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Research Article

Cigarette smoking and alcohol consumption are enemy of male fertility? A patho-radiological correlation study

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ABSTRACT

Background: About 15% of the sexually active population is suffering from infertility in India, and in 50% of cases, male partner is involved, either as a primary cause or in combination a problem in the female partner. Modern life style changes like cigarette smoking and alcohol consumption are emerging out to cause a detrimental effect on male fertility due to adverse effects on semen volume, sperm morphology, total count and motility. The aim of this study was to study the effects of cigarette smoking and alcohol consumption on the semen parameters (volume, sperm motility, sperm count and morphology of sperms) and to study the morphological changes in testes in chronic alcoholics and/or cigarette smokers by high resolution sonography (HRSG).

Methods: 200 male partners of infertile couple were included in the study referred from infertility clinic of department of obstetrics and gynecology in people's college of medical sciences and research Centre, Bhopal, MP, India in-between Jan 2015 to December 2015. All the patients were divided in two group; each have 100 patients. Group A include 100 cases with history of smoking or alcohol consumption or both at least since 5yr. Group B also include 100 patients without any history of smoking and alcohol consumption or any medication for chronic illness and they will serve as controls. Detailed history about cigarette smoking and alcohol consumption was taken and recorded in the proforma. Semen sample has been collected in lab of department of pathology and results were recorded. All these patients were then subjected to HRSG of scrotum and testis in department of Radiodiagnosis of same institute to see any smoking or alcohol induced testicular atrophy.

Results: Cigarette smoking has been found to have detrimental effects on male fertility particularly in moderate and heavy smokers who showed decreased semen volume, sperm count as well as sperm motility. Alcohol consumption resulted in abnormal sperm morphology. All the patients underwent for HRSG of scrotum and testis and 18% cases were found associated with testicular atrophy in group A and only 3% in group B.

Conclusions: Heavy smoking and chronic alcohol consumption have detrimental effects on both quality as well as quantity of sperms. Moderate to heavy smoking was associated with decreased semen volume, sperm count and motility whereas chronic alcoholism was related to increased number of morphologically abnormal sperms and testicular atrophy.

Keywords: Smoking and alcohol abuse, Male fertility, Patho-radiological correlation, Sperm count, Sperm motility, Testicular atrophy

INTRODUCTION

Various lifestyle habits adversely affect male fertility which includes cigarette smoking and alcohol consumption. Numerous studies have identified effects on various systems of the body especially respiratory and cardiovascular system but the effects of smoking and alcohol on male fertility is still unrevealed to an extent. Infertility is defined as the incapability to conceive after a reasonable time of sexual intercourse (>1 yr) without any

contraceptive measure. Male factor infertility with abnormal semen is the main cause in about 30-50% of infertile couples. In the general population, this affects 1 in every 20 men.[1,2]

One-third of the world's population older than 15 years are smokers and maximum prevalence of smoking is observed in young males of reproductive age group (46% smokers are between 20 and 39 years old).[3-5] A number of research studies have been conducted in various parts of the world have shown the effects of smoking on semen quality, especially in males who are heavy smokers since long time. One of the study revealed that smoking leads to impairment in semen parameters such as semen volume, total sperm count, motility and morphology of sperm.[4] Smoking has also been related to raise the reactive oxygen species (ROS) levels, leading to oxidative stress and may exceed the antioxidant capacity of seminal plasma which may be toxic for sperm, causing oxidative damage.[6,7]

The male reproductive system consists of hypothalamus, anterior pituitary gland and testes. Alcohol can interfere with the function of these components, thereby causing impotence, infertility, and reduced male secondary sexual characters. Previous studies have found that chronic heavy alcohol intake results in reduced testosterone levels in blood. Finally, alcohol can interfere with hormone production in hypothalamus.[8] Chronic alcohol consumption in some studies has shown to disturb the sperm morphology and their genetic background. Concomitant, alcohol consumption related conditions like smoking can influence the degree of testicular damage. Moderate or high alcohol intake (≥15.4 gm/day) is associated with an increase in morphologically abnormal sperm.[9] Alcohol consumption can reduce the quantity of sperm a man produces and the quality of those sperms also. One way by which alcohol does this is by preventing absorption of zinc in body in normal way. It is an important mineral for the formation of the sperm's outer layer and tail. Zinc deficiency has been detected frequently in men who have low sperm counts.[10] A Sperm needs strong tails for good motility (the ability to move forward and swim and to penetrate outer layer of ovum). Alcohol consumption has therefore been linked to production of abnormal sperm with deformed heads and tails. Abnormal sperm are less likely to have capability to fertilize which finally results in infertility.

