

# A Cross-Sectional Analysis of the Effect of Obesity on Sperm Quality in Infertile Couples

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## ABSTRACT

**Background:** The obesity pandemic is emerging which is clearly because of changes in caloric habits and lifestyles of people worldwide. A number of serious medical problems are associated with obesity. One of them is infertility.

**Objective:** The main purpose of this research was to evaluate the relationship of body mass index (BMI) with standard semen parameters by measuring hip circumference and waist circumference.

**Study design:** A cross-sectional study

**Place and Duration:** This study was conducted at Abassi Shaheed Hospital Karachi hospital from November 2021 to November 2022.

**Methodology:** All infertile couple who visited gynaecology outpatient department for infertility treatment interviewed and after taking relevant history of both partners total of 180 men were enrolled in this research. By using the standard methods, the weight and height of the patients was measured. Moreover, their WC (waist circumference) and hip circumference were also measured. After two to five days of abstinence from coitus, the patients were advised to give the semen in laboratory for semen analysis. First, the liquefaction was done. Later, the Makler counting chamber was used to analyze the semen. A number of semen parameters were noted by using the World Health Organization criteria

**Results:** Most of the individuals were from the age group of 31 to 40 years. Most of the men (n=144) were having primary infertility, representing 80% of the total sample size. The waist-hip ratio was seen in the majority of the men. There was a negative link seen between semen parameters and WHR. The majority of the men were having a body mass index of 23 to 27 kg/m<sup>2</sup>, representing 51.5% of the total sample size. A total of 27 males were having mildly decrease sperm concentration, representing 15% of the sample size. On the other hand, a total of 35 men with mildly decrease sperm counts, represented 19.4 percent of the sample size.

**Conclusion:** There is a negative relationship between semen parameters (total sperm count, total motility, sperm concentration, and total progressive motility) and WHR.

**Keywords:** Semen analysis, obesity, waist-hip ratio, infertility

## INTRODUCTION

The obesity pandemic is emerging which is clearly because of changes in caloric habits and lifestyles of people worldwide[1]. When the human body's white adipose tissues are accumulated or the human body has excess body fat, this condition is called obesity [2]. This condition has many severe effects on the human body, their health, and life expectancy. A number of serious medical problems are associated with obesity. One of them is infertility [3]. After regular unprotected sexual intercourse, when couples failed to achieve a clinical pregnancy after 1 year or more, it is likely that one of them had developed a serious condition of the reproductive system which is called infertility [4]. It is common that female obesity is associated with infertility but this is also found in men.

Nowadays, an independent cause of fertility is the male factor. Male factor infertility is a global situation but men do not accept that they are the cause of infertility of the couple [5]. The independent contribution of male factor infertility is 30 percent. When we talk about couple infertility, male factor infertility has about 30 percent contribution in that as well [6]. There are a number of etiologies of male infertility. They include trauma or testicular torsion, erectile dysfunction, hypogonadotropic hypogonadism, testicular varicocele, scrotal surgery or previous groin, genital infections, anti-sperm antibodies, gonadal dysgenesis, chronic and serious systemic illness, environmental toxins, and obstruction of reproductive channels [7].

Semen quality is being studied in various studies where obesity and poor lifestyle factors are observed to find out their influence on semen quality [8]. Due to obesity, the male reproductive hormonal profile is disturbed that severely affects male infertility [10]. Hence, the main purpose of this research was to evaluate the relationship of Body Mass Index with standard

semen parameters by measuring hip circumference and waist circumference.

## METHODOLOGY

This research was performed in the department of gynecology and obstetrics of our hospital. Overall, a total of 180 men were enrolled in this research. Written consent was taken from all the men. Every patient's detailed history was taken. The historical records included age, occupational status, educational status, type of infertility (whether primary or secondary), time period of infertility (how many years), hypertension or diabetes, coital frequency and difficulty, sexually transmitted infections, childhood illness, alcohol consumption, smoking history, use of tobacco, intake of drugs, and surgeries in the past. A general physical examination was conducted along with the historical records.

**Exclusion criteria:** Men who had testicular failure, varicocele, surgeries, and undescended testes were not included in this research study.

