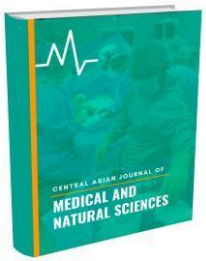

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Article

Association of Obesity with Infertility in Infertile Women in Baghdad

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Abstract: Obesity is becoming a fast growing health problem across the world. It leads to alterations in reproductive functions and menstrual irregularities especially chronic anovulation and infertility. Obesity leads to hyperinsulinemia and consequent ovarian hyperandrogenism. To assess the association of females obesity with infertility and related menstrual abnormality This study was cross- sectional study performed at Kamal Alsamaraee Infertility Treatment and In Vitro Fertilization Hospital in Baghdad. The educational level and the type of infertility showed a significant difference in BMI levels, being illiterate had higher means of BMI compared to those of post graduate education, being of secondary infertility showed higher means of BMI. This study also demonstrated a positive; highly significant correlation of both fasting blood sugar and HOMA-IR levels with BMI of infertile women.

Keywords: Infertility , Obesity, Infertile , BMI.

1. Introduction

Obesity is defined as an abnormal accumulation of body fat, usually 20% or more over an individual's ideal body weight (1). This is often described as a body mass index (BMI) over 30. However, BMI does not account for whether the excess weight is fat or muscle, and is not measure of the body composition (2). For most people, however, BMI is an indicator used worldwide to estimate nutritional status.

Obesity is usually the result of consuming more calories than the body needs and not expending that energy by doing exercise (2). There are genetic causes and hormonal disorders that causes people to gain significant amount of weight but this is rare (3). People in the obese category are much more likely to suffer from fertility problems than people of normal healthy weight (3). A report carried out by the Nurses' Health Study demonstrated risk of anovulation in women with an increasing BMI value (4). Its major effects include a reduction in ovulation rate, a decline in oocyte quality, menstrual irregularities, a decrease pregnancy rate and a rise in miscarriages (4).

Obesity can have particularly damaging effects in young women as they being menstruating earlier than non-obese girls, essentially enhancing the defects associated with obesity and fertility (4). The hormones involved in the reproductive system are negatively affected with an increase of weight. In human, via with adipocytes, production

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of the hormone leptin (an adipokine) acts on the hypothalamus where the reproductive hormone Gonadotropin releasing hormone(GnRH) is produced (5).

Leptin is also a product of obese gene (6) has interaction with them hypothalamus decreases appetite, therefore a mutation in the obese gene would result in an increased appetite, leading to inevitable obesity (7). Leptin has been found to be linked to the HBG axis as it can induce the release of GnRH by the hypothalamus and subsequently follicle stimulating hormone (FSH) and luteinizing hormone (LH) by anterior pituitary gland (5).Pre-pubertal individuals who lack leptin fail to reach the pubertal stage (6) If given leptin administration, the mutation would be reversed and puberty resumed (6). Leptin is further expressed in mature follicles produced by the ovary(5), suggesting it play a role in oocyte maturation, hence embryo development.

Aim and Objectives

prevention of obesity in women in order to produce healthy reproductive life. Objectives

1. To assess the association of females obesity with infertility and related
2. menstrual abnormality.
3. To assess the effect of body fat distribution on reproductive function.
4. To detect the prevalence of insulin resistance among infertile women
5. Identify the difference in BMI and Hormonal profile between primary and
6. secondary infertile women.

2. Materials and Methods

Study Design and Setting:

A cross sectional study was carried out at Kamal Alsamaraee Infertility Treatment and In Vitro Fertilization Hospital /Baghdad/Iraq.

Data Collection Time:

Data collection was done through daily visits and spending about four hours per day from (nine a.m. till one p.m.). The investigator spent nearly fifteen minutes in each interview with the participant. The number of the interviewed participants was nearly 8 to 12 participants/day.

