Ethyl Alcohol Induced Pathological Changes in Male Reproductive System of Albino Rats

Article · December 2016

DOI: 10.12816/0034850

3 authors:

Genan Al-bairuty
University of Baghdad
14 PUBLICATIONS **366** CITATIONS
SEE PROFILE

Hanady Al-Shmgani
University of Baghdad
16 PUBLICATIONS **43** CITATIONS
SEE PROFILE

Mohammed N. Taha
1 PUBLICATION **0** CITATIONS
SEE PROFILE

Ethyl alcohol induced pathological changes in male reproductive system of albino rats

Genan A. Al- Bairuty, Hanady S. Al-shmgani and Mohammed N. Taha

Dept. of Biology/ College of Education for Pure Sciences –Ibn Al-Haitham / University of Baghdad / Republic of Iraq

E- mail: galbairuty@yahoo.com

ABSTRACT

Exposure to ethanol results in decline of testosterone levels, elevates oxidative stress and decreases semen parameters. The present study was designed to investigate the histological structure of testes and epididymes (head and tail) of albino rats treated with different concentrations (20%. 30%, 40%) of ethyl alcohol for 30 days.
The results indicated that alcohol produced histopathological changes in the tissues of testes and epididymis (head and tail), which included degeneration, necrosis and decline in the sperm number in lumen of seminiferous tubules in testis and lifting epithelium from the basement membrane with damage of some epithelial cell, as well as the lowest thickness of epithelial cell in the head and tail of epididymis tubules. Thus, consumption of alcohol for one month caused histopathological changes in male reproductive system of the albino rats that cause decrease of the sexual activity of these animals.

Keywords: Ethanol, Testis, Epididymis, Histology, Rats, alcohol

---

الملخص باللغة العربية

يؤدي التعرض إلى الكحول الإيثيلي (الإيثانول) إلى تراجع في مستويات هرمون التستوستيرون وارتفاع في الجهد الأوكسجيني وانخفاض في معايير السائل المنوي. لذا تم تصميم الدراسة الحالية للتحري عن التركيب النسيجي للخصية والبربخ (الرأس والذيل) في الجرذان المعاملة بتراكيز مختلفة (20٪ 30٪، 40٪) من الكحول الإيثيلي ولمدة 30 يوما.
أشارت النتائج إلى أن الكحول ينتج تغيرات مرضية نسجية في أنسجة الخصى والبرابخ (الرأس و الذيل) والتي تضمنت تحطم وتنخر وانخفاض أعداد النطف في تجويف النبيبات المنوية للخصى، وانفصال الظهارة عن الغشاء القاعدي، مع تضرر بعض الخلايا الظهارية، فضلا عن انخفاض في سمك الخلايا الظهارية في رؤوس وذيول الأنابيب البربخية. وهكذا، فإن استهلاك الكحول لمدة شهر واحد تسبب بحدوث تغيرات مرضية نسجية في الجهاز التكاثري الذكري للجرذ الأبيض والتي أسفرت عن انخفاض النشاط الجنسي في هذه الحيوانات.

INTRODUCTION

Alcohol was identified to be among the most widely harmed drug which can affected male sexual functional and behavior in both animals and human (1). Alcohol harm has been observed as one of the factors that associated with reduced in semen production and sperm character (2, 3). The consumption of either chronic or acute alcohol has been reported to cause fertility disturbances such as low sperm count and motility, impaired serum/plasma testosterone level, testicular atrophy and irregularity in the diameter of the seminiferous tubules in human men and laboratory animals (4-9). Dosumu *et al.* reported reduction in the seminiferous tubule diameter and decrease testicular weight in rats after orally administration of 7 ml/kg ethanol (1). Lipid peroxidation has been reported as one of the consequences of ethanol alterations in reproductive system of rats orally demonstrated ethanol (2 g/kg, 25% v/v) for 63 days (9). Alteration in sperm morphology, motility and count as well as histological changes in some reproductive organs were observed in ethanol treated rats (1, 7, 9). Little is known about the histopathological alteration in male reproductive organs following administration of ethanol.
Therefore, this study aimed to determine the effects of different concentrations of ethanol on the histostructure of rats' testes and epididymis head and tail.