Still the impact and pathophysiology of cigarette smoking and alcohol consumption on male fertility and sperm characteristics remains unrevealed and controversial. Hence, this prospective study was carried out to observe effect of cigarette smoking and alcohol abuse on vital parameters of semen and their association with testicular atrophy on Ultrasonography.

METHODS

This prospective cross-sectional study was conducted among 200 male partners of infertile couple attending infertility clinic of department of obstetrics and gynecology, Peoples College of Medical sciences and research center Bhopal, over a period of one year in between Jan 2015 to December 2015. All the patients were divided in two groups; each has 100 patients. Group A include 100 cases with history of smoking or alcohol consumption or both at least since 5yr. Among 100 patients of group A, 25 were purely smoker, 50 smokers as well as alcoholic and 25 were pure alcoholic from more than 5yr. Group B also include 100 patients without any history of smoking and alcohol consumption or any medication for chronic illness and they will serve as control.

Male partner of couple with primary infertility who were married since at least one year, and none of them were using any contraceptive measures from one year or longer, were taken in the study, a detailed history about cigarette smoking, its duration and number of cigarettes taken per day were recorded in the proforma. Similarly, history of alcohol intake, its duration, its amount taken per day or per week, was noted. The results of semen analysis of these patients were analysed and recorded. Subjects were divided into non- smokers, only smoker, smoker and alcoholic and only alcoholic. Smokers were further categorized into light, moderate and heavy smokers. A detailed history about duration and number of cigarettes smoked per day was elicited from the subjects. Alcoholics consuming a minimum of 180 ml of alcohol per day for a minimum of 5 days per week for five year or more than five years were included.

All these patients were then subjected to HRSG of scrotum to see any smoking or alcohol induced testicular atrophy. More than 10 cc single testicle volumes was considered normal and less than it was considered small or atrophied. Testicular volume has been measured by the ultrasound machine by using this formula.

Volume = Length x Width x Thickness x 0.52

The subjects were instructed to keep only three days of sexual abstinence because a longer period of abstinence reduces the sperm motility and shorter period reduces sperm count. The subjects were instructed to obtain the semen sample by masturbation, making it sure to include the first portion of the ejaculate since it is the most concentrated and contains the highest number of sperms. Condom collection was not entertained as it may contain spermicidal agents. The entire ejaculate was collected in a clean, dry and sterile and leak proof wide mouthed plastic container in a collection room attached to the laboratory. Routine semen analysis was carried out to study vital parameters of semen according to the 5th edition of WHO laboratory manual for examination and processing of human semen.[11] In first step volume of the semen was

recorded in every patient. After liquefaction of semen, the wet sample was first assessed by placing 10 microliter of semen on the glass slide covered with the cover slip. Approximately 200 sperms in 5 fields at 200x magnification were counted to calculate the percentage of motility under three categories as progressive motile, non-progressive motile and immotile.

Sperm counting was then done by using modified Neubauer counting chamber. The total number of sperms was calculated by using this formula; Total sperm count= number of sperms counted x50, 000/ml. semen samples from controls were also collected in a similar fashion for comparison. All the cases including 100 non-smoker and non-alcoholic infertile controls undergone for high resolution ultrasonography of scrotum and testes to see any smoking and alcohol induced atrophic changes in the testes taking proper controls of males of reproductive age group. To study radiological correlation, ultrasonography of testes was done by measuring the size and volume of the testicle (length, width, height and echotexture was measured in study and control groups).

Inclusion criteria

1. Male partner of primary infertile couple between 20 to 50-year age group.
2. Study group includes patients with history of smoking or alcohol consumption and both at least since 5yr or more.
3. Control group include male partner of primary infertile couple with no history of smoking or alcohol consumption and any medication for chronic illness which can interfere with sperm production or viability.

Exclusion criteria

1. Patients suffering from secondary infertility.
2. Subjects with undescended testis, hydrocele, varicocele and past history for any of these conditions.
3. Subjects with chronic illness like diabetes mellitus, hypertension, tuberculosis and autoimmune disease.
4. Subjects with occupational exposure to excessive heat.
5. Patients above 50 years of age, to avoid effects of ageing on sperm variables.

Statistical analysis

Statistical analysis done by using statistical Package of Social Science (SPSS Version 19; Chicago Inc., USA). Data comparison done by applying specific statistical tests e.g. Chi Square test, Student t test were applied to find out the statistical significance of the comparisons. Quantitative variables were compared using mean values and qualitative variables were compared using proportions. Significance level was fixed at $P \leq 0.05$.

