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Impact of Glutathione on Male Fertility

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ABSTRACT

The equilibrium of the creation and scavenging of free radicals is mandatory in the spermatozoa to fertilize and initiate a full-term pregnancy. Growing evidence indicates that oxidative stress can be a primary cause of male infertility. Non-enzymatic antioxidants play an important protective role against oxidative damages and lipid peroxidation. Glutathione has a central role in the defense against oxidative damage; however, the data on glutathione concentrations in the semen of infertile men are limited. To expand this knowledge the concentrations of total glutathione were assessed in spermatozoa and seminal plasma of patients of unexplained infertility. This study demonstrated that intracellular glutathione levels of spermatozoa are decreased in unexplained infertile cases.

KEYWORDS : Antioxidants, Glutathione, Oxidative stress, Reactive oxygen species.

INTRODUCTION

Glutathione exists in a number of cells and plays an essential role in the defense against oxidative stress. In this way it can react with many ROS and play a cofactor role for glutathione peroxidase. Glutathione peroxidase uses glutathione to reduce hydrogen peroxide to H2O and lipoperoxides to alkyl alcohols. Glutathione is vital to sperm antioxidant defenses and has demonstrated a positive effect on sperm motility .Glutathione(GSH), a tripeptide enzyme (L-glutamyl - L - Cysteinyl glycine, being an intracellular reductant, takes part in a number of biological functions, viz. catalysis metabolism and cellular transport etc. The compound has a protective action against radicals of reactive oxygen species (ROS) like peroxidase and other toxic compound. GSH is present in erythrocyte and in several tissues. Glutathione helps in keeping the enzyme in an active state by preventing the oxidation by their -SH (sulphydrl groups to -S-S (disulphide) groups.GSH also protects the liver by detoxicating into foreign substances by forming mercapturic acid, which are excreted from their body. Glutathione exert significant effect on sperm motility pattern. Glutathione appears to have therapeutic effect on some andrological pathologies causing male infertility.

METHOD AND MATERIAL

Detailed investigation on the functional aspects of the spermatozoa in semen of cases unexplained infertility from Ahmedabad and its vicinity was carried out in two groups according to the age range of 20-30(Group II) and 31-40 (Group III).The physical properties of Semen like colour, odour and pH showed no significant alteration in all the groups of unexplained infertility as compared to control. This analysis of physical properties was however imperative to determine altered accessory gland function, which may influence sperm survival and function .The semen quality, judged by ejaculate volume, sperm density, percent motility and morphology of spermatozoa was found to be altered in the cases investigated. The cases under study, were in fact, grouped as Group A and B, based on the sperm density, where Groups IIA and III A had counts : comparable to the normospermic range, whereas Group IB and III B had Counts in the oligozoospermic range. Semen samples from 46 normozoospermics II A and III B and 60 oligozoospermics, Group IIB and IIIB and 60 were analyzed for physical and biochemical parameters. This data was compared with normal fertile Group I. The concentration of glutathione in human Semen was assayed by the method of Grunert and Philips (1951) (2). Glutathione (GSH) present in the semen reacts with the sodium nitroprusside to give a red colour complex in saturated alkaline medium.

DISCUSSION

Several investigators have demonstrated that damaged or defective spermatozoa produces higher level of reactive oxygen species (ROS). The possible relationship between the prevalence of ROS and infertility has been elucidated in recent years. Iwasaki and Gagnon (1992) (3) and Zini et al. (i993)(5) have reported that as many as 20% semen samples from an unselected population of men attending an infertility clinic produced significant levels of ROS. Furthermore, Iwasaki and Gagnon (1992) showed that there is an inverse correlation between the percentage of motile spermatozoa and level of ROS. Recent basic research suggests the possible role of antioxidants in Scavenging ROS and prevent internal damage.Glutathione (GSH) has a protective action against free radicals reactive oxygen species (ROS) like peroxidase and other toxic compounds. It has a central role in defense against oxidative damage, however, the data on a glutathione concentration in the semen of infertile men are limited. The present data showed significant decline in glutathione content of all the men investigated for unexplained infertility as compared to normal. Further corroborating with our data, Oschsendorf et al. (1998)(4) also reported significant decrease in GSH levels, which may be due to its increased utilization in protecting - SH containing proteins from lipid peroxidation. Free radical scavengers - such as glutathione - that restore the structure and function of poly-unsaturated fatty acids (PUFA) in the cell membrane can be used to treat cases of infertility, where sperm motility is

