

Semen and spermatozoa characteristics in alcohol users and non-users

ABSTRACT:

Introduction: To find out the characteristics of semen and spermatozoa in alcohol users and compare these characteristics with that of non-users of alcohol. **Methodology:** The study was initiated after getting approval from the Institutional Human Ethics Committee. The data on alcohol use and semen analysis were obtained from case records of patients reported to the Department of Andrology & Reproductive Medicine of a tertiary care hospital for a period of one year from January 2018 to December 2018. The semen volume, sperm concentration, motility and morphology in alcohol users were compared with non-users. **Results:** A total of 231 patients had reported to the Department of Andrology & Reproductive Medicine during the study period. Among them 81 (35.06%) were alcohol users and 150 (64.94%) alcohol non-users. Analysis of their semen reports revealed that the difference in semen volume and sperm morphology was not found to be statistically significant, but the sperm concentration and progressive motility of spermatozoa showed significant reduction in alcohol users compared to non – users ($p < 0.05$). **Conclusion:** The semen volume and sperm quality were found to be low in alcohol users. Among the spermatozoa characteristics, sperm concentration and motility were significantly reduced in alcohol users.

Keywords: alcohol, spermatozoa, semen

INTRODUCTION:

Infertility: Infertility is defined as the “Failure to achieve a clinical pregnancy after 12 months or more of regular unprotected sexual intercourse” (WHO-ICMART glossary)¹. Up to 15% of reproductive-aged couples are affected with infertility worldwide. Infertility can be of two types, primary and secondary. Primary infertility means that the couple has never conceived. In secondary infertility the couple has experienced a pregnancy before but failed to conceive later. Globally, most infertile couples suffer from primary infertility. The WHO estimate shows that the prevalence of primary infertility in India ranges from 3.9% - 16.8% and it varies from state to state. Irrespective of the type, about one third is female infertility and another one third is male infertility. The remaining is due to problems in both the partners or the cause is unclear. Female infertility can be caused by a number of factors like fallopian tube damage, ovarian dysfunction, hormonal imbalance, uterine or cervical causes. Male infertility is due to low spermatozoa count, poor sperm motility, poor morphology or all of them. The other causes include anatomical problems, hormonal imbalances and genetic defects. The factors that could affect the fertility in both the sexes include apart from hormonal changes, environmental/occupational factors, alcohol consumption, tobacco and marijuana use, other drugs like spironolactone and cimetidine, malnutrition, extreme weight loss or gain and advanced age². The association between infertility and alcohol consumption and smoking tobacco has been reported by a few authors^{3,4}. **Effects of alcohol on male reproductive system:** Alcohol can adversely affect the Leydig cells of testis, which produce and secrete the hormone testosterone. Alcohol also impairs the function of the testicular Sertoli cells that play an important role in spermatozoa maturation. In the pituitary gland, alcohol can decrease the production, release, and activity of Luteinizing hormone (LH) and Follicle-stimulating hormone (FSH) which have crucial reproductive functions. Finally, alcohol can interfere with hormone production in the hypothalamus⁵ which in turn leads to abnormal development and maturation of spermatozoa, decreased rate of spermatozoa production, gonadal atrophy, impotence and infertility^{6,7,8,9,10}. Excessive alcohol intake leads to increased acetaldehyde, a by-product of alcohol metabolism, which interacts with proteins and

lipids generating ROS¹¹. Excessive alcohol intake is also associated with morphologically abnormal spermatozoa, reduction in spermatogenesis, decreased seminal fluid volume, low LH, FSH, and testosterone, and increased oxidative stress¹². Animal studies have also proven the association between alcohol and abnormal spermatozoa¹³. Hence the present study was undertaken to find out whether there are differences in the semen and spermatozoa characteristics in relation to alcohol consumption.

Materials and Methods: This study was a retrospective study conducted after getting the approval from the Institutional Human Ethics Committee, The case records of men who reported to the department of Andrology & Reproductive Medicine in a selected tertiary care institute in Tamilnadu for the treatment of infertility during the period from January 2018 to December 2018 were collected and screened. Demographic details were recorded and the information regarding alcohol use and the semen analysis report were collected.

