



Effect of Educational Program on Knowledge, Attitudes, and Intention of Unmarried Healthy Females regarding Oocyte Cryopreservation

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ABSTRACT

Recently, there are increasing numbers of unmarried healthy reproductive-aged females and young females who have diseases associated with early loss of ovarian reserve. Oocyte cryopreservation is a specific technique for freezing one or more unfertilized ovum to be used in the future to get pregnancy.

Aim: The aim of this study was to determine effect of the educational program on knowledge, attitudes, and intention of unmarried healthy females regarding oocyte cryopreservation. **Subjects and method:**

Design: A quasi experimental research design was used to conduct this study. **Setting:** The study was conducted at six faculties of Tanta University Tanta Egypt. **Subjects:** A simple random sample of 100 unmarried working females was included in the study. **Tools: (I):** Knowledge, **(II):** Attitudes, and **(III):**

Intention of unmarried females regarding oocyte cryopreservation. **Results:** There was a highly statistical significant difference between pre and post-program implementation in the studied unmarried healthy females' knowledge, attitudes, and intention regarding oocyte cryopreservation ($p < 0.001^*$). **Conclusion:**

Implementation of the educational program improved knowledge, attitudes, and intention of the studied healthy unmarried females regarding oocyte cryopreservation. **Recommendations:** Health education and counselling programs, modules, and guidelines regarding oocyte cryopreservation should be provided by maternity and gynecological nurses to unmarried healthy females to help them have an informed decision to preserve their fertility in order to be pregnant during their preferred time.

Key words: Knowledge, Attitudes, Intention, Oocyte Cryopreservation

Introduction

Recently, there are increasing numbers of females who delay marriage and childbirth to their thirties and forties with an average age of thirty-five years old. It is estimated that 45% of females between twenty and forty-four years' old

will be single by the year 2030. Fertility rate decreases gradually by aging. Deterioration of females' fertility increases from early 30 years, and reaches its highest level by the age of ≥ 37 years. Egypt demographic and health surveys recorded a general collapse in fertility rate,

especially among working age groups females (Hasab et al. 2021, Hussein et al. 2019, & OECD 2022).

Healthy females who postpone marriage, pregnancy and childbearing to an older age are at risk for “involuntary childlessness” due to the physiological changes that occur in their reproductive system leading to decrease in oocyte quantity and quality, as well as due to changes in the other body systems. Delay in marriage and childbirth and reproductive aging affect females’ fertility rate, perinatal morbidity, child wellbeing, and the whole community (Kocourková et al. 2021, Esencan et al. 2022, Hasab et al. 2021, & Lazzari et al. 2023).

Moreover, technological advances in management of various diseases increased life span of females who have medical and oncological diseases, with the subsequent harmful effects of the diseases and their managements on fertility of the unmarried females as early loss of ovarian reserve, damaging effect of pathologic process on the ovarian follicle reservoir, and poor quality of life (Kim et al. 2020, Kato et al. 2021, Kaja et al. 2021, Skaczkowski et al. 2018, Yasmin et al. 2018, & Latif et al. 2022).

Therefore, unmarried healthy and non-healthy young and reproductive-aged females are at an abundant need for health education regarding various methods of fertility preservation (Brownell et al. 2022). Fertility preservation means saving ova or tissue from the ovary by a specialized advanced technique to have biological children in the future. It is performed for "medical" and “non-medical”/“social” reasons and is

provided terms for eggs freezing related to such reasons (Chronopoulou et al. 2021, & Muaygil, 2023).

Various methods of fertility preservation can be used to help females to get pregnant during their suitable time depending on their conditions and preferences, and the indications, results and risks of the methods. Fertility preservation methods include medical therapy before chemotherapy; ovarian transposition; embryo cryopreservation; ovarian tissue cryopreservation; and oocyte cryopreservation (OC) / vitrification (Marci et al. 2018, & Dolmans et al. 2021).

Oocyte cryopreservation (OC) is a specific important advanced reproductive technology technique for fertility preservation. It is a novel method known as egg cryopreservation, egg freezing, ‘social egg freezing’ (SEF), and ‘elective oocyte cryopreservation’ (EOC). The procedure of oocyte cryopreservation involves hormonal stimulation, trans-abdominal or trans-vaginal retrieval of oocytes from the ovaries, oocyte freezing using vitrification or slow freezing methods, and storage at -196°C . (Walker et al. 2022, von Wolf et al. 2018, & Conn's, 2018).

Oocyte cryopreservation is used to freeze one or more unfertilized ovum in the laboratory, in order to be fertilized by a sperm in the future. It can be used by unmarried healthy females as a family planning method and by non-healthy females who have different reproductive, gynecological, and medical illnesses to preserve their fertility for appropriate times. It can also be used to electively cryopreserve gametes of fertile women who will undergo in vitro fertilization

(IVF) (Van De et al., 2020, Pai et al. 2021, Gelety 2022, & Walker et al. 2022).

