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Biochemical and Nutritional Studies of Saw Palmetto (*Serenoa Repens*) in Male Albino Rats Suffered with Fertility and Immunity Dysfunction Induced by Cadmium Chloride

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ABSTRACT:

This study aimed to investigate the effect of saw palmetto on the fertility and immunity indices in male Albino rats suffering from fertility and immunity dysfunctions. Thirty-six adult male albino rats were used in this study and divided into six groups. The first major group was represented by the negative control group (n=6), which fed a basal diet. The second groups (n=30) were injected intraperitoneally by (CdCl2) 0.1 mL/100g body weight to infect infertility rats, then divided into five subgroups (n=6 in each). The first subgroup represented the positive control group, while the other groups were fed a basal diet supplemented with saw palmetto powder 3%-5% and water extract 3%-5%. The feeding course was carried out for up to 28 successive days. At the end of the experiment, blood samples were collected from each rat to estimate serum levels of Follicle-stimulating hormone, Luteinizing Hormone, and testosterone hormones. Immunoglobulins (IgG, IgM, and IgA) titer and serum liver and kidney enzyme function were determined. Obtained data indicated that both testosterone and LH hormone levels increased with water extract by 5%. FSH hormone level was decreased with water extract 5%. There was a significant increase in immunity indices and a decrease in liver and kidney enzymes. The histological structure of the testis was clearly improved, which reflects the powerful therapeutic effect of feeding on saw palmetto powder and their water extract for improving fertility and immunity in rats. The most potent result was obtained at 5% water extract of saw palmetto.

Keywords: *Infertility, subfertility, Hormones, Immunoglobulin, Phytotherapy*

INTRODUCTION

Global reports indicate a decline in male fertility [1] associated with multiple interfered factors related to genetic, environmental and nutritional ones.

According to estimates of the World Health Organization (WHO), between 45 and 80 million couples worldwide are infertile [2,3].

Due to indications of declining semen quality among young in healthy men, the problem of male infertility has received increased attention globally [4]. The rates of male infertility have been reported to be in the range from 2.5% to 12%, in Central/Eastern Europe while Africa is having the highest rate [5]. The prevalence rates in other locations, including in North America, and Australia has ranged from 4.5-6%, 9%, and 8-12%, respectively. Seminal quality, which is indicative of fertility, is a key factor in determining male infertility, albeit other factors dependent on the couple's situation also play a role. [6].

Native to the Southeast of the United States, saw palmetto is a miniature palm tree in the Acer family. Native Americans employed saw palmetto berries for genitourinary issues, mucosal irritation relief, testicular function enhancement, and breast augmentation. [7,8].

Several components found in saw palmetto have been demonstrated to be helpful in the treatment of benign prostatic hyperplasia. These components include fatty acids, **β**-sitosterol and its 3-O-glucoside, **β**-sitosterone, ursolic acid, oleanolic acid, maslinic acid, and long-chain fatty alcohols (n-docosanol, n-docosanol, and its trans-ferulate ester) [9]. Fatty acids decrease the biosynthesis of testosterone as well as inhibit cholesterol levels in the prostate., phytosterols which occur naturally in saw palmetto such as campesterol, **β**-sitosterol, and **β**-sitosterone compete with precursors of androgens and prevent the formation of prostaglandins [10].

Saw palmetto was first utilized by Native Americans in the United States to cure impotence and infertility [11]. Subsequent settlers began use the entire berry as a tonic. Its usage in treating urinary tract issues was first documented in the literature in the early 1900s [11]. Traditionally, saw palmetto has been utilized in ethanol and water extracts [11]. It is claimed to have anabolic, endocrine, urinary, and diuretic qualities [12]. It has historically been used to treat urogenital mucositis, testicular atrophy, sex hormone abnormalities, particularly prostatic hypertrophy, and chronic or subacute cystitis [12]. Conventional medicine also lists indications including cough, eczema, bronchial illness, and irritation of the mammary glands. thought to heighten one's desire for sex [12].

