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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 life event and assisted reproductive technology is a revolution for infertility treatment, in vitro fertilization is one of the most common assisted reproductive technology procedures performed, there are so many factors that affect the success rate of in vitro fertilization. Body mass index is one of the controlled factors which affecting in vitro fertilization success. **Aim** The aim of this study was to explore the relation between maternal body mass index & in vitro fertilization success rate. **Subject and methods**: a descriptive correlational **design** conducted by prospectively investigating the in vitro fertilization cycles of 100 women they were within the age from 25 to 35 years who were selected based on the inclusion and exclusion criteria in a private assisted reproductive technology clinic between 2015 and 2016. The women were classified into six groups based on their body mass index, i.e., under weight (n=5), normal weight (n=9), overweight (n=36), obese grade I (n=32), obese grade II (n=14), and obese grade III (n=4). Then, body mass index - and related variations in the in vitro fertilization cycle parameters and clinical pregnancy rates of women were investigated. 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 to determine whether there was a relation between body mass index and in vitro fertilization success rate. **Results**: Finding of the study show that the mean age is 29.75± 3.88 years. According to the classes of body mass index, 36% of women were overweight body mass index (25-29.9kg/m), 32% were grade I obesity body mass index (30-34.9kg/m), 9% normal weight body mass index (18.5-24.9kg/m), and 5% underweight body mass index (less than18.9kg/m). Eighty-one percent of women had primary infertility. Variations in variables with body mass index showed that doses of drugs for ovulation induction were negatively affected by body mass index. Ovulation induction cycles were found to be negatively affected by body mass index. Chemical pregnancy rate was found to be negatively affected by body mass index. Higher implantation rate was associated with normal body weight .Clinical pregnancy rates were found to be lower in the obesity grade III than in the other groups. **Conclusion:** The present study evaluated the relation between body mass index and in vitro fertilization success rates according to their body mass index groups, the clinical pregnancy rates were observed to be lower in the obesity grade III than in the other body mass index groups. Recommendations: Provide women undergoing in vitro fertilization process with a counseling program or teaching class about factors affecting the success of the procedure, administration of medication and follow up.
Keywords: 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 feeling of failure and dissatisfaction (Countries, n.d.). Infertility is recognized as a disease state which, after appropriate investigation, can be treated by appropriate assisted reproductive technology. The World Health Organization (WHO) defines infertility as: disease of the reproductive system defined by the failure to achieve a clinical pregnancy after 12 months or more of regular unprotected sexual intercourse(NATIONAL INFERTILITY GROUP NATIONAL INFERTILITY GROUP, 2016). In general, 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 (cited @ http://www.cdc.gov/reproductivehealth/infertility/ 9/10/2016)

The worldwide prevalence of infertility is about 15% of couples globally, estimated to 48.5 million couples (Agarwal, Mulgund, Hamada, & Chyatte, 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 has 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 @(http://www.news-medical.net/health/Infertility-Prevalence.aspx).

In Egypt, the incidence of infertility has been reported to be 10.4% of married couples (Shahin AY,2007) cited in (Gibreel, Eladawi, El-Gilany, Allakkany, & Shams, 2015).In Egypt 64 % of infertility causes 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 partner, 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 a retrospective – cross sectional survey conducted by Mansour, El-Faissal and Kamal(2014) to search out 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 USA found that, the percentage of delivered babies was 47.6% (61,610) out of 129,355cycles (ART surveillance by Centers for Disease Control and Prevention 2014).

The nurse has 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, has 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 in the treatment cycle. (Abd El-Fttah et al., 2013)

Significance of the study

The current study explored the effect of BMI on success rate of IVF .the results of the study will contribute to increase body of knowledge of nurse's information which will be reflected on nursing practice during IVF preparation, counseling and health teaching regarding to weight pattern, nutritional regimen and adopting 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 current study may will be a crucial part in constructing IVF programs which indirectly affect women's health.

Aim of the research

This study aimed to explore the relationship between women's body mass index and IVF success rate.

Research Question

What is the relationship between maternal body mass index and IVF success rate?

