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Original Article

Multivariate analysis of oocyte donor and recipient factors affecting cumulative live birth rate in oocyte donor IVF (OD-IVF) cycles

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ABSTRACT

Objective: To study donor and recipient factors affecting cumulative live birth rate (CLBR) in oocyte donor IVF (OD- IVF) cycles.

Methods: The present retrospective study was conducted at the ART center of a tertiary care referral hospital after ethical approval, and included all OD-IVF cycles done between January 2014 - October 2019. Donor parameters included age, body mass index (BMI), ovarian reserve markers, serum estradiol (E2) on trigger day, and number of total/grade 1 oocytes; recipient parameters included age and BMI. The primary outcome was CLBR resulting from one complete donor-recipient (D-R) cycle through fresh/frozen embryo transfer. Secondary outcomes included number of total and grade 1 oocytes, fertilization rate, cleavage rate and clinical pregnancy rate (CPR).

Results: We analyzed 262 D-R cycles for donor characteristics and 260 cycles for CLBR. The mean age of the recipients was 35.20±4.05, and for donors it was 25.29±2.03 years. The CPR and CLBR per started cycle was 60% and 55.7%, respectively. Recipient BMI and grade 1 oocytes were found to be independent predictors of CLBR in multivariate analysis. As the number of grade 1 oocytes increased, the likelihood of live births increased by 10% (95% CI, 1.04 – 1.32, p=0.008). Recipient BMI ≥25kg/m² reduced the chances of CLBR by 50% (95% CI, 0.27 – 0.81, p=0.007).

Conclusions: Number of grade 1 oocytes and recipient BMI significantly affect CLBR in OD-IVF cycles. Recipients with BMI ≥25kg/m² may be advised to lose weight and improve CLBR likelihood.

Keywords: oocyte donation, *in-vitro* fertilization, body mass index, pregnancy rate, live birth

INTRODUCTION

With the global trend towards late marriages and delayed child bearing, the proportion of infertile women presenting with diminished ovarian reserve (DOR) has increased considerably in the last few years. This has led to a significant worldwide shift towards oocyte donor IVF (OD-IVF) cycles (CDC, 2018). As donor oocytes may compensate for age-related decline in implantation and bypass the hormonal disturbances, pregnancy rates with donor oocytes have been reported to be higher than those with fresh autologous oocytes (Crawford *et al*., 2017; Hipp *et al*., 2020). Apart from age-related infertility, other indications of OD-IVF include DOR as a result of cancer treatment, ovarian diseases like endometriosis, premature ovarian insufficiency and genetic or chromosomal aberrations. Donor oocyte cycles comprise about 4.5% (Fitzgerald *et al*., 2018), 5.6% (Kupka *et al*., 2014) and 12% (CDC, 2016) of all IVF cycles in Australia, Europe and USA, respectively.

Oocyte donation is more complex than traditional IVF for reasons including, coordinated treatment of two individuals, financial implications, limited availability of suitable donors, and lack of uniform legal and ethical guidelines. For any couple undergoing IVF, cumulative live birth rate (CLBR) is considered as the main outcome as it gives the estimate of having a child per one stimulated cycle (Maheshwari *et al*., 2015).

Donor age has been portrayed to be the most crucial factor affecting live birth rate (LBR) in OD-IVF cycles (Hogan *et al*., 2019). Ideal donors are in the age range of 20s or early 30s, in good health and free from hereditary diseases (Savasi *et al*., 2016). Donors older than 35 years have comparatively reduced LBRs than their younger counterparts (Pennings *et al*., 2014).

Apart from age, other donor factors such as body mass index (BMI), ovarian reserve markers including anti-Mullerian hormone (AMH), follicle stimulating hormone (FSH) and antral follicle count (AFC)), number of oocytes retrieved have also been studied, with variable association with OD-IVF outcome (Barton *et al*., 2010; Bellver *et al.,* 2013).

