



## Effect of Body Mass Index on sperm and semen parameters for infertile Patients

Samah A.AL-Ubaidy<sup>1</sup>      Muhsen K.AL-Murshedy<sup>2</sup>      Saheb Y. AL-Murshedy<sup>3</sup>  
University of Kufa / College of sciences ( 1,2)

University of Kufa / College of Medicine (3)

Correspondence should be sent to: [samah.alobaidi@uokufa.edu.iq](mailto:samah.alobaidi@uokufa.edu.iq)

### Abstract

Out of 130 specimens of seminal fluid were collected from patients suffering of infertility , after abstinence of 3-5 a period of days from Fertility Center Laboratories \ Al – Saader Medical City at Al-Najaf Province ,the study continuouse from 1\7\2011 to 1\9\2011. The aims of this study at clarifying the role of the body weight on infertility patients suffering from Normospermia , Asthenospermia ,Oligospermia ,Azoospermia ,and Teratospermia ,by calculated the Body Mass Index (BMI) for each patients as  $\text{kg} \backslash \text{m}^2$  which classify to normal weight and over weight .

The results of this study revealed an increased of percentage Oligospermia percent with BMI of patients in comparison to that of other infertility types , as well as ,it showed clear effect of increase BMI to Normospermia and Asthenospermia patients which it significant decrease ( $P < 0.05$ ) of sperm motility, morphology and concentration of sperm compared between normal and over weight. The study results had revealed significant decrease ( $P < 0.05$ ) of sperm concentration , liquificative time of semen, motility and normal sperm morphology of Oligospermia suffering for increase BMI (over weight). In Azoospermia and Teratospermia patients, the results of sperm and semen parameters revealed a non significant ( $P > 0.05$ ) correlation ships between normal and over weight.

It can be concluded that BMI correlated with reproductive physiology through increase of infertility men percent , when infertile men with high BMI typically are found to have an abnormal semen analysis represented by decrease in sperm concentration, decrease in sperm motility percent , as well as, increase of abnormal forms of spermatozoa.

### Introduction

Infertility is the failure of a couple to conceive even after one year of unprotected intercourse ,which causes by many complex and variable from region to region depending on a number of bio – social factors [1]. A person s weight can have a profound impact on fertility , men who are either under or over their ideal weight have a higher risk of experiencing infertility [2]. The Body Mass Index (BMI) is the routine measure used to assess whether a person is under or over their ideal weight . When the BMI is less than or greater than the desired value it may lead to fertility problems in males and can disrupt the hormonal balance which is necessary for normal sperm production [3].

An individual can be defined as being overweight, if their BMI is  $25\text{--}30 \text{ kg} \backslash \text{m}^2$ , and obese if their BMI exceeds  $30 \text{ kg} \backslash \text{m}^2$ . However, the distribution of body fat specifically in the central abdominal region has also been used to diagnose a patient as obese and currently waist circumference is believed to be a more accurate marker of obesity, these definitions should only be considered as guidelines, as the risk of

developing chronic diseases increases progressively when the BMI increases above 21 kg/m<sup>2</sup> [4] .

A combination of an increasingly sedentary lifestyle and unfavorable diet in the western world has resulted in increasing numbers of overweight and obese children and adults [5]. According to the WHO, approximately 1.6 billion adults were classed as being overweight and 400 million adults were obese in 2005, statisticians have predicted that, by 2015, approximately 2.3 billion adults will be overweight and 700 million will be obese[6], also gaining attention is the reported decline in semen quality and male reproductive potential over the past 50 years according to [7], the quality of semen has substantially declined, with the consequent negative effect of poor semen quality on male fertility conceivably contributing to an overall decrease in male reproductive potential. These decline in fertility has occurred in parallel with increasing rates of BMI, the possibility that obesity is a cause of male infertility and reduced fecundity should be addressed[8].

The objective of our study was to determine the effects of body mass index on sperm and semen parameters (sperm quantity and quality) in the infertile patients.

## Materials and methods:

This study included the examination of 130 samples of seminal fluid for infertile patients after a period of abstinence of 3 – 5 days . The samples were collected in Fertility Center Laboratories / AL-Saader Medical City at AL-Najaf province, study continued from period 1/7/2011 to 1/9/2011.

**1:Physical examination:** All physical methods were performed by physician method. Body weight and height were measured in kilograms using the same weighing Scale .Height was measured in meters and BMI was calculated as weight in kilograms divided by squared height in meters. Then the BMI classified according to[9] to be in normal or overweight where BMI: underweight,  $\leq 18.5 \text{ kg/m}^2$ ; normal-weight,  $18.5\text{--}24.9 \text{ kg/m}^2$ ; overweight,  $25\text{--}29.9 \text{ kg/m}^2$ ; obese,  $\geq 30 \text{ kg/m}^2$ .

**2:Seminal fluid collection:** Human semen was collected by masturbation into a sterile, dry, disposable plastic Petri dish in a private room near the laboratory .after a 3 – 5 days. Immediately, the semen samples were placed in an incubator at 37°C for 25-30min. for liquefaction

**2:1:Seminal fluid analysis :** After semen liquefaction, macroscopic and microscopic examinations of seminal fluid were performed at room temperature [10].

### 2:1:1:Macroscopic examination:

#### 2:1:1:1:Volume of ejaculate:

Normal volume is about 2 to 6 ml. Samples , volume was assessed by using graded test tube. Plastic syringes should not be used because they may affect sperm motility and hypodermic needles are unsafe [6].



**2:1:1:2:Liquefaction time:**

The liquefaction was finished complete if there was not gel particles or mucous streaks. A normal semen sample liquefies within 15 minutes to more than 60 minutes, and normal semen samples may contain jelly-like grains (gelatinous bodies) which do not liquefy and do not appear to have any clinical significance.

