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RELATIONSHIP BETWEEN WOMEN'S BODY MASS INDEX AND SUCCESS RATE OF *IN VITRO* FERTILIZATION

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ABSTRACT

Background: Infertility considered a traumatic event, and assisted reproductive technology is now a revolution for treatment. *In vitro* fertilization is a commonly performed procedure. Many factors affect the procedure success, including body mass index.

Aim: This study aimed to explore the relationship between body mass index & *in Vitro* fertilization success.

Subject and methods: Descriptive co relational design prospectively investigated 100 women who underwent *in vitro* fertilization with age from 25 - 35 years, selected upon the basis of the defined criteria. Women were classified into groups according to body mass index, i.e., (underweight n=5), (normal-weight n=9), (overweight n=36), (obese I n=32), (obese II n=14), and (obese III n=4). Then, body mass index, related variations in cycle parameters and clinical pregnancy rates of women were investigated.

Results: Current research shows that 81% of women had primary infertility. Doses of drugs for ovulation induction, ovulation induction cycles, and chemical pregnancy rate were found to be negatively affected by body mass index. Higher implantation rates were associated with normal body weight. Clinical pregnancy rates were lower in the obesity grade III than in other groups.

Conclusion: Current study evaluated the relationship between body mass index and *in vitro* fertilization success portraying that clinical pregnancy rates are significantly lower with obesity grade III than in the other groups.

Key words: Body mass index, success rate, in vitro fertilization

INTRODUCTION

The loss of ability to have a child is a traumatic event, which is associated with a feeling of failure and dissatisfaction. Infertility is recognized as a disease state which, after appropriate investigation, can be treated by proper assisted reproductive technology. The World Health Organization (WHO) defines infertility as the disease of the reproductive system defined by the failure to achieve a clinical pregnancy after 12 months or more of regular unprotected sexual intercourse (Louis, *et al*., 2013). In addition, women who do not have regular menstrual cycles, or are older than 35 years and have not conceived during a 6-month period of trying, considered infertile (CDC, 2016).

The global prevalence of infertility is about 15% of couples globally, estimated to 48.5 million couples (Agarwal *et al*., 2015). For the prevalence of female infertility worldwide an analysis operated by the World Health Organization (WHO) which included 277 demographic health surveys in 190 countries, revealed that the estimated levels and trends of infertility burden have remained similar between 1990 and 2010, it showed that women aged between 20 and 44 who wanted a child, 1.9% had not the ability to have their first child after five years of trying and 10.5% of women who had previously given birth had not been able to have another baby after the same length of time cited (Robertson, 2015).

In Egypt, the incidence of infertility has been reported to be 10.4% of married couples (Gibreel *et al*., 2015). In Egypt, 64 % of infertility cases related to the female partner, while, 20.5 % are due to problems with the male partner, the remaining 12.2 % ensue from factors in both partners, and 3.3 % remain unexplained. In the

female partners, infertility results from tubal problems in 41.5%, disorders of ovulation in 25.3%, pelvic endometriosis in 5.6%, a malfunctioning cervix in 4.2%, while in 23.4% of cases, it is due to a combination of these factors (Sallam, 2013).

In Egypt retrospective – cross-sectional survey conducted by Mansour, El-Faissal, and Kamal, 2014) to investigate the success rate of IVF, which was indicated by the percentage of delivered babies, among 10,353 cycles, they found that, the success rate was 32% (3352). Worldwide other researches carried out in the USA found that the percentage of delivered babies was 47.6% (61,610) out of 129,355 cycles (Sunderam *et al*., 2015).

The nurse has an important role in the field of IVF operation technique, while, she cooperates with the other members of the IVF team that actively assists in taking history, provides health information before and after IVF operation, calculates BMI, assesses individual patient needs, fears and anxieties, have empathy and concern for the women undergoing IVF operation, offers support on both clinical and psychological levels, maintains confidentiality and ensures patients' rights and dignity at all times, preparation for treatment cycles and follow up, evaluates patients' progress and instructions regarding further management, communicates with the senior staff in the planning and organization of time schedule for blood sample, ultrasonography scan, takes and collects blood samples and assists in the explanation of results, teaches patients to give their own injections, administer subcutaneous and intra-muscular injections as required during the treatment cycle (Ali, Ebraheem, & Mohamed, 2013).