Considering financial and emotional stakes associated with OD-IVF cycles, factors affecting success rates need to be evaluated. Since there is no data about factors affecting CLBR in donor cycles among Asian women, we planned this study to evaluate the factors (both donor and recipient) that may affect CLBR in women undergoing OD-IVF cycles.

MATERIAL AND METHODS

Study design and population

The present retrospective study included all the consecutive OD-IVF cycles done between January 2014 and October 2019 at the Assisted Reproductive Treatment (ART) center of a tertiary care hospital in India. The medical records of all consecutive OD-IVF cycles between January 2014 to October 2019 were reviewed. Unmatched donors and recipients for whom data was incomplete for LBR were excluded. After exclusion, 262 Donor-Recipient (D-R) matched cycles were included in the final analysis.

Ethical approval

The study was started after ethical approval from the Institute's Ethics Committee (IEC-596/03.07.2020) and we retrospectively collected data on donor and recipient characteristics, pregnancy rates and CLBR for one complete IVF stimulation cycle.

Donor and recipient selection

According to the Indian Council of Medical Research guidelines (Government of India. Ministry of Health and Family Welfare, 2017) donors selected by the registered ART banks were brought to ART center and screened by the clinician for a specific commissioning couple. IVF cycle was initiated only after complete work up of donor and commissioning couple, after completion of legal documentation with the ART bank.

The donors were screened for their age, parity, BMI, ovarian reserve and further evaluation as per ASRM recommendations (Practice Committee of the American Society for Reproductive Medicine & the Practice Committee of

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the Society for Assisted Reproductive Technology, 2013). The commissioning couple was screened for male and uterine factors and those with no uterine factor, and no or mild male factor infertility were recruited for D-R cycles. Oocytes retrieved from a single donor were used for the same designated commissioning couple, and extra embryos were frozen for future use by the same couple. No oocyte sharing was permitted as per unit policy.

D-R cycle preparation

Figure 1 explains the matching process and treatment plan for the D-R cycle. Both donor and recipient were called one cycle prior to treatment cycle for matching. The recipients were confirmed for normal uterine cavity with three dimensional (3-D) ultrasonography or hysteroscopy done within 3-6 months of recruitment.

Data collection

We collected data retrospectively from the registered database of the ART center and couple were contacted by phone for compiling the information about their deliveries and live births. The data included age and BMI of recipient, donor's age, BMI, ovarian reserve markers (FSH and AMH), ovarian stimulation duration starting and total dose of gonadotropins, and peak estradiol (E2) levels on the day of ovulation trigger. Cycle variables included for analysis were number of total and grade 1 (metaphase II) oocytes retrieved, fertilization rate (identified by 2PN stage on day 1) and cleavage rate (total number of day-3 embryos by total number of fertilized oocytes)

Outcome measures

The primary outcome measure was CLBR. Secondary outcomes included total and grade I oocytes, fertilization and cleavage rates and clinical pregnancy rate.

CLBR was defined as at least one live birth (>24 weeks period of gestation) from one donor stimulation cycle, which may be from a fresh or frozen cycle.

Statistical analysis

We entered the data into Excel® and scrutinized for error and then expressed as mean (standard deviation), median (range) and frequency (percentage). Association of categorical variables was assessed by the Chi-square/Fisher exact test. Correlation of two continuous variable was assessed by the Spearman or the Karl-Pearson correlation coefficient. Continuous variables were compared among the groups by t-test or One-Way ANOVA (parametric data) and Wilcoxon rank sum or Kruskal Wallis test (Non-parametric data). Analysis for each exploratory categorical variable was carried out against the dependent variable using the Chi-square test. All the exploratory variables were significant at a 25% level of significance in a bivariate analysis were considered for stepwise multivariable analysis. Univariate and Stepwise linear regression analysis was carried to find out independent predictors of fertilization rate and oocytes retrieved, and we calculated the unadjusted and adjusted regression coefficients. In the case of a live birth, univariate and a stepwise logistic regression analysis was carried out to find out an independent predictor; we also calculated the unadjusted and adjusted regression coefficient. An entry probability of 0.05 and an

