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Study the Potential Role of Nutritional Properties and Fertility for Some Cereals and Nuts in Experimental Male Albino Rats Poisoned with Nicotine

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Abstract: Over the years, male fertility has been on the decline with environmental and congenital factors. This study investigated the nutritional effect of barley, oat, walnuts, almonds, hazelnuts and peanuts on biological evaluation, semen analysis, fertility hormones and histopathological examination of testis. Forty eight mature male rats feed on diet mixed with cereals (barley and oat 10%) and nuts (walnuts, almonds, hazelnuts and peanuts 2.5%) of each one for group after 30 days nicotine injection. The results showed significant decrease of body weight, feed efficiency ratio, relative organs weight, motility %, progressive %, sperms count and histopathological changes of testis as a results of nicotine injection. But, the supplemented diet with cereals and nuts ameliorated the previous data toward the normal level comparing nicotinic group. So, these results confirmed that cereals and nut supplements can be used to improve infertility against nicotine toxicity among male rats' hens, smokers due to high nicotine intake.

Key words: biological evaluation, semen analysis, fertility hormones, histopathological examination, testis.

1. Introduction

Nicotine described as alkaloid compound of tobacco and considered the main compound responsible for harmful effects in smokers. Nicotine alters the balance in the various organ systems such as endocrine and the male reproductive system [1]. The nicotine action on testis has been recorded to reduce fertility in experimental and clinical trials [2]. Chronic nicotine use on mice showed reduction in testicular weight and atrophied male sex glands, due to the androgenic depletion. In experimental animals, nicotine has been observed to block the production of sperm and decrease the size of testicle [3]. The gonadotropins, luteinizing hormone (LH) and follicle-stimulating hormone (FSH) have ability to regulate the synthesis of the sex steroids (androgens and estrogens), which are important for proper gonadal development and function. The synthesis and secretion of gonadotropins are regulated by the hormones produced by the pituitary gland, the hormones from the hypothalamus and the gonads [4]. The successful and complete development of male germ cell is dependent on the balanced endocrine interaction of hypothalamus, pituitary and the testis [5]. The pituitary failure to secret FSH and LH will result in dysfunction of testis which leading to infertility. Testosterone, estradiol and inhibin are control the secretion of gonadotropins [6].

Phytonutrients are abundant in cereals, whole grains such as barley and oat which protect beings against many diseases. Dietary modulation by barley or oat β-glucans is useful to immune system and increase resistance against pathogens [7]. Barley and oat are good dietary sources of amino acids, sugar, carbohydrate, minerals such as, Ca, P, Na, K, F, Cu, Zn, Mn, and Mg as well as water soluble, fat soluble and insoluble antioxidants include vitamin E, tocotrienals, vitamins, β-glucans, phenolic flavons, flavonoids and selenium [8, 9, 10]. Nuts are a concentrated food and suggest that some early civilizations relied on nuts as a staple food before cereal grains. Nut may be defined as a hard, dry, single-seeded fruit, partially or totally enclosed in a husk. A feature of all nuts is their high content of oils, protein, fibers, vitamins and minerals. Almonds are good sources of anti-oxidant nutrients, phytosterols, proteins and many minerals such as calcium and magnesium. They are a rich source of dietary fiber, mono-unsaturated fats vitamin E and B-vitamins [11].

2. Materials

Animals and diet:

Experiment was used forty eight male albino rats (Sprague Dawley Strain) weight 180± 10 g, aged 10 weeks. They were obtained from laboratory animal house of science faculty, Cairo University. The animals were acclimatized for one week to laboratory condition, kept under temperature (20-25°C) and humidity control (55 -60 % humidity) with a 12 h light/ dark cycle. Rats were fed on basal diet (casein – basal diet), composed of 12 g of casein (85 % protein); corn oil (10% fat); minerals mixture (4% minerals); vitamins mixture (1% vitamins); cellulose (4% fiber); and corn starch (71 % starch), and tap water supply was given ad-libitum daily. Mineral mixture was composited as (g/kg) [12]. Vitamin mixture composition presented as (g/kg) [13]. Nicotine hydrogen tartrate salt powder ≥98% (TLC) with product number 5260 was purchased from Sigma–Aldrich Company for Pharmaceutical and Chemical Industries (St. Louis, MO, USA).

