for large populations.

Sample type: A purposive sample was used.

Study subjects:

One hundred young female cancer patients were chosen from the previous setting to participate in the current study according to the following criteria:

Inclusion criteria:

- Young females.
- Age: 18-35 years.
- Cancer patients.

Exclusion criteria:

- Females with uterine cancer/ bilateral ovarian cancer.
- End stage of cancer.

- Those undergoing hysterectomy.
- Those undergoing chemotherapy.

Sample size calculation:

The sample size was calculated according to the study of **Rashed et al., 2018) and depending on G 'power' version 3.1,** where a paired-samples t-test was used to assess the difference in (knowledge, & attitude) before and after ovarian tissue cryopreservation counseling.

The parameters used for the calculation were as follows:

- Effect size (Cohen's d) = 0.26
- Significance level (α) = 0.05
- Statistical power (1–β) = 0.80
- Two-tailed test

Based on these parameters, the estimated minimum required sample size was approximately 99 participants. Therefore, a total of 100 participants were included in the study to ensure adequate statistical power and account for possible data loss.

Data collection tools:

Three tools were developed by the researcher after reviewing the related national and international studies to attain the study's aim **(Khattak et al., 2022; Trapphoff & Dieterle, 2023 & Rashed et al., 2018).**

Tool (I): A Structured Interview questionnaire:

It included 2 parts:

Part (1): It contained general characteristics of young female cancer patients as age, education, occupation, residence, & income.

Part (2): It covered current oncology history as a type of cancer, & recommended type of treatment.

Tool (II) Knowledge of young female cancer patients about ovarian tissue cryopreservation (OTC.): This tool was developed by the researcher to assess knowledge of the young female cancer patients regarding ovarian tissue cryopreservation pre and post counseling. It contained 34 closed-ended questions in the form of multiple choices divided into **4 domains** as the following:

The **first domain** assessed knowledge about cancer and included 5 questions as definition, treatment, & effect of cancer on fertility……, etc.

The **second domain** assessed knowledge of females about ovarian tissue cryopreservation and included 9 questions as definition, aim, indication, suitable age for utilizing ovarian tissue cryopreservation …. , etc.

The **third domain** entitled mechanism & techniques of OTC: This part included 8 questions as first step of OTC., method used for protection, slow freezing and vitrification……., etc.

The **fourth domain** assessed knowledge regarding ethical considerations, clinical applications and challenges for applying OTC: This part consisted of 12 questions as Islamic ruling about OTC., important issues following cryopreservation, ethical challenges, and potential risks……etc.

Scoring system: Each correct answer was scored as (1), while incorrect answer equaled (0). The total score ranged from (0–34). Unsatisfactory knowledge ranged from 0 to 16 (< 50%), & satisfactory knowledge ranged from 17 to 34 (≥ 50%) **(Farrag & El-tohamy, 2020).**

Tool (III): Young Female Cancer Patients' Attitude Scale:

This tool was developed by the researcher to assess young females' attitude toward ovarian tissue cryopreservation pre, & post counseling. It consisted of **16** statements with three points Likert Scale: **(1) disagree, (2) neutral and (3) agree** for the positive sentences as I feel that ovarian tissue cryopreservation gives me a real chance to conceive after recovering from cancer, I believe that ovarian tissue cryopreservation represents a significant medical advancement in the care of female cancer patients…, etc. While, for the negative reversed statements these were scored as: **(3) disagree, (2) neutral and (1) agree** as I am worried that ovarian tissue cryopreservation may delay the start of my cancer treatment., I fear that ovarian tissue cryopreservation may have long-term side effects, …. etc.

Scoring system:

The scale of attitude had a total score ranged from (1-48). The score of 1 to 24 (< 50%) referred to as negative attitude while, a score of 25 to 48 (≥ 50%) indicated a positive attitude **(Farrag& El-tohamy, 2020).**

Validity of the tools:

Data collection tools were tested and injured for the content validity by three specialists in woman's health & midwifery nursing field and the recommended modifications were done as deleting some questions to become suitable for patients' time.

Reliability of the tools:

The tools of data collection: Knowledge of young female cancer patients about ovarian tissue cryopreservation, & young female patients' attitude scale were examined by "Cronbach's Alpha Coefficient" for their reliability and they were **(0.94, & 0.95 respectively)** which means high reliability of the current study's tools.

