**Journal of Food and Dairy Sciences**

**Journal homepage: www.jfds.mans.edu.eg**
**Available online at: www. jfds.journals.ekb.eg**

# Effect of (*Alpinia officinarum*) Hance on Sex Hormones and Certain Biochemical Parameters of Adult Male Experimental Rats

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## ABSTRACT

Notwithstanding scientific advances, a significant number of the treatments in male infertility remained stayed vague. This study was aimed to study the impact of *Alpinia Officinarum* on sex hormones, serum antioxidant and biochemical markers in rats. Forty adult male rats, of (220 ± 10g) were partitioned into five groups (each consists of eight rats). The primary group was negative control group (-ve) and fed on basal diet only. The other four groups were subcutaneously injected with a single dose of lead acetate (200 mg/kg b.w) to reduce fertility, then were divided into 4 subgroups: including control positive group, and 2nd, 3rd and 4th subgroup were fed on basal diet with supplementation of dried *A. officinarum* at (5, 7.5 and 10%) respectively for two month. The results revealed that, supplementation with *A. officinarum* caused a significant positive effects on testes which due to a significant increase in the levels of serum total testosterones, Follicular stimulating Hormone (FSH), Luteinizing Hormone (LH) and Superoxide Dismutase (SOD) levels while Malondialdehyde (MDA) level was diminished. In addition, liver functions and serum lipid profiles were significantly improved compared to the positive control group. In conclusion: Our findings provide a scientific evidence to substantiate *A. officinarum* in improving fertility in human which may be due to its potent antioxidant properties and androgenic activities.

***Keywords:*** *A.officinarum*, Galangin, Lesser Galangal, Male infertility, Sex hormones, Blood biochemical.

## INTRODUCTION

Infertility is one of the significant medical issues on the planet (Ghalehkandi, 2014). It is a multi-parametric phenomenon which more than 30 % of infertilities are related to a male factor 45% related to female and 25% related to both genders (Vincent *et al*., 2012). It is a typical issue going from 10% to 15% in various nations (Akhtari *et al*., 2015). Increasing reactive oxygen species (ROS) in seminal fluid might be one of the primary driver of harms to spermatozoa in idiopathic infertility (Khosrowbeygi *et al*., 2012). A few elements influence spermatogenesis and sperm quality for example drug treatment, chemotherapy, toxins (Adeeyo *et al*., 2011), air pollutions and insufficient vitamins intake (Barkhordari *et al*., 2013).

Traditional medicinal herbs are being used extensively in various part of the world, may be an alternative source of medicine for infertility enhancement and has excited scientists' advantage nowadays given its little or no side effects (Rabeh, 2016).

*A.officinarum* Hance (lesser galangal) is an important member of family Zingiberaceae (Saboo *et al*., 2014). It is an enduring herb with thick, crawling rosy dark colored rhizomes, lineolate taper decorative leaves, and pompous white blooms in racemes (Daniel, 2006). The rhizome of *galangal* looks like ginger in taste and appearance. It is a source of antioxidant and vitamins (A, B, and C) (Indrayan *et al*., 2009). A few examinations have detailed that dietary antioxidants, flavonoids and vitamins in diet can enhance sperm quality and thusly increment fertility rate in men (Haghighian *et al*., 2015).

*A. officinarum* has been utilized for sexual dysfunction medicine (Rezaeizadeh *et al*., 2009). It is normally utilized as a food additive (Liu *et al*., 2015) and has been as often as possible utilized for culinary purposes, it has been utilized in flavors, spices, curries, drinks and even tea (Lim, 2016). Also, the rhizomes have been utilized for stomachic, diseases of the liver and kidney, useful in headaches, rheumatic pains, cancer, diabetes, aphrodisiac and tonic, because of its health-promoting properties (Chouni and Paul, 2018).

Although, there are little investigations that have tended to assess its impacts on spermatozoa characteristics for this reason,the point of this examination was to explore the impact of *A.officinarum* on promoting sperm parameters and investigate the ability of *A. officinarum* in improving sex hormones of adult male rats.

## MATERIALS AND METHODS

### Materials

**Plant material:** Hance rhizomes (*A. officinarum*) were obtained from a Local market, Port Said, Egypt. Herbs were identified and authenticated by a plant taxonomist, Faculty of Science, Port Said University, Egypt.

**Rats:** Forty healthy adult male albino of Sprague Dawley strain rats (220±10g) were obtained from Helwan Farm, Ministry of Health and Population, Cairo, Egypt.

**Chemicals:** Kits for biochemical examination were bought from Biodiagnostic Company for Pharmaceutical and chemicals, Dokki, Egypt. Casein, vitamins, cellulose, minerals and methionine were obtained from Morgan Company for Chemicals, Cairo, Egypt.