Barriers to use oocyte cryopreservation include lack of knowledge, and awareness about the technique, number of high-quality retrieved mature oocytes, concerns regarding long-term effects of the hormones and risks to females' health from the process of oocyte retrieval, and regarding disposition of oocytes, as well as possible risks to a child from frozen oocytes. Other factors include costs of the procedure for social and medical reasons, other illness, social relations, competence, and social stigma (Hafezia et al. 2021, Stevenson et al. 2021, Walker et al. 2022, Hong et al. 2019, & Hasab Allah et al. 2021).

Furthermore, attitudes of unmarried females' towards oocyte cryopreservation are important issues that can be influenced by their sociodemographic characteristics, culture, fertility and other reproductive problems, ethical values or moral concerns, and intention toward fertility, psychological factors, fear of mortality carelessness related to fertility health care issues unless they get married and become older (Stevenson et al. 2021, & Walker et al. 2022).

Unmarried healthy females should be educated by maternity and gynecological nurses regarding oocyte cryopreservation to improve their knowledge, attitudes and intention, to help them make informed reproductive decisions regarding their fertility preservation, to inform them about relation between age and fertility, cost, risk, and the estimated number of eggs needed to get pregnant. Thus, it is crucial to implement educational programs and guidelines for unmarried

healthy females regarding oocyte cryopreservation (Walker et al. 2022).

Significance of the problem:

Fertility is a fundamental component of the 2030 Agenda for Sustainable Development Goals (SDGs) (United Nations transforming our world the 2030). Fertility rate decreases gradually by 6% at age 20 – 24, 9% at age 25 - 29, 15% at age 30 - 34, 30% at age 35 - 39 and 64% at age 40 – 44 years. Delay in marriage and reproductive aging have harmful effects on females' fertility, pregnancy, childbirth outcomes, maternal and perinatal morbidity and mortality rates, and the whole community (Sayed 2019, Kocourková et al. 2021, Esencan et al. 2022). Thus, Maternity and gynecological nurses should encourage unmarried healthy females via educational programs to preserve their fertility by the use of oocyte cryopreservation. Scarce research studies exist concerning the effect of educational programs on knowledge, attitudes, and intention of unmarried healthy females regarding oocyte cryopreservation.

Aim of the study:

The aim of this study was to determine the effect of educational program on knowledge, attitudes, and intention of unmarried healthy females regarding oocyte cryopreservation.

Research hypothesis:

Unmarried healthy females are expected to have better knowledge, attitudes, and intention regarding oocyte cryopreservation after implementation of the educational program.

Subjects and Method:**Design:**

A quasi experimental research design pre-posttest was used to conduct this study. This design is suitable for the present research, because it tolerates simple assessment of the study participants' who were selected using a simple random sample to determine the effect of the educational program (Stratton, 2019).

Setting:

The study was conducted at 6 faculties out of 17 faculties and the Technical Institute of Nursing at Tanta University Tanta Egypt.

Subjects:

A simple random sample of 100 unmarried healthy working females was selected from the previously mentioned study settings. The total number of unmarried females at the previously mentioned study settings was 113; 10 were included in the pilot study, and 3 refused to participate in the study. The sample size and power analysis were calculated using Epi-Info software statistical package created by World Health Organization and Center for Disease Control and Prevention, Atlanta, Georgia, USA version 2002. Calculation of the sample size was estimated at 95% confidence limit. So, the sample size was determined to be (n= 85) females, which is increased to (n=100) to improve quality of the study data.

Tools of data collection:

Three tools were developed and used by the researchers to collect data of this study:

Tool (I): Unmarried healthy females' knowledge regarding oocyte cryopreservation:

It was developed by the researchers after reviewing recent related literatures (Stevenson et al. 2021, Hafezia et al. 2022, Yeung et al. 2020, & Hong et al. 2019). Tool I included the following two parts.

Part (1): Sociodemographic characteristics of the studied unmarried healthy females:

It included the following 6 items: Name code, age, residence, education, occupation and monthly income.

Part (2): Knowledge of unmarried healthy females regarding oocyte cryopreservation:

It included the following 10 items: Definition, reasons or indications, appropriate age, steps, period of freezing, advantages, risks/complications, factors affecting, role of the females, and laboratory tests required before the procedure. The total score of unmarried females' knowledge regarding oocyte cryopreservation (part 2) ranged from (0 to 20).

The scoring system of unmarried healthy females' knowledge was as follows: Correct and complete answers scored (2), Correct and incomplete answers scored (1), Incorrect answers and didn't know scored (0). **The total score level of unmarried females' knowledge was as follows:** High level of knowledge $\geq 75\%$, moderate level of knowledge $50 - <75\%$, and low level of knowledge $<50\%$.

Tool (II): Unmarried healthy females' attitudes regarding oocyte cryopreservation:

It was adapted by the researchers from relevant literatures (Fahmy et al. 2021, Hafezia et al. 2022, Platts et al. 2020, Yeung et al. 2020, & Hong et al. 2019). Tool II included 10 statements

(five negative statements, and five positive statements) as follows: Concern about the ovum cost of withdrawal, concern about retrieval and storage, concern about the wrong use of frozen ovum, concern about poor storage of frozen ovum concern about the long storage period and fear of not using frozen ovum in the future, information about ovum freezing is important to me, freezing and storage operations must be monitored, ovum freezing settings must be certified and standards, infection control precautions should be used during freezing and storage operations, and I feel the test to check ovarian reserve should be freely available. The unmarried females' attitudes were measured in a 3 point bipolar Likert scale. The total score of unmarried females' attitudes regarding oocyte cryopreservation ranged from (0 to 20).