MATERIALS AND METHODS

Experimental animals: twenty adult Wister albino male rats (*Ruttus norreqicu*s) weighting 350-400 gm. Animals were housed in plastic cages in the animal laboratory of biological department in education of pure sciences/ Ibn Al-Haitham under controlled environmental conditions (12L:12D light cycles; 24Cº± temperature). Water and food were given *ad libitum*. Twenty male rats were divided into four groups, five rats each.

Administration of ethanol: All rats were administrated ethanol orally by oral cannula for 30 days. The control group orally administrated with distilled water, where the ethanol treated group subdivided into three groups orally administration with 5 ml of ethanol concentrations (20%, 30%, and 40%, continually), ethanol concentrations were prepared according to Luna (10). At the end of the experimental period, animals were sacrificed by cervical dislocation under light either anesthesia.

Histopathological study: Testes and epididymes (head and tail) were removed and fixed in bouin's fluid for histopathological study. Samples were prepared according to Bancroft and Stevens (11). Briefly, samples were passed through ascending series of ethanol concentrations, cleared in xylene and embedded in paraffin, sectioned at 7 µm and stained with Haematoxylin and Eosin Harrison (H&E) to observe the structure of testes and epididymis parts (head and tail). Then, the slides were examined at magnifications of 400 X (testis and epididymis head) and 200 X (epididymis tail) under optical microscope.

RESULTS AND DISCUSSION

Histological observation on the testes

Light microscopy examination of the seminiferous tubules in the testes of the control rats showed normal structural features with normal stratified seminiferous epithelium which showing series of spermatogenic cells and spermatozoa within lumen (figure 1A). The testes sections of rat treated with 20%, 30% and 40% of ethanol showed injuries that includes lifting epithelium from the basement membrane, the occasional area of necrosis and degeneration of some seminiferous tubule cells (figures 1 B, C, and D). Decline the sperm number in lumen was observed in rats treated with 30% and 40% of ethanol. These results are constant with previous study that exhibited deterioration and appearance of vacuoles in seminiferous tubules in rats after exposure to 3 g/kg, 40% v/v of ethanol for 8 weeks (12), and decline in the diameter of the seminiferous tubules with the presence of degenerative germ cells in rats treated with alcohol (13). On the other hand, Oliva *et al.* (14) had been reported no morphological changes in the testicular tissue after treatment with ethanol. Histopathological injuries in testes that observed in the present study suggested to be caused by ether direct effect of alcohol on spermatocells or lipid cell membrane, as well as the level of hormones such as: testosterone (TT), Luteinizing hormone (LH) and Follicular stimulating hormone (FSH) (15). Maneesh *et al.* (16) found that oral ethanol administration in rats for four weeks caused decline in testicular weight and increase oxidative stress in the testes. Taha and Al-Bairuty (17) found that the gastric administration of 5 ml from each 30% and 40% of ethanol over 30 days caused decrease in the weight of testes, testes and tunica albuginae, epididymis parts (head, body, tail), seminal vesicles and prostate. A decrease in testosterone levels was observed in the male rats treated orally with 40% v/v ethanol for 8 weeks (12). Oremosu and Akang (18) showed that acute and chronic administration of alcohol in male rats caused reduce of TT levels, increase in oxidative stress and decrease in semen parameters.