Sampling Technique:

All infertile women aged 18_ 40 years, and those who don't have male factors cause of infertility were included in this study. All of women`s general characteristics were taken by face to face interview using structured questionnaire. Anthropometric measurement were taken by the researcher .Fasting blood sample were collected between 8:00 am and 11:00 am . five milliliter fasting venous blood sample was drawn from the subjects on the day 2 of menstrual cycle using standard venipuncture procedure . Couple that has never conceived despite exposure to the risk of pregnancy for a period of 1 year were defined primary infertility and couples who fail to conceive following a previous pregnancy despite cohabitation and exposure to the risk of pregnancy (in the absence of contraception, 8 breastfeeding or postpartum amenorrhea) for 1 year were defined secondary infertility.

Body mass index (BMI)was evaluated according to World Health Organization (WHO) standard . To calculate BMI the mathematical formula based on persons weight and height, with BMI equal to Weight in kilogram divided by Height in square meter. WHO. Regional office of Europe .body mass index_BMI .

BMI 18.5 _24.9 kg/m2 as normal weight

BMI 25.0_29.9kg/m2 as pre-obesity

BMI 30.0_ 3409 kg/m2 as obesity class I

BMI 35.0_39.9 kg/m2 as obesity class II

BMI above 40 kg/m2 as obesity class

Waist-hip –ratio (WHR) refers to the relationship between the circumference of waist and circumference of hip .WHR is calculated by dividing the waist circumference by the hip circumference. Waist hip ration was measured and classified according to the WHO classification.

Health risk	Women
Low	0.80 or lower
Moderate	0.81–0.85
High	0.86 or higher

Homeostatic model assessment for insulin resistance (HOMA-IR) was computed depending on the following formula (8).

HOMA-IR = [glucose (nmol/L) * insulin (mU/mL)/22.5], using fasting values.

The normal HOMA IR value of healthy human ranges from

< than 1.0; which means an optimal insulin sensitivity

>1.9 early insulin resistance

>2.9 significant insulin resistance.

Fasting blood sugar was changed from mg/dl to nmol/L by dividing it by 18.

As for fasting insulin levels, they were changed from pmol/L to mU/mL by dividing it by 6 (8).

Inclusion Criteria:

a- infertile

b-age between 18 and 40 years.

Exclusion Criteria:

a- male factor infertility

b- those who refuse to participate in our study.

The Questionnaire:

The questionnaire (appendix), which was designed by the research team, includes questions on:

A- Socio-demographic variables (personal characteristics)

1. Age
2. Occupation
3. Duration of infertility
4. Educational level classified as illiterate, primary school , middle school, college ,post graduate .
5. Previous history of abortion, pregnancy, still birth.
6. Menstrual history.
7. Question on co-existing conditions like hyperlipidemia ,thyroid problems and others.

B- Anthropometric measurement of weight ,height ,BMI, waist and hip circumference.

C- Hormonal profile of LH, FSH, TSH, prolactin, AMH.

D- Fasting blood sugar and insulin.

Ethical consideration

1. Approval of Scientific Committee, Department of Community Medicine, supported by approval of College Council; College of Medicine, University of Baghdad.
2. Approval from Kamal Alsamaraee Infertility Treatment and In Vitro Fertilization Hospital /Baghdad/Iraq.
3. Oral consent was taken from all participants in this study.

Limitation

1. Sample size was limited because large number of infertile women refuses participation.
2. Time was not enough to study the problem and measure changes overadequate period.

Data were collected and recorded first in excel files that later extracted in SPSS version 18 were the statistical analysis was performed. The results were presented in tables and figures. According to the type of data; categorical data were presented in frequencies and percentages, while numerical data were presented in means and standard deviations. T test and one-way ANOVA was used to determine the effect of sociodemography on BMI levels. Pearson correlation was used to illustrate the correlation between BMI levels and the hormonal profile together with blood analysis of the studied sample. P value of <0.05 was considered to be statistically significant.

3. Results

Sociodemographic characteristics

The average age of participants was 27.59 ±5.07 years within a range of (18-42) years. Nearly two thirds (64.7%) of the sample were below thirty years of age. One third (34%) of women had middle school education. Less than one quarter (24%) were employed. Majority (82%) lived in urban settings. Table (1) demonstrates the socio-demographic features of the studied sample.