Significance of the study

The current research explored the effect of BMI on success rate of IVF. The results of the study will contribute to increase the body of knowledge of nurse's information, which will be reflected in nursing practice during IVF preparation, counseling and health teaching regarding to weight pattern, nutritional regimen and adopting the healthy lifestyle which might affect IVF success rate. Moreover, it will contribute to increase baseline data for review of literature related to BMI and its impact on IVF success rate, and also; the results of the current research may be a crucial part in constructing IVF programs, which indirectly affect women's health.

Operational Definition: Success Rate

The success rate in the current research will be measured through clinical and chemical pregnancy diagnostic test, clinical pregnancy diagnostic test defined as the confirmation of pregnancy through visualization of gestational sac by ultrasonography at 5th to 7th week after embryo transfer while the presence of more than one sac is considered as one clinical pregnancy. Chemical pregnancy test (qualitative) is the detection of a positive β- hCG concentration 2 weeks after embryo transfer (Zegers-Hochschild *et al*., 2009).

METHODOLOGY

Design

A descriptive correlational research design was adopted in this research to explore the relation between women's body mass index & IVF success rate.

Sample

A total of 100 women undergoing IVF procedure were recruited at convenience according to the following inclusion criteria: age from 25-35 years old, free from chronic diseases and no history of failed IVF trail, while, PCO cases, smokers, frozen ovum or sperm, women with score 75% or more in State-trait anxiety inventory (STAI) which equal to 60 grades out of total score of 80 grades it was defined by the statistician as a cut-off point that indicated high level of anxiety and congenital anomalies in reproductive system were excluded. As infertility is one of the major stressors the research investigator by an assistance of the statistician decided to exclude women with the score of 60 as a cutoff point or more from the study.

Setting

The research was conducted in private ART center in Benha city in Qulubia governorate, Egypt, it composed of two floors, the 1st floor is outpatients clinics and reception for check up, follow up, and antenatal care; the 2nd floor consisted from reception, 3 laboratories in which hormonal assay, semen analysis, gametes culture and studies were done, in addition to 3 operation room for ART procedures including egg retrieval embryo transfer and utilized for delivery.

Tools for Data Collection

To achieve the aim of the research two tools were

developed-women's profile questionnaire and State-trait anxiety inventory tool (Spielberger, 1983).

1) Women's Profile Questionnaire. These included 5 parts

Part I: Demographic characteristics.

Part II: Gynecological history.

Part III: Obstetric profile.

Part IV: Anthropometric measurements which included measuring height, weight, calculation of BMI and determination of the class of each woman.

Part V: Data related to infertility and IVF management.

This was composed of demographic characteristics, which included woman code, age, educational level, occupation, date of marriage and phone number for the follow-up purpose, the gynecological history which included menstrual history, previous contraception use, types of invasive diagnostic procedure in the pelvic area.

Obstetric profile: This included a number of gravidities, parity, abortion and living child, as well as complication of the postpartum period if present. Data related to IVF management, which included the duration of infertility.

Types of infertility: Examination was done to check Etiology of infertility and the causes of infertility, Types of previous infertility treatment if presented, in a case of ART which type of procedure, Type of ovulatory stimulation protocol; Names, doses, and duration of medication used for induction.

Duration of ovulation induction: The included the number of current cycle of induction, if there were side effects of ovulation induction as ovarian hyperstimulation, the number of the aspirated ovum, the number of a fertilized ovum and the number of embryos transferred.

The result of a chemical pregnancy test: The result of clinical pregnancy was done through the visualization of the fetal sac and fetal pulse. Test was done to check the number of implanted embryo. Women's weight was assessed by the same weight scale after calibration and measuring the women's height by the tape measure. Calculation of women's BMI and classification of women's BMI according to BMI classes were done.