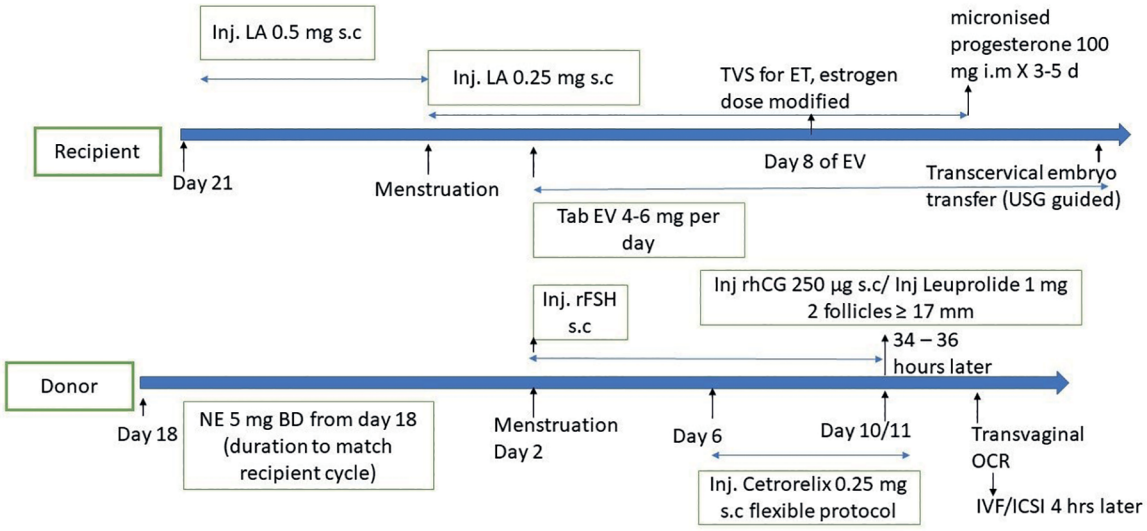

Figure 1. Donor-Recipient matching process (Dose of rFSH on the basis of age, body mass index, ovarian reserve) *LA=leuprolide acetate (Leuprofact, Bayer Zydus, Mumbai, India); TVS=transvaginal scan; ET=endometrial thickness; s.c=subcutaneous; i.m=intramuscular; EV=estradiol valerate; NE=norethisterone acetate; rFSH=recombinant FSH (Gonal F, Merck Serono, UK); rhCG=recombinant hCG (Ovidrell, Merck Serono UK); USG=ultrasonography; Cetrorelix=(Cetrotide, Merck Serono UK); OCR=oocyte retrieval; ICSI=intracytoplasmic sperm injection*.

exit probability of 0.1 were used for the stepwise model. The analysis was carried out on Stata software (version 14, StataCorp, College Station, Texas, USA) and a *p*-value less than 0.05 was considered significant.

RESULTS

From a total 2801 IVF cycles done during the time period, 272 were OD-IVF cycles (9.7%). Of these 272 cycles, 10 with incomplete information were excluded, leaving 262 cycles for assessment. Oocyte vitrification was done for two O-D cycles because of non-availability of partners on the day of oocyte retrieval. So, two hundred and sixty patients were evaluated for CLBR per started cycle. Figure 2 depicts the flow chart of OD-IVF cycles analyzed.

Table 1 shows the baseline demographic and clinical parameters of recipients and donors. The mean (±SD) age of the recipients was 35.20±4.05 years, and that of the donors was 25.29±2.03 years. The maximum age of donors in our study was 31 years. Overall clinical pregnancy rate and CLBR per started cycle was found to be 60% (156/260) and 55.7% (145/260), respectively. Out of the total clinical pregnancies, eleven had miscarriage at less than 24 weeks. There were 16 multiple pregnancies comprising of twins-14 (5.3%); triplets-2 (0.7%). All of the multiple pregnancies occurred after transfer of two or more embryos. Fourteen twin pregnancies had successful live birth outcome. The two patients with triplet pregnancies suffered miscarriages prior to 24 weeks. A total of 232 patients underwent fresh embryo transfer, nine patients had empty follicle syndrome and in 19 patients, fresh transfer was cancelled due to other reasons. The pregnancy rate in fresh transfer was 58.18% (135/232). Total frozen embryo transfers were 38, and the pregnancy rate in frozen transfers was 55.26% (21/38).