Saw palmetto is commonly used because it improves sperm quality and pregnancy rates in men with teratozoospermia [13]. In order to assist maintain testosterone levels, saw palmetto reduces the activity of 5-alpha reductase, an enzyme that converts testosterone to Dihydrotestosterone (DHT) [14]. One review suggests that saw palmetto may assist in blocking DHT's absorption and reducing its capacity to bind to androgen receptors by almost half [15]. Consequently, this could aid in controlling testosterone levels [15].

Thus, the current study's objective is to assess how saw palmetto powder and

water extract affect the immunity and fertility of rats.

MATERIALS AND METHODS

MATERIALS

Plant materials:

Saw palmetto (*Serenoa repens*) seeds were obtained from herbalists in the month of May 2022 in Cairo, Egypt.

Chemical materials:

The supplier of hydrated cadmium chloride powder was El-Nasr Company in Cairo, Egypt. The chemical kits used in this study were bought from Bio diagnostics Co. in Cairo, Egypt, and included LH, FSH, testosterone, TC, TG, HDL-c, ALT, AST, urea, creatinine, and albumin.

Experimental animals:

The experimental was done in the Faculty of Medicine Ain shams Research Institute. A total of 36 adult normal male albino rats strain weighing 140±10 g (about 6 weeks old) were obtained from Vaccine and Immunity Organization, Ministry of Health, Cairo, Egypt.

METHODS:

Preparation of Saw palmetto (*Serenoa repens*):

Saw palmetto were milled into powder and kept in dusky stoppered glass bottles in a cool and dry location until use

Biological investigations:

The rats were kept in separate stainless-steel cages with controlled lighting and were given a basal food for a week before being switched to an experimental diet to help them become used to it. To prevent feed loss and contamination, rats were given their diets in a specialized feeding cup that did not scatter. Rats were given access to tap water through glass tubes that protruded through wire cages from bottles that were flipped and supported on one side of the cage.

Basal diet composition of tested rats:

Basal diet was prepared according to describe preparation [16].

The induction of experimental infertility :

During the experiment, 0.1 mL/100 g body weight of cadmium chloride (CdCl2, 0.1%) was injected intraperitoneal by twice into healthy, normal male albino rats [17].

Experimental design:

Thirty-six (36) male adult strains of albino rats, each weighing 140±10 g, were used in this study and split into six groups, each of which has six rats, as follows:

Group 1: rats were fed a baseline diet and represents a negative control.

Group 2: Fed a basal diet and represents a positive control and injected with (CdCl2, 0.1%) of the rat's body weight.

Group 3: were fed a basal diet with a supplementation of 3% saw palmetto powder.

Group 4: were fed a basal diet with a supplementation of 5% Saw palmetto powder.

Group 5: were fed a basal diet with a supplementation of 3% saw palmetto water extract.

Group 6: were fed a basal diet with a supplementation of 5% saw palmetto water extract.

Blood sampling collection:

Blood samples were taken from the retroorbital vein after a 12-hour fast in clean and dry glass tube, The samples were then allowed to clot in a water bath at 37°C for 30 minutes. Serum was then carefully aspirated and transferred into a clean cuvette tube. The tube was then frozen in a deep freezer until investigations, following the procedure outlined by [18].

Biochemical analysis:

Serum test parameters were evaluated using a certain technique, as follows: The hormones LH and FSH were measured calorimetrically [19]. The hormone testosterone was measured using colorimetry [20]. Using commercial plates (Behringwerke; Scoppito-Italy), single radial immunodiffusion assay was used to measure the amounts of serum IgM, IgG, and IgA [21]. The modified kinetic method was used to measure the AST activity in serum [22]. The modified kinetic method was used to measure the ALT activity in serum [23]. Liquicolor or the modified kinetic technique were used to determine the amount of urea in serum [24]. The modified kinetic technique was used to measure serum creatinine [25]. The modified kinetic technique was used to measure serum uric acid [26].

Histopathological investigation:

Testis were removed, washed in saline solution, wiped by filter paper, weighted, and stored frozen in formalin solution 10% for histopathological examination [27].

Statistical analysis:

A fully randomized factorial design was used to examine the data [28]. The student-Newman-Keuls Test was used to separate the means when a significant main effect was found. Using the Costat Program, differences between treatments ($P \leq 0.05$) were deemed significant. One-way ANOVA was used to assess the biological results.