Pilot study:

A pilot study was conducted on 10% (10 young female) from the beginning of November to the end of December 2023 to assess the feasibility, objectivity application of the study's tools, and the required time to fulfill such tools. Necessary modifications were done as deleting some questions to make the tool more concise. Those females were excluded from the total sample.

Ethical considerations:

An ethical approval from the Research Ethics Committee of the Faculty of Nursing at Mansoura University, Egypt with **Ref. No. 0522 on (31/8/2023),** in addition to an approval from the director of Mansoura University to carry out this study. Following an explanation of the study's aim and approach, each female gave her written consent. All females were reassured regarding the privacy of collected data and were given the option to withdraw from the study when they want.

Field work:

The data was carried out from the beginning of January 2024 to the end of December 2024. The researcher followed **four phases** to attain the aim of the current study:

Preparatory phase:

- After revising the relevant literature to prepare the data collection tools, the researcher obtained approval from both the head of the Woman's Health & Midwifery Nursing Department, Faculty of Nursing, Mansoura University and the director of Oncology Center at Mansoura University Hospitals.
- The pilot study was conducted to evaluate the ability of the tools to be utilized and estimate the time allotted for data collection.
- The researcher created and arranged the schedule of the counseling sessions. Media, teaching strategies, learning activities, and goals were designed. The content of counseling was divided into four sessions; each lasted between 30-45 minutes.

Assessment phase:

"At the beginning, the researcher attended the Oncology Center at Mansoura University Hospitals on Sundays and Mondays each week for the Medical Outpatient Clinics, and on Saturdays and Tuesdays each week for the Hematology Outpatient Clinics." from 9-2 P.M. to interview from (4-5) young female cancer patients, introduced herself to each participant, clarify the study's aim and obtained her written consent to participate in the study. To keep confidentially and obtain the data of general characteristics and current oncology history, each female was interviewed individually for 30 minutes. After that, a pre-counseling assessment (pretest) was performed regarding young female cancer patients' knowledge and attitude about ovarian tissue cryopreservation using the prementioned tools.

Implementation phase:

- Based on pre-counseling assessment, four sessions regarding ovarian tissue cryopreservation were provided in Arabic language to suit the different educational levels of the young female cancer patients using PowerPoint presentation and attractive colored booklet contained related pictures that was given to each female from the first session.
- The researcher attended the study setting in the morning for 4 days/ week, conducted each session for (4-5) young female cancer patients for (30-45) minutes including group discussion and differ according to the young female cancer patient's response. The counseling sessions included the following:

First session: Involved orientation, explaining the aim of the study and covering the basic knowledge about cancer as definition, treatment, it's effect on fertility, definition of fertility and methods to preserve female fertility.

Second session: Concerned with knowledge related to ovarian tissue cryopreservation as its definition, aim, indication, suitable age, factors affecting success of the technique…., etc.

Third session: Discussed knowledge related to the mechanism and technique of ovarian tissue cryopreservation as the first step of OTC., technique, methods.

Fourth session: Provided knowledge related to ethical considerations, clinical applications and challenges related to utilizing OTC. technique as Islamic concern, ethical issues, harms after implantation of cryopreserved ovarian tissue cryopreservation.

- The researcher employed different teaching methods during the sessions, including interactive group discussions and lectures. Additionally, the instructional materials and techniques (such as simple booklet with colored pictures, PowerPoint presentations and poster, brainstorming,). Each session started with a feedback session.

Evaluation phase:

After 4 weeks, the researcher conducted post-test by utilizing the same prementioned tools to evaluate the effect of counseling on young female cancer patients' knowledge and attitude regarding ovarian tissue cryopreservation.