Operational Definition: **Success Rate**

Success rate in the current study 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 5^{th} to 7^{th} week after embryo transfer while 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).

Subject and Methods

Design

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

Sample

A convenient sample 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 cut off point that indicated high level of anxiety and congenital anomalies in reproductive system were excluded. Cut-off scores for the STAI demarcating low- or high stress states (or traits) have not been adequately identified in 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; how- ever, other studies have suggested a higher cut score of 54–55 for older adults. As infertility is one of the major stressors the research investigator by an assistance of the statistician decided to exclude women with score of 60 or more from the study.

Setting

The study was conducted in private ART center in Benha city in Qulubia governorate, Egypt, it composed of two floors, the 1^{st} floor is outpatients clinics and reception for check up, follow up, and antenatal care; the 2^{nd} 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 study 2 tools were developed; women's profile questionnaire and State trait anxiety inventory tool (Spielberger, 1983).

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

Part I: demographic characteristics. This included woman code, age, educational level, and occupation, date of marriage and phone number for the follow up purpose.

Part II: gynecological history. Which included menstrual history obtained; last menstrual period, duration, frequency, regularity of menstruation and any recent changes in the menstrual cycle during the last 6 months as dysmenorrhea, hyper menorrhea and premenstrual syndrome. It included previous contraception use as type of contraceptive used if oral contraceptive pills, Injection, IUD or norplant. Duration of contraception used if less than 2 years, 2years, for 3years or more than 3 years. Types of invasive diagnostic procedure in pelvic area if done like hystroscope, hystrosalpingography or laparoscopy.

Part III: Obstetric profile. This included number of gravidity, parity, abortion and living child, as well as complication of postpartum period if present as puerperal sepsis, postpartum hemorrhage or adhesions.

Part V: Anthropometric measurements which included measuring height, weight, calculation of BMI and determination of the class of each woman. BMI Scale. Was 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 was establish the following values, agreed in 1997 and published in 2000 & 2004 (World Health Organization, 2004).It separated 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, Mendis, Zheleznyakov, Reddy and Chan, 2010)

Part IV: Data related to infertility and IVF management which contained duration of infertility if less than 2 years,2years to 4years, 5years to 7 years or more than 7years.Type of infertility either primary or secondary. Etiology of infertility if female cause, male cause, combined cause or unexplained cause. Factors referred to female as endometriosis, uterine fibroid, ovulatory factors, tubal factors, incompetent cervix, hormonal disturbance, Pelvic inflammatory disease or recurrent vaginal infection. Factors related to male as oligospermia, athenozospermia, leukocytospermia or athenocoiled tail. Type of previous infertility treatment if presented as medical treatment, surgical treatment or ART, in case of ART which type of procedure if ICSI or IUI. Type of ovulatory stimulation protocol included short, long or ultra short protocol. Names, doses and duration of medication used for induction .Duration of ovulation induction. Number of current cycle of induction if 1st cycle,2nd cycle or 3rd cycle. If there were side effects of ovulation induction as ovarian hyperstimulation.Number of aspirated ovum if less than 5 ovum,6 to 10 ovum,11 to 15 ovum or 16 to 20 ovum. Number of fertilized ovum.Number of embryo transferred if less than3, 3embryo or more than 3 embryos. Result of chemical pregnancy test if positive or negative.Result of clinical pregnancy through the visualization of fetal sac and fetal pulse or not.Number of implanted embryo if one embryo, 2embryo,3embryo or more than three embryo. Validation of the women's profile questionnaire was done through submission to 5 experts in the field of maternity nursing and obstetrics medicine who were specialist in ART to confirm its validity. Modifications were carried out according to the experts' judgments on the clarity of sentences and the appropriateness of content.

2) State trait anxiety inventory (STAI) (Spilberger, 1983) Appendix (B). Is a commonly used measure of trait and state anxiety there are 2 subscales within this measure. First, the State Anxiety Scale (S-Anxiety) evaluates the current state of anxiety, asking how person feel "right now," 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 current study the research investigator took the 2nd part which related to state anxiety. It has 20 items to evaluate how 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. 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 recent study by Matthiesen et al., (2012) the internal consistency was acceptable (STAI: alpha = .94). In another study the coefficient alpha for state anxiety was .94. The scale was translated to Arabic language and tested for validity and reliability by Abdelkhalek, 1984.