The mean weight of the sample was 78.6±12.9 kilograms in a range from 45 to 130 kilograms, as for the height, the average height reached to 159.09±3.5 centimeters within a range 150-170 centimeters. The average body mass index (BMI) of the sample was 31.06±5.02 Kg/m^2, in a range of 17.15 - 48.93 Kg/m^2.

Ranging from 75 to 200 centimeters, the waist circumference mean was 103.09±15.15 centimeters. As for the hip circumference; the average was 113.30±14.8 centimeters within a range 70-228 centimeters. The average waist hip ratio (WHR) of the sample was 0.90±0.05 within a range (0.74-1.09).

Infertility and obstetric history.

The average years of marriage was 6.71±3.6 years in a range of 2-19 years. Seventeen percent (17.3%) of respondents had been married for 10 years or more. Table (2). Illustrates the infertility and obstetric history. The mean years of infertility was 4.19±9.2 years within a range of 1 to 16 years. More than half (56%) of women had amenorrhea. Half (57.3%) of the studied sample attended Kamal Al Samarai hospital for secondary infertility. More than half (55.3%) had previous history of pregnancy and another half (54.7%) had no previous history of abortion. Only 17 (11.3%) of the studied sample had a previous history of stillbirths.

Table (1): The distribution of the studied sample according to sociodemographic characteristics, (n=150).

Socio-demographic features		Frequency	Percentage
Age (Years)	<20	4	2.7
	20-29	93	62.0
	30-39	51	34.0
	≥40	2	1.3
Education	Illiterate	22	14.7
	Primary school	30	20.0
	Middle school	51	34.0
	high school	24	16.0
	College	19	12.7
	Post graduate	4	2.7
Occupation	Housewife	100	66.7
	Student	14	9.3
	Employed	36	24.0
Residency	Urban	123	82.0
	Rural	27	18.0
Body Mass Index	Underweight	3	2.0
	Normal	13	8.7
	Overweight	38	25.3
	Obese	96	64.0
Waist Hip Ratio	Low	7	4.7
	Moderate	17	11.3
	High	126	84.0
Total		**150**	**100%**

Table (2) : The distribution of the studied sample according to infertility and obstetric characteristics, n=150

Marriage and Infertility characteristics		Frequency	Percentage
Years of Marriage (years)	<5	55	36.7
	5-	69	46.0
	10-	20	13.3
	15-	6	4.0
Menstrual History	Oligo menorrhea	2	1.3
	Cycle 21-35 days	58	38.7
	Amenorrhea	84	56.0
	Others (irregularity)	6	4.0
Years of Infertility	1 year	5	3.3
	2 years	49	32.7
	3-4 years	48	32.0
	5-9 years	37	24.7
	≥10 years	11	7.3
Type of infertility	Primary	64	42.7
	Secondary	86	57.3
Hx of pregnancy	No	67	44.7
	Yes	83	55.3
Hx of abortion	No	82	54.7
	Yes	68	45.3
Hx of stillbirth	No	133	88.7
	Yes	17	11.3
Total		150	100%

Only ten women of the studied sample didn't receive treatment for infertility at the time of the study and the majority 140 (93.3%) of women had a previous infertility treatment. The commonest infertility treatment used were oral treatments 140(100%) followed by injectable 74 (52.9%). Figure (1) shows the distribution of the users according to the type of infertility treatments.

