

# AN EVALUATION OF IMPACT OF OBESITY ON MALE FERTILITY IN NIGERIAN MEN-RETROSPECTIVE COHORT STUDY AT 68 NIGERIAN ARMY REFERENCE HOSPITAL YABA.

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## ABSTRACT

**BACKGROUND:** Infertile men contribute an intriguing 30-50% of infertility burden worldwide. This is even more worrisome in Nigeria being one of the countries located in the infertility belt of Africa. The rising trend in male factor infertility is evidenced by the decrease in seminal fluid parameters which has since been used as a surrogate marker of male fecundity.

This study analysed the effect of body mass index on seminal fluid parameters of men who sought fertility treatment at 68 Nigerian Army Reference Hospital Yaba, Lagos. (68 NARHY) over a five-year period.

**METHODS:** This was retrospective cohort study of the cases of infertile couples that attended Gynaecology and Urology clinics of 68 NARHY from 1st January 2019-December 31st, 2023. A purposely designed proforma using the WHO manual for the examination of human semen was used for data collection. Outcome measures were volume of semen, total sperm number, sperm concentration, PH, agglutination, liquefaction, motility, morphology, vitality, and white blood cell count. Data was analysed using SPSS version 23. Data were presented as means and proportions. P-value of < 0.05 was used as the level of significance.

**RESULTS:** Overall, 562 couples attended Gynaecology and urology clinics with fertility-related concerns within the study period with a retrieval rate of 98.3%. Age and BMI of the participants significantly affected sperm motility, and morphology. (p-values of 0.001, and 0.002 respectively).

**CONCLUSION:** Obesity presents a myriad of problems as regards to male sexuality and fertility. This study has demonstrated that increasing age has a negative effect

on sperm morphology, and total motility with obesity also showing additional negative effect on the above and sperm concentration.

**Keywords:** Male infertility, Body mass index, Sperm motility, sperm concentration, sperm morphology.

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## Introduction

Recently, there have been an increasing number of men with inability to achieve pregnancy with a fertile female despite regular unprotected, penetrative, penovaginal intercourse.<sup>1,2,3,4</sup> In many countries, especially the developing nations, aspersions are usually cast on the female partner for barren marriages.<sup>3,4,5</sup> On one hand, this may be because the majority of the populace are ignorant of the causes and pattern of distribution of the probable causes of infertility, therefore, attribute almost all causes to the female partner<sup>3,4,5</sup> while on the other hand, it may also be because most men don't present themselves for medical examination considering the fact, that some men equate adequate erection and ejaculation with ability to reproduce.<sup>3,4</sup> Furthermore, with increasing number of infertile men and decline in semen quality, literature abound to support that men having difficulty with conception contributes about 30-50% of infertility in humans.<sup>3,4,6,7</sup> Generally, the differences in quantity and quality of the semen parameters are used as a surrogate marker of male fecundity.<sup>2,3,6,7</sup>

Obesity is a complex medical disorder resulting from excessive deposition of adipose tissue in the body.<sup>8</sup> It is "defined as the body mass index (BMI) greater or equal to 30 kilograms per square meter" "(BMI  $\geq 30\text{Kg/m}^2$ )".<sup>8</sup> The prevalence has been on the increase worldwide with an estimate that it may have doubled since late 20th Century.<sup>8</sup> It has both genetic and environmental component as its risk factors.<sup>8</sup> Obesity has been fingered as one major risk factor implicated in aetiopathogenesis of many diseases through the secretion of different kinds of adipokines and numerous other mechanisms.<sup>8-12</sup>

The aetiology of male infertility is "multi-factorial and polygenic in nature".<sup>3, 13</sup> They are broadly classified into pre-testicular (hypothalamic-pituitary), testicular, and

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post-testicular (obstructive) causes.<sup>3, 14, 15</sup> It has been suggested that genetic changes, lifestyle such as diet and obesity have a role to play in the aetiopathogenesis of male infertility especially the pre-testicular and testicular causes.<sup>13, 14, 15</sup>

A man is known to be fertile if he “produces at least 1.5ml of ejaculate which contains more than 15 million sperm cells per milliliter of semen. Out of these at least 32% should swim in a forward direction, and at least 4% should have a normal morphology.”<sup>2,3</sup>

This study, therefore, aims to critically evaluate the impact of obesity on semen parameters of Nigerian men seeking fertility care at 68 Nigerian army reference hospital Yaba. (68 NARHY)

## MATERIALS AND METHODS

**STUDY DESIGN:** This was retrospective cohort study of the cases of infertile couples that attended Gynaecology and Urology clinics of 68 NARHY from 1st January 2019-December 31st, 2023.

**STUDY SETTING:** Sixty-eight Nigerian Army Reference Hospital Yaba (68NARHY), Lagos is a 500- bed capacity military hospital that serves about 6000 in-and-out patients per month and provides referral services to Nigerian service men and civilians alike. This is situated in Yaba Local Council Development Area of Lagos State.

## DATA COLLECTION AND ANALYSIS

A purposely designed proforma using the WHO manual for the examination of human semen was used for data collection. Outcome measures were volume of semen, total sperm number, sperm concentration, PH, agglutination, liquefaction, motility, morphology, vitality, and white blood cell count. Data was analysed using SPSS version 23. Data were presented as means and proportions. P-value of < 0.05 was used as the level of significance.

