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Original Research

Study of the relationship between anthropometric indices and the status of sperm in infertile men referred to IVF center of Fatemieh hospital, Hamedan

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ABSTRACT:

Infertility is one of the most common problems in the present day society that the stress arising from it reduces confidence, increases anxiety and, finally, decreases erectile dysfunction. Furthermore, having experienced the grief of not having children cause families to suffer from various physical and mental problems so that the psychological pressures and nervous tensions associated with infertility is devastating. Considering the importance of this issue, this study aimed to investigate the relationship between the anthropometric indices and the status of sperm in infertile men. 350 infertile men were participated in this cross-sectional study. Ensuring the absence of any other disease, demographic and anthropometric data (weight, height), body fat percentage, and sperm parameters were collected. In this study, SPSS.16.5 software was used for statistical analysis. In order to compare quantitative traits the Pearson correlation test was used. To compare quantitative traits, such as sperm, at different levels of BMI and/or body fat percentage, the analysis of variance (ANOVA) and T- test were also used. In this study, no statistically significant relationship was observed between BMI and sperm parameters, but there found relation between fat mass percentage and sperm count. It is necessary to encourage them to do physical activity and use proper nutrition.

Keywords:
Anthropometric, Body Mass Index (BMI), Sperm, Infertility

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INTRODUCTION

Infertility is one of the individual and social problems that can lead to the loss of stability of the family. Over the last decade, researchers found that at least one-third of infertility problems are related to men and in 20% of the cases, the cause of infertility involves both male and female (Meybodi and Aflatounian, 1996).

In 1998, a study was conducted to evaluate the primary infertility in Tehran. The general fertility rate was reported to be 21.9% (Barooti, 1999). Another study in 1999 was conducted on 1174 women in the Western parts of Tehran, among which 12.7 of the participants were infertile patients. This study also revealed that 98 women (8.3%) had experienced primary infertility and 43 (3.7%) of them were experiencing secondary infertility (Nojoumi *et al.,* 2002). The estimated infertility rate has been reported to be 9 - 22% in Iran (Rojouei, 1997).

In those suffering from infertility problems, the grief associated with not having a child leads to various physical and mental problems. Thereby, the psychological pressure and nervous tensions, as a result of infertility, may have the similar effect as of chronic diseases such as cancer, heart attack, high blood pressure and chronic pain (Moein, 2001). The stress associated with infertility can contribute to the reduced self-esteem, increased anxiety and eventually cause erectile dysfunction (Seibel, 1997).

In vitro fertilization and intrauterine insemination and other advanced techniques to treat infertility has opened a new gate of hope for infertile couples (Küchenhoff, 1999). Although infertility treatment is physically stressful, lack of infertility treatment is followed by anxiety, more than any other type of disease, and threats the mental health of infertile couples are affected. Although obesity is a known risk factor for infertility in women (Pasquali *et al.,* 2003), the effect of obesity on sperm count still remains an issue of widespread debate in males (Jensen *et al.,* 2004).

In many studies, obese samples or those with weight gain were reported as having normal semen quality. However, one must take into account that nutritional factors and lifestyle are associated with obesity or weight gain. It is also noteworthy that the reduction of normal morphology of sperm in men with a higher body mass index has also been observed (Magnusdottir *et al.,* 2005; Macdonald *et al.,* 2013; MacDonald *et al.,* 2010; Feldman *et al.,* 2000). The relationship between obesity and erectile dysfunction has been frequently discussed. Accordingly, among those diagnosed and experiencing symptoms of erectile dysfunction, 79% were obese or had weight gain.

The relationship between obesity and erectile dysfunction is expressed, to some extent, by the increased levels of several pro-inflammatory cytokines in obese people. Such markers of inflammation are positively associated with endothelial dysfunction, which acts directly with erectile dysfunction through nitric oxide (Sullivan *et al.,* 1999). It is well known that erectile dysfunction is associated with infertility. In one study, 27% of infertile men are reported as experiencing erectile dysfunction compared to 11% of the fertile controls (O'BRIEN *et al.,* 2005). In one Health Study, obesity was associated with a 1.3 relative risk of erectile dysfunction (Bacon *et al.,* 2003). Among other genetic factors contributing to obesity and male infertility, one can name the Bardet-Biedl and Laurence-Moon syndromes, which are associated with fatal obesity (Mohsin, 2003). The physical and chemical factors in the environment also impact the fertility in males, as well (Oliva *et al.,* 2001).