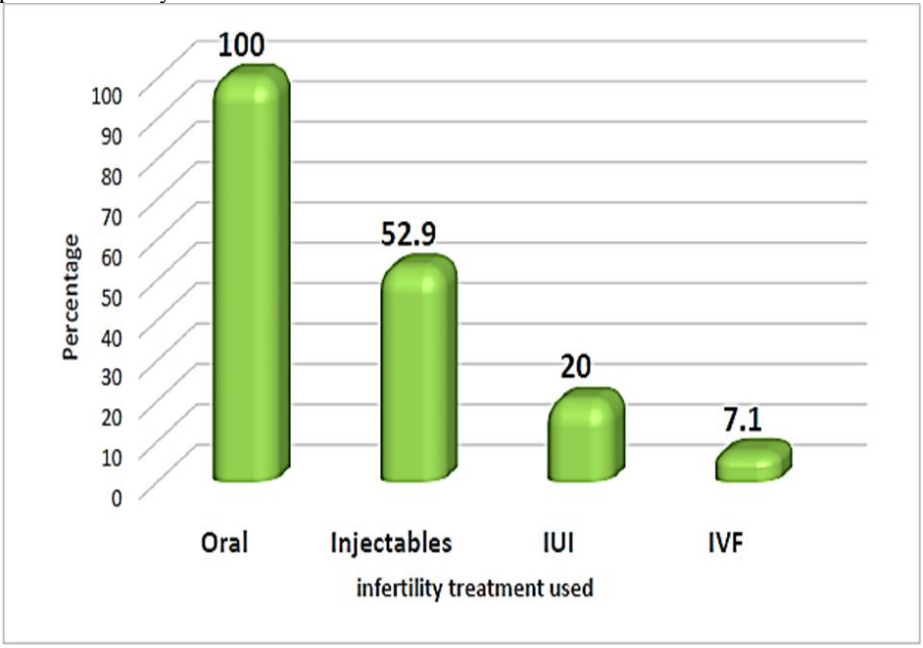

Figure (1). the distribution of the studied sample according to the types of infertility treatment used, (n=140).

Regarding chronic diseases, 52 (34.8%) of the sample reported having a chronic disease. Less than a quarter, 34(22.7 %) of the respondents had hyperlipidemia. Seven (4.7%) of women had thyroid disease and another seven (4.7%) had been diagnosed with diabetic mellitus, while four (2.7%) had other chronic illnesses.

Hormonal profile and blood analysis

Regarding hormonal investigation, table (3) demonstrates the mean and standard deviation of each hormonal and blood test.

Table (3). Distribution of the sample according to the investigation, (n=150)

Test	Mean	SD
LH (IU/L)	7.04	4.22
FSH(IU/L)	4.57	4.40
TSH (IU/L)	2.43	0.96
Prolactin (IU/L)	27.56	17.61
LH / FSH ratio	1.88	1.76
AMH (IU/L)	4.86	3.06
FBS (nmol/L)	4.83	4.2
Fasting Insulin (mU/mL)	5.62	1.7
HOMA-IR	1.11	0.4

Regarding the presence of significance difference in means of BMI with sociodemographic characteristics of the sample; as seen in table (4), the current study showed that only the educational level and the type of infertility showed a significant difference in BMI levels.

Education displayed a significant difference in mean with BMI level, being illiterate had higher means of BMI compared to those of post graduate education (P value = 0.007).

Type of infertility had a significant effect on BMI, being of secondary infertility showed higher means of BMI (P value 0.012).

While the age, occupation, residency, menstrual cycle patterns, years of marriage, years of infertility, receiving previous treatment for infertility, having previous history of pregnancy, abortions or still births showed no significant difference on BMI levels of the studied sample.

Table (4): The distribution of the studied sample's BMI levels according to sociodemographic characteristics, (n=150)

