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Examining the association of body mass index and waist circumference with semen analysis parameters among infertile men

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ABSTRACT

This study aims to investigate the relation of body mass index and waist circumference with semen analysis parameters in infertile men referred to Infertility and Urology Clinic of Golestan Hospital of Ahvaz. Infertility refers to the inability to give birth after one year of unprotected sex. Infertility affects about 15% of couples with 50% due to male infertility. This study is a descriptive study. 200 men with the BMI of 17-41 and age of 20-45, who referred for male infertility and have no exclusion criteria, are selected. Body mass index, waist circumference and semen analysis parameters (semen volume, pH, and the total number of sperms per milliliter, percentage of sperm morphology and sperm motility) of each person are determined. Pearson correlation test is used to determine the relationship of body mass index and waist circumference with semen analysis parameters. There is a significant difference in the total number of sperms among different BMI groups. Sperm morphology, the number of sperms and semen volume show no significant difference based on BMI groups. The present study shows a significant negative correlation between the number of sperms with body mass index (p=00.0, r =-0.340) and waist circumference (p=0.00, r=-0.321). However, there is no significant correlation between body mass index and waist circumference with the total number of motile sperms, type of sperm motility, semen volume and sperm morphology. There is a significant relationship between body mass index and waist circumference with the total number of sperms.

Keywords: Body mass index, Waist circumference, Semen analysis parameters.

INTRODUCTION

Infertility or reducing it is one of the biggest challenges facing medical researchers. Infertility refers to the inability of a couple to conceive a child after one year of intercourse without using means of preventing pregnancy.10-15% of couples suffer from infertility which is so important that it has been estimated that one in six couples is infertile and therefore it is an important part of clinical medicine for many doctors. Men are responsible for 30% as a result of fertility disorders and 20% is because of both sides. Thus, male fertility disorders account for 50% of the couple's infertility. The cohort study conducted between 2004 and 2005 in 28 provinces of the country showed that the prevalence of primary infertility (one or two years of unprotected sex since marriage) was 9.24% during life and 3.4% for a period of one year.

In men, semen evaluation (analysis) is used as a first step toward infertility evaluation, which is a rather simple and inexpensive on-invasive method. Factors that can affect semen parameters include weight gain, hormonal and genetic problems, radiation, trauma, certain surgeries such as vasectomy and varicocele, smoking and environmental toxins.

Based on recent studies, there has been a downward trend in the quality of men's semen, which coincides with the obesity epidemic, making the population of obese people in the world reach 315 million people. Obesity affects secretory pulses GnRH-LH/FSH that can disturb the function of Leydig and Sertoli cells, the release of sex hormones and sperm maturation. The conversion of androgen to estrogen in the fat tissue may increase leptin production and can crush

pituitary (gland) function by creating disruption in the negative feedback of testicles. The Setrumleptin level in obese people increases and this causes Leyding cells to produce less testosterone, which leads to the disruption in sperm maturation. Also, because of the levels of immunoglobulin B decreased, Sertoli cell function in obese people is disrupted.

Jensen et al reported that 24.4% of obese men have sperm concentration below 20 million per millilitre, whereas it is only 21.7% in people of normal weight. Unlike their study, Magusdottir did not report a significant reduction in semen parameters in obese men. Given the differences of opinion on various investigations into the association of body mass index with changes in semen-analysis parameters, this study aims to investigate the relation of body mass index and waist circumference with semen analysis parameters

In infertile men referred to the Infertility and Urology Clinic of Golestan Hospital of Ahvaz, to, if there is a significant relation and there is proof that changes in the size of semen parameters along with increasing body mass index and waist circumference, lead to an increase in infertility, provide appropriate solutions preventing these causes [1].

MATERIALS AND METHODOLOGY

The present paper is an epidemiological study. 200 men with the BMI of 17-41 and age of 20-45, who referred for male infertility and have no exclusion criteria, are selected and studied. These married couples have tried for a baby for a year or more, but without success, so they were studied in these centers so as to find the cause of infertility. In order for the participants to willingly cooperate, the study aim was explained to them and informed consent was obtained from all the participants. The exclusion criteria included history of trauma, history of drug use, drugs and smoking, radiation and chemotherapy, job stress, death of loved ones, legal conflicts, azoo spermia and diseases such as diabetes and varicocele.

