



Review Article

CHRONIC ALCOHOLISM A CAUSE OF MALE INFERTILITY: A REVIEW

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ABSTRACT:

Many couples nowadays are suffering from infertility which leads to many physical, psychological and social issues. In 2008, around 70 million couples suffered from infertility. Out of which in 50% cases male factor was responsible either as a lone factor or in combination with that of problems in female partners. The risk of health problems in many organ systems increased with the Consumption of more than 2 standard drinks per day. In the alcoholic's, abnormalities were detected in the reproductive hormones, sperm count and number of morphologically normal sperms. Significant association was found between alcohol abuse & impotence. Hyper-oestrogenisation along with decreased production as well as enhanced metabolic inactivation of testosterone leads to testicular atrophy in chronic alcoholic persons. Evidence for hypogonadism and feminization are also demonstrated frequently in chronic alcoholic men. Alcohol acts as a gonad toxin which specially affects Leydig cells. Quantitative and qualitative abnormalities are observed in semen of alcoholic men. Alcohol exerts a dual effect on the hypothalamic-pituitary-gonadal axis. It directly inhibits testicular steroid genesis. It also blocks the release of LH-releasing hormone/LH from the hypothalamic-pituitary axis. Hence the male partner should be encouraged to stop alcohol consumption when a couple is planning to conceive. Measures should be taken from school level with special emphasis given on pubertal age group males as that is the age of starting alcohol consumption.

KEY WORDS: Alcoholism, Infertility, Klaibya, Madya

INTRODUCTION:

Millions of couples are struggling with infertility every year. The curse of sterility has strained many relationships despite relentless effort, even treatments and various therapies⁽¹⁾. Infertility can be defined as the inability to achieve pregnancy during a year or more of unprotected intercourse⁽²⁾. Charakacharya have described an infertile male like a lonely tree amidst a dense forest who can neither provide shelter nor fruits to anyone & have obnoxious smells⁽³⁾. In 2008, around 70 million couples

suffered from infertility⁽⁴⁾ and majority of couples suffering from infertility are located in developing countries. According to Weiyan, "15% of reproductive aged couples worldwide are affected due to infertility"⁽⁵⁾. In India general rate for infertility is 10% for reproductive aged couples⁽⁶⁾. Approximately 30 million couples are suffering from infertility in India⁽⁷⁾. Infertility is a common problem; approximately 56% of couples need treatment⁽⁸⁾.

In many cultures, childless women have to face problems like discrimination, stigma and ostracism. In 50% cases male factors are responsible for infertility but the social burden falls disproportionately on women. The guilt and shame felt by couples suffering from infertility is amplified, since child is considered as continuation of one's family and duty towards community. Prevention of infertility & treatment remains a neglected public health issue. In many developing countries infertility treatments are not widely available & IVF is unaffordable⁽⁵⁾.

In 50% cases male factor was responsible either as a lone factor or in combination with that of problems in female partners. In one study sperm dysfunction was found out as single most common cause leading to male infertility.⁽¹⁾

In another study, sperm quality in moderate drinkers was compared with that of 66 alcoholic men who drank about six ounces or more of alcohol daily, or nearly so. Abnormalities were detected in their reproductive hormones and their sperm count and number of morphologically normal sperms were significantly lower compared with the non-alcoholic control group⁽⁹⁾.

Lifestyle factors such as obesity, tobacco smoking or chewing, alcohol & addiction to some of the illicit drugs like cocaine, cannabis, etc. were found affecting male fertility along with exposure to extreme heat in some cases⁽¹⁰⁾. The risk of health problems in many organ systems increased with the Consumption of more than 2 standard drinks per day⁽¹¹⁾. Knowledge about deleterious effects can help many by motivating to abstain. Hence, a review has been done with special reference to effects of consumption of alcohol on male reproductive system with ayurveda and modern perspective. Psychological, physical and physiological effects are considered, as these three play important role in fertility.

Effects of alcohol on sexual desire:

Spoiled *Madya* (Alcohol) is a cause of vitiation and of all *Doshas*⁽¹²⁾. This condition is a cause of *Klaibya* (Impotence)⁽¹³⁾.