On analysis of total oocytes retrieved with donor characteristics, we found a significant positive correlation (r=0.4992, *p* value<0.001) between the median number of oocytes retrieved and serum E2 levels on the day of trigger. No other donor characteristics correlated with median oocyte retrieved or fertilization rate (Table 2).

On univariate analysis, we found that there was a significant association between the number of oocytes retrieved and the starting dose of FSH (p=0.03), total dose of FSH (p=0.001), and serum E2 on day of trigger (p=0.0001) (Table 3). In a multivariate analysis for total oocytes, there was a significant negative correlation with E2 <1000 pg/ml (Adjusted β coefficient -4.5, 95% CI, (-7.46, -0.53), p=0.003) and there was a significant positive correlation with E2 >3000 pg/ml (Adjusted β coefficient 3.20, 95% CI, (2.01, – 4.39), *p* value<0.001) (Table 4). Similarly, for grade 1 oocytes there was a significant negative correlation with E2 <1000pg/ml (Adjusted β coefficient -2.3, 95% CI, (-4.04, -0.57), *p* value 0.009) and significant positive correlation with E2 >3000 pg/ml (Adjusted β coefficient 1.79, 95% CI, (1.10, 2.49), *p* value<0.001) (Table 4).

In a univariate analysis of donor characteristics with fertilization rate, there was a significant association with donor age (p=0.044) and total FSH dose (p=0.043) (Table 3). In a multivariate analysis, donor age >25 years had significant negative association with fertilization rate (Adjusted β coefficient -21.9, 95% CI (-42.29, -1.67), *p* value=0.034), and total FSH dose >4000 had significant