Based on alcohol use, patients were classified into two groups - alcohol users and alcohol non-users. Semen analysis report was assessed based on WHO criteria (2010).

The following semen parameters were compared between the two groups. 1) Semen volume, 2) pH 3) Sperm concentration 4) Sperm motility and 5) Sperm morphology.

Cut-off values for normal sperm characteristics (WHO criteria 2010)

Parameters	Lower Reference Limit
Semen volume	1.5 ml
pH	≥ 7.2
Sperm concentration	15 million/ml
Progressive motility	32%
Total motility	40%
Normal morphological forms	4%

Table 1: WHO criteria for assessing sperm characteristics (2010)

Statistical analysis:

The difference in semen characteristics between both the groups was estimated by using chi-square test.

RESULTS: A total of 231 patients had reported to the Department of Andrology & Reproductive Medicine during the study period and their case records were screened. Among them 81 (35.06%) were found to be alcohol users and 150 (64.94%) alcohol non-users.

The age of the patients ranged from 21 – 52 years. The usage of alcohol was high in the age group of 31-40 years. The semen analysis report was analyzed between the alcohol non-users and users.

The following table shows the sperm and semen characteristics between alcohol users and non-users.

Semen analysis	Alcohol non-users (Total 150)	Alcohol users (Total 81)	P value
Reduction in semen volume (less than 1.5 ml)	26.70%	29.62%	0.74

pH (less than 7.2)	0.66%	1.23%	0.76
Reduction in sperm concentration (less than 15 mill/ml)	35.64%	49.38%	0.04
Reduction in progressive motility (less than 32%)	25.08%	43.21%	0.008
Reduction in normal morphological forms (less than 4%)	34.66%	43.21%	0.26

Table 2: Semen characteristics in alcohol and non- alcohol users

Data were analyzed using the chi-square test. The results revealed that

- The number of persons who had reduced sperm concentration and reduced sperm motility were significantly higher among alcohol users than non-users ($p < 0.05$).
- The semen volume, pH and the percentage of abnormal morphological forms were not significantly different between alcohol non-users and users.

DISCUSSION: In this study, it was found that the sperm characteristics like sperm concentration and progressive motility were reduced in alcohol users. As it is a retrospective study the information on the type and the duration of alcohol consumption could not be obtained. However, La Vignera S et al., (2013) have reported that irrespective of the type (beer, wine, whisky and brandy), alcohol was found to affect spermatogenesis¹⁴. Alcohol can affect spermatogenesis through different mechanisms. It can act centrally and reduce the level of testosterone and peripherally cause oxidative damage in the testicular tissue. Sunil Kumar et.al (2014) has reported that alcohol consumption could cause significant alteration in sperm quality. Reactive oxygen species (ROS) liberated during alcohol metabolism could be the reason for DNA damage in sperm which in turn affects sperm quality and fertility¹⁵. R. A. Condorelli et al., (2015) in their study conducted with 40 occasional drinkers and 36 daily drinkers observed a high percentage of morphological abnormal spermatozoa in daily drinkers in addition to reduction in seminal volume and increased mucus production. However, in our study with 81 alcohol users, the percentage of spermatozoa with abnormal morphology was not found to be significant¹⁶. The animal study conducted by O. O. Dosumu et al., (2014) with male Sprague–Dawley rats also confirmed similar outcome¹⁷. Jensen TK et al., also observed a dose related adverse change in semen quality and habitual alcohol intake was most pronounced in men who consume above 25 units in a week¹⁸. However, the limitation in the present study is the lack of information on the type of alcohol, quantity consumed and the duration of alcoholism. Most of these studies have been conducted in non-Indian population. The current study was on Indian population. Hence further studies using larger population is needed to derive additional information on the severity and duration of alcoholism. From our study we suggest that alcoholism may be an important cause for male infertility. Hence when couple reports with infertility, counselling should be given to male alcoholics to slowly withdraw from drinking alcohol.