Shakespeare has quoted in famous Macbeth that, "alcohol provokes the desire, but it takes away the performance"⁽¹⁴⁾. Ethanol doses causing blood alcohol concentration of less than or equal to 100 mg/dl can both increase sexual drive & decrease erectile capacity in men⁽¹⁵⁾. Alcohol consumption often leads to enhanced sexual behaviour due to loss of inhibition. When an objective measurement of penile tumescence was done in human beings it showed that ethanol significantly decreases sexual responsiveness⁽¹⁶⁾. Impairment of spinal reflexes, also caused by excessive alcohol abuse, leads to reduced sensation and innervations of the penis, and thus may also contribute to erectile dysfunction⁽¹⁷⁾. Prevalence of impotence was observed more among patients with greater liver damage⁽¹⁸⁾. Fourteen of the 20 alcoholics with cirrhosis and 10 of the 40 non-alcoholic liver transplant candidates with cirrhosis reported a history of impotence. The association between impotence and alcohol abuse was found significant. Impotence index is found out by multiplying the frequency by the duration of impotency for each individual. It demonstrated a more severe degree of impotence in the alcoholics when compared to the non-alcoholics⁽¹⁹⁾.

High levels of blood alcohol lead to reduced sexual stimulation. Ability to enjoy orgasm is decreased along with retarded ejaculation⁽²⁰⁾⁽²¹⁾. Erectile dysfunction was reported in 54% of hospitalized alcoholic men and 24% of healthy controls⁽²²⁾. Erectile dysfunction due to lack of sexual desire was reported in 63% of married alcoholic men and 10% of controls⁽²³⁾.

Effects on testes:

Hyper-oestrogenisation along with decreased production as well as enhanced metabolic inactivation of testosterone leads to testicular atrophy in chronic alcoholic persons.⁽¹⁶⁾ Also concomitant shrinkage of seminiferous tubules is observed. There is decrease in ejaculate volume & lower sperm count is observed in chronic alcoholic men⁽¹⁵⁾. Spermatogenesis is inhibited due to alcohol consumption. Suppression of Leydig cell synthesis of testosterone or suppression of gonadotrophin levels are found as a cause⁽²⁴⁾.

Evidence for hypogonadism and feminization are frequently demonstrated in chronic alcoholic men⁽²⁵⁾. Testicular atrophy, loss of libido, impotence, a high prevalence of infertility and reduced plasma levels of testosterone are observed in these males due to hypogonadism. Feminization is clearly different from hypogonadism. Symptoms like gynaecomastia, the presence of spider angiomas, palmar erythema, and changes in body hair patterns are found due to feminization⁽²⁶⁾. A change in the mitochondrial structure is one of the effects of alcohol on testis⁽²⁷⁾. In study of liver cells in chronic alcoholic persons, the mitochondria were found often elongated and distorted. They appeared either as swollen or elongated structures with the cristae often distorted and without normal organization. These structural changes suggest that chronic ethanol consumption affects testicular energy metabolism⁽²⁸⁾.

Ethanol has hepatotoxic effect and associated nutritional disturbance. It also acts as a direct gonadotoxin⁽²⁹⁾. Inhibition of *in vitro* testicular steroidogenesis occurs after moderate alcohol consumption due to alcohol and its metabolite, acetaldehyde⁽³⁰⁾.

Alcohol's Effects on Leydig Cells and Testosterone Metabolism:

Ethanol acts as a Leydig cell toxin⁽³¹⁾. Morphometric techniques were used to demonstrate that the Leydig cells of alcohol-fed animals were smaller. They also had less cytoplasm, larger mitochondria and less smooth endoplasmic reticulum than compared to those of the isocaloric controls⁽³²⁾.

Reduction in testosterone levels in male rats, mice, monkeys, and humans are observed in acute, short term, and long term alcohol use⁽³³⁾. Studies show alcohol-mediated elevations in testosterone following low dose consumption in both women and men. So the effects of a low dose have been rather contradictory.^{(34), (35)}

A single alcohol dose resulted in a profound reduction in testosterone levels in healthy male rats that lasted for up to 96 hours⁽³⁶⁾. Plasma testosterone levels were depressed in mice consuming 5 & 6 % ethanol diet⁽³⁷⁾.