**2:1:1:3:Viscosity:**

The viscosity of the sample was assessed by filling a pipette with semen and let the semen flow back into the container. If the droplets form threads that were more than 2 cm long, that means the sample have high viscosity.

**2:1:1:4:The PH:**

A drop of semen was spread evenly onto the pH paper. After 30 seconds, the color of the impregnated zone should be uniform and was compared with the calibration strip to read the pH.

**2:1:1:5:The Colour:**

For normal semen Homogenous \ Grey-Opalescent, if found red or other colour ,it refer to pathogenicity state.

**2:1:2:Microscopic examination:**

It was done under light microscope (400 X objective) at room temperature.

**2:1:2:1:Sperm concentration:**

Ten µL of well-mixed semen was put on a clean microscope slide,then covered with cover slip (22 × 22 mm). Ten different fields were assessed. One spermatozoon per field of vision corresponds to one million sperm/mL.

**2:1:2:2:Sperm motility:**

Ten µL of well mixed semen was put on a clean microscope slide and covered with cover slip. Assessment of sperm motility should begin immediately to avoid artifacts caused by either a temperature decrease or dehydration of the preparation. Spermatozoa with pin heads or free tails should not be counted. Percentage of sperm motility was assessed as following:

The total number of spermatozoa in each motility group was divided on the total number of spermatozoa assessed in each field .

**2:1:2:3:Sperm morphology:**

Ideally, a good sperm should have a regular oval head, with a connecting mid-piece and a long straight tail. If too many sperms are abnormally shaped (round heads; pin heads; very large heads; double heads; absent tails) this may mean the sperm are abnormal and will not be able to fertilize the egg.

$$\text{Percentage of Normal sperms morphology} = \frac{\text{No. of normal sperms}}{\text{Total no. of spermatozoa count}} \times 100$$

**2:1:2:4: Sperm agglutination:**

Sperm agglutination means that motile spermatozoa stick to each other and it may be head to head, tail to tail or in a mixed way, e.g., head to tail, also are adhering without other cells and debris. It is estimated as a percentage of spermatozoa trapped in clumps. Sperm agglutination was determined in ten randomly chosen fields, away from the cover slip edges.

$$\text{Percentage of agglutinated sperms} = \frac{\text{No. of agglutinated sperms}}{\text{Total no. of spermatozoa count}} \times 100$$



### **2:1:2:5: Round cells:**

These include epithelial cells from the genitourinary tract, prostatic cells, round spermatids, spermatocytes, spermatogonia and leukocytes. The concentration of such cells was estimated in the same way as spermatozoa. As a general guide, a normal ejaculate should not contain more than  $5 \times 10^6$  round cells /mL.

### **2:1:2:6: Assessment of human sperm viability:**

Sperm viability was assessed using eosin staining. One drop of prepared semen was mixed with one drop of eosin solution on a microscope slide, covered with cover slip and examined after 30 seconds under the microscope (400 X). The slide had to be assessed immediately. Live spermatozoa were unstained (white), while dead cells are stained red. The percentage sperm viability was estimated below:

$$\text{Sperm viability \%} = \frac{\text{No. of alive spermatozoa}}{\text{Total No. of spermatozoa}} \times 100$$

### **Statistical analysis:**

Statistical tests were performed using version( SPSS 10.01) of Statistical Package for Social Scientists (SPSS Inc.), to determine the mean and standard error of mean. Also the P value <0.05 considered to be significant in comparison among means of groups and using T –test to estimate the variance between groups. [11].

### **Results:**

In the present study, fitted examination of 130 semen specimens for infertile patients, and the results showed as in the following :-

#### **1: BMI and infertile patients :**

The mean BMI of the patients were  $24.5 \pm 1.78 \text{ kg/m}^2$  . The distribution of the BMI groups were found significantly higher in percentage of Oligospermia patients than of Normospermia , Azoospermia , and Asthenospermia .Figure (4-1).

#### **2: Normospermia patients :**

Classification of Normospermia infertile males according to the BMI reviewed significant higher ( $P < 0.05$ ) in sperm motility, figure (4-2) , normal sperm morphology, figure (4-3) in normal weight ,and not found significant different for concentration of sperm , figure (4-4) between normal weight and over weight .

#### **3: Asthenospermia patients :**

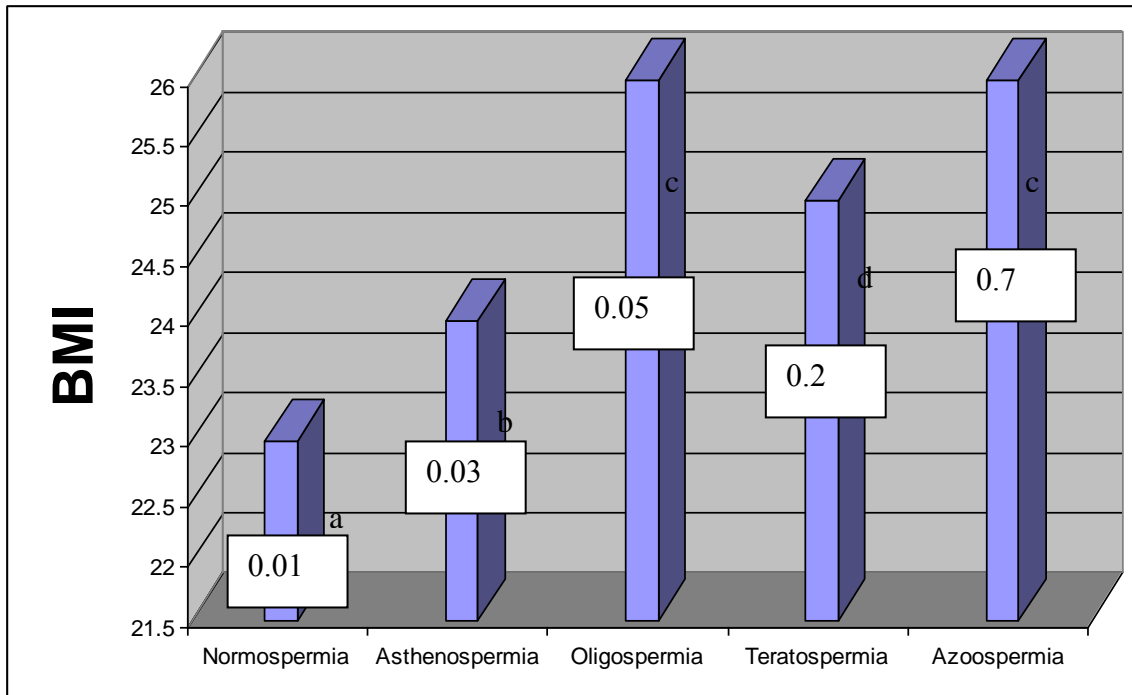
The data of the Asthenospermia males were represented in over weight significantly lower ( $P < 0.05$ ) than in normal weight for concentration of sperm, figure(4-5) ,sperm motility ,figure (4-6) and sperm morphology , figure(4-7).

