DOI: 10.55522/jmpas.V11I5.3794 ISSN NO. 2320–7418

International peer reviewed open access journal

Journal of Medical Pharmaceutical and Allied Sciences

Journal homepage: www.jmpas.com CODEN: JMPACO

Research article

Sesamol counter act toxicity of arsenic on testicular tissues

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ABSTRACT

The main aim of the study includes analyzing the protective effects of sesamol of testicular in arsenic-induced toxicity. Primarily there have been different treatments and sample preparation methods that includethe mixing of drugs seasonal and arsenic, as they were immersed into the aqueous solution of tween 80 and further arsenic stabilisation was done using gum of 0.2%. A total of four groups, each group having 8 rats selected. Testicular catalase is decreased in arsenic treated rats whereas testicular (Glutathione synthetase) GSH, testicular (nitric oxide) NO and testicular malondialdehyde are increased in arsenic treated rats. These indicate sesamol has a protective effect against arsenic induced testicular toxicity.

Keywords: Arsenic, Immunohistochemistry, Sesamol And Testicular Toxicity.

Received – 03-06-2022 Accepted – 27-09-2022

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INTRODUCTION

Arsenic is a natural component of the crust of the earth and is distributed all throughout the environment, in air, water as well as land and is highly toxic in the inorganic form. The most toxic inorganic forms include Arsenate and Arsenate which have several mechanisms based on balance state. Though arsenic homicides are published in media, the primary source of arsenic toxicity to the public is through water contamination and utilizing the water in food and irrigation of crops and smoking tobacco. Exposure in the long term to toxic arsenic by drinking water and food leads to chronic arsenic poisoning [1]. The characteristic effects include cancer as well as skin lesion [2]. The release of Arsenic within the environment propagates through weathering and the mining process with other phenomena such as volcanic activity [3]. The elements of inorganic arsenic are toxic to a higher degree and that of organic arsenic tend to cause less harm to a human being. Because of the higher toxicity level of arsenic, the indication of acute poisoning includes vomiting, abdominal pain with diarrhea, muscle cramp and in some cases death. In long term exposure, a high rate of arsenic in the inorganic form is observed in the skin and include changes in pigmentation, hard patches on palms and feet sole [4]. Moreover, the skin cancer, long-period exposure might cause lung cancer as well as bladder cancer. Another adverse health impact might be associated with longer period ingestion of inorganic arsenic that consists of developmental impact, diabetes, pulmonary disease and cardiovascular disease [5]. It is also associated with adverse outcomes for pregnancy and infant mortality with effects on children health and exposure to utero in the early stage of childhood. There is no such specific method of treating arsenic poisoning but the best way to treat the condition is to curtail the exposure of arsenic [6].

Sesamol is a phenolic compound that is found in sesame seeds as well as sesame oil and is considered to be the major component of antioxidants in the oil. While raw seeds of sesame contain a trace amount of sesamol and it is produced from the decomposition of sesamol in during the process of roasting sesame seeds [7]. Sesamol has essential biological activities and health-promoting benefits like inducing growth arrest and apoptosis in cancer and cardiovascular cells and enhanced vascular fibrinolytic capability [8]. It possesses effective ROS scavenging and the properties of antioxidants and is capable to protect against the damage of IR induced DNA in human lymphocyte cells [9]. Moreover, sesamol has significant attenuates damage of IR induced in the hematopoietic system of mice and minimizes genotoxicity in bone marrow cells [10]. It also protects the system of gastrointestinal as well as hematopoietic against injury of IR-induced in mice. The effects of radio-protective of sesamol are mediated through ROS scavenging and enhance DNA repair activity [11]. In previous studies, it has been evident that treatment with sesamol significantly decreased the size and weight of the solid tumour. Also, SML enhances the DOX activity of anti-tumour.

The treatment with either sesamol or with a combination of DOX induces up-regulation of Fas/FasL and Trail R2 / TRAIL

gene expression while decreasing Vcl-2 gene expression. Thus it can be considered that sesamol up-regulates expression of death receptors and improves apoptosis induces in the cells of tumour which might explain the activity of anti-tumour. Sesamol improves DOX activity of anti-tumour and attenuates cardiotoxicity [12].

The main aim of the study includes analyzing the protective effects of sesamol of testicular in arsenic-induced toxicity.

MATERIAL AND METHOD

The powder having sesamol and arsenic were gathered from Sigma Chemical Co., USA. In 1% of an aqueous solution of Tween 80, Sesamol was made where arsenic was produced in normal saline that was stabilized through gum of 0.2%.

Animals and treatments

32Male Sprague Dawley rats were used in this study in college of medicine king Faisal university KFU-REC/2020-10-12. These rats were preserved in the normal condition of approximately 24℃ temperature, 45% humidity and 12hr light or dark cycle. They were then delivered with standard laboratory chow along with water and libitum. The rats were kept to be acclimatized for a week before carrying out of experiments.