3. Methods

Experimental designs:

Male albino rats (single rat/metal cage) were classified into eight groups. Gr.1: six rats per kept as normal group received basal diet for successive thirty five days. Gr.2: forty two rats were intraperitoneal injected with nicotine (2.5mg/kg/day) and received basal diet for successive thirty days [14] then, six rats kept as nicotinic rats and thirty six rats divided in to six groups as follows: Gr.3: rats fed on basal diet supplemented with 10% barley powder. Gr.4: rats fed on basal diet supplemented with 10% oat powder. Gr.5: rats fed on basal diet supplemented with 2.5% walnuts. Gr.6: rats fed on basal diet supplemented with 2.5% almonds. Gr.7: rats fed on basal diet supplemented with 2.5% hazelnuts. Gr.8: rats fed on basal diet supplemented with 2.5% peanuts for successive 28 days. Ethics of laboratory care were followed

accordance with committee's protocols for Cairo University, Faculty of Science experimental animals' research [15].

Biological Evaluation:

Body weight was recorded twice / week. Consumed diet (feed intake) and / or wasted were calculated every day. On the last day of the experimental, rats were fasted and allowed free access to water. Feed intake, body weight gain (BWG %) and feed efficiency ratio (FER) were calculated [16] by using the following equations: Feed intake = Initial weight of diet (g) - Weight of diet lost (g). Weight gain (g)= Final weight (g) – Initial weight (g). Feed efficiency ratio = Gain in body weight (g)/ Feed intake (g). At the end of the experimental period, lung, heart and testis were removed carefully from each rat after an abdominal laparotomy, washed with saline solution, dried with filter paper and weighted [17]. Relative organ weight calculated by the following formula: Relative organ weight (ROW) % = Organ weight / Final body weight× 100.

Biochemical Analysis:

At the end of experiment, all rats were anaesthetized after fasting12 hours by using diethyl either 60% for 100 second. Blood samples were collected by orbital sinus/plexus bleeding. Serum were separated from collected blood samples then centrifuged for 10 minutes at 3000 revolutions / minute to separate the serum. Serum was carefully separated into dry clean Wassermann tubes by using a Pasteur pipette and used freshly for determination of biochemical analysis. The obtained serum samples were analyzed to determine the concentration of testosterone, luteinizing hormone (LH) and follicle-stimulating hormone (FSH) were analyzed for hormone estimation using enzyme immunoassay (EIA), according to the World Health Organization WHO (protocol/version of December 1998 for LH, FSH) matched reagent program protocol (manual) for EIA kits [18].

Semen collection and microscopic analysis:

Semen was collected from the distal cauda epididymidis of rats. For each rat, a small cut was made with a scalpel blade into the engorged tubules of the distal cauda epididymidis. Two epididymis were used for the aspiration method alternating right and left. Two milligrams of epididymal fluid were aspirated into a capillary tube. Additional medium was added excluding air when the vial was closed with a teflon-lined cap. The sample was carefully inverted several times and placed in a dry heating block at 37 °C for approximately 10 min to allow the spermatozoa to disperse into the medium [19]. A semen analysis is performed to determine the fertility potential of male rats. At a minimum, four basic parameters were assessed: sperm motility%, non-motility%, progressive % and count (106)/ml. Semen analysis follows the guide instructions for WHO [20].

Histopathological examination:

The testis tissue samples of sacrificed rats were obtained at different developmental phases and fixed in 4% paraformaldehyde phosphate buffered solution. The fixed tissue blocks were made and paraffin sections at 6 microns (µm) thickness. Samples were prepared from the paraffin-embedded material and serial sections were stained with hematoxylin eosin (H&E) for light microscopy at x 400 [21].

Statistical analysis:

The obtained data in tables were calculated as mean values with their standard deviation (S.D.) of each group. Values were statistically analyzed by one-way analysis of variance (ANOVA) by using SPSS software package (SPSS version 20.0; SPSS, Inc.). The P values (0.05) were considered significant) [22].

