Original Article

Effect of BMI on Semen Parameters in Male Infertility in Tertiary Care Hospital of Karachi

Fareena Khalil Ahmed[1], Abdul Shakoor Memon[1], Intesar Burney[1], Khalida Bano[3] and Afshan Mehboob Khan[2]

ABSTRACT

Objective: To study the effect of BMI on semen parameters in male infertile patients in tertiary care hospital of Karachi.

Study Design: Case control study

Place and Duration of Study: This study was conducted at the Department of Physiology, Basic Medical Sciences Institute (BMSI) in collaboration with Reproductive Health Sciences, (Male Infertility Clinic) at JPMC, Karachi from October 2015 to May 2016.

Materials and Methods: This study was conducted on 100 married males which are divided into two major groups, Group A (control group) and Group B (case group). Group A contains 25 subjects married fertile males and Group B contains 75 married infertile males which were further subdivided into three subgroups of 25 subject each B1= Azoospermia, B2 =Oligospermia and B3=Others. Semen Analysis was done using WHO criteria and BMI was done by dividing the subjects into three groups, 18.5-24.9 kg/m^2 (normal weight), 25-29.9 kg/m^2 (overweight) and >or= 30 kg/m^2 (obese) and by measuring the waist circumference of the subjects.

Results: The BMI examination of case and control showed a significant positive association with abnormal morphology across all the groups with the $p < 0.05$ and negative association of BMI with sperm count, pH, motility activity and normal morphology.

Conclusion: This study showed a strong positive significant association between BMI and Semen Parameters in male infertility as fertility is reduced in men with increased BMI which is the risk factors that influences the quality of semen.

Key Words: BMI, Obesity Semen Analysis, Male Infertility.

Citation of articles: Ahmed FK, Khan AM, Memon AS, Burney I, Bano K. Effect of BMI on Semen Parameters in Male Infertility in Tertiary Care Hospital of Karachi. Med Forum 2019;30(8):104-108.

INTRODUCTION

Over weight in men appears to be one of the most neglected issues in the diagnosis of infertility. Obesity is define as deposition of excessive amount of adipose issues which produce ill health effect and is categorized as body mass index (BMI) and the person is suffering from obesity if their BMI exceeds 30 kg/m2 (WHO,2010).[1]

Obesity is considered to be the risk factor in female infertility, but for its importance in male infertility there is no consensus found on this relation till present (Martini et al., 2010)[2] and its effects on semen parameters are less evident (Alshahrani.S et al.,2016)[3]. There are several methods to assess obesity which encompass body mass index (BMI), skin folds caliper measurements, waist circumference and waist to hip ratio (Akindele M et al., 2016)[4]. Weight is categorized by body mass index (BMI) into: underweight (18.5 kg/m^2), normal weight (18.5-24.9 kg/m^2), overweight (25.0-29.9 kg/m^2) and Obese (>30kg/m^2) according to international classification of Adult Weight Status (Moore .S et al., 2010)[5].

Spermatogenesis and sperm quality is vital for male fertility and any disturbances in the process of spermatogenesis leads to the infertility in male (Zhang E, et al, 2014)[6]. Male infertility is define as when a male is unable to achieve pregnancy with a fertile female (Hirsh, 2003)[7]. The reason of infertility in men is diversified in different situations. It is strongly affected by three main factors i.e. lifestyle, environmental and nutritional and the main causes of infertility are low sperm count ,Endocrine problems, Drugs, Infections and Radiations.(Treeds et al., 2011)[8] and the effect of obesity on the health are devastating and are related to future cardiovascular diseases, diabetes and cancers (XU X et al., 2016)[9] and male factor is responsible for 8-15% of couples (WHO

[1.] Department of Physiology / Biochemistry[2], SSCMS, Karachi.
[3.] Department of Physiology, DIMC, Karachi.