By using the standard methods, the weight and height of the patients was measured. Moreover, their waist circumference (WC) and hip circumference (HC) were also measured. To measure the WC, the top of the iliac crest and the lower margin of the last palpable rib was noted. To note the hip circumference, an inch tape was placed parallel to the floor from the widest portion of the buttocks. The participants were divided into several groups based on their weights. For measuring central obesity, hip circumference, WC, and WHR were used.

As a cutoff measurement, 102 centimeters in males were used as waist circumference. As a cutoff measurement for central obesity, 0.9 in men as the waist-hip ratio [10]. To exclude anatomical causes of infertility, an examination of the male urogenital tract was done. Moreover, other examinations of all other systems were also done.

After two to five of abstinence, the patients were advised to collect the semen. First, the liquefaction was done. Later, the Makler counting chamber was used to analyze the semen. A number of semen parameters were noted by using the Worth Health Organization criteria [11]. The parameters were the following; WHR, BMI, and semen parameters (total sperm count, immotile spermatozoa, sperm concentration, total progressive motility, and ejaculate volume). The frequency of males in each body mass index category was expressed as proportions, and the semen characteristics were expressed as means. To compare the proportions between the groups, a chi-square test was used. The means were compared using ANOVA. The important factors of poor semen quality were measured using logistic regression. Overall 95 percent confidence interval was used. 70 percent of power was consumed using OpenEpi software. SPSS version 23 was used to examine the data.

**RESULTS**

A total of 180 men were a part of this research. Out of 180 men, most of the males were from the age group ranging from 31 years to 40 years, which represents 60% of the total sample size (n=108). A total of 58 men were from the age group 20 to 30 years while only 14 men were from the age group 41 to 50 years. Table number 1 shows the characteristics of those enrolled in this research. The majority of the men (n=144) were having primary infertility, representing 80% of the total sample size. Overall 25 percent of men consumed alcohol while 20% of men were involved in smoking. Table number 2 shows the BMI and the number of males with sperm count and sperm concentration. The majority of the men were having a body mass index of 23 to 27 kg/m<sup>2</sup>, representing 51.5% of the total sample size. A total of 27 males were having sperm concentration, representing 15% of the sample size. On the other hand, a total of 35 men with sperm counts, represented 19.4 percent of the sample size. The waist-hip ratio was seen in the majority of the men. There was a negative link seen between semen parameters and WHR. Table number 3 shows the relationship between waist-hip ratio and waist circumference with semen parameters.

Table 1: characteristics of those enrolled in this research

Characteristics	Frequency (n)	Percentage (%)
Age (Years)		
20-30	58	32.2
31-40	108	60
41-50	14	7.8
Infertility type		
Primary	144	80
Secondary	36	20
Features		
Childhood illness	2	1.1
Smoking	36	20
Ejaculation disorder	1	0.5
Diabetes mellitus	9	5
Consumption of alcohol	45	25
Chronic drug intake	11	6.1

Table 2: BMI and the number of males with sperm count and sperm concentration.

Body mass index (kg/m <sup>2</sup> )	Frequency (n)	No. of men with sperm concentration (n)	No. of men with sperm count (n)
<18	7	0	0
18-23	41	7	11
23-27	92	12	17
>27	40	8	7
Total	180	27	35

Table 3: The relationship between waist-hip ratio and waist circumference with semen parameters.

Variables	N	N
WHR	<0.9 (n= 38)	>0.9 (n=142)
Sperm concentration	12	21

Total sperm count	16	27
Total motility	14	20
Total progressive motility	20	34
WC	<102 (n=166)	>102 (n=14)
Sperm concentration	31	2
Total sperm count	41	2
Total motility	30	4
Total progressive motility	49	5

**DISCUSSION**

Nowadays, obesity is a common issue which is increasing everyday globally along with a number of non-communicable diseases [12]. Due to obesity, the reproductive systems of men and women are also affected adversely. There was a research study conducted in which the odds ratio of infertility among couples were studied. It was shown that the ratios were 2.74 and 1.41 where both of the partners were obese. The study also shows that the odds ratio of subfertility was more in females than males [13]. It is very common that obesity has a negative impact on the female reproductive system. Similar to this, it is also found that the hormonal milieu in men and their reproductive systems are also disturbed by obesity and the results are alteration in semen parameters. In order to have a significant positive correlation with the increase of sperm concentration in men, the time period of pregnancy was recorded. Male fertility is also negatively impacted by obesity.