BMI Scale was as defined as weight in kilograms divided by height in meters squared (kg/m2) and was developed by the anthropometrist Belgian Adolphe Quetelet. The current definitions commonly used established the following values, agreed in 1997 and published in 2000 & 2004 (World Health Organization, 2004). It was classified into six categories as following underweight > 18.5, normal weight 18.5 to 24.9, overweight 25.0 to 29.9, Obese Class I 30.0 to 34.9, Obese Class II 35.0 to 39.9, Obese Class III ≥ 40.0 (Huxley *et al*., 2010).

Follow up: Follow-up of the women after implantation of the embryo was carried out either from women's file or through the phone. Follow-up included the confirmation of pregnancy both chemically by measuring the β subunit of the HCG in the blood after 14 days from embryo transfer or clinically by ultrasound for about 5 to 7 weeks from the embryo transfer. It also included documentation of a number of implanted embryo.

2) State-trait anxiety inventory (STAI) (Spilberger, 1983).

This is a commonly used measure of trait and state anxiety. There are 2 subscales within this measure. First, the State Anxiety Scale (S-Anxiety) that evaluates the current state of anxiety, using items that measure subjective feelings of apprehension, tension, nervousness, worry, and activation/arousal of the autonomic nervous system. The Trait Anxiety Scale (T-Anxiety) evaluates relatively stable aspects of "anxiety proneness," including general states of calmness, confidence, and security. The STAI has 40 items, 20 items allocated to each of the S-Anxiety and T-Anxiety subscales. In the current study, the research investigator took the 2nd part which related to state anxiety. It has 20 items to evaluate how the person feels `right now'. The score for each item ranged from 1 to 4 started with not at all, somewhat, moderately so and very much so respectively. With higher scores indicated greater anxiety. Thus, total scores ranged from 20 to 80. Cut-off scores for the STAI demarcating low- or high-stress states (or traits) have not been adequately identified through the literature (Turner *et al*., 2013). But Julian (2011) reported that a cut point of 39–40 has been suggested to detect clinically significant symptoms for the S-Anxiety scale; however, other studies have suggested a higher cut score of 54–55 for older adults The SAI is reliable, sensitive to change, resistant to practice effect, and has

been successfully used in other studies to measure the anxiety level. In a recent study by Martin *et al*., (2015) the internal consistency was acceptable (STAI: alpha =0.94). In another study, the coefficient alpha for state anxiety was 0.94. The scale was translated to Arabic language and tested for validity and reliability (Abdel-Khalek, 1989).

PROCEDURES

Data were collected through:

1. Preparation phase: During this phase, an official permission was taken from the ethical committee at Faculty of Nursing-Cairo University and administrative personnel at the private center for ART. Also, it included a review of the recent literature to develop the tool used in the study.

2. Interviewing and assessment phase: The women who underwent IVF procedure were recruited and they were explained about the purpose and nature of the study to obtain informed written consent in a private nursing room in the preoperative area.

The researcher investigated the eligibility of the women by measuring women's level of anxiety via STAI questionnaire, which is a self-report questionnaire, women with score 60 and more were excluded from the research.

3. Follow up: Follow-up of the women after implantation of the embryo was carried out either from women's file or through the phone. Follow-up included the confirmation of pregnancy both chemically by measuring the β subunit of the HCG in the blood after 14 days from embryo transfer or clinically by ultrasound for about 5 to 7 weeks from the embryo transfer. It also included documentation of a number of implanted embryo.

Statistical Design

Data were analyzed using the SPSS windows statistical package for social science version 21. Frequency and percentage were used for numerical data as well as a mean ± standard deviation, minimum and maximum. For finding the differences between normally distributed numeric data, t-test and Analysis of Variance One Way ANOVA test were used. For finding the differences between categorical data, nonparametric Chi-square (X^2) test was used. Probability (*p*-value) less than 0.05 was considered significant, and less than 0.001 considered as highly significant.