10 hours before the experiment, animals were grouped in random process in the group of four with each group consisting of 8 rats. First group had been treated with normal saline having a 0.2% level of concentration referred to as a controlled group. While for the second group was treated with arsenic treatment based on 10mg/kg weight for 21 days (Fouad et.al. 2015, Islam et.al. 2015).In the case of the other two groups, the third group had been treated with sesamol considering 50mg/kg for 7 days (Wei et.al. 2020) and later by arsenic 10mg/kg had been provided consecutively for 21 days. Lastly, the fourth group had been treated with only sesamol for 7 days.

Table 1: Animal Experiment

Name	Duration	Dosage	Treatment
Group One	-	-	Normal Saline
Group Two	21 Days	10mg/kg	Arsenic
Group Three	First 7 Days	50mg/kg	Sesamol
	Followed by 21 Days	10mg/kg	Arsenic
Group Four	7 Days	50mg/kg	Sesamol

The experiment protocol was approved via the research ethic committee (REC) at king Faisal university (KFU-REC/2020-10-12). Local Animal Care Committee [REC] ensure that all procedure that is carried out aligning with international guidelines depending on care and use of the species in the laboratory.

Preparation of sample and biochemical studies

A day after the arsenic administration the animals were killed and organ been extracted according to previous study [1]. The collection of blood samples was conducted and is left out for 1 hour for clotting. After the blood was centrifuged for 10 minutes at 5000 rpm to provide pure serum which was then stored at the temperature of 20℃. To measure antioxidant degree depending on a manufacturer whose name is Randox Laboratories Ltd. UK, having the recommendation of colorimetrickits which were used.

Histopathological finding of testicular tissue

The tissues sample for the test from each rat were fixed in 10% formalin which is subjected to dehydration in ascending grades of alcohol and after which it is submerged in paraffin. The section was cut into pieces of 4m that is marked with hematoxylin

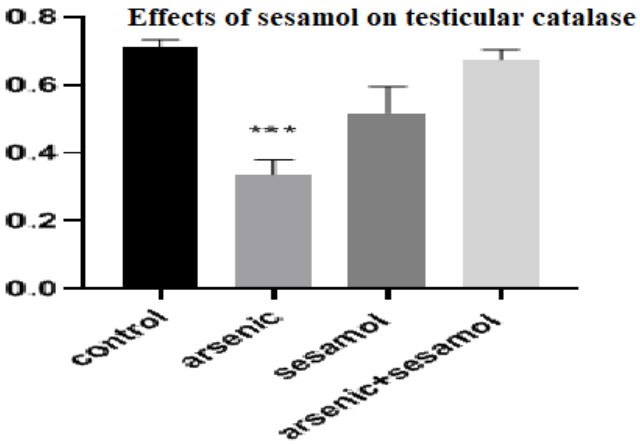
d eosin and evaluated using a light microscope through a\= pathologist that is not aware in terms of treating with the protocol [13].

Analysis of statistical data

To analyze the gathered data, value is expressed in mean ± S.E.M. one way analysis of variance was carried out by following the Tukey test in multiple comparisons. SPSS version 21 has been used and the difference is conducted at the significance degree of $p<0.5$.

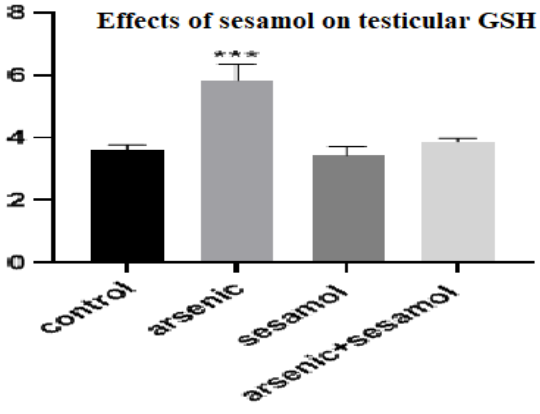
Results and discussion

Figure 1: Effects of sesamol on testicular catalase in rats exposed to arsenic testicular injury. Results are mean ± S.E.M., *p<0.05 vs. control group.



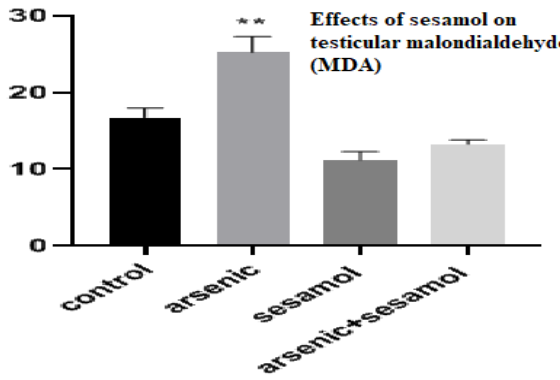
In Figure 1 the testicular catalase has been shown to dramatically decrease in arsenic treated rats compared to control, whereas pre-treated rats with sesamol have reverse effect on arsenic.

