

The Epidemiological and Clinical Profile of the Patients Having Oocyte Donation Treatment in Northern Cyprus

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Abstract

BACKGROUND/AIMS: Oocyte donation is a popular form of in vitro fertilisation (IVF) treatment for health tourists worldwide and in Northern Cyprus. Patients with various medical conditions requiring this treatment have diverse demographic profiles and clinical findings. Viewing patients holistically may provide new insights into treatment.

MATERIALS AND METHODS: This retrospective study included patients who underwent oocyte-donation IVF at the Near East University Hospital IVF Centre in Northern Cyprus between October 2021 and March 2024. The ages of female and male patients at the time of treatment, their smoking and alcohol habits, body mass index (BMI), endometrial parameters, transfer quality, sperm parameters, donor age and BMI, and oocyte and embryo evaluation parameters were assessed.

RESULTS: The mean ages of female and male patients were 41.91 ± 6.78 and 41.47 ± 9.21 , respectively, with most being overweight. Most patients preferred two-embryo transfers on day five of embryo development. While 18.1% of patients wished to add preimplantation genetic diagnosis to their treatment, 29.4% opted for sperm microchipping, and 11.3% chose sperm donation. The endometrial rim was thicker in younger female patients ($p < 0.001$) and in non-smoking female patients ($p = 0.021$). A trilaminar pattern of the endometrium was observed more frequently in younger ($p = 0.001$), non-smoking ($p = 0.031$), and non-alcohol-consuming ($p = 0.014$) patients.

CONCLUSION: Personalised treatments require evaluation of demographic and clinical variations among patients with diverse profiles and findings. This methodology may enable more effective modifications to clinical outcomes.

Keywords: Oocyte donation, ageing, smoking, endometrium, sperm count

INTRODUCTION

In vitro fertilisation (IVF) treatment with oocyte donation, first applied in 1984, has become a common practice in IVF clinics approved to perform oocyte donation.¹ The patient groups who require oocyte donation to achieve pregnancy are heterogeneous. The well-known aetiologies are women with poor ovarian reserve with premature ovarian insufficiency or age-related depletion of the ovarian reserve; advanced female age, women with genetically inherited disease or unidentified familial genetic condition; women with poor embryo or oocyte quantity and

quality; women with recurrent implantation failure and men with no partner or who have a trans female partner undergoing a gestational surrogacy program.² Given the range of needs for donor oocytes, it is no surprise that patient profiles can be quite diverse.

Oocyte donation programs exclude the ovarian factor. Thus, male and uterine parameters are essential. These programs provide favourable conditions for comparing the effects of demographic parameters with those of clinical parameters, such as sperm parameters and endometrial maturation. The standard semen evaluation in IVF procedures includes

To cite this article: Özbakır B. The epidemiological and clinical profile of the patients having oocyte donation treatment in Northern Cyprus. Cyprus J Med Sci. 2026;11(5):424-429

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Received: 12.03.2026
Accepted: 02.10.2026
Publication Date: 16.10.2026



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semen volume, sperm concentration, motility, and morphology, or the total forward-motile sperm count.^{3,4} The standard endometrium evaluation in oocyte donation IVF procedures includes the measurement of the endometrial thickness.⁵ More recently, researchers have begun evaluating the trilinear pattern in endometrial assessment.⁶ We can also assess hormonal effects by examining cervical mucus.⁷

Objectives

Our study, which has two primary objectives, has significant implications for reproductive medicine. The first objective is to provide a comprehensive profile of patients undergoing oocyte-donation IVF treatment in Northern Cyprus, a health-tourism region with unique demographic and clinical characteristics. The second objective is to investigate the correlations between female factors [age, body mass index (BMI), lifestyle habits, and endometrial thickness] and male factors (age, BMI, lifestyle habits, and total forward-motile sperm count). These objectives are crucial for advancing our understanding of oocyte-donation IVF treatment.

MATERIALS AND METHODS

Study Design and Population

Our research was a retrospective cross-sectional study. We reviewed the medical records of women who participated in the oocyte-donation IVF treatment program at the Near East University Hospital IVF Centre between October 2021 and March 2024. We evaluated 320 embryo transfer cycles from 230 female patients who underwent the same endometrial preparation protocol.