CONCLUSION: Based on the current study and the available evidences it can be concluded that the spermatozoa quality especially sperm concentration and motility are adversely affected in alcohol users irrespective of the type of alcohol.

ETHICAL CLEARANCE: Ethical Clearance for this study was got approved from the Institutional Human Ethical Committee (IHEC).

REFERENCES:

- De Neubourg D, Van Duijnhoven NT, Nelen WL, D'Hooghe TM. Dutch translation of the ICMART- WHO revised glossary on ART terminology. *Gynecologic and obstetric investigation*. 2012;74(3):233-48.
- Infertility | National Health Portal of India [Internet]. Available from: <https://www.nhp.gov.in/disease/reproductive-system/infertility>.

3. Esakky P, Hansen DA, Drury AM, Moley KH. Cigarette smoke condensate induces aryl hydrocarbon receptor-dependent changes in gene expression in spermatocytes. *Reprod Toxicol*. 2012;34:665–76.
4. Nesper K, Scheansova A. Alcohol, tobacco and other addictive substances and reproductive health. *Cas Lek Cesk*. 2011;150:339–43.
5. Emanuele MA, Emanuele NV. Alcohol's effects on male reproduction. *Alcohol health and research world*. 1998 Jan 1;22:195-201.
6. Gude D. Alcohol and fertility. *Journal of human reproductive sciences*. 2012;5(2):226.
7. Rai T, Rai GS. Cigarette smoking and alcohol consumption are enemy of male fertility? A patho-radiological correlation study. *International Journal of Research in Medical Sciences*. 2016;4(3):847-54.
8. Lwow F, Medraś M, Słowińska-Lisowska M, Józaków P, Szmigiero L. The effect of occasional alcohol drinking on semen quality and sperm morphology among young and healthy Polish men. *Journal of Mens Health*. 2017;13(2):e16-24.
9. Ricci E, Al Beitawi S, Cipriani S, Candiani M, Chiaffarino F, Viganò P, Noli S, Parazzini F. Semen quality and alcohol intake: a systematic review and meta-analysis. *Reproductive biomedicine online*. 2017;34(1):38-47.
10. Sansone A, Di Dato C, de Angelis C, Menafra D, Pozza C, Pivonello R, Isidori A, Gianfrilli D. Smoke, alcohol and drug addiction and male fertility. *Reproductive Biology and Endocrinology*. 2018;16(1):3.
11. Agarwal A, Virk G, Ong C, du Plessis SS. Effect of oxidative stress on male reproduction. *World J Mens Health* 2014;32:1–17.
12. La Vignera S, Condorelli RA, Balercia G, Vicari E, Calogero AE. Does alcohol have any effect on male reproductive function? A review of literature. *Asian J Androl* 2013;15:221–5.
13. Muthusami KR, Chinnaswamy P. Effect of chronic alcoholism on male fertility hormones and semen quality. *Fertility and sterility*. 2005;84(4):919-24.
14. La Vignera S, Condorelli RA, Balercia G, Vicari E, Calogero AE. Does alcohol have any effect on male reproductive function? A review of literature. *Asian journal of andrology*. 2013 Mar;15(2):221.
15. Kumar S, Murarka S, Mishra VV, Gautam AK. Environmental & lifestyle factors in deterioration of male reproductive health. *The Indian journal of medical research*. 2014 Nov;140(Suppl 1):S29.
16. Condorelli RA, Calogero AE, Vicari E, La Vignera S. Chronic consumption of alcohol and sperm parameters: our experience and the main evidences. *Andrologia*. 2015 May;47(4):368-79.
17. Dosumu OO, Osinubi AA, Duru FI. Alcohol induced testicular damage: Can abstinence equal recovery?. *Middle East Fertility Society Journal*. 2014 Sep 1;19(3):221-8.
18. Jensen TK, Gottschau M, Madsen JOB, et al Habitual alcohol consumption associated with reduced semen quality and changes in reproductive hormones; a cross-sectional study among 1221 young Danish men *BMJ Open* 2014;4:e005462. doi: 10.1136/bmjopen-2014-005462