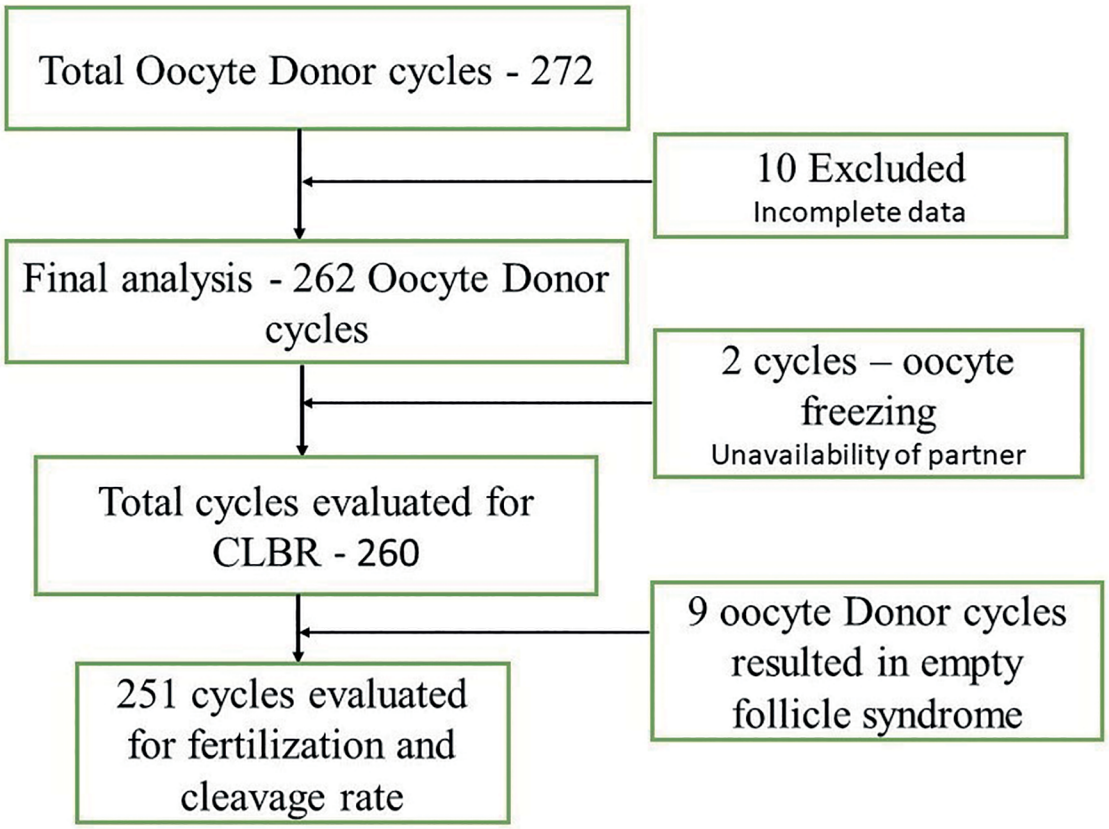

Figure 2. Flow chart of number of patients included in analysis *CLBR=cumulative live birth rate*.

Table 1. Baseline characteristics of the study population.

Recipient (n=262) Baseline characteristics	**Mean ± SD/Median (Range)**
Age (years)	35.20±4.05
BMI (kg/m²)	24.96±3.61
Donor (n=262) Baseline characteristics	**Mean ± SD/Median (Range)**
Age (years)	25.29±2.03
BMI (kg/m²)	22.25±2.60
Serum AMH (ng/ml)	4.25 (2 - 13.8)*
Baseline serum FSH (mIU/ml)	5.26±1.56
Starting dose of FSH (IU)	225.79±59.39
Total dose of FSH (IU)	2518.19±856.76
Duration of stimulation (days)	10.29±1.47
Serum estradiol on day of trigger (pg/ml)	3398 (114-18384)*
Total oocytes (n)	9 (0-32)*
Grade 1 oocytes (n)	4 (0-15)*
Fertilization rate (%)(n=251)	70.44±18.0
Cleavage rate (%) (n=251)	93.89±14.2
Total embryos	5 (0-18)*

*Represented as median (Range)
Abbreviation: BMI, body mass index; AMH, anti-Mullerian hormone; FSH, follicle-stimulating hormone

Table 2. Correlation of total oocytes and fertilization rate with donor characteristics.

Variables	**Total Oocytes Correlation coefficient "r"/median**	***p* value**	**Fertilization rate Correlation coefficient "r"/ median**	***p* value**
Age (years)	-0.0875	0.15	0.0291	0.65
BMI (kg/m²)	0.1171	0.058	0.0024	0.97
AMH (ng/ml)	0.0874	0.158	0.0887	0.16
Baseline serum FSH (mIU/ml)	-0.1136	0.066	0.0776	0.22
Starting dose of FSH (IU)	-0.0577	0.352	0.0945	0.13
Total FSH dose (IU)	-0.0788	0.203	0.0461	0.46
Duration of stimulation (days)	-0.1007	0.103	-0.0033	0.96
Serum estradiol on day of trigger (pg/ml)	0.4992	0.000	-0.0011	0.98

positive association with the fertilization rate (Adjusted β coefficient 9.9, 95% CI (0.45, 19.28), *p* value=0.040) (Table 4).

Table 5 shows a correlation of CLBR with donor categorical variables in a univariate analysis. There was no significant association of CLBR with age and BMI of donor or recipient. However, there was a significant association of CLBR with grade 1 oocytes ($p<0.001$) and total embryos ($p=0.001$).

In the multivariate analysis for CLBR, grade 1 oocytes and BMI of recipients were identified as independent factors predicting CLBR. Total number of embryos and donor BMI were approaching significance in predicting LBR (Table 6). Further, we found that as number of grade 1 oocytes increased, chances of live birth increased 10% more (95% CI, 1.04, 1.32, *p* value=0.008). When BMI of recipient was ≥ 25 kg/m² then chances of CLBR reduced by 50% (95% CI, 0.27, 0.81, *p* value=0.007) (Table 6).