Figure 2: Effects of sesamol on testicular GSH, results are mean ± S.E.M., *p<0.05 vs. Control group



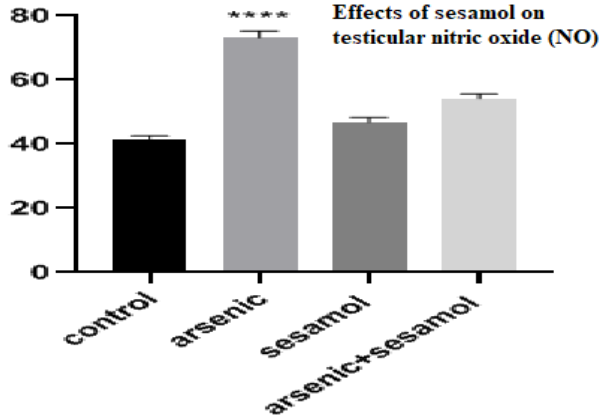
In figure 2 testicular GSH has been shown to be dramatically increase in arsenic treated rat as that of comparison of control whereas pre-treated rat with sesamol have adverse effect on arsenic [14].

Figure 3: effects of sesamol on testicular malondialdehyde (MDA) in rats that are exposed to arsenic testicular injury (results are mean ± S.E.M., *p<0.05 vs. control group)



In figure 3 testicular malondialdehyde has been shown to be dramatically increase in arsenic treated rat as that of arsenic plus sesamol that reveals proactive effect of sesamol upon arsenic induced testicular toxicity [15].

Figure 4: Effects of sesamol on testicular nitric oxide (NO) in rats that are exposed to arsenic testicular injury (results are mean ± S.E.M., *p<0.05 vs. control group).



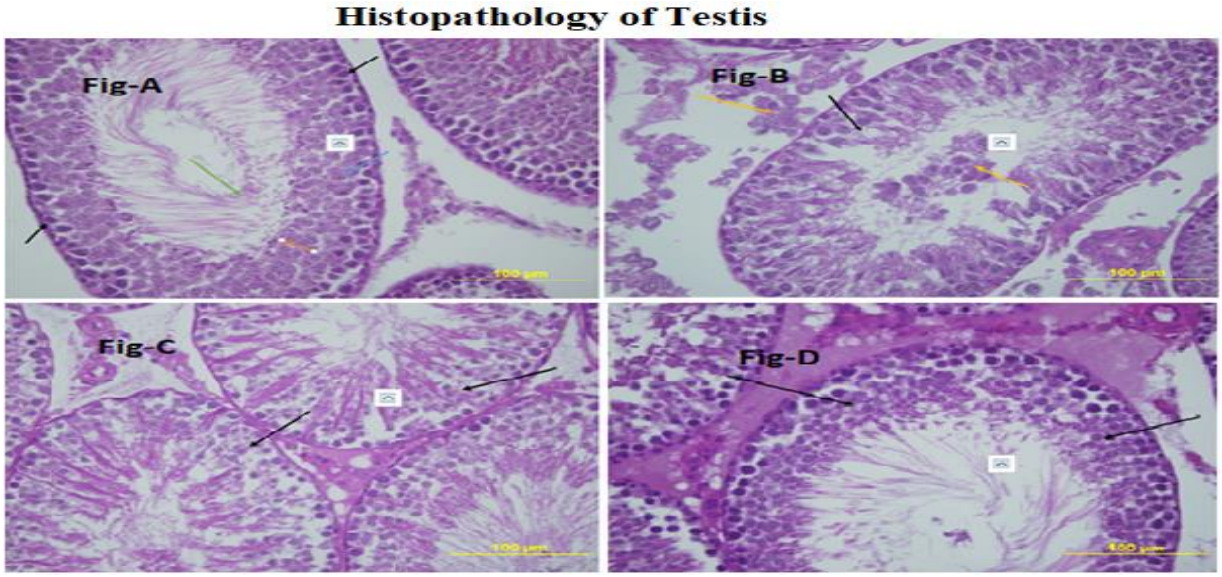
In figure 4 testicular nitric oxide has been shown to be dramatically increase in arsenic treated rat as that of control whereas arsenic plus sesamol have adverse effect on arsenic testicular injury [16].

Figure 5 A: Photomicrograph of the testis from the control group, illustrating normal seminiferous tubules of the testis. Spermatogonia (black arrow), primary spermatocytes (blue arrow) and spermatids (orange arrow). The lumen of the seminiferous tubule contains sperms (green arrow). H&E stain. X 40.

