



Full length article

Awareness of fertility and reproductive aging in women seeking oocyte cryopreservation, reproductive aged controls, and female health care professionals: A comparative study

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ABSTRACT

Objective: To compare the awareness of fertility and reproductive aging in women seeking oocyte cryopreservation (OC) with age matched controls.

Study design: In this cross-sectional comparative study, women who were candidates for OC due to impending oocyte depletion (n=81) were compared to age matched reproductive aged women (RAW) (n=91) and female healthcare professionals (FHP) (n=82) in terms of awareness about fertility and reproductive aging and knowledge about OC. A study specific 18-item questionnaire was constructed on the basis of previous research on OC and fertility.

Results: Awareness of fertility and reproductive aging was similar among groups. The majority of study population was quite realistic of women's most fertile age period whereas they were fairly optimistic about the age that a woman may lose her ability to conceive, monthly fecundity rate, and estimated in vitro fertilization treatment success. OC candidates and FHP were more realistic compared to RAW regarding the age after which the chances of conception is severely diminished (p=0.005).

When the knowledge on OC and willingness to preserve fertility in the future were asked to FHP and RAW, 90% stated that they were aware of the option (93% in FHP versus 88% in RAW, p=0.006). However, they lacked detailed information about OC and they were unlikely to consider it in the future.

Conclusions: Women seeking OC did not appear to have a better awareness of reproductive ageing compared to the general female population. The results of this study highlight the need for additional awareness campaigns and education on both personal and professional levels.

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Introduction

In developed countries, improved educational and professional opportunities for women, care commitments, economic difficulties, absence of a partner, and improved access to effective contraception increased the trend to delay childbearing [1,2]. Until recently, there were no options for fertility preservation in women who wished to delay conception and women who wished to do so had to cope with diminished chances of getting pregnant spontaneously or for that matter with assisted reproductive technologies [3,4]. Freezing oocytes using conventional methods such as slow freezing did not yield satisfactory results and thus was far from offering a reasonable alternative. However, this changed

radically with the advent of oocyte vitrification resulting in very high post warming survival and fertilization rates [5,6]. The success of vitrification renewed a surge of interest in oocyte cryopreservation (OC) for preservation of fertility and the possibility of insuring against age related subfertility. OC has been legal for cancer patients in Turkey, however, since October 2014 the scope of the legislation has been widened to include women with a diminished ovarian reserve and/or a family history of premature ovarian insufficiency.

OC is growing in popularity all over the world; however general public awareness about the natural and profound fertility decline that occurs before the onset of menopause is still less than expected [7,8]. Reports showed that knowledge regarding reproductive aging is low even in medical students and obstetrics and gynecology residents [9,10], as well as in medical doctors and female healthcare professionals such as nurses and midwives [11]. Women who are interested in fertility preservation are expected to be more aware of age related fertility decline including its risk

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factors as they may have more likely inquired into the issue and discussed the topic with their physicians and friends [12]. However, there are no studies that compared their level of knowledge with that of health care professionals or reproductive aged women.

In this context, the objective of our study was two fold: 1) to assess the fertility and treatment expectations of women pursuing OC due to anticipated gamete exhaustion, 2) to compare their knowledge with those of female healthcare professionals (FHP) and reproductive aged women (RAW).

Patient and methods

A study specific 18-item questionnaire was administered to three groups of women between 21 and 41 years of age. The study was conducted in Womens' Health and Assisted Reproduction Unit of the American Hospital, Istanbul between January 2015 and June 2017. Institutional review board approval was obtained from the Koc University School of Medicine Committee of Human Research (2017.024.IRB3.011). All women participated in the study on a voluntary basis following their verbal consent.

Patients

Women seeking OC: All patients who applied to our clinic for OC due to advanced age, diminished ovarian reserve and/or family history of premature ovarian failure. These subjects completed the questionnaire prior to taking personalized counseling on fertility preservation.

Female healthcare professionals (FHP): The same survey was administered to age-matched nurses and midwives working in Womens' Health and Assisted Reproduction Unit of the American Hospital.

Reproductive aged women (RAW): Age-matched patients attending our clinic for gynaecological reasons were offered to fill out the questionnaire while waiting to see their physicians. Women who had a history of infertility or prior assisted reproduction treatment were excluded.

The questionnaire

A study specific 18-item questionnaire was constructed on the basis of previous research on OC and fertility. The survey had three sections. In the first section (7-item), demographic characteristics such as age, education level, marital status, and professional activities were recorded. Intentions regarding conception and age of desired motherhood were assessed as well.

In the second section (6-item), awareness of women about natural fertility decline and knowledge about risk factors

associated with premature/accelerated decrease of ovarian reserve were assessed (Table 1). In order to compare their awareness, the participants were classified as optimistic, pessimistic or realistic according to their answers to the questions. While realists marked the correct answers, optimists overestimated and pessimists underestimated their reproductive potential.

In the third section (5-item) knowledge of RAW and FHP about fertility preservation were analyzed with questions such as; 'Have you ever heard of oocyte freezing for fertility preservation?', 'What is the source of your information?', 'Do you have in depth information about OC?' and 'Would you like to have more information about OC?' and 'Would you consider OC for social or medical reasons?' This part of the questionnaire was not given to OC women.

