Impact of Obesity on Male Fertility in an Urban Nigerian Town

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ABSTRACT

Introduction: Obesity is gradually becoming an epidemic disease that is rapidly spreading in both developed and developing countries. Recently it has been linked with fertility problems in men. The aim of this study is to evaluate the effect of male obesity on semen quality.

Material and Methods: This was a prospective Cross-sectional multicenter study carried out over a period of six months (February to July 2011). Seminal fluid of 42 obese and 42 non obese male partners of infertile couples were analyzed.

Results: There was a statistically significant association between obesity, class of obesity with sperm count and motility (p = 0.0001, 0.0141, 0.0055, 0.0099) (All p > 0.005).

Conclusion: This study found obesity to be associated with poor semen quality. Hence tremendous efforts and health education is needed to curb the growing disease, obesity.

Keywords: Body mass index, male obesity, infertility, sperm quality.

INTRODUCTION

Available evidence suggests that male infertility is an important but neglected reproductive health issue in Nigeria.[1] Published studies indicate that the male factor is present in between 20% and 70% of the causes of infertility in different parts of the country.[2,3]

Studies from several populations around the world indicate that smoking[4], type of occupation[5], alcohol and coffee intake[5] and nutritional factors[6] affect male fertility. Several sexually transmitted bacteria such as Neisseria gonorrhoeae and Chlamydia trachomatis have been linked with reduced fertility because of reduced sperm function.[7] Important local factors include infection such as tuberculosis[8] which can directly or indirectly damage the male reproductive system.

Abnormalities in semen production and quality have however been the main problem in majority of cases.[9] This emphasizes the importance of seminal fluid analysis as an indispensable laboratory diagnostic procedure.[7,4]

According to a commonly used definition, obesity is said to be present when more than 20% of the body weight is due to fat in men.[9] Normal value of fat is 12-18% for men.[9] Normal height and weight tables are also used extensively but an index that correlates better to body fat is the Quetelet index or body mass index {which is the body weight (in kilogram) divided by the square of the height (in metre)}.[9,10] The normal value for this index is 20-25kg/m^2. Values greater than 30kg/m^2 denote obesity.[9,10] Obese class I is BMI of 30-34.9kg/m^2, obese class II is BMI of 35-39.9kg/m^2 and obese class III is BMI of 40kg/m^2.[10] In both sexes, obesity, particularly the abdominal obesity (truncal obesity) phenotype, may impair fertility.[11] This adverse effect appears to be mainly related to disorders of sex hormone secretion and/or metabolism, leading in turn to a condition of relative hyperandrogenism in obese women and of hypotestosteronemia (and in some cases, a true hypogonadotropic hypogonadism) in obese men.[11] These hormonal alterations may also play an important role in the pathophysiology of different obesity phenotypes and associated metabolic and cardiovascular co-morbidities.[11]

Obese men were found to exhibit reduced androgen and sex hormone binding globulin (SHBG) levels accompanied by elevated estrogen levels.[12,13] Reduced inhibin B levels correlate with the degree of obesity and are not accompanied by compensatory increase in FSH. The complexly altered reproductive hormone profile suggests that endocrine dysregulation in obese men may explain the increased risk of altered semen parameters and infertility. In other words, excess weight may be linked with altered testosterone, estradiol levels, poor semen quality and infertility.[13]

In view of the facts that the causes of male infertility are diverse, treatment of male infertility can be difficult and more importantly, the effect of obesity on semen quality has not been extensively studied in our sub-region before, it is imperative to undergo this study to generate local data, contribute to the global discourse on obesity and male infertility and invariably, improve male reproductive health care in this centre and society, at large.

MATERIAL AND METHOD

Setting

The study was a multi-Centre study conducted at the University of Ilorin Teaching Hospital, Ilorin, Kwara State, Nigeria and Centre's that offer management for infertility in Ilorin which are Anchor Medical Centre, Royal Medical Centre, Surulere Medical Centre and Mid-land Fertility Centre.

Study population

The study population were males with body mass index (BMI) greater or equal to 30kg/m^2 i.e obese male partners in infertile couples. The controls were non-obese male partners in infertile couples with BMI of 20-25kg/m^2.

Study design

The study was a prospective comparative analytical study. It involved recruitment of males attending these health Centre's for infertility who satisfied the inclusion criteria.

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Inclusion criteria

The participants were healthy male partners of infertile couples with no known medical illness such as diabetes mellitus, epilepsy and hypertension.

Sample size determination

Sample size was determined by the Fisher's formula[14]

$n = z^2 pq/ d^2$

Where n = sample size for the study

z = standard normal deviation (a constant) which is 1.96 at 95% confidence interval

p = the prevalence of obesity amongst males in Nigeria which is 2%

q = 1-p

d = observed difference of 5% or more taken as being significant

$n = 1.96^2 \times 0.02 \times 0.98$

$(0.05)^2$

n = 30

Provision was made for attrition by adding 40% of sample size i.e 12. Thus, making a sample size of 42 for the study and control groups respectively.