On the day of the visit to the doctor's office

biographies of the patients were collected by the doctor. The weight of the patients with minimal clothing and no shoes was accurately measured by the use of scales and their heights were measured with an error of one centimetre while standing with no shoes using a wall mounted stadiometer, as the hips, shoulders and heels were against the wall and the head looking ahead. The body mass index was calculated based on the ratio of weight to height (kg/m2). Then, the waist circumference (WC) regarding the last rib and the iliac spine with a normal exhalation of breath was measured in centimeters by a plastic tape measure with an error of one centimeter. To reduce the error of observation, with the help of only one person, the data were collected. In this study, BMI classifications of the World Health Organization were taken into account. Accordingly, the body mass index of less than 18.5 was considered as underweight, 18.5-25 as normal weight, 25.1-30 as overweight and above 30 as obese. Also, a semen sample for analysis and evaluation of semen volume, viscosity, color, PH, the number of sperms per milliliter, the percentage of the sperm shapes and sperm motility was taken. All the semen samples in a single laboratory by a single specialist meeting the requirements (in a warm environment) were prepared. In the event of disruption of the semen criteria, including volume (less than 2 ml), sperm count (less than 20 million per milliliter), motility percentage (less than 40%), natural shape (less than 30%), which are based on the World Health Organisation 2010, for a second time, the semen samples were taken and if they were the same as the first samples, the individuals were allowed to take part in the study.

The data collected was analyzed through SPSS Version 20, using statistical tests such as T Test, ANOVA and Pearson correlation coefficient. The significance level was set at 5% [2-5].

RESULTS

In this study, 200 patients who were referred to Golestan hospital as they had infertility problems were chosen. The mean body mass index, waist circumference and semen parameters of the patients studied. 4 patients (2%) have a body mass index of less than 18.5 kg per square meter, 53 patients (26.5%) have a body mass index of 18.5 – 25 kg per square meter, 91 patients (45.5%) have a body mass index of 25.1 –30 kg per square meter, and 52 patients (26%) have a body mass index greater than 30 kg per square meter. 79 patients have a waist circumference from 94 to 121 cm, and 121 patients have a waist circumference greater than 94 cm. Mean ± Variable Standard Min. Max. Deviation Body mass 27/55±4/49 index (kg / 15.6 40 m²) The total 25/14±18/03 number of sperms 1 98 (millions per milliliter) PH semen 7/86±0/17 6 8 Sperm 9/81±16/21 morphology 0 80 (percent) Sperm 24/48±14/84 motility 0 74 (percent) Waist 95/87±12/10 circumference 66 131 (cm) Semen 3/26±1/53 0.50 8.30 volume (ml)

According to the total number of sperms was significantly different in groups of body mass index ($p < 0/05$). There is no significant difference between sperm morphology, sperm motility and semen volume based on different groups of body mass index. According to the graph, the total number of sperms in the underweight group was significantly higher than that of the normal and overweight groups ($p < 0/05$). Although the total number of sperms in obese and overweight groups was lower than that of the normal group, it was not significant.

Semen parameters (mean ± SD) BMI groups The total number Sperm Sperm motility Semen volume of sperms morpholog y Underw ±18/69 ±13/84 ±18/35 ±0/47 eight (4 patients 69/75 7/25 15/50 2/50) Normal ±21/03 ±12/72 ±15/87 ±1/62 (53 patients 28/62 7/37 23/39 3/23) Overwe ±15/14 ±18/17 ±14/39 ±1/54 ight (91

patients 23/75 11/04 25/45 3/43) Obese ±14/14 ±15/98 ±14/39 ±1/45 (52 patients 20/65 10/32 24/57 3/06) Signific *0/00 0/62 0/54 0/381 ance.

Shows the average (mean) number of sperms based on different groups of waist circumference. According to the results given in the table, there is a significant difference between the total number of sperms in the normal and obese groups ($p < 0/05$).