Ethical Consideration

For ethical reasons an official permission was obtained from the research ethics committee at Faculty of Nursing-Cairo University and official permission was taken from administrative personnel from El: Nada center for ART. Also, each woman was informed about the purpose of the study and its importance. The research investigator emphasized that their participation in the study was voluntary; anonymity and confidentiality were assured through coding the data. Written informed consent was obtained from women who accepted to be

included in the study and the women can be withdrawn anytime.

Pilot study

A pilot study was conducted on 10% of the sample to assess the feasibility of the study as well as clarity and objectivity of the tools. The needed modifications were incorporated and those women were included in the actual study according to the result of the pilot study.

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 review of the recent literature to develop the tool used in the study.
2- **Interviewing and assessment phase.** The research investigator introduced herself to the women underwent IVF procedure in the day of embryo transfer and explained the purpose and nature of the study to obtain informed written consent in a private nursing room in preoperative area.

After that the research investigator started to investigate 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 study. Women with score less than 60 in STAI and met inclusion criteria were included in the study. Utilizing structured interviewing tool **Appendix (A)** which composed of demographic characteristics, Which included woman code, age, educational level, occupation, date of marriage and phone number for the follow up purpose, gynecological history Which included menstrual history, previous contraception use, types of invasive diagnostic procedure in pelvic area. Obstetric profile. This included number of gravidity, parity, abortion and living child, as well as complication of postpartum period if present. Data related to IVF management which included which contained duration of infertility.Type of infertility. Etiology of infertility if female cause, male cause, combined cause or unexplained cause. Factors referred to female. Factors related to male. Type of previous infertility treatment if presented, in 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. Number of current cycle of induction. If there were side effects of ovulation induction as ovarian hyperstimulation.Number of aspirated ovum. Number of fertilized ovum. Number of embryo transferred .Result of chemical pregnancy test. Result of clinical pregnancy through the visualization of fetal sac and fetal pulse or not. 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.

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

Statistical Design

Data were analyzed using SPSS windows statistical package for social science version 21. Frequency and percentage were used for numerical data as well as 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.

Results

will be presented in 2 sections the 1st one description of the sample which contained 6 parts included socio-demographic Characteristics; menstrual history; obstetric history; gynecological history; women's anthropometric measurements; infertility and IVF data. The 2nd section contained 10 parts which included the correlation between women's BMI as independent variable and medications doses , medications durations, duration of induction, Number of induction cycles, Side effect of induction, Number of aspirated eggs, number of fertilized eggs, Number of fetus transferred, Pregnancy test result Number of implanted eggs and Ultrasound result.

Part (1): Socio-Demographic Characteristics this part includes data related to age, duration of marriage and occupation.

The women age ranged from 25 – 35 years, with a mean age of 29.75± 3.88 years. As for occupation, 95 % of women were housewives. Marriage Duration was ranged from one year to18 years with mean duration of 6.93± 4.39 years. Forty eight percent of the women their marriage duration was 1-5 years, and 33.0% of them their marriage duration was 6-10 years , while the marriage duration of 19% of them was (>10 years).

Part (2): Menstrual history

As regard to menstrual cycle regularity; 88% of the women had regular menstrual cycle. Twenty –nine percent of women had menstrual cycle problems as 19% of them had dysmenorrhea, and 10% had metrorrhagia. The mean of menstrual interval was 28.28± 2.16. The mean days of the menstrual duration were 4.67± 1.06.

Part (3): Gynecological history

Regarding to the contraceptive method used 7% of women used contraception method, 57.1 % of them used injection contraception method, 42.9% of them used oral contraception method, and 57.1 % of the women used the contraception method for more than 3 years (Table, 3).

Regarding to the performance of fertility diagnostic procedure in the reproductive system, 81% of the women performed diagnostic procedure, as 63.3 % of them performed a hysteroscopy, 30.8 % performed laparoscope, while 39.5% of women performed hystrosalpingography.

