

Male body mass index and sperm parameters

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Abstract

It is known that body mass index (BMI) correlate with female fertility; however, little information is available on the effect of BMI on male fertility or sperm parameters. Therefore, the study objective was to determine the relationship between BMI and sperm parameters. We analyzed data on sperm samples from 375 men who were grouped based upon calculated BMI values (normal, 20-24 kg/m²; overweight, 25-30 kg/m²; obese, >30 kg/m²). The data collected included patient height and weight, sperm concentration, percent sperm motility, percent of normal sperm morphology, and percent of ejaculate volum. Data were analyzed by Chi-Square and Fisher tests. The overall BMI mean (\pm SEM) was 27.01 (\pm 4.44) kg/m². There was no significant correlation between BMI and low sperm concentration ($p=.720$), low percent sperm motility ($p=.051$), abnormal percent sperm morphology ($p=.368$) and percent of low ejaculated volume ($p=.180$).

Keywords: obesity, body mass index, sperm parameter

Introduction

Overweight in women appears to be one of the major and neglected causes of infertility. The excessive amount and distribution of body fat is related to fertility loss⁽¹⁾. The percentage of body fat is estimated by calculated body mass index (BMI). Female patients presenting with high BMI values (>25 kg/m²) typically are insulin resistant, have polycystic ovarian syndrome and have poor fertility prognosis⁽²⁾. Obesity and overweight are the most frequent chronic medical problems and are characterized by excessive storage of adipose tissue in the organism⁽³⁾. Obesity is a well recognized risk factor for female infertility⁽⁴⁾. In contrast to effects on female fecundity, there is much less evidence that obesity adversely affects male fertility. Men with low BMI (<20 kg/m²) may present an abnormal sperm analysis and have low circulating testosterone levels. However, this may be attributed to physical factors of training⁽⁵⁾.

Over the years, a number of population-based studies have highlighted a trend towards deterioration in sperm quality⁽⁶⁾. It is believed that with the increasing prevalence of sedentary life styles and dietary changes, obesity is emerging as an important cause of adverse health outcomes, including male infertility⁽⁷⁾.

The purpose of this study was to determine the relationship between BMI and sperm parameters (low sperm concentration, low sperm motility, abnormal sperm morphology, and low ejaculate volume).

Material and methods

All of male partners who presented to our infertility center for infertility evaluation between 1 April 2010 and 1 January 2011 were included in this study, after obtaining their written agreement.

All of them were Iranians and Muslims. Sperm was collected from 375 normal, healthy men (mean age was 34.05 \pm 6.64 years and mean years of infertility were 4.8 \pm 2.4). Five men were excluded for reasons of: BMI <20 kg/m², smoking and alcohol use, substance abuse, suffering from known physical and mental diseases including all heart, renal and immune diseases, all kinds of cancers, hepatitis and diabetes mellitus and men who had previously experienced surgery in the

genital and pelvic area, including vasectomy, orchidopexy, hernia surgery, azoospermia and self-reported male sexual dysfunction. A single sperm sample was collected from each man. Patients' height (m) and weight (kg) were recorded on the day of semen collection. BMI was calculated for each patient as kg/m². Patients were grouped according to published BMI ranges as follows: normal (<25 kg/m²), overweight (25 \leq BMI< 30 kg/m²), and obese (\geq 30 kg/m²)⁽⁸⁾.

Sperm specimens were permitted to liquefy for 60 minutes at 37°C. Criteria parameters for a normal sperm analysis were evaluated according to World Health Organization (WHO) guideline⁽⁹⁾. An aliquot (~50 μ L) of sperm was smeared and stained via the HEMA-3 staining procedure. Smears were examined under oil immersion with bright light at 1000x. Each specimen had 150 cells systematically evaluated at the time of collection. Sperm morphology scores were determined by the Tygerberg "strict" criteria system⁽⁹⁾.

Sperm parameters (sperm concentration (in million per milliliter), percent sperm motility, percent sperm morphology, and percent of low ejaculate volume) were calculated and compared among the three BMI groups.

Data was recorded in the special forms according to our variables and analyzed by Chi-Square and Fisher Tests using SPSS version 7. Statistical significance was defined as $p < .05$. This study was achieved after getting the license from ethical committee of Islamic Azad University, Sari Branch, Iran.