The number of motile sperms and semen volume ($r = 0.167$, $p = 0.018$). There is a positive significant relationship between body mass index and waist circumference ($r = 0.824$, p The total number of sperms Variable (Mean ± SD) Normal (79 patients) 30/12±22/0 5 Waist circumference Obese (121 patients) 21/90±14/00 Significance *0/01.

The results related to the correlation between body mass index and waist circumference with semen parameters are shown in Table 4. According to the results given in the table, while there is a significant positive relationship between the total number of sperms and sperm morphology ($r = 0.173$, $p = 0.014$) and the total number of motile sperms ($r = 0.245$, p 0.000), there is a negative significant relationship between the total number of sperms and body mass ($r = -0.340$, $p = 0.000$) index and waist circumference ($r = -0.321$, $p = 0.000$). There is a significant positive relationship between sperm morphology and the sperm motility ($r = 0.175$, $p = 0.013$). There is a significant positive relationship (0.000). Based on the results, body mass index and waist circumference were not significantly related to the sperm motility, sperm morphology and semen volume. The correlation between body mass index and waist circumference with the variety of sperm motility. According to the results given in there is no significant relationship between waist circumference and body mass index with different kinds of sperm motility. There is a significant relationship between non progressive, rapid progressive, progressive and slow progressive [6, 7].

DISCUSSION

This study aims to investigate the relation of body mass index and waist circumference with semen analysis parameters in infertile men referred to Infertility and Urology Clinic of Golestan Hospital of Ahvaz. In this study, the participants, who were referred to the clinic as they were suffering from infertility, were categorized according to BMI such that those with a BMI offewer than 18.5 kg per square meter were classified as underweight, between 18.5 and 25 kg per square meter as normal weight, between 25.1 and 30 kg per square meter as overweight, and over 30 kg per square meter as obese. Also, abdominal obesity was considered bya waist circumference criterion of more than 94 cm.4 patients (2%) have a body mass index of less than 18.5 kg per square meter, 53 patients (26.5%) have a body mass index of 18.5 – 25 kg per square meter, 91 patients (45.5%) have a body mass index of 25.1 – 30 kg per square meter, and 52 patients (26%) have a body mass index greater than 30 kg per square meter. 79 patients have a waist circumference from 94 to 121 cm, and 121 patients have a waist circumference greater than 94 cm.

According to the results obtained, there is a significant difference in the total number of sperms in different groups such that the total number of sperms in the underweight group is significantly higher than that of the normal weight, overweigh, and obese groups. However, there is no significant difference in the normal weight, overweight and obese groups. In addition, there is no significant difference in sperm morphology, the sperm motility and semen volume based on different groups of body mass index. The average (mean) number of sperms based on different groups of waist circumference is significantly different and it is significantly different in the normal group from the obese group. Examining the relationship of body mass index, waist circumference and semen analysis parameters (semen volume, pH, the total number of sperms per milliliter, percentage of sperm morphology and sperm motility)shows that there is a significant relationship between the total number of sperms and body mass index ($r = -0.340$, $p = 0.000$) and waist circumference ($r = -0.321$, $p = 0.000$). There is no significant relationship between body mass index and waist circumference with the sperm motility, sperm morphology and semen volume. Moreover, there is no significant correlation between waist circumference and body mass with the variety of sperm motility.

The association of body mass index and waist circumference with semen parameters in a number of studies has been investigated, some of which show no correlation, while others do. In the paper of Eisenberg et al, which was a study done over 501 couples referred to infertility clinics, it was observed that there was a significant relationship between increased body mass index and waist circumference with semen concentration, morphology, and sperm motility and viability. Aggerholm et al concluded that concentration and the number of sperms in overweigh people (Body Mass Index of 25.1 - 30 kilograms per square meter) had no significant relationship in comparison to people with a normal BMI. Hajshafiha et al in 2010 (solar year 1389) reported that body mass index has no significant relationship with semen parameters. In the study of Bazargani et al in 2013, body mass index had no significant difference with semen parameters including the number of sperms, motility, and sperm morphology. In a cohort study between 2000 and 2007, which was done on 1466 men referred to with infertility problems, Duties et al reported that semen parameters did not have a significant difference in people with a different BMI. Also, multivariate analysis (linear model) and modified confounding factors did not reveal a significant relationship between BMI and semen parameters. Mac Donal in 2010, in a meta-analysis study, studied the effect of body mass index on