#### **4: Oligospermia patients:**

Significant negative correlation ships( $P < 0.05$ ) of over weight compared to normal weight of Oligospermia patients were found in concentration of sperm ,figure(4-8), motility ,figure(4-9), morphology, figure(4-10),and Liquefaction time ,figure(4-11).

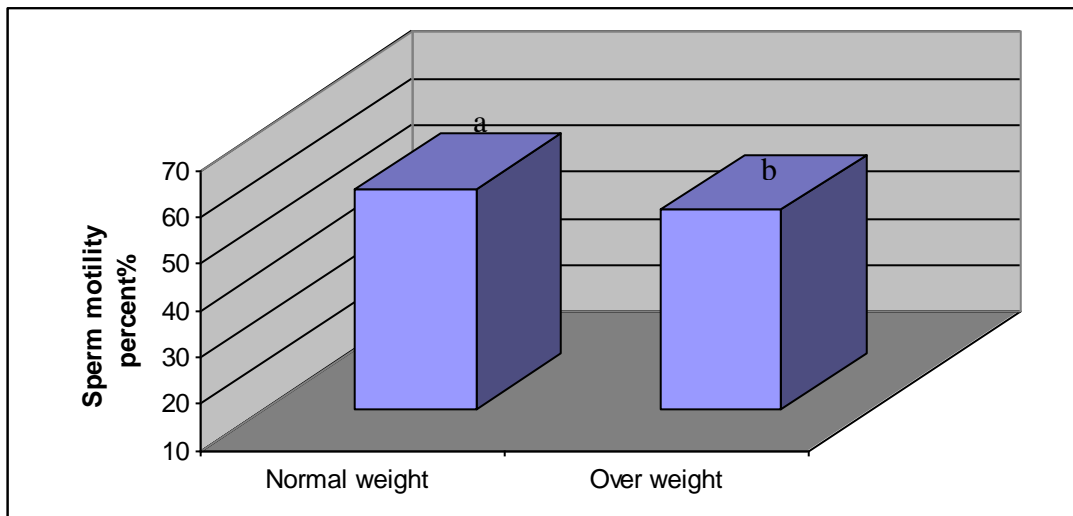
#### **5: Azoospermia , Teratospermia patients:**

Table (4-1) revealed the results which were founded non significantly relation ships ( $P > 0.05$ ) between sperm and semen parameters in normal weight and over weight .



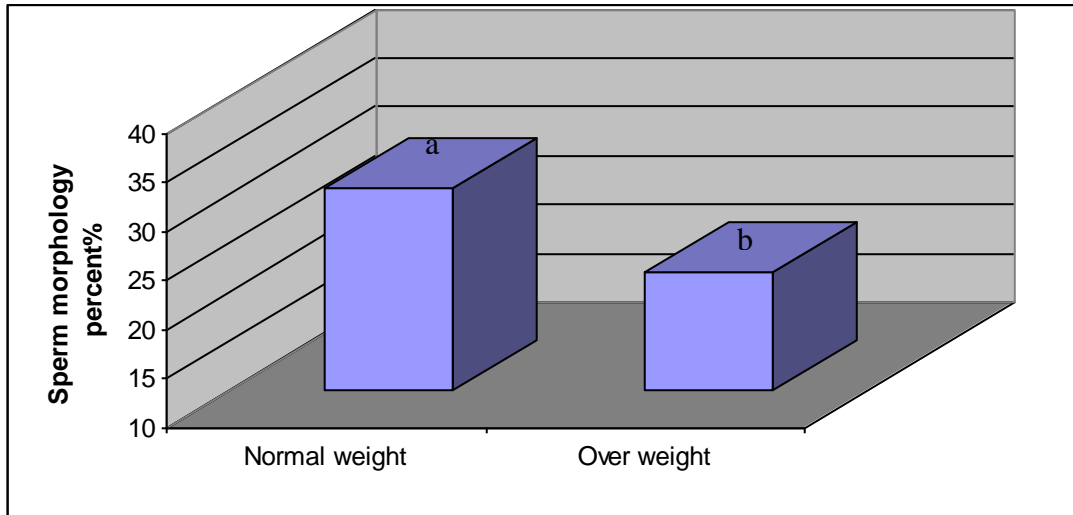
**Figure ( 4-1) Distribution of BMI according to Infertile Patients**

- Number of samples = 130.
- The values represented as mean± standard error of mean.
- P value < 0.05( The unlike letters indicate significant difference between groups )