Results

A total of 375 semen specimens were analyzed as described. There was no significant difference in patient ages ($p=.233$) among the different BMI groups.

The overall BMI mean (\pm SEM) was 27.01 (\pm 4.44) kg/m²; the results classifies the total group as overweight. The prevalence of low sperm concentration (<20 \times 106/mL) was 22.66% (83 of 375). The prevalence of low sperm motility (progressively motile sperm <10 \times 106) was 7.53% (32 of 375). The prevalence of abnormal sperm morphology (normal morphology <15%) was 21.03% (81 of 375). The prevalence of low ejaculate volume (semen volume <2 ml) was 5.7% (21 of 375) (see table 1).

Table 1 Sperm disorders among the three BMI groups (normal, overweight and obese)

Sperm disorders	Normal	Overweight	Obese	p
Low sperm concentration	28 (21.9%)	39 (23.8%)	16 (19.3%)	.720*
Low sperm motility	11 (8.6%)	19 (11.6%)	2 (2.4%)	.051**
Abnormal sperm morphology	24 (18.8%)	41 (25.0%)	16 (19.3%)	.368***
Low ejaculate volume	11 (8.6%)	6 (3.7%)	4 (4.8%)	.180****

*There was not significant difference in the prevalence of sperm concentration among the three BMI groups; **There was not significant difference in the prevalence of low progressively motile among three BMI groups; ***There was not significant difference in the prevalence of abnormal morphology among three BMI groups; ****There was not significant difference in the prevalence of low ejaculate volume among three BMI groups.

Discussion

Obesity and overweight are the most frequent chronic medical problems and are characterized by excessive storage of adipose tissue in the organism. They are recognized by WHO⁽⁹⁾ as a worldwide public health problem⁽¹⁰⁾.

In men with normal BMI values, all studied sperm parameters (low sperm concentration, low sperm motility, low sperm morphology and low ejaculate volume) were found highest than normal. Patients with overweight BMI presented almost double values of these abnormal sperm parameters, compared with the ones from normal BMI values; in obese patients, only the percent of abnormal sperm morphology (19.3%) and the percent of low ejaculate volume (4.8%) presented high values, the other parameters (low sperm concentration 19.3% and percent of low sperm motility 2.4%) presented very low values compared with normal BMI.

Jensen et al.⁽¹¹⁾ demonstrated that serum testosterone and inhibin B decreased with increasing BMI, whereas free androgen index increased with increasing BMI. They reported that semen volume and percentage of motile spermatozoa were not affected by normal BMI values, but men with a BMI >25 kg/m² (overweight and obese) had a reduction in sperm concentration, and motility. That study is in agreement with our results, in which in obese patients, incidence of low sperm concentration and percent of low sperm motility are decreased.

Chavarro et al.⁽¹²⁾ found that the measured volume of ejaculate decreased with increasing BMI, conclusion in agreement with our results and suggested that despite major differences in reproductive hormone levels with increasing body weight, only extreme levels of obesity may negatively influence male reproductive potential.

Hofny et al.⁽¹³⁾ reported that BMI correlated positively with abnormal sperm morphology and this increase with the increasing BMI values. This study is not correlated with our results, the obese patients presented a decreased incidence of abnormal sperm morphology, compared with overweight patients.

Studies carried out in infertile males have shown that a reduction in obesity is associated with an improvement in reproductive function^(14,15,16). There are several theories to explain the reasons behind the relationship between obesity and poor semen quality, and resulting poor male fertility: sperm chromatin integrity theory; hormonal imbalance theory; oxidative stress theory and increased scrotal temperature theory⁽¹⁷⁾.

Shayeb et al.⁽¹⁷⁾ who studied the sperm parameters showed that initial steps in treating infertility in obese men are counseling to reduce weight and change lifestyle; each one is likely to reduce the risk of chronic diseases associated with obesity. Our results showed that none of the parameters studied correlated positively with BMI values, the percent of sperm morphology in obese men seems not to be in agreement with previous studies. Despite results of other studies, in our study population sperm parameters were not affected by obesity. While normal body weight is clearly beneficial in terms of enhancing general health, more research is necessary to evaluate its role in male fertility⁽¹⁷⁾.

Conclusions

Contradictory to other authors, we were unable to show in the patients included in this study any statistical correlation between BMI and low sperm concentration, low sperm motility, abnormal sperm morphology and low ejaculate volume. ■

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