		Mean ± SD	Tests	P value
Age	<20	31.4±3.8	F=0.261	0.853
	20-29	30.8±5.33		
	30-39	31.4±4.59		
	40 and above	29.0±4.2		
Occupation	Housewife	31.5±5.0	F=2.797	0.064
	Student	31.9±4.5		
	Employed	29.3±4.8		
Education	Illiterate	32.5±4.0	F=3.371	0.007
	Primary school	32.7±5.6		
	Middle school	30.3±5.0		
	high school	30.9±3.7		
	College	30.2± 4.8		
	Post graduate	23.6±5.1		
Residency	Urban	30.7±4.9	T=-1.696	0.098
	Rural	32.5±5.1		
Years of Marriage	<5	29.9±5.0	F=1.756	0.158
	5-	31.3±4.7		
	10-	32.4±5.8		
	15-	32.6±3.8		
Years of infertility	1 year	28.9±3.3	F=0.888	0.473
	2	31.1±5.4		
	3-4	30.3±4.5		
	5-	32.0±5.3		
	10 and above	31.7±4.17		
Type of infertility	Primary	29.8±5.5	T=-2.449	0.016
	Secondary	31.9±4.4		
History of Abortion	No	30.3±5.2	T=-1.855	0.068
	Yes	31.8±4.6		
History of pregnancy	No	30.1±5.5	T=-1.907	0.059
	Yes	31.7±4.4		
History of stillbirths	No	30.8±5.2	T=-1.865	0.071
	Yes	32.3±2.7		
Received previous treatment for infertility	No	29.4±5.4	T=-0.990	0.345
	Yes	31.1±4.9		
Menstrual Cycle	Oligo menorrhea	33.4±0.5	F=1.318	0.271
	cycle21-35 days	30.2±5.2		
	Amenorrhea	31.4±4.9		
	others	33.5±2.2		

Regarding the correlation of BMI with the hormonal profile and blood analysis of the studied sample; as seen in table (5). Thyroid stimulating hormone (TSH) should a positive correlation (r=0.171; p value =0.036).

Prolactin level showed also a negative significant correlation with BMI (r = - 0.220; P value = 0.007), higher prolactin levels are seen with lower BMI levels. Fasting insulin levels showed a positive significant correlation with BMI level (r= 0.191; p value= 0.019).

The current study also demonstrated a positive; highly significant correlation of both fasting blood sugar (r=0.395; P value = 0.000) and HOMA-IR levels (r=0.315; P value= 0.000) with BMI of infertile women. While neither LH nor FSH or LH/FSH ratio or AMH showed any correlation with BMI levels.

Table (5) : Correlation among BMI and hormonal and blood analysis levels for infertile women

	Pearson Correlation	P Value
BMI		
LH	0.048	0.558
FSH	-0.034	0.680
TSH	0.171	0.036
Prolactin	-0.220	0.007
LH/FSH ratio	0.122	0.138
AMH	0.039	0.632
Fasting insulin (mU/mL	0.191	0.019
FBS (nmol/mL)	0.395	0.000
HOMA-IR	0.315	0.000

No significant correlation was reported between hormonal profile and blood analysis of participants with waist hip ratio (WHR). As seen in table (6).

Table (6) : Correlation among WHR and hormonal and blood analysis levels for infertile women, (n=150).

	Pearson Correlation	P Value
WHR		
LH (IU/L)	0.007	0.931
FSH (IU/L)	0.011	0.898
TSH (IU/L)	0.006	0.937
Prolactin (IU/L)	0.093	0.255
LH/FSH ratio	-0.023	0.781
AMH (IU/L)	-0.071	0.385
Fasting insulin (mU/mL	0.045	0.581
FBS (nmol/mL)	0.052	0.530
HOMA-IR	0.059	0.473

Majority of the studied sample (138; 92%) had normal HOMA IR range. Only 12 (8%) of the infertile women showed insulin resistance. Figure (2) illustrate the distribution of the sample according to insulin resistance status. Seven women (4.7%) had a HOMA range of 1.9- 2.89, i.e. had an early insulin resistance, while the remaining five (3.3%) showed a HOMA-IR range above 2.90, i.e. had a significant insulin resistance.