Statistical analysis:

"IBM SPSS Statistics Version 26 for Windows Package Program" was utilized to analyze data of the current study. Percentages and numbers presented categorical data. While (Mean ± SD) for numerical data. Differences between the pre and posttest for the studied group were tested using (X^2) for categorical variables while, (t-test) for numerical variables. In addition to Modified Blake's Gain Ratio test to evaluate level of improvement in knowledge among young female cancer patients concerning ovarian tissue cryopreservation. Moreover, Cronbach's Alpha Coefficient was used to test tools' reliability. Pearson correlation co-efficient was used to test correlation between variables. Significance differences were estimated at p-value ≤ 0.05 (**Kwak, 2023).**

Results:

Table (1): General characteristics of young female cancer patients (n=100)

Variables	No.	%
Age		
< 20 years.	11	11%
20- < 30 years.	54	54%
30- 35 years	35	35%
Mean ± SD	**25.15 ± 5.53**	
Education level		
Can read & write.	6	6%
Primary education	33	33%
Secondary education.	26	26%
University education.	35	35%
Residence		
Urban	45	45%
Rural	55	55%
Marital status		
Single	41	41%
Married	55	55%
Divorced	4	4%
Occupation		
Student	21	21%
Working	37	37%
Housewife	42	42%
Income		
In sufficient	65	65%
Sufficient	29	29%
Sufficient & saved.	6	6%

Table (2): Current oncology history of young female cancer patients(n=100)

Variables	No.	%
Type of cancer		
Leukemia	30	30%
Breast cancer	32	32%
Unilateral ovarian cancer	19	19%
Lymph nodes	7	7%
Intestinal	6	6%
Kidney	1	1%
Bone	5	5%
Recommended treatment of cancer		
Chemotherapy only	41	41%
Chemotherapy then surgery	27	27%
Surgery then chemotherapy	19	19%
Radiotherapy on pelvic region	13	13%

Table (3): Knowledge of young female cancer patients regarding ovarian tissue cryopreservation (n= 100)

Variable	Before counseling		After counseling		t	P - value
	Mean	SD	Mean	SD		
1. Knowledge regarding cancer	0.93	1.39	3.99	1.32	17.65	0.001**
2. Knowledge regarding ovarian tissue cryopreservation.	1.48	2.19	7.42	2.04	22.19	0.001**
3. Mechanism and techniques of ovarian tissue cryopreservation.	1.42	2.08	6.46	1.84	21.08	0.001**
4. Ethical considerations, clinical applications, and challenges regarding ovarian tissue cryopreservation.	2.22	3.18	10.23	2.25	24.56	0.001**
Total knowledge score	6.05	7.72	28.10	6.95	25.46	0.001**

Paired t sample test ***Highly statistically significant difference (p< 0.001)*

Table (4): Blake Modified Gain Ratio regarding the knowledge of young female cancer patients about ovarian tissue cryopreservation(n=100)

Total knowledge score	Mean in the pretest	Mean in the post test	Modified gain ratio	Significance
34	6.05	28.10	1.44	effective as it is above 1.2

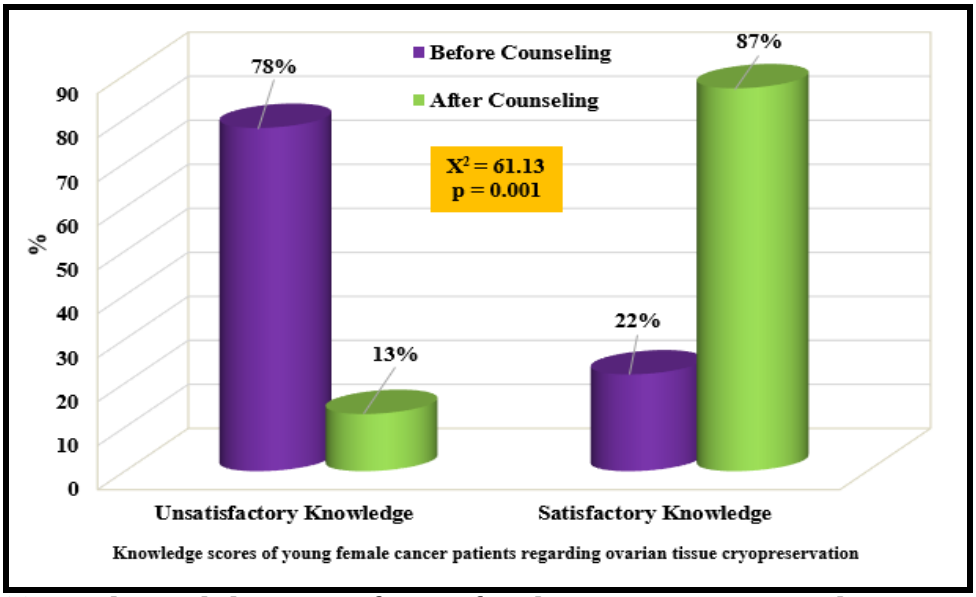

Figure (2): Total Knowledge scores of young female cancer patients regarding ovarian tissue cryopreservation before & after counseling (n=100)

