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Title:

EVALUATING THE RELATIONSHIP BETWEEN LOW BODY MASS INDEX AND IVF OUTCOMES

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Objective:

Patients with significantly elevated or diminished BMI may exhibit a variety of health consequences, including metabolic and endocrine alterations, as well as decreased fecundity. The reproductive impact of elevated BMI has been well studied, but few studies have convincingly quantified the effects of low BMI on oocyte and embryo quality and implantation efficacy. Patients with low BMI are known to be at risk for alterations in steroid metabolism, insulin secretion, and changes in other hormones, including ghrelin, leptin, and adiponectin. [1-6] The current study aimed to determine the impact of low BMI on ovarian response to controlled ovarian stimulation (COS) for IVF.

Design:

Retrospective cohort study

Material and Methods:

This single center study included all patients with a recorded BMI who underwent controlled ovarian stimulation (COS) from August 2002 to March 2018. Oocyte donation cycles were excluded from analysis. Trophectoderm biopsy and preimplantation genetic testing for aneuploidy (PGT-A) were performed on select blastocysts. BMI was categorized as underweight (BMI < 18.5 kg/m^2) and normal weight (BMI 18.5-24.9 kg/m^2). Patient age, gravidity, parity, Anti-Müllerian hormone (AMH) level, basal antral follicle count (BAFC), estradiol (E2) and

progesterone (P4) level at time of surge, total gonadotropin (GND) dose, number of total oocytes and metaphase II (MII) oocytes retrieved, number of oocytes fertilized, number of blastocysts, day of blastocyst biopsy, and number of euploid embryos were recorded. MII rate, fertilization rate, blastulation rate and euploidy rate were determined. A Student's t-test and chi-squared/Fisher's exact test and multivariate logistic regression were used for the analysis.

Results:

A total of 571 underweight women and 9,220 normal weight women's IVF cycles were identified. Underweight patients were younger (35.3 ± 5.1 yrs, $p<0.0001$), had a higher AMH (3.2 ± 4.3 ng/mL, $p = 0.02$), BAFC (11.9 ± 6.6, $p<0.0001$), E2 (2279 ± 1175 pg/mL, $p<0.0001$) and P4 (0.99 ± 1.1 ng/mL, $p<0.0001$) level at time of surge, but lower cumulative GND dose (3572 ± 1559 IU, $p<0.001$) than women with a normal BMI. Underweight patients also were more likely to be treated with an antagonist stimulation protocol (65%, $p=0.04$) as compared to normal weight patients. Gravidity, parity and type of trigger used were similar between groups. While the number of MII oocytes (11.3 ± 8.1, $p<0.002$) and fertilized oocytes (8.3 ± 6.6, $p<0.01$) were greater in underweight compared to normal weight women, the MII and fertilization rates did not differ between groups, before and after adjusting for confounders. Blastulation and euploidy rates were not significantly different between BMI groups after accounting for significant covariates.

Conclusions:

Extreme alterations in body composition and decreased energy availability associated with a low BMI may result in serious health consequences, yet in this large single center study, we demonstrate that ART outcome is not affected. With IVF utilization, underweight women can overcome the detrimental effects of ovulatory dysfunction associated with a low BMI and achieve successful reproductive outcomes. While this study provides reassurance to underweight patients undergoing IVF, providers are encouraged to focus on discussing nutritional and exercise guidelines that may optimize pre-conception health.

Support:

None

References:

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Table 1:

Demographics and Cycle Characteristics

	Underweight BMI (n=9220)	Normal BMI (n=571)	P-value
Age (y)	35.3 ± 5.07	37.0 ± 4.6	<0.0001
Nulligravid	252 (47.9%)	4082 (45.0%)	0.34
Nulliparous	379 (67.6%)	6435 (70.9%)	0.13
AMH (ng/mL)	3.2 ± 4.3	2.6 ± 3.7	0.02
BAFC	11.9 ± 6.6	10.8 ± 6.1	<0.001
Stimulation Type			0.04
Antagonist/Estrogen Priming	40 (7.0%)	774 (8.4%)	
Antagonist	372 (65.1%)	5698 (61.8%)	
Clomiphene Citrate/Antagonist	6 (1.1%)	120 (1.3%)	

Down Regulation	23 (4.0%)	646 (7.0%)	
MicroFlare	130 (22.8%)	1982 (21.5%)	
Trigger Type			0.44
Dual	131 (23.2%)	2179 (24.0%)	
hCG	410 (72.7%)	6605 (72.8%)	
Lupron	23 (4.1%)	284 (3.1%)	
D3FSH (mIU/mL)	6.3 ± 4.0	6.6 ± 3.7	0.06
Surge E2 (pg/mL)	2279 ± 1177	2069 ± 1127	<0.0001
Surge P4 (ng/mL)	0.99 ± 1.1	0.89 ± 0.5	<0.0001
Total GND (IU)	3572 ± 1559	3784 ± 1406	<0.001
Number of MIIs	11.3 ± 8.1	10.4 ± 7.3	0.002
MII Rate (%)	78.4 ± 19.0	78.8 ± 19.2	0.56
Number of Fertilized Oocytes	8.3 ± 6.6	7.6 ± 6.1	0.01
Fertilization Rate (%)	71.7 ± 23.8	72.1 ± 22.9	0.68
Number of Blastocysts	7.5 ± 8.5	6.8 ± 7.9	0.06
Blastulation Rate (%)	78.9 ± 55.8	78.7 ± 56.8	0.93
Number of Euploid Embryos	2.6 ± 2.6	2.3 ± 2.6	0.12
Euploidy Rate (%)	45.8 ± 32.0	45.2 ± 35.0	0.8
Number of Aneuploid Embryos	2.2 ± 1.9	2.0 ± 1.9	0.13
Aneuploid Rate (%)	48.0 ± 33.1	49.1 ± 35.7	0.67