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Abnormalities in Semen Parameters of Men Due to Consumption of Alcohol

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Abstract: ***To investigate the effects of alcohol consumption on semen parameters, semen samples were collected from eighty (80) alcohol consumption men. This sample was from a cross section of population of Anantapuramu district, Andhra Pradesh, India. They were divided into two age groups namely 25-35 years and 35-45 years. In both age groups persons were selected basing as how many units of alcohol they consumed in a day. Different semen parameters like volume, liquefaction, alkalinity, sperm count, motility and morphology were analysed. Incidences of Hypospermia in 43, Teratozoospermia in 21, Oligozoospermia in 59, Oligoasthenozoospermia in 22 and Oligoasthenoteratozoopermia in 6 persons were observed. Abnormalities were seen in both age groups and was more pronounced in persons who consumed alcohol either moderately or heavily.***

Keywords: Alcohol Consumption, Men, Reproductive health, Semen analysis.

1. Introduction

Male infertility plays a key role in conception difficulties of up to 40% infertile couples. Infertility, defined as the inability to conceive after 12 months of regular unprotected sexual intercourse, affects 10-15% of all couples [1], [2]. The known reasons for male infertility are hormonal disorder, hereditary diseases and chromosomal abnormalities, gonadotoxins (medicine, insecticides, radiation, magnetic fields, alcohol, smoking, drugs and food additives), abnormal spermatogenesis and various metabolic diseases [3]. Alcohol is one of the lifestyle factors that have effects on male reproduction.

Excessive alcohol consumption contributes to a variety of health and social problems, including unintentional injuries (e.g., injuries due to motor vehicle crashes), suicide, homicide, liver cirrhosis, gastrointestinal cancers, vandalism and lost productivity [4]. Alcohol consumption also contributes to the three leading causes of death (unintentional injuries, suicide and homicide) among adolescents [5]. Also any underage drinking is not acceptable.

Alcohol abuse is a major health issue and is responsible for 2.5 million deaths worldwide each year [6]. Consumption of alcohol causes several diseases, and it is the high burden of mortality around the world [6]. In addition, seminiferous tubules in alcohol users mostly contain degenerated spermatids with a consequent azoospermia [7]. These effects may be due to alteration of the endocrine system controlling the hypothalamic pituitary testicular (HPT) axis function and/or to a direct effect on testis and/or male accessory glands [7], [8], [9].

Modest habitual alcohol consumption of more than 5 units per week had adverse effects on semen quality although most pronounced associations were seen in men who consumed more than 25 units per week. Ethanol is a material which is regarded as a reproductive toxin [10]. Chronic consumption of ethanol by men causes atrophy in testicles, reduction in sperm production and drop in testosterone levels [11]. Chronic use of ethanol causes gonadal dysfunction; suppresses spermatogenic cases; reduces the proliferative activation of the spermatogoniums in every level of seminiferous tubule cycles [12], [13]. In particular, experimental evidence suggests that ethanol is a Leydig cell toxin [9], [14]. Alcohol was shown to have deleterious effect on testis and the consequent testicular damage along with decrease of sex hormones leads to a loss of secondary sexual characteristics followed by the onset of erectile dysfunction and infertility [15], [16]. Investigation of 34 healthy Argentine medical students who consumed alcohol had a non-significant reduction in sperm concentration, motility, viability and normal morphology [17]. Hence in the present study we evaluated the effects of alcohol consumption as a sample population between age group of 25-45 years in the district of Anantapuramu, Andhra Pradesh, India.

2. Materials and Methods

One hundred and fifty healthy human males, who consumed alcohol, were interviewed particularly regarding age and the number of years they were alcohol drinking. From this sample, eighty (80) persons were selected and divided into two age groups namely 25-35 years and 35-45 years. Each group consisted of forty (40) men. Out of this forty, twenty were moderate drinking (4±1 Alcohol units/day) and twenty were heavy drinking (7±1 Alcohol units/day). The study protocol was approved by the Institutional Animal Ethical Committee. Before enrollment in the study, written consent was obtained from volunteers.