The scoring system of unmarried healthy females' attitudes regarding oocyte cryopreservation was as follows: Agree answer was given score (2). Uncertain answer was given score (1). Disagree or didn't know answer was given score zero (0). The scores were inverted for the negative statements. **The total score of unmarried healthy females' attitudes was calculated as follows:** Positive attitude $\geq 60\%$ and Negative attitude $< 60\%$.

Tool (III): Unmarried healthy females' intention regarding oocyte cryopreservation:

It was adapted by the researchers from relevant literatures (Greenwood et al. 2018, Fahmy et al. 2021, & Platts et al. 2020). It included the following 7 statements: I would be interested in checking the ovarian reserve, I will pay for a test to check my ovarian reserve, the

decision to freeze ova is a valid decision, the decision to freeze ova is a wise decision, I am in favor of ovum freezing, I am ashamed of making the decision to freeze my ova, making the decision to freeze my ova would cause me a lot of trouble. Unmarried females' intention was measured in a five point's bipolar Likert Scale. The total score of unmarried females' intention regarding oocyte cryopreservation ranged from (0 to 28).

The scoring system of unmarried healthy females' intention was categorized as follows: (strongly agree= 4, agree= 3, neutral= 2, disagree=1 and strongly disagree= 0). The scores were inverted for negative statements. **The total score level of unmarried healthy females' intention was calculated as follows:** High intention $\geq 75\%$, moderate intention 50 - $< 75\%$, and low intention $< 50\%$.

Method

Approval: An official letter clarifying the purpose of the study was obtained from the Faculty of Nursing Tanta University and submitted to the responsible authorities of the selected settings for permission to carry out the study.

Ethical and administrative consideration: The study was approved by the ethical committee of Faculty of Nursing Tanta University. The researchers met with the unmarried females individually or in groups ranged from 4 to 6; explained the purpose of the study, invited them to participate; and had their informed consent. The researchers assured the participants that the nature of the study will not cause any harm and/or pain and the confidentiality and privacy will be put into

consideration regarding the data collected, which will be used only for the purpose of this study.

Tools development: Tools (I) was developed by the researchers after extensive review of recent related literature, and tools (II) and (III) were adapted from relevant literatures. The study tools were developed in Arabic language to avoid confusion of the study subjects with scientific medical terms related to oocyte cryopreservation.

Tools validity and reliability: The three tools were tested for content and construct validity by five Maternal and Neonatal Health Nursing experts. Cronbach's Alpha coefficient was used to measure the internal consistency / reliability of the study tools.

Pilot study: After development of the tools, a pilot study was carried out on 10% of the unmarried females (10 females) from the previously mentioned settings to test the clarity, feasibility and applicability of the tools. Based on the results of the pilot study, the necessary modifications were done by the researchers before conduction of the actual study. Then, the tools were made ready to collect the necessary data of the study. The unmarried females who participated in the pilot study were excluded from the actual study data.

The actual study field:

The study is composed of the following four phases: (Assessment, planning, implementation and evaluation):

Phase I: Assessment phase (Pretest):

Tool (I) part (1) was used by the researchers one time to assess sociodemographic characteristics of the studied females.

Tool (I) part (2) was used by the researchers three times before, immediately, and one month after implementation of the educational program to assess knowledge of the studied unmarried females regarding oocyte cryopreservation.

Tools (II) and (III) were used by the researchers two times before, and one month after implementation of the educational program to assess attitudes and intention of the studied unmarried healthy females regarding oocyte cryopreservation.

Phase II: Planning phase: Setting the study goal and objectives and preparing the educational program components:

The **goal** of the educational program was to improve knowledge, attitudes, and intention of unmarried females regarding oocyte cryopreservation.

The study **objectives** were to improve unmarried females' knowledge regarding definition of ovum freezing, reasons or indications for ovum freezing, appropriate age for ovum freezing, steps for ovum freezing, period that the ovum lives after freezing, advantages of ovum freezing, risks/complications that may occur due to ovum freezing, factors affecting egg freezing, role of the unmarried females towards the frozen ovum, and laboratory tests required before performing the ovum freezing technique. The study objectives also were to enhance unmarried females' attitudes, and intention regarding oocyte cryopreservation.

To attain the goal and objectives of the program, the researchers developed and prepared

the information contents and an educational booklet based on the goal and objectives, assessment of unmarried females' knowledge, attitudes, and intention in the assessment phase before conducting the program sessions, and based on relevant literatures.

The researchers also prepared different teaching and learning methods and materials included group discussion, video, poster, and power point presentation to improve knowledge, attitudes, and intention of unmarried females regarding oocyte cryopreservation.

Phase III: Implementation phase:

This phase was carried out by the researchers at the pre-mentioned study settings. After recruitment of the unmarried healthy females, the researchers interviewed with the studied unmarried females three times to conduct the educational program that included three sessions.