Table 3. Relation of total oocytes and fertilization rate with Donor categorical variables.

Variables	Total Oocytes n=262		*p*	Fertilization rate n=251		*p*
	N	Median (Min-Max)		n	Mean±SD/ Median* (Min-Max)	
Age(years)			0.06			0.044
≤25	3	5 (4-5)		3	100 (75-100)*	
>25	259	9 (0-32)		248	71.4 (10-100)*	
BMI (kg/m²)			0.21			0.378
18-24.9	225	9 (0-26)		216	70.85±17.89	
≥ 25	37	9 (0-32)		35	67.94±18.93	
AMH (ng/ml)			0.24			0.536
<5	165	9 (0-32)		160	69.91±18.11	
≥5	97	10 (0-26)		91	71.38±17.95	
Baseline Serum FSH (mIU/ml)			0.05			0.431
<4 (n=115)	115	10 (0-26)		111	69.31±17.99	
5-8 (n=134)	134	9 (0-32)		128	70.90±18.36	
>8 (n=13)	13	8 (0-14)		12	76.06±14.48	
Starting dose of FSH (IU)			0.03			0.164
100-150	42	9 (0-26)		41	71.38±15.10	
151-200	61	10 (0-26)		58	68.52±17.00	
201-250	86	10 (0-32)		82	67.96±20.37	
251-300	62	9 (0-20)		59	73.54±17.49	
>300	11	7 (2-111)		11	78.93±14.90	
Total FSH (IU)			0.001			0.043
<2000	73	8 (0-26)		72	71.65±18.31	
2001-3000	128	11 (0-32)		124	69.19±17.27	
3001- 4000	41	9 (0-20)		38	67.41±18.87	
>4000	19	7 (0-17)		17	81.22±17.70	
Duration of stimulation (days)			0.205			0.907
<10	164	9 (0-26)		157	70.34±17.25	
≥11	98	9 (0-32)		94	70.61±19.36	
Serum estradiol on day of trigger(pg/ml)			0.0001			0.193
1001-3000	103	8 (0-32)		96	68.87±21.01	
≤1000	11	3 (0-6)		8	80.42±16.91	
>3000	148	11 (2-26)		147	70.93±15.76	

* Represented as median (Range).

DISCUSSION

The present study evaluated the factors affecting OD-IVF cycle outcomes and showed that recipient BMI and number of grade 1 oocytes available directly affect CLBR in these couples. As recipient BMI ≥25Kg/m² was found to significantly reduce CLBR, it may be considered a crucial factor affecting IVF outcome in OD cycles. Hence, counselling recipients regarding weight reduction before IVF cycle through strategies like life style modifications and dietary restrictions may help improve the success rate of OD-IVF cycle. To the best of our knowledge, no previous study has been published on the correlation of donor and recipient factors affecting CLBR in Asian women.

The percentage of OD-IVF cycles out of total IVF cycles in our study is comparable to western data, but this does not represent the total number of women in need of donor oocytes. This is perhaps explained by a mismatched demand supply chain and no availability of suitable donors.

Donor oocyte IVF cycles are performed according to the availability of donors and national guidelines of a particular country. These are done either through donor and recipient matching (Hariton *et al*., 2017) or donors are stimulated and oocytes are cryopreserved followed by future use in commissioning couple. In both models, CLBR have been shown to increase linearly with an increase in the number of oocytes retrieved (Hariton *et al*., 2017). Similar results have been found in the present study, showing increases in CLBR with increasing number of oocytes and grade 1 oocytes.

Unlike the study by Hogan *et al*. (2019), our result did not show any correlation between donor age and CLBR. This may be explained by the narrow age range and strict selection criteria being followed at our center. ART banks are discouraged to bring donors older than 35 year of age. Maximum donor age in our cohort was 31 years. Similarly, the selection criteria is strict in terms of the BMI of recruited donors.