RESULT

The women age was ranged from 25-35 years, with a mean age of 29.75±3.88 years. As for occupation, 95% of women were housewives. Mean Marriage duration was is 6.93±4.39 years. Eighty-eight percent of the women had the regular menstrual cycle, the mean of the menstrual interval was 28.28±2.16 days, and the mean days of the menstrual duration were 4.67±1.06 day. According to the classes of BMI, 36% of women were overweight BMI (25-29.9kg/m), 32% grade I obesity BMI (30-34.9kg/m), 9% normal weight BMI (18.5-24.9kg/m), and 5% underweight BMI (less than18.5kg/m).

Regarding the type of infertility 81% of women had primary infertility. The mean of infertility duration was 2.76± 0.9 years. Regarding the origin of infertility, 33% of women had a female origin while, 31% had the male origin, 24% both male and female cause and 12% of women had an unexplained cause. According to the female causes of infertility, 35% of women had an ovulatory problem, 13% had a tubal factor. Regarding the male cause of infertility, 23% of women's husband had oligospermia, 26% had athenozoospermia, 1% had leukocytospermia and 8% had coiled tail sperm.

As for the ovulation induction 94% of women received long-acting protocol, 3.0% of them received short-acting protocol, and 3.0% of them received ultra short protocol. Regarding the duration of induction, current research shows that the mean of induction duration was 10.06±1.23days. Regarding the side effect of induction 11% of women had ovarian hyperstimulation.

Regarding the number of aspirated ovum the highest percentage 37.0% with 6-10 ovums being aspirated and the lowest percentage 12.0% where 1-5 ovum were aspirated. For the number of fertilized ovum the highest percentage is 37% where 5-10 ovum were fertilized and the lowest percentage was 29% <10 ova were fertilized with a mean of 8.61±4.99. For the number of fetus transferred the highest percentage 73.0%, 3 embryos were transferred and the lowest percentage 4.0% where more than 3 embryos were transferred.

Regarding the results of hormonal pregnancy test (HCG), 60.0% of women had the positive pregnancy test. For the visualization of the fetal sac in Ultrasound result, 46% had a clinical pregnancy.

Regarding the correlation between women's BMI and

doses of medication for induction, for the fostimon (FSH) it showed that the highest dose was received by the obese women grade III with a mean of 300.00±0.000 IU, while the lowest doses were received by the underweight with a mean of 225.00± 0.000 IU. There is a significant statistical correlation between the women's BMI and doses of fostimon (F=3.08 at p = 0.019). For menogon (Human Menopaual Gonadotrophine) dose it showed that the highest dose was received by obese women grade III with a mean of 150.00±61.237 IU, while the lowest doses were received by the underweight with a mean of 100.96±36.387IU. There is a significant statistical correlation between the women's BMI and doses of menogone (F=2.409 at p=0.044). For Gonal f dose it showed that the highest dose was received by obese women grade II with a mean of 271.96±50.079IU, and also the lowest dose associated with underweight with a mean of 174.88±30.552IU There is a significant statistical correlation between the women's BMI and doses of Gonal f (follitropin alfa) (F=4.902 at p=0.002). There is a significant statistical correlation between the women BMI and doses of medication for induction (Table 1)

Table 1: Correlation between medications doses and BMI

Variables		BMI		F	*p*
		Mean	SD		
Fostimon	Under weight	225.00	0.000	3.082	0.019*
	Normal	275.00	43.301		
	Over weight	235.00	47.996		
	Obesity grade I	296.67	38.807		
	Obesity grade II	262.50	69.437		
	Obesity grade III	300.00	0.000		
Menogon	Under weight	100.96	36.387	2.409	0.044*
	Normal	112.50	53.033		
	Over weight	121.88	38.816		
	Obesity grade I	141.35	68.170		
	Obesity grade II	144.23	20.801		
	Obesity grade III	150.00	61.237		
Gonal f	Under weight	174.88	30.552	4.902	0.002*
	Normal	196.58	80.754		
	Over weight	263.10	47.840		
	Obesity grade I	205.00	74.498		
	Obesity grade II	271.96	50.079		

**Significant<0.05*

For the correlation between duration of ovulation induction and BMI the results showed that the longest duration associated with obesity grade III with a mean of (11.00±1.41) day, and the shortest duration was received by the underweight class with a mean of (9.20±1.304) day, but there is no significant statistical correlation between the women's BMI and duration of induction (F=1.122 at *p*=0.354) (Table 2).