The duration of each session ranged from 30-45 minutes. Each session started with discussion of the previous session and the introduction to the new session's objectives. At the end of each session, the researchers scheduled a time to interview with the studied unmarried females for the next session, informed them about the next session's objectives, allowed them to ask questions and provided a period of discussion.

The first session of the educational program included orientation about the study' goal and objectives, and assessment of the studied unmarried healthy females' knowledge, attitudes, and intention regarding oocyte cryopreservation (pretest) using the pre developed study **tools I, II,**

and III. Then, the researchers had their personal contact information to follow up with them via cell phone, e-mail, and Whats/App.

In the second session of the educational program, the researchers provided a lecture included general knowledge regarding oocyte cryopreservation supported by the pre prepared teaching and learning tools. They also distributed the pre designed booklet to each participant in the study to improve their knowledge, attitudes, and intention regarding oocyte cryopreservation. Then, the researchers assessed knowledge of the studied unmarried healthy females regarding oocyte cryopreservation immediately after implementation of this session.

In the third session of the educational program, the researchers provided a lecture included knowledge about the procedure of oocyte cryopreservation and the care before and after the technique. At the end of this session, the researchers scheduled a time to interview with the studied unmarried females one month later to conduct the post-test using tools (I part 2, II, and III).

Phase IV: Evaluation phase.

The effect of the educational program was evaluated by the researchers to determine the outcome of the study, to evaluate the difference between pre and post-test levels of knowledge, attitudes and intention of the studied unmarried healthy females regarding oocyte cryopreservation, and to determine the extent to which the program achieved its goal and objectives. The three pre designed study tools were used by the researchers as follows:

Tool (I): Part (1) was used by the researchers one time to assess Sociodemographic characteristics of the studied unmarried healthy females.

Tool (I): Part (2) was used by the researchers three times (pre, immediately after and one month after the program implementation) to assess knowledge of the unmarried healthy females regarding oocyte cryopreservation.

Tools (II) and (III) were used by the researchers two times (pre, and one month after the program implementation) to assess their attitudes and intention regarding oocyte cryopreservation three times.

Data collection:

The data of this study were collected from the beginning of September 2022 to the end of January 2023 by using the previously mentioned study tools.

Statistical analysis:

The collected data were organized, tabulated and statistically analyzed using SPSS version 19 (Statistical Package for Social Studies) created by IBM, Illinois, Chicago, USA. For numerical variables, the range mean and standard deviations were calculated. The differences between two mean values were calculated using paired student's t test for data normally distributed, and Wilcoxon signed ranks test for data not normally distributed. For categorical variable the number and percentage were calculated. As cases were 100, so the number is identical to the percentage. Differences between subcategories before and after implementation of the educational program (intervention) were tested by Wilcoxon

signed ranks test. The correlation between two variables was calculated using Pearson's correlation coefficient (r) for normally distributed variables and Spearman's correlation coefficient (ρ) for variables not normally distributed. The level of significant was adopted at $p < 0.05$, and a highly significance was adopted at $P < 0.01$ for interpretation of results of tests of significance (**).

Results:

The results of the present study are demonstrated into six tables and three figures as follows:

Table (1): Indicates that (27%) of the studied unmarried healthy females were (20 to 29) years old, (68%) were (30 to 39) years, and (5%) were (40 to 49) years old with a range of (25-42) years and Mean \pm SD (31.60 \pm 3.78). The table also presents that (83%) were both urban residents and had university and postgraduate studies; (51%) were staff members, and (44%) had insufficient family income.

Table (2): Demonstrates that there is a highly statistical significant difference between the studied unmarried healthy females' knowledge regarding oocyte cryopreservation before and immediately after, as well as between immediately after and one month after the program implementation in all items of knowledge ($p < 0.001$). The table also shows that there is a highly statistical significant difference in the total level of knowledge of the studied unmarried healthy females' before and immediately after, and one month post the program ($p < 0.001$).

Figure (1): Illustrates that (95%) of the studied unmarried healthy females had low total level of knowledge regarding oocyte cryopreservation before the program, compared to (90%, and 55%

respectively) of them had high level of knowledge immediately and one month after the program.

Table (3): Exhibits that there is a highly statistical significant difference between the unmarried healthy females' attitudes regarding oocyte cryopreservation pre, and one month post the program implementation for most variable ($p < 0.001$), except for the variable "concern about the cost of ovum withdraw" ($p > 0.05$). The table also demonstrates that there is a highly statistical significant difference in the total level of attitudes of the studied unmarried healthy females' before and one month post the program ($p < 0.001$).

Table (4): Shows that there is a highly statistical significant difference between the unmarried healthy females' intention regarding oocyte cryopreservation pre, and one month post the program implementation in all variable ($p < 0.001$). The table also proves that there is a highly statistical significant difference in the total level of intention of the studied unmarried healthy females' before and one month post the program ($p < 0.001$).

Figure (2): Identifies that (100%) of the studied unmarried healthy females had negative attitudes regarding oocyte cryopreservation before the program, compared to (80%) of them had positive attitude one month after the program.

Figure (3): Confirms that (90%) of the studied unmarried healthy females had low level of intention regarding oocyte cryopreservation before the program, compared to (80%) of them had high level of intention one month after the program ovum freezing.