Table (5): Attitude of young female cancer patients regarding ovarian tissue cryopreservation before and after counseling (n=100)

Items	Before Counseling			After Counseling			X^2	P- value
	Agree	Neutral	Disagree	Agree	Neutral	Disagree		
1. I feel that Ovarian tissue cryopreservation (OTC) gives me a real chance to conceive after recovering from cancer.	5	9	86	60	22	18	37.73	0.001**
2. I am worried that OTC. may delay the start of my cancer treatment.	90	6	4	19	22	59	25.06	0.001**
3. I believe that OTC. represents a significant medical advancement in the care of female cancer patients.	4	5	91	64	23	13	19.57	0.001**
4. I fear that OTC. may have long-term side effects.	84	12	4	19	27	54	19.40	0.001**
5. I support OTC. if I have the opportunity before starting treatment.	3	2	95	70	13	17	14.87	0.005**
6. I think society is not very accepting of the idea of having children after recovering from cancer.	87	9	4	16	18	66	18.01	0.001**
7. I want OTC. to be part of the treatment plan, not just a secondary option.	1	10	89	48	33	19	17.33	0.002**
8. I fear that OTC. may lead to the loss of virginity in young females.	87	11	2	19	25	56	12.04	0.02*
9. I encourage women with cancer to consider ovarian tissue preservation.	3	5	92	63	21	16	21.33	0.000**
10. I see that OTC. is unsafe or complicated.	85	12	3	11	16	73	27.12	0.000**
11. I believe that doctors should discuss	4	2	94	64	19	17	10.88	0.03*

Items	Before Counseling			After Counseling			X^2	P- value
	Agree	Neutral	Disagree	Agree	Neutral	Disagree		
how to preserve ovarian tissue through cryopreservation with all women diagnosed with cancer.								
12.I believe that OTC. is too expensive and not worth the hassle.	88	10	2	17	18	65	39.87	0.001**
13.I see that OTC. provides me with psychological support during my treatment journey.	5	10	85	62	22	16	12.82	0.01*
14.I believe that OTC. is ineffective in preserving fertility.	89	9	2	20	27	53	10.14	0.04**
15.I know that preserving fertility after cancer is important to me.	3	4	93	59	24	17	15.11	0.004**
16.I'm afraid that OTC. might get mixed up between female patients during cryopreservation.	82	14	4	16	23	61	14.09	0.007**
Total attitude score	**18.36± 4.96**			**39.07± 8.15**			**t=24. 42**	**0.001****

X^2 Chi square test ***Highly statistically significant difference (P <0.001).*

Table (6): Blake Modified Gain Ratio regarding the attitude of young female cancer patients about ovarian tissue cryopreservation(n=100)

Total attitude score	Mean in the pretest	Mean in the posttest	Modified gain ratio	Significance
48	18.36	39.07	1.13	Moderate effective as it is < 1.2

