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Comparison of Oocyte Yield in Medical, Social or Donor Oocyte Cycles

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ABSTRACT

Purpose: To compare oocyte yield, maturation rates, cumulative vitrified oocyte counts, incidence rate of ovarian hyperstimulation syndrome (OHSS), and clinical-demographic factors influencing efficiency in oocyte cryopreservation cycles performed for donor and social fertility preservation purposes.

Methods: A retrospective cohort analysis was conducted on 1,041 women who underwent oocyte pick-up and vitrification between 2020 and 2024 in four private in vitro fertilization centers. Participants were grouped into donor (n=590) and social (n=451) cohorts. Clinical, hormonal, stimulation protocol data and oocyte outcomes were compared between groups.

Results: The mean age was 24.8 and 34.4 years in the donor and social group, respectively ($p<0.001$). Donors had lower basal follicle stimulating hormone and higher anti-Müllerian hormone concentrations and antral follicle counts. The mean total gonadotropin dose was 1,516 international unit (IU) in donors and 3,425 IU in the social group ($p<0.001$). Ovulation triggering was predominantly performed with human chorionic gonadotrophin; in 88.3% of donors versus 76% of the social group. Mean number of retrieved oocytes was 39.5 in donors and 5.0 in the social group; mature (30.4 vs. 4.3) and vitrified oocyte counts (23.0 vs. 4.7) were significantly higher in donors ($p<0.001$). OHSS incidence was 14.7% in donors and 1.3% in the social group. Most social group participants were self-funded, reflecting a higher socioeconomic status and fertility preservation, motivated by career planning.

Conclusion: Significant socio-demographic, biological, and clinical differences existed between donor and social groups undergoing oocyte cryopreservation in the study population. These findings highlight the importance of individualized stimulation protocols and counseling tailored to patient profiles. Data from this study may aid optimization of fertility preservation strategies and resource allocation.

Keywords: Oocyte cryopreservation, fertility preservation, oocyte donation, social freezing, ovarian stimulation, oocyte yield, vitrification, ovarian hyperstimulation syndrome, reproductive outcomes, assisted reproductive technology

INTRODUCTION

Oocyte cryopreservation is the process of freezing mature metaphase II (MII) oocytes obtained from women in a laboratory setting for long-term storage. This technique halts the biological aging process of oocytes, thereby enabling the possibility of becoming pregnant in later years. Today, a rapid freezing method known as vitrification ensures high success rates by preserving the structural integrity of the oocytes.[1]

Within modern assisted reproductive technologies, oocyte cryopreservation is gaining increasing importance and is based on three main indications. Medical indications aim to preserve fertility in conditions that threaten reproductive potential, such as malignancies (e.g., breast or hematologic cancers), autoimmune diseases, and gonadotoxic treatments.[2] Social indications address the desire of healthy women to preserve their fertility potential at an advanced age due to personal, professional, or social reasons for delaying pregnancy.[3]

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Donor cycles involve the freezing or preparation of oocytes obtained from young donors with high ovarian reserves for use by infertile couples, either for freezing or fresh transfer.[4]

This diversity in indications leads to significant differences in controlled ovarian hyperstimulation protocols, stimulation duration, gonadotropin dosages, and clinical objectives. Consequently, noticeable variations are observed in parameters such as the total number of oocytes retrieved, maturation rates, and the risk of complications.[2-4] Only a limited number of studies in the literature have directly compared social, medical, and donor cycles.

Existing findings indicate that obtaining a sufficient number of high-quality oocytes is critical for pregnancy success in social fertility preservation cycles at an advanced age, whereas in medical indications, due to time constraints, the yield is relatively limited. Donor cycles, on the other hand, are considered a reference group due to the high oocyte yield from young healthy donors.[5]

The aim of this study is to compare parameters, including total oocyte yield, proportions of mature and immature oocytes, maturation rates, cumulative number of vitrified oocytes, incidence of ovarian hyperstimulation syndrome (OHSS), and the frequency of oocyte pick-up (OPU) procedures in oocyte cryopreservation cycles performed for social, medical, and donor purposes. The findings may help the development of individualized approaches for fertility preservation practices and to provide a scientific basis for social fertility planning.