Results and Discussion

The effects of saw palmetto powder and its water extract on the FSH, LH, and testosterone of infertile rats are displayed in Table 1. The positive control group's FSH mean value was 5.8 (mlu/mL), but the negative control group's FSH mean value was much lower at 0.98 (mlu/mL), Additionally, groups 3, 4, 5, and 6 had mean values that were 4.34, 4.22, 3.36 and 2.5 (mlu/mL), respectively, substantially different from the positive control.

The effects of saw palmetto powder and its water extract on LH in infertile rats were demonstrated by the results. According to the results, the mean LH values in the positive and negative control groups were 1.44 and 2.2 (mlu/mL), respectively, and showed a significant difference. Furthermore, groups 3, 4, 5, and 6 had mean values of 2.36, 2.52, 2.6, and 2.92 (mlu/mL) that were substantially different from the positive control.

Our results showed that the positive control group's mean testosterone value (ng/ml) was substantially lower than that

of negative control groups, at 0.71 and 4.93 (ng/mL), respectively. Additionally, group 3, 4, 5, and 6's mean values 2.65, 3.21, 3.86, and 4.97 (ng/mL) differed considerably from the positive control. The best group seems to be that of group (6). Other advantages of Saw Palmetto include prevention of hair loss, treatment of UTIs, preservation of prostate health, reduction of inflammation, and control of testosterone levels [29]. Saw palmetto is also used to reduce inflammation and boost fertility and sexual drive [30]. Saw palmetto supplementation has significantly increase spermatogenesis.

This finding is agreed with that reported in another study which conclude that after 12 months of saw palmetto medication, there was a considerable improvement in mean sperm concentration, sperm progressive motility, and the rate of sperm with normal morphology [31]. SPE could inhibit 5**α**-reductase in the human prostate in vivo after reporting a significant increase in testosterone and decrease in DHT in the periurethral region of prostate tissue from BPH patients receiving Permixon (320 mg/day) for three months [32]. An in vitro investigation showed that this medication boosted motility [33].

Table (1): Effect of saw palmetto powder and its extract on the FSH, LH, and testosterone hormones of infertile rats:

Parameter / Groups	FSH mlu/mL M ± SD	LH mlu/mL M ± SD	Testosterone ng/mL M ± SD
Group 1: control (-ve)	0.98f±0.003	2.2e±0.06	4.93b±0.001
Group 2: control (+ve)	5.8a±0.09	1.44f±0.002	0.71f±0.002
Group 3: Infertile rats with Saw Palmetto powder (3 %)	4.34b±0.007	2.36d±0.004	2.65e±0.004
Group 4: Infertile rats with Saw Palmetto powder (5%)	4.22c±0.002	2.52c±0.004	3.21d±0.006
Group 5: Infertile rats with water extract of Saw Palmetto (3%)	3.36d±0.005	2.6b±0.03	3.86c±0.001
Group 6: Infertile rats with water extract of Saw Palmetto (5%)	2.5e±0.09	2.92a±0.009	4.97a±0.002
LSD	0.09	0.05	0.01

Each value is presented as mean ± standard deviation (n = 6).

*Means under the same line bearing different superscript letters are different significantly ($p < 0.05$). * FSH: Follicle stimulating hormone and LH: Luteinizing hormone*

The effects of saw palmetto powder and its water extract on IgG, IgM, and IgA in infertile rats are displayed in Table 2. Between the positive and negative control groups, the mean IgG (mg/dl) values were 163 and 195, respectively, and were considerably lower in the negative control group. Additionally, there was a notable difference in the mean values of groups 3, 4, 5, and 6 (mg/dl) compared to the positive control; these differences were 273, 185, 266, and 163, respectively.

The effects of saw palmetto powder and its water extract on IgM in infertile rats were shown by the results. The findings

showed that, at 32 and 48 mg/dl, respectively, the mean value of IgM in the positive control group was much lower than that in the negative control group. Furthermore, groups 3, 4, 5, and 6 had mean values of 43, 44, 46, and 47 (mg/dl), respectively, that were statistically different from the positive control.