RESULTS

Group A had 100 male partners of infertile couples involved in any one or both addiction. Out of those 100 cases 25 (25%) are purely smoker, 50 (50%) are alcoholic as well as smoker and rest 25 (25%) are purely alcoholic. Smokers were further categorized into light (44.0%), moderate (36.0%) and heavy smokers (20.0%) (Table 1) and alcoholic were further categorized in occasional and chronic regular (Table 1). Alcoholics those included in the study consumed a minimum of 180 ml of alcohol per day (which have 40-50 % of alcohol content).

Table 1: Status of smoking and alcoholic patients.

S. No	Status	No. of patients	Smoking status (No. of cigarettes per day)	No. of patients (%)
1	Only smoker	25	Light (1-20)	12 (48.0%)
			Moderate (21-40)	8 (32.0%)
			Heavy (>40)	5 (20.0%)
2	Smoker and alcoholic	50	Light (1-20)	12 (24.0%)
			Moderate (21-40)	22 (44.0%)
			Heavy (>40)	16 (32.0%)
3.	Only alcoholic	25	Occasional alcoholic	10 (40.0%)
			Chronic alcoholic	15 (60.0%)

Table 2: Relationship between pure smoker and motility of sperms.

S. No	Smokers (n=25)	Sperm motility (>50%)	Sperm motility (20-40%)	Sperm motility (5-19%)	Sperm motility (<5%)
1.	Light (n=12)	09 (75.0%)	01 (8.3%)	01 (8.3%)	01 (8.3%)
2.	Moderate (n=8)	03 (37.5%)	02(25.0%)	02 (25.0%)	01 (12.5%)
3.	Heavy (n=5)	01 (20.0%)	01 (20.0%)	01 (20.0%)	02 (40.0%)
Chi square value		6.62			
P value		0.357(NS)			

NS-Non significant

While evaluating the effect of smoking on the semen volume, sperm count, motility and morphology of sperm, it was observed that only 32 patients out of 100 controls had abnormality and 68 controls had normal sperm count. Out of 25 smokers 17 patients (68%) showed low sperm count further categorizing into light, moderate and heavy smokers (Table 5). Out of 50 alcoholic and smoker 34 patients (68%) showed low sperm count whereas out of 25 purely alcoholic patients only 5 (20%) showed low sperm count (Table 5). Effect of smoking on sperm

morphology has been demonstrated in table no. 3. 13 smokers (52%) out of total 25 showed less than 30% normal sperms whereas 12 smokers (48%) showed >30% normal sperms (Table 3).

Table 3: Relationship between pure smokers and abnormal sperm morphology.

S. No.	Smoking status (n=25)	Sperm morphology				
		Normal sperm				
		>30%	20-30%	10-19%	3-9%	<3 %
1	Light smoker (n=12)	08 (66.6%)	01 (8.3%)	01 (8.3%)	00	02 (16.6%)
2	Moderate smoker (n=8)	03 (37.5%)	02 (12.5%)	01 (12.5%)	00	02 (25.0%)
3	Heavy smoker (n=5)	01 (20.0%)	01 (20.0%)	01 (20.0%)	02 (40.0%)	00
Chi square value	12.4					
P value	0.135 (NS)					

NS-Non significant

Table 4: Relationship between pure alcoholics and abnormal sperm morphology.

S. No.	Alcohol habit (n-=25)	Normal sperm				
		>30%	20-30%	10-19%	3-9%	<3 %
1	Occasional alcoholic (n=10)	02 (20.0%)	01 (10.0%)	04 (40.0%)	02(20.0%)	01 (10.0%)
2	Chronic regular Alcoholic (n=15)	02 (13.3%)	01 (6.7%)	02 (13.3%)	04 (26.7%)	06 (40.0%)
Chi square value	4.07					
P value	0.397 (NS)					

NS-Non significant

Table 5: Correlation of smoking and alcohol with sperm motility and count.