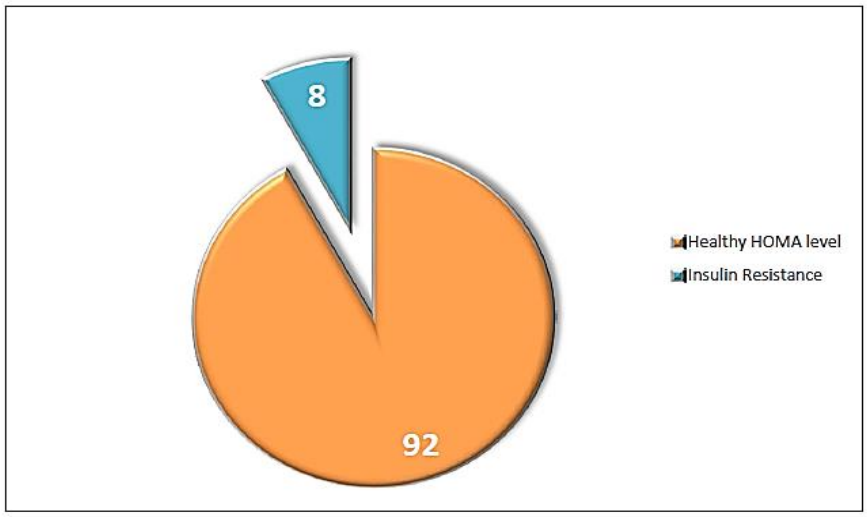

Figure (2) The prevalence of insulin resistance among infertile women, n=150.

There was a significant difference in BMI levels (t=-2.449; P value = 0.016) between women of primary and secondary infertility, BMI levels were higher among those with secondary infertility. While Waist Hip Ratio (WHR) showed no significant difference at all.

The significant differences which seen between infertile women with primary and secondary infertility groups regarding hormonal and blood investigations were the level of LH (t= -2.543; P value=0.012), LH/FSH ratio (t=-2.236, P value= 0.027) and the fasting blood sugar (t=-2.019; P value 0.045). women with secondary infertility had higher means for LH and fasting blood sugar than those of primary infertility. Table (7), illustrate the comparison between primary and secondary infertility groups.

Table (7): Comparison of Obesity indicators and Hormone Profile of Women with Primary and Secondary Infertility

Features	Primary infertility N=64	Secondary infertility N=86	T Test	P value
Obesity Indicators				
BMI	29.88±5.5	31.94±4.4	t=-2.449	0.016
WHR	0.90±0.05	0.90±0.05	t=0.129	0.898
Hormonal and Blood Analysis investigations				
LH	6.03±4.3	7.80±4.0	t=-2.543	0.012
FSH	4.55±2.7	4.59±1.9	t=-0.100	0.921
TSH	2.39±0.9	2.46±0.9	t=-0.459	0.647
Prolactin	28.55±20.0	26.82±15.6	t=0.571	0.569
LH/FSH ratio	1.54±1.1	2.14±2.0	t=-2.236	0.027
AMH	4.58±2.23	5.07±2.9	t=-0.955	0.342
Fasting Insulin (mU/L)	4.33±1.61	5.20±5.40	t=-1.406	0.163
FBS (nmol/mL)	5.32±1.16	5.85±2.04	t=-2.019	0.045
HOMA-IR	1.06±0.30	1.15±0.47	t=-1.397	0.165

4. Discussion

Regarding the presence of significance difference in means of BMI with sociodemographic characteristics of the sample; the current study showed that only the educational level and the type of infertility showed a significant difference in BMI levels. Educational level displayed a significant difference in mean with BMI level, being illiterate had higher means of BMI compared to those of post graduate education, this goes with what found in Jordan by Al Nsour M et al (9) that about 30.8% of the high educated was obese in comparison to 51.6% of the Primary or less, this relation is in contradiction with what found in previous study in Iraq by Al-Tawil NG et al (10) , that there was no significant association between education and BMI. This may be related to different study sample as the later study done among general population not the infertile women, highly educated female tend to decrease weight in order to obtain good result in ovulation induction.

Type of infertility had a significant effect on BMI, being of secondary infertility showed higher means of BMI than the 1ry , Gaskins AJ et al 2015 found that the change in body weight after age 18 affected women ability to get pregnancy. For every 5-kilogram increase in the body weight after age 18, the women had 5% longer to get pregnancy; women who were underweight (with a BMI under 18.5) also experienced a 25% longer time to pregnancy than those whose weight was in the normal range (11). Usually, those with secondary infertility had increased weight due to previous pregnancies and lactation, and increased age. In Iraq there is a believe that pregnant and lactating women should eat more and this proved by Al-Tawil NG and et al. (10).