Part (4): Obstetric history

Regarding to the delivery of term pregnancies, 78.9 % of women had a full term pregnancy, and 36.8% of women had a preterm pregnancy, 89.4% of them were aborted, while 89.4 % had living child. Regarding to postpartum complications occurrence 89.4% of women didn't have any postpartum complications, while 10.6% of them had postpartum complications, 50% of them had postpartum hemorrhage and 50% of them had tubal adhesions.

Part (5): Anthropometric measurements

According to the classes of BMI, 36% of women were overweight BMI (25-29.9kg/m), 32% were 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), (Table, 1).

Table (1)*Distribution of the Women according to their BMI*

Items	Frequency (n=100)	%
-Classes of BMI		
▪ Under weight	5	5.0
▪ Normal	9	9.0
▪ Over weight	36	36.0
▪ Obesity grad I	32	32.0
▪ Obesity grade I I	14	14.0
▪ Obesity grade I I I	4	4.0

Part (6): fertility history and current IVF data

Regarding to the type of infertility 81% of women had primary infertility. Forty three percent of women had infertility duration from 2-4 years, 26.0% of them had infertility duration from 5-7 years and 27.0% of them had infertility duration more than 7 years, with mean infertility duration 2.76± 0.9. Regarding to the origin of infertility 33% of women had female origin while, 31% had male origin, 24% both male and female cause and 12% of women had unexplained cause. According to the female causes of infertility35 % of women had ovulatory problem, 13% had tubal factor. Regarding to male cause of infertility 23% of women's husband had oligospermia, 26% had athenozoospermia, 1% had leukocytospermia,and 8% had coiled tail sperm (Table, 2).

Table (2)*Distribution of the Women according to fertility history*

Items	Freq (n=100)	%
- Infertility duration		
▪ less than 2 yrs	4	4.0
▪ 2-4 yrs	43	43.0
▪ 5-7 yrs	26	26.0
▪ More than 7 yrs	27	27.0
- Type of infertility		
▪ Primary	81	81.0
▪ Secondary	19	19.0
- Origin of infertility		
▪ Wife	35	35.0
▪ Husband	31	31.0
▪ Both of couples	24	24.0
▪ Unexplained cause	10	10.0
–Causes of female infertility n(35)		
▪ *Ovulation problems	35	100.0
▪ *Tubal factors	13	37.1
▪ *Endometriosiss	2	5.7
▪ *Cervical cause	2	5.7
▪ *Hormonal cause	3	8.6
▪ *Uterine fibroid	2	5.7
▪ *Pelvic inflammatory disorder	8	22.8
▪ *Recurrent vaginal infection	2	5.7
-Causes of male infertility n(31)		
▪ *Oligospermia	23	74.1
▪ *Athenozoospermia	26	83.8
▪ *leukocytospermia	1	3.2
▪ *Athenocoiledtail	8	25.8

*numbers aren't mutually exclusive.

Regarding to the previous fertility treatment75% of women were received treatment, as 82.6% of them received medical treatment, 5.3% of them had surgical treatment, and 57.3% of them performed ART treatment . Ninety-five point one percent of women who did ART were performed ICSI, while 4.9% of them performed IUI.

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 to the doses and duration of medication used for ovulation induction, for the fostemone mean of (267.93± 52.87 IU) and (9.68± 2.15)days respectively. For menegone mean of (126.27± 51.71 IU) and (95.57± 2.90) days respectively,for gonal f mean of (243.95± 63.54IU) and (9.52± 2.17)days respectively, for leuverse mean of (117.86± 40.08IU) and (3.86± 1.34)days respectively. (Table, 3).

