The Impact of Obesity on Some Reproductive Hormones in Infertile Men

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Abstract:

Background:

Obesity, defined by the World Health Organization (WHO) as “abnormal or excessive fat accumulation that may impair health .The effects of obesity on male reproduction have been less well studied than those on female reproduction, but there is a growing body of evidence suggesting that obesity has an adverse effect on male reproduction However, a little is known about the effect of obesity on male reproductive system and infertility. Infertility is defined as inability to achieve conception within one year. It has not yet been clearly established how excess adiposity relates to the biological changes that underlie male infertility, although there are several theories worth exploring. The endocrine abnormalities associated with obesity in women are well known with an increase in androgen metabolism and changing in reproductive hormones in over weight and obese men.

Objective:

The study aim at assessing the role of obesity in infertile males through measurement of BMI, some of sex hormones.

Methods:

This study was carried out in Tikrit Teaching Hospital, on the adult male population aged 17-45 years, from September 2013 to April 2014. The recruited cases divided into 90 infertile obese male and 30 normal weights infertile as pathological control group and 30 normal weight fertile men as normal control group.The serum samples willed collect of the patients and measure the concentrations of the sex hormones (FSH, LH, INHB) by using ELISA technique. Body Mass Index Calculation Height (m) and weight (kg).

Results:

There was no significant correlation between BMI (30.1±93.45, 21.40±5.24,23.24±1.42)kg/m^2 in patients group, pathological control group and control group and serum LH level (22.35±12.79, 19.31±9.94, 13.90±8.33) ml U/ml in all three group respectively. There was a significant negative correlation (P< 0.03) between BMI (23.24±1.42)kg/m^2 and serum FSH level (7.10±3.77) ml U/ml, in control group. While there was no significant correlation between BMI (30.19±3.45,21.40 ±5.24) kg/m^2 and serum FSH level (13.59±15.72, 11.58±14.06) ml U/ml in both patients' group and pathological control group respectively.There was no significant correlation between BMI (30.19±3.45,

21.40±5.24,23.2±1.42) kg/m^{2}and serum INHB level in the patients group, pathological control group and control group (88.8±57.96, 108.51±78.39, 141.65±63.95) pg/ml respectively**.**

Conclusions:

The BMI did not correlated with some reproductive hormones (LH, FSH,INHB) in obese infertile males, but there was a significant correlation between the FSH and BMI in control group. In infertile obese group found the highest level of LH, FSH, and the lowest level of INHB comparing with other group in this study.

Keywords:

Obesity,Reproductive Hormones, Infertile Men

Introduction

Obesity, defined by the World Health Organization (WHO) as "abnormal or excessive fat accumulation that may impair health, "One most common tools of weight measurement used by both the WHO and researchers alike is Body Mass Index (BMI). Specifically, weight in kilograms divided by his height squared in meters The WHO has set forth standards to classify individuals as underweight, normal, overweight or obese. In particular, a BMI of 18.5-24.99 kg/m^2 is classified as normal, 25-29.99 kg/m^2 as overweight, 30-34.99 kg/m^2 as class I obesity, 35-39.99 kg/m^2 as severely obese, and a BMI greater than 40 kg/m2 as morbidly obese[(1)(2)(3)]. The incidence of obesity as a risk factor for normal life is increasing worldwide. Its impact on hypertension, cardiovascular diseases, osteoporosis, insulin resistance and diabetes mellitus, is well recognized[(4)].

The effects of obesity on male reproduction have been less well studied than those on female reproduction, but there is a growing body of evidence suggesting that obesity has an adverse effect on male reproduction However, a little is known about the effect of obesity on male reproductive system and infertility. Male infertility is defined as the failure to conceive after 12 months of regular unprotected intercourse [(5)]. Male related factors play a role in approximately half of cases of infertility[(6) (7)]. In past, women were commonly considered to be the major cause of couples' infertility, because the influence of male infertility disturbances on couples fecundity was not adequately addressed [(8)]. Evidence suggests that human semen quality may have been deteriorating in recent years. Measures of male infertility are needed to monitor the biological capacity for males to reproduce over time or between different populations [(9)].

It has not yet been clearly established how excess adiposity relates to the biological changes that underlie male infertility, although there are several theories worth exploring [(10)].

The endocrine abnormalities associated with obesity in women are well known with an increase in androgen metabolism and changing in reproductive hormones in over weight and obese men[(11)(12)].

Lack of such study in Asian countries and particularly in Iraqi population who are more prone to obesity necessitates picking up this research to achieve robust findings in this regard.

Materials And Methods

This study was carried out in Tikrit Teaching Hospital, on 150 adult male subjects aged 17-45 years, from September 2013 to April 2014.
In this study the subjects classify into three equal groups as showing below:

1-Patients group(n=90): this includes ninety persons who were obese according to their BMI and infertile at the same time. All patients were married for at least two years and had no children.