Table (5): This table reports that there was no statistical significant relation between knowledge, attitude and intentions of the studied unmarried healthy females regarding oocyte cryopreservation before and after implementation of the educational program ($p > 0.05$).

Table (6): Exemplifies that there was no statistical significant correlation between intention regarding oocyte cryopreservation and sociodemographic characteristics of the studied unmarried healthy females before and after implementation of the educational program ($p > 0.05$).

Table (1): Sociodemographic data of the studied unmarried healthy females (n= 100).

Sociodemographic characteristics	Number (n=100)	%
Age in years:		
20-29	27	27.0
30-39	68	68.0
40-49	5	5.0
Range	25-42	
Mean \pm SD	31.60 \pm 3.78	
Residence:		
Urban	83	83.0
Rural	17	17.0
Educational level:		
Read and write and primary school	7	7.0
Secondary school	10	10.0
University and post graduate studies	83	83.0
Occupation:		
Workers	15	15.0
Employers	34	34.0
Staff members	51	51.0
Family monthly income		
Insufficient	44	44.0
Enough	25	25.0
Enough and saving	31	31.0

Table (2): Knowledge of the studied unmarried healthy females regarding oocyte cryopreservation before, immediately after, and one month after implementation of the educational program (n= 100).

Items of knowledge	Before the program (n=100)			Immediately after (n=100)			Immed. P	After one month (n=100)			One month p
	Incorrect	Incomplete	Correct	Incorrect	Incomplete	Correct		Incorrect	Incomplete	Correct	
1-Definition of ovum freezing.	74	26	0	0	15	85	<0.001	0	36	64	<0.001*
2- Reasons or indications for ovum freezing.	78	22	0	4	20	76	<0.001	4	37	59	<0.001*
3- Women's fertility decreased with aging.	78	22	0	0	16	84	<0.001	10	27	63	<0.001*
4- Steps for ovum freezing.	83	17	0	5	16	79	<0.001	7	33	60	<0.001*
5- Period that the ovum lives after freezing.	73	27	0	5	10	85	<0.001	5	37	58	<0.001*
6- Advantages of ovum freezing.	80	20	0	2	20	78	<0.001	2	32	66	<0.001*
7- Risks/complications that may occur due to ovum freezing.	73	27	0	3	18	79	<0.001	6	30	64	<0.001*
8- Factors affecting egg freezing.	7	24	0	1	16	83	<0.001	6	32	62	<0.001*
9- Role of the females towards the frozen ovum.	81	19	0	1	9	90	<0.001	0	34	66	<0.001*
10- Laboratory tests required before performing the ovum freezing technique.	87	13	0	0	0	100	<0.001	14	25	61	<0.001*
Total knowledge				t 85.271			<0.001	t 55.620			p<0.001*

*Significant
p value of Wilcoxon signed ranks test
t & p values of paired t test

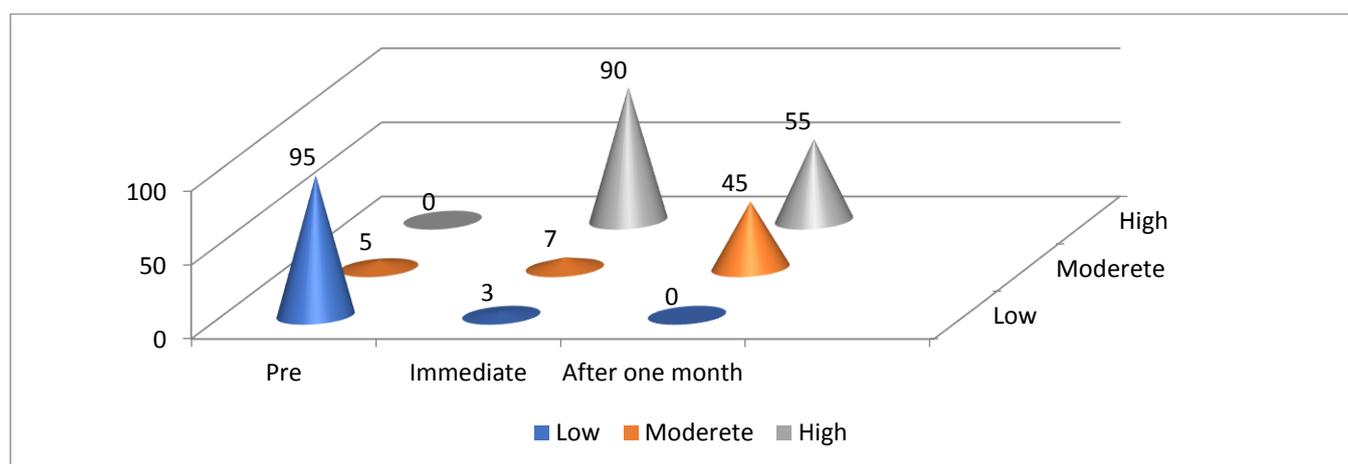


Figure (1): Total level of knowledge of the studied unmarried healthy females regarding oocyte cryopreservation before, immediately, and one month after implementation of the educational program (n= 100).