4. Results

Biological Evaluation:

Data present in table 1 showed the effect feeding of barley, oat, walnuts, almonds, hazelnuts and peanuts on feed intake (FI), body weight gain % (BWG%) and feed efficiency ratio (FER) in male fertility level of rats. Results for feed intake (FI) (M± SD) recorded s of non-significant decrease of negative group (18.66± 0.05 g) when compared to nicotinic group (18.66± 0.05 g). Rats received supplemented diet groups recorded non-significant increases (P<0.05) in feed intake, when compared with nicotinic rats. Body weight gain (BWG %) after nicotine injection illustrated that significant decreases (P<0.05) of nicotinic group compared to negative group (- 27.2± 0.8 and 12.7± 2 respectively). All treated groups have significant increases (P<0.05) as compared to nicotinic except walnuts groups. Feed efficiencies ratio recorded significant decrease (P<0.05) in nicotinic group when comparison with the negative group (-3.45± 0.11 and 1.24± 0.39 respectively). All treated groups have significant increases (P<0.05) as compared to nicotinic except walnuts groups.

Table 1: Nutritional role of barley, oat, walnuts, almonds, hazelnuts and peanuts on feed intake, body weight gain% and feed efficiency ratio of nicotinic rats

Groups	FI g/day	BWG%	FER
Negative	18.77± 0.05 ^{ab}	12.7± 2 ^{c}	1.24± 0.39 ^{c}
Nicotinic	18.66± 0.05 ^{abc}	- 27.2± 0.8 ^{a}	-3.45± 0.11 ^{a}
Barley	18.42± 0.14 ^{c}	- 11.4± 1.4 ^{b}	-1.43± 0.49 ^{b}
Oat	18.53± 0.16 ^{bc}	- 11.6± 2.9 ^{b}	-1.43± 0.87 ^{b}
Walnuts	18.64± 0.7 ^{abc}	- 18.0± 1.8 ^{ab}	-2.23± 0.46 ^{ab}
Almonds	18.69± 0.12 ^{abc}	- 14.5± 2.9 ^{b}	-1.69± 0.22 ^{b}
Hazelnuts	18.74± 0.04 ^{ab}	- 12.1± 2.8 ^{b}	-1.35± 0.82 ^{b}
Peanuts	18.95± 0.04 ^{a}	- 12.9± 2.3 ^{b}	-1.49± 0.67 ^{b}

Values denote arithmetic means ± SD of the mean .Means with different letters (a, b, c, d) in the same column differ significantly at p≤0.05, while those with similar letters are non-significant.

Table 2 presented mean values of different organs relative weights of negative, nicotinic and supplemented groups with barley, oat, walnuts, almonds, hazelnuts and peanuts. Relative lungs weight ratio values showed non-significant decrease in nicotinic group as compared with normal rats group (0.70± 0.05 and 0.66± 0.02). Supplemented diets with cereals and nuts illustrated non-significant increase (P<0.05) when compared with nicotinic and negative groups. The best result found in walnuts and almonds groups (0.71± 0.05 and 0.72± 0.03) which nearly value to negative group. Relative heart and testis weight ratio values showed non-significant increase of nicotinic group (0.43± 0.01 and 1.5.± 0.14, respectively) as compared with normal rats group. Supplemented diets with cereals and nuts recorded non-significant decreases (P<0.05) when compared with nicotinic group, the best result found in oat (1.2± 0.05) which nearly value to negative group.