S. No	Categories	Normal sperm motility	Motility <30%	Normal sperm count	Low sperm count
1.	Only smoker (n=25)	05 (20.0%)	20 (80.0%)	08 (32.0%)	17 (68.0%)
2.	Smoker and alcoholic (n=50)	07 (14.0%)	43 (86.0%)	16 (32.0%)	34 (68.0%)
3.	Only alcoholic (n=25)	20 (80.0%)	5 (20.0%)	20 (80.0%)	5 (20.0%)
4.	Controls (n=100)	82 (82.0%)	18 (18.0%)	68 (68.0%)	32 (32.0%)
Chi square value		112.00			
P value		0.001 (HS)			

HS-highly significant

While investigating the effect of alcohol on sperm motility, count and morphology, out of 100 patients of group A, 75 patients were alcoholic, among them 50 were smokers also and rest 25 were pure alcoholic. Evaluating the effect of alcohol on sperm morphology 19 cases (76%) out of 25 patients of purely alcoholic group showed < 20% normal morphology (Table 4). This result suggests major detrimental effect of alcohol on sperm morphology rather than count. 43 patients (86%) out of 50 patients had sperm motility < 30 % whereas 34 patients (68%) had low sperm count in group of alcoholics and smokers. Among purely alcoholic group of 25 cases only 5 patients (20%) showed < 30% motility and low sperm count which suggest that smoking play major detrimental effect on sperm motility and count than alcohol (Table 5).

Table 6: Association of semen volume with smoking and alcohol.

S. No	Categories of patients	Semen vol. < 2ml	2-4 ml	>4ml
1	Controls (n=100)	08 (8.0%)	74 (74.0%)	18 (18.0%)
2	Only smoker (n=25)	8 (32.0%)	13 (52.0 %)	04 (16.0%)
3	Smokers and alcoholic (n=50)	18 (36.0%)	30 (60.0%)	02 (4.0%)
4	Only alcoholic (n=25)	5 (20.0%)	17 (68.0%)	3 (12.0%)
Chi square value		22.7		
P value			0.001(HS)	

Vol- Volume, ml-Milliliter, HS-highly significant

In 31 patients (31%) of the study group (Group A) showed reduced volume of semen (< 2ml) and most of the patient was found moderate to heavy smoker and /or alcoholic whereas in control group only 8 patients demonstrated reduced semen volume (Table 6).

Evaluating the effect of smoking and alcohol on testicle size which was measured by high resolution ultrasonography it was found that 3 cases (12.0%) out of 25 smokers showed testicular atrophy. 9 cases (18.0%) among group of 50 smoker and alcoholic patients (group A) showed testicular atrophy and 6 cases (24%) out of 25 pure alcoholic showed testicular atrophy. These figures are statistically significant and it showed higher tendency of testicular atrophy in alcoholic in comparison to smokers (Table 7).

Table 7: Correlation of smoking and alcohol with testicular size.

S. No	Categories	Normal testicle size	Testicular atrophy
1	Controls (n=100)	97	03 (3.0%)
2	Only Smoker (n=25)	22	03 (13.6%)
3	Smoker and alcoholic (n=50)	41	09 (18.0%)
4	Only alcoholic (n=25)	19	06 (24.0%)
Chi square value		13.9	
P value		0.003 (HS)	

HS-highly significant

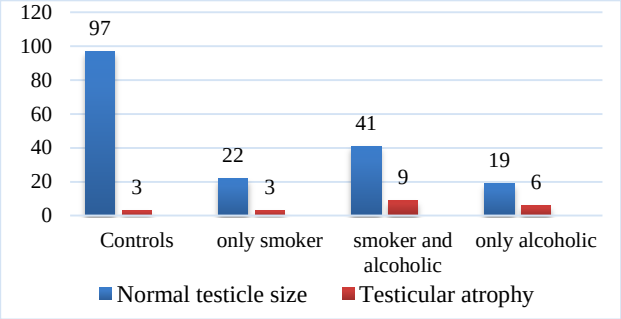

Figure 1: Prevalence of testicular atrophy in all four groups of patients.

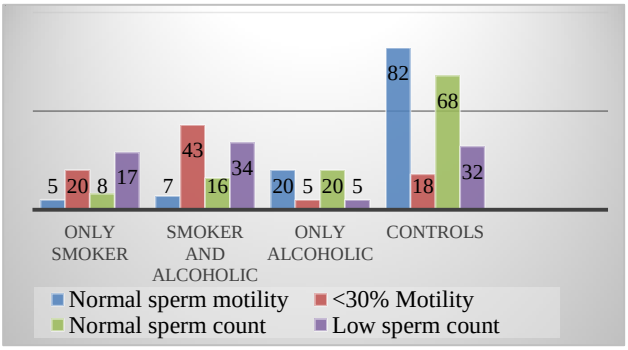

Figure 2: Effect of cigarette smoking and alcohol consumption on sperm count and motility.