Data Collection

We meticulously extracted the demographic data from the patient application forms, which were completed by the patient under the supervision of healthcare personnel, and the clinical and laboratory data from the medical files. We recorded add-on treatments, including preimplantation genetic diagnosis (PGD), sperm microchipping, and sperm donation, when present. We recorded the female patients' date of birth; month and year of embryo transfer; smoking status; alcohol consumption; weight and height at the time of embryo transfer; endometrial thickness and presence of a trilinear pattern at the time we started progesterone supplementation, or presence of cervical mucus at the time of embryo transfer, both of which indicate peak estrogen effect; transfer ease (easy, medium, hard); and presence of blood on the transfer catheter. We recorded the male patients' date of birth; month and year of embryo formation; smoking and alcohol consumption status; weight and height at the time of sperm sample deposition; and semen volume, sperm concentration, and sperm percentages for fast-forward and slow-forward motility. We also recorded the sperm donors' demographic and clinical information when donor sperm was used. We recorded the oocyte donors' dates of birth, weights, and heights at the time of donation. In the embryology laboratory, we recorded the number of metaphase-2 (M2) quality oocytes used; the number of 2 pronuclear (2 PN) formations at 16-18 hours after intracytoplasmic sperm injection (ICSI); the number of blastocyst formations on days 5-6 of embryo growth; the number of embryos transferred on days 5-6 of embryo growth; and whether the embryo transfer used fresh or frozen embryos. This meticulous data collection process ensures the reliability and accuracy of our study's findings.

We calculated the age of the female patient at the time of the embryo transfer, the age of the male patient or sperm donor at the time of the embryo formation, the age of the oocyte donor at the time of the donation, the BMI of the female and male patients as well as the oocyte donor, the total forward-motile sperm count of the semen sample used, the 2 PN formation percentage out of the M2 used, the blastocyst formation percentage out of the 2 PNs.

Ethics

Ethical approval was obtained from the Near East University Medical Faculty Ethical Committee (approval no: 2025/136, date: 25.09.2025).

Statistical Analysis

During the statistical analysis, we first examined the participants' demographic characteristics using frequency analysis. Before comparing any variables, we checked for normality by evaluating the "Skewness and Kurtosis values" ($-2 \leq \text{Skewness} \leq +2$; $-2 \leq \text{Kurtosis} \leq +2$). We used the Independent Samples t-test (t) to compare the variables when the data followed a normal distribution. For categorical variables, we used the Independent Samples chi-square test when expected cell counts exceeded 5. When the data were normally distributed, we evaluated the relationships between numerical variables using the "Pearson correlation test" (r = correlation coefficient). For descriptive statistics, we reported the number of observations (n), mean, standard deviation (SD), median, minimum, maximum, and significance value (p). Variables with a p-value < 0.25 in the bivariate analyses were considered candidates for the multiple linear regression model.⁸ Female age at embryo transfer and smoking status met this criterion and were entered simultaneously into the model, using the Enter method to evaluate their independent associations with endometrial thickness. We assessed the assumptions of multiple linear regression, including linearity; the normality and homoscedasticity of residuals; independence of errors; multicollinearity; and influential observations, before interpreting the model. We used a significance level of $p < 0.05$ for all calculations and interpretations. Statistical analyses were performed using the IBM SPSS, version 27.0 (IBM Inc., Armonk, NY, USA).

RESULTS

Sample Characteristics

Tables 1 and 2 present the characteristics of the research participants. This study, which included three hundred and twenty cycles, reported various participant attributes, such as smoking and alcohol consumption; embryo transfer ease; presence of blood on the embryo transfer catheter; number of transferred good-quality embryos; whether embryos were fresh or frozen; trilinear pattern/cervical mucus status; PGD; sperm microchipping; age and BMI of the female patient, the male patient, and the donors; total forward-motile sperm count; percentage of fast forward-motile sperm; number of M2 oocytes used; 2 PN number; 2 PN/M2 percentage; day 5-6 blastocyst number; and blastocyst/2 PN percentage.

