

The Relationship Between Body Mass Index and Semen Quality and Sex Hormones Among Infertile Men

Katayon Berjis, Azra Azmodeh*, Nasser Salsabili, Ebrahim Mostafavi, Mansoureh Moaya, and Mahdieh Sadat Ghiasi

Department of Medicine, Cellular and Molecular Research Center, Iran University of Medical Sciences, Tehran, Iran

ABSTRACT

Obesity decreases fertility in women. There are some reports in case of semen quality disorder in men with increasing weight. With regard to the effect of weight gain in decreasing fertility we decided to investigate the relation of body mass index with semen parameters and sex hormones. We grouped 550 infertile men between 20-45 years old based on calculated BMI values (normal, 19 to 24 kg/m², overweight, 24/1 to 29, obese > 29/1). Clinical examinations and BMI calculation by measuring weight and height, semen analysis, and blood serology were done for all patients. There were significant differences between semen parameters and BMI in three groups. Body mass index was negatively correlated with total sperm count, motility and morphology. In comparison between sex hormones with sperm count positive meaningful statistical relation with LH, FSH and estradiol and negative meaningful statistical relation with testosterone were observed. With regard to these results we concluded that body mass index more than 24 had reverse relation with sperm count. Therefore, we suggest to decrease weight and prescribe a diet are important in men with low fertility due to semen quality disorder.

Key words: BMI, Blood serology, Semen index.

INTRODUCTION

Obesity is introduced as an epidemic problem in the whole world (2). The prevalence of obesity in Europe is estimated at 10–20% of men and 10–25% of women. (1). The relationship between obesity and infertility in men was first described by Avicenna in the 10th century. (3) But there isn't complete information about the exact effect of body mass index in semen quality (5). Over weight not only increases chronic diseases following mortality and morbidity but also increases fertility problem (4) both infertility and obesity decrease quality of life among people So many studied indicated the relationship between male obesity and fertility problems that ended to poor pregnancy outcome. Positive relations have been reported between male factors infertility and metabolic syndrome. Finally, it has been shown obese couple are less fertile than those with normal body mass index. Only recently in the last 2–3 year the impact of an obese male partner on embryo development and pregnancy been assessed (6). In a study in 2008 with 520 men

inverse effect between sperm count and its mobility with body mass index have been found (7, 8). There are several studies that have investigated the impact of male obesity on the traditional sperm parameters mandated by the world health organization (WHO), that is sperm concentration, sperm motility and sperm morphology (6). Also a Positive relation between the percent of sperm DNA fragmentation and high BMI was found. Hilton (9) (10, 11) here is some evidence that male obesity reduces sperm concentration that were reported by 15 out of 23 recent studies. There was another study at which the unpleasant effect of obesity on erectile dysfunction and sperm parameters were emphasized. Ahmad, Settle, Chung (12, 13, 14)

Obesity in men is almost accompanied with hormonal disorders and infertility problems. Several studies documented that increased male BMI is associated with reduced plasma concentrations of SHBG and therefore free and total testosterone and increased plasma concentration of estrogen. (6)

*Correspondence to: Berjis K. Department of Medicine, Cellular and Molecular Research Center, Iran University of Medical Sciences, Tehran, Iran. E-mail: mahdieh.ghiasi@yahoo.com

Received date: Apr 23, 2021; Accepted date: September 16, 2021; Published date: September 27, 2021

Citation: Berjis K (2021). The Relationship Between Body Mass Index and Semen Quality and Sex Hormones Among Infertile Men. J Clin Med Sci. Aff. 5: p788

Copyright: © 2021 Berjis K. This is an open-access article distributed under the terms of the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original author and source are credited.

Meeker (15) There are various reports showing that fat accumulation in men consequence decrease of free and total testosterone and increase of serum estradiol level and these two changes can lead to a general decrease in sperm counts. The answer of this question how obesity results infertility in men can be multifactorial. As we known Obesity leads to a kind of hypoandrogenism by increasing the serum estradiol level and decreasing the testosterone level, these affect changes spermatogenesis that can cause low sperm count and then male factor infertility problems Akingbemi , Strain (18, 19) With regard to increased obesity especially in civilized societies, over weight and infertility should be more focused. We cannot found similar studied about body mass index and semen quality inside our country in our researches'. There was not many studied that assess the effect of obesity in semen parameters. The main goal of this study is to investigate the relation between body mass index and semen quality.

