

Study of Body Mass Index, Central Obesity and Oxidative Stress in relation to Sperm Parameters:

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Abstract:

INTRODUCTION:Subfertility affects 15% of the couple who seek to attain a pregnancy and a male contribution is identified in 20-15% of the cases. In majority,no identifiable cause can be detected. The recent trend of overweight and obesity in men of reproductive age is rising at an alarming rate and this study aims to assess the association between BMI, Central obesity, Oxidative Stress and Sperm quality in men visiting infertility clinic.

Materials and Methods:286 males between the age20-45 yrs were selected as our subject. They were grouped according to fertility. 155 infertileand 131 fertile males are grouped as A and B respectively. Their BMI and waistcircumference were measured for overweight and central obesity.Their semen were analysed for sperm parameters. Seminal carbonyl protein was measured for evaluation of oxidative stress.

Result: BMI was negatively correlated with sperm concentration (SC) and sperm motility (MT) in both groups A and B.

Key Words:Body Mass Index(BMI), Waist Circumference (WC), Overweight, Central Obesity, Sperm Parameters. Oxidative Stress, Subfertility.

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I. Introduction:

Overweight is a global health problem that is reaching high proportions with 2.1 billions of adults classified as overweight or obese(1).There is an increasing awareness that male overweight reduces sperm quality and in particular alters the physical molecular structure of sperm(2)(3)(4). Subfertility affects 15% of the couple who seek to attain a pregnancy(5) and a male contribution is identified in 25-30% of the cases(6) of which in the majority no apparent cause can be found(7)(8). It is coincident with a growing no of couples requiring intracytoplasmic sperm injection for the treatment of male factors of sperm defects(9).In conjunction, obesity is also associated with a no of chronic states including metabolic syndrome, hyperlipidemia, cardiovascular diseases etc. Obesity is a proinflammatory state that are all independently linked with male Subfertility(10). Spermatogenesis is underpinned by the hypothesis that Hypothalamo-pituitary gonadal axis is dysregulated by obesity. Several studies document that increased male BMI and adiposity are associated with decreased plasma concentration of sex hormone binding protein. There is decreased in plasma testosterone and concomitant increase in plasma oestrogen concentration(11)(12) which may impair Leydig and Sertoli cell function, thus interfere with release of sex hormones, production and maturation of sperm(13). Lower testosterone and higher oestrogen level in plasma have long been associated with subfertility and reduced sperm count(14). Numerous studies have noted that obesity and several of its causes, such as insulin resistance and dislipidemia are associated with increasd oxidative stress. Oxidative stress is an independent marker for male factor of Subfertility since it impairs sperm quality(15). Among the various causative agents, Oxidative Stress has always been concomitant with nonspecific DNA fragmentation (16)(17). Higher level of reactive oxygen species (ROS) overwhelms the impaired antioxidant defence and damage sperms. Carbonyl is most commonly found in irreversible form of protein oxidation(18)(19) and damage spermatozoa.

II. MATERIALS And METHODS:

Total 286 males between the age 25-45 attending OPD in RG Kar Medical college were selected as our study group. They were selected according to fertility. Among them 155 persons were infertile,selected as group A and 131 fertile males as group B. In both groups A and B, Body Mass Index (BMI),Waist Circumference (WC) were measured. Samples of semen were analyzed and seminal Carbonyl Proteins (PC) were measured.BMI was measuerd by body weight/ height²(Kg/m²).WC is measured in cm taking the narrowest

point between the lower border of the rib cage and tip of the iliac crest. Semen samples were collected from both the groups by masturbation into a wide mouthed container after 72 hrs abstinence. Collected samples were liquified at room temperature for at least 30-60 min. After liquefaction, semen samples were analyzed under sperm concentration(SC) million/ml, motility of sperm(MT), Motility of sperm was evaluated as progressive/ non-progressive/non-motile. Samples of semen were analyzed in Improved Neubauer Haemocytometer counting chamber.Total sperm count was calculated as the product of ejaculate volume and sperm concentration. Total motile sperm count was calculated as the product of ejaculate volume,sperm concentration and progressive motile spermatozoa. Total immotile sperm count also evaluated. Estimation of Protein Carbonyl of semen was done by using standard kit in spectrophotometric method. Statistical analysis was done by SPSS-17 and value <0.001 was considered as statistically significant.