Overweight or obesity, definitely affect the ovarian function and increase the risk of women infertility, and they are significantly associated with decreased pregnancy rates, increased requirements for gonadotrophins and higher miscarriage events. High BMI is also associated with adverse pregnancy outcomes such as gestational diabetes, hypertension and premature labor (12).

The age, occupation, residency, menstrual cycle patterns, years of marriage, years of infertility, receiving previous treatment for infertility, having previous history of pregnancy, abortions or still births showed no significant difference on BMI levels of the studied sample. This mostly due to small sample size and similarity of most of our subjects in these aspects.

The correlation of BMI with the hormonal profile and blood analysis of the studied sample show a significant weak positive correlation with TSH. This goes with previous studies; Bastemir M. et al (2007) found a significant positive correlation between serum TSH and body weight BMI ($r = 0.270$) (12) In another study, morbidly obese women (BMI > 40 kg/m2) had higher TSH levels than others with moderate obesity (BMI < 40 kg/m2), and TSH values were positively correlated to BMI in euthyroid subjects (13) . Michalaki M. A et al also found the positive relation between morbidly obese subjects levels of TSH (14).

This due to increase deiodinase activity leading to high conversion of T4 to T3 and ,or compensatory increase in secretion of TSH in an attempt to overcome decrease tissue responsive to thyroid hormone which result from adipocytes activity (38). Prolactin level showed a negative significant correlation with BMI, this finding was incontrast of the findings in previous studies; Santos-Silva . et al found no correlation between serum PRL levels and BMI (15), and Pereira-Lima et al 65.2% of the hyperprolactinemia were overweight or obese (16).

Fasting insulin (FI) levels showed a positive significant correlation with BMI level. this goes with Panag KM et al (17) Positive correlation was found between FI and weight, BMI as well as with body fatness.

This may explained by that obese patients had a lower tissue response to insulin than lean individuals(18). This suggests that obesity promotes the development of IR. Obese patients have decreased glucose-oxidation and increased lipid oxidation compared with lean individuals. There are hyperinsulinemic, but insulin sensitivity improves with weight

loss in obese patients. Obesity has been strongly associated with IR in normoglycemic patients and in individuals with Type 2 diabetes (19).

The current study demonstrated a positive; highly significant correlation of both fasting blood sugar and HOMA-IR levels with BMI of infertile women. This goes with previous studies done by Agrawal N (2017) (20), Lee KS et al (21), and Costa GB et al (22).

Positive significant correlation of HOMA-IR levels (r=0.315) with BMI, this goes with Chung JO, et al 2012 in Korea that found a higher BMI was associated with higher HOMA-IR (r=0.5) (23).This may be explained by what reported previously by Chang et al. that BMI was the most important determinant of insulin resistance (24).

As insulin resistance increases, β-cells compensate by increasing insulin secretion, resulting in compensatory hyperinsulinemia and the maintenance of normal glucose tolerance (25, 26).

In this study neither LH nor FSH or LH/FSH ratio or AMH showed any correlation with BMI levels. The non-significant correlation of the LH, FSH, LH/FSH ratio or AMH, levels may be related to the fact that hormones are the end result of infertility(27), and all the study sample were infertile women and 89.3% of them were overweight or obese.

No significant correlation was reported between hormonal profile and blood analysis of participants with waist hip ratio (WHR). This in concomitant with Kayatas S et al who found no relation between waist/hip ratio and the fertility, body fat mass proved to have a stronger association with fecundity than the percentage of body fat, body mass index, or the waist/hip ratio (28).

These finding was opposite to what reported previously by Evans ,et al that waist to hips girth ratio (WHR), associated with Increasing androgenicity , as reflected by a decrease in plasma sex hormone-binding globulin capacity and an increase in the percentage of free testosterone, this relationship being independent of and additive to that of obesity level; and increasing plasma glucose and insulin levels, and diminished in vivo insulin sensitivity, as revealed by increasing steady state plasma glucose levels at comparable plasma insulin levels, attained by the infusion of somatostatin, insulin, and glucose, (29) and Zaadstra et al (30) reported that an increasing waist-to-hip ratio is negatively associated with the probability of conception and concluded that the body fat distribution in women of reproductive age has greater impact on fertility than age or obesity.

