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Association between male body mass index and semen parameters

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ABSTRACT

Objective: Obesity is a modern-day epidemic. Body mass index (BMI) is an easily computed surrogate marker of obesity. The incidence of obesity has paralleled the incidence of male infertility. The evidence of the association between BMI and semen parameters stays rather inconclusive. The aim of this study was to understand the association between BMI and semen parameters of male subjects evaluated at the infertility clinic.

Materials and Methods: A prospective study was conducted on 410 male subjects (>18 years of age) who were referred to clinical pathology from the infertility clinic. Semen analysis for macroscopic parameters – total sperm concentration, motility, morphology, and viability, was done as per the guidelines laid by the WHO (WHO-5th edition 2010).

Results: All the semen parameters showed higher aberrations in the obese group than the normal BMI group. However, on Pearson Chi-square analysis, none of these differences were found to be statistically significant ($P > 0.05$). On Pearson correlation analysis, none of the parameters showed a statistically significant correlation with BMI.

Conclusion: The present study did not find any statistically significant differences for the commonly measured semen parameters, among the three BMI groups. We thus conclude that increased BMI or obesity has no significant impact on the semen parameters.

Keywords: Body mass index, Infertility, Semen analysis, Obesity

INTRODUCTION

Obesity was first considered as a major health problem by the World Health Organization (WHO) in 2000.[1] According to the data provided by the WHO 2013 and European Association for the Study of Obesity 2014, the prevalence of obesity in European countries is greater than 60%.[2,3] It is increasingly being seen that the obesity "epidemic" is not restricted to European and other developed countries but is also now a major health problem in developing countries.[4] The current WHO definition of obesity is based on a computation of body mass index (BMI) which is defined as the weight of an individual divided by the square of the body height, expressed in units of kg/m^2. A BMI exceeding 30 kg/m^2 qualifies as obesity.

Few studies from India have shed light on the exact disease burden of obesity. However, a recently conducted ICMR-INDIAB study has highlighted on a high prevalence of both generalized and abdominal obesity in the country afflicting both urban and rural areas.[5] This global rise in the incidence of obesity has paralleled the worldwide increase in male subfertility

and decreased sperm quality.[6,7] The relationship between semen parameters and BMI is less explored and the studies have been rather inconclusive. Indian data on this subject are further extremely sparse.[8]

MATERIALS AND METHODS

Study design and selection of subjects

A prospective study was conducted over a period of 6 months from May 2018 to October 2018. The study was given ethical clearance by the Ethical Committee of Human Research, Lady Hardinge Medical College. All men older than 18 years of age, evaluated at the institutional infertility clinic and referred to clinical pathology laboratory for semen analysis, were included in the study after obtaining bilingual, written, and informed consent. Exclusion criteria were (a) all men, whose female counterpart had evident pathology implicated as cause of infertility, (b) males with other risk factors that can cause subfertility: Smokers, alcoholics, diabetics, and chronic illness like tuberculosis, (c) patients with testicular pathology such as hydrocele or varicocele, (d) patients with any surgical history of the genital or pelvic area, (e) patients with azoospermia, (f) patients whom written consent is not available, and (g) patients in which pus cells were equal to or greater than 1×10^6 pus cells/ml, i.e., leukocytospermia.

Collection procedure

After obtaining the patient's informed consent, a detailed history of all subjects including their age, occupation, any prior illness/therapeutic interventions, addiction, drugs, and history was taken followed by routine general examination. Semen samples were collected in a widemouthed plastic container after 3 days of abstinence. Semen analysis for macroscopic parameters including total sperm concentration, morphology, motility, and viability was done as per the guidelines laid by the World Health Organization (WHO-5th edition 2010).[9]

The candidates were divided into three categories as per the WHO guidelines of BMI: The candidates with BMI of 18.5–24.99 kg/m^2 as normal range, BMI 25–29.9 as overweight, and a BMI of greater than or equal to 30 kg/m^2 as obese, respectively.

Statistical analysis

All data were documented and analyzed. Pearson Chi-square test was used to analyze the differences with $P < 0.05$ considered statistically significant. Pearson correlation coefficient and P value were also calculated to look for any statistically significant correlation ($P < 0.05$ was statistically significant).

RESULTS

Demographics (Distribution of age and BMI of patient cohort)

Over a period of 6 months, a total of 410 candidates were included in the study, age ranging from 20 to 49 years with a mean age of 30.37 years. On the basis of BMI, they were classified as per the WHO guidelines, into 220 normal, 138 overweight, and 52 obese, respectively.