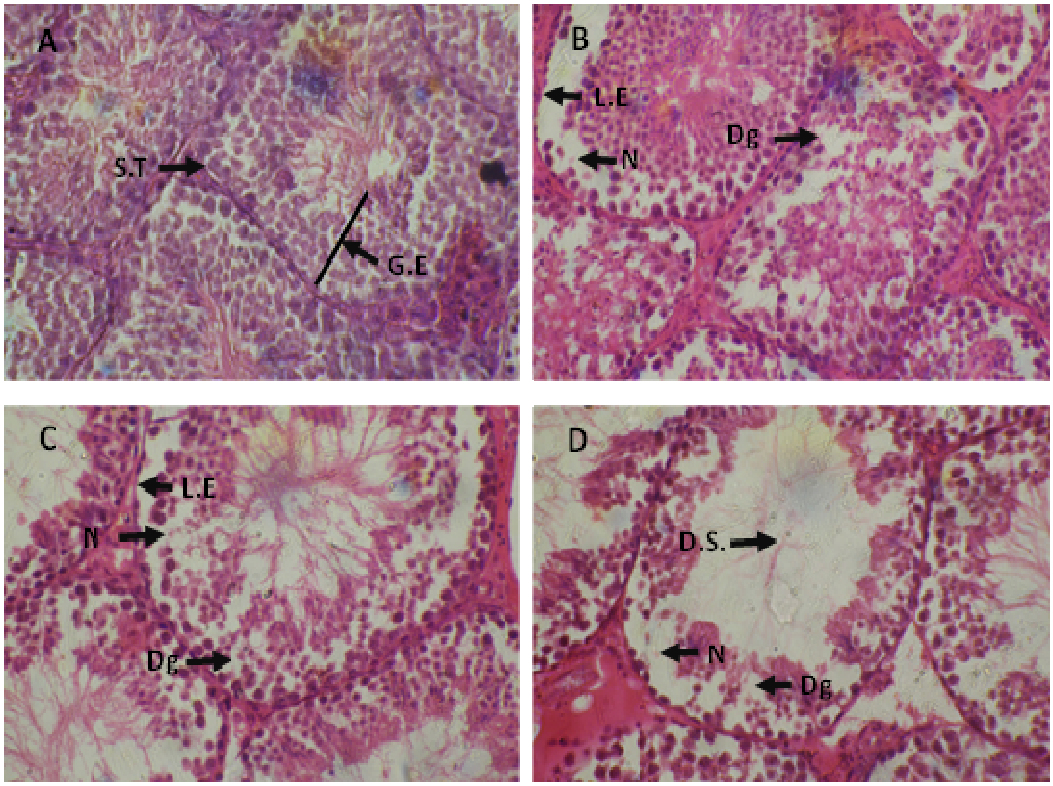

Figure (1): Transvers section of seminiferous tubules in rat testes of (A) Control, (B) treated with 20% of ethanol, (C) treated with 30% of ethanol, (D) treated with 40% of ethanol. Control group showing regular seminiferous tubules (S.T) with normal germinal epithelium (G.E). All treated groups showed some lesion include: Lifting epithelium (L.E.), necrosis (N.) and degeneration (Dg) of seminiferous tubule cells. Decline the sperm number in lumen (D.S). Stained with H&E, sectioned 400 X.

Histological observation on the epididymis

The epididymis has an important role in male reproduction and it has been recognized that spermatozoa are produced in the germinal epithelia of the seminiferous tubules in testes and are transported to the epididymis for onward passage maturation and storage of spermatozoa (19, 20). The transvers section of epididymis in head and tail parts of control groups showed regular epididymis tubules with normal structure of epithelium as well as normal cell height (figures 2A and 3A). All ethanol concentration (20%, 30% and 40%) caused lesion in the head and tail of epididymis which include lifting epithelium from the basement membrane, occasional pyknotic nuclei, the lowest epithelial cell height, enlargement of interstitial space and abnormal shape of nuclei with appearance of vacuole in epididymal lumen and degeneration of some epithelial cell (figures 2 and 3 B, C, D). The lesions that observed in the head and tail of epididymis could occur due to suppress TT production by the leydig cell that will adversely impact on the epididymis and cause lesion. Oliva *et al.* (14) found that rats treated with ethanol exhibit decrease in daily sperm production, testis and epididymis sperm quantity and mobility. Additionally, Srikanth *et al.* (21) described a reduction in sperm number in the head and tail of rat epididymis that received ethanol (3 g/kg,25 % v/v) for 30 days and they suggested that occur due to the reduction of testosterone.