MATERIAL AND METHOD

This study has been done as a Crosse sectional study. Among the infertile men who were the clients of Myrza- koochak- khan male infertility clinic from May 2011 to November 2014. a total of 550 healthy infertile men between 20-45 years old were enrolled in this study . They were couples with at least one year infertility period. All of the men were examined and body mass index was calculated as body weight (kg) divided by height squared (m²) . Blood sample to evaluate serum testosterone, estradiol, prolactin, FSH, LH, and TSH have been taken and were sent to the laboratory. Hormonal evaluations were made using ELISA techniques. Elisa reader system was used for FSH, LH evaluations with moonblind kite. Elisa reader system was used for Testosterone and Estradiole evaluations with DRG kite. Elisa reader system was used for prolactin evaluations with PADTANELM kite. Also by self masturbation semen samples were achieved and after 60 minutes being in 37 centigrade degree were analyzed with 40 empowering microscope for morphology and motility and 10 empowering microscope for sperm count with regard to WHO criteria . Variables included age, BMI, semen parameters and serum hormonals assessment. Exclusion criteria were varicocele, vasovasectomy , alcohol or alcohol abuse ,Smoking, male impotency, hyper prolactinemia , Erectile dysfunction , diabetes Mellitus, thyroid dysfunction and Oligo spermia . Also none of the cases has had chronic drug consumption .In diabetic patients obesity, retrograde ejaculation and neuropathic disorders of diabetes affect sperm count so it can be as an interventional factor. All cases based on BMI, were divided into three groups: group A : BMI= 18-24 kg/m², group B: BMI = 24/1 -29 kg/m², and group C BMI > 29/1 kg/m². Financial support has been done by Tehran University of medical science.

Statistical analysis: All data's were assessed in SPSS 15 with ANOVA test and linear regression. Significant value was set at $\alpha < 0/05$. All p values were two -tailed.

RESULT

In this study 540 infertile men were analyzed. The mean value of age in group A(n=177) : BMI18-24 kg/m² was 32/2 and in

groups B(n=182) : BMI = 24/1 -29 kg/m² was 32/3 and in group C (n=178) : BMI > 29 kg/m² was 33/1. There were no significant differences between age in three groups. The mean value of BMI in group A was 22/4, in group B, it was 26/3 and in group C was 31/5. In the assessment of correlation between sex hormones (FSH , LH ,testosterone and estradiol) and BMI in 250 cases , positive correlation between BMI and estradiol($p = + 0/04$) we observed table1

Variables	LH	FSH	Estradiole	Testosterone
BMI	.12 NS	.58 NS	+.04 S	.69 NS

Table1: The relation between BMI with sex hormones

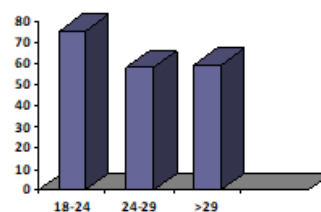
In the assessment of correlation between semen parameters and BMI , sperm count had meaningful negative statistical relation with BMI ($P = - 0/0001$). We had negative statistical relation between BMI and morphology($p = - 0/002$) and motility ($p = - 0/0001$) as well .the relation between BMI and volume of semen was not significant (Table 2).

Variables	count	morphology	mothitiy	volume
BMI	-0.0001	-0.0001	-0.0001	NS

Table 2: the relation between BMI and semen parameters

The mean value of sperm count in group A was 75/8, group B was 58/4 and group C was 59 (Graph 1).

Graph 1: the relation between BMI and sperm count



Liner regression for assessment of relation between BMI and semen parameters has been done and negative meaningful statistical relation between BMI and sperm count was seen($p = 0/0001$) (% 95 CI:-.04 to -.01). In assessment three groups in ANOVA study significant statistical relation between BMI ,sperm count ($p = 0/0001$) and morphology($p = 0/007$) were seen.

In assessment between groups with independent sample T-test, The comparison of the two groups A and B showed that the sperm count in group A had a higher rate compared to groups B ($p = 0/0001$) and comparing morphology of sperm between two groups was meaningful($P = 0.03$). The comparison between groups A and C , the mean value of sperm count has a higher rate in group A ($p = 0/002$) and comparing morphology of sperm between two groups showed in group A morphology of

sperm was more than group C ($p=0/02$). Both morphology and sperm count decreased with increasing BMI. In contrast two groups B and C there were no meaningful statistical difference between sperm count in two groups but comparing morphology of sperm in two groups B and C morphology of sperm in group B had a higher rate compared to group C ($P= 0.05$) (Table 3).