Table (3): Attitude of the studied unmarried healthy females regarding oocyte cryopreservation before, and one month after implementation of the educational program (n= 100).

Attitudes of unmarried females towards egg freezing	Before the program (n=100)			After one month (n=100)			p
	Agree	Uncertain	Disagree	Agree	Uncertain	Disagree	
1. Concern about the cost of ovum withdrawal, retrieval and storage.	69	10	21	55	13	32	0.101
2. Concern about the wrong use of frozen ova.	90	5	5	14	6	80	<0.001*
3. Concern about poor storage of frozen ova.	87	6	7	11	10	79	<0.001*
4. Concern about the long storage period.	76	15	9	8	11	81	<0.001*
5. Fear of not using frozen ova in the future.	79	10	11	10	7	83	<0.001*
6. Information about ovum freezing is important to me.	10	16	74	78	10	12	<0.001*
7. Freezing and storage operations must be monitored.	13	12	75	80	13	7	<0.001*
8. Ovum freezing banks must be certified and have standards.	10	8	82	81	14	5	<0.001*
9. Infection control precautions should be used during freezing and storage operations.	16	9	75	77	12	11	<0.001*
10. I feel the test to check ovarian reserve should be freely available.	18	10	72	85	5	10	<0.001*
Total attitude				t= 8.728			p<0.001

*Significant

p value of Wilcoxon signed ranks test

t & p value of paired t test

Table (4): Intention of the studied unmarried healthy females regarding oocyte cryopreservation before, and one month after implementation of the educational program (n= 100).

Intention to freeze eggs	Before the program (n=100)					After one month (n=100)					p
	Strongly disagree	Dis-agree	Neutral	Agree	Strongly agree	Strongly disagree	Dis-agree	Neutral	Agree	Strongly agree	
1. I would be interested in checking the ovarian reserve	66	17	17	0	0	0	3	4	27	66	<0.001*
2. I will pay for a test to check my ovarian reserve	67	20	10	3	0	0	2	5	18	75	<0.001*
3. The decision to freeze eggs is a valid decision	64	25	9	2	0	0	0	5	12	83	<0.001*
4. The decision to freeze eggs is a wise decision	70	16	14	0	0	0	2	5	13	80	<0.001*
5. I am in favor of egg freezing	73	13	12	2	0	0	2	9	0	69	<0.001*
6. I am ashamed of making the decision to freeze my eggs	1	6	26	67	0	76	22	2	0	0	<0.001*
7. Making the decision to freeze my eggs would cause me a lot of trouble	0	1	5	19	75	72	22	4		0	<0.001*
Total intention						t (88.409)					p<0.001*

t & p value of paired t test

p value of Wilcoxon signed ranks test

*Significant

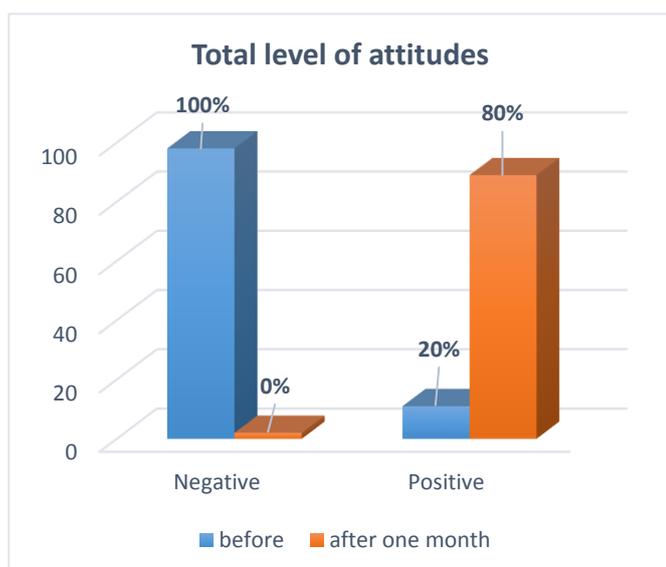


Figure (2): Total level of attitudes of the studied unmarried healthy females regarding oocyte cryopreservation before, and one month after implementation of the educational program (n=100).

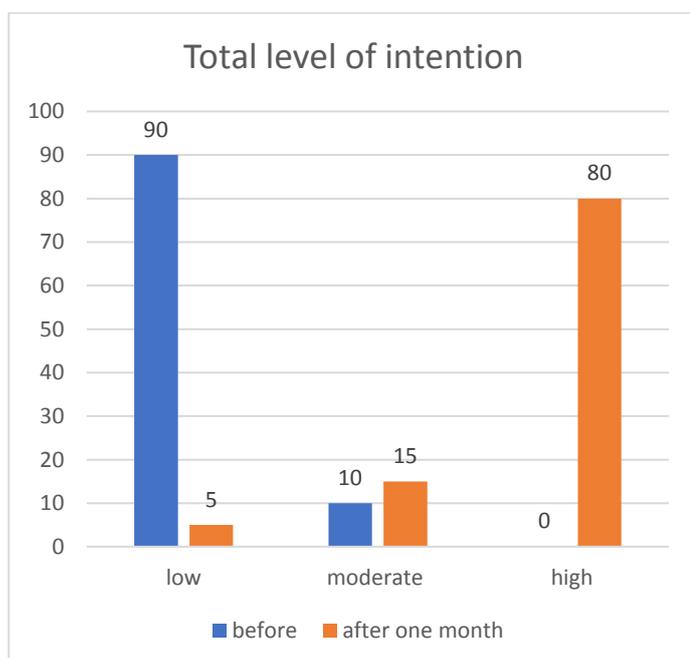


Figure (3): Total level of intention of the studied unmarried healthy females regarding oocyte cryopreservation before, and one month after implementation of the educational program (n=100).