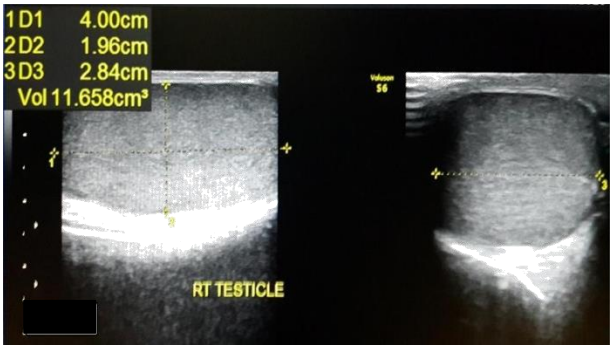

Figure 3: An ultrasonography image shows normal size, shape and echotexture of testicle in an adult.

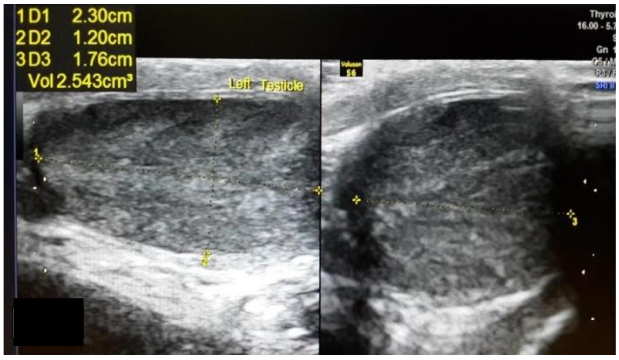

Figure 4: An ultrasonography image shows testicular atrophy with heterogeneous echotexture in a chronic alcoholic person.

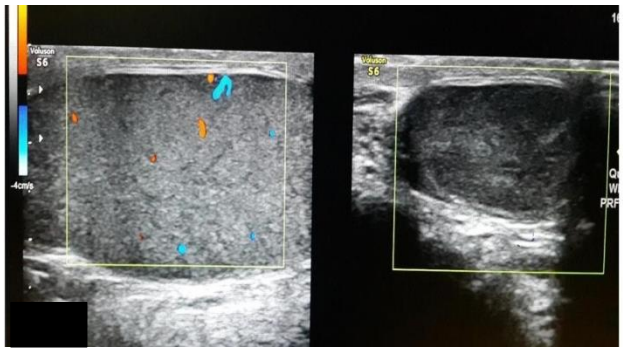

Figure 5: An ultrasonography image with color Doppler shows difference in vascularity of normal testicle (on left) and atrophied testicle (on right).

DISCUSSION

Although the adverse effects of cigarette smoking on all seminal parameters have been proven to an extent by many studies, its effect on individual parameters and on the testicular atrophic changes are yet to be established. Both smoking and alcohol has adverse effects particularly on male fertility proven by some studies.[9,10,12] Smoking leads to increase in reactive oxygen species, which affect sperm quality.[9] In many cases, good testicular functioning can recompense the hazardous effects of these free radical's injury. Sperm count is the measurement of

effectiveness of spermatogenesis and sperm motility indicates epididymal maturation and sperm functional capability. Motility is vital in normal functioning of sperm, as it helps in transportation.[12,13] Some previous studies have shown that heavy smoking (>20 cigarettes / day) was integrated with reduced sperm count.

In our study it was found that most of the controls (group B) had normal seminal parameters i.e. semen volume, sperm count, motility and morphology whereas in group A smoking had significant influence not only on sperm motility but count as well with significant 'p' value. Similarly, alcohol had detrimental effects on sperm count, motility and morphology as shown in some studies.[9-13] Most of the patients of this study had abnormal sperm morphology who was chronic alcoholic. These results were in concordance with previous studies[9,12-14] with statistically significant correlation between alcohol consumption and testicular atrophy.

Significantly reduction in sperm count was found in chronic a smoker which is quite treacherous for male fertility. Presence of antisperm antibody was noted in previous study among smokers which was considered responsible for reduction in sperm count.[5] Smokers were also known to own lower concentrations of non-methyl tetrahydrofolate in semen which leads to reduced sperm count.[16] the findings are in accordance to earlier studies who have shown decreased to sperm count due to smoking.[14,17,18] Sperm motility is well known to be a good predictor of male fertility in vivo and in vitro also and this thing has also been found strongly associated with probability of conception.[19-21] Choline acetyl transferase (CAT) is known to facilitate sperm motility and cigarette smoke condensates have CAT inhibitors which lead to reduced sperm motility.[22] Strong relationship has been observed between sperm motility and number of cigarettes smoked per day in a study of Zhang, et al.[23] Reduced sperm motility was also found by other researchers in smokers.[24,25]