## ETHICAL APPROVAL

This was obtained from the Health Research Ethics Committee (HREC) of 68 NARHY (68NARHY/EC/137). Ethical principles according to Helsinki’s declaration were observed throughout the study duration.

## RESULTS

A total of 562 couples attended Gynaecology and urology clinics with fertility related concerns within the study period. More than half of the participants, 54.98% were in the age range of 35-44 Table 1. The mean age of the participants was 37.1±2.2.

Obesity negatively correlates with sperm concentration, total motility and abnormal morphology while advancing age correlates with decreasing total motility and abnormal morphology with a significant p-value of < 0.001.

**Table 1- Seminal fluid parameters of our cohort**

Variable	n (%)	Mean± SD
<b>Sperm concentration (x106)</b>		22.01±11.3
0.00	112(19.9)	
0.01-14.9	331(58.9)	
≥15	119(21.2)	
<b>Progressive motility (%)</b>		26.03±6.9
<32	410(72.9)	
≥32	152(27.1)	
<b>Total motility (%)</b>		19.86±3.4
<40	486(86.5)	
≥40	76(13.5)	
<b>Normal sperm morphology (%)</b>		
<4	399(70.99)	
≥4	163 (29.01)	
<b>Semen Volume (mls)</b>		
<1.5	51 (9.1)	
>1.5	511 (90.9)	

**Table 2. Relationship between Body Mass index and semen parameters in our study**

	BMI Of the participants					P-value
Semen Parameters	<18.5	18.5-24.9	25-25.9	30-34.9	≥35	
Seminal fluid volume (>1.5 ml)	11	197	186	104	13	0.12
Sperm concentration (×106/ml)	16	35	31	22	15	0.00*
Total sperm motility (>40%)	1	43	18	9	5	0.001*
Normal sperm morphology (>4%)	2	68	45	28	20	0.001*

Statistically significant value.

**Table 3. Relationship between Age of the participants and semen parameters**

	Age Of the Participants in years					P-value
Semen Parameters	25-34	35-44	45-54	≥55		
Seminal fluid volume (>1.5 ml)	10	362	121	18		0.13
Sperm concentration (×106/ml)	22	44	33	20		0.13
Total sperm motility (>40%)	3	39	19	15		0.00*
Normal sperm morphology (>4%)	5	56	53	49		0.001*

### Discussion

It is evident from our study that obesity and paternal age have a deleterious effect on male infertility. Overweight and obesity were associated with decrease semen concentration, motility and morphology. This is similar to the study of Sekhavat and colleague who also reported an inverse relationship between increasing body mass index (BMI) and sperm concentration and total motility.<sup>13</sup> It is also in consonance with the work of Kozopas et al who in their study found that increasing BMI is associated with poor sperm morphology, lower concentration progressive motility.<sup>14</sup> Additionally, Abu et al also affirmed that there is significant negative association between BMI and semen concentration,<sup>15</sup> So also is the study of Jixuan and colleagues who also found that overweight is associated with reduction in sperm concentration.<sup>16</sup> Along those lines, Darand and co-workers also reported a negative relationship between obesity and sperm morphology.<sup>17</sup> Several mechanisms have been proposed to explain this effect of increasing body mass index on semen parameters.<sup>18-20</sup> These mechanisms include; the effects of obesity on male hormones, chronic inflammatory changes associated with obesity, or due to epigenetic changes in obese men.<sup>18-20</sup> In obese men, it is believed that there exist defective hypothalamic-pituitary-gonadal axis (HPG) secondary to increased aromatization of estrogen from peripheral tissues which acts through a negative feedback mechanism to inhibit the secretion gonadotropin releasing hormone thereby affecting a tightly controlled physiologic process of spermatogenesis.<sup>19</sup> Likewise, the chronic inflammatory condition in obesity increases oxidative stress, and rise in the production of reactive oxygen species (ROS), pro-inflammatory cytokines, leptin, and increased scrotal temperature, all of which has been shown to be deleterious to sperm production.<sup>20</sup>

There have been varied reports on the relationship between age and semen parameters. Our study showed that total sperm motility and morphology decrease with age. This corroborates the finding of Ibitoye and colleagues, which shows that advancing age negatively correlates with total motility.<sup>21</sup> But differs by showing a positive relationship between age and abnormal morphology.<sup>21</sup> It also differs from the study of over 500 men by Ajayi et al, which showed that increasing age had no influence on sperm morphology, motility and sperm count but only had a significant effect on seminal fluid volume.<sup>22</sup>

Age associated increase in mutation, oxidative stress from rising reactive oxygen species, and other chronic illnesses, with resultant changes in inter/intra-testicular micro-environment may explain the possible mechanisms of increasing age with abnormal semen parameters.<sup>3</sup>

In conclusion, Obesity presents a myriad of problems as regards to male sexuality and fertility. This study has demonstrated that increasing age has a negative effect on sperm morphology, and total motility with obesity also showing additional negative effect on the above and sperm concentration.

Our strength lies in a relatively large sample size, however, we are limited by the study being an in-hospital study of husbands of women seeking fertility care in our facility which may just be a snapshot of the entire population of Lagos.

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