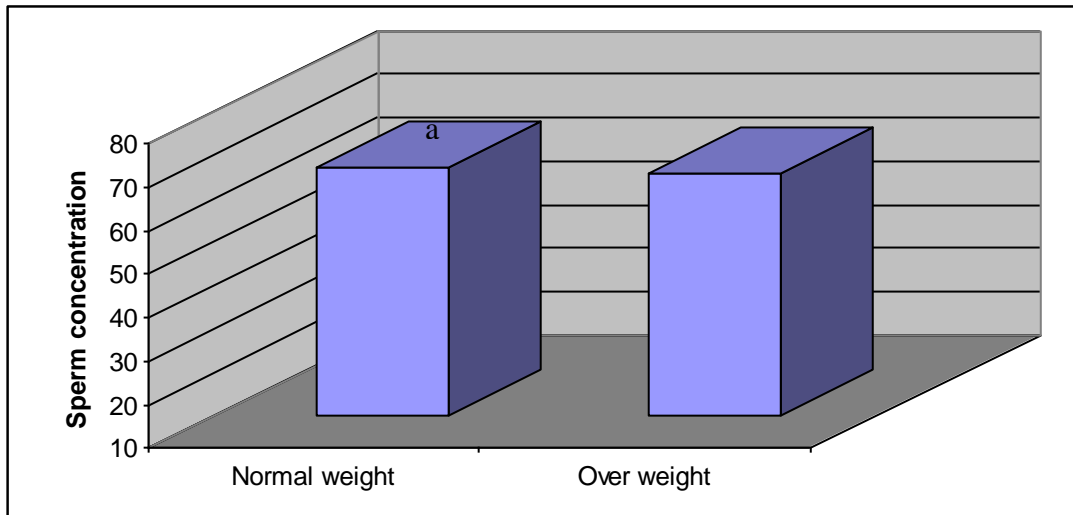
**Figure (4-2)Effect of BMI on sperm motility of Normospermia patients**

- Number of samples = 12.
- The values represented as mean± standard error of mean.
- P value < 0.05( The unlike letters indicate significant difference between groups )



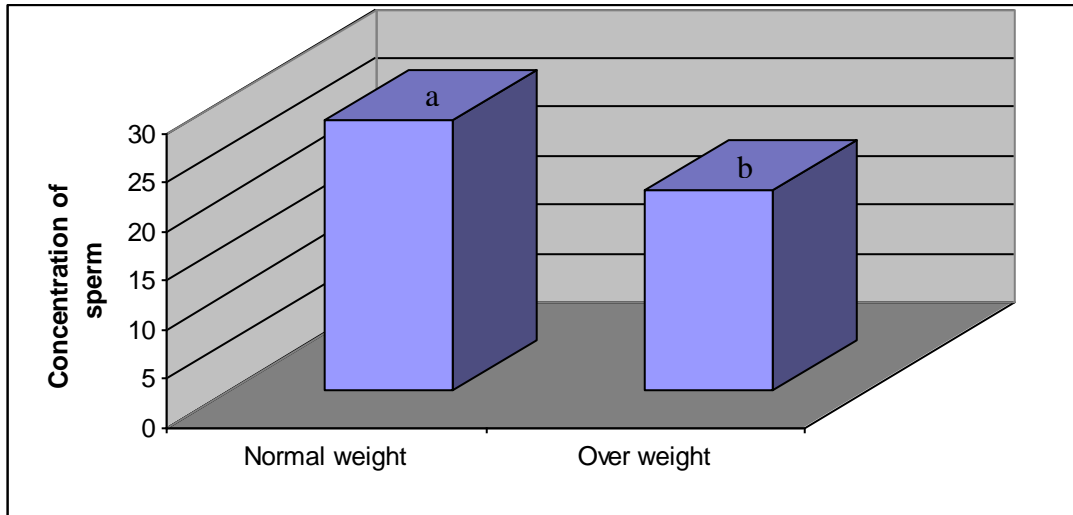
**Figure (4-3) Effect of BMI on sperm morphology of Normospermia patients**

- Number of samples = 12.
- The values represented as mean $\pm$  standard error of mean.
- P value < 0.05 (The unlike letters indicate significant difference between groups )



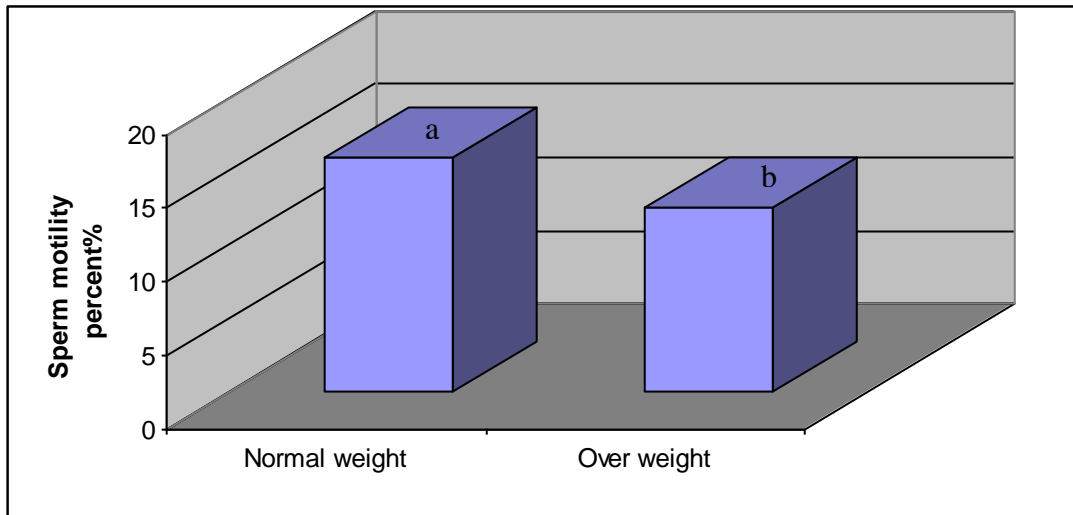
**Figure (4-4) Effect of BMI on sperm concentration of Normospermia patients**

- Number of samples = 12.
- The values represented as mean $\pm$  standard error of mean.
- P value < 0.05(The same letters indicate non significant difference between groups ).