In a recent study involving 8627 donor oocyte IVF cycles, there was a negative correlation between total FSH dose and live birth rates in fresh donor IVF cycles (Shaia *et al*., 2020). We found a similar correlation in our data,

Table 4. Multivariate analysis for total oocytes, grade 1 oocytes and fertilization rate.

Variable	Unadjusted Regression coefficient" β" (95% CI)	*p*	Adjusted regression coefficient" β" (95% CI)	*p*
Total oocytes				
Serum Estradiol (pg/ml)				
1000-3000	1			
<1000	-5,2 (-8.22, -2.25)	0.001	-4.5 (-7.46, -.53)	0.003
>3000	3.2 (2.00, 4.42)	<0.001	3.2 (2.01, 4.39)	<0.001
Total FSH(IU)				
<2000	1			
2001-3000	1.4 (-0.01, 2.91)	0.05	1.2 (-0.09, 2.60)	0.068
3001-4000	-0.8 (-2.74, 1.15)	0.421	-1.1 (-2.86, 0.74)	0.247
>4000	-2.9 (-5.54, -0.40)	0.024	-2.1 (-4.46, 0.33)	0.092
Grade 1 oocytes				
Serum estradiol (pg/ml)				
1000-3000	1			
<1000	-2.3 (-4.04, -0.59)	0.006	-2.3 (-4.02, -0.57)	0.009
>3000	1.8 (1.13, -2.52)	<0.001	1.79 (1.10, -2.49)	<0.001
Fertilization rate				
Age of donor (years)				
>25	-21.4 (-41.97, -0.97)	0.04	-21.9 (-42.29, -1.67)	0.034
Total FSH				
<2000				
2001-3000	-2.4 (-7.67, 2.74)	0.353	-2.5 (-7.68, 2.66)	0.340
3001-4000	-4.2 (-11.29, 2.80)	0.237	-3.9 (-10.94, 3.06)	0.269
>4000	9.5 (0.08, 19.04)	0.048	9.9 (0.45, 19.28)	0.040

although it did not reach statistically significance level due to comparatively smaller sample sizes.

Peri fertilization factors, including number of oocytes, grade 1(MII) oocytes and fertilization rates have been shown to affect LBR in donor oocyte IVF cycles (Hariton *et al*., 2017). In the present study, the number of total, grade 1 oocytes and number of embryos available showed positive correlation with LBR in a univariate analysis. A multivariate analysis showed grade 1 oocytes directly affecting CLBR. The number of grade 1 oocytes available may be used to counsel the recipient couple regarding the probability of having a cumulative live birth from one cycle.

Recipient factors, which have been studied in terms of correlation with LBR are age, BMI and uterine factors. In the study by Provost *et al*. (2016), in OD-IVF cycles after adjusting for other factors, LBRs were significantly higher in cycles with low or normal BMI of recipient and decreased with increasing BMI. Since obesity disturbs the endometrial hormonal milieu, recipient BMI is considered as an independent factor affecting clinical pregnancy rates and LBR irrespective of oocyte quality. Our study also showed that if the recipient BMI is 25 kg/m^2 or more, there is reduction by 50% in the CLBR.

The main strength of our study is that it is the first study evaluating factors affecting CLBR in OD-IVF cycles in India. Obesity is one of the rising concerns worldwide. In a recent study, the prevalence of overweight and obesity has been shown to increase considerably in the Indian population, affecting women more than men (Ahirwar & Mondal, 2019). In addition, Indian women have been seen to age more rapidly than their western counterparts, which puts them at risk of DOR, infertility and increased need of donor oocyte IVF. Therefore, the results of our study can be generalized to predict OD-IVF outcomes in Indian women, and counselling should be done for weight reduction before going to IVF. Another strength of our study is that we analyzed all the donor and recipient factors affecting CLBR. Limitations of our study are the comparatively smaller sample size for being a single center study besides the non-availability of the male partner's BMI. There are studies published on male partner BMI causing adverse outcomes in IVF cycles (Anifandis *et al*., 2013). Donor age, BMI and ovarian reserve markers failed to show any association with IVF outcome, it may be advised to narrow the selection range of these parameters at the time of screening. The effect of IVF type (IVF/ICSI) and endometrial thickness on the day of trigger was also not studied, and this may have variations due to different clinicians doing scans at different times.