MATERIALS AND METHODS

This cross - sectional study included all infertile men (N = 350) in year 2007 referring to the Infertility Center of Fatemieh Hospital- Hamadan. None of these people had a history of specific diseases and all were satisfied to enter into the study. Male infertility was

Table 2. Comparison of the sperm count means according to the BMI of infertile men

BMI	Number	Mean	Std	F	P-Value
Underweight	42	10^6×96.28	10^6×58.11	0.58	0.62
Normal	127	10^6×85.66	10^6×42.54	0.58	
Overweight	142	10^6×91.72	10^6×56.68	0.58	
Obese	39	10^6×90.33	10^6×41.28	0.58	

defined as the inability to conceive a pregnancy after a year of intercourse without contraception (Meybodi and Aflatounian, 1996). For the observation of ethical principles, the participant was given written consent after providing them required explanations.

Since the age and duration of infertility are not factors involved in male infertility (Khalili *et al.,* 2001), therefore people of different ages were selected in this study. Demographic factors were collected using a questionnaire; anthropometric parameters were measured by standard means as well, and semen analysis was also done by hand. Also, Body Mass Index was calculated according to the formula BMI = (Weight in Kilograms / (Height in Meters x Height in Meters) (Eisenberg *et al.,* 2014).

The body fat percentage was measured using the Bioelectrical Impedance (BI) method by means of Omron's body composition monitor (Raustorp *et al.,* 2006).

SPSS 16.0 software was used for statistical analysis. The Pearson correlation test was used to determine the correlation between quantitative traits. The t-test and analysis of variance (ANOVA) were used to compare body fat percentages and quantitative traits such as sperm counts at
different BMI levels.

RESULTS

The average age of participants was 32.6 years. The minimum and maximum ages were 17 and 75 years respectively. As it can be seen in table 1, the mean, body mass index was 25.2 kg/m^2, and minimum and maximum body mass indices were 14.7 kg/m^2 and 48 kg/m^2, respectively.

In terms of body mass index, 12% of subjects were underweight (BMI <20) 36.3% were normal weight (BMI =20-24 .9), and 6/40% were overweight (BMI =25-29. 9). Additionally, 11.1% were obese (BMI> 30) in which the majority (51.7%) normal weight (Table 1).

According to table 2, no statistically significant relationship was observed between BMI and sperm count, sperm motility, mean, semen volume, semen concentration and the morphology of sperm in infertile men.

The results represented in table 2 indicate that, when significance level is set at .05, it seems that mean count of sperms for four mentioned subgroups are statistically equal. That is because the P-value (0.62) is higher than the significance level (0.05).

The results represented in table 3 indicate that, when significance level is set at .05, it seems that mean mobility of sperms for four mentioned subgroups are statistically equal. That is because the P-value (0.374) is higher than the significance level (0.05).

The results represented in table 4 indicate that, when significance level is set at .05, it seems that mean semen volume for four mentioned subgroups are statistically equal. That is because the P-value (0.253) is high-

Table 1. Distribution of BMI among infertile men

BMI category	Number	Percent
Underweight<20 BMI	42	12
Normal weight BMI(20-24/9)	127	26.2
Overweight BMI(25-29/9)	142	40.6
Obese BMI>30	39	11.1

Table 3. Comparison of the sperm motility

BMI	n	Mean	Std	F	P-Value
Underweight	42	29.28	15.14	10.42	0.374
Normal	127	33.3	17.52		
Overweight	142	34.35	16.99		
Obese	39	31.76	17.61		

Table 4. Comparison of the Semen volume of infertile men according to the BMI

BMI	n	Mean	Std	F	P-Value
Underweight	42	2.95	0.76		
Normal	127	2.88	0.99	1.367	0.253
Overweight	142	3.11	1.04		
Obese	39	2.97	0.84		