Table 2: Correlation between duration of induction and BMI

Variables	Induction duration		F	*p*
	Mean	SD		
Under weight	9.20	1.304	1.122	0.354
Normal	10.33	1.118		
Over weight	9.97	1.298		
Obesity grade I	10.03	1.177		
Obesity grade II	10.21	1.188		
Obesity grade III	11.00	1.414		

**Significant<0.05*

For the correlation between a number of aspirated ovum and BMI the results showed that lowest number of aspirated ovum associated with overweight class, there is no significant statistical correlation between the women's BMI and the number of an aspirated ovum (X^2=15.215 at *p*=0.436) (Table 3).

Table 3: Correlation between number of aspirated eggs and BMI

Variables			Number of aspirated eggs			
			< 5	6-10	11-15	16-20
BMI	Under weight	N	2	2	1	0
		%	16.7%	5.4%	4.0%	0.0%
	Normal weight	N	0	4	4	1
		%	.0%	10.8%	16.0%	3.8%
	Over weight	N	5	12	8	11
		%	41.7%	32.4%	32.0%	42.3%
	Obesity grade I	N	3	15	5	9
		%	25.0%	40.5%	20.0%	34.6%
	Obesity grade II	N	2	3	6	3
		%	16.7%	8.1%	24.0%	11.5%
	Obesity grade III	N	0	1	1	2
		%	.0%	2.7%	4.0%	7.7%
X^2 =15.215, *p*=0.436						

**Significant<0.05*

For the correlation between the incidence of ovulation induction side effect and BMI current research showed that the highest incidence of a side effect associated with obesity grade II. There is no significant statistical correlation between the women's BMI and the side effect of ovulation induction (X^2=7.011at *p*= 0.220) (Table 4).

Table 4: Correlation between incidence of induction side effect and BMI

Variables			Side effect of induction		X^2	*p*
			No	Yes		
BMI	Under weight	N	5	0	7.011	0.220
		%	5.6%	0		
	Normal weight	N	8	1		
		%	9.0%	9.1%		
	Over weight	N	34	2		
		%	38.2%	18.2%		
	Obesity grade I	N	29	3		
		%	32.6%	27.3%		
	Obesity grade II	N	10	4		
		%	11.2%	36.4%		
	Obesity grade III	N	3	1		
		%	3.4%	9.1%		

**Significant<0.05*

For the correlation between the number of fertilized ovum and BMI the table showed that the lowest number of fertilized ovum associated with obesity grade III with the mean of 5.60±2.60 egg, and the highest number of fertilized ovum associated with normal weight with the mean of 10.50 ± 5.91 ovum, but there is no significant statistical correlation between the women's BMI and the number of fertilized ovum (F=0.561 at *p*=0.730) (Table 5).

Table 5: Correlation between number of fertilized eggs and BMI

Variables	Number of fertilized eggs		F	*p*
	Mean	SD		
Under weight	8.78	3.4	0.561	0.730
Normal weight	10.50	5.91		
Over weight	9.08	5.70		
Obesity grade I	8.28	4.940		
Obesity grade II	8.57	4.56		
Obesity grade III	5.60	2.60		

**Significant<0.05*

For the correlation between a number of transferred fetus and BMI the results showed that lowest foetal number is associated with obesity grade 1, while there is a significant statistical correlation between the women's BMI and fetal number (X^2=18.032 at *p*=0.054) (Table 6).