The effects of saw palmetto powder and its water extract on IgA in infertile rats are also demonstrated by the results. The outcome showed that, at 121 and 135 mg/dl, the mean IgA value in the positive control group was considerably lower than that in the negative control group.

Additionally, groups 3, 4, 5, and 6 had mean values of 125, 127, 145, and 156 (ng/mL), respectively, that were substantially different from the positive control. It appears that group (6) is the best group. Mahapokai came to the conclusion that inflammatory infiltration came before hyperplasia developed. One of SPE's (saw palmetto extract) reported mechanisms of action was an anti-inflammatory impact [34]. It's actually possible that SPE has an impact on a number of inflammatory mediators. In vivo, SPE demonstrated anti-inflammatory and anti-edematous properties [35]. According to Kyprianou, there was a statistically significant increase in the intensity of BCL-2 immunoreactivity and the number of positive epithelial cells in BPH specimens compared to the normal prostate, as well as a statistically significant elevation in TGF-**β**, a negative growth factor that can induce apoptosis under physiological conditions, in the epithelial cells of BPH tissue [36].

Table (2): Effect of saw palmetto powder and its extract on IgG, IgM, and IgA of infertile rats:

Parameter / Groups	IgG (ng/dl) M ± SD	IgM (ng/dl) M ± SD	IgA (ng/dl) M ± SD
Group 1: control (-ve)	163e±0.13	48a±0.05	135c±0.22
Group 2: control (+ve)	195c±0.18	32f±0.01	121f±0.28
Group 3: Infertile rats with Saw Palmetto powder (3 %)	273a±0.11	43e±0.09	125e±0.29
Group 4: Infertile rats with Saw Palmetto powder (5%)	185d±0.14	44d±0.02	127d±0.2
Group 5: Infertile rats with water extract of Saw Palmetto (3%)	266b±0.17	46c±0.03	145b±0.26
Group 6: Infertile rats with water extract of Saw Palmetto (5%)	163e±0.19	47b±0.08	156a±0.24
LSD	0.28	0.09	0.45

Each value is presented as mean ± standard deviation (n = 6).

Means under the same line bearing different superscript letters are different significantly ($p < 0.05$).

** IgG: Immunoglobulin G, IgM: Immunoglobulin M and IgA: Immunoglobulin A*

The effects of saw palmetto powder and its water extract on the ALT, AST, and ALP of infertile rats are displayed in Table 3. The mean ALT (U/L) values for the positive and negative control groups were 48.5 and 79.5 (U/L), respectively, and were considerably lower in the negative control group. Additionally, groups 3, 4, 5, and 6 had mean values that were substantially different from the positive control; they

were, respectively, 63.5, 57, 45, and 40.5 (U/L).

The effects of saw palmetto powder and its water extract on AST in infertile rats were demonstrated by the results. The outcome showed that the mean AST values in the positive and negative control groups, which were 95 and 67 (U/L), respectively, were considerably lower in the negative control group. In addition, groups 3, 4, 5, and 6 had mean values that were notably different from the positive control (84, 79, 75, and 65 (U/L), respectively.

The effects of saw palmetto powder and its water extract on ALP in infertile rats are also demonstrated by the results. The results showed that the positive control group's mean ALP (U/L) value was 206.5 and the negative control group was 183, respectively, a significant difference. Furthermore, the mean value of groups 3, 4, 5, and 6 was 194, 190, 181, and 176 (U/L), respectively, which was substantially different from the positive control. It appears that group (6) is the best group. According to Suzuki's research, the activity and composition of the hepatic drug-metabolizing enzymes were not significantly affected by the repeated oral administration of SPE to rats. Additionally, rats given SPE orally repeatedly showed no changes in blood biochemical indicators (apart for a slight increase in albumin value), indicating that even long-term intake of the drug is rather safe [37].