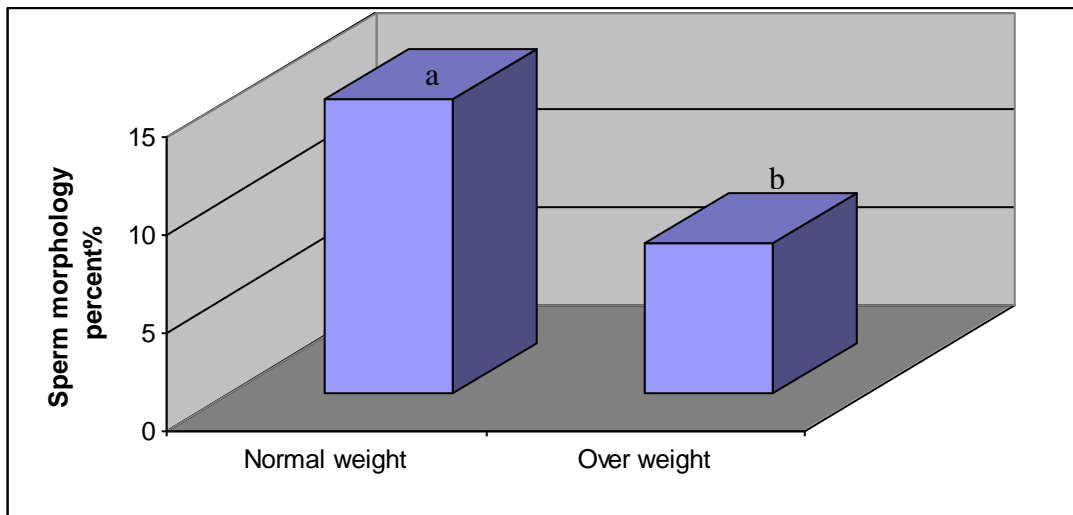
**Figure (4-5) Effect of BMI on sperm concentration of Asthenospermia patients**

- Number of samples = 10.
- The values represented as mean $\pm$  standard error of mean.
- P value < 0.05 (The unlike letters indicate significant difference between groups ).



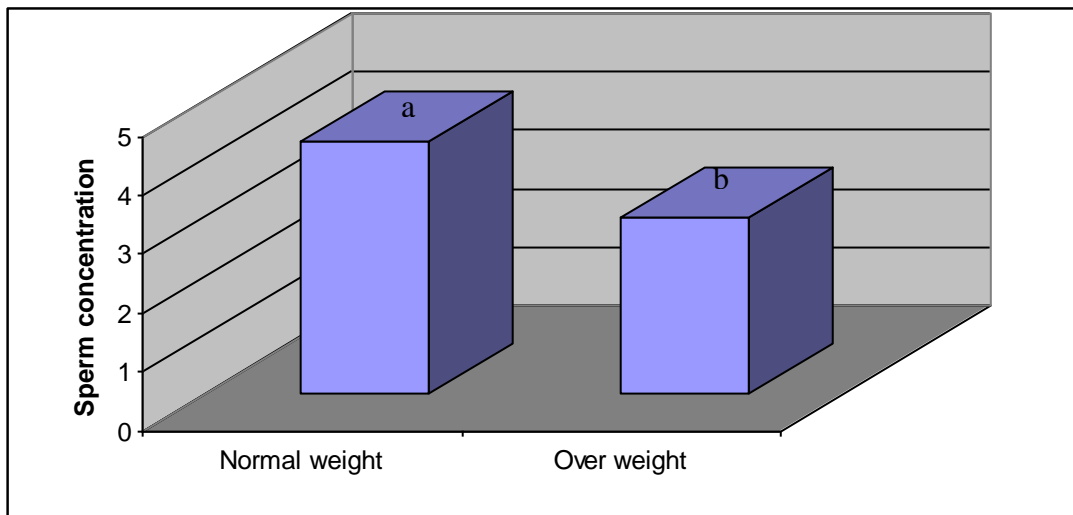
**Figure (4-6) Effect of BMI on sperm motility of Asthenospermia patients**

- Number of samples = 10.
- The values represented as mean $\pm$  standard error of mean.
- P value < 0.05 (The unlike letters indicate significant difference between groups ).