Table 2: Nutritional role of barley, oat, walnuts, almonds, hazelnuts and peanuts on relative organs weight ratio of nicotinic rats

Groups	lung	heart	testis
Negative	0.70± 0.05 ^{ab}	0.37± 0.02 ^{b}	1.17± 0.06^{b}
Nicotinic	0.66± 0.02^{b}	0.43± 0.01 ^{ab}	1.5.± 0.14^{ab}
Barley	0.68± 0.02^{ab}	0.40± 0.02 ^{ab}	1.29± 0.07 ^{ab}
Oat	0.64± 0.05 ^{b}	0.40± 0.4 ^{b}	1.2± 0.05 ^{b}
Walnuts	0.71± 0.05 ^{ab}	0.47± 0.01 ^{a}	1.45± 0.07 ^{ab}
Almonds	0.72± 0.03 ^{ab}	0.48± 0.02 ^{a}	1.58± 0.11 ^{a}
Hazelnuts	0.76± 0.03 ^{ab}	0.43± 0.02 ^{ab}	1.39± 0.09^{ab}
Peanuts	0.82± 0.04 ^{a}	0.38± 0.02 ^{b}	1.34± 0.17 ^{ab}

Values denote arithmetic means ± SD of the mean .Means with different letters (a, b, c, d) in the same column differ significantly at p≤0.05, while those with similar letters are non-significant.

Semen microscopic analysis

As shown in table 3 data recorded semen microscopic analysis as motility, non-motility, progressive percentages and sperm count (106)/ml for negative, nicotinic and treated groups. Motility percent revealed to high significant decrement (p< 0.05) of nicotinic rats sperm as compared to normal rats group (43± 2.0 and 80± 2.7%). Treated groups induced high significant increment (p< 0.05) of motility percent sperm as compared to nicotinic rats group. The best results found in barley, almonds, oat, peanuts, walnuts and hazelnuts, respectively. Non-motility percent recorded high significant increment of nicotinic rat sperms as compared to normal rats group (57± 2.0 and 20± 2.7%). All plants induced significant decrement as compared to nicotinic sperm rats. Barley sperm rats revealed lowest results of non-motility

sperms as compared to nicotinic and negative rats (12± 2.5 %). Injected rats with nicotine induced high significant decrement (p< 0.05) of progressive sperms as compared to normal rats sperms (27± 2.5 and 68± 3.7 %). All cereals and nut recorded high significant increment in sperms progressive percent as compared to nicotinic rats. Barley group followed by almonds showed the best percent's (76± 4 and 66± 5.5%). Sperms count/ml recorded high significant decrement (p< 0.05) in nicotinic rats group compared to normal rats sperms (16.0± 1.8 and 23.4± 1.6 106/ml). All plants showed high significant increment of sperms count which the best compared to normal rats as follows barley, peanuts, almonds, hazelnuts, oat and walnuts, respectively.

Table 3: Nutritional role of barley, oat, walnuts, almonds, hazelnuts and peanuts on sperm analysis of nicotinic rats

Groups	Motility %	Non-motility %	Progressive %	Count (10^6)/ml
Negative	80± 2.7 ^{ab}	20± 2.7 ^{bc}	68± 3.7 ^{ab}	23.4± 1.6 ^{b}
Nicotinic	43± 2.0 ^{d}	57± 2.0 ^{a}	27± 2.5 ^{c}	16.0± 1.8 ^{c}
Barley	88± 2.5 ^{a}	12± 2.5 ^{d}	76± 4 ^{a}	31.7± 2.07 ^{a}
Oat	72± 4.6 ^{bc}	28± 4.6 ^{bc}	55± 6.5 ^{b}	26.8± 2.4 ^{ab}
Walnuts	68± 2.5 ^{c}	32± 2.5 ^{b}	54± 2.4 ^{b}	25.5± 2.7 ^{ab}
Almonds	77± 4.3 ^{abc}	22± 4.3 ^{bcd}	66± 5.5 ^{ab}	27.3± 2.8 ^{ab}
Hazelnuts	67± 3.8 ^{c}	32± 3.8 ^{b}	54± 5.6 ^{b}	26.9± 3.3 ^{ab}
Peanuts	69± 5.3 ^{bc}	31± 5.3 ^{bc}	59± 6.2 ^{b}	28.5± 2.7 ^{ab}

Values denote arithmetic means ± SD of the mean .Means with different letters (a, b, c, d) in the same column differ significantly at p≤0.05, while those with similar letters are non-significant.