Table (3)*Distribution of the Women by mean of doses and duration of medication*

Medication	Mean doses of medication		Mean duration of medication	
	Mean	SD	Mean	SD
Fostemone n(47)	267.93	± 52.87	9.68	± 2.15
Menegone n(81)	126.27	± 51.71	95.57	± 2.90
Gonal f n(50)	243.95	± 63.54	9.52	± 2.17
leuverse n(7)	117.86	± 40.08	3.86	± 1.34

Regarding to the duration of induction the women were classified in to 2 groups the 1st group percentage 58. % received the protocol for 7-10 days and the 2nd group percentage 42%received the protocol for 11-13 days with mean of 10.06± 1.23 days. Regarding to the number of induction cycle the highest percentage 71.% were in the 1st cycle and the lowest percentage 8%were in the 3rd cycle(Table, 4).

Table (4)*Distribution of the Women according to* D*uration of ovulation induction and number of induction cycle Total (100)*

Items	Freq (n=100)	%
-**Duration of ovulation induction**		
▪ 7-10 days	58	58.0
▪ 11-13 days	42	42.0
-Mean ±SD 10.06± 1.23		
-**Number of induction cycle**		
▪ 1st cycle	71	71.0
▪ 2nd cycle	21	21.0
▪ 3rd cycle	8	8.0

Regarding to the side effect of induction 11% of women had ovarian hyper stimulation.

Regarding to the number of aspirated egg the highest percentage 37.0% 6-10 ovum were aspirated and the lowest percentage 12.0 % 1-5 ovum were aspirated. For the number of fertlized.egg the highest percentage 37% 5-10 ovum were fertilized and the lowest percentage 29% about <10 ovum were fertilized with mean of 8.61± 4.99.For the number of fetus transferred the highest percentage 73.0% 3 embryo were transferred and the lowest percentage 4.0 % more than 3 embryos were transferred (Table, 5).

Table (5)*Distribution of the Women according number of aspirated and fertilized ovum and number of embryo transfer Total (100)*

Items	Freq (n=100)	%
- Numer of aspirated eggs		
▪ 1-5 ovum	12	12.0
▪ 6-10 ovum	37	37.0
▪ 11-15 ovum	25	25.0
▪ 16-20 ovum	26	26.0
- Numebr of fertlized.egg		
▪ < 5 eggs	34	34.0
▪ 5 -10 eggs	37	37.0
▪ <10 eggs	29	29.0
-Mean ±SD 8.61± 4.99		
- Number of embryo transfer		
▪ 2 embryo	23	23.0
▪ 3 embryo	73	73.0
▪ more than 3 embryo	4	4.0

Regarding to the results of hormonal pregnancy test (HCG) 60.0% of women had positive pregnancy test. For the visualization of fetal sac in Ultrasound result 46% had clinical pregnancy. The highest percentage 54.0% 54 of women hadn't implanted fetus. The highest implantation rate 34.0% for women was referred to the implantation of one embryo. (Table, 6).

Table (6)*Distribution of the Women according to the results of pregnancy test, ultrasound results and implantation rate Total (100)*

Items	Freq (n=100)	%
-Hormonal pregnancy test result		
▪ Positive	60	60.0
▪ Negative	40	40.0
- Presence of fetal sac in U/S n(60)		
▪ No	14	23.3
▪ Yes	46	76.0
- Number of implanted fetuses		
▪ Failed implantation	54	54.0
▪ One embryo implanted	34	34.0
▪ Two embryo implanted	8	8.0
▪ Three embryo implanted	4	4.0

Regarding to the correlation between maternal BMI and doses of medication for induction, for the fostemone it showed that the highest dose was received by the obese women grade III with a mean of 300.00± .000 IU, while the lowest doses was received by the underweight with a mean of 225.00± .000 IU.There is a significant statistical correlation between the maternal BMI and doses of Fostemone (F=3.08 at p =.019). For monegone 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 was received by the Underweight with a mean of 100.96± 36.387IU.There is a significant statistical correlation between the maternal BMI and doses of monegone (F=2.409 at p=.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 maternal BMI and doses of Gonal f (F=4.902 at p=.002). There is a significant statistical correlation between the maternal BMI and doses of medication for induction.