The selected men were invited to clinical laboratory and semen sample was collected by masturbation and ejaculated into a clean wide mouth glass container. Care was taken to see that the sample was collected after a minimum of two days and maximum of seven days sexual abstinence. The semen sample collected was kept at room temperature (20°C-37°C) to avoid any effect on spermatozoa. Container was labeled with person‟s name, identification number, date and time of collection. WHO guidelines were followed in

collection and analysis of semen sample [18]. The following investigations were carried out in the samples.

2.1. Colour, volume and pH

Colour of the semen was observed immediately after collection and the volume was measured using graduated test tube. The semen reaction was observed by measuring its pH.

2.2. Liquefaction

Immediately after ejaculation into the collection vessel, sample was kept at room temperature and time of liquefaction was observed up to 90 min. Semen was typically a semisolid coagulated mass first and within a few minutes at room temperature, the semen usually begins to liquefy (become thinner). The time taken to liquefy was noted.

2.3. Sperm Count and Motility

Sperm count and motility were made using the above liquefied sample under the microscope. Total sperm count (Mill/ml) was calculated by using neubauer chamber [18]. Briefly the liquefied semen was diluted 1:20 with sodium carbonate and this diluted sample was placed on the neubauer chamber and counted under the microscope (Labomed). Motility was determined by counting the number of motile and immotile spermatozoa from the same slide in several randomly selected fields under 20X objective until at least 200 spermatozoa were counted. The minimum of five microscopic fields were examined.

2.4. Sperm Morphology

This was determined with the help of smears made from semen samples using feathering technique. A clean glass slide was taken, washed in 70% ethanol and dried. A small drop of semen (5 to 20 µl) was taken onto the slide. The edge of a second slide was placed on the first, at an angle of 45° and the semen drop was dragged along the surface to make a thin smear. These were then air dried and fixed. Sperm morphology was evaluated using hematoxylin and eosin stain. Normal and the abnormal sperms were observed under 100X oil immersion microscope. Each of the spermatozoa was examined for head, mid–piece and tail defects. A total of 200 spermatozoa were observed for defects and expressed in percentage. Loose heads were counted (as abnormal forms), while free tails were not counted. Structures without any head anterior to the basal plate were not counted.

3. Results

Evaluation of semen analysis in men addicted to alcohol drinking are given in tables 1 to 3. In this investigation we found that all men had white and alkaline semen. The volume of semen measured was less than the normal values in forty three (43) men out of eighty (80). In men who consumed moderate alcohol, eight persons in the age group of 25-35 and in heavy alcohol drinkers ten persons in the age group of 25-35 have shown hypospermia (Table 1). In men who consumed moderate alcohol, twelve persons in the age group of 35-45 and in heavy alcohol drinkers thirteen persons in the age group of 35-45 have shown hypospermia (Table 2).

Liquefaction time of semen observed in men of both groups was within the time given by WHO in all age groups (Table 1-2). With regard to sperm count it was less than the normal values in fifty eight (59) men out of eighty (80) men who were examined. In men who consumed moderate alcohol, fifteen persons in the age group of 25-35 and in heavy drinkers, sixteen persons in the age group of 25-35 have shown oligozoospermia (Table 1). In men who consumed moderate alcohol, thirteen persons in the age group of 35-45 and in heavy drinker men fifteen persons in the age group of 35-45 have shown oligozoospermia (Table 2).

Oligoasthenozoospermia have been noticed in twenty two men (22) out of eighty (80) men examined. In men who consumed moderate alcohol, four persons in the age group of 25-35 and in heavy drinkers group, eight in the age group of 25-35 have shown Oligoasthenozoospermia (Table 1). In men who consumed moderate alcohol, five persons in the age group of 35-45 and in heavy drinkers group, five persons in the age group of 35-45 have shown Oligoasthenozoospermia (Table 2).

Oligoasthenoteratozoospermia have been noticed in six men (6) out of eighty (80) men examined. In men who consumed moderate alcohol, one person in the age group of 25-35 and in heavy drinkers group, two persons in the age group of 25-35 have shown Oligoasthenoteratozoospermia (Table 1). In men who consumed moderate alcohol, two persons in the age group of 35-45 and in heavy drinkers group, one person in the age group of 35-45 have shown Oligoasthenoteratozoospermia (Table 2).