Table (3): Effect of saw palmetto powder and its extract on the liver function of infertile rats:

Parameter / Groups	ALT (U/L) M ± SD	AST (U/L) M ± SD	ALP (U/L) M ± SD
Group 1: control (-ve)	48.5d±0.02	67e±0.13	183d±0.03
Group 2: control (+ve)	79.5b±0.01	95a±0.19	206.5a±0.01
Group 3: Infertile rats with Saw Palmetto powder (3 %)	63.5a±0.08	84b±0.11	194b±0.57
Group 4: Infertile rats with Saw Palmetto powder (5%)	57c±0.5	79c±0.14	190c ±0.48
Group 5: Infertile rats with water extract of Saw Palmetto (3%)	45e±0.54	75d±0.2	181e±0.5
Group 6: Infertile rats with water extract of Saw Palmetto (5%)	40.5f±0.06	65f±0.18	176f±0.55
LSD	0.54	0.29	0.76

Each value is presented as mean ± standard deviation (n = 6).
Means under the same line bearing different superscript letters are different significantly ($p < 0.05$).
**ALT: Alanine transaminase, AST: aspartate aminotransferase and ALP: Alkaline phosphatase*

The effects of saw palmetto powder and its water extract on the urea, uric acid, and creatinine of infertile rats are displayed in Table 4. The mean urea (mg/dl) for the negative control group was notably lower than the mean value of 68.5 mg/dl for the positive control group. Furthermore, compared to the positive control, the mean values of groups 3, 4, 5, and 6 were substantially different; they were 35.5, 38.5, 33, and 30.5 (mg/dl), respectively.

The effects of saw palmetto powder and its water extract on uric acid in infertile rats were demonstrated by the results.

The average level of uric acid in the negative control group was 2.75 mg/dl, whereas it was 2.85 mg/dl in the positive control group, according to the results. The mean values of groups 4, 5, 6, and 2.1, 2.25, 1.9, and 2.4 (mg/dl), respectively, showed a significant difference from the positive control. The impact of saw palmetto powder and its water extract on creatinine in infertile rats is also demonstrated by the results.

The results showed that the mean creatinine (mg/dl) in the positive control group was 0.7 and 0.5 mg/dl, respectively, whereas the mean value in the negative control group was much lower. Furthermore, the mean values of groups 3, 4, 5, and 6 (mg/dl) were 0.65, 0.65, 0.6, and 0.60, respectively, which were substantially different from the positive control. It appears that group (6) is the best group. reported reduced levels of uric acid, urea, and creatinine [38]. The fruit of the Serenoa repens tree is the natural source of saw palmetto. It is generally used to treat enlarged prostates and enhance urine function [28]. There have also been reports of saw palmetto extract helping with the symptoms of benign prostatic hypertrophy, a disorder where the prostate gland expands uncontrollably. BPH is more prevalent in the elderly and needs to be treated right away to prevent detrimental effects on health [39]. In normal individuals, Markowitz found that SPE (320 mg/day for 14 days) did not change the plasma concentrations of probe agents for cytochrome P-450 (CYP)2D6 and CYP3A4 activity when used to treat lower urinary tract symptoms suggestive of BPH [39].

Table (4): Effect of saw palmetto powder and its extract on uric acid, urea and creatinine of infertile rats:

Parameter / Groups	Urea (mg/dl) M ± SD	Uric acid (mg/dl) M ± SD	Creatinine (mg/d)l M ± SD
Group 1: control (-ve)	52b±0.13	2.75b±0.006	0.5c±0.02
Group 2: control (+ve)	68.5a±0.09	2.85a±0.009	0.7a±0.05
Group 3: Infertile rats with Saw Palmetto powder (3 %)	35.5d±0.06	2.4c±0.02	0.65b±0.007
Group 4: Infertile rats with Saw Palmetto powder (5%)	38.5c±0.04	2.1e±0.06	0.65b±0.008
Group 5: Infertile rats with water extract of Saw Palmetto (3%)	33e±0.18	2.25d±0.006	0.6b±0.01
Group 6: Infertile rats with water extract of Saw Palmetto (5%)	30.5f±0.03	1.9f±0.07	0.60b±0.004
LSD	0.18	0.07	0.04

Each value is presented as mean ± standard deviation (n = 6). Means under the same line bearing different superscript letters are different significantly (p < 0.05).