2-Pathological control group or cross-sectional group(n=30): which including thirty person who were normal weight according to their BMI and infertile at the same time. All pathological control group were married for at least two years and had no children.

3-Normal control group(n=30): which including thirty persons who were normal weight according to their BMI and fertile at the same time. All Normal control group were married and had children. Exclusion criteria were Venereal diseases, mumps, D.M, orchitis, alcohol consumption, DXT, genital tract infections, associatedvaricocele, chronic medical illness (cerebrovascular, hypertension, hereditary hyperlipidemia, and thromboembolic events), drugs that induce infertility (β-Blocker, cimetidine, nitrofurantoin, etc.) cryptorchidism, trauma and tumors.

For each subjects (patients &controls) the BMI was calculated through record their weight and height for each subjects by using the following formula [13];

Body mass index (BMI) = Weight per kilogram / Hieght^{2}according to BMI the subjects were classify as following [13];
1-Persons their BMI between 18.5-24.9 kg/m^2 consider normal weight.
2- Persons their BMI between 25 -29.9 kg/m^2 consider over weight.
3- Persons their BMI >30 kg/m^2 consider obese.

Blood samples were obtained from the patients and control. All men were invited to a quiet room. Sterile disposable syringes (G21 needle) and plain plastic tubes. Blood samples of 4 ml were taken by an antecubital vein puncture. The blood sample obtained from each man was transferred into plain tube for separation of serum. Then blood in the plain tubes was allowed to clot at room temperature (25 ˚C) for 1 hour .After that centrifugation was done at (3000) rpm for 5 minutes to separate the serum.The sera were stored at -20˚C until the assay was done [14]. Thawing of the samples was allowed to take place at 40˚C before conducting the assay. All the assay tubes were arranged and labeled in the assay racks.

Results:

Body Mass Index(BMI) and Age:

Table (1) shows the distribution of patients, pathological control, and the control groups according to BMI, and Age (Mean, and SD).

Table (1):Mean value and SD of BMI &Age in three groups.

parameters	Patients group n=90		pathological control group n=30		control group n=30	
	Mean	S.D	Mean	S.D	Mean	S.D
BMI kg/m2	30.19	3.45	21.40	5.24	23.24	1.42
Age	31.09	7.04	26.89	4.68	32.22	7.57

Luteinizing, Follicular stimulating, and Inhibin B hormones:

Table (2) shows the Mean ±SD of serum LH, FSH, and INHB hormones level expressed of patients group, pathological control group, and normal control group

Table (2):Mean value and SD of serum LH, FSH, and INHB hormones level in three groups.

parameters	Patients group n=90		Pathological Control group n=30		Control group n=30	
	Mean	S.D	Mean	S.D	Mean	S.D
S.LH	22.35	12.79	19.31	9.94	13.90	8.33
S.FSH	13.59	15.72	11.58	14.06	7.10	3.77
INHB	88.80	57.96	108.5	78.39	141.65	63.95

Serum LH:

There was no significant correlation between BMI (30.1±93.45,21.40±5.24,23.24±1.42) kg/m^2 in patients group, pathological control group and control group and serum LH level (22.35±12.79, 19.31±9.94, 13.90±8.33) ml U/ml in all three group respectively in table (3).

Table(3):Biostatistical Calculation and Correlation for Serum LH Level (ml U/ml) withBMI kg/m^2.

Groups / Biost calculation	Patients Group n=90		Pathological Control Group n=30		Normal Control Group n=30	
	Mean	S.D	Mean	S.D	Mean	S.D
LH	22.35	12.79	19.31	9.94	13.90	8.33
BMI kg/m^2	30.19	3.45	21.40	5.24	23.24	1.42
Correlation	NS		NS		NS	

Serum FSH:

Table (4) shows the mean ±SD of BMI kg/m^2 and serum FSH level expressed as ml U/ml of patients group, pathological control group, and normal control group.

There was a significant negative correlation (P< -0.03) between BMI (23.24±1.42)kg/m^2 and serum FSH level (7.10±3.77) ml U/ml, in control group. While there was no significant correlation between BMI (30.19±3.45,21.40 ±5.24) kg/m^2 and serum FSH level (13.59±15.72,11.58±14.06) ml U/ml in both patients' group and pathological control group respectively.

Table (4)Biostatistical Calculation and Correlationfor Serum FSH Level (ml U/ml) withBMI kg/m^2 .