Table (5): Correlation between total knowledge, total attitude, and total intentions of the studied unmarried healthy females regarding oocyte cryopreservation before and after implementation of the educational program (n=100).

Variables	Before intervention			After intervention			
	Knowledge	Attitude	Intention	Knowledge	Attitude	Intention	
Knowledge	R	-----	-0.020	0.096	-----	0.041	0.073
	P	-----	0.847	0.341	-----	0.685	0.470
Attitude	R	-0.020	-----	-0.020	0.041	-----	-0.165
	P	0.847	-----	0.827	0.685	-----	0.101
Intentions	r	0.096	-0.020	-----	0.073	-0.165	-----
	p	0.341	0.827	-----	0.470	0.101	-----

Spearman's correlation coefficient

Table (6): Correlation between intention and sociodemographic characteristics, knowledge, and attitude of the studied unmarried healthy females regarding oocyte cryopreservation (n= 100).

Variables	Before intervention		After intervention	
	r/rho	p	r/rho	P
Age in years	-0.089	0.380	-0.162	0.107
Education	-0.035	0.732	-0.008	0.941
Monthly income	0.109	0.282	0.019	0.852
Knowledge	0.096	0.341	0.073	0.470
Attitude	-0.022	0.827	-0.155	0.124
Residence	z= 0.906	0.365	z= 0.173	p=0.863
Occupation	Kruskal-Wallis test 0.094	0.993	Kruskal-Wallis test 5.116	0.163

Kruskal-Wallis test

Z value of Wilcoxon signed ranks test

*Significant

Discussion

World-wide, fertility preservation is an advanced emerging technology field in reproductive health that gained growing attention for both medical and non-medical causes. This technology has made childbearing possible to healthy females who want to delay marriage and progeny, as well as to non-healthy females who suffer from diseases or treatments that can limit their fertility (Al Ghaithi et al. 2023). The aim of this study was to find out the effect of educational program on knowledge, attitudes, and intention of unmarried females regarding oocyte cryopreservation.

The results of the present study revealed that the age of unmarried healthy females ranged from twenty-five to forty-two years, most of them were urban residents and had university

and/or postgraduate studies, slightly more than one half had were staff members, and slightly more than two fifths had insufficient monthly family income.

This result agrees with (Yeung et al. 2020) who reported that the age of more than two fifths of the study subjects ranged from eighteen to thirty-four years old, they had tertiary level education, more than three quarters had full-time job, and about half of them had middle income. Another study by (Hasab Allah et al. 2021) clarified that his study sample included women aged eighteen to thirty eight years old, the majority were single, had higher level of education or a post-graduate degree, and more than one third of them was living in urban areas. Additionally, (Tozzo et al. 2019) mentioned that

the majority of respondents were 18-22 years old, nearly one half of them were single, 3% were married or cohabiting and 47.6% were engaged.

Concerning knowledge of the studied unmarried healthy females regarding oocyte cryopreservation, there was a highly statistical significant difference between knowledge before, immediately after, and one month after the program. In this regard, nobody correctly defined oocyte cryopreservation / ovum freezing before the educational program, while the majority of them answered correctly immediately after implementation of the educational program, and two thirds answered correctly one month after the program.

This result is in line with **Tozzo et al. 2019**) who exhibited that the majority of the studied students did not understand the meaning of egg freezing. On the other hand, (**Hasab Allah et al. 2021**) contradicted the results of the present study, and reported that one fifth of the studied students completely and correctly answered the definition of egg freezing in the pretest, increased to more than one half in the posttest. From the researchers' point of view, this contradiction may be related to differences in the study sample and design.

The current study also illustrated that more than three quarters of the studied unmarried healthy females lacked knowledge regarding: steps of oocyte cryopreservation, period that the ovum lives after freezing, advantages, factors affecting, laboratory tests required before the technique, complications, and effect of aging on women's fertility preprogram implementation,

compared to the majority of them completely and correctly answered knowledge questions regarding the previous items immediately after, and almost less than two thirds gave complete and correct answers one month post program implementation.

This result is not in line with (**Hasab Allah et al. 2021, & Khattak et al. 2022**) who declared that less than one quarter, one half, nearly two fifths, nearly one fifth, and 2.4% respectively of their study subjects completely and correctly answered in the pretest the following questions: indications for oocyte cryopreservation, effect of advanced age on woman's fertility, advantage of oocyte cryopreservation, number of eggs that should be stored to attain conception later on, and barriers or risks of oocyte cryopreservation.