Alcohol affects testosterone metabolism differently in men suffering from alcoholic liver disease when compared with men without alcoholic liver disease. The production rates and blood levels of testosterone are lowered in both groups, increase in the metabolic clearance of testosterone found only in men without alcoholic liver disease. In contrast men with alcoholic liver disease demonstrate the decrease in metabolic clearance^{(38), (39)}.

Aromatization is the conversion of testosterone or one of its precursors into oestrogens. For example, testosterone can be metabolized to an oestrogen called oestradiol. Androstenedione is the immediate precursor of testosterone which can be converted into a less potent oestrogen called oestrone. This is another mechanism by which alcohol lowers testosterone levels. In men who regularly consume alcohol this conversion process is enhanced. An increased level of oestrogens is found in blood of people suffering from alcoholic liver disease^{(40), (41), (42)}.

Alcohol's Effects on semen & sperms:

Alcoholic beverages with *Ruksha* (Dry) property are also the cause of *Kshaya* (decrease)⁽⁴³⁾. *Madya* and *Oja* (Vitality) have opposite *Gunas* (Properties). *Madya* upon entering the body enters *Hridaya* (Heart) and destroys functions of *Oja* due to its opposite effects. *Oja* as well as *Shukra* (Semen) is *Saumya* (Mild) in quality. *Madya* varieties with excessive *RukshaGuna* decreases *Saumya* property of both *Oja* and *Shukra*.

A study was conducted in 100 males suffering from infertility. Addiction history was obtained in these individuals. It was found out 33 males were alcoholics, 42 were addicted to tobacco and 25 were addicted to both alcohol and tobacco. Seminogram was also done in these people. 29.7 % Men who had semen abnormality were addicted to alcohol. 40.05 % Men with semen abnormalities were addicted to tobacco. Amongst those with abnormal seminograms 29.7% men were addicted to both tobacco and alcohol⁽⁴⁴⁾. This supports that excessive alcohol consumption can be a cause of male infertility.

According to another study, 35.49%, 86.49% and 53.75% smokers, alcoholics and in combinations of these addictions respectively showed abnormal semen analysis report⁽⁴⁵⁾. The mechanism is unclear but, it appears, however, the Sertoli cells which provide proteins required for sperm cell production are damaged by alcohol⁽⁴⁶⁾.

Both acute and chronic alcohol consumption may lead to abnormal spermatozoa. After consumption of alcohol in amount of 0.4 to 0.8 gm/kg, semen analysis showed following abnormalities like spermatozoa had heads broken off, curled tails, and distended midsections⁽⁴⁷⁾. In sperm specimens from alcoholic men grossly abnormal ejaculate was produced with reduced total cells and more abnormal cells⁽⁴⁸⁾.

Alcohol's Effects on the Anterior Pituitary Gland & hypothalamus:

Alcohol exerts a dual effect on the hypothalamic-pituitary-gonadal axis. It directly inhibits testicular steroidogenesis. It also blocks the release of LH-releasing hormone/LH from the hypothalamic-pituitary axis⁽⁴⁹⁾.

Alcohol's effects on the hypothalamus and pituitary have been studied by many researchers. Alcohol's effects on the hormones namely LHRH which is produced by the hypothalamus, LH and FSH which are produced by the pituitary. Effect on LH levels was not consistent. Increased FSH levels were observed in alcoholics. Alcohol has a direct toxic effect on the testis which leads to decreased somniferous tubular function. The testicular feedback regulation at the pituitary level (i.e. hampered negative feedback mechanism) is absent which in turn causes FSH elevation⁽⁵⁰⁾,⁽⁵¹⁾,⁽⁵²⁾.

Decrease in the levels of LH, FSH hormones was observed in acute alcohol intoxicated males. This effect was due to inhibition of the secretion of the hypothalamic GnRH and/or pituitary LH⁽⁵³⁾,⁽⁵⁴⁾.