Comparison of incidence of aberrant semen parameters among the BMI groups

The incidence of low sperm concentration, abnormal sperm morphology, low motility, and viability was higher in the obese group as compared to the normal reference group [Table 1]. However, none of these differences were statistically significant ($P > 0.05$).

On Pearson correlation analysis, all the measured parameters had weak negative correlation with BMI [Table 2]. However, the correlation was not statistically significant for any of the parameters ($P > 0.05$).

DISCUSSION

Infertility is defined as the inability to conceive after 1 year of unprotected intercourse. On a global level, 60–80 million people suffer from infertility every year, of which approximately 15–20 million are contributed by India alone.[10] Male infertility constitutes about 51.2%, according to a large WHO study.[11] In an Indian epidemiological study on male infertility, the cause of infertility was pure male factor in 31.6% and the problem lay with both male and female partners in 20.4%.[12]

Recent study shows that the prevalence of obesity in India ranges from 13% to 50% of urban and 8–38.2% of the rural population.[13] The paradigm shift to obesity can be attributed to sedentary lifestyle and consumption of energy-dense food.

BMI is an easily calculable factor, devised as weight in kilograms divided by square of height in meters. On the basis of BMI, population can be stratified to four categories as per the WHO into underweight, normal, overweight, and obese. Waist circumference and BMI are accurate, easy to obtain, and accurate markers of visceral adiposity.[14]

The increase in obesity has paralleled the increase in subfecundity. A complex interplay between various factors underlies male infertility. Obesity is known to increase the risk of erectile dysfunction.[15,16] Several studies have linked BMI with an altered hormonal milieu. Studies have associated increased BMI with reduction in testosterone and inhibin B, with an increase in serum estradiol.[17-20]

Table 1: Comparison of incidence of aberrant semen parameters among different BMI categories.

	Normal BMI, *n*=220/410	Overweight, *n*=138/410	Obese, *n*=52/410	*P*
Low sperm concentration (Million/ml) (%)	51/220 (23.2)	32/138 (23.2)	14/52 (26.9)	0.839
Low sperm motility (%)	101/220 (45.9)	66/138 (47.8)	29/52 (55.8)	0.441
Abnormal sperm morphology (%)	23/220 (10.5)	13/138 (9.4)	7/52 (13.5)	0.72
Low sperm viability (%)	121/220 (55)	83/138 (60.1)	36/52 (69.2)	0.155

Table 2: Correlation analysis and two-tailed test between BMI and semen parameters.

	Pearson correlation coefficient	*P* value
Total sperm concentration	−0.004	0.937
Motility	−0.039	0.434
Morphology	−0.006	0.899
Viability	−0.061	0.221

To date, no conclusive direct causal relationship between BMI and routine semen parameters is established. If a correlation is established, reduction of weight might be a conceivable intervention in increasing the chances of natural conception or the outcomes of assisted reproductive techniques. It, thus, becomes pertinent to unravel the connection. There are few studies on the topic and fewer so in India. The present study aimed to establish a connection between BMI and semen parameters in the male candidates referred to clinical pathology from the infertility clinic.

Hammoud *et al*., in 2008, concluded that obesity is associated with low sperm concentration and low progressive sperm motility.[21] In an Indian study, Waghmare *et al*., in 2014, demonstrated a statistically significant decline in sperm count per ml, total sperm count, motile sperm count per ml, and total motile sperm count from normal to the obese group.[22] Ajayi *et al*., in 2018, concluded that semen volume, sperm count, and motility were significantly lower in obese men.[23] Eisenberg *et al.,* in their LIFE study, demonstrated that semen volume showed a negative decline with BMI and waist circumference while waist circumference correlated with sperm concentration and total sperm count.[24] Jaffar, in 2016, showed that weight loss had significant positive correlation with the percentage of progressive motile sperm and percentage of static sperm.[25]

A recent meta-analysis by Macdonald *et al*. suggested that no association exists between BMI and seminal parameters.[26] Aghamohammadi *et al*., in 2014, concluded that there was no statistical correlation between BMI and sperm concentration, sperm motility, sperm morphology, or ejaculate volume.[27] Alahmar *et al*., in 2018, demonstrated that obesity did not have an effect on sperm concentration, motility, and morphology.[28] The present study is in concordance with the above studies.

CONCLUSION

The present study is one of the largest studies of the Indian subcontinent. This study shows that increased BMI or obesity does not have any impact on the semen parameters in males.

Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent forms.

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Nil.

Conflicts of interest

There are no conflicts of interest.

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