Regarding to the correlation between maternal BMI and medications durations for induction, for the fostemone in spite of that the longest duration was received by the obesity grade III class with a mean of 11.00± 1.414 day,and the shortest duration was received by the normal weight class with a mean of 8.25± 3.77day , there is no significant statistical correlation between the maternal BMI and duration of fostemone administration (F=.909 at p= .485). For monegone duration it showed that the longest duration was received by the obesity grade II class with a mean of 6.77± 3.345 day, and the shortest duration was received by the underweight class with a mean of 3.50± .707day ,and there is no significant statistical correlation between the maternal BMI and duration of monegone (F=1.107at p= .364). For Gonal f dose it showed that the longest duration was received by the obesity grade II class with a mean of 10.67± .816 day, and the shortest duration was received by the normal weight class with a mean of 8.40± 4.09day ,there is no significant statistical correlation between the maternal BMI and duration of Gonal f (F=1.257 at p= .377).For duration of Leuverse du duration it showed that the longest duration was received by the obesity grade I class with a mean of 4.33± .577 day, and the shortest duration was received by the normal weight class with a mean of 5.00± 0.00day , there is no significant statistical correlation between the maternal BMI and duration of Leuverse du (F=1.020at p=.408).There is no significant statistical correlation between the maternal BMI and duration of medication for induction .

For the correlation between duration of ovulation induction and BMI the table showed that the longest duration associated with obesity grade III with a mean of11.00± 1.41 day, and the shortest duration was received by the Under weight class with a mean of 9.20± 1.304day, but there is no significant statistical correlation between the maternal BMI and duration of induction (F=1.122at p=.354).

For the correlation between number of ovulation induction cycle and BMI the table showed that the more number of cycle associated with obesity grade I, there is significant statistical correlation between the maternal BMI and number of induction cycle (X2=26.386at p=.003) (Table 7).

Table (7)*Correlation between number of induction cycle and BMI*

Variables			Number of induction cycle			X^2	p
			One	Two	Three		
BMI	Under weight	N	3	2	0	26.386	.003*
		%	4.2%	9.5%	0		
	Normal	N	9	0	0		
		%	12.7%	.0%	0		
	Over weight	N	30	6	0		
		%	42.3%	28.6%	0		
	Obesity grade I	N	18	8	6		
		%	25.4%	38.1%	75%		
	Obesity grade I	N	10	4	0		
		%	14.1%	19.0%	0		
	Obesity grade III	N	1	1	2		
		%	1.4%	4.8%	25%		

*Significant<0.05

For the correlation between the incidence of ovulation induction side effect and BMI the table showed that the highest incidence of side effect associated with obesity grade II, There is no significant statistical correlation between the maternal BMI and side effect of ovulation induction (X^2=7.011at p=. .220) (Table 8).

Table (8)*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	.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 number of aspirated eggs and BMI the table showed that lowest number of aspirated eggs associated with over weight class, there is no significant statistical correlation between the maternal BMI and side number of aspirated eggs (X^2=15.215at p=. 436) (Table 9).

Table (9)*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%
	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=.436						

*Significant<0.05

For the correlation between number of fertilized eggs and BMI the table showed that the lowest number of fertilized eggs associated with obesity grade III with the mean of 5.60 ± 2.60 egg, and the highest number of fertilized eggs associated with normal weight with the mean of 10.50 ± 5.91 egg ,but there is no significant statistical correlation between the maternal BMI and number of fertilized eggs (F=.561at p=.730) (Table 10).

Table (10)*Correlation between number of fertilized eggs and BMI*

Variables	fertilized eggs Number of		F	p
	Mean	SD		
Under weight	8.78	3.4	.561	.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 number of transferred fetus and BMI the table showed that lowest fetal number associated with obesity grade 1, there is significant statistical correlation between the maternal BMI and fetal number (X^2=18.032at p=. 054) (Table 11).

Table (11)*Correlation between number of fetus transferred and BMI*

Variables			Number of fetus transferred		
			two	three	≥ 4
BMI	Under weight	N	0	5	0
		%	.0%	6.8%	0
	Normal weight	N	0	9	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%	5.5%	0
X^2=18.032 , p=.054					

*Significant<0.05

For the correlation between Pregnancy test result and BMI the table showed that the reduced pregnancy rate was associated with obesity grade I, there is significant statistical correlation between the maternal BMI and Pregnancy test result (chemical pregnancy) (X^2=14.985at p=.010) (Table 12).