Correspondence: Dr Fareena Khalil Ahmed, Assistant Professor of Physiology, SSCMS, Karachi.
Contact No: 0300-8271211
Email: fareenazahoor@gmail.com

Received: January, 2019
Accepted: March, 2019
Printed: August, 2019

2010)[1] .Infertility affects around 48.5 millions couples worldwide (Datta J, et al, 2016),[10] however, no underlying cause can be identified for primary or secondary infertility in approximately 25% of couples (Arcaniolo D et al .,2014)[11]

The relationship between semen parameters and BMI is present and it is due to the derangement in the male reproductive hormone profile and obesity is linked with poor semen quality and male infertility (Davidson L, et al, 2015)[12] and in this study we evaluated the relation between BMI and semen parameters (semen volume, sperm concentration, motility and morphology), in male infertility.

MATERIALS AND METHODS

This case control study was conducted in the Department of Physiology, Basic Medical Sciences Institute in collaboration with Reproductive health sciences (Male Infertility Clinic) at Jinnah Post Graduate Medical Centre Karachi and approval was taken from ethical committee of BMSI, JPMC Karachi for conducting the research (Ref.No.F.1-2/BMSI-E.COMT/040/JPMC)

One hundred subjects were selected from RHS A centre, Department of Obstetrics and Gynaecology, JPMC, Karachi. They are divided into two groups, Group A (control group) = Fertile married males (25 subjects) Group B (case group) = Infertile married males (75 subjects) is further subdivided into three groups

B1= Azoospermia (25 subjects)

B2=Oligospermia (25 subjects)

B3=Asthenospermia, Aspermia, Necrospermia, Oligoasthenospermia, Teratospermia (25 subjects)

Determination of Biophysical and Biochemical Parameters

Biophysical Parameters

1. Age (years)
2. Body Mass Index (BMI) (kg/m^2)
3. Waist Circumference if BMI > than 30.

Biochemical Parameters

1. Semen Analysis.

Selection Criteria

Married males aged between 18-45 years, living with their reproductively healthy wives and having unprotected sex. There is no restriction of socioeconomic status. Unmarried males and those suffering from any chronic diseases are excluded from this study.

A detailed history was taken on questionnaire with their informed consent, the examination was performed by a reproductive health expert and two types of samples (blood and Semen were collected.

Semen analysis was done according to WHO manual 2010, Analysis was done an hour after the collection of semen by a method prescribed in the WHO manual and the physical (Liquefacation, Volume, Color, Consistency, pH) and microscopic

(Sperm count, Morphology and Motility) was estimated.

Normal Semen Parameters

WHO MANUAL (2010)

Semen Parameters With Lower Reference Limits

Sperm volume (ml)	1.5
Sperm concentration (10^5/ml)	15
Total sperm number (10^5/ejaculate)	39
Progressive motility (PR,%)	32
Total motility (PR+NP,%)	40
Vitality (live sperm,%)	58
Sperm morphology (NF,%)	4
pH	>/= 7.2

BMI was measured using the standard formula kg/m^2 and waist circumference was measured if BMI is greater than 30.

Category BMI range (kg/m^2)

Underweight <18.5

Normal range 18.5-24.9

Overweight 25.0-29.9

Obese $\geq$ 30

Waist Circumference if BMI > 30. (WHO, 2013).

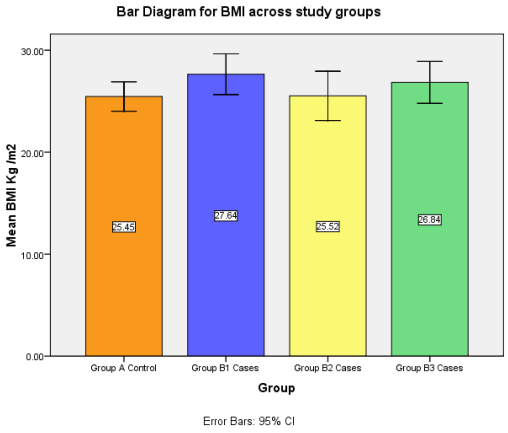
Data was stored and analyzed using SPSS 16. Counts with percentages were reported for different Variables. Mean and standard deviations were given for all quantitative variables like age in years, BMI and Sperm count. ANOVA test was applied.