Fertility hormones

Table 4 showed data of fertility hormones as testosterone, LH and FSH of normal, nicotinic and treated rats groups. About testosterone, results recorded high significant decrement (p< 0.05) of nicotinic rats compared to negative rats (0.68± 0.11 and 2.24± 0.10 nmol/L). All treated plants induced high significant increment especially in walnuts group (2.3± 0.14 nmol/L), which closed to normal rats group. Serum luteinizing hormone (LH) and Follicle-stimulating hormone (FSH) illustrated high significant increment (p< 0.05) in nicotinic rats compared to negative rats (2.30± 0.03, 0.96± 0.09, 0.60± 0.08 and 0.30± 0.05 mlU/ml, respectively). All cereals and nuts recorded high significant decrement compared to nicotinic rats group, which is close to normal rats in most treated plants. Barley group have the best results in these hormones (0.86± 0.11 and 0.36± 0.04 mlU/ml).

Table 4: Nutritional role of barley, oat, walnuts, almonds, hazelnuts and peanuts on fertility hormones of nicotinic rats

Groups	Testosterone nmol/L	LH mlU/ml	FSH mlU/ml
Negative	2.24± 0.10 [a]	0.60± 0.08 [c]	0.30± 0.05 [c]
Nicotinic	0.68± 0.11 [c]	2.30± 0.03 [a]	0.96± 0.09 [a]
Barley	1.7± 0.09 [b]	0.86± 0.11 [bc]	0.36± 0.04 [bc]
Oat	1.3± 0.04 [b]	1.0± 0.12 [bc]	0.50± 0.04 [bc]
Walnuts	2.3± 0.14 [a]	1.14± 0.14 [b]	0.40± 0.04 [bc]
Almonds	1.55± 0.11 [b]	0.95± 0.03 [bc]	0.53± 0.06 [b]
Hazelnuts	1.51± 0.13 [b]	1.30± 0.16 [b]	0.38± 0.08 [bc]
Peanuts	1.58± 0.06 [b]	1.04± 0.11 [bc]	0.52± 0.03 [b]

Values denote arithmetic means ± SD of the mean .Means with different letters (a, b, c, d) in the same column differ significantly at p≤0.05, while those with similar letters are non-significant.

Histopathological examination of testis (H & E x 400):

Testis of negative rat group showed the normal histological structure of seminiferous tubule as found in Fig.1. Testis of nicotinic rat illustrated interstitial oedema and degeneration of spermatogoneal cells lining seminiferous tubules as showed in Fig. 2 and 3. Rat testis of almond group showed complete spermatogenesis with production of sperms as illustrated in Fig. 4. Testis of barley rat group revealed hyper activation of spermatogoneal cells lining seminiferous tubules and interstitial oedema in Fig. 5 and 6. Testis of hazelnut rat group showed the normal histological structure of seminiferous tubule in Fig.7. Testis of walnut rat group illustrated interstitial oedema in Fig.8. Testis of oat rat group showed hyperactivation of spermatogoneal cells lining seminiferous tubules in Fig.9. Testis of peanut rat group revealed hyper activation of spermatogoneal cells lining seminiferous tubules in Fig.10.

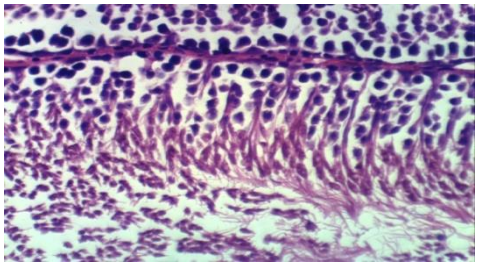

Fig. 1. Testis of negative group.

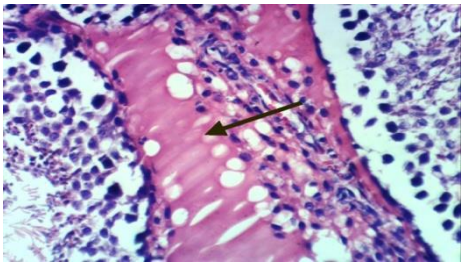

Fig. 2. Testis of nicotinic group.