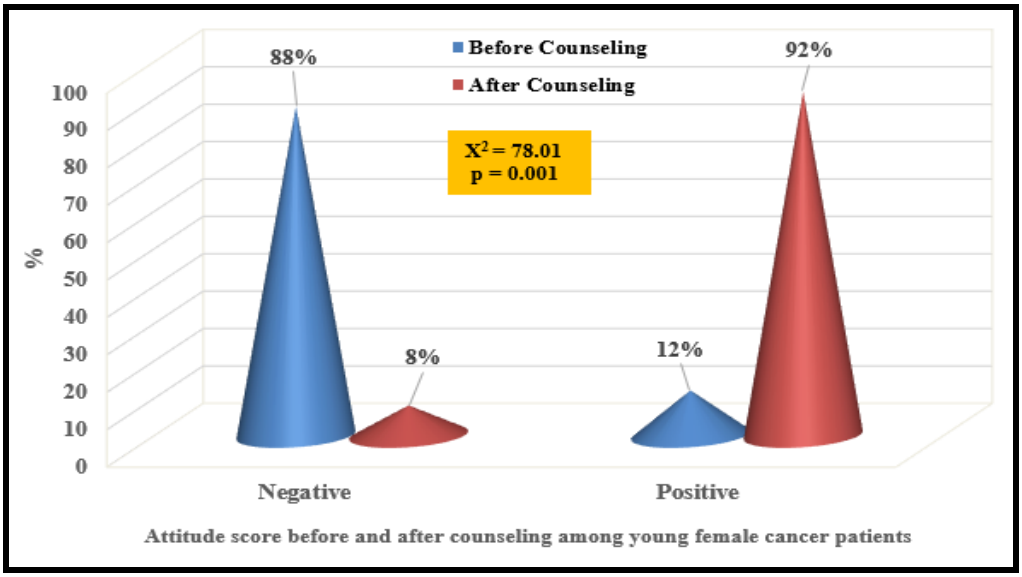

Figure (3): Total attitude score before and after counseling among young female cancer patients (n=100)

Table (7): Correlation between total knowledge and total attitude scores regarding ovarian tissue cryopreservation before and after counseling among young female cancer patients (n=100)

Variable		Total knowledge score			
		Before counseling		After counseling	
		R	P	R	P
Total attitude score	Before counseling	0.17	0.10		
	After counseling			0.80	0.001**

*** Highly statistically significant (p=0.001)* *R Pearson Correlation Coefficient*

Table (1): Displays general characteristics of the female cancer patients. The mean age of female is 25.15 ± 5.53. Regarding education, 6 % of female can read & write, while 35% of them had university education. 55 % of female are married, with 55 % are living in rural areas. Concerning occupation, 42 % are housewives. In addition to 65 % of female had insufficient income.

Table (2): Presents current oncology history of young female cancer patients, among them, 32% have breast cancer, while 1% have kidney cancer. Additionally, 41% of the females are recommended for having chemotherapy only, while 13% are recommended for having radiotherapy on the pelvic region.

Table (3): Shows highly statistically significant differences between before & after counseling among the young females in all domains of knowledge regarding cancer, ovarian tissue cryopreservation, mechanism and techniques of ovarian tissue cryopreservation, ethical considerations, clinical applications, and challenges regarding ovarian tissue cryopreservation (p= 0.001).

Table (4): Points to significant improvement in total knowledge score as presented by test of **MG** $_{\text{Blake Ratio}}$ = 1.44 which is effective as it is > 1.2.

Figure (2): Explains before counseling, 78% of young female cancer patients have unsatisfactory knowledge regarding ovarian tissue cryopreservation compared to only 22% of them have satisfactory knowledge. While, after counseling 87% of young female have satisfactory knowledge compared to 13% have unsatisfactory knowledge with highly significant differences at (p =0.001).

Table (5): Demonstrates highly statistically significant differences between before and after counseling in all items of attitude regarding ovarian tissue cryopreservation among young female cancer patients with mean and SD (18.36 ± 4.96, 39.07 ± 8.15 respectively) at (p= 0.001).

Table (6): Reveals moderate effectiveness of the (OTC.) counseling on females' attitude regarding ovarian tissue cryopreservation as presented by test of **MG** $_{\text{Blake Ratio}}$ = 1.13 which is < 1.2.

Figure (3): Clarifies before counseling, 88% of young female cancer patients had a negative attitude toward ovarian tissue cryopreservation, and only 12% had a positive attitude. While, after counseling 92% of young females developed a positive attitude, and only 8% maintained a negative attitude.

Table (7): Highlights that after counseling, a highly statistically positive correlation was found between the total knowledge score and the total attitude score among young female cancer patients regarding ovarian tissue cryopreservation, compared to before counseling (p = 0.001).

Discussion:

The current study aimed to evaluate the effect of ovarian tissue cryopreservation counseling on knowledge and attitude of young female cancer patients. The findings of this study reported that there was significant improvement in knowledge and a change in attitude. Additionally, a positive correlation was found between knowledge and attitude regarding ovarian tissue cryopreservation among young female cancer patients after counseling. Therefore, hypotheses of the study "counseling significantly improves knowledge of young female cancer patients regarding ovarian tissue cryopreservation, counseling significantly changes attitude of young female cancer patients regarding ovarian tissue cryopreservation. Also, significant positive correlation between knowledge, and attitude of young female cancer patients regarding ovarian tissue cryopreservation were reinforced.