RESULTS

In this case control study, we investigated subjects attending the male infertility clinic at RHS centre, JPMC.

Table 1 shows the basic information of biophysical parameters and their association across all the study groups. Table 2 shows the comparison of BMI among the groups. Table 3 shows the comparison of seminal parameters between case and control groups

Table 4 shows the correlation of BMI with the semen parameters.



Graph No.1: Error Bar Diagram

Table No.1: Physical parameters of control and case groups

Parameters	Control Group A (Fertile) n=25		Case Group B (Infertile) - n=75						P value
	Group A - n=25 Proven Father		Group B1 - n=25 Azoospermia		Group B2 - n=25 Oligospermia		Group B3 - n=25 Others		
	n	%	n	%	n	%	n	%	
Age(years)									0.60
Less or Equal to 35 Years	17	68	13	52	17	68	15	60	
More than 35 yrs	8	32	12	48	8	32	10	40	
BMI(Kg/m^2)									0.049*
Under 18.5 Under weight	-	-	1	4	4	16	-	-	
18.5-24.9 Normal	12	48	7	28	9	36	10	40	
25-29.9 Over weight	11	44	9	36	6	24	12	48	
Over 30 Obese	2	8	8	32	6	24	3	12	
Examination									<0.01*
Normal	25	100	22	88	20	80	15	60	
Have Problem	-	-	3	12	5	20	10	40	

Table No.2: Comparison of physical parameters between case and Control Groups

Parameters	Control Group A **(Fertile) n=25**	Cases Group B **(Infertile) n=75**			P value
	Group A n=25 Proven Father Mean±S.D	Group B1 n=25 Azoospermia Mean±S.D	Group B2 n=25 Oligospermia Mean±S.D	Group B3 n=25 Others Mean±S.D	
BMI(Kg/m2)	25.45±3.5	27.63±4.85	25.51±5.86	26.84±4.99	0.316
*p<0.05 was considered significant using ANOVA					

Table No.3: Comparison of Seminal Parameters between case and control groups

Parameters	Control Group A **(Fertile) n=25**	Cases Group B **(Infertile) n=75**			P value
	Group A n=25 Proven Father Mean±S.D	Group B1 n=25 Azoospermia Mean±S.D	Group B2 n=25 Oligospermia Mean±S.D	Group B3 n=25 Others Mean±S.D	
Volume(ml)	2.38±0.7	2±1.16	2.59±1.2	1.94±1.41	0.144
PH	8.1±0.36	7.8±0.46	7.79±0.33	7.97±0.43	0.018*
Motility Activity(%)	0.64±0.17	0 ±0	0.25±0.24	0.37±0.3	<0.01*
Morphology Normal(%)	0.64±0.16	0±0	0.27±0.26	0.43±0.29	<0.01*
Morphology Abnormal(%)	0.35±0.16	0±0	0.61±0.28	0.57±0.28	<0.01*
Sperm million/ml	77.92±27.02	0±0	8.2±5.52	28.78±30.84	<0.01*
*p<0.05 was considered significant using ANOVA					

Table 1 gives the basic information of the study samples; it was found that, 68% samples of control group fall in age group of less or equal to thirty five years old, 36% sample of azoospermia group were found overweight. 48% Azoospermia cases were found with age more than thirty five years old however p=0.60 gives the evidence that there was no significant association between age and study groups.

It was found that more cases of oligospermia were underweight that gives the significant association of

BMI with studied group. 40% of the samples during examination found with problem in others group while 88% samples were found normal in azoospermia group, 80% sample found with normal examination in oligospermia group, p-value <0.01 gives the significant association of studied groups with examination.

Table 2 gives the mean and standard deviation of BMI with testing of mean across studied group using one way ANOVA, it was found that, BMI across all four groups was found same on average with p value 0.316.

Table 3 showed that, PH was high in proven father on average and in other groups it was getting down, a significant change across the four groups was found with p=0.018

The mean and standard deviation of motility activity (%), morphology normal (%) and morphology abnormal, a significant p-value gives the evidence that mean values of these parameters were varying across the groups. Mean sperms in oligospermia groups was lowest, then in other, as compare to proven father, p<0.01 declared that sperms count varying significantly across the groups.