METHODS

Study Design

This study was a retrospective cohort analysis. The primary outcome of the study was oocyte yield per retrieval cycle, while secondary outcomes included oocyte maturation rates, cumulative vitrified oocyte counts, incidence of OHSS, and socio-demographic characteristics. The study included patients who applied to four private in vitro fertilization centers for oocyte cryopreservation between 2020 and 2024. A total of 1,041 women who underwent oocyte retrieval and vitrification procedures were identified, and their medical records were reviewed. The patients were evaluated under two categories: donor group and social group. Data were retrospectively obtained from patient files and digital archive records. All patient identities were strictly kept confidential.

Participants

Ethical approval for this study was granted by the Ethics Committee of Bolu Abant İzzet Baysal Faculty of Medicine (approval number: 2025/340, date: 21.07.2025). The study included patients who underwent at least one OPU procedure. The study population consisted of cases evaluated within the context of social (elective), medical (fertility preservation), or donor oocyte programs and who underwent vitrification following oocyte retrieval.

Inclusion criteria were: complete and accessible clinical records regarding the patient's stimulation protocols and oocyte yield, an age range between 18 and 42 years, and appropriate permissions obtained within the scope of ethics committee approval for data sharing.

Exclusion criteria included patients who did not undergo oocyte retrieval or vitrification, those with undefined indications, i.e., not clearly categorized as social, medical, or donor, patients with incomplete or untraceable data, women under 18 or over 42 years of age, cycles with severely diminished ovarian reserve and poor stimulation response (≤3 oocytes retrieved), cases canceled due to OHSS with no oocytes retrieved, transgender individuals, and patients undergoing gender transition.

Assessment

The cases included in the study were divided into two groups based on the indication for oocyte cryopreservation. The donor group (n=590) consisted of healthy women with a high ovarian reserve profile who donated their oocytes for use in infertility treatment. These individuals had no reproductive concerns of their own, participated solely as donors, and all costs related to the stimulation process were covered by the recipient couple or the clinic. The social group (n=451) comprised women who applied for elective (social) fertility preservation and sought to safeguard their reproductive potential due to advancing age. Individuals in this group aimed to preserve their own fertility for future family planning and personally bore all treatment-related expenses. Thus, the medical and social indication cases were combined into a single social group for the purposes of analysis.

All participants presented on the second or third day of menstruation, at which point transvaginal ultrasonography was performed to assess antral follicle count, and serum levels of follicle stimulating hormone (FSH), luteinizing hormone, estrogen, prolactin, and thyroid function tests were evaluated. In both groups, sociodemographic data, clinical and hormonal indicators [body mass index (BMI), FSH, anti-Müllerian hormone (AMH), baseline antral follicle count], controlled ovarian stimulation protocols (type of protocol used, total gonadotropin dose, triggering method), and oocyte yield and cycle outcomes (total and mature oocytes retrieved, proportion of cycles with >15 oocytes retrieved, number of vitrified oocytes, incidence of OHSS were analyzed comparatively. Mature oocytes were defined as MII oocytes confirmed under microscopy. OHSS was diagnosed according to the criteria of the American Society for Reproductive Medicine, based on clinical symptoms and laboratory findings.[6]

Statistical Analysis

Statistical analyses were performed using SPSS version 26.0 (IBM inc., Armonk, NY, USA).

The distribution of continuous variables was assessed using the Kolmogorov-Smirnov test.

Data with a normal distribution are expressed as mean ± standard deviation, while non-normally distributed data are expressed as median (min-max). For comparisons between groups, the independent samples t-test (for normally distributed data), the Mann-Whitney U test (for non-normally distributed data), and the chi-square test or Fisher's exact test (for categorical variables) were used. To identify factors

affecting oocyte yield, multivariate logistic regression analysis was performed. A p-value of <0.05 was considered statistically significant for all analyses.