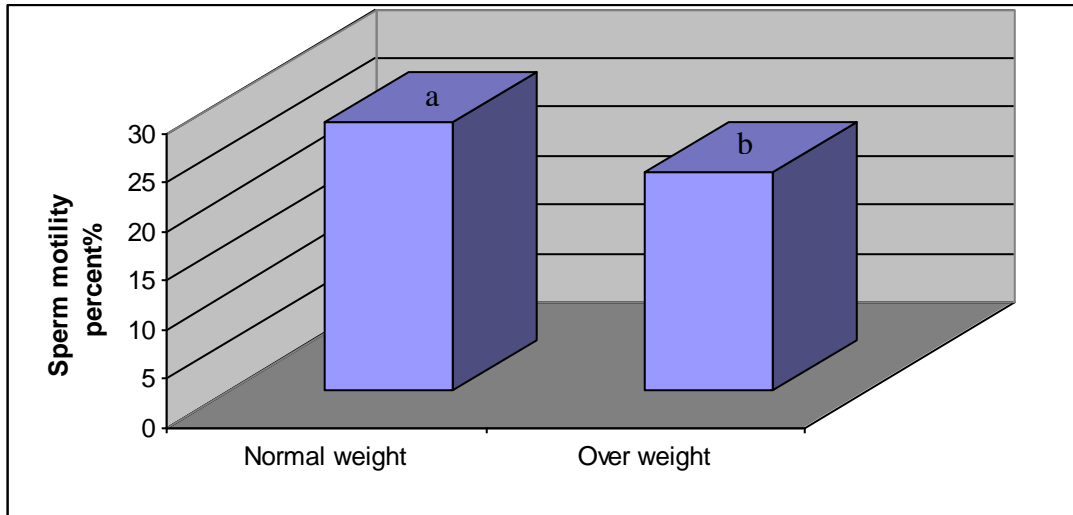
**Figure (4-7) Effect of BMI on sperm morphology of Asthenospermia patients**

- Number of samples = 10.
- The values represented as mean± standard error of mean.
- P value < 0.05(The unlike letters indicate significant difference between groups ).



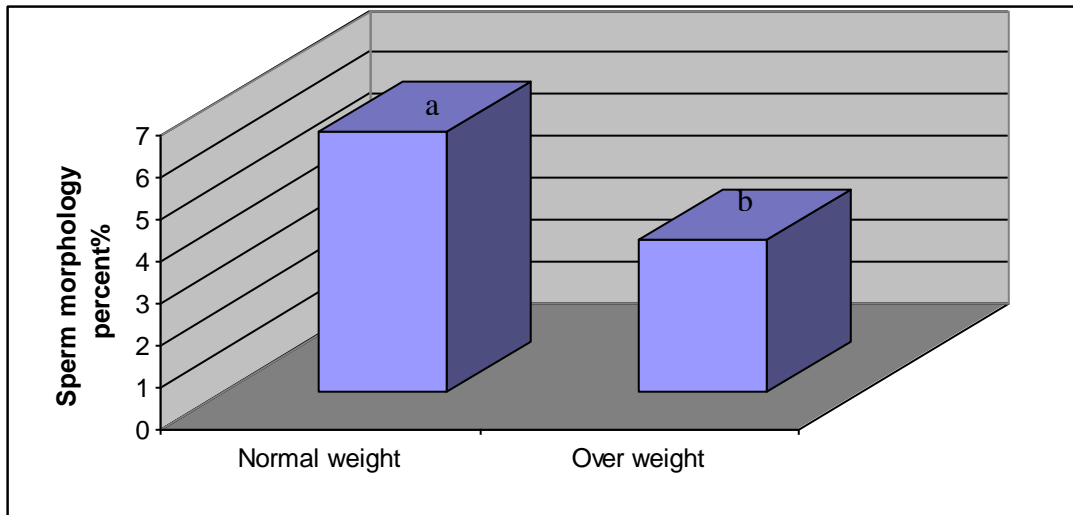
**Figure (4-8) Effect of BMI on sperm concentration of Oligospermia patients**

- Number of samples = 12.
- The values represented as mean± standard error of mean.
- P value < 0.05(The unlike letters indicate significant difference between groups ).



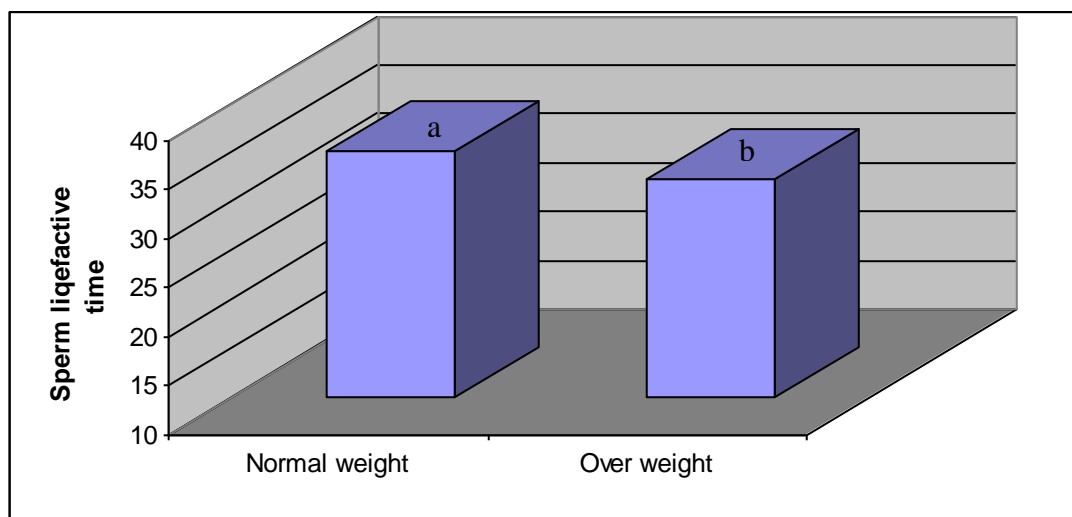
**Figure (4-9) Effect of BMI on sperm motility of Oligospermia patients**

- Number of samples = 12.
- The values represented as mean $\pm$  standard error of mean.
- P value < 0.05(The unlike letters indicate significant difference between groups) .



**Figure (4-10)Correlation between BMI and sperm morphology of Oligospermia patients**

- Number of samples = 12.
- The values represented as mean $\pm$  standard error of mean.
- P value < 0.05(The unlike letters indicate significant difference between groups) .



**Figure (4-11) Effect of BMI on sperm Liquefaction time of Oligospermia patients**

- Number of samples = 12.
- The values represented as mean± standard error of mean.
- P value < 0.05 (The unlike letters indicate significant difference between groups).