Table (12)*Correlation between Pregnancy test result and BMI*

Variables			Pregnancy test result		X^2	p
			Positive	Negative		
BMI	Under weight	N	4	1	14.985	.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%		

*Significant<0.05

For the correlation between HCG level and BMI the table 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 maternal BMI and HCG level (F =1.865at p=. 108) (Table 13).

Table (13)*Correlation between HCG level and BMI*

Variables	HCG		F	p
	Mean	SD		
Under weight	794.00	802.297	1.865	.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 eggs and BMI the table showed that the lowest implantation rate was associated with obesity grade II with the mean of .21± .579 implanted eggs, the highest implantation rate was associated with normal weight with the mean of 1.00± .866 implanted eggs, there is significant statistical correlation between the maternal BMI and number of implanted eggs (F =3.264at p=. 009) (Table 14).

Table (14)*Correlation between number of implanted eggs and BMI*

Variables	Number of implanted eggs		F	p
	Mean	SD		
Under weight	.80	.837	3.264	.009*
Normal weight	1.00	.866		
Over weight	.92	.874		
Obesity grad I	.38	.660		
Obesity grade II	.21	.579		
Obesity grade III	.25	.500		

*Significant<0.05

For the correlation between clinical pregnancy rate and BMI the table showed that the lowest clinical pregnancy rate was associated with obesity grade I, there is significant statistical correlation between the maternal BMI and clinical pregnancy rate (X^2 =17.873at p=. 003) (Table 15).

Table (15)*Correlation between clinical pregnancy rate and BMI*

Variables			Ultrasound result		X^2	p
			No	Yes		
BMI	Under weight	N	2	3	17.873	.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 to the correlation between maternal BMI and doses of medication for induction,the current study shows that for fostemone the highest dose was received by the obese women grade III with a mean of 300.00± .000 IU, while the lowest doses was received by the underweight with a mean of 225.00± .000 IU.There is a significant statistical correlation between the maternal BMI and doses of Fostemone (F=3.08 at p =.019). For monegone 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 was received by the Underweight with a mean of 100.96± 36.387IU.There is a significant statistical correlation between the maternal BMI and doses of monegone (F=2.409 at p=.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 is a significant statistical correlation between the maternal BMI and doses of Gonal f (F=4.902 at p=.002). There is a significant statistical correlation between the maternal BMI and doses of medication for induction.

Petanovski et al.,(2011) represents the dose of medication for induction by the number of ampoules used, the result of current study is in accordance with the result of this study, which shows 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 significant statistical correlation between the maternal BMI and doses of medication for induction at (p= < 0.0001).A study conducted by (Bailey, Hawkins, Missmer, Correia, & Yanushpolsky, 2014) to investigate age-related variations in the effect of body mass index on in vitro fertilization outcomes, The patients were classified into three groups based on their BMI, i.e., normal weight (n=299), overweight (n=208), and obese (n=146). The patients were also grouped by age: 562 patients were under the age of 35 years and 91 patients were above the age of 35 years. It shows that the doses of medication 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 significant statistical correlation between dose of medication and BMI at (p= 0.298).A study conducted by (Hill, Hong, & Frattarelli, 2011) represents the dose of gonadotropins by ampoules, the mean of ampoules number 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< .01).Sathya,

Balasubramanyam, Gupta, & Verma, (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, Bouzayen, Hamilton, & Young,(2014) reported that the highest mean of dose 4580 ± 2789 IU received by I 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.