We observed that male participants consumed almost twice as many cigarettes and four times as much alcohol as female participants. We observed that embryo transfer was easy for most participants, was moderate or difficult for 9.0% of participants, and that blood was present on the catheter in 15.6% of cases. We observed that frozen embryo transfers were slightly more frequent than fresh embryo transfers.

Table 1. Participants' demographic characteristics 1

Characteristic	Group	Number	%
Female-smoking existence	Smoking	78	24.4
	Not smoking	242	75.6
Female-alcohol consumption existence	Consuming	25	7.8
	Not consuming	295	92.2
Male-smoking existence	Smoking	136	42.5
	Not smoking	184	57.5
Male-alcohol consumption existence	Consuming	99	30.9
	Not consuming	221	69.1
Ease of the embryo transfer	Easy	288	90.0
	Medium	17	5.3
	Hard	15	4.7
Blood existence on the embryo transfer catheter	Not existing	270	84.4
	Existing	50	15.6
Transferred embryo number	1	100	31.3
	2	201	62.8
	3	19	5.9
Transferred embryo type	Fresh	131	40.9
	Frozen	189	59.1
Trilinear pattern of the endometrium/ cervical mucus	Not existing	119	37.2
	Existing	201	62.8
Preimplantation genetic diagnosis	Not added	262	81.9
	Added	58	18.1
Sperm microchipping	Not added	226	70.6
	Added	94	29.4
Sperm donation	Not added	284	88.7
	Added	36	11.3

Table 2. Participants' demographic characteristics 2

Characteristic	Mean	SD	Med	Min	Max
Female-age at ET	41.9	6.8	43	22.0	58.0
Female-BMI at ET	25.7	4.4	26	17.4	39.0
Male-age at embryo formation	41.5	9.2	42	19.0	72.0
Male-BMI at embryo formation	27.4	10.2	26	18.5	37.9
Male-total forward-motile sperm count	76.1	78.4	50	0.0	637.5
Male-a motile sperm percentage	6.3	7.4	5	0.0	40.0
Female-endometrial thickness at progesterone start date	9.0	1.6	9	5.8	16.0
Oocyte donor-age at donation	25.9	3.6	26	18.0	35.0
Oocyte donor-BMI at donation	21.8	3.7	21	16.7	33.8
M ² number reserved for the patient	15.0	6.0	15	1.0	38.0
2 PN number	11.0	4.3	11	1.0	27.0
2 PN/M ² percentage	76.4	16.8	78	12.5	100.0
Blastocyst number	6.5	3.2	7	1.0	18.0
Blastocyst/2 PN percentage	61.2	23.0	62	10.0	100.0

ET: Embryo transfer, SD: Standard deviation, Med: Median, Min: Minimum, Max: Maximum, BMI: Body mass index, M²: Metaphase-2 oocyte, 2 PN: 2 pronuclear formation.

Additionally, we reported that 31.3% of participants had a single embryo transferred, 62.8% had two, and 5.9% had three; decisions were based on patient preferences. With trilinear pattern and cervical mucus status reflecting estrogen levels in clinical practice, 62.81% exhibited a trilinear pattern or cervical mucus formation. When we examined the use of PGD, sperm microchipping, and sperm donation, the rates of participants benefiting from these additional treatments were 18.1%, 29.4%, and 11.3%, respectively.

The mean female age at the time of the embryo transfer was 41.9±6.8 (SD) years, and the mean BMI was 25.7±4.4 (SD) kg/m². The mean age of males at the time of embryo formation was similar to that of females. The mean for total forward-motile sperm count was 76.1±78.4 (SD) million/sample; for the fast-forward sperm percentage variable, the mean was 6.3±7.4 (SD) percent. The mean endometrial thickness among embryo transfer patients in the study was 9.0±1.6 mm, and the mean number of M2 eggs received by patients was 15.0±6.0. Considering the number of fertilised eggs (2 PN numbers) and the number of embryos surviving for five days, they were 11.0±4.3 and 6.5±3.2, respectively. The average donor age was 25.9±3.6 years, and the average donor BMI was within the normal range.