Morphologically abnormal sperms have been noticed in twenty one men (21) out of eighty (80) men examined. In men who consumed moderate alcohol, three persons have shown Teratozoospermia in the age group of 25-35 and in heavy drinkers group, four persons in the age group of 25-35 have shown Teratozoospermia (Table 1). In men who consumed moderate alcohol, six persons have shown Teratozoospermia in the age group of 35-45 and in heavy drinkers group, eight persons in the age group of 35-45 have shown Teratozoospermia (Table 2).

4. Discussion

Many studies have proved the detrimental effect of alcohol on seminal parameter but its association with individual parameter is yet to be established. Alcohol causes impaired testosterone production and thereby has great impact on fertility and potency. It also has deleterious effect on sertoli cells, thereby decreasing LH, FSH production [19], [20]. Spermatogenesis is sensitive to a variety of chemical and physical stressors. Testicular hyperthermia is one such cause which has deleterious effect on male fertility since the time of Hippocrates and is a well-recognized cause of impaired sperm production [21]. In all the persons who consumed alcohol, semen color was found to be white in color. There was no change with regard to alkalinity of the semen also.

Alcohol does not seem to have a recognizable effect on these two parameters. Our study has shown decrease in the volume of semen in forty three (43) men. Men who drink moderately or heavily are more affected. It was shown earlier that excessive alcohol consumption decreased sperm volume [22], [23]. In addition, chronic alcohol intake was known to affect male fertility by decreasing sperm volume [20], [22], [24]. Martini et al found significant reduction in seminal Volume [25]. Semen volume significantly decreased in 66 drug-free alcoholics who consumed a minimum of 180 ml alcohol per day (brandy and whisky, both 40%–50% alcohol content) [23]. A significant seminal fluid volume and sperm concentration decrease has been reported in 20 men with alcohol dependence syndrome [26].

At the time of ejaculation semen is a thick gel under normal circumstances becomes liquid within 20 minutes (or 15 to 60 mins) after ejaculation. The thick gel is formed by proteins from the seminal vesicles. It was shown that liquefaction occurs only in a pH range of 6.8-8.8, at which pepsin is not active [27]. If liquefaction is delayed it will be difficult for sperm to break thick semen. Also the semen must liquefy quickly for sperm to swim out of the acidic vagina. All men examined from two different groups exhibited liquefaction time within the normal time range.

Sperm count was made in 80 alcoholics and it was observed that in fifty nine (59) alcoholics sperm count was reduced; which is quite dangerous. It was shown earlier that chronic consumption of alcohol increases oxidative stress [28]. Increased and prolonged oxidative stress causes testicular damage which impedes spermatogenesis resulting in decreased sperm count [29], [30]. Young men in the western world have a high alcohol intake, which of public health concern and could be a contributing factor to the low sperm count reported among young men [31]. In addition, chronic alcohol intake may affect male fertility by decreasing sperm count [20], [22], [24].

Sperm motility has been shown to be a good predictor of human male fertility *in vivo* and *in vitro* [32] and as such has also been found to be strongly associated with the probability of conception [33], [34]. Reduced testosterone level leads to disturbed epididymal function which results in reduced sperm motility [35]. Though testosterone was not estimated in the present study this could be contributing to reduced sperm motility. CAT (Choline acetyl transferase) is known to facilitates sperm motility [36]. Chronic alcohol intake was shown to affect male fertility by decreasing sperm motility [20], [22], [24]. Decreased sperm motility was more evident in heavy alcoholics. The alcohol affects mitochondrial functions and increases oxidative stress induced change of plasma membrane of spermatozoa, resulting in reduced motility [37]. Alcohol exposures *in vitro* induced reduction of sperm motility and morphology and the response is dose-related [38].

Normal sperm has an oval head and long tail. Abnormality of sperm could be defective heads/tails. If semen sample contains 4% of morphologically normal forms, it is considered fit. It is observed in this study that twenty one (21) persons in all age groups have shown morphologically abnormal sperm. In the case of semen morphology, there is a report of Teratozoospermia in 72% of heavy alcoholic persons and 63% moderate alcoholic persons [39]. Alcohol consumption was associated with increased numbers of morphologically abnormal sperm [40]. Heavy alcohol consumption has been associated with abnormal sperm morphology [20], [38]. Alcohol has been implicated adversely to affect all sperm parameters causing oligo-, astheno- and teratozoospermia [41].