Histopathological examination of testis: Under a microscope, the testes of the rats in group 1 control (-) displayed a normal seminiferous tubule histological structure, complete spermatogenesis, and normal spermatogoneal cells (Photo1). Conversely, testes from group 2 control (+) showed small-diameter seminiferous tubules, interstitial edema, a spermatid giant cell development, and noticeable

necrosis and the total lack of spermatogoneal cells lining seminiferous tubules (Photo 2). Rats in group 3 (saw palmetto powder, 3%), on the other hand, showed mild interstitial edema, small-diameter seminiferous tubules, and spermatogoneal cell degeneration in their testes (Photo 3). In contrast, certain sections from Group 4 (5% saw palmetto powder) showed a minor degradation of the spermatogoal cells lining some seminiferous tubules, while other sections showed no such degeneration (Photo 4). Furthermore, no histopathological abnormalities were seen in the testes of the rats in groups 5 and 6 (saw palmetto extract 3% and 5%); the seminiferous tubules seemed histologically normal (Photos 5 and 6).

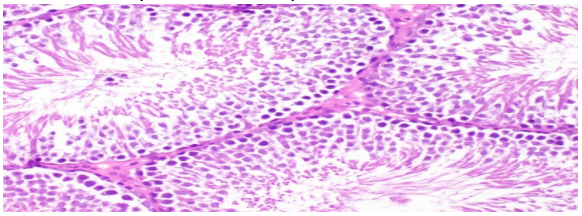

photo (1): Rat testis from group 1 control (-) demonstrating the typical seminiferous tubule histological structure with typical spermatogonial cells and full spermatogenesis (H & E X 400).

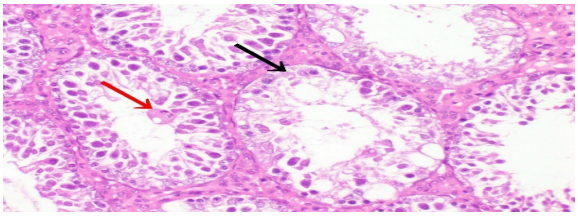

photo (2): Testis of rat from group 2 control (+) demonstrating small diameter seminiferous tubules (black arrow) connected to the development of the spermatid giant cell (red arrow) and prominent necrosis of spermatogoneal cells lining seminiferous tubules (H & E X 400).

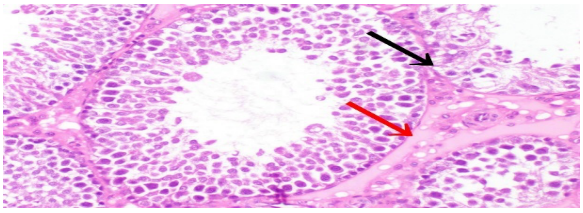

photo (3): Rat testis from group 3 (saw palmetto powder, 3%), displaying small diameter seminiferous tubules (black arrow) and mild interstitial edema (red arrow), along with a minor degeneration of spermatogoneal cells lining the tubules (H & E X 400).

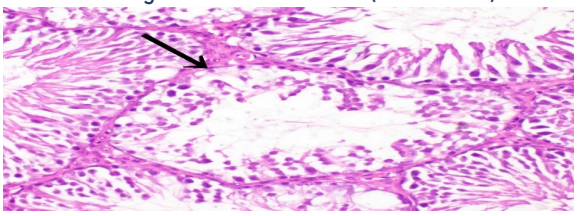

photo (4): A modest degeneration of spermatogoneal cells lining some seminiferous tubules (black arrow) is visible in the testis of a rat from group 4 (saw palmetto powder, 5%) (H & E X 400).

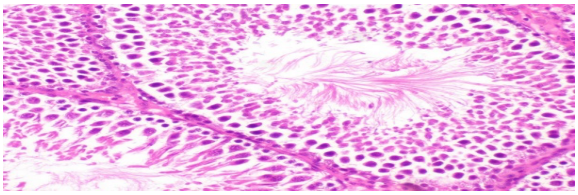

photo (5): Rat testis from group 5 (saw palmetto extract 3%), with seminiferous tubules appearing histologically normal, showed no histopathological abnormalities. (H & E X 400).