Table 5. Comparison of the sperm morphology of infertile men according to the BMI

BMI	n	Mean	Std	F	P-Value
Underweight	42	17.02	5.11		
Normal	127	17.74	6.24	0.574	0.632
Overweight	142	17.64	6.51		
Obese	39	18.84	7.62		

Table 7. Classification of the infertile men according to BMI

Body fat percentage	%	N
Less than normal	14.9	52
Normal	52.00	182
Higher than normal	33.1	116

Table 9. Comparison of the mean sperm motility according to the body fat percentage of infertile men

Body fat percentage	P-Value	F	Std	Mean	N
Less than normal			17.54	34.82	52
Normal	0.708	0.345	17.02	32.59	182
Higher than normal			16.99	33.04	116

er than the significance level (0.05).

The results represented in table 5 indicate that, when significance level is set at .05, it seems that sperm morphology for four mentioned subgroups are statistically equal. That is because the P-value (0.632) is higher than the significance level (0.05).

The results represented in table 6 indicate that, when significance level is set at .05, it seems that Semen concentration of infertile men attending Fatemieh infertility center for four mentioned subgroups are statistically equal. That is because the P-value (0.33) is higher than the significance level (0.05).

The average body fat of the samples was17.63%. The highest sperm count (90.74×10) was observed in people with normal body fat percentage. Those with body fat percentage of less than normal had the lower sperm count accordingly

No statistically significant correlation was observed between body fat percentage and sperm count, sperm motility, mean, semen volume, sperm concentration and morphology of sperm among infertile men (Table 7).

The results represented in table 8 indicate that, when significance level is set at .05, it seems that mean sperm count according to the body fat percentage of infertile men attending Fatemieh infertility center are statistically equal. That is because the P-value (0.889) is higher than the significance level (0.05).

The results represented in table 9 indicate that, when significance level is set at .05, it seems that mean sperm motility according to the body fat percentage of infertile men attending Fatemieh infertility center are

Table 6. Comparison of the semen concentration of infertile men

BMI	P-Value	Semen concentration (S.W) N (%)	Semen concentration (T.H) N (%)	Normal semen concentration N (%)
Underweight			1(2.4%)	41(97.6%)
Normal	χ^2= 6.89	6(4.7%)	1(0.8%)	121(94.5%)
Overweight	df=6	5(3.5%)		137(96.5%)
Obese	p= 0.33			36(92.3%)
Total		14(4%)	2(0.6%)	334(95.4%)

Table 8. Comparison of the mean, sperm count according to the body fat percentage of infertile men

Body fat percentage	P-Value	F	Std	Mean	N
Less than normal			42.52×10	68.88×10	52
Normal	0.889	0.117	51.9×10	90.74×10	182
Higher than normal			52.05×10	89.99×10	116

Table 10. Comparison of the mean semen volume according to the body fat percentage

Body fat percentage	P-Value	F	Std	Mean	N
Less than normal	0.584	0.529	0.87	2.94	52
Normal			0.96	3.04	182
Higher than normal			1.04	2.93	116

Table 11. Comparison of the mean morphology of sperm according to the body fat percentage

Body fat percentage	P-Value	F	Std	Mean	N
Less than normal	0.894	0.112	5.63	17.59	52
Normal			6.13	17.89	182
Higher than normal			7.11	17.56	116

statistically equal. That is because the P-value (0.708) is higher than the significance level (0.05).

The results represented in table 10 indicate that, when significance level is set at .05, it seems that mean semen volume according to the body fat percentage of infertile men attending Fatemieh infertility center are statistically equal. That is because the P-value (0.584) is higher than the significance level (0.05).

The results represented in table 11 indicate that, when significance level is set at 0.05, it seems that mean morphology of sperm according to the body fat percentage of infertile men attending Fatemieh infertility center are statistically equal. That is because the P-value (0.894) is higher than the significance level (0.05).

The results represented in table 12 indicate that, when significance level is set at .05, it seems that mean semen concentration according to the body fat percentage of infertile men attending Fatemieh infertility center are statistically equal. That is because the P-value (0.36) is higher than the significance level (0.05).