semen parameters in men of productive age. 31 studies were conducted over the association of body mass index with semen parameters and sex hormones. The results of showed that semen parameters were not significantly associated with body mass index. Pauli et al carried out a study on 87 men referred to the infertility clinics of Pennsylvania in 2008 and reported that semen analysis parameters including sperm concentration, semen volume, sperm motility, the total number of motile sperms and the number of sperms did not have a significant relationship with body mass index. Furthermore, Koloszar in 2005 suggested that the total number of sperms in groups with BMIs of fewer than 20, 20.1 – 25, and 25.1 – 30 did have a significant relationship with each other, whereas in the group with a BMI of over 30, it was significantly higher than other groups.

This is while Najafi et al in a study in 2011 reported that the number and the motility of sperms in overweight and obese men decreased. Also, in the study of Jensen et al in 2014, men with a BMI of over 25 kg per square meter had a 21.6% decrease in the number of sperms and a 23.9% decrease in sperm concentration compared to men with a BMI of 20-25 kg per square meter. Hammoudet all in their study conducted in 2008 suggested that the incidence of oligospermia and the prevalence percentage of immovable sperms significantly increased as the BMI increased. Balloc et al in a cohort study carried out between 2010 and 2011 reported the effect of body mass index and semen parameters evaluated over 10655 individuals. They concluded that semen volume increased in men with a normal BMI from 1.6 ± 3.3 milliliter to 1.6 ± 2.7 in men with a BMI of over 40 kg. Moreover, semen concentration, the total number of sperms and sperm motility significantly decreased as the BMI increased. As BMI increased, the percentage of azoospermia increased from 1.9% to9.1% respectively.

The differences observed in various studies may be related to the population investigated in these studies. For example, in a study carried out by Jensen et al in 2014, which reported a significant difference between semen parameters and BMI, 76% of the participants were 18-20 years old and their average (mean) body mass index was 22.4 kg per square meter. The number of participants with a BMI of fewer than 20 kg per square meter was 217, with a BMI of 20.1-25 kg per square meter was 1042, and with a BMI of more than 25 kg per square meter was 299. In their study most young people with a normal body mass index were studied. In a cohort study conducted by Duits et al between 2000 and 2007, which showed no significant relationship between body mass index and semen parameters, the number of participants with a BMI of fewer than 20 kg per square meter was 18, with a BMI of 20.1 – 25 kg per square meter was 355 and with participants with a BMI of more than 25 kg per square meter was 419. In their study, the number of people with a BMI of 25 kg per square meter was larger. In a cohort study done by Aggerholm et al between 1992 and 2005, they reported that there was no significant relationship between body mass index and semen parameters. In their study, the number of participants with a BMI of fewer than 20 kg per square meter was 67, with a BMI of 20.1 – 25 kg per square meter was 986, with a BMI of 25.1 – 30 kg per square meter was 733, and the number of participants with a BMI of more than 30 kg per square was 171. In their study, the highest frequency was for the people with a body mass index of more than 25 kg per square meter. In the present study, 4 patients (2%) have a body mass index of less than 18.5 kg per square meter, 53 patients (26.5%) have a body mass index of 18.5 – 25 kg per square meter, 91 patients (45.5%) have a body mass index of 25.1 – 30 kg per square meter, and 52 patients (26%) have a body mass index greater than 30 kg per square meter. Also, in the present study, the number of patients with a body mass index of more than 25.1kg per square meter is larger. [8, 9].

CONCLUSION

This study showed a significant relationship between waist circumference and body mass index with the total number of sperms, but revealed no significant relationship between BMI and waist circumference with the motility,varity motility, semen volume and semen morphology. Therefore, it is recommended that the same study be conducted but with a larger and more homogenized population.Even in the absence of a significant relationship between BMI and waist circumference with semen analysis parameters, couples are advised to lose weight and maintain a healthy weight so as to prevent myriad complications of obesity and related diseases.

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