The BMI was in the lower range for those men who have already been fathers to a child before. The obese males who were fertile also have lower sex hormone binding globulin (SHBG), inhibin B, testosterone levels, and total sperm count. In some research studies, it was concluded that there was a link between low sperm count and both low and high body mass index [14]. This has increased the importance for males to have a normal weight. In a research study, the occurrence of infertility among couples was shown to be 12 percent [15]. There was a trend seen which showed an association between higher BMI and increased infertility. The men with higher BMI had an odds ratio of 1.36. The LIFE study's data analysis revealed a negative link between body mass index and sperm concentration and total sperm count.

Another research was conducted which showed the occurrence of oligozoospermia in overweight men [16]. The occurrence was 15.62 percent and 9.52 percent, respectively. The incidence of oligozoospermia was increased with the increase in body mass index. The odds ratio of abnormal sperm morphology and oligozoospermia was 1.6 and 3.3. There was also a negative relationship seen between body mass index and total motile sperm. The sperms were reduced when the weight was increased. Another similar research was conducted which showed a negative link between total sperm motility and body mass index. However, the link between total sperm concentration and BMI was not found [17].

In our research, the prevalence of obesity was 20% and there was no relationship shown between semen parameters and body mass index. Similar to our research, there are a number of other research studies that also show no link between semen parameters and BMI. There was research conducted which included 1400 subfertile couples which showed a 10.4% prevalence of obesity [18]. The research shows no link between sperm concentration, sperm morphology, and percentage of motile sperm with body mass index. Similar studies where men attended infertility clinics also showed no link between sperm count and body mass index. There was also one research conducted that also showed no relationship between BMI and semen parameters. However, one thing that was noted in obese men was high sperm DNA damage in semen parameters [19]. There was also a negative impact on the male reproductive system seen in overweight men. There was a decrease in SHBG, testosterone levels, and Inhibin B levels, respectively. Similar studies were conducted which showed similar results of no link between semen

parameters and body mass index but showing a negative association between SHBG and testosterone levels and BMI.

The BMI of the patients was calculated based on their weight and height. It is an inexpensive tool to examine obesity. However, it is not a specific marker of central obesity. The measures of central obesity are waist-hip ratio (WHR) and waist circumference (WC). They both overcome the disadvantage of body mass index.

The research that we conducted evaluated the effect of WHR and WC on semen parameters. 7.7 percent of men showed waist circumference above 102 cm. No significant relationship was seen between semen parameters and waist circumference. The LIFE study's analysis showed that there was no significant association between semen parameters such as motility, DNA fragmentation, morphology, sperm concentration and waist circumference. However, a linear relationship was seen between sperm count and waist circumference [20]. Moreover, it was also shown that men who have lower sperm count had higher waist circumferences and the odds ratio was higher. Another study concluded that men who have higher waist circumference had lower sperm concentration, lower total motile sperm count and total lower sperm count. Another measure of central obesity is the waist-hip ratio. The majority of the men had a waist-hip ratio of less than 0.9. Our research shows a significant negative relationship between semen parameters and waist-hip ratio.

The limitations of this research was that the effect of obesity on sperm morphology was not evaluated and only single sperm sampling was considered. Moreover, the effect of obesity on reproductive hormone levels was also not evaluated in this research.

## CONCLUSION

We conclude that there is a negative relationship between semen parameters (total sperm count, total motility, sperm concentration, and total progressive motility) and waist-hip ratio. Moreover, waist circumference, semen parameters, and body mass index showed no relationship between them. Unlike other research studies, our research study has the benefit of classifying men according to their body mass index set for Asian standards. It is because at a lower body mass index, mostly Asians are predisposed to a number of non-communicable diseases in comparison to other ethnic groups. Furthermore, there are limited research studies that focus on central obesity such as hip circumference, waist circumference, and WHR and study their impact on semen parameters.

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