Table1:Correlation of BMI,SC and WC in Infertile Males

GROUP A		B.M.I	IMMOT.	MT	P.C (nmol/mg)	RP	SC(m./ml)	W.C(cm)
B.M.I	Correlation Coefficient Significance Level p N		0.933 <0.001 155	-0.915 <0.001 155	0.921 <0.001 155	0.941 <0.001 155	-0.947 <0.001 155	0.934 <0.001 155
IMMOT.	Correlation Coefficient Significance Level p N	0.933 <0.001 155		-0.955 <0.001 155	0.966 <0.001 155	0.975 <0.001 155	-0.983 <0.001 155	0.971 <0.001 155
MT	Correlation Coefficient Significance Level p N	-0.915 <0.001 155	-0.955 <0.001 155		-0.940 <0.001 155	-0.964 <0.001 155	0.966 <0.001 155	-0.954 <0.001 155
P.C (nmol/mg)	Correlation Coefficient Significance Level p N	0.921 <0.001 155	0.966 <0.001 155	-0.940 <0.001 155		0.969 <0.001 155	-0.972 <0.001 155	0.956 <0.001 155
RP	Correlation Coefficient Significance Level p N	0.941 <0.001 155	0.975 <0.001 155	-0.964 <0.001 155	0.969 <0.001 155		-0.992 <0.001 155	0.977 <0.001 155
SC(m./ml)	Correlation Coefficient Significance Level p N	-0.947 <0.001 155	-0.983 <0.001 155	0.966 <0.001 155	-0.972 <0.001 155	-0.992 <0.001 155		-0.984 <0.001 155
W.C(cm)	Correlation Coefficient Significance Level p N	0.934 <0.001 155	0.971 <0.001 155	-0.954 <0.001 155	0.956 <0.001 155	-0.977 <0.001 155	-0.984 <0.001 155	

Table2: Correlation of BMI,SC and WC in Fertile Males

GROUP B		B.M.I	IMMOT.	MT	PC (nmol/mg)	RP	SC (m/ml)	W.C (cm)
B.M.I	Correlation Coefficient Significance Level p N		0.907 <0.001 131	-0.890 <0.001 131	0.913 <0.001 131	-0.892 <0.001 131	-0.838 <0.001 131	0.822 <0.001 131
IMMOT.	Correlation Coefficient Significance Level p N	0.907 <0.001 131		-0.956 <0.001 131	0.952 <0.001 131	-0.942 <0.001 131	-0.896 <0.001 131	0.870 <0.001 131
MT	Correlation Coefficient Significance Level p N	-0.890 <0.001 131	-0.956 <0.001 131		-0.935 <0.001 131	0.906 <0.001 131	0.879 <0.001 131	-0.849 <0.001 131
PC (nmol/mg)	Correlation Coefficient Significance Level p N	0.913 <0.001 131	0.952 <0.001 131	-0.935 <0.001 131		-0.940 <0.001 131	-0.900 <0.001 131	0.876 <0.001 131
RP	Correlation Coefficient Significance Level p N	-0.892 <0.001 131	-0.942 <0.001 131	0.906 <0.001 131	-0.940 <0.001 131		0.932 <0.001 131	-0.907 <0.001 131
SC (m/ml)	Correlation Coefficient Significance Level p N	-0.838 <0.001 131	-0.896 <0.001 131	0.879 <0.001 131	-0.900 <0.001 131	0.932 <0.001 131		-0.889 <0.001 131
W.C (cm)	Correlation Coefficient Significance Level p N	0.822 <0.001 131	0.870 <0.001 131	-0.849 <0.001 131	0.876 <0.001 131	-0.907 <0.001 131	-0.889 <0.001 131	

***Acronyms:** 1) BMI: Body Mass index
2) IMMOT: immotile
3) PC: protein carbonyl
4) RP: Rapidly Progressive
5) SC: Sperm count

6) WC: waist circumference

III. Result:

Table I and Table II show the correlation with BMI, SC and WC in Group A and Group B males respectively. In infertile group (GrA), mean BMI was 24.15 kg/m² and mean WC was 94.29 cm as compared with the fertile group (GrB) whose mean BMI was 22.67 kg/m² and WC was 89.77 cm. In Group A, BMI was negatively correlated with MT (r=-0.915, p<0.001) but positively correlated with PC (r=0.921, p<0.001). In Group B, BMI was negatively correlated with RP (r=-0.892, p<0.001) and SC (r=0.838, p<0.05) but positively correlated with PC (r=0.913, p<0.05). BMI has significant positive correlation with WC in both Group A (r=0.934, p<0.001) and in Group B (r=0.822, p<0.001). WC was inversely associated with SC (r=-0.984, p<0.001). PC was elevated in overweight infertile male 2.201±1.109 nmol/mg vs 1.357±1.346 nmol/mg in normal weight fertile group. Seminal Protein Carbonyl values were also statistically significant (<0.001). The study showed that BMI and WC both were negatively correlated with SC in both Group A and B and Protein carbonyl content of semen was positively correlated with BMI in both groups.

IV. Conclusion:

Increased body weight is a contributory factor to Oxidative Stress leading to subfertility.

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