Demographic Factors and the Endometrium

The findings show that there is a weak negative correlation between endometrial thickness and women's age at embryo transfer, indicating that younger patients tend to have a thicker endometrium. On the other hand, are weak and non-significant relationships between endometrial thickness and BMI, and between BMI and women's age at embryo transfer (Table 3).

The mean endometrial thickness of non-smokers was 0.4 mm higher than that of smokers, a difference that was statistically significant. On the other hand, the mean endometrial thickness in women who did not consume alcohol was similar to that in women who consumed alcohol (Table 4).

There was no significant difference in women's BMI values based on the presence of a trilinear cervical mucus pattern. However, we found a substantial difference in the mean ages of women with and without a trilinear pattern of cervical mucus at the time of embryo transfer. The mean age of women with a trilinear pattern of cervical mucus was lower than that of women without this pattern (Table 5).

The study examined the association of smoking status and alcohol consumption status with the presence of a trilinear pattern in cervical mucus. The results indicated that smoking status was associated with the presence of a trilinear pattern of cervical mucus ($\chi^2=4.638$, $p=0.031$). Specifically, women who smoke (52.6%) are less likely to have a trilinear pattern of cervical mucus than those who do not smoke (66.1%). Additionally, the analysis revealed a statistically significant relationship between alcohol consumption status and the presence of a trilinear pattern of cervical mucus ($\chi^2=6.042$, $p=0.014$). Women who consumed alcohol (40.0%) were less likely to have a trilinear cervical mucus pattern than women who did not consume alcohol (64.7%).

As shown in Table 6, we used multiple linear regression to evaluate the independent associations of female age at embryo transfer and of smoking status with endometrial thickness. The overall model was statistically significant and explained 5.2% of the variance in endometrial thickness ($p<0.001$).

After adjustment for smoking status, the age of the female at embryo transfer remained independently and negatively associated with endometrial thickness. After adjustment for age, smoking status was not independently associated with endometrial thickness.

Demographic Factors and the Sperm

Correlation analysis indicated that the relationship between total forward-motile sperm count and BMI was weak and not statistically significant ($r=-0.032$, $p=0.568$). There was also a weak and statistically non-significant relationship between the total forward-motile sperm count and the male age ($r=-0.071$, $p=0.208$). The relationship between male age and BMI during embryo formation was also weak and not statistically significant ($r=-0.023$, $p=0.687$).

Regarding male smoking, we calculated the mean total forward-motile sperm count for non-smokers as $73.9 \pm 71.71.1$ (SD) million/sample, and for smokers as 79.1 ± 87.5 (SD) million/sample. We found no significant difference in total forward-motile sperm counts between groups ($t=-0.594$, $p=0.556$). In terms of alcohol use in male patients, the mean total forward-motile sperm count of those who did not consume alcohol was calculated as 73.4 ± 74.6 (SD) million/sample, and the

mean total forward-motile sperm count of those who drank alcohol was 82.2 ± 86.3 (SD) million/sample. The results showed no significant difference in total forward-motile sperm count between the groups ($t=-0.928$, $p=0.381$). These findings indicate that male patients' smoking or alcohol-use status did not have a statistically significant effect on the total forward-motile sperm counts.

DISCUSSION

Main Findings

Demographic factors

Some studies examined only specific demographic characteristics of oocyte donation patients. The first study grouped the women into age categories: <40 or ≥ 40 .⁹ The study was interested only in information about the patients' previous pregnancies and IVF. It provided no information about the clinical aspects or the male patient. The second study also grouped the female patients into four age groups. It also included previous antenatal history, maternal education, and marital history. This study also included semen abnormalities.¹⁰ Neither study reported personal clinical parameters such as BMI, endometrial status, or laboratory follow-up. We added these parameters and did not group patients by age, instead treating age as a continuous variable to assess the potential effects of other parameters. Another study examined the relationship between BMI and pregnancy outcomes and found no correlation.¹¹ Our research found no correlation between the female patients' BMI and endometrial maturity.