RESULTS

A total of 1,041 women were evaluated in this study. Participants were divided into two groups based on the indication for oocyte cryopreservation: the donor group (n=590) consisted of healthy volunteers who froze their oocytes for donation purposes; the social group (n=451) included women who aimed to preserve their fertility due to advancing age.

Table 1 compares the donor and social groups in terms of information sources, educational level, income status, employment status, and payment methods for treatment expenses. A significant difference was found between the groups regarding sources of information ($p<0.001$). The majority of social group participants (89.3%) received information from obstetricians/gynecologists, while the most common sources in the donor group were media/social media (55.5%) and acquaintances/friends (39.1%). Participants informed through family physicians were only represented in the social group (2.6%). There was no significant difference between the groups in terms of educational level ($p=0.500$). In both groups, the majority of participants were university graduates (donor group: 86.1%; social group: 83.5%). Income status showed a marked difference between the groups ($p<0.001$). In the donor group, 32.8% reported no income, and 58.9% reported earning at the minimum wage level. In contrast, 95.7% of the social group had incomes above the minimum wage.

Employment status also differed significantly between the groups ($p<0.001$). While 97.3% of the social group were actively employed, this rate was 67.1% in the donor group. Among the donor group, 21.8% were unemployed, and 11% were students. The method of covering treatment expenses also varied significantly between the groups ($p<0.001$). In the donor group, all costs were covered by the recipient couple or the clinic. In the social group, 86.9% of participants financed the procedure themselves, while support from family (11.9%) and relatives (1.1%) was also reported. Table 2 presents a comparative analysis of the baseline demographic and clinical characteristics of participants in the donor and social groups. The mean age of participants in the donor group was significantly lower than that of the social group ($p<0.001$). Similarly, BMI was also found to be significantly lower in the donor group ($p<0.001$). In terms of ovarian reserve parameters, the donor group had significantly lower baseline FSH levels ($p<0.001$), while their AMH levels and antral follicle

Table 1. Motivators and sociodemographic characteristics of participants according to group

Variable	Donor group (n=590)	Social group (n=451)	*p* value
Source of information			
General practitioner	0 (0.0%)	12 (2.6%)	<0.001
Oncologist	0 (0.0%)	0 (0.0%)	–
Gynecologist	31 (5.3%)	403 (89.3%)	<0.001
Acquaintance/friend	231 (39.1%)	19 (4.2%)	
Media/social networks	328 (55.5%)	17 (3.7%)	
Education level			0.500
Primary school	6 (1.0%)	5 (1.1%)	
High school	76 (12.8%)	69 (15.2%)	
University	508 (86.1%)	377 (83.5%)	
Income level			<0.001
None	194 (32.8%)	11 (2.4%)	
Minimum legal wage	348 (58.9%)	8 (1.7%)	
Higher than minimum wage	48 (8.1%)	432 (95.7%)	
Employment status			<0.001
Unemployed	129 (21.8%)	5 (1.1%)	
Student	65 (11.0%)	7 (1.5%)	
Employed	396 (67.1%)	439 (97.3%)	
Expense coverage			<0.001
Recipient	590 (100%)	–	
Self	–	392 (86.9%)	
Parents	–	54 (11.9%)	
Relatives	–	5 (1.1%)	

Categorical variables were compared using the chi-square test or Fisher's exact test where appropriate. A p-value <0.05 was considered statistically significant.

counts were significantly higher ($p<0.001$), indicating a more favorable ovarian reserve profile compared to the social group.