5. Conclusion

In this study we report that consumption of alcohol has an adverse influence on semen quality. Moderate/high alcohol consumption (4±1/7±1units/day) was associated with an increase in morphologically abnormal sperms. Incidences of Hypospermia in 43, Teratozoospermia in 21, Oligozoospermia in 59, Oligoasthenozoospermia in 22, and Oligoasthenoteratozoopermia in 6 persons were observed. The abnormalities were more in the age group of 35-45 than 25-35 age group. It could be due to resistance of young people. Also effect was more in people who consumed more alcohol.

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Table 1: Analysis of semen in men who have consumed Alcohol for more than five years

S. No	Parameters Examined	Normal Values	Age:25-35 4±1[a]	Age:25-35 7±1[a]
1	Colour	White	White	White
2	Reaction	Alkaline	Alkaline	Alkaline
3	Volume	1.5-5ml	1.53±0.60 (0.5-2.5)	1.43±0.58 (0.5-2.5)
4	Liquefaction	15-60mins	30.25±10.06 (15-50)	39.25±9.35 (25-50)
5	Sperm count	39-150mill/ml	28.6±18.55 (10-70)	25.4±15.02 (4-56)
6	Total motility	32%	44.8±15.09 (20-65)	32.3±13.68 (15-60)
7	Morphology	4%	3.85±0.36 (3-4)	3.8±0.41 (3-4)

Note: Values are mean ± SD (n=20). Minimum and maximum values are given in parentheses.
[a]Alcohol consumed per person,Units/day.

Table 2: Analysis of semen in men who have consumed Alcohol for more than five years

S. No	Parameters Examined	Normal Values	Age:35-45 4±1[a]	Age:35-45 7±1[a]
1	Colour	White	White	White
2	Reaction	Alkaline	Alkaline	Alkaline
3	Volume	1.5-5ml	1.30±0.42 (0.5-2)	1.24±0.40 (0.5-2)
4	Liquefaction	15-60mins	39.75±8.50 (25-55)	40.25±10.57 (25-50)
5	Sperm count	39-150mill/ml	27.55±16.90 (0-60)	21.75±14.74 (0-50)
6	Total motility	32%	34.5±14.29 (0-60)	33.85±12.41 (0-60)
7	Morphology	4%	3.7±0.47 (3-4)	3.6±0.50 (3-4)

Note: Values are mean ± SD (n=20). Minimum and maximum values are given in parentheses.
[a]Alcohol consumed per person,Units/day.

Table 3: Abnormalities observed in persons of two different age groups due to Alcohol

S. No	Addiction of Alcohol	Age group in years	Abnormalities in number of men
1	Group-1	25-35 4±1 Alcohol Units/day	Hypospermia-8, Oligozoospermia-15, Oligoasthenozoospermia-4, Teratozoospermia-3, Oligoasthenoteratozoopermia-1.
		25-35 7±1 Alcohol Units/day	Hypospermia-10, Teratozoospermia-4, Oligozoospermia-16, Oligoasthenozoospermia-8, Oligoasthenoteratozoopermia-2.
2	Group-2	35-45 4±1 Alcohol Units/day	Hypospermia-12, Oligozoospermia-13, Teratozoospermia-6, Oligoasthenozoospermia-5, Oligoasthenoteratozoopermia-2.
		35-45 7±1 Alcohol Units/day	Hypospermia-13, Teratozoospermia-8, Oligozoospermia-15, Oligoasthenozoospermia-5, Oligoasthenoteratozoopermia-1.

Hypospermia (43) : Semen volume less than 1.5 ml.
Oligozoospermia (59) : Sperm count is less than 39 Mill/ml.
Teratozoospermia (21) : When less than 4% of the normal sperms show abnormal morphology.
Oligoasthenozoospermia (22) : Combination of low sperm count (less than 39 Mill/ml) and sperm motility (less than 32%).
Oligoasthenoteratozoospermia (6) : Combination of low sperm count, motility and abnormal morphology (less than 4% of normal forms).