Figure 5 B: Photomicrograph of the testis from arsenic-treated group depicting disrupted seminiferous tubules (black arrow) and detached spermatocytes become visible inside as well as outside of the seminiferous tubules (orange arrows). H&E stain. X 40.

Figure 5 C: Photomicrograph of testis from the group treated with (arsenic plus sesamol), showing recovery of seminiferous tubules (black arrows). H&E stain. X40.

Figure 5 D: Photomicrograph of the testis from sesamol treated group, illustrating normal seminiferous tubules of the testis (black arrow). H&E stain. X 40.



RESULTS AND DISCUSSION

In the fig 5A, it depicts the animals of the control group that shows normal seminiferous tubules of the testis. Spermatogonia, spermatocytes, spermatids and sperms become visible as well as normal in appearance [17]. In the fig 5B, it highlights the animals from the arsenic-treated group shows disruption of seminiferous tubules, some of the spermatocytes become detached from the germinal epithelium and have become visible both inside and outside of seminiferous tubules [18]. In fig 5C it shows that the animals from the group treated with arsenic plus sesamol were showing recovery of seminiferous tubules [19]. In fig 5D it shows that the animals from sesamol treated group shows normal seminiferous tubules of the testis. Spermatogonia, spermatocytes, spermatids and sperms were normal in appearance [20].

It has been evident from the study that testicular catalase has shown a decrease in arsenic treated rat as comparison to control

and pre-treated rats with sesamol have adverse impact on arsenic. In case of testicular GSH it has been seen that there is an increase in arsenic treated rat as compare to control whereas pre-treated rat with sesamol have adverse effect on arsenic. Testicular malondialdehyde leads to the increase in arsenic treated rat as that of arsenic plus sesamol which reveals proactive impact of sesamol upon arsenic induced testicular toxicity. Testicular nitric oxide leads to the increase in arsenic treated rat as that of control whereas arsenic plus sesamol have adverse impact on arsenic testicular injury. Animals having control group have normal seminiferous tubules of testis. Spermatogonia, spermatocytes, spermatids and sperms are visible and normal in appearance. Animals from arsenic treated group have disruption of seminiferous tubules and some of spermatocytes become detached from germinal epithelium and is visible both inside and outside of somniferous tubules. Animals from group treated with arsenic plus sesamol shows recovery of seminiferous tubules and animals from sesamol treated group shows normal somniferous tubules of testis.

Spermatogonia, spermatocytes, spermatids and sperms were normal in appearance. As per the previous study it has been evident that there is a significant decrease of serum testosterone and testicular GSH and a significant increase in testicular MDA, NO and arsenic level were observed in rats which had receive sodium arsenate as comparison to control group. Testes of rats treated with arsenate and telmisartan that had significant high level of serum testosterone and testicular GSH and have significant lower degree of MDA, NO, arsenic and MPO activity than rats treated with only arsenic [21]. There is a need of further studies on the protective effect of sesamol of testicular on arsenic treated rat in order to have in-depth analysis on the preventive measures of these effect on arsenic treated rat. As per the molecular mechanism of the arsenic toxicity there has been a mechanism through which arsenic releases its toxicity effect resulting in impairment of cellular respiration caused by the inhibition of different enzymes and due to the uncoupling of oxidative phosphorylation cell death has been the final resultant. Therefore, due to the nature of arsenic being impacting enormously towards the transduction pathways resulting in alternation of important cell functions there is a future scope to understand the rate and extent of such impact due to the induction of apoptosis [22].

CONCLUSION

The findings in this study presents indicates that with testicular catalase it leads to the decrease in arsenic treated rat and pre-treated rats with sesamol have reverse effect on arsenic. Testicular GSH increases in rat treated with arsenic whereas testicular malondialdehyde is increased in arsenic treated rats and thus it has proactive effect of sesamol on arsenic induced testicular toxicity. Testicular NO is also increased in arsenic treated rat. There is a slight difference between animals treated with arsenic and arsenic plus sesamol in the seminiferous tubules. These findings could be useful clinically as they are associated with effect of sesamol and arsenic and thus helps the researcher to analyze the protective effect of sesamol of testicular in arsenic induced toxicity. Further studies are needed for in-depth analyze of effect of sesamol on arsenic induced rat.

Conflict of interest

Author confirms no conflict of interest.

ACKNOWLEDGMENT

Special thanks to Mr. Hussain Alnuwaiser for technical help during the experiments.

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How to cite this article

Sara Abdulraman Aldossary, 2022. Sesamol counter act toxicity of arsenic on testicular tissues. Journal of Medical Pharmaceutical and allied Science V 11 - I 5, Pages - 5259 – 5263. Doi: 10.55522/jmpas.V11I5.3794.