affected.in one of the cross-over study of twenty infertile men, treatment with glutathione led to a statistically significant improvement of the sperm quality.The study concerned men in whom the sperm quality was poor due to unilateral varicocele or germ-free genital tract inflammation - two conditions in reduced glutathione which ROS or other toxic compounds are indicated as causative factors. Treatment with glutathione was also found to have a statistically significantly positive effect on sperm motility (in particular forward motility) and on sperm morphology. The findings of these studies indicate that glutathione therapy Could represent a possible therapeutical tool in cases where ROS or exposure to toxins is the probable cause of infertility. Bharadwaj et al. (2000) (1) have also shown levels of in oligospermia and azoospermic groups similar to our observation in cases of unexplained infertility. In each group, with older and younger age ranges, there was a decline in glutathione activity.

RESULT

Glutathione: The data obtained on biochemical analysis in this study showed a highly significant decline ($p<0.001$) in the level of glutathione in samples from men with unexplained infertility, Groups II B, III A and III B (normozoospermia and oligozoospermia) as compared

to the normal Groups I and IA (Tables I and II while in Group IIA a significant decrease ($p<0.01$) was observed in the glutathione levels as compared to normal men of Group I. (Table I). This report revealed that decreased seminal GSH are implicated in low sperm quality and may be an important indirect biomarker of idiopathic male infertility.

TABLE-I: SHOWING GLUTATHIONE LEVELS IN SEMEN OF GROUP II MALES (CAUSES OF UNEXPLAINEDINFERTILITYOFAGERANGE20-30 YEARS)

Group	Parameter
	Glutathione(µg/100ml)
GroupI normal n=40	18.16±0.15
Group II-A (Normospermia) n=62	11.8±0.02*
GroupII-B (Moderate Oligozoospermia) n= 46 n=46	3.2±0.03**

Values are Mean±S.E.

*p<0.01

**p<0.001

TABLE-II: SHOWING GLUTATHIONE LEVELS IN SEMEN OF III MALES (CAUSES OF UNEXPLAINED INFERTILITY OF AGE RANGE 31-40YEARS)

Group	Parameter
	Glutathione(µg/100ml)
Group I-A Normal n=40	19.12±0.5
Group lll-A (Normospermia) n=53	8.15±0.76**
GroupIII-B Moderate Oligozoospermia) n=59	5..86±0.07**

Values are Mean±S.E.

**p<0.001

CONCLUSION

Increased free radical attack on the sperm cell, which subsequently showed a. decline in sperm function and alteration in sperm metabolism of sperm. Glutathione (GSH) has a protective action against free radicals reactive oxygen species (ROS) like peroxidase and other toxic compounds. It has a central role in defense against oxidative damage. The present data showed significant decline in glutathione content of all the men investigated for unexplained infertility as compared to normal. Our results sustain that the evaluation of seminal antioxidant status in infertile men is necessary and can be helpful in fertility assessment.

REFRENCES

1. Bhardwaj, A., Verma, A., Majumdar, S. and Khanduja, K.L. (2000): Status of vitamin E and reduced glutathione in semen of oligozoospermic and
2. azoospermic patients. Asian JAndrol; 2: 225-8.
3. Grunert and Philips (1951): A modification of the nitroprussude method of analysis for glutathione.Arch.Biochem. 30:217-225.
4. Iwasaki and Gagnon (1992): Formation of reactive oxygen species in spermatozoa of infertile patients.Fertil.Sterile..57:409-416.
5. Oschsendorf F.R., Buhl R.,Basylein A. and Beschmann H.(1998) : Glutathione in spermatozoa and seminal plasma of infertile men.Hum repro.,Feb.13(2):353-9.
6. Zini, A., De Lamirande, E. and Gagnon, C. (1993) : Reactive oxygen
7. species in semen of infertile patients: levels of Superoxide dismutase
8. and catalase like activities in seminal plasma and Spermatozoa. Int. J.
9. Androi, 16, 183-188.