In vitro studies were done on isolated pituitary gland. They have proven that alcohol partially acts directly on pituitary⁽⁵⁵⁾.

DISCUSSION:

Objectives of Ayurveda are "*Swasthasya Swasthya Rakshanam* (maintaining health by prevention of diseases) & *Aturasya Vikara Prashamanam*" (treatment of the patients who are suffering from any ailments)⁽⁵⁶⁾. Many developing countries are facing a problem of infertility. Rather than treating infertility, measures should be taken to prevent infertility. In this context review was done of effects of chronic alcohol consumption as a cause of infertility.

When we consider ayurveda perspective and focus over the properties of various formulations of Madya explained in the literature. It is quite possible that drinking RukshaMadya like *Yavasura* (alcohol prepared from *Barley*), *Baibhitaki* (alcohol prepared from *Bibhitaka (Terminaliabelerica)*), *Sura* (ancient Indian alcoholic drink) or modern varieties like Vodka with high alcohol content can cause *ShukraKshayajaKlaibya* (Impotence due to reduced semen).

Alcohol affects all human body systems but its main effects are on reproductive system. Research over the past few years has greatly expanded knowledge of alcohol's effects on male reproduction system.

Effects of alcohol are often reversible. They are more common in patients with liver failure. Alcohol affects sexual desire and erectile dysfunction. It is also responsible for testicular atrophy, hypogonadism, shrinkage of somniferous tubules, decrease in ejaculate volume & lower sperm count.

Association between excessive alcohol consumption and poor reproductive function has been found. Alcohol acts as a gonad toxin specially, Leydig cell toxin. It acts by reducing testosterone synthesis. Its metabolite, acetaldehyde, causes membrane damage and leads to the formation of Leydig cell auto-antibodies. Acute & chronic alcoholism leads to abnormal sperms and decreased seminal quantity. It affects sperms both qualitatively and quantitatively.

A patient can be convinced to modify habits so that adverse effects on fertility will decrease. This ultimately improves the chances of achieving a successful pregnancy⁽⁵⁷⁾.

CONCLUSION:

In about 50% cases of infertility male factors are responsible, semen abnormalities are most common cause in it. Alcohol & smoking are

culprits found in changing lifestyle leading to problem of infertility. Hence, men should be encouraged to stop alcohol consumption especially while trying to conceive. Measure should be taken from school level to emphasis about harmful effects of alcohol, especially pubertal age group males should be focused as it is the age of starting alcohol consumption.

Future Scope:

In India nowadays female alcohol consumption is increasing. Statistical data is not available about alcohol drinking in females. So a study should focus on changing lifestyles leading to problems in India.

REFERENCES:

1. M G R Hull et al, Population study of causes, treatment, and outcome of infertility, British Medical Journal 1985 Volume 291
2. TabersCyclopedic Medical DictionaryVol 1 Jaypee 2002 Pg Number 1091
3. Dr Bramhanand Tripathi Charak Samhita Chikitsa Sthana Edition 2015 chapter 2/1 verse 16
4. Willem Ombelet et al, Infertility and the provision of infertility medical services in developing countries, Hum. Reprod. Update. 2008 Nov-Dec; 14(6): 605–621
5. Mother or nothing: the agony of infertility Bull World Health Organ 2010;88:881–882 | doi:10.2471/BLT.10.011210
6. Mahesh, Roshni Infertility Rate among Indian Couples on the Rise Says Survey. Sept 20, 2013.
7. <http://archive.indianexpress.com/news/-30-million-couples-in-india-suffer-from-infertility-/588934/> (accessed on 20/04/2017)
8. Jacky Boivin et al International estimates of infertility prevalence and treatment-seeking: potential need and demand for infertility medical care; Hum Reprod 2007; 22 (6): 1506-1512. doi: 10.1093/humrep/dem046