Table 6: Correlation between number of fetus transferred and BMI

Variables			Number of fetus transferred		
			two	three	≥ 4
BMI	Under weight	N	0	5	0
		%	0.0%	6.8%	0
	Normal weight	N	0	9	0
		%	0.0%	12.3%	0
	Over weight	N	6	30	0
		%	26.1%	41.1%	0
	Obesity grade I	N	12	17	3
		%	52.2%	23.3%	75%
	Obesity grade II	N	5	8	1
		%	21.7%	11.0%	25%
	Obesity grade III	N	0	4	0
		%	0.0%	5.5%	0
X^2=18.032, *p* =0.054					

**Significant<0.05*

For the correlation between Pregnancy test result and BMI the results showed that the reduced pregnancy rate was associated with obesity grade I, there is a significant statistical correlation between the women's BMI and Pregnancy test result (chemical pregnancy) (X2=14.985at p=0.010) (Table 7).

Table 7: Correlation between Pregnancy test result and BMI

Variables			Pregnancy test result		X^2	*p*
			Positive	Negative		
BMI	Under weight	N	4	1	14.985	0.010*
		%	6.7%	2.5%		
	Normal weight	N	7	2		
		%	11.7%	5.0%		
	Over weight	N	26	10		
		%	43.3%	25.0%		
	Obesity grade I	N	15	17		
		%	25.0%	42.5%		
	Obesity grade II	N	4	10		
		%	6.7%	25.0%		
	Obesity grade III	N	4	0		
		%	6.7%	0.0%		

**Significant<0.05*

For the correlation between HCG level and BMI the results showed that the lowest HCG level was associated with obesity grade II with the mean of

354.64± 660.013 IU/ml, the highest HCG level was associated with Overweight class with the mean of 1114.25±1357.93 IU/ml, and there is no significant statistical correlation between the women's BMI and HCG level (F=1.865 at p=0.108) (Table 8).

Table 8: Correlation between HCG level and BMI

Variables	HCG		F	*p*
	Mean	SD		
Under weight	794.00	802.297	1.865	0.108
Normal weight	1002.44	1098.616		
Over weight	1114.25	1357.937		
Obesity grad I	469.94	691.239		
Obesity grade II	354.64	660.013		
Obesity grade III	839.00	1187.606		

**Significant<0.05*

For the correlation between number of implanted embryo and BMI the results showed that the lowest implantation rate was associated with obesity grade II with the mean of 0.21±0.579 implanted embryo, the highest implantation rate was associated with normal weight with the mean of 1.00±0.866 implanted embryo, there was a significant statistical correlation between the women's BMI and number of implanted embryo (F=3.264 at p=0.009) (Table 9).

Table 9: Correlation between number of implanted eggs and BMI

Variables	Number of implanted eggs		F	*p*
	Mean	SD		
Under weight	0.80	0.837	3.264	0.009*
Normal weight	1.00	0.866		
Over weight	0.92	0.874		
Obesity grad I	0.38	0.660		
Obesity grade II	0.21	0.579		
Obesity grade III	0.25	0.500		

**Significant<0.05*

For the correlation between clinical pregnancy rate and BMI the results showed that the lowest clinical pregnancy rate was associated with obesity grade I, there was significant statistical correlation between the women's BMI and clinical pregnancy rate (X^2=17.873 at *p*=0.003) (Table 10).

Table 10: Correlation between clinical pregnancy rate and BMI

Variables			Ultrasound result		X^2	*p*
			No	Yes		
BMI	Under weight	N	2	3	17.873	0.003*
		%	3.7%	6.5%		
	Normal weight	N	2	7		
		%	3.7%	15.2%		
	Over weight	N	13	23		
		%	24.1%	50.0%		
	Obesity grade I	N	22	10		
		%	40.7%	21.7%		
	Obesity grade II	N	12	2		
		%	22.2%	4.3%		
	Obesity grade III	N	3	1		
		%	5.6%	2.2%		