Biochemical alterations have been documented in seminal fluid of chronic smokers and the chances of DNA damage are more in sperm of smokers. The embryos generated from sperm of smokers have comparatively low potential of in utero implantation. In 2007 Ramlau Hansen published largest cross-sectional study on this issue.[26] 2,542 semen samples of healthy males were analyzed and it showed that with increasing smoking, a 20%–30% reduction in sperm count, motility and semen volume was observed. In cases of male infertility, apart from the alterations in classical sperm parameters, tobacco compounds may affect sperm quality in other ways. Biochemical changes that may reduce sperm quality have been documented in seminal fluid of smokers and genotoxicity of tobacco smoke is indisputable. Cigarette smoking is responsible for increased serum levels of noradrenaline, which can increase aromatization of testosterone to estradiol in Sertoli cells in vitro.[27] There is a little but significant correlation between concentration of cotinine in seminal plasma and abnormal sperm morphology, but not for other semen parameters.[28] Cotinine concentrations of 400–800 ng/mL in seminal plasma impair the sperm motility, membrane function, and their ability to undergo capacitation.[29]

Oxidative stress causes impairment in the quality parameters of seminal fluid of male smokers. The concentrations of lead, cadmium, reactive oxygen species (ROS) and others toxins are significantly higher [(13)] in semen of smokers and, at the same time, the concentration of ascorbic acid and activity of other components of the antioxidant defense system reduced significantly.[30] Ascorbic acid is the main extra cellular water soluble antioxidant. The scavenging capacity of the antioxidant defense system is therefore limited. Oxidative stress has been associated with a number of physiological and structural impairments in human sperm. Fertilizing capacity of sperm can be reduced significantly because of failure to extrude residual spermatozoon cytoplasm, declined membrane maturation and acrosin activity with an increased incidence of structural abnormalities in sperm tail.[31–33] Cotinine has been targeted as one relevant molecule on the impairment of these processes. The DNA damage caused by ROS is documented and constitutes the worst effect of oxidative stress in sperm.

Sufficient data have been obtained from researches of last decade to declare that ethanol have gonadotoxic effects. This toxicity is both direct, being expressed at the level of the testes, and indirect, being expressed at the level of the brain in hypothalamic pituitary axis.[34] It has been seen in previous studies performed both in humans and in animals that ethanol abuse per se, and not the associated disease that occurs as a complication after alcohol exposure, is responsible for the impotence, lack/loss of libido, and testicular atrophy which are commonly seen in chronic alcoholic men. Recent studies have suggested that after prolonged abstinence from alcohol exposure spontaneous recovery of sexual function is possible in chronic alcoholics if testicular atrophy has not yet occurred and if their responses to clomiphene and/or luteinizing hormone [LH] releasing factor stimulation are still normal. In contrast, abstinent alcoholic men with either undisguised testicular atrophy or insufficient response to clomiphene and/or LH releasing factor fail to recover spontaneously despite continued alcohol abstinence and will require either a penile prosthesis or long-term oral androgen replacement therapy to restore "acceptable" sexual functioning.[15]

The alcohol abuse may lead to testicular lipid peroxidation because ethanol is a well-known testicular toxin and its chronic abuse may lead to both reproductive as well as endocrine failure.[35] Because testicular membranes are rich in polyenoic fatty acids those are prone to peroxidative decomposition so it is considerable that lipid peroxidation may be a contributory factor in the membrane injury and gonadal dysfunction that occurs as

a result of chronic alcohol use/abuse. So it can be postulated that enhanced peroxidation of testicular lipid that occurs as a result of chronic alcohol exposure may be an important factor in the pathogenesis of alcohol induced gonadal dysfunction.[35] It is well known fact that peroxidation process can be attenuated by vitamin A so here Vitamin A acts as 'antioxidant' and stabilize testicular membranes by reducing lipid peroxidation and prevent alcohol induced gonadal atrophy. So in chronic alcoholic vitamin A supplementation may prevent testicular atrophy and gonadal dysfunction.[35]

Our study group has shown decrease in the volume of semen in 31 men particularly in those who smoke moderately or heavily and consuming alcohol with smoking. Significant difference in volume of semen was also reported previously in smokers than nonsmokers by other researchers also.[23,37-39] Researchers have concluded that toxins of cigarette smoke after long exposure reach into male reproductive system and causes direct interaction with components of seminal fluid and the accessory glands, which contribute their secretions to make seminal fluid volume, leading to its increased viscosity, reduced seminal volume and delayed liquefaction time, thus impair forward linear progression of spermatozoa however those effects and their pathophysiology is still under research. In previous studies conducted among fertile men, it was found that those who were smokers showed reduced semen volume in comparison to non-smokers; and this reduction in volume was in proportion to the number of cigarettes smoked per day.[36,39]