The total gonadotropin dose used during ovarian stimulation was significantly lower in the donor group ($p<0.001$). The proportion of cycles initiated with a random-start protocol was comparable between the two groups ($p=0.230$). However, a significant difference was observed in the types of stimulation protocols employed ($p=0.002$). While the most commonly used regimen in both groups was the short antagonist protocol, the progesterone-primed protocol was more frequently used in the social group (12.4% vs. 6.4%). Trigger methods for ovulation also differed significantly between groups ($p<0.001$); human chorionic gonadotrophin (hCG) was predominantly used in the donor group, whereas agonist and especially dual trigger protocols were more frequently employed in the social group. Notably, the dual trigger method was exclusively used in the social group 7.9% vs. 0% in the donor group.

Table 3 summarizes the findings related to oocyte yield in the donor and social groups. A comparison between the groups revealed that oocyte retrieval was predominantly performed in a single attempt in the donor group (95.4%), whereas this rate was significantly lower in the social group (78.0%), with a higher frequency of second retrieval cycles observed (19.5%) ($p<0.001$). Dual stimulation protocols were applied in 2.4% of the social group, while no such cases were recorded in the donor group. The mean number of oocytes retrieved per patient was significantly higher in the donor group ($p<0.001$). Similarly, the proportion of patients with more than 15 oocytes retrieved per cycle was markedly higher in the donor group ($p<0.001$). Both the number of mature MII oocytes ($p<0.001$) and immature oocytes ($p<0.001$) were significantly greater in the donor group compared to the social group. The cumulative number of vitrified oocytes was also substantially higher in the donor group, with an average of 23.0 oocytes per patient, compared to 4.7 in the social group ($p<0.001$).

Table 2. Baseline characteristics of participants

Variable	Donor group (n=590)	Social group (n=451)	*p* value
Age (years)	24.8±3.3	34.4±6.9	<0.001
BMI (kg/m²)	21.5±5.1	24.1±3.4	<0.001
FSH (mIU/mL)	7.5±3.9	11.8±4.6	<0.001
AMH (ng/mL)	2.7±3.7	0.6±0.6	<0.001
Baseline antral follicle count	8.7±5.4	5.1±2.8	<0.001
Total dose of stimulation (IU)	1516±315	325±1047	<0.001
Random start (n, %)	19 (3.2%)	21 (4.6%)	0.230
Stimulation protocol			0.002[1]
Short antagonist	519 (87.9%)	410 (90.1%)	
Progesterone-primed	38 (6.4%)	56 (12.4%)	
Long agonist	33 (5.5%)	15 (3.3%)	
Ovulation trigger			<0.001[2]
hCG	521 (88.3%)	343 (76%)	
Agonist trigger	69 (11.6%)	72 (16%)	
Double trigger	–	36 (7.9%)	

[1]Chi-square test for multiple group comparison within stimulation protocols.
[2]Chi-square test for multiple group comparison within ovulation trigger methods.
All continuous variables were analyzed using independent samples t-test and categorical variables were analyzed using chi-square test.
BMI: Body mass index, FSH: Follicle stimulating hormone, AMH: Anti-Müllerian hormone, IU: International unit, hCG: Human chorionic gonadotrophin

Table 3. Oocyte yield of the groups

Variable	Donor group (n=590)	Social group (n=451)	*p* value
Oocyte pick-up - once	563 (95.4%)	352 (78.0%)	<0.001
Oocyte pick-up - twice	27 (4.5%)	88 (19.5%)	
Oocyte pick-up - double stimulation	0 (0.0%)	11 (2.4%)	
Number of oocytes retrieved/patient	39.5±19.7	5.0±4.8	<0.001
>15 oocytes retrieved/cycle	544 (92.2%)	19 (4.2%)	<0.001
Number of mature oocytes/patient	30.4±16.3	4.3±4.4	<0.001
Number of immature oocytes/patient	3.3±2.8	0.4±0.7	<0.001
Cumulative number of oocytes vitrified	23.0±14.4	4.7±4.8	<0.001
Ovarian hyperstimulation syndrome	87 (14.7%)	6 (1.3%)	<0.001

Moreover, the incidence of OHSS was significantly higher in the donor group ($p<0.001$).