The amount of body fat, particularly the android kind of fat distribution, is an indicator of the hormonal situation and the reproductive status of women with PCOS or anovulation. In the present study, not all participants are PCOS and an ovulatory patient; therefore, our results were not affected by the fat distribution. The waist-to-hip ratio describes body shape and not the quantitative amount of body fat (30).

Prevalence of insulin resistance among infertile women was 12 (8%), this was lower than what previously in Iraq by Ansam A. Al-Bayatti (31) that 76.5 % of patient with PCOS had insulin resistance (IR), in Jordan 2017 by Al-Jefout M et al (32) IR was observed in 133 (83.6%) women with PCOS and in 25 (46.3%). In Vietnam the overall prevalence of IRS in women with PCOS was 27.0% (33).The cause of this change in prevalence may be due to change in life style and modernization in some instance.

There was a significant difference in BMI levels between women of primary and secondary infertility; BMI levels were higher among those with secondary infertility. While Waist to Hip Ratio (WHR) showed no significant difference at all. No significant differences were seen between infertile women with primary and secondary infertility groups regarding all hormonal and blood investigations except for the level of LH and the fasting blood sugar. Women with secondary infertility had higher means for LH and fasting blood sugar than those of primary infertility.

LH level for 2ndry (7.80±4.0) was higher than among 1ry infertility (6.03±4.3),this level was near from what found by Rafique M, and Nuzhat A (34) (8.1±11.03) among infertile women in Saudia Arabia, AL-Shalah and Al Hilli (35) in Iraq (9.1±4.3). Al-Fahham

et al found that the prevalence of abnormal LH level among Iraqi infertile women was (20.46 %) (36), Al-Hilali B M et al (37) reported the mean LH among infertile women was 4.7±1.9, and Olooto W. E et al in Nigeria (38) (3.16 ± 1.49) which lower than what found in this study

Pergola et al (39), also determined the effect of obesity on gonadotropin, estradiol, and inhibin B levels in infertile women and established significant relation statistically to lower FSH, LH, inhibin B, and estradiol levels in the early follicular phase of overweight and obese infertile women , and anticipated it to be due to direct inhibitory effect of BMI on gonadotropin and estradiol production(40).

LH/FSH ratio was significantly higher among those with 2ndry infertility (2.14±2.0) than those with 1ry infertility (1.54±1.1). This may be due to the high (LH) concentration which is an indicator of imbalance secretion process; the higher hormone concentration meant to higher incidence rate of infertile women. Poly Cystic Ovarian Syndrome (PCOS) disease may cause high levels of LH hormone in infertile woman where the results appear in a number of studies that there was decreased and increased secretions ratio of FSH hormone. The LH/FSH ratio in infertile women having PCOS may reach (2:1) which made the ovary unable to produce the hormones in the right way (41, 42) Also, Rita, V. W., and Ruth (42) pointed that high LH hormone concentration indicates the occurrence of dysfunction in the pituitary gland (43).

Fasting blood sugar was significantly higher among those with 2ndry infertility (5.85±2.04) than those with 1ry infertility (5.32±1.16). Patient with secondary infertility tend to be overweight /obese due to previous pregnancies and lactation, and increased age, which may be due to the believe that pregnant and lactating women should eat more which is a traditional and cultural believes(10).

5. Conclusion

As expressed by this research, most of the studied sample are obese, and there is significant relation between obesity and infertility. In general, there is no effect of body fat distribution on fertility, thus, waist-hip ratio has no significance in measurement of the impact of obesity on fertility. From this study we conclude that insulin resistance is a hidden consequence of obesity even though small portion of the sample show real resistant while the insulin level of most of patient was very high that's mean these patient in their way to become insulin resistance patients. Briefly, we found that hormonal change more advanced in secondary infertile women that's go with change of PCOS of high luteinizing hormone and fasting blood sugar level than primary infertile women

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