**Table (4-1) Effect of BMI on sperm and semen parameters of Azoospermia - Teratospermia patients**

Sperm and Semen parameters	Azoospermia		Teratospermia	
	Normal weight Mean± SE	Over weight Mean± SE	Normal weight Mean± SE	Over weight Mean± SE
Concentration of sperm	0±.0 a	0 ±.0 a	14±0.36 a	12.5±0.41 a
Sperm motility percent%	0 ±.0 a	0 ±.0 a	22.5±1.22 a	22.3±1.20 a
Sperm morphology percent%	0 ±.0 a	0 ±.0 a	4.31±0.13 a	4.4±0.16 a
Volume(ml)	2.63± 0.37 a	2.19± 0.99 a	2.1±0.23 a	2.2±0.25 a
Liquefaction time (min.)	28.1±3.23 a	27.8±2.23 a	30±0.26 a	32.± 0.25 a

- Number of samples = 16.
- The values represented as mean± standard error of mean.
- P value < 0.05 (The same letters indicate non significant difference between groups).



## Discussion:

Increase body weight is a major health issue and the relationships between BMI and male infertility has been proposed to effect male fertility both directly and indirectly, by inducing alteration in sleep and sexual behavior, hormonal profiles, scrotal temperature and semen parameters [12]. The present study, showed that levels of Oligospermia and Azoospermia infertile patients are more significant of BMI compare with Normospermia, Asthenospermia and Teratospermia , this study aggregate meet with [3] result, It is well known that deviations from normal body weight disturb the endocrine system, especially the gonadal hormones; Increased BMI is associated with decreasing Testosterone, LH ,and FSH levels and significant increasing Estradiol and Prolactine levels [13], which it can be effect of spermatogenesis directly within the testis as well as by alterations in gonadotropin secretion by the pituitary.

Attention should be paid to the weight of patients , especially the mass of abdominal subcutaneous fat , by measuring the waist \ hip ratio not only in cases with Oligospermia or Asthenospermia, but also in those with Normospermia, as an abnormal weight gain can result in decreases sperm motility and morphology characteristics [14], which the our results meet with him study compared it between normal weight and over weight, studies have shown that increase BMI is associated with an increased incidence of erectile dysfunction in relation to patient age , smoking status , alcohol use , use of antidepressant , and BMI was also evaluated [15].

Men of infertile couples with high BMI values present with few normal – motile sperm cells ( Asthenospermia ) in his study ,[16] suggest appositive relationship between over weight and DNA Fragmentation Index (DFI) per subjects was observed, as man increases beyond  $25 \text{ kg} \backslash \text{m}^2$  , his respective sperm DFI also increase, typically, a man presenting with a DFI over  $30 \text{ kg} \backslash \text{m}^2$  will have reduced fertility especially in motility .

Over weight , Induced increase conversion of Testosterone to Estradiol , and the effect this increase has on suppressing gonadotropin release and spermatogenesis [13], high BMI in Oligospermia men correlates with reduced Testosterone levels which are due to lower sex hormone – binding globulin , the enhancement of negative feedback on gonadotropin by increase E2, Insulin resistance , and sleep apnea [17], results of Oligospermia met also with other student which show high BMI typically are found to have an abnormal semen analysis represented by decrease in sperm count, decrease in sperm motility and liquefactive time as well as increase in the abnormal forms of spermatozoa , these changes were statistically significant as compared with the normal weight [18].

Estrogens play important roles in the function of the reproductive organs , In earlier work, found a correlation between weight and semen concentration , it has been demonstrated that not only the BMI, but also the body fat distribution is a risk factor for several diseases [19]. We found also no correlation between the normal \ over weight and any of the sperm and semen characteristics in compared results, This suggests that it is not the type of fat deposition that plays an important role in sperm and semen production, but merely also the amount of fat, which could well be related to changes in the Testosterone/ Estradiol ratio, The increased fat produces more Estrogen from Testosterone, which suppresses the hypothalamic and pituitary hormonal secretion and can affect the testis directly by altering in spermatogenesis processes [20]. Moreover, in over weight the sexual hormone – binding globulin (SHBG) levels are lower, which reflects on further testosterone deficiency.