DISCUSSION

In the present study, individuals who underwent oocyte cryopreservation were categorized into two groups, donor and social groups, and compared. Significant differences were observed between the groups in terms of sociodemographic characteristics, biological parameters, ovarian stimulation response, and oocyte yield. The findings indicate that the two groups differed not only clinically but also in terms of motivation and socioeconomic status.

The majority of participants in the donor group were low-income, unemployed or students, and all treatment expenses were covered by the egg-donation recipients. These factors strongly suggest that the primary motivation for participation in the donor group was financial. This is consistent with previous reports indicating that oocyte donors often engage in donation primarily for economic reasons rather than altruism.[7,8] Although the donor group had a slightly higher rate of university education than the social group, the social group differed in terms of employment and having a higher income, suggesting that these were career-oriented women making informed, elective decisions to postpone childbearing.

Furthermore, the fact that most of these individuals obtained information directly from gynecologists reflects a high level of medical awareness. These findings again align with the existing literature suggesting that increasing educational attainment and professional aspirations are driving women to delay reproduction and opt for elective fertility preservation.[9,10]

Significant differences were also observed in biological parameters, such as age, BMI, hormone profiles, and ovarian reserve. Donors were almost 10 years younger on average than the social group participants. Donors are typically young women with high fertility potential, and most studies report oocyte donors to be within the 20-30 years old age range.[7] Age also impacts BMI and hormone levels. The donor group had a significantly lower mean BMI than the social group but both were in the normal weight range. A lower BMI is generally preferred in donor selection and is associated with better ovarian reserve.[11]

The significantly higher mean FSH and lower AMH levels in the social group reflect an age-related decline in ovarian reserve.[12] Similarly, the antral follicle count was significantly lower in the social group. Antral follicle count is a widely accepted biomarker for predicting ovarian response and is expected to be higher in younger individuals. These biological differences influenced stimulation strategies. The mean total gonadotropin dose was significantly higher in the social group than in the donor group, reflecting an effort to compensate for diminished ovarian reserve.[13]

Although the short antagonist protocol was the most commonly used stimulation method in both groups, a progesterone-primed ovarian stimulation (PPOS) protocol was more frequently used in the social group. PPOS is favored in fertility preservation for its flexibility in cycle scheduling.[14]

The random-start protocol also tended to be more common in the social group, though not significantly so. This protocol is widely adopted in time-sensitive indications, such as fertility preservation for cancer patients.[15] Trigger methods for ovulation also differed significantly between groups, with hCG predominantly being used in the donor group, whereas agonist or dual-trigger methods were more frequently employed in the social group to minimize OHSS risk.[16] In terms of oocyte yield, the donor group demonstrated a superior quantitative and qualitative response. A single stimulation cycle was sufficient for 95.4% of donors, while 19.5% of the social group required a second cycle, and 2.4% underwent dual stimulation. Dual stimulation is considered effective for patients with limited time and diminished ovarian reserve.[17,18] The average number of retrieved oocytes was also significantly higher in the donor group. Furthermore, the proportion of cycles yielding ≥15 oocytes was more than 90% in the donor group versus <5% in the social group. These differences are attributed to variations in age, ovarian reserve, and stimulation protocols.[19,20]

The number of mature oocytes MII was also significantly higher in the donor group compared to the social group. Although the donor group also had a significantly higher number of immature oocytes, this is likely due to the overall higher oocyte yield. A greater number of mature oocytes provides a distinct advantage for fertilization and embryo development.