**Significant<0.05*

DISCUSSION

Regarding the correlation between women's BMI and doses of medication for induction, the current research shows that for fostimon the highest dose was received by the obese women grade III with a mean of 300.00± 0.000 IU, while the lowest doses were received by the underweight with a mean of 225.00±0.000 IU. There was a significant statistical correlation between the women's BMI and doses of fostimon (F=3.08 at p =0.019). For menogon dose, it shows that the highest dose was received by obese women grade III with a mean of 150.00±61.237 IU, while the lowest doses were received by the underweight with a mean of 100.96±36.387IU. There was a significant statistical correlation between the women's BMI and doses of monegon (F=2.409 at p=0.044). For Gonal f dose it shows that the highest dose was received by obese women grade II with a mean of 271.96± 50.079IU, and also the lowest dose associated with underweight with a mean of 174.88± 30.552IU. There was a significant statistical correlation between the women's BMI and doses of Gonal f (F=4.902 at p=0.002). There was a significant statistical correlation between the women's BMI and doses of medication for induction. It may refer to the large body surface area in obese women.

The finding of the current research is in accordance with Petanovski *et al*., (2011) who represented the dose of medication for induction by the number of ampoules used, which showed that the highest mean number of ampoules 37.3±11.7 received by obese women with BMI > 30 and the lowest mean number of ampoules 30.9±11.6 received by underweight women. There is a significant statistical correlation between the women's

BMI and doses of medication for induction at (p=< 0.0001). A study (Bailey, *et al*., 2014) was done to investigate age-related variations in the effect of body mass index on *in vitro* fertilization outcomes. It showed that the doses of medication were associated with age and BMI. The highest dose 3375 IU received by obese BMI ≥30 and 3525 IU with age group ≥35, while the lowest dose 2550 IU received by normal weight and 2925 IU with age group <35. There is a significant statistical correlation between the dose of medication and BMI at (*p*=0.298). But the finding of a study carried by (Hill, Hong & Frattarelli, 2011) revealed that the dose of gonadotropins determined by ampoules showed that the mean of number of ampoules for women with BMI < 25kg/m2 is 59.3±10.9, while for women with BMI ≥ 25 kg/m2 the mean number of ampoules is 52.3±11.8. So a significant negative correlation between BMI and ampoules of gonadotropins used (r = −0.25, *P*< 0.01). Sathya *et al*., (2010) reported that the mean dose of gonadotropins was 2490.6 ±1057.6 for BMI<25 kg/m2, 2690.7 ±1048 for BMI 25-30kg/m2 and 2658 ±887.3 for BMI >30 kg/m2, so overweight and obese women showed similar gonadotrophin requirements as that of normal weight women. Legge *et al*., (2014) reported that the highest mean of dose 4580±2789 IU received by Overweight BMI 25 to 29.99 kg/m2 and the lowest mean of dose 4344±2644IU received by Obese BMI ≥ 30 kg/m2. Being overweight (β=0.024, *P*=0.394) or obese (β=0.042, *P*=0.144) was not significantly correlated with total FSH dose requirements.

The current research shows that the longest duration of induction is associated with obesity grade III, and the shortest duration is associated with the under weight class, but there is no significant statistical correlation between maternal BMI and duration of ovulation induction. The same result was reported by Sarais *et al*., (2016); Orvieto, (2015); Legge *et al*., (2014) and Toma *et al*., (2008), that there are no statistical differences were reported across BMI groups for duration of stimulation. On controversy the results of current study did not match with Alassiri *et al*., (2016), who found statistically significant correlation but not clinically (Sharma *et al*., 2013; Moragianni, Jones & Ryley, 2012; Petanovski *et al*., 201; Hill, Hong & Frattarelli, 2011). El-attar, (2008) reported that there is significant statistical correlation between BMI and duration of controlled ovarian hyper stimulation (COH).