CONCLUSION

This study proves the fact that smoking and alcoholism certainly has detrimental effects on semen volume and quality parameters however these are not solely responsible for infertility. Male fertility is compromised particularly in moderate to heavy smoking and sperm quality parameters become adversely affected. In chronic alcoholics mainly morphology of sperm is affected whereas smoking affects total sperm count and motility. In this study, 6 cases out of 25 chronic alcoholics (24%) showed testicular atrophy which proves gonadotoxic effect of ethanol.

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REFERENCES

1. Brugo- Olmedo S, Chilik C, Kopelman S. Definition and causes of infertility. Reprod Biomed Online. 2001;2:41-53.
2. Iltmer DC, Berker B, Bayrak O, Aydos K, Ozturk Turhan N, Satronglu H. Comparison of semen parameters between pregnant and nonpregnant couples with male factor in fertility during intrauterine insemination. Tuurk J Med Sci. 2009;39:531-6.
3. Saleh RA, Agarwal A, Sharma RK, Nelson DR, Thomas AJ. Effect of cigarette smoking on levels of seminal oxidative infertile men: a prospective study. Fertil Steril. 2002;78:491-9.
4. Kunzle R, Mueller MD, Hangggi W, Bersinger NA. Semen quality of male smokers and nonsmokers in infertile couples. Fertil Sterile. 2003;79;287-91.
5. Langgassner J. Rauchgewohn der osterreichischen Bevolkerung. Statistische Nachrichten. 1999;5:319-26.
6. Sepaniak S, Forges T, Gerard H, Foliguet B, Bene MC, Monnier-Barbarino P. The Influence of cigarette smoking on human sperm quality and DNA fragmentation. Toxicology. 2006;223(1):54-60.
7. Yeni E, Ciftci H, Savaş M, Verit A, Taşkın A. Is oxidative stress an etiologic factor in idiopathic male infertility. Turk J Med Sci. 2010;40:1-6.
8. Emanuele MA, Emaluele NV. The combined effect of cigarette smoking as well as alcohol consumption on vital parameters of semen and to study their role in testicular atrophy by ultrasonography.
9. Soares S. Cigarette smoking and fertility. Reproductive Biology Insights. 2009;2:39-49.
10. Colagar AH, Marzony ET, Chaichi MJ. Zinc levels in seminal plasma are associated with sperm quality in fertile and infertile men. Nutrition Research. 2009;29(2):82-8.
11. WHO laboratory manual for the examination and processing of human semen -5th ed.2010. Available from http://wholibdoc.who.int/publications/2010/9789241547789-eng.
12. Aitken RJ, Nixon B, Lin M, Koppers AJ, Lee YH, Baker MA. Proteomic changes in mammalian spermatozoa during epididymal maturation. Asian journal of andrology. 2007;9(4):554-64.
13. Kiziler AR, Aydemir B, Onaran I, Alici B, Ozkara H, Gulyasar T. High levels of cadmium and lead in seminal fluid and blood of smoking men are associated with high oxidative stress and damage in infertile subjects. Biological trace element research. 2007;120(1-3):82-91.
14. Joo KJ, Kwon YW, Myung SC, Kim TH. The effects of smoking and alcohol intake on sperm quality: light and transmission electron microscopy findings. Journal of International Medical Research. 2012;40(6):2327-35.