Table No.4: Correlation of BMI with Semen parameters

Spearman Rank Correlation with BMI	r	p-value
Volume (ml)	0.129	0.20
Viscocity	0.138	0.17
PH	-0.19	0.06
Colour	0.233	0.024*
Motility Activity %	-0.096	0.43
SPERM Count (million/ml)	0.043	0.71
Morphology Normal %	-0.187	0.12
Morphology Abnormal %	0.271	0.03*
*p<0.05 considered as significant		

Table 4 reports the correlation values of semen parameters with BMI, it was found that, BMI gives 23.3% significant positive association with color and 27.1% significant positive association with abnormal morphology, with p value less than 0.05, PH gives negative relation with BMI, Motility activity, and morphology Normal, however they all parameters did not give any significant association with BMI, correlation values with their significance are reported.

DISCUSSION

In this case control study we had investigated the subjects of male infertility attending the male infertility clinic at RHS a centre, JPMC. The main aim of our study was to assess the role of BMI on semen parameters and find out its association with them. Very few studies have been conducted on male infertility in Pakistan as it is the most neglected issue of the society and male are absconded to be a part of it. In our study we observed that there was a strong positive association of BMI with some semen parameters and negative association with others. Guo, et al, 2017[13] suggested that metabolites alterations in seminal plasma may be the mediator of obesity and abnormal semen quality. Anderson, et al, 2016[14] showed in their study that BMI affects the fatty acid composition of spermatozoa through regulation of fatty acid metabolism in the testis and therefore results in the abnormal semen parameters. Wen-Hao, et al, 2015[15] in their study suggested that obesity and metabolic syndrome are known to have effects on male sexual function and infertility and increasing BMI could influence the quality and quantity of semen and thereby trigger fertility status of male and this is also a result of our study. Petty J, et al, 2014[16] found from their study that decrease in total number of normal motile sperm cells occurred due to increase in BMI which suggested the combined effects of obesity on the sperm cell structure and function which causes the lower fertility in male and not the single parameter alone. Thomsen, et al, 2014[17] also find the association of BMI with the different parameters of semen and that the semen volume is reduced with the increase in BMI due to obesity and male overweight. Hajshafiha, et al, 2013[18] also proved in their study that overweight male are more likely to produce low sperm count and the production of abnormal sperms and this is also in agreement of our study. Tunc and Bakos, 2011[19] also showed that increased BMI was also associated with a fall in sperm concentration and this was also in association of our study. Hanafy, et al, 2010[20] also proved in their study that BMI had a positive correlation with abnormal sper morphology and negative correlation with sperm concentration and motility and this is in agreement with our study. Hammoud and Griffin, 2010[21] also proved that increase in BMI leads to alteration in semen parameters due to the suppression of hypothalamic pituitary-gondal axis by elevated estrogen levels. Hammoud and Gibson, 2008[22] suggested in their study that BMI was associated with low sperm concentration and lows motile perm count as it was also a result of our study.

CONCLUSION

In our study there is a strong association between BMI and different semen parameters and these parameters can be used to find out the cause of male infertility, as obesity decreases the semen quality and quantity resulting in defective spermatogenesis. Our study strongly suggests the significant positive association with color and abnormal morphology, pH gives negative association with BMI.

Author's Contribution:

Concept & Design of Study: Fareena Khalil Ahmed
Drafting: Afshan Mehboob Khan, Abdul Shakoor Memon

Data Analysis:	Intesar Burney, Khalida Bano
Revisiting Critically:	Fareena Khalil Ahmed
Final Approval of version:	Fareena Khalil Ahmed

Conflict of Interest: The study has no conflict of interest to declare by any author.