Regarding to the relationship between number of induction cycle and BMI the current study shows that the high cancellation rate associated with obesity grade I, it may be related to the presence of adipose tissue which contains fats that antagonize gonadotrophine action. There is significant statistical correlation between the maternal BMI and number of induction cycle. This result agreed with Sharma *et al*., (2013) and El-attar, (2008) who reported that there is significant statistical correlation between BMI and cancellation rate. Alassiri *et al*., (2016); Orvieto, (2015); Legge *et al*., (2014) and Matalliotakis *et al*., (2008) reported that there is no significant statistical correlation between BMI and cycle cancellation among the BMI subgroups.

Regarding to the relationship between incidence of ovulation induction side effects and BMI the current study shows that, there is no significant statistical correlation between the maternal BMI and side effect of ovulation induction. This result agreed with (Sharma *et al*., 2013) reported that there is no significant correlation between BMI and side effect.

For the correlation between number of aspirated ovum and BMI the current research shows that the lowest number of aspirated ovum associated with overweight class, but there is no significant statistical correlation between women BMI and number of aspirated ovum. This result does not match with Sharma, (2013) and Sarais *et al*., (2016). The research shows that the lowest number of fertilized ovum is associated with obesity grade III, while the highest number of fertilized ovum associated with normal weight. But there is no significant statistical correlation between the women BMI and number of fertilized ovum, this result is in accordance with *et al*., (2010) and Sarais *et al*., 2016

For the correlation between embryo transfer number and BMI the research showed that the lowest embryo transfer number associated with obesity grade I. There is significant statistical correlation between the women's BMI and number of number of embryo transfer. This result is in accordance with Matalliotakis *et al*., (2008); El-attar, (2008). But this was against Sarais *et al*., (2016); Alassiri *et al*., (2016); Orvieto, (2015), Kasim & Roshdy, (2014); Sharma *et al*., (2013); Moragianni, Jones, & Ryley, (2012); Petanovski *et al*., (2011); Hill, Hong, & Frattarelli, (2011) and Moini *et al*., (2008) who reported that there is no significant statistical correlation between the

women's BMI and number of number of embryo transfer.

For the correlation between Pregnancy test result and BMI this research shows that the reduced pregnancy rate was associated with obesity grade I, there is significant statistical correlation between the women's BMI and Pregnancy test result (chemical pregnancy) (Kasim & Roshdy, 2014). But this result does not matched with Petanovski *et al*., (2011); Alassiri *et al*., (2016); Sathya *et al*., (2010) and Moragianni *et al*., (2012); Hill, Hong, & Frattarelli, (2011) and El-attar, (2008), reported that there a significant statistical correlation between the women's BMI and Pregnancy test result.

Current research showed that the lowest implantation rate was associated with obesity grade II, and the highest implantation rate was associated with normal weight, there is significant statistical correlation between the women BMI and number of implanted embryo. The same result was found by Moragianni *et al*., (2012). But the findings were against Sathya *et al*., (2010); Sharma *et al*., (2013); Hill, Hong, & Frattarelli, (2011); El-attar, (2008) who didn't find any statistical correlation between women BMI and number of implanted embryo.

Therefore the present study showed that the lowest clinical pregnancy rate was associated with obesity grade I, there is significant statistical correlation between the women's BMI and clinical pregnancy rate. This finding matched with result of Kasim & Roshdy, (2014); Petanovski *et al*., (2011); Orvieto, (2015); El-attar, (2008); Moini *et al*., (2008) and Moragianni *et al*., (2012). But was against the reports of Hill, Hong, & Frattarelli, (2011); Sathya *et al*., (2010); Legge *et al*., (2014); Sharma *et al*., (2013) and Luke *et al*., (2011) who reported that there is no statistical correlation between the women's BMI and clinical pregnancy rate.

CONCLUSION

Finally, the results of the current research concluded that the women's BMI had an impact on IVF success rate, as it affects the medication dose, number of embryo transfer, chemical and clinical pregnancy.

RECOMMENDATION

1-Emphasize on the appropriate preparation for IVF procedure, including screening of factors affecting success rate of IVF.

2- Conduct counseling program before and during the process.

3- Conduct research, including BMI and age as a factor

4- Conduct research about effect of central obesity on IVF success.

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