15. Ludwikowski G, Szymański W, Szymański M, Adamczak R, Kazdepka-Ziemińska A, Pasińska M. [Influence of cigarette smoking on some sperm parameters in males with decreased fertility]. Przeglad lekarski. 2003;61(10):1031-2.
16. Wallock LM, Tamura T, Mayr CA, Johnston KE, Ames BN, Jacob RA. Low seminal plasma folate concentrations are associated with low sperm density and count in male smokers and nonsmokers. Fertility and sterility. 2001;75(2):252-9.
17. Gaisamudre KB, Waghmare AR, Naghate GR. Study on effect of cigarette smoking on sperm count and seminal malondialdehyde levels of infertile men. International Journal of Medical Research & Health Sciences. 2013;2(3):451-7.
18. Gaur DS, Talekar M, Pathak VP. Effect of cigarette smoking on semen quality of infertile men. Singapore medical journal. 2007;48(2):119.
19. Auger J, Serres C, Wolf JP, Jouannet P. sperm motility and fertilization. Contracept. Fertility and Sex. 1994;22:314-8.
20. Jouannet P, Ducot B, Feneux D, Spira A. Male factors and the likelihood of pregnancy in infertile couples. I. Study of sperm characteristics. International journal of andrology. 1988;11(5):379-94.
21. Larsen L, Scheike T, Jensen TK, Bonde JP, Ernst E, Hjollund NH, et al. First Pregnancy Planner Study Team. Computer-assisted semen analysis parameters as predictors for fertility of men from the general population. Human Reproduction. 2000;15(7):1562-7.
22. Kulikauskas V, Blaustein D, Ablin RJ. Cigarette smoking and its possible effects on sperm. Fertility and sterility. 1985;44(4):526-8.
23. Zhang JP, Meng QY, Wang Q, Zhang LJ, Mao YL, Sun ZX. Effect of smoking on Semen quality of infertile men in Shandong, China. Asian journal of andrology. 2000;2(2):143-6.
24. Lado-Abeal J, Norman RL: Leptin and reproductive function in males. Seminal Reproductive Medical 2002;20:145-52.
25. Somwanshi SD, Madole MB, Bikkad MD, Bhavthankar SS, Gavkare A, Shelke B. Effect of Cigarette smoking on sperm count and sperm motility. Journal of Medical Education and Research. 2012;2(1):30-8.
26. Ramlau-Hansen CH, Thulstrup AM, Aggerholm AS, Jensen MS, Toft G, Bonde JP. Is smoking a risk factor for decreased semen quality? A cross-sectional analysis. Human. Reproduction. 2007;22(1):188-96.
27. Klaiber EL, Broverman DM. Dynamics of estradiol and testosterone and seminal fluid indexes in smokers and nonsmokers. Fertil Steril. 1988;50:630-4.
28. Wong WY, Thomas CM, Merkus HM, Zielhuis GA, Doesburg WH, Steegers-Theunissen RP. Cigarette smoking and the risk of male factor subfertility: minor association between cotinine in seminal plasma and semen morphology. Fertil Sterile. 2000;74:930-5.
29. Sofikitis N, Takenaka M, Kanakas N, Papadopoulos H, Yamamoto Y, Drakakis P, et al. Effects of cotinine on sperm motility, membrane function, and fertilizing capacity in vitro. Urol Res. 2000;28:370-5.
30. Mostafa T, Tawadrous G, Roaia MM, Amer MK, Kader RA, Aziz A. Effect of smoking on seminal plasma ascorbic acid in infertile and fertile males. Andrologia. 2006;38(6):221-4.
31. Mak V, Jarvi K, Buckspan M, Freeman M, Hechter S, Zini A. Smoking is associated with the retention of cytoplasm by human spermatozoa. Urology. 2000;56(3):463-6.
32. Zalata AA, Ahmed AH, Allamaneni SS, Comhaire FH, Agarwal A. Relationship between acrosin activity of human spermatozoa and oxidative stress. Asian J Androl. 2000;6(4):313-8.
33. Alvarez JG, Storey BT. Differential incorporation of fatty acids into and peroxidative loss of fatty acids from phospholipids of human spermatozoa. Molecular reproduction and development. 1995;42(3):334-46.
34. Van Thiel DH. Ethanol: its adverse effects upon the hypothalamic-pituitary-gonadal axis. The Journal of laboratory and clinical medicine. 1983;101(1):21-33.
35. Rosenblum ER, Gavaler JS, Van Thiel DH. Lipid peroxidation: a mechanism for alcohol-induced testicular injury. Free Radical Biology and Medicine. 1989;7(5):569-77.
36. Pasqualotto FF, Sobreiro BP, Hallak J, Pasqualotto EB, Lucon AM. Cigarette smoking is related to a decrease in semen volume in a population of fertile men. BJU international. 2006;97(2):324-6.
37. Zhang ZH, Zhu HB, Li LL, Yu Y, Zhang HG, Liu RZ: Decline of semen quality and increase of leukocytes with cigarette smoking in infertile men. 2013;11(7):589-96.
38. Sangita RP, Boramma S. Effect of tobacco chewing and smoking on male infertility, International Journal of Recent Trends in Science and Technology. 2014;9(3):386388.
39. Gaur DS, Talekar M, Pathak VP. Effect of cigarette smoking on semen quality of infertile men. Singapore medical journal. 2007;48(2):119.

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