Statistical analysis

Descriptive statistics were used to characterize study participants and their responses. Correct answers were given as percentages and compared among groups by using Chi-square test. SPSS Statistics version 20.0 was used to analyze the data and p value of < 0.05 was considered to be statistically significant.

Results

A total of 254 women completed the survey. Fourteen women who did not fully complete the survey were excluded from then analysis of the results.

Demographics

Mean age of the women in the three groups was similar. Significantly more women in the OC and FHP groups were educated and employed. All women inquiring into OC were single at the time of the survey (Table 2). There was no difference in the number of desired children, however, more women in the OC group wished to defer conception to a more advanced age compared to FHPs and RAW. Women in all groups expressed their wish to complete childbearing before 40 years of age.

Awareness about fertility and reproductive aging

Knowledge-based questions and the correct answers derived from the published data are given in Table 1. In all three groups the majority of the participants were quite realistic about the age of women's most fertile period (Q1) whereas they were fairly optimistic about the age that a woman loses her ability to get pregnant (Q3), monthly fecundity rate (Q4) and predicted IVF treatment outcome (Q5). When three groups were compared, no difference was found in number of optimistic, realistic or

Table 1
Questions in the survey to determine awareness of women about fertility and aging.

	1	2	3	4	5
Q1: What is the age range of a woman's most fertile period?	15-24	25-29 [*]	30-34	35-39	40-50
Q2: At what age there is a marked decrease in women's ability to become pregnant?	15-24	25-29	30-34	35-39 [*]	40-50
Q3: At what age does a woman lose her ability to get pregnant?	35-40	40-45	45-50 [*]	50-55	60<
Q4: What is the monthly chance of conception with regular intercourse in women 25-35 years of age?	5-10	20-25 [*]	30-40	40-50	60-70
Q5: What is the likelihood of pregnancy after one IVF treatment after 40 years of age?	5-10	20-25 [*]	30-40	40-50	60-70
Q6: What are the potential risk factors associated with decreased ovarian reserve?	None	I,II,III	I,III,IV,V,VI	II,III,IV,V,VI	All [*]
I. Age					
II. Smoking					
III. History of premature menopause					
IV. Previous ovarian surgery					
V. Endometriosis					
VI. Cancer treatment					

^{*} Indicates the correct answer according to the literature.

Table 2
Demographic data of the participants.

	Women seeking OC (N=81)	Female healthcare professional (N=82)	Reproductive aged women (N=91)	P value
Mean Age (\pm sd)	38 \pm 2	37 \pm 3	37 \pm 3	0.08
Education level				
Low	2(2.5)	0	21(24)	<0.001
Medium	5(6)	5(6)	26(27.5)	
High	74(91.5)	77(94)	44(48.5)	
Marital status				
Single	81(100)	27(33)	22(24)	<0.001
Married	0	49(60)	62(68)	
Widowed	0	6(7)	7(8)	
Employment				
Employed	69(85)	82(100)	46(51)	<0.001
Unemployed (e.g. housewife, student)	12(15)	0	45(49)	
Number of desired children				
One	30(38)	20(24)	17(19)	0.28
Two	41(51)	55(67)	59(65)	
More than two	10(11)	7(9)	15(16)	
Age at which first child is desired				
<35years	56(69)	75(92)	83(92)	<0.001
36–40 years	9(23.5)	7(8)	5(6)	
>40 years	6(7.5)	0	3(3)	
Age at which last child is desired				
<35years	39(49)	50(62)	59(65)	0.10
36–40 years	30(38)	28(35)	27(30)	
>40 years	12(13)	4(3)	5(5)	

OC: oocyte cryopreservation.

Data are given as number and percentages unless otherwise indicated.

pessimistic women. OC candidates and FHP were more realistic compared to RAW about the age that a woman markedly loses her ability to get pregnant (Q2) ($p=0.005$). Furthermore, only one in five participants had knowledge about risk factors associated with a diminished ovarian reserve (Q6).

Knowledge on OC and willingness to preserve fertility in the future

The four question (Q7–11) shown in Table 3 were asked to FHP and RAW. The majority (90%) had already heard about oocyte freezing for fertility preservation (93% in FHP versus 88% in RAW, $p=0.006$), however they had no in depth information on the

subject. Half of the participants stated they learned about OC from their friends (47%) followed by their gynecologists (35%), the internet (13%), and TV or magazines (5%).

When the three groups were compared regarding the estimated chances of conception after one IVF cycle using cryopreserved oocytes (Q5) or the success of IVF per frozen oocyte (Q12), there was no differences in the number of optimistic, realistic or pessimistic answers (Table 4).

Discussion

The characteristics of women pursuing OC in Turkey are similar as described elsewhere [12,13]. All of them were single, highly

Table 3
Questions to determine awareness of fertility preservation.