Findings of the current study showed that, post implementation of the counseling sessions, young female cancer patients exhibited a statistically significant improvement in all domains of knowledge regarding cancer, ovarian tissue cryopreservation, mechanism and techniques in addition to its ethical considerations, clinical applications. The researcher interpreted this result due to the positive effect of counseling that provided females with the most necessary, simplest and accurate knowledge.

This finding is consistent with **Haering et al. (2024)** they studied ovarian tissue cryopreservation for fertility preservation in patients with hemoglobin disorders: a comprehensive review. They stated that although (OTC.) procedures are becoming more widespread, the goal is still to promote accessibility and provide patients, and their families with serious health concerns and knowledge they need to make educated reproductive decisions with their families with serious.

Another similar study by **Ruan et al. (2024)** entitled practice guideline on ovarian tissue cryopreservation and transplantation in the prevention and treatment of iatrogenic premature ovarian insufficiency. They summarized advantages and disadvantages of fertility preservation as (OTC) methods necessitate multidisciplinary deliberation and decision-making, and it is crucial to give patients the necessary information and support their choices.

Also, an Egyptian study by **Rashed et al. (2018)** about cryopreservation counseling and its effect on knowledge and attitude of young female cancer patients. They showed significant improvement in their knowledge after counseling as compared to before. Another an Egyptian study by **Eltelt (2021)** about empowering perspectives: assessing the effect of an instructional program on female students'

knowledge, attitudes, and challenges towards egg freezing. They revealed more than two-thirds of them have poor knowledge, while a minority of them have good knowledge. There were statistically significant improvements in female students' total levels of knowledge scores regarding egg freezing at the post instructional program compared to preprogram in all knowledge items at $p \leq 0.001$.

Moreover, **Belal et al. (2023)** studied effect of virtual educational program on female faculty nursing students' perception toward egg freezing technology (EFT) and their fears. They revealed the total score of knowledge regarding (EFT) only 6.3% of the nursing students had high scores of knowledge before applying virtual educational program which significantly improved to 50% of them three months post program.

Regarding the total score of knowledge about ovarian tissue cryopreservation among the young females cancer patients after implementing the counseling sessions, the current study revealed that the majority of young females had satisfactory knowledge regarding ovarian tissue cryopreservation that can be due to the simple way used in explanation of the counseling sessions which met their needs in enhancing their knowledge and how to preserve their fertility through ovarian tissue cryopreservation. Also, cancer patients may feel embarrassed about asking questions related to fertility issues while, after counseling, they gain knowledge related to the topic.

These findings are in concurrence with **Fahmy & Mohamed (2021)** who conducted a study titled "knowledge, attitude and barriers of unmarried female bridging program nurse regarding egg frozen at South Valley University''. They stated that more than half of the students had inadequate knowledge before the program implementation. Also, the current study is into the bargain with **Hasab Allah et al. (2021)** who studied "impact of educational guideline on nursing students' knowledge, beliefs and attitudes toward oocyte cryopreservation. They reported that compared to before the program was implemented, the majority of the unmarried females in the study had adequate knowledge regarding egg freezing during the immediate post and follow-up phases.

Another similar study by El-Adham and Shaban (2023) studied "effect of educational program on knowledge, attitudes, and intention of unmarried healthy females regarding oocyte cryopreservation''. They reported a highly significant difference concerning knowledge of the unmarried healthy females before, immediately after, and one month after the program. **Likewise,** a population-based survey of women in the United States of reproductive age that examined knowledge, attitudes, and practices related to conception and fertility by **Lundsberg et al. (2019)** found that 70.0% of women had inadequate pre-program knowledge and increased to 90.0% of them with high knowledge after the training and there were statistically significant gains in the overall knowledge scores of female students about egg freezing across all knowledge items ($p < 0.001$).

Based on the current study results, the first hypothesis which states: Counseling significantly improves the knowledge of young female cancer patients regarding ovarian tissue cryopreservation was achieved.

Concerning attitude of young female cancer patients about ovarian tissue cryopreservation, the current study results revealed that there were highly significant statistically differences in terms of attitude regarding ovarian tissue cryopreservation after providing the counseling sessions than before. The researcher emphasized how the pivotal role of counseling sessions influenced the young female cancer patients to understand and accept OTC. This, in turn, helped them to become more self-prepared for the topic of fertility preservation, particularly ovarian tissue cryopreservation. Furthermore, the counseling sessions addressed social beliefs like worries about losing one's virginity and social stigma in addition to medical issues such as safety, side effects, and treatment delays.