Similarly, the mean number of vitrified oocytes was significantly greater in the donor group, indicating that younger women with better ovarian reserve exhibit a better response to stimulation.[21]

The significantly higher incidence of OHSS observed in the donor group compared to the social oocyte cryopreservation group highlights a notable clinical concern. This increased risk (approximately 14% vs approximately 1%) is likely attributable to the higher ovarian reserve typically observed in donors, the more robust ovarian response to stimulation, and the prevalent use of hCG for triggering final oocyte maturation in this group. In contrast, the social group generally demonstrated a more attenuated ovarian response, and protocols incorporating gonadotropin releasing hormone (GnRH) agonist or dual triggering were more frequently employed, both of which are recognized strategies for reducing OHSS risk.[22] In the literature, OHSS incidence in oocyte donors undergoing hCG-triggered protocols has been reported to range between 17% and 30%, which is higher than the 14.7% incidence found in our donor cohort.[23] The selection of trigger agent and stimulation protocol plays a critical role in OHSS pathogenesis.[22,24] Given the typically diminished ovarian reserve in social oocyte cryopreservation patients, the risk of OHSS in this population is inherently lower.[25] This corresponds well with our finding of a 1.3% OHSS incidence in the social group. Systematic reviews and clinical studies have shown that GnRH agonist triggering is associated with a significantly lower risk of OHSS compared to hCG, particularly in antagonist protocols.

Therefore, in high responders such as oocyte donors, the use of GnRH agonist triggering, cycle segmentation strategies, and close patient monitoring are strongly recommended.[22,24]

However, reports exist of OHSS development even after GnRH agonist triggering, particularly in young women with very high oocyte yield, suggesting that no approach is entirely risk-free.[26] Given the potential severity of OHSS, including hospitalization, thromboembolic events, and long-term reproductive complications, mitigating this risk is paramount. Severe OHSS can result in life-threatening complications, such as deep vein thrombosis, acute renal failure, and acute respiratory distress syndrome, with some studies reporting a 4.4% rate of such outcomes.[27] Moreover, OHSS has been associated with adverse obstetric outcomes, including low birth weight and preterm delivery.[28] Therefore, careful monitoring of ovarian response during stimulation, individualized protocols, and the use of preventive strategies, such as GnRH agonist triggering and freeze-all approaches, should be strongly considered, especially in high responders.[29] Close follow-up, timely recognition of symptoms, and proactive management can significantly reduce the clinical burden of OHSS and improve patient safety, as supported by prospective protocols such as stop OHSS.[29]

Study Limitations

This study's strengths include a large sample size and comprehensive evaluation of sociodemographic and biological factors across donor and social oocyte cryopreservation groups. Limitations include its retrospective design, reliance on patient records without standardized questionnaires, and lack of adjustment for potential confounders such as age, BMI, and AMH.

CONCLUSION

In conclusion, this study comprehensively investigated the socioeconomic, biological, and clinical disparities between donor and social oocyte cryopreservation groups in a Turkish population and highlights the need for individualized treatment strategies in fertility preservation. Donors were typically young women with high ovarian reserve and financially motivated participation, whereas the social group comprised older, highly educated, career-oriented women making elective reproductive choices. Recognizing these distinctions in clinical practice may enhance patient counseling and optimize treatment outcomes. Moreover, in light of the growing demand for elective fertility preservation, the findings of this study may help inform evidence-based decision-making regarding fertility planning and resource allocation. In this context, the increased OHSS risk observed among donors underscores the importance of vigilant clinical follow-up and the implementation of safer stimulation and triggering strategies. The study was conducted to provide guidance for clinical practice and establish a foundation for future research in the field of fertility preservation.

Ethics

Ethics Committee Approval: Ethical approval for this study was granted by the Ethics Committee of Bolu Abant İzzet Baysal Faculty of Medicine (approval number: 2025/340, date: 21.07.2025).

Informed Consent: This study was a retrospective cohort analysis.

Authorship Contributions

Surgical and Medical Practices: N.E.A., Y.İ., H.U.Ş., Concept: Y.İ., Ö.D.S., Design: N.E.A., Ö.D.S., Data Collection or Processing: Y.İ., H.U.Ş., Analysis or Interpretation: N.E.A., Ö.D.S., Literature Search: Y.İ., H.U.Ş., Writing: N.E.A., Ö.D.S.

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