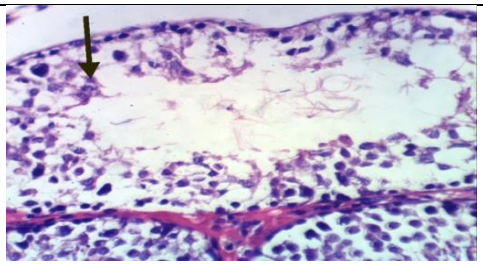

Fig. 3. Testis of nicotinic rat group.

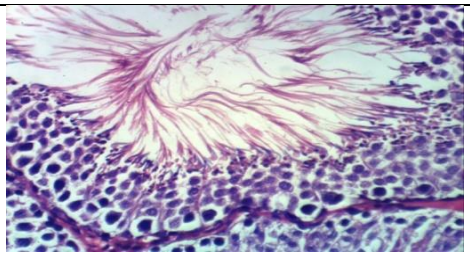

Fig. 4. Testis of Almond rat group.

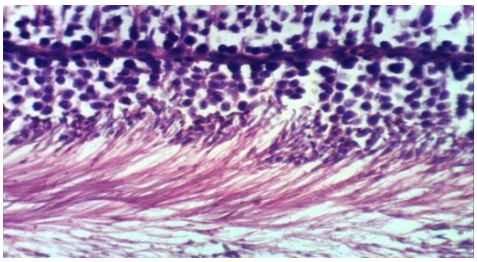

Fig. 5. Testis of Barley rat group.

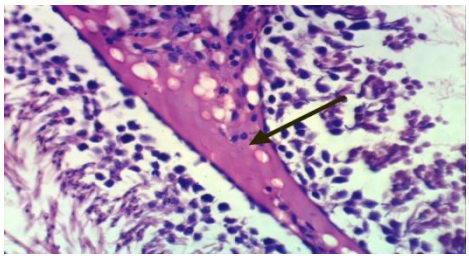

Fig. 6.Testis of Barley rat group.

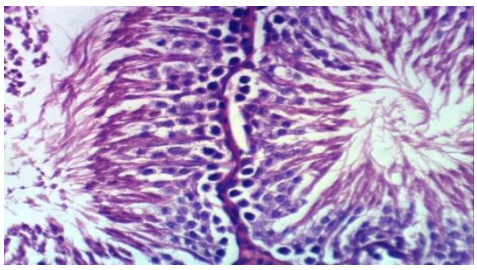

Fig. 7. Testis of Hazelnut rat group.

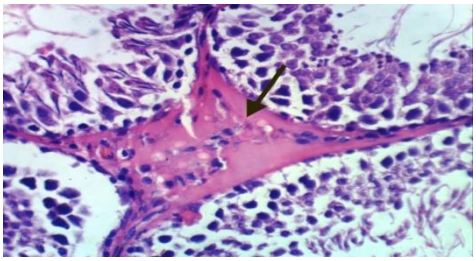

Fig. 8. Testis of Walnut rat group.

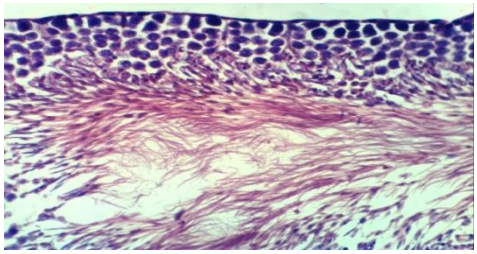

Fig. 9. Testis of Oat rat group.

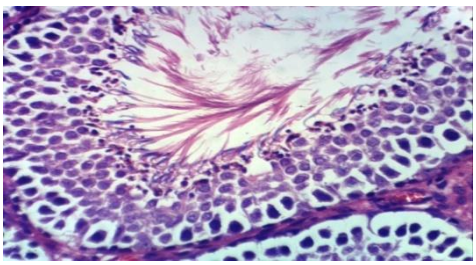

Fig. 10. Testis of Peanut rat group.