This finding is parallel to the study of **Rashed et al. (2018)** they found young female cancer patients had improvement in their attitude towards cryopreservation as compared to before. Another similar study conducted by **Hasab Allah et al. (2021)** regarding the "influence of educational guidelines on nursing students' attitudes, knowledge, and beliefs regarding oocyte cryopreservation". They demonstrated that following the implementation of the educational intervention, the study respondents' overall posttest attitude score increased noticeably. The majority of respondents in the posttest expressed a positive attitude towards oocyte cryopreservation, compared to only 25% in the pretest.

In addition to, **Ibrahim et al. (2023)** conducted an Egyptian study about efficacy of educational package on gynecological cancer females' knowledge and attitude regarding oocyte cryopreservation. They reported young female attitudes towards cryopreservation have improved since receiving instructional materials from negative to positive.

Also, at Benha University in the Qaliobya governorate, Egypt, **Araby et al. (2025)** investigated the effect of nano-educational sessions on unmarried females' awareness, willingness, and barriers regarding elective oocyte cryopreservation. According to their findings, the majority of the sample showed a positive attitude towards elective oocyte cryopreservation post intervention, while the

minority had unfavorable opinions regarding this topic. They found that to boost effectiveness and uptake; women must be meaningfully involved in educational initiatives.

The researcher can say that based on the current study results, the second hypothesis which states: Counseling significantly changes the attitude of young female cancer patients regarding ovarian tissue cryopreservation was achieved.

Concerning correlation between the total knowledge and attitude scores among the young female cancer patients, the current study result demonstrated highly statistically positive correlation between young female cancer patients' knowledge and their attitude in terms of ovarian tissue cryopreservation after implementing the counseling sessions. These results prove that the young female cancer patients' knowledge played an effective role in improving their self-awareness, enhance confidence and changing attitude toward ovarian tissue cryopreservation.

This finding is consistent with a study by **Rashed et al. (2018)** that found a significant positive correlation between the knowledge and attitude total scores of young female cancer patients after counseling compared to before. In other words, a young woman's attitude was more positive the higher her overall knowledge score was, and vice versa. A low level of information will result in a negative attitude. Also, **Mansour & Hassan (2021)** who evaluated the effect of an educational package for oncology nurses regarding fertility preservation among female cancer patients, in Mansoura, Egypt. They revealed that total knowledge and total attitude level of nurses were found to be positively and significantly correlated post-intervention.

Additionally, **Eltelt (2021)** found that female students' attitudes and understanding about frozen eggs changed significantly before and after the implementation of the instructional program ($p \leq 0.001$). Another study by **Stoop et al. (2019)** examined women of reproductive age's intentions and attitudes regarding oocyte cryopreservation for non-medical purposes. They revealed that there was a significant difference in the mean scores for knowledge, attitude, and the difficulties of applying frozen eggs before and after the implementation of the instructional program ($p \leq 0.001$).

By the current study findings, the researcher reports that third hypothesis titled: Significant positive correlation between the young females' cancer patients' attitude and their knowledge was reinforced.

Conclusion:

The current study findings concluded that implementing ovarian tissue cryopreservation counseling had significantly improved knowledge of the young female cancer patients, changed their attitude toward ovarian tissue cryopreservation technique. Furthermore, significant positive correlation was found between females' attitude and their knowledge regarding OTC.

Recommendations:

- Young female cancer patients should be treated with a multidisciplinary approach, and they should receive counseling from gynecologists, oncologists, and nurses regarding the potential side effects of radiotherapy and chemotherapy on fertility.
- Integrate protocols to enhance counseling and communication between health care team and the young female cancer patients regarding ovarian tissue cryopreservation as a method to preserve fertility.
- One way to enhance awareness among cancer patients is to provide oncology nurses with educational sessions concerning ovarian tissue cryopreservation.

Further studies:

- Implement the same study on other health sectors.
- Apply the same study on a large sample to serve as baseline data for a pre-treatment program.

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Conflict of interest

No conflict is announced

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