Group / Biost calculation	Patients Group n=90		Pathological Control Group n=30		Normal Control Group n=30	
	Mean	S.D	Mean	S.D	Mean	S.D
FSH	13.59	15.72	11.58	14.06	7.10	3.77
BMI kg/m2	30.19	3.45	21.40	5.24	23.24	1.42
Correlation	NS		NS		Significant	

Serum INHB

Table (5) shows the mean ±SD of BMI kg/m^2 and serum INHB level expressed as pg/ml of patients group, pathological control group, and normal control group.There was no significant correlation between BMI (30.19±3.45, 21.40±5.24, 23.24 ±1.42) kg/m^2 and serum INHB level in the patients group, pathological control group and control group (88.80±57.96,108.51±78.39,141.65±63.95) pg/ml respectively.

Table (5) Biostatistical Calculation and Correlation for Serum INHB Level

Group / Biost. calculation	Patients Group n=90		Pathological Control Group n=30		Normal Control Group n=30	
	Mean	S.D	Mean	S.D	Mean	S.D
SHBG	88.80	57.96	108.51	78.39	141.65	63.95
BMI kg/m2	30.19	3.45	21.40	5.24	23.24	1.42
Correlation	NS		NS		NS	

Discussion:

Regarding the relationship between male obesity and infertility it has not yet been clearly established how excess adiposity relates to the biological changes

that underlie male infertility [15]. Obesity is a known risk factor for female infertility; however, the relation between obesity and male infertility was not documented until recently [11].This study evaluated the association of BMI and multiple markers of male reproductive potential in a group of men. It has been found that overweight and obesity were associated with abnormalities in standard semen analysis.

Effect of BMI on levels of the Serum hormones:

Effect of BMI on levels of LH:

The present study showed no significant effect of BMI on levels of the LH, This result is in agreement with Qin *et al* [16], who evaluated 990 men in China comparison of mean hormone levels between men of four BMI categories. They found that BMI had no significant correlation with serum LH .The present study also agrees with the previous study [17-20], who explained that there was no correlation existed between BMI and LH, and suggested that there was a hypothalamic–pituitary dysfunction.

On the other hand, the result of the present study disagrees with the Allen *et al* [21] who evaluated 696 men in the UK recruited from the general population for a study investigating the effect of lifestyle and nutrition, particularly vegetarianism and veganism, on male hormones. They found significant negative association between BMI and LH.The differences between the result of Allen *et al* [21] the participants recruited from general population without exclusions and the sample size was greater whilst the sample size of this study was smaller because of exclusion of the obese fertile male and alcohol drinkers and other criteria applied on the selection of the samples. Furthermore this study disagree with that of Giagulli *et al*[22], who evaluated 110 men recruited as volunteers in Belgium and comparison of mean hormone levels between men of three BMI categories. In severely obese men, LH and free T are decreased as well, resulting in hypo gonadotrophic hypogonadism.

The differences between the result of Giagulli *et al*[22] and the result of the present study is that they studied LH levels as well as LH pulsatility that is mean they drawn more than one blood samples of each subjects and measured the hormones level and pulsatility.

Effect of BMI on levels of FSH, INHB:

The present study shows negative significant correlation between BMI and levels of the FSH in the normal control group. whilst the BMI has no effect on the FSH level in both the pathological control group and patients group, This result is in agreement with previous study [17] [19] [20], who suggested that there was a hypothalamic–pituitary dysfunction. Furthermore, this study agrees with Andersson *et al*[23] who evaluated 178 men recruited in Denmark, where 100 were proven fertile men and 78 were idiopathic oligozoospermic men, and no relationships were found between BMI and FSH. On the other hand, the results of the present study disagrees with Qin *et al* [16], who evaluated 990 men in China comparison of mean hormone levels between men of four BMI categories. They found that BMI had significant positive correlation with serum FSH. No P-values or confidence intervals published, therefore statistical significance of these trends not reported. The present study shows no significant effect of BMI on levels of the INHB, This result is in agreement with Andersson *et al*[23].The differences between the result of Andersson *et al*[23] and this study beside to

the size of sample, the subject of this study was infertile whilst in the Andersson *et al*[23] was proven fertile male. On the other hand the results of the present study disagree with the Aggerholm *et al*[17], who found that the relationship between the BMI and INHB was inverse. The relationship between the BMI and the sexual hormones still not settled in scientific circles so, the difference between the results in studies was found but most studies did not find any significant relationship between BMI and the gonadotrophins.

Conclusions:

The BMI did not correlated with some reproductive hormones (LH, FSH,INHB) in obese infertile males, but there was a significant correlation between the FSH and BMI in control group. In infertile obese group found the highest level of LH, FSH, and the lowest level of INHB comparing with other group in this study.

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Author contribution:

Dr. Mahdi made the drafting of the article and revising it critically for important intellectual content. Dr.Ruwaidah was responsible for the design and acquisition of data. diagnosis, analysis and interpretation of results and statistical analysis,while Dr.Mutaz was responsible for samples and patients selections with record the weight of patients.

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