9. K. R. Muthusami, M.Phil., and P. Chinnaswamy, Effect of chronic alcoholism on male fertility hormones and semen quality, *Fertility and Sterility* October 2005 Vol. 84, No. 4, pg no. 919-924
10. Sunil kumar et al Lifestyle factors in deteriorating male reproductive health. *Ind.Jou. of Exp.Biology.* 2009 vol.47 Aug. pg. 615-624
11. Harrison's Principles of Int. Med. Vol. II McGraw Hill 16th Edition Pg.No. 2564
12. DrBramhanandTripathiAsthangahrudayaSamhita, Edition 2005Nidanasthana Chapter 1 verse 20
13. DrBramhanandTripathiCharakaSamhitaSutrasthanaEdition 2015 chapter 16 verse 15
14. Macbeth act 2 scene 3
15. Harrison's principles of Int. Med. Vol. II McGraw Hill 16th Edition Pg.No.2566
16. V.V.PillayComprehensive Medical Toxicology Paras Publication 2ndEdition Pg. No. 182
17. Buffum J. The effects of drugs on sexual function a review. *Pharmacosexology: J Psychoactive Drugs* 1983;14:5-44.
18. Van thiel DH, Lester r, Sherinstj, Hypogonadism in Alcoholic Liver Disease: Evidence for Double Defect. *Gastroenterology*; 1974 dec 67(6) : 1188-99
19. Cornely CM et al,Chronic advanced liver disease and impotence: cause and effect? *Hepatology.* 1984 Nov-Dec; 4(6):1227-30.
20. Mulligan Tet al, The Role of Aging and Chronic Disease in Sexual Dysfunction.*J Am Geriatric Soc* 1988;36:520-4.
21. Rosen RC, Alcohol and drug effects on sexual response. Human experimental and clinical studies. *Ann Rev Sex Res* 1991; 2:119-80.
22. Whalley LJ., Sexual Adjustment of Male Alcoholics .*ActaPsychiatrScand* 1978; 58:281-98.
23. Jensen SB,Sexual Function and Dysfunction in Younger Married Alcoholics. *ActaPsychiatrScand* 1984; 69:543-9.
24. D.C.DuttaTextbook of gynaecology New Central Book Agency 4thEdition Page No.213
25. Van Thiel DH, Lester R Alcoholism: its effect on hypothalamic-pituitary-gonadal function. *Gastroenterology*: 71:318-327, 1976
26. David H. Van Thiel, M.D. Feminization of Chronic Alcoholic Men: A Formulation *The Yale Journal Of Biology And Medicine* 52 (1979), 219-225
27. O.O. Dosumu, Ph.D. Thesis, Histomorphometric studies of the effects of coconut (Cocosnucifera) oil on alcohol-induced testicular injury in Sprague-Dawleyrats. University of Lagos, Lagos, Nigeria, 2010.
28. Kiessling KH, Tobe U. Degeneration of Liver Mitochondria in Rats after Prolonged Alcohol Consumption.*Exp Cell Res* 1964;33: 350-64.
29. Boyden TW, Pamerter RW, Effects of ethanol on the male hypothalamic-pituitary-gonadal axis*Endocr Rev.* 1983 Fall;4(4):389-95.
30. Cicero TJ, Bernard JD, Newman K., Effects of Castration and Chronic Morphine Administration on Liver Alcohol Dehydrogenase and the Metabolism of Ethanol in the Male Sprague-DawleyRat. *J PharmacolExpTher.* 1980 Nov; 215(2):317-24..
31. Van Thiel DH et al, Ethanol, a LeydigCell Toxin: Evidence Obtained in Vivo and In Vitro. *PharmacolBiochemBehav* 1983; 18:317-23.
32. J.S. Gavalier, et al .Morphologic alterations of rat Leydig cells induced by ethanol, *Pharmacology Biochemistry and Behavior*Volume 18, Supplement 1, 1983, Pages 341-347
33. Chiao, Y. B. and Van Thiel, D. H.,Biochemical mechanisms that contribute to alcoholinducedhypogonadism in the male. *Alcohol ClinExp Res* (1983). 7(2): 131-134.