5. Discussion

Nicotine can cause inhibitory role on food intake and body weight in beings. So as to, chronic nicotine used in mice provokes the reduction in testicular weight and atrophied male accessory sex glands, due to the androgenic depletion. Previous studies had been shown that nicotine was a major toxic for reproductive health and had toxic influences on sperm count and motility in adult mouse [23]. Nicotine group indicated significantly lower sperm count, more dead sperm and lesser sperm with normal morphology than of treated groups. Also, our results were in agreement to the findings in which the administration of nicotine reduced the epididymal sperm count, grade of motility and the percentage of

normal sperm morphology [24]. Tobacco smoke reduced sperm concentration, sperm motility, and fertilizing capacity in rat [25]. Previous researcher claimed that nicotine involved in inhibiting testosterone production through its effects on acetylcholine receptors on cell membrane [26]. A drop in the testosterone level will lead to infertility of males due to its major role in spermatogenesis. Cotinine, the nicotine metabolite has effects on neurotransmitters released from the central nervous system. These in turn affect several enzymes, which involved in the synthesis of estrogen and testosterone [27]. Our findings supported past studies that nicotine reduced reproductive capacity of male. It was reported that nicotine had a mutagenic consequences towards the germ cell production and maturation as well as the reproductive organ itself and accessory reproductive organs [28].

All of these studies confirmed that smoking more than twenty cigarettes daily or smoking greater than ten years has a deleterious effect on semen volume, sperm motility and morphology in smokers [29]. Defective sperm function has been identified as the most common cause of infertility. Our results are agreement with that mentioned serum testosterone had significant decrease in experimental groups ($p<0.05$) and there was significant decrease in body weight testis weight and the number of germinal and somatic cells in testis in experimental groups. There was also a significant decrease in experimental groups of trifluralin [30]. Moreover, oral nicotine as two doses for thirty days induced infertility and associated with altered male reproductive hormones in male albino rats. Results showed that nicotine administration significantly decreased ($P < 0.05$) testosterone in the low and high treated groups and FSH in the high dose treated group when compared with the control group. There was a significant increase ($P < 0.05$) in mean LH and prolactin level in the high dose treated group when compared with the control [31]. Effect of nicotine on male fertility recorded a significant reduction in mean values of sperm parameters (count and motility), serum concentration of testosterone and testicular weight in male Wistar rat. Also, in the test group, histopathology revealed to a marked degeneration of germ cell layers in the seminiferous tubule and disruption of interstitial cells of the testis thereby interfering with spermatogenesis [32]. Infection, inflammation, and/or increased oxidative stress often require a specific treatment with antibiotics, anti-inflammatory drugs, and/or antioxidants. Combined therapies can contribute to improve sperm quality [33]. In evaluating the toxic effect of nicotine and the possible protective role of green tea extract on some organs of Swiss albino mice four successive weeks by using histological studies. The experimental period was nicotine treatment induced histological changes in both the lung and testicular tissue as revealed by light microscope. The administration of green tea extract might suppress the cytotoxicity and mutagenic activity of nicotine [14]. Antioxidants play a protective role, although a delicate balance of reduction and oxidation is required for essential functions, including fertilization. Reducing oxidative stress may improve a couple's chances of conception either naturally or via assisted reproduction [34]. The effects of various antioxidants on male fertility are consider. High amounts of poly unsaturated fatty acid are found in the mammalian spermatozoa membranes, thereby making them susceptible to lipid peroxidation.