In general, this study had described the pathological changes in testis and epididymis head, as well as epididymis tail after administration of different concentrations of ethyl alcohol. Previously published studies investigated the subject with single concentration of alcohol. In addition, few studies covered this subject (1, 3, 5, 13- 15). The histological alterations in some organs of male reproductive system observed in the present study suggested pathological changes and fertility reduction along with long-term alcohol exposure.

Results of this study investigated the effects of different concentrations of ethanol alcohol on reproductive system, and need further studies to determine its effects on complete process from infertility through abortion, aneuploidy, structural natal anomaly, disturbed fetal growth, death of perinatal, and delay the development of natal.

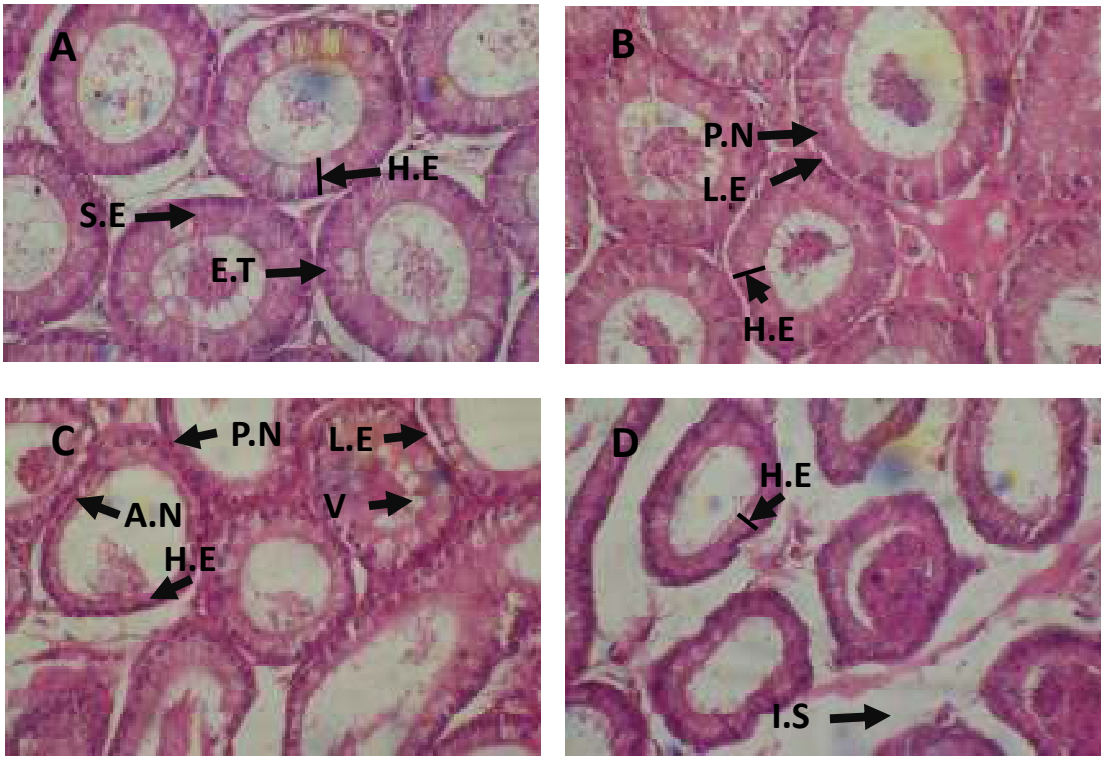

Figure (2): Transvers section of epididymal head in rat of (A) Control, (B) treated with 20% of ethanol, (C) treated with 30% of ethanol, (D) treated with 40% of ethanol. Control group showing regular epididymis tubules (E.T) with normal structure of epithelium (S.E) and normal cell height. All treated groups showed some lesion include: Lifting epithelium (L.E.), Pyknotic nuclei (P.N), the lowest epithelial cell high, enlargement of interstitial space and abnormal shape of nuclei (A.N) with appearance of vacuole in epididymal lumen. Stained with H&E, sectioned 400X.