	Female healthcare professional (N = 82)	Reproductive aged women (N = 91)	P value
Q7: Have you ever heard of oocyte freezing for fertility preservation?			
Yes	76(93)	80(88)	0.006
No	6(7)	11(12)	
Q8: What is the source of your information?			
Friend	39(48)	56(62)	0.005
Ob/Gyn	16(20)	2(3)	
Medical Doctor	12(15)	10(11)	
TV/ Magazine	10(13)	17(19)	
Internet	5(4)	6(5)	
Q9: Do you have in depth information about OC?			
Yes	3(4)	4(5)	0.23
No	77(94)	81(89)	
A little	2(2)	6(6)	
Q10: Would you like to have more information about OC?			
Yes	77(94)	30(33)	<0.001
No	5(6)	61(67)	
Q11: Would you consider OC for social or medical reasons?			
Yes	2(2)	9(10)	0.31
No	77(94)	79(87)	
Maybe	3(4)	3(3)	

OC: oocyte cryopreservation.

Data are given in numbers and percentages.

Table 4

Questions in the survey to determine the knowledge on chance of pregnancy following assisted reproductive techniques.

	Women seeking OC (N = 81)	Female healthcare professional (N = 82)	Reproductive aged women (N = 91)	P value
Q5a: What is the likelihood of pregnancy after one IVF treatment at 40 years of age?				
Optimistic (30–40%, 40–50%, 60–70%)	42(52)	40(49)	52(57)	0.34
Realistic (20–25%)	19(23)	24(29)	27(30)	
Pessimistic (5–10%)	20(25)	18(22)	12(13)	
Q5b: What is the chance of pregnancy per frozen egg?				
Optimistic (10–20%, 30–40%, 50–60%)	49(60)	61(75)	68(75)	0.21
Realistic (4–5%)	23(28)	15(19)	16(18)	
Pessimistic (1–2%)	9(12)	6(6)	7(7)	

Data are given as numbers and percentages.

educated and self-employed. The age of women at the time of application to OC ranged from 31 to 41 years with an average of 38 years. These findings are similar to previous studies, which showed that women undergoing OC were usually in their mid-to-late-30s [12–14]. In our study population, 88% of OC candidates were > 35 years of age and 40% of them were ≥ 40 years of age. This may be due to low public awareness on natural fertility decline, the lack of public announcement of OC as preventative treatment for future infertility and the legislation in Turkey that allows fertility preservation only in women with cancer or with a diminished ovarian reserve.

The success of oocyte freezing is likely associated with the age at which the procedure is undertaken. According to a recent meta-analysis, age 36 showed the highest discrimination capability for success or failure of a live birth when cryopreserved oocytes were used [15]. Since the cumulative live birth rate in patients aged ≤ 35 years is significantly higher compared to those aged ≥ 36 years, despite using the same number of oocytes [5], this appears to be the optimal time to undertake the procedure. Our results indicate that women pursuing this course of action in Turkey at least are late in their endeavor thus possibly limiting their future success.

In our study population, OC candidates, FHP and RAW represented three distinct groups: OC candidates were those who were interested in fertility preservation due to various reasons and were proactive in their attempt to secure a reproductive future. FHPs were expected to have a broader and more accurate knowledge on the decline of and preservations options for fertility. RAW more closely represented the general female population and were expected to be less knowledgeable in this respect. However, contrary to expectations, OC candidates did not appear to be more realistic or have a better awareness of reproductive ageing compared to FHP or RAW. One of the reasons is the lack of education prospects for natural fertility and its decline thereof. Although TV shows, magazines, health news, social media, etc. are available tools to improve knowledge of fertility and reproductive health; none of them emphasizes the subject adequately. According to our results, only 5% of the participants heard OC from TV or magazines. The information sources were mainly friends and their gynecologists. Annual visits offer a unique opportunity to assess the reproductive potential of a gynecologic patient, provided that the physicians are knowledgeable in this regard and timely refer the patients at risk to a fertility specialist. However, nearly half of the gynecology residents overestimated the age at which female fertility markedly declines [10]. Fertility preservation was offered after 40 years of age, a time when prospects for future childbearing were greatly diminished [16]. Although OC candidates were more realistic about a woman's most fertile period, they had a tendency to overestimate the age at which conception was unlikely. More than 60% believed that a woman loses her ability to conceive after 50 years of age. Owing to the

inaccurate knowledge of the fertility decline with age, they felt more comfortable in postponing their desire for pregnancy. On the other hand, once they were faced with reality of reproductive ageing, they were ready to pursue all available options [17].

Another reason of low fertility awareness in OC candidates is due to the misperception that stems from the overvaluation of IVF treatment. The participants believed that ART would help them to conceive in later ages. Even physicians other than gynecologists indicated that IVF treatment carries 28% chance of pregnancy in women > 45 years of age [16] in contrast with the 5% that is quoted by the HFEA (Human Fertilization and Embryology Authority) of the United Kingdom [18].

To conclude, women seeking OC did not appear to have a better awareness of reproductive ageing compared to the general female population. The results of this study highlight the need for additional population based education programs to increase the awareness of fertility preservation.

Declaration of interest

The authors have no relevant affiliations or financial involvement with any organization or entity with a financial interest in or financial conflict with the subject matter or materials discussed in the manuscript. No writing assistance was utilized in the production of this manuscript.

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