Regarding to the correlation between maternal BMI and medications durations for induction the current study shows that, for the fostemone in spite of the longest duration was received by the obesity grade III class with a mean of 11.00± 1.414 day,and the shortest duration was received by the normal weight class with a mean of 8.25± 3.77day , there is no significant statistical correlation between the maternal BMI and duration of fostemone administration (F=.909 at p= .485). For monegone duration it showed that the longest duration was received by the obesity grade II class with a mean of 6.77± 3.345 day, and the shortest duration was received by the underweight class with a mean of 3.50± .707day ,and there is no significant statistical correlation between the maternal BMI and duration of monegone (F=1.107at p= .364). For Gonal f dose it showed that the longest duration was received by the obesity grade II class with a mean of 10.67± .816 day, and the shortest duration was received by the normal weight class with a mean of 8.40± 4.09day ,there is no significant statistical correlation between the maternal BMI and duration of Gonal f (F=1.257 at p= .377).For duration of Leuverse du duration it showed that the longest duration was received by the obesity grade I class with a mean of 4.33± .577 day, and the shortest duration was received by the normal weight class with a mean of 5.00± 0.00day , there is no significant statistical correlation between the maternal BMI and duration of Leuverse du (F=1.020at p=.408).There is no significant statistical correlation between the maternal BMI and duration of medication for induction. For the correlation between duration of ovulation induction and BMI current study shows that the longest duration associated with obesity grade III with a mean of11.00± 1.41 day, and the shortest duration was received by the Under weight class with a mean of 9.20± 1.304day, but there is no significant statistical correlation between the maternal BMI and duration of induction (F=1.122at p=.354)

Petanovski et al.,(2011) reported that there is significant statistical correlation between BMI and duration of controlled ovarian hyper stimulation (COH) at (p= 0.039) as the longest mean of duration 10.7 ± 2.5 days related to women with BMI > 30,while the shortest mean of duration 10.0 ± 1.9days related to underweight group. The current study is in accordance with (Bailey et al., 2014) study that reports there is no significant statistical correlation between the maternal BMI and ovulation induction duration, and total drug doses (p=0.180, and 0.298, respectively).

Orvieto,(2015) reported that in spite of the longest mean of duration 8.6 ± 3.1day related to obese group and the shortest mean of duration 8.5 ± 2.5 day related to normal weight group, but there is no significant statistical correlation between the maternal BMI and ovulation induction duration at (p= 0.977),also for gonadotropin dose (p= 0.546).(RichaSharma,M.D.,FNBE,FRM,MIMA,MRCOG y, 2013) reported that the shortest mean duration of stimulation 10.30±0.67days related to BMI <19.0 group while longest mean duration of stimulation 11.67±1.79days related to BMI 30& above group, doses of gonadotropin represented by ampoules the highest mean dose of stimulation 43.97±14.89ampoules related to BMI 30& above group while lowest mean dose of stimulation 28.20±13.92 ampoules related to BMI <19.0 group, there is significant statistical correlation between BMI ,duration of stimulation and dose of stimulation at (p= 0.037), (p= 0.003)respectively.(Sarais et al., 2016) reported that no statistical differences were reported across BMI groups for duration of stimulation, total doses of gonadotropin required.

Moragianni, Jones, & Ryley, (2012) reported that there is significant statistical correlation between BMI groups, duration of stimulation and total doses of gonadotropin required.(Legge et al., 2014) reported that no statistical differences were reported across BMI groups for duration of stimulation, total doses of gonadotropin required.

For the correlation between number of induction cycle, incidence of ovulation induction side effect and BMI the current study showed that the high cancellation rate associated with obesity grade I, there is significant statistical correlation between the maternal BMI and number of induction cycle (X2=26.386at p=.003) and the highest incidence of side effect associated with obesity grade II, There is no significant statistical correlation between the maternal BMI and side effect of ovulation induction (X^2=7.011at p=. .220).(Orvieto, 2015)reported that there is no significant statistical correlation between BMI and cycle cancellation at (p= 0.732). (Alassiri, Almadany, Ateeq, & Tamim, 2016)reported that there is no significant difference among the four BMI subgroups with regard to cancellation rate (P = 0.10). (RichaSharma,M.D.,FNBE,FRM,MIMA,MRCOG y, 2013)reported that there is significant relation between BMI and cancellation rate (p= 0.027) and no significant relation between BMI and side effect (p= 1.000).

Conclusion: Finally, the results of current study show that, the women's BMI has impact on IVF success rate, as it affects the medication dose, number of embryo transfer, chemical and clinical pregnancy, as well as these

results supported the research question and accepted through the findings of the previous results.

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