Endometrium

A study evaluated the impact of age on the endometrium in patients undergoing oocyte donation.¹² They grouped the patients by age and analysed clinical and pregnancy outcomes. The research concluded that age did not affect endometrial thickness but reduced the chances of pregnancy. Another more recent review that sought similar information suggested a slight reduction in pregnancy rates among advanced-age patients, even with oocyte donation, but did not assess endometrial thickness.¹³ A recent study of the ultrasound appearance of the endometrium evaluated endometrial thickness and the presence of the trilaminar pattern and found no correlation between them. It also did not compare age with endometrium; instead, it focused only on pregnancy rate, which was insignificant.⁶ A more recent review of the biological basis of endometrial receptivity revealed an age-related decline. Still, they did not search for this information among oocyte-donation patients receiving hormonal supplementation.¹⁴ A review analysing the outcomes of oocyte-donor patients revealed a decline in pregnancy success rates with increasing age. The study attempted to elucidate the potential causes of endometrial ageing.¹⁵ Our study used multiple linear regression analysis and found that age significantly affected endometrial thickness after adjustment for smoking. A meta-analysis evaluating the cervical mucus in fertile women also revealed

Table 3. The relationship between the endometrial thickness and the characteristics of the female patients

Variable	Value	Endometrial thickness	Female age at the time of ET	Female patient's BMI
Endometrial thickness	r p	1		
Female age at the time of ET	r p	-0.204 <0.001	1	
Female patient's BMI	r p	0.053 0.343	0.096 0.087	1

It is the p-value of the change in r value of endometrial thickness with increasing female age at the time of embryo transfer.
 r : Correlation coefficient, p : Value of significance, ET: Embryo transfer, BMI: Body mass index.

Table 4. The relationship between smoking or alcohol consumption parameters and the endometrial thickness of female patients

Variable	Group	Mean	SD	Med	t	p
Female-smoking	Not smoking	9.1	1.6	9	2.31	0.021
	Smoking	8.7	1.3	8		
Female-alcohol consumption	Not consuming	9.0	1.5	9	0.04	0.98
	Consuming	9.0	2.1	8		

It is the p-value of the difference between smoking and non-smoking female participants in endometrial thickness.
SD: Standard deviation, Med: Median, t: Independent Samples t-test, p: Value of significance.

Table 5. The relationship between the female age at the time of embryo transfer and BMI, and the existence of the trilaminar pattern or cervical mucus

Trilaminar pattern/cervical mucus	Not existing			Existing			t	p
	Mean	SD	Med	Mean	SD	Med		
Female-BMI at ET	25.7	4.1	25.7	25.8	4.6	25.7	-0.15	0.89
Female-age at ET	43.6	5.1	44.0	40.9	7.4	43.0	3.50	0.001

It is the p-value of the difference between trilaminar pattern existence and non-existence with increasing female age at the time of embryo transfer.
BMI: Body mass index, ET: Embryo transfer, SD: Standard deviation, Med: Median, t: Independent Samples t-test, p: Value of significance.

Table 6. Multiple linear regression analysis of factors associated with endometrial thickness

Variable	B	SE	β	t	p	95% CI
Constant	11.342	0.572	-	19.839	<0.001	10.217, 12.467
Female age at embryo transfer, years	-0.044	0.013	-0.19	-3.452	0.001	-0.070, -0.019
Smoking status						
Non-smoker (ref)	-	-	-	-	-	-
Smoker	-0.381	0.203	-0.104	-1.879	0.061	-0.781, 0.018

Dependent variable: endometrial thickness. The non-smoker group was used as the reference category for smoking status. Model: $R=0.228$, $R^2=0.052$, adjusted $R^2=0.046$, Durbin-Watson =1.974.
B: Unstandardized regression coefficient, SE: Standard error, β : Standardised regression coefficient, CI: Confidence interval.

a decrease in cervical mucus maturity with advanced age.⁷ Our study also observed that advanced age had a mild negative impact on the endometrium and cervical mucus.