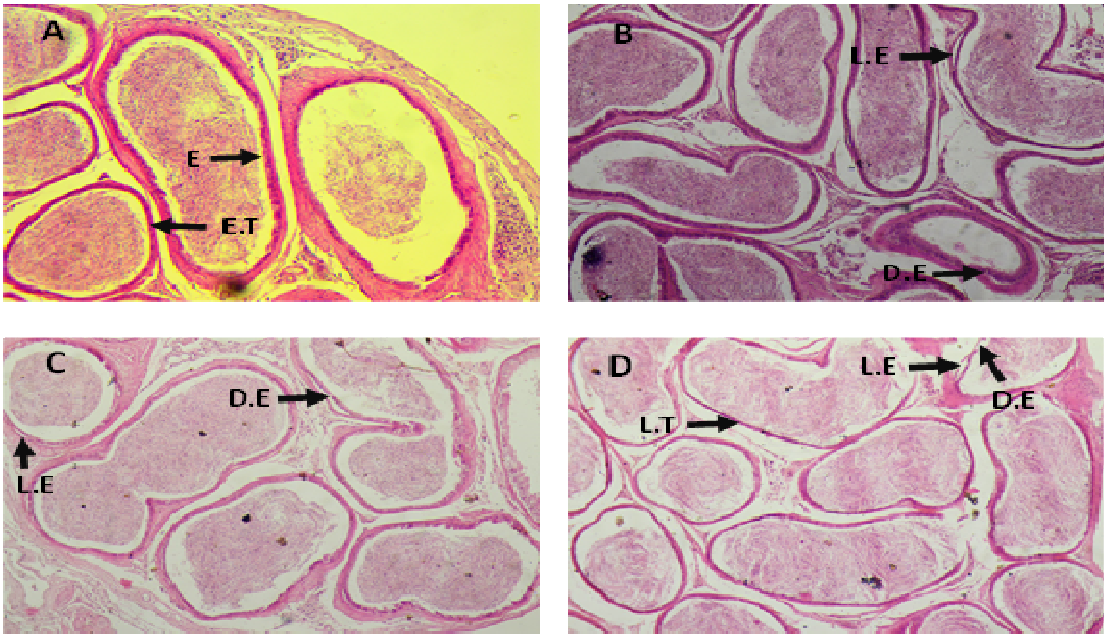

Figure (3): Transvers section of epididymal tail in rat of (A) Control, (B) treated with 20% of ethanol, (C) treated with 30% of ethanol, (D) treated with 40% of ethanol. Control group showing regular epididymis tubules (E.T) with normal structure of lining epithelium (E) and normal cell height. All treated groups showed some lesion include: Lifting epithelium (L.E.), damaged of some epithelial cells (D.E), the lowest thickness of epithelial cell (L.T). Stained with H&E, sectioned 200X.

Acknowledgments

The authors would like to thank Mr. Nadear A. Fazaa, Department of Biology, College of Science for Women, University of Baghdad for his assistance during the design of this experiment.