Groups	mean \pm SD of sperm count	mean \pm SD of morphology
A	75.8 \pm 46.1	32.4 \pm 28.4
B	58.4 \pm 42.6	27.8 \pm 26.1
	P= 0.0001	P= 0.03
A	75.8 \pm 46.1	32.4 \pm 28.4
C	59 \pm 44.6	24.4 \pm 28.2
	P= 0.002	P= 0.02
C	59 \pm 44.6	24.4 \pm 28.2
B	58.4 \pm 42.6	27.8 \pm 26.1
	p = NS	P= 0.05

Table 3: The comparison sperm count between groups with independent samples t-test

Discussion

Obesity has been known as a rapidly increasing problem in the world (1, 2). Overweight was considered for a neglected male infertility factor. In our study we observed a relationship between morphology, motility and sperm count with BMI. All parameters of sperm decreased with increasing BMI. In Meeker and colleagues study for 388 sperm sample LH and FSH had negatively statistical relation with motility, morphology and sperm count. Finally Meeker and colleagues had found positive statistical relation between testosterone level and sperm motility (15). In the other study by Gopalkrishnan and colleagues in Danish a relation between high BMI and low quality of sperm in infertile men were seen. So prevention of some types of male infertility were hoped (21). In so many studies the reverse effect between sperm parameters and BMI were reported (11,12,16, 18,19,22, 23).

In Macdonald and colleagues study in New Zealand they created No significant correlation between BMI and semen parameters (17, 24). As we know Obesity by increasing estradiol which is produced in peripheral tissues has negative feedback in pituitary gland then causes hypogonadotropin and hypoandrogenism. In recent study a relation between obesity with increasing estradiol level, decreasing testosterone level and decreasing sperm count were seen. Decreasing in sperm count is a known factor in male infertility. In Aggerholm et al study qualification of sperm parameters in infertile men were assessed and lower sperm count concluded in the cases with BMI 25/1-

30 to compare with BMI 20 to 25. Also they saw sperm count reduction with BMI more than 30. They concluded high BMI had none appropriately accompanied with sex hormone and sperm quality (25,26,27). In our study increasing BMI accompanied with increasing estradiol level and decreasing in testosterone level and they caused to lower sperm count. We observed the lowest sperms count in the cases with BMI 24-29 kg/m² and more than 29 kg/m² to compare with BMI 18-24 kg/m². Also in cases with high BMI changes in sperms count and morphology were meaningful. It seems changes in BMI firstly involve morphology of sperm then decreased the count of it. So in comparing all three groups of this study with each other decreasing of morphology was significant.

In Qin and colleagues research, men with a BMI lower than the normal, compared to men with a normal BMI and high BMI. A reduction in sperm quality and sperm count were observed in the cases with BMI lower than normal rate by them, but the sexual hormones could not justify it (28). In our study increasing of BMI accompanied with decreasing of sperm morphology and sperm count.

In Fejes and colleagues study the relation between the weight and testosterone - estradiol ratio in Oligospermic men was assessed and they were concluded that in men with high BMI the ratio will be decreased.

In Hafner and Strain teams' study, obesity was finally marked as an effective factor in infertility with spermatogenesis reduction which is caused by the increased levels of estradiol and decreased level of Testosterone. Other hormones involved in the regulation of Sertoli cell function and spermatogenesis, such as FSH/LH ratios, inhibin B and Sex Hormone Binding Globulin levels have all been observed to be decreased in males with increased BMI (19), (22).

CONCLUSION

In present study, obesity has always been accompanied with estradiol increase, Testosterone reduction and decreased sperms count. Therefore, when BMI increase at the same time sperms count and morphology of sperm decrease and it can be concluded that with weight control, some infertility reasons in men can be avoided. Finally we observed the most fertility in men with normal BMI compare to the other. Our study, however provided useful information about some reason of male factor infertility that can be avoided easily with changes in life style and overweight.

REFERENCES

1. Sperof L Marc A. Clinical gyn end & infertility. 6th Ed. Philadelphia; Robert-D; 2012
2. Guo D, Wu W, Tang Q, Qiao S and etal. The impact of BMI on sperm parameters and the metabolite changes of seminal plasma concomitantly. *Oncotarget*. 2017; 25;8(30):48619-48634.
3. Piotr Kocelak, Jerzy Chudek, Beata Naworska, Monika Bąk-Sosnowska, Barbara Kotlarz, Monika Mazurek and etal 1. Psychological Disturbances and Quality of Life in Obese and Infertile Women and Men. *Int J Endocrinol*. 2012; 14.