Sampling technique

This was by multi-stage sampling technique. The first stage was proportional allocation to get the number of subjects from each of the five study centres. The second stage was systemic sampling technique to select subjects that were used from each of the study centres. Sampling interval was one in every two. Over the period of study (February to July 2011), with a systemic random sampling technique of one in every two, 26 obese male partners of infertile couples were recruited from UITH, 13 from Mid-Land Fertility Centre and 1 from each of the other three centres.

Data collection

The selected patients were informed and counseled about the study. Only those who consented to participate in the fully explained study were included in the study.

Seven research assistants who were selected doctors, one from each of the three units in the department of Obstetrics and Gynaecology in UITH as well as one for each of the other four centres, attending to the couples regularly in the Gynaecology Clinics, were trained and educated prior to administration of questionnaire with the study objectives and protocol in mind. Their duty was primarily to help recruit patients based on the study criteria for the researcher. These patients were later seen by the researcher who also carried out the clinical examination on these patients. Two laboratory scientists (research assistants) from the department of microbiology in UITH, were involved in carrying out the analysis of the semen samples.

Collection and analysis of semen

The standard WHO guideline for semen analysis[15] was used. The participants abstained from sexual intercourse for three days before semen collection. The masturbation method was adopted for semen collection into the sterile wide mouthed container provided for the purpose. Semen sample was produced in a private room within the hospital and brought to the laboratory within thirty minutes of collection. The semen samples were examined within one hour of collection or as soon as liquefaction occurred.

The information obtained was coded and transferred onto a proforma already designed for the study. Approval for this study was obtained from the ethical committee of the University of Ilorin Teaching Hospital.

Permission to use other study sites was also obtained from constituted authorities. Patients' data were treated confidentially. The study was explained to the subjects and their written informed consent was obtained before inclusion into the study.

STATISTICAL ANALYSIS

Data analysis was carried out using Epi-info version 6.0 software package. Descriptive analyses was used, mean±standard deviation (minimum-maximum) and percentage (number), whereas intergroup comparisons were done using chi-square test. The $p<0.05$ was considered to be significant

RESULTS

During the six months study period (1st of February to 31st of July 2011) 84 male partners in infertile couples were involved in the study; 42 of whom were obese (study group) while the remainder (control group) had normal BMI (20-25kg/m^2).

Table-1 shows that the mean age of the obese males was 38.7 ± 6.3 years. Age group 30-34 years accounted for 26.2% while age groups 35-39years and 40-44years accounted for 23.8% respectively. The age group of 35-39 years accounted for the highest proportion in the control group (28.6%). As shown, no statistical significant difference was observed in the age. All the subjects that participated in the study had at least primary education. Most of the subjects, however, had tertiary education (64.3% of the obese and 71.4% of the control). As shown, no statistical significant difference was observed in the educational status distribution of study and control groups. The average BMI of the study group was 32.9 ± 2.8kg/m^2 while for the control while for the control was 22.4 ± 1.4kg/m^2. As shown, the difference is significant statistically.

Table-2 showed semen quality of study and control groups. The

Age group(y)	Obese (N-42)		Non-Obese (N-42)		p-value
25-29	2	(4.8)	3	(7.1)	*0.275
30-34	11	(26.2)	10	(23.8)	** 0.60
35-39	10	(23.8)	12	(28.6)	
40-44	10	(23.8)	10	(23.8)	
45-49	8	(19.0)	5	(11.9)	
50-54	1	(2.4)	2	(4.8)	
Mean	38.7±6.3		37.9±5.7		
Level of Education					
Primary	3	(7.1)	3	(7.1)	0.746
Secondary	12	(28.6)	9	(21.4)	**0.59
Tertiary	27	(64.3)	30	(71.4)	
					** 21.01

Table-1: Distribution of Sample size according to Age and Educational level

Parameters	Obese	Non obese	P value
Sperm Count (M/ml)	17.1 ± 12.3	43.4 ± 45.1	0.000
Sperm Motility (%)	37.4 ± 21.8	48.6 ± 20.8	0.014
*Values are reported as mean± SD			

Table-2: Semen quality of study participants

Group	Frequency (%)	BMI (Kg/m²)	Sperm Count (M/ml)	Sperm Motility (%)
Non obese	42 (100)	22.4 ± 1.4	43.4 ± 45.1	48.6 ± 20.8
Class I Obese	33 (78.6)	31.7 ± 1.4	18.8 ± 11.7	38.8 ±18.1
Class II Obese	7 (16.6)	36.5 ± 0.9	11.5 ± 14.2	33.3 ± 21.1
Class III Obese	2 (2.8)	41.6 ± 2.1	7.0 ± 9.9	10.0 ± 14.1
P value		0.000	0.006	0.009
*Values are reported as mean± SD; **Obese class I= BMI 30-34.9kg/m², obese class II = BMI 35-39.9kg/m² and obese class III BMI 40kg/m² or more.[2]				

Table-3: Semen quality classified according to obesity class.