34. Eriksson, et al "Sex hormone response to alcohol." (1994). *Nature* 369(6483): 711.
35. "Sarkola, T. and Eriksson, C. J. P."Testosterone increase in men after a low dose of alcohol (2003).*Alcohol Clin Exp Res* 27(4): 682-685.
36. Steiner, J.et al, Sustained effects of a single injection of ethanol on the hypothalamic-pituitary-gonadal axis in the male rat. *Alcoholism: Clinical and Experimental Research* 20:1368–1374, 1996.
37. B R Willis et al, Ethanol-induced male reproductive tract pathology as a function of ethanol dose and duration of exposure. *Journal of Pharmacology and Experimental Therapeutics* May 1983, 225 (2) 470-478
38. A.L.et al Metabolism in cirrhosis of the liver Southren, *Metabolism* 22:695–702, 1973.
39. Mary Ann Emanuele, M.D., and Nicholas V. Emanuele, M.D. Alcohol's Effects on Male Reproduction , *Alcohol Health & Research World* Vol. 22, No. 3, 1998 pg.no.195-201
40. Van Thiel et al, Hypogonadism in alcoholic liver disease: Evidence for a double defect. *Gastroenterology* 67:1188–1199, 1974.
41. Van Thiel et al, Evidence for a defect in pituitary secretion of luteinizing hormone in chronic alcoholic men. *J. Journal of Clinical Endocrinology and Metabolism* 47:499–507, 1978.
42. Gordon, G.S et al, The effects of alcoholic liver disease and alcohol ingestion on sex hormone levels.*Alcoholism: Clinical and Experimental Research* 2:259–263, 1978.
43. Dr.Bramhanand Tripathi Charak Samhita Sutra Sthana Edition 2015 Chapter 17, verse 77
44. Jajoo S et al, Prevalence of abnormal semen analysis in patients of infertility at a rural setup in Central India. *Int J Report Contracept Obstet Gynecol.* 2013 Jun;2 (2):161-164
45. Samal S et al, Epidemiological study of male infertility, *Indian Medical Gazette*, May 2012, 174-80.
46. Zhu et al, Effects of ethanol on rat Sterol cell function: Studies in vitro and in vivo, *Alcoholism: Clinical and Experimental Research* 21:1409–1417, 1997.
47. Dixit VP et al Effects of a single ethanol injection into the vas deferens on the testicular function of rats.: *Endocrinology* 67:8, 1976
48. Lester R, Van Thiel DH, Gonadal function in chronic alcoholism. *Adv. Exp Med Bioi* 85A:399, 1977
49. Little. P.J et al, Effects of alcohol on the hypothalamic-pituitary-gonadal axis in the developing male rat.*J Pharmacol Exp Ther.* 1992; 263: 1056–1061
50. Gumus B et al, Effect of long-term alcohol abuse on male sexual function and serum gonadal hormone levels. *IntUrolNephrol* 1998; 30:755–9.
51. Van Thiel DH et al, Effects of ethanol on endocrine cells: testicular effects. *Ann N Y Acad Sci*1987; 492:287–302.
52. K. R. Muthusami & Chinnaswami, Effect of chronic alcoholism on male fertility hormones and semen quality, *Fertility & Sterility* Vol. 84, No. 4, October 2005
53. Frias, J., et al., Effects of acute alcohol intoxication on pituitary-gonadal axis hormones, pituitary-adrenal axis hormones, beta-endorphin and prolactin in human adults of both sexes.2002. *Alcohol.* 37, 169–173.
54. J.K., Dees, W.L., Ethanol inhibits luteinizing hormone-releasing hormone release from the median eminence of pre-pubertal female rats in vitro: investigation of its actions on nor epinephrine and prostaglandin - E 2. *Hiney* 1991. *Endocrinology* 128, 1404–1408.
55. Pohl, C.R.et al, Inhibitory action of ethanol on luteinizing hormone secretion by rat anterior pituitary cells in culture *Endocrinology* 120:849–852, 1987.
56. Dr. Bramhanand Tripathi Charaka Samhita Sutra Sthanaby Edition 2015 chapter 30 verse 26
57. Fábio Firmbach Pasqualot to et al ,Effects Of Medical Therapy, Alcohol, Smoking, And Endocrine Disruptors On Male Infertility *Rev. Hosp. Clín. Fac. Med. S. Paulo* 59 (6):375-382, 2004

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