## References:

- 1- Bentley,G.R. and Mascie –Taylor ,CGN.(2000). Infertility in modern world. Present and future prospets . Ed . Vol ., Cambridge University Press . UK
- 2- Bolumar ,F.;Olsen ,J.; Rebagliato ,M.;Saez-Lioret,I.and Bisanti,L.(2000). Body mass index and delayed conception :a European multicenter study on infertility and subfecundity .Am. J.Epidemiol;151:1072-1079.
- 3- Abdullah, A. and Bakry, S.(2008). Obesity and Infertility in Egyptian Men. Research Journal of Medicine and Medical Sciences, 3(2): 135-139.
- 4- Haslam, D. w. and James, w. P. (2005). Obesity. *Lancet*; 366, 1197–1209.
- 5- Dohle, G.R; Jungwirth, A.; Colpi, G.; Giwercman, A.; Diemer ,T.and Hargreave, T.B.(2007). Guidelines on Male Infertility . European Association of Urology. 1:70.
- 6- World Health Organization (2010). Laboratory manual for the examination and processing of human semen 5<sup>th</sup> ed, Cambridge University press, Cambridge. United States. *Physiol Behav* 2005;86:599–602.
- 7- Carlsen, E., Giwercman, A., Keiding, N. and Skakkebaek, N. E. (1992).Evidence for decreasing quality of semen during past 50 years. *BMJ*, 305, 609–613.
- 8- Swan, S. H., Elkin, E. P. and Fenster, L(2000). The question of declining sperm density revisited: an analysis of 101 studies published 1934 1996. *Health Perspect.* 108, 961–966.
- 9- Flegal K.M.; Sokol, R.Z.and Sprakes ,R. (1987) .Demonstrated Paternity inspite Epidemiologic aspects of overweight and obesity in the of oligospermia. *Fertil Steril* ; 47:356-8.
- 10- World Health Organization (WHO) (1999): Laboratory manual for the examination of human semen and sperm-cervical mucus interaction, fourth edition. Cambridge University Press, U.K.: 1-71.
- 11- George, A.; Darren, G.; Mallery, D. and Paul, C.(2003). SPSS for windows step by step. Boston, Pearson Education. Inc, 55 – 65.
- 12- Mara, Y., J. Roth, K. Amory and T.P. Stephanie,( 2008). Treatment of male infertility secondary to morbid obesity. *Nature Clinical Practical Endocrinology and Metabolism*, 4 (7): 415-419.
- 13- Nguyen, R. ;Wilcox, A.; Skjaerven, R. and Baird, D. ( 2007). Men’s body mass index and infertility. *Hum. Reprod.*, 22: 2488-93.
- 14- Fejes, I. ; Koloszar, S. ; Szollosi, J. ; Zavaczki, Z .and Pal, A. (2005) . Is semen quality affected by male body fat distribution? *Journal Compilation Blackwell Publishing Ltd Andrologia* 37 155–159 .
- 15- Hammoud, A. O.; Gibson, M.; Peterson, C. M.; Hamilton, B. D. and Carrell, D. T. (2006). Obesity and male reproductive potential. *J. Androl.* 27, 619–626 .
- 16- Bungum .M; Humaidan. P; Spano. M;Jepson .K; Bungum. L; and Giwercman. A (2004). The predictive value of sperm chromatin structure assay (SCSA) parameters for the outcome of intrauterine insemination, IVF and ICSI. *Hum Reprod.*;19:1401–1408.
- 17-Magnusdottir, E. V.; Thorsteinsson, T.; Thorsteinsdottir, S.; Heimisdottir, M. and Olafsdottir, K. (2005). Persistent organochlorines, sedentary occupation, obesity and human male subfertility. *Hum. Reprod.* 20, 208–215 .
- 18- Sallmen, M.; Sandler, D.;PHoppin, . J.A. ; Blair, A. and Baird, D( 2006). Reduced fertility among verweight and obese men. *Epidemiology*, 17: 520-3.
- 19- Mery, C.M.; Rubio ,V.; Duarte-Rojo, A.; Suazo-Barahona ,J;Pelaez-Luna, M.; Milke. P; and Robles-Diaz, G .(2002) .Android fat distribution as predictor of severity in acute pancreatitis. *Pancreatology* 2:543–549.

20- Carreau S, Bourguiba S, Lambard S, Galeraud-Denis I, Genissel C, Levallet J (2002). Reproductive system: aromatase and estrogens. Mol Cell Endocrinol 193:137–143.

## تأثير معامل كتلة الجسم على معالم المنى والنطف لمرضى العقم

صاحب يحيى المرشدي  
كلية الطب / جامعة الكوفة

محسن كاظم المرشدي  
كلية العلوم / جامعة الكوفة

سماح عامر العبيدي  
كلية العلوم / جامعة الكوفة

### الخلاصة

جمعت خلال هذه الدراسة (130) عينة من السائل المنوي من أشخاص مصابين بالعقم بعد امتناع عن الجنس من 3-5 أيام في مختبرات مركز الخصوبة / مدينة الصدر الطبية / محافظة النجف الاشرف للفترة ما بين 7/1 ولغاية 1/9/2011 م . هدفت الدراسة الى توضيح تأثير وزن الجسم تمثلت في حالات مرضى العقم سوي النطف و وهن النطف و قلة النطف وأنعدام النطف وتشوه النطف اذ قيس معامل كتلة الجسم BMI (كغم /متر مربع ) لكل شخص وتقسيمة الى مجموعتين أشخاص ذو أوزان طبيعية وفوق الوزن الطبيعي . بينت نتائج الدراسة الحالية زيادة واضحة في نسبة مرضى العقم المصابين بقلة النطف مقارنة بمظاهر العقم الأخرى عند تصنيفها اعتمادا على معامل كتلة الجسم ، ولوحظ تأثير زيادة معامل كتلة الجسم على مرضى العقم سوي النطف و وهن النطف ، اذ لوحظ انخفاض معنوي (  $P < 0.05$  ) في حركة النطف وشكل النطف وتركيز النطف مقارنة بالقيم بين الوزن للشخص ذو الوزن الطبيعي وفوق الوزن الطبيعي . أوضحت نتائج الدراسة انخفاض معنوي (  $P < 0.05$  ) في تركيز النطف و زمن الأماعة و حركة وشكل النطف السوي لمرضى العقم المصابين بقلة النطف مع زيادة معامل كتلة الجسم المتمثل (( بفوق الوزن الطبيعي )) . أشارت نتائج أنعدام النطف وتشوه النطف لمعالم المنى و النطف بعدم وجود فرق معنوي (  $P > 0.05$  ) بين مرضى العقم ذو الأوزان الطبيعية وفوق الوزن الطبيعي . يستنتج من هذه الدراسة بأنه يمكن أن يؤثر معامل كتلة الجسم بفسلجة التكاثر وزيادة نسبة الرجال المصابين بالعقم ، اذ ان الرجال العقيمين الذين يعانون من ارتفاع معامل كتلة الجسم يمتلكون نمودجيا تحليل للسائل المنوي غير طبيعي متمثلا بانخفاض في عدد النطف وحركة النطف بالإضافة الى زيادة تشوه شكل النطف .