REFERENCES

1. Dosumu OO.; Osinubi AAA. and Duru FIO. (2014). Alcohol induced testicular damage: Can abstinence equal recovery? Middle East Fert. Soc. J. 19: 221–228.
2. Abel EL. (1980). A review of alcohol's effects on sex and reproduction. Drug and Alcohol Depend. 5:321–332.
3. Talabi AR.; Sarchesmeh AA.; Khalili MA. and Tabibreyad N. (2011). Effects of ethanol consumption on chromatin condensation and DNA integrity of epididymal spermatozoa in rat. Alcohol. 45(4): 403–409.
4. Van Thiel DH.; Gavaler JS.; Eagon PK.; Chiao YB.; Cobb CF. and Lester R. (1980). Alcohol and sexual function. Pharmacol. Biochem. Behav.13(1):125–129.
5. Adler RA. (1992). Clinically important effects of alcohol on endocrine function. J. Clin. Endocrinol. Metabol.74: 957–960.
6. Maneesh M.; Dutta S.; Chakrabarti A. and Vasuderan DM. (2006). Alcohol abuse-duration dependent decrease in plasma TT and antioxidants in males. Ind. J. Physiol. Pharmacol. 50(3):291–296.
7. Martinez M.; Macera S.; de Assis GF.; Pinheiro PF.; Almeida CC.; Tirapelli LF.; Martins OA.; Mello-Júnior W.; Padovani CR. and Martinez FE. (2009). Structural evaluation of the effects of chronic ethanol ingestion on the testis of Calomys callosus. Tiss. Cell. 41:199– 205.
8. Dosumu OO.; Duru FIO.; Osinubi AA.; Oremosu AA. and Noronha CC. (2010). Influence of virgin coconut oil (VCNO) on oxidative stress, serum testosterone and gonadotropic hormones (FSH, LH) in chronic ethanol ingestion. Agri. Biol. J. North Am. 1(6):1126–1132.
9. Siervo GEML.; Vieira HR.; Ogo FM.; Fernandez CDB.; Gonçalves GD.; Mesquita SFP.; Anselmo-Franci JA.; Cecchini R.; Guarnier F A. and Fernandes GSA. (2015). Spermatic and testicular damages in rats exposed to ethanol: Influence of lipid peroxidation but not testosterone. Toxicol. 330:1-8.
10. Luna LG. (1968). Manual of histological staining methods of the forces institute of pathology. 3rd ed. McGraw. Hillbook, New York. P.: 2258.
11. Bancroft JD. and Stevens A. (1982). Theory and practice of histological techniques. 2nd ed. Churchill Living Stone, London. P.: 624.
12. Uygur R.; Yagmurca M.; Alkoc OA.; Genc A.; Songur A.; Ucok K. and Ozen OA. (2013). Effects of quercetin and fish n-3 fatty acids on testicular injury induced by ethanol in rats. Androl. 1–14.
13. El-Sokkary GH. (2001). Quantitative study on the effects of chronic ethanol administration on the testis of adult male rat. Neuro-Endocrinol. Lett. 22:93-99.
14. Oliva SU.; Messias AG.; Silva DA.; Pereira OC.; Gerardin DC. and Kempinas WG. (2006). Impairment of adult male reproductive function in rats exposed to ethanol since puberty. Reprod. Toxicol. 22 (4): 599–605.
15. Emanuele MA. and Emanuele NV. (1998). Alcohol's effects on male reproduction. Alcohol Health Res. World. 22(3): 195-201.
16. Maneesh M.; Jayalekshmi H.; Dutta S.; Chakrabarti A. and Vasudevan DM. (2005). Role of oxidative stress in ethanol induced germ cell apoptosis- an experimental study in rats. Ind. J. Clin. Biochem. 20(2): 62-67.
17. Taha MN. and Al-Bairuty GA. (2004). The effect of different concentrations of ethyl alcohol on the weight of some organs in reproductive system in rats. Ibn Al-Haitham J. Pure. Appl. Sci. 17(3): 1-9.
18. Oremosu AA. and Akang EN. (2015). Impact of alcohol on male reproductive hormones, oxidative stress and semen parameters in Sprague–Dawley rats. Middle East Fert. Soc. J. 20: 114–118.
19. Hinton BT. and Palladino MA. (1995). Epididymal epithelium: Its contribution to the formation of a luminal fluid microenvironment. Microscop. Res. Techn. 30: 67-81.
20. Franca LR. and Cardoso FM. (1998). Duration of spermatogenesis and sperm transit time through the epididymis in the Piau boar. Tiss. Cell. 30(5): 573-582.
21. Srikanth V.; Malini T.; Arunakaran J.; Govindarajulu P. and Balasubramanian K. (1999). Effects of ethanol treatment on epididymal secretory products and sperm maturation in albino rats. J. Pharmacol. Experim. Therap. 288: 509-515.