Endogenous antioxidants system exists to mediate these damages. In a normal physiological state, the seminal plasma contains antioxidant enzyme mechanism that is capable of quenching these ROS as well as protecting the spermatozoa against any likely damage. Evaluation of such oxidative stress is the first step in the treatment of male infertility through administration of suitable antioxidant. Notably, antioxidant such as vitamin E and C, carotenoids and carnitine have been found beneficial in restoring a balance between ROS generation and scavenging activities. There are emerging evidences that cereals and nut products can also boost male reproductive functions. Nonetheless, a good lifestyle, regular exercise, avoidance of stress and observing safety rules at work are habits that can reverse male infertility [35]. Acrylamide ACR induced toxic, clastogenic, and histological alterations. Both barley and sage have a protective role against these deleterious effects possibly due to their higher contents of antioxidant substances which can modulate the metabolism of ACR resulting in the reduction of its toxicity and/or increase the GSH production by the target organs which involved in the detoxification of ACR. These plants may be useful when add to certain foods cooked in a higher temperature [36]. Cereal grains such as barley and oat have protective effect by their phyto-nutrients and antioxidants when added to diet and food products on teratogenic effects induced by amitraz after maternal exposure during pregnancy [37]. Vitamin E addition showed enough antioxidant protection only when associated with no lipid enriched diets. The n-3 supplementation modified the fatty acid profile of the spermatozoa membrane and simultaneously enhanced oxidative processes. Only the association with supra nutritional levels of vitamins E and C inhibited the oxidative processes and improved the characteristics of fresh and stored male rabbit semen [38]. In studying on walnut, the results demonstrated that 75 g of whole-shelled walnuts added to healthy young men Western-style diet improved serum fatty acids profiles (omega-6 and omega-3), Sperm vitality, motility, and morphology [39]. All nuts have sufficient amount of menials which can improvement the fertility status. So that, zinc supplements has an important modulator/protector effect on certain parameters. The mechanism of zinc protection can be through an increase of SH concentration. Thus, zinc supplementation may be a promising addition to conventional treatments for male infertility related to smoking [40]. Also, iron and copper are essential trace nutrients playing important roles in general health and fertility. Excess or deficiency of either element may lead to defective spermatogenesis, reduced libido, and oxidative damage to the testicular tissue and spermatozoa, ultimately leading to fertility impairment [41].

6. Conclusions

The findings in this study suggest that nicotine injection is associated with lower in body weight, testis weight, sperms analysis and disturbance of reproductive hormones and testis histopathological tissue for male rats. Using barley, oat and nuts (walnuts, almonds, hazelnuts and peanuts) ameliorated

previous data to normal range. So, the safe and useful uses of cereals and nut daily can improve nutritional status, hormone level, and fertility of human body and improving public health as well.

7. Acknowledgments

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دراسة الدور المحتمل للخصائص الغذائية وخصائص الخصوبة لبعض الحبوب والمكسرات في ذكور فئران التجارب البيضاء المسممة بالنيكوتين

الملخص: على مدار السنوات الماضية كانت خصوبة الذكور في الانخفاض خاصة مع العوامل البيئية والخِلقية. وقد أجريت هذه الدراسة لبحث التأثير الغذائي للشعير والشوفان والجوز(عين الجمل) واللوز والبندق والفول السوداني على التقييم البيولوجي وتحليل السائل المنوي وهرمونات الخصوبة والفحص النسيجي للخصية. تم تغذية ثمانية وأربعين من ذكور الفئران البالغة على النظام الغذائي المدعم بالحبوب (الشعير والشوفان بتركيز (10%) والمكسرات (الجوز واللوز والبندق والفول السوداني بتركيز(2.5%) من كل نوع للمجموعة وبعد 30 يوماً تم حقن النيكوتين. ومن هنا أظهرت النتائج انخفاضاً معنوياً في وزن الجسم ومعدل كفاءة الغذاء والوزن النسبي للأعضاء والنسب المئوية لحيوية وسرعة حركة الحيوانات المنوية وعددها والتغيرات النسيجية للخصية نتيجة الحقن بالنيكوتين. ومع هذا تحسنت البيانات السابقة نتيجة النظام الغذائي المكمل مع الحبوب والمكسرات نحو المستوى الطبيعي مقارنة بالمجموعة المحقونة فقط بالنيكوتين. لذا، أكدت هذه النتائج أن تدعيم النظام الغذائي بالحبوب والمكسرات يمكن استخدامها لتحسين الخصوبة المنخفض ضد سمية النيكوتين بين ذكور الفئران والمدخنين نتيجة لارتفاع النيكوتين المتناول.

الكلمات المفتاحية: التقييم البيولوجي، تحليل السائل المنوي، هرمونات الخصوبة، الفحص النسيجي، الخصية.