As regard to total level of knowledge of the studied unmarried healthy females regarding oocyte cryopreservation, it was found that there were highly statistical significant differences between their total knowledge before, immediately after, and one month after implementation of the educational program intervention shown in improvement of their knowledge posttest comparing to pretest.

These findings are supported by studies carried out by (**Hasab Allah et al. 2021, & Rafiei et al. 2020**) who revealed significant differences in the mean score of participants' knowledge regarding oocyte cryopreservation pre and post the educational intervention. From researchers' point of view, it may be due to effectiveness of the educational program on unmarried females' knowledge regarding oocyte cryopreservation.

Additionally, (**Malhotra et al. 2022**) clarified that less than two fifths of their participants lacked knowledge regarding fertility preservation, and the majority asked for continued medical education programs and seminars to improve their knowledge.

In relation to the attitudes of the studied unmarried healthy females regarding oocyte cryopreservation, this study clarified that there was a highly statistical significant difference between pre, and one month posttest of the educational program for most variables such as information about ovum freezing is important to me, freezing and storage operations must be monitored, ovum freezing banks must be certified and have standards, expect for the variable “concern about the cost of ovum withdraw, retrieval and storage.

This result is in the same line with finding of (**Hasab Allah et al. 2021**) who Illustrated that slightly less than three quarters of studied students mentioned that egg preservation should be encouraged, more than two thirds reported that oocyte freezing may be a possible option, and more than one half thought that egg preservation is very expensive and cannot be feasible to anyone. On the other hand, (**Esfandiari et al. 2019**) reported that their participants want to do oocyte cryopreservation, but were concerned about the financial burden, the time needed for the procedure, the process and the risks of oocyte freezing.

Concerning to the total score level of studied unmarried healthy females’ attitudes toward oocyte cryopreservation, the results of the

present study explained that majority had negative attitudes before implementation of the educational program, while the majority of them had positive attitudes one month after the program, with a statistically significant difference due to improvement in their attitude.

This finding matches with (**Hasab Allah et al. 2021, & Khattak et al. 2022**) who displayed that only one quarter of studied students had positive attitudes about egg freezing in pretest increased to more than one half in the posttest. Another study by (**Nasab et al. 2020**) revealed that more than one half of the responders in their study had positive attitudes regarding oocyte cryopreservation to be a potential fertility preservation option.

As regard to the intention of the studied females regarding oocyte cryopreservation, the present study proves that more than three fifths of the studied un married healthy females strongly disagreed with the following statements; I am in favor of egg freezing, the decision to freeze eggs is a wise decision, I will pay for a test to check my ovarian reserve, and the decision to freeze eggs is a valid decision before implementation of educational program, while the more than three quarters strongly agreed on the decision to freeze eggs is a valid and a wise decision, and I will pay for a test to check my ovarian reserve after implementation of the educational program.

This result in line with (**Hasab Allah et al. 2021**) illustrated in the posttest of their study that three fifths of the studied students believed that women should preserve her fertility through oocyte cryopreservation. Additionally,

(Esfandiari et al. 2019) clarified that, more than one half of the female residents' considered doing egg freezing between ages thirty-one to thirty-four years old if they still single.

Concerning to total level of intention of unmarried healthy females regarding oocyte cryopreservation, the present study identifies that most of them had low level of intention before implementation of the educational program compared to the majority had high level of intention one month after the program. This result is consistent with (Gambadauro et al. 2023) who asserts that Swedish female university students agree to have oocyte cryopreservation either for medical reason or for reproductive aging.

Likewise, the present study reports that there is no statistical significant relation between total knowledge, total attitude, and total intention of the studied unmarried healthy females regarding oocyte cryopreservation before and after implementation of the educational program.

This result disagrees with (Hasab Allah et al. 2021) who demonstrated that there was a highly statistical significant relation between students' total knowledge, total attitude, and total beliefs about oocyte cryopreservation.

Finally, the present study exemplifies that there was no statistical significant correlation between intention regarding oocyte cryopreservation and sociodemographic characteristics of the studied unmarried healthy females before and after implementation of the educational program.

Such result disagree with (Hasab Allah et al. 2021, & Khattak et al. 2022) who

demonstrated that there was a highly statistical significant relation between students' total beliefs about oocyte cryopreservation and their age, academic level, marital status and mother's education in both pretest and posttest. From the researchers' point of view, their study subjects were not homogenous.

Conclusion:

Based on the study outcome, implementation of the education program regarding oocyte cryopreservation improved knowledge, attitudes, and intention of the studied unmarried females. Thus, the aim of the study is achieved and the research hypothesis is supported.

Recommendations:

Health education programs, modules, guidelines, and counselling regarding oocyte cryopreservation should be provided by maternity and gynecological nurses to all unmarried females of fertile age to help them have an informed decision to preserve their fertility in order to be pregnant during their preferred or appropriate time.

Additionally, all females with cancer or other diseases that can affect their fertility should be educated about this risk, as well as about oocyte cryopreservation and other methods for fertility preservation according to their conditions.

Oocyte cryopreservation should be made available to encourage unmarried females to decide actively regarding preserving their fertility for future reasons.

Further studies should be carried out at different settings and with different study groups and design.

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