DISCUSSION

In the evaluation of sperm counts, according to body mass index, the lowest amount was observed in normal weight individuals (66. 85×106), and the highest amount was reported in underweight individuals (28.96×106). Additionally, no statistically significant correlation was observed between BMI and sperm count in infertile men. By considering this case, our study was consistent with a number of previous studies (Magnusdottir *et al.,* 2005; Macdonald *et al.,* 2013; MacDonald *et al.,* 2010; Feldman *et al.,* 2000). However, it did not comply with some other studies (Tsao *et al.,* 2015; Eisenberg *et al.,* 2014; Sermondade *et al.,* 2012).

The highest percentage of normal morphology of sperm according to the body mass index was observed in obese patients (18/84), and the lowest amount was observed in underweight individuals (17/02). As well, no significant relationship was observed between BMI and normal morphology of sperm, which is consistent with the study of Jeansen (Jensen, 2004).

However, this is in contrary to the findings of Tsao *et al.* (2015). In the few studies, the relationship between body fat percentage and factors affecting semen quality has been investigated.

The highest sperm count was reported in individuals with normal body fat mass percentage, (10 × 74.90), and the lowest amount was observed in those with lower fat mass percentage (10 × 88.68).

In comparison of the semen volume, according to fat mass percentage, the highest volume was observed in the group with normal body fat percentage

Table 12. Comparison of the mean semen concentration according to the body fat percentage of infertile men

BMI	P-Value	Semen concentration (S.W) N (%)	Semen concentration (T.H) N (%)	Normal semen concentration N (%)
Less than normal	χ^2=4.3	2(3.8%)	1(1.9%)	49(94.2%)
Normal	df=4	5(2.7%)	1(0.5%)	176(96.7)
Higher than normal	p= 0.36	7(6.0%)	0	109(94%)

(3.04) and the lowest amount was observed in the group with fat content of higher than normal.

Nonetheless, there was no statistically significant relationship between semen volume and percentage of body fat. The highest percentage of normal morphology of sperm, according to the body fat percentage was observed in individuals with normal fat (17.89) and the lowest amount was reported in subjects with body fat content of more than normal (17.56). No statistically significant relationship between these two variables was observed as well. However, chih-wei Tsao *et al.* showed that the normal morphology of sperm is reduced by increasing the body fat percentage (Tsao *et al.,* 2015).

Since leptin is secreted by adipose tissue, the percentage of body fat may affect fertility through the secretion of leptin., Animal studies have also shown that with an increase in the percentage of dietary fat, the leptin levels are increased that can contribute to a reduction in sperm motility (Guo *et al.,* 2014).

The results of this study agree with a number of other studies, so that no reduction in the quality of morphology of sperm in men having a higher BMI was not observed (Pasquali *et al.,* 2003; Fejes *et al.,* 2005; Magnusdottir *et al.,* 2005; Macdonald, 2013; MacDonald, 2010; Jensen *et al.,* 2007). However, this is in contrary to some other studies.

CONCLUSION

Today, development of science and technology has demonstrated to the scholars of the field of infertility that infertility is not just a women's issue, but male factor also is involved. Despite the past declarations, doctors nowadays acknowledge that couples play the same role and women and men both allocate about 35 to 40 percent of the causes of infertility. Different factors of men's lifestyle can affect their fertility that obesity can be named among them.

The effect of obesity on the infertility associated with erectile dysfunction should be noted. This is because frequent studies have revealed symptoms of erectile dysfunction among obese men or those having gain weight (Eisenberg, 2014; Feldman, 2000). Therefore, the cause of infertility among some subjects in this study may be associated with erection dysfunction.

Among infertile men, the highest risk of mortality was observed in those having abnormal parameters of semen were exposed to a higher risk of mortality, which is suggestive of a common cause of infertility and mortality (Eisenberg, 2014).

Although in many studies, obese or overweight subjects had normal semen quality (Magnusdottir *et al.,* 2005; Macdonald, 2013; MacDonald, 2010; Feldman, 2000), but it is important to note that nutritional factors and lifestyle are associated with obesity, weight gain, and health of individuals.

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