REFERENCES

1. World Health Organization, 2010. WHO Laboratory Manual for the Examination and Processing of Human Semen. World Health Organization, 2010.
2. Martini AC, Tissera A, Estofan D, Molina RI, Mangeaud A, de Cuneo MF, et al. Overweight and seminal quality: a study of 794 patients. Fertil Steril 2010;94:1739–1743.
3. Alshahrani S, Ahmed AF, Gabr AH, Abalhassan M, Ahmad G. The impact of body mass index on semen parameters in infertile men Andrologia 2016;48(10):1125-1129.
4. Akindele MO, Phillips JS, Igumbor EU. The relationship between body fat percentage and body mass index in overweight and obese individuals in an urban African setting J. Publ. Health Africa 2016;7(1):515.
5. Moore SJN, Hall S, Harper JW. Lynch Global and national socioeconomic disparities in obesity, overweight, and underweight status. J Obes 2010; 10.1155/2010/514674.
6. Zhang E, Zhang H, Zang Z, Chen J, Zhang B. Association of Body Mass Index with Semen Quality and Sexual Hormone Levels among Men in Intrauterine Insemination. Sci Res 2014;6:1861-1865.
7. Hirsh A. Male subfertility. Br Med J. 2003; 327(7416):669-672.125.
8. Teerds KJ, de Rooij DG, Keijer J. Functional relationship between obesity and male reproduction: from humans to animal models. Hum. Reprod. Update 2011;17(5):667–83.
9. Xu X, Zhou L, Miao R, Chen W, Zhou Y, Pang Q, Qu K, Liu C. Association of cancer mortality with postdiagnosis overweight and obesity using body mass index. Oncotarget 2016;7:5023–29.
10. Datta J, Palmer MJ, Tanton C, et al .Prevalence of infertility and help seeking among 15 000 women and men Hum. Reprod 2016;31(9): 2108-2118.
11. Arcaniolo DV. Favilla D. Tiscione, et al. Is there a place for nutritional supplements in the treatment of idiopathic male infertility? Arch Ital di Urol e Androl 2014;86(3):164,
12. Davidson LM, Millar K, Jones C, Fatum M, Coward K. Deleterious effects of obesity upon the hormonal and molecular mechanisms controlling spermato-genesis and male fertility Hum. Fertil 2015;18(3):184-193,
13. Guo D, Wu W, Tang Q, Qiao S, Chen Y, Chen M, et al. The impact of BMI on sperm parameters and the metabolite changes of seminal plasma concomitantly. Oncotarget 2017;8(30):48619-48634.
14. Andersen JM, Rønning PO, Herning H, Bekken SD, Haugen TB, et al. Fatty acid composition of spermatozoa is associated with BMI and with semen quality. Androl 2016;4:857–865.
15. Wen HT, Xin JZ, Lu M, Jie Q, Kai H, Lian MZ, et al. Correlation between body mass index and semen quality in male infertility patients. Turk J Med Sci 2015;45: 1300-1305.
16. Petty J, Jabara S, Prien S, Penrose L. Obesity Appears to Impact Male Fertility by Degrading Overall Semen Quality Rather than Individual Semen Parameters. Open J Obstet and Gynaecol 2014;4:917- 923.
17. Thomsen L, Humaidan P, Bungum L, Bungum M. The impact of male overweight on semen quality and outcome of assisted reproduction. Asian J Androl 2014;16:749–754.
18. Hajshafiha M, Ghareaghaji R, Salemi S, Sadegh-Asadi N, Sadeghi-Bazargani H. Association of body mass index with some fertility markers among male partners of infertile couples. Int J General Med 2013:6:447–451.
19. Tunc O, Bakos HW, Tremellen K. Impact of body mass index on seminal oxidative stress. Andrologia 2011;43:121–128.
20. Hanafy ER, Ali ME. Semen parameters and hormonal profile in obese fertile and infertile males. Fertil Steril 2010; 94(2):581-584.
21. Hammoud AO, Griffin J. Association of aromatase (TTTAn) repeats polymorphism length and the relationship between obesity and decreased sperm concentration. Hum Reprod 2010; 25(12):3146-3151.
22. Hammoud AO, Gibson M. Impact of male obesity on infertility: a critical review of the current literature. Fertil Steril 2008; 90(4):897-904.