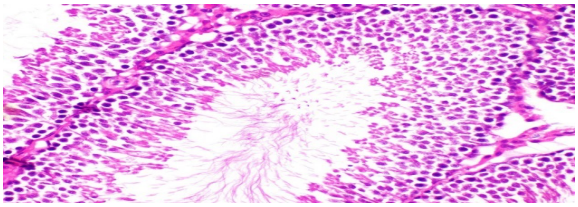

Photo (6): Seminiferous tubules appeared histologically normal in the testis of the rat from group 6 (saw palmetto extract 5%), which showed no histopathological abnormalities. (H & E X 400).

Conclusion

From the obtained results, saw palmetto water extract of 5% recorded the best result. The 3% saw palmetto powder, and the 5% saw palmetto powder group recorded the lowest value. Saw palmetto improved LH, FSH, Testosterone hormones, IgG, IgM, IgA, liver enzymes, and kidney functions of infertile rats. The highest LH hormone, Testosterone levels, IgM, and IgA values were recorded for the 5% saw palmetto water extract group. So, 5% saw palmetto water extract supplementation can improve fertility and immunity in infertile rats.

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الترقيم الدولي اون لاين 2735-590X الترقيم الدولي للطباعة 2735-5934

التغذية وعلوم الاطعمة

دراسات بيوكيميائية وتغذوية على البلميط المنشاري في ذكور الفئران البيضاء المصابة بضعف الخصوبة والمناعة المستحث بكلوريد الكادميوم

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الاستشهاد الي:

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الملخص العربى:

تهدف هذه الدراسة إلى معرفة تأثير البلميط المنشاري على مؤشرات الخصوبة والمناعة فى ذكور الفئران البيضاء المصابة بخلل في مؤشرات الخصوبة والمناعة. تم استخدام (36) من ذكور الفئران البيضاء قسمت إلى ست مجموعات، كل منها ستة فئران. قسمت المجموعات المستخدمة فى هذه الدراسة لمجموعتين رئيسيتين. المجموعة الأولى سلبية (6 فئران) تم تغذيتها بالنظام الغذائي الأساسى طوال فترة التجربة. المجموعة الثانية (30 فأر) تم حقنها داخل الغشاء البريتوني بكلوريد الكادميوم بمعدل 0.1 مل/100 جرام من وزن الجسم لإصابة الفئران بالعقم، و تم تقسيمها إلى 5 مجموعات فرعية على النحو التالى: احتفظت إحداهما كمجموعة مراقبة إيجابية، بينما تم تلقى الآخرين مسحوق البلميط المنشاري3٪ - 5٪ ومستخلص الماء منه بنسبة 3٪ - 5٪ من النظام الغذائي الأساسى. وكانت مدة التجربة 28 يوما. فى نهاية التجربة تم جمع عينات الدم وتم اجراء تحاليل الدم لهرمون المنشط للحويصلة المنوية (FSH)، وهرمون الملوتن (LH) وهرمون التستوستيرون، واجراء تحاليل المناعة (IgG- IgA- IgM) ونشاط إنزيمات الكبد فى الدم ALT- ALP (-AST) ووظائف الكلى (مستويات الكرياتينين وحمض اليوريك واليوريا). أما بالنسبة لهرمون التستوستيرون وهرمون LH فقد كانت هناك زيادة معنوية مقارنة بالمجموعة الضابطة الموجبة. انخفض هرمون FSH معنويا مقارنة بالمجموعة الضابطة الموجبة. أما فى الاختبارات المناعية فقد حدثت زيادات معنوية مقارنة بالمجموعة الضابطة الموجبة. كما لوحظ انخفاض معنوي فى مستويات إنزيمات الكبد ووظائف الكلى. وحدوث خلل فى البناء الهستوباثولوجى للخصية فى الفئران المصابة بالعقم. مما يعكس التأثير العلاجى الغذائى القوي للتغذية على مسحوق البلميط المنشاري ومستخلصه المائى فى رفع مستوي الخصوبة والمناعة عند الفئران. النتيجة الأكثر فاعلية كانت عند استخدام مستخلص مائي بنسبة 5% من البلميط المنشاري.

الكلمات الكاشفة: العقم، ضعف الخصوبة، الهرمونات، الجلوبيولين المناعي، العلاج بالنباتات