CONCLUSION

Recipient BMI significantly affects the pregnancy rate and CLBR in OD-IVF cycles in Indian Asian women and increasing BMI is associated with decreasing CLBR. Recipients with BMI ≥ 25kg/m^2 may be advised life style modification while waiting for the availability of suitable donors, which may improve conception rate, live birth rate, and reduce pregnancy complications. Future research is warranted to evaluate the effects of the male partner age, semen parameters and BMI on CLBR of OD-IVF cycles and the pathophysiology behind decreasing clinical pregnancy rates and CLBR with rising BMI among recipients.

CONFLICT OF INTEREST

The authors have no conflicts of interest to declare.

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Table 5. Correlation of live birth rate with baseline variables.

Variables	Live birth		*p*-value
	NO n/(%)	YES n/ (%)	
Age of recipient (years)			0.640
<35	54 (41.86)259	75 (58.14)	
36-40	54 (45.76)	64 (54.24)	
41-45	7 (53.85)	6 (46.15)	
BMI of recipient (kg/m²)			0.057
18-24.9	49 (38.28)	79 (61.72)	
≥ 25	66 (50)	66 (50)	
Age of donor (years)			0.431
≤25	2 (66.67)	1 (33.33)	
>25	113 (43.97)	144 (56.03)	
BMI of donor (kg/m2)			0.19
18-24.9	102 (45.74)	121 (54.26)	
≥25	13 (35.14)	24 (64.86)	
AMH (ng/ml)			0.524
<5	75 (45.73)	89 (54.27)	
≥5	40 (41.67)	56 (58.33)	
Baseline Serum FSH (mIU/ml)			0.557
<4	53 (46.49)	61 (53.51)	
5 -8	55 (41.35)	78 (58.65)	
>8	7 (53.85)	6 (46.15)	
Starting dose of FSH (IU)			0.710
100-150	16 (38.10)	26 (61.90)	
151-200	31 (51.67)	29 (48.33)	
201-250	37 (43.53)	48 (56.47)	
251-300	26 (41.94)	36 (58.06)	
>300	5 (45.45)	6 (54.55)	
Total FSH (IU)			0.723
<2000	31 (42.47)	42 (57.53)	
2001-3000	56 (44.09)	71 (55.91)	
3001-4000	21 (51.22)	20 (48.78)	
>4000	7 (36.84)	12 (63.16)	
Duration of stimulation (days)			0.929
<10	72 (44.44)	90 (55.56)	
≥11	43 (43.88)	55 (56.12)	
Serum estradiol on day of trigger (pg/ml)			0.084
1001-3000	48 (47.06)	54 (52.94)	
≤1000	8 (72.73)	3 (27.27)	
>3000	59 (40.14)	88 (59.86)	
Grade 1 oocytes	3 (0-11)	5 (0-15)	<0.001
Total embryos	4 (0-18)	6 (0-18)	0.001

Table 6. Association of LBR with demographic and clinical variables using univariate and multivariate logistic regression.

Variable	Univariate Odds Ratio (95% CI)	*p*	Adjusted Odds Ratio (95% CI)	*p*
Total embryos	1.2 (1.07, 1.26)	<0.001	1.1 (0.99, 1.21)	0.056
Grade 1 oocytes	1.2 (1.11, 1.35)	<0.001	1.1 (1.04, 1.32)	0.008
BMI donor (25-30) kg/m²	1.6 (0.75, 3.21)	0.19	2.1 (0.97, 4.71)	0.059
BMI recipient (25-30) kg/m²	0.6 (0.37, 1.01)	0.058	0.5 (0.27, 0.81)	0.007

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