4. Jensen T , Andersson A , Jorgensen N , Andersen A , and etal . Body mass index in relation to semen quality and reproductive hormones among 1558 danish men . *fertile sterility* 2004 ; 82:863-870 .
5. Catalano P , management of obesity in pregnancy . *Obstet Gynecol* 2007 ; 109: 419 -433 .
6. Nicole O. Palmer, 1 Hassan W. Bakos, 2 , 3 Tod Fullston, 1 and Michelle Lane 1 , 3 ,* Impact of obesity on male fertility, sperm function and molecular composition. *Spermatogenesis*. 2012 October 1; 2(4): 253-263.
7. Kasturi S , tannir J, and brannigan R .E . The metabolic syndrome and male infertility . *Journal And* 2008;29(3):251-259 .
8. Tsai ES , Matsumoto AM , Fujimoto WY , Boyko EJ and etal . Assosiation of bioavailable , free and total testosterone with insulin resistance : influence of sex hormone-binding globulin and body fat . *Diabetes care* 2004 ; 27: 861-8 .
9. Kort HI1, Massey JB, Elsner CW, Mitchell-Leef D and etal . Impact of body mass index values on sperm quantity and quality. *J of And* 2006 ; 27 (3). 450-2
10. Ramlau -hansen C H ,Thulstrup A.M ,. Nohr E . A and etal . Sub fecundity in overweight and obese couples .*human repro* 2007; 22(6) : 1634-1637.
11. Magnusdottir Ev, Thorsteinsson T , Thoresteinsdottir S, Hemisdottir M , and etal. Persistent Organochlorines , sedentary occupation , Obesity and Human male sub fertility. *Human rep* 2005 ; 208 - 215 .
12. Ahmad O. Hamood, M.D Nicole Wide, M.P.H Mark Gibson, M.D Anna Parks and etal. Male obesity and alteration in sperm parameters . *Fert Ster* 2008
13. Seftel A . Mal hypogonadism . part 2 : etiology , pathophysiology and diagnosis . *Int J Impot Research* 2006 ; 18: 223- 8 .
14. Chung WS , Sohn JH , Park YY . is obesity underlying factor in erectile dysfunction ? *European urology* 1999 ; 36 : 68 - 70 .
15. Meeker JD, Godfrey L , Hauser R .Relationships between serum hormone levels semen quality among men from an infertility clinic. *J And* 2007 28(3):397-406 .
16. Giagulli VA , Kaufman JM,Vermeulen A .pathogenesis of the decreased androgen levels in obese men .*J Clin Endoceanol Metab* 1994 ; 79: 997-1000 .
17. Macdonald AA , Stewart AW, Farquhar CM. Body mass index in relation to semen quality and reproductive hormones in New Zealand men: a cross-sectional study in fertility clinics. *Hum Reprod*. 2013 ;Dec;28(12):3178-87.
18. Akingbemi B T . Estrogen regulation of testicular function . *reproductive biology end* 2005 ; 3 : 51.
19. Strain GW, Zumoff B , kream J , Strain JJ , Deucher R and etal . Mild hypogonadotropic hypogonadism in obese men . *Met* 1982 ; 31 : 871-5 .
20. Wass P , Waldenstron U , Rossner S , Hellberg D . An Android body fat distribution in females impairs the pregnancy rate of in-vitro fertilization - embryo transfer . *Human rep*1997 ; 12: 2057-2060 .
21. Gopalkrishnan K ,Padwal V , Meherji PK , Gokral JS and etal . Poor quality of sperm as it affect repeated early pregnancy loss . *Arch Andro* 2000 ; 45 :111-117 .
22. Bieniek JM, Kashanian JA, Deibert CM, Grober ED, Lo KC and et al . Influence of increasing body mass index on semen and reproductive hormonal parameters in a multi-institutional cohort of subfertile men. *Fertil Steril*. 2016 Oct;106(5):1070-1075.
23. Alshahrani S, Ahmed AF, , Gabr AH, Abalhassan M , Ahmad G . The impact of body mass index on semen parameters in infertile men. *Andrologia*. 2016 Dec;48(10):1125-1129.
24. Thomsen L, Humaidan P, Bungum L, Bungum M. The impact of male overweight on semen quality and outcome of assisted reproduction. *Asian J Androl*. 2014 Sep-Oct;16(5):749-54.
25. Sallmen M, Sandler DP,Hoppin Ja, Blair A, Baird DD. Reduced fertility among overweight and obese men . *Epi* 2006;17:520-3.
26. Nguyen R, Wilcox A,Skjaern R, Baird DD. Men's body mass index and infertility.*Hum Reprod* 2007;22:2488-93
27. Aggerholm AS , Thulstrup AM , Toft G , Ramlau -Hansen CH .Is overweight a risk factor for reduced semen quality and altered serum sex hormone profile ? *fertile steril* 2007 .
28. Qin DD , Yuan W, Zhou WJ , Cui YQ and et al . do reproductive hormones explain association between body mass index and semen quality ? *Asian j And* 2007 ; 9 (6) : 827 -34.
29. Fejes I , Koloszar S , Zavaczki Z , Daru J and et al . Effect of body weight on testosterone / estradiol ratio in oligozoospermic patients. *Arch Androl* 2006 ; 52 (2) : 97- 102 .
30. Mokdad AH, Serdula MK, Dietz WH, Bowman BA, Marks JS, Koplan JP. The spread of obesity epidemic in United States. *JAMA* 1999;282:1519-22
31. Hedley AA, Ogden CL, Johnson CL, Carroll MD, Curtin LR, Flegal KM . Prevalence of overweight and obesity among US children , adolescents , and adults. *JAMA* 2004; 291:2847-50