Semen parameter	Study Frequency (%) (n-42)	Control Frequency(%) (n-42)	Total Study Frequency(%) (n-84)
Semen Count (M/ml)			
0	3(7.1)	2 (4.8)	5 (6.0)
1-5	7 (16.7)	5 (11.9)	12 (14.3)
6-19	13 (31.0)	6 (14.3)	19(22.5)
≥20	19 (45.2)	29 (69.0)	48 (57.1)
Total	42(100.0)	42(100.0)	84(100.0)
Mean	17.1(±12.3)	43.4 (±45.1)	30.2(±35.4)
Semen Motility (% active)			
0-24	13(31.0)	5(11.9)	18 (21.4)
25-49	12(28.6)	10(23.8)	22(26.2)
≥50	17(40.4)	27(64.3)	44(52.4)
Total	42(100.0)	42(100.0)	84(100.0)
Mean	37.4(±21.8)	48.6(±20.8)	42.9(±21.9)

Table-4: Showing semen parameters in the study population

mean sperm count for the obese was 17.1 million spermatozoa per ml (oligozoospermia) as against 43.4 million spermatozoa per ml for the non obese and this was statistically significant.The mean sperm motility was 37.4% vs 48.6% for the obese against the non obese and was also statistically significant.as 22.4± 1.4kg/m². As shown, the difference is significant statistically.

Table-3 showed a statistically significant association between the class of obesity and sperm count (p value-0.0055) as well as with sperm motility (p value-0.0099). The spermmotility and count decreased as obesity increased i.e inverse relationship between BMI and semen parameters (motility and count).

Table-4 shows that the mean sperm count for the obese subjects was 17.1 ± 12.3 million spermatozoa per ml and 43.4 ± 45.1 million spermatozoa per ml for the control. Azoospermia was commoner amongst the obese male partners in infertile couples (7.1% vs 4.8%). The same was noted for oligozoospermia (47.7% vs 26.2%).The mean sperm motility was 37.4 ± 21.8% for the obese; 31% of whom had asthenozoospermia. The control had sperm motility of 48.6 ± 20.8% with 11.9% of subjects with asthenozoospermia.

DISCUSSION

This study was a multi-centered, prospective case-controlled study assessing the effect of male obesity on semen quality of male partners of infertile couples in Ilorin.

The interaction between obesity and fertility has received increased attention owing to the rapid increase in the prevalence of obesity in the developed world[11] and in near future, might become a public health issue in Nigeria and sub-Saharan Africa because of better economic opportunities in our own society.

In this study, obesity was associated with reduced sperm count (17.1 ± 12.3M/ml vs 43.4 ± 45.1M/ml; p-0.0001) and reduced sperm motility (37.4 ± 21.8% vs 48.6 ± 20.8%; p-0.0141). A similar but less marked effect was noticed on sperm count but not on sperm motility, in a similar study[16] which revealed a reduction in sperm count of 23.9% (95% confidence interval 4.7 – 43.2%) as against a 60.6% reduction in sperm count noticed in this study. The marked reduction in sperm count in this study may not be unrelated to the small population size of this study and the ethnicity/race of the subjects studied. The findings of reduced sperm motility with obesity in this study was also similar to that of some studies[16-18] which showed a negative association between BMI and sperm motility. Other studies however, noted no significant correlation between BMI and sperm count[17,19,20] as well as sperm motility.[19,20] These varying results may be attributed to the population sizes of these studies.

Amongst the obese group, majority (78.6%) had class I in obesity. There was an inverse relationship between increasing obesity class and semen parameters {sperm count p-0.0055 and sperm motility p-0,0099}. This was similar to the findings in a study[16] which noted a p-0.0055 for the association between increasing BMI and percentage of motile sperm. Also, participants with class III obesity had reduced average sperm motility of 10%. This emphasizes the role of life style modification i.e, dietary control and weight reduction, as important management protocol in male infeThe prevalence of oligozoospermia in the obese men compared with normal BMI men was also high{47.7% vs 26.2%}. This was similar but more than that reported in a similar study[16] which found a prevalence of 24.4% vs 21.7% for oligozoospermia in over-weight and obese men compared with normal-weight men. The reason for the increase in this study may also be related to the small population size of this study. The prevalence of 7.1% reported for azoospermia amongst the obese male partners of infertile couples in this study was however, less than 23.4% reported in a similar study carried out in this environment[19] about ten years ago. The marked decrease in the prevalence of azoospermia could be attributed to better health seeking behaviour of these men in addition to the increased number of accessible health facilities in Ilorin.

Overall, this result is an important addition to the emerging evidence of the relationship between obesity and male infertility.

CONCLUSION

This study has demonstrated an inverse but significant relationship between male obesity and semen parameters (sperm count and motility) amongst male partners of infertile couples in Ilorin. This suggests that male obesity has an adverse effect on the quality of semen amongst male partners of infertile couples. Concerted effort should be made to prevent excessive weight gain as well as reduce weight amongst the obese as this is a

recognized management option for altered semen parameters seen in the obese.

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