Sperm

There was research evaluating the relationship between semen analysis and paternal age over time, but they did not find any significant correlation.^{16,17} The relationship between BMI and total motile sperm count showed conflicting results across studies. Some found a significant negative correlation between advanced paternal age and the motile sperm count, whereas others found no correlation.¹⁸⁻²¹ The smoking and semen parameters, especially sperm motility, also yielded conflicting results, with positive, negative or no impact.²²⁻²⁵ The relationship between alcohol consumption and total motile sperm count showed conflicting results as well.²⁶⁻²⁸ In our research, the semen analysis, in particular total motile sperm count, was found not to be affected by paternal age, BMI, smoking, or alcohol.

Sturdy Limitations

One of the strengths of the research was the inclusion of demographic factors, such as biological age, BMI, smoking, and alcohol consumption habits, in the evaluation of endometrial maturation in female patients. However, a limitation was that we did not evaluate these parameters with respect to pregnancy achievement; rather, we only evaluated endometrial thickness and maturation. A similar pattern was observed among male patients. We included the effects of biological age, BMI, smoking, and alcohol consumption on the total forward-motile sperm count, an approach that was relatively novel in the field. We did not evaluate these parameters in relation to pregnancy outcomes. Another limitation was that we did not group the patients by smoking status and alcohol consumption levels when assessing the total forward motile sperm count or the endometrial maturation. If we had done so and had the dose-response data, we could have shown the effect of smoking or alcohol consumption more precisely.

Another strength was the inclusion of the total forward motile sperm count as an outcome, because sperm used for ICSI are preferably forward motile and the embryologist's ability to select sperm that meet the chosen criteria depends on sperm count and concentration, which may affect the outcome. To date, the closest parameter evaluated was the total motile sperm count, which includes non-progressive sperm. This research is unique in this respect.

Another strength of the research was that it included more than 300 evaluation cycles, which gave us a more precise assessment. However,

it did not group patients by the aetiology underlying the need for oocyte donation, which could have improved our understanding of the demographic findings.

CONCLUSION

When we described the demographic features of the population undergoing oocyte donation IVF treatment, we found that most patients preferred transferring two embryos rather than one and did not prefer PGD. The embryo growth rates were consistent with the previous data.

Almost two-thirds of the female patients had signs of adequate endometrial preparation, with endometrial thickness >7.4 mm; notably, patients' age affected endometrial thickness and maturation. Almost one-quarter of the female patients were smokers, and smoking appeared to affect the endometrial thickness and maturation. Alcohol did not significantly affect the endometrial thickness but did appear to affect the endometrial maturation.

More than forty per cent of the male patients were smokers, and one-third consumed alcohol; however, we observed that both parameters had no significant effect on the total forward-motile sperm count. BMI did not affect endometrial thickness, endometrial maturation, or total forward-motile sperm count.

When evaluating success, we focus solely on the pregnancy rates, but sometimes overlook the preparatory steps for embryo transfer. These steps may shed light on a higher pregnancy rate and alter the results.

MAIN POINTS

- Patients undergoing oocyte donation treatment had their profiles evaluated comprehensively in a medical research study, and the results were noteworthy.
- The endometrial thickness appeared greater in younger, nonsmoking patients than in older patients.
- The endometrial trilinear pattern was seen more often among younger, non-smoking, and non-alcohol-consuming groups compared with the older, smoking, and alcohol-consuming groups.
- Neither male age nor body mass index seemed to affect the mean total forward-motile sperm count.
- The male patients' history of smoking or alcohol consumption did not seem to affect the mean total forward-motile sperm count.

ETHICS

Ethics Committee Approval: Ethical approval was obtained from the Near East University Medical Faculty Ethical Committee (approval no: 2025/136, date: 25.09.2025).

Informed Consent: The informed consents of the all participants/patients were obtained at the time of the treatment protocol.

DISCLOSURES

Financial Disclosure: The author declared that this study received no financial support.

Declaration on the Use of Artificial Intelligence (AI): No artificial intelligence tools were used in the preparation of this manuscript.

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