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**DOI: 10.21608/jfds.2019.55653**

**Methods**

**Preparation of Herb:** Fresh galangal rhizomes (*A. officinarum*) were washed under faucet water to expel the dirt and soil. The rhizomes were then sliced and dried at 40 ºC in oven and subjected to grinding for 10 min to make a fine powder (Dahui *et al*., 2014).

**Chemical analysis:**

*A. officinarum* was analysed by standard methods for moisture, protein fat, ash and crude fibre according to AOAC, (2010). Potassium, Calcium and iron contents were also determined by using the atomic absorption spectrophotometer according to Subramanian *et al*., (2012). The total phenolic and total flavonoids contents of rhizome of *A. officinarum* were evaluated using a method described by Ao *et al*., (2009) and Hajiaghaalipour *et al*., (2016) respectively. Total Phenolic was expressed as mg of gallic acid equivalent (GAE) per 100g of sample, while, total flavonoids content was expressed in mg/g of Quercetin equivalent, per 100 g of sample.

**Determination of (DPPH) scavenging activity:** 1,1-Diphenyl-2-picryl-hydrazyl radical scavenging activity was determined according to Hwang and Do Thi, (2014).

**Determination of Total Antioxidant Activity (TAA):** TAA of *A. officinarum* was determined using 0.3mL of sample with 3mL of a reagent solution consisting of 0.6 $MH_2SO_4$, 28mM sodium phosphate and 4mM ammonium molybdate according to Nampoothiri *et al*., (2015).

**Biological Study:**

The basal diet was formulated according to Reeves *et al*., (1993). After acclimatization period, forty adult male rats were randomly divided into 5 experimental groups (8 rats/group) and the treatment was as follows:

The primary group was negative control group (-ve) and fed on basal diet only. The other four groups were subcutaneously injected with a single dose of lead acetate (200 mg/kg b.w) to reduce fertility (Acharya *et al.*, 2003). One group of them was selected as a positive control group (+ve). The other three groups were fed on basal diet which supplementation of dried *A. officinarum* at (5, 7.5 and 10%) respectively.

At the finish of the experiment (8weeks) the rats were fasted for 12 hour, and after that sacrificed under ether anesthesia. Blood samples were gathered from medial canthus of the eyes of rats by means of fine capillary glass tubes in a centrifuge tube without any anticoagulant and centrifuged for 20 minutes at 3000r.p.m. to obtain serum.

**Spermatozoa characteristics:**

At the end of the study, semen samples were accumulated from the Cauda epididymis cautiously separated from the testes and then sperm was placed in the incubator for 15 min according to (Padmanabhan *et al*., 2008). Approximately, 10µL of the diluted sperm suspension was once transferred and allowed to stand for 5 min (Wyrobek *et al*., 1983). The cells which settled during this time had been counted through a light microscope at 200X magnifcation (Seed *et al*., 1996).

**Biological Assay:**

Serum total testosterone level was determined by Wilke and Utley, (1987). Plasma FSH and LH concentration were determined using a modified heterologous radioimmunoassay Bolt and Rollins, (1983) and Bernard *et al*., (1983) respectively. Oxidative stress markers: Malondialdehyde (MDA) and Superoxide Dismutase (SOD) were determined according to (Draper and Hadly, 1990 and Spitz and Oberley 1989) respectively. Serum aspartate aminotransferase (AST) and alanine aminotransferase (ALT) were measured according to Bergmeyer *et al*., (1978), alkaline phosphatase (ALP) was determined according to Belfield and Goldberg, (1971). Total cholesterol (TC) by the method of Fossati and Principe, (1982), HDL-cholesterol by Albers *et al*., (1983), triglyceride (TG) by Wahlefeld (1974).Calculation of LDL-c and VLDL-c by the equation of Fruchart (1982).

**Statistical Analysis:**

All statistical analysis was conducted with SPSS program at significant levels of P<0.05 (Sunilson *et al*., 2008).

## RESULTS AND DISCUSSION

### Results

Total of bioactive compounds (phenols, total flavonoids) and antioxidant activity content of *A.officinarum* were recorded in Table (1). It contains bioactive compounds and antioxidant activity being (49.42 mg GAE100g, 56.36 mg CE100g and 37.32 %), respectively.

**Table 1. Antioxidant activity of *Alpinia officinarum*.**

| Sample Parameters | *Alpinia officinarum* |
|---|---|
| Total phenols (mg GAE / 100g) | 49.42 |
| Total flavonoids (mg CE/ 100g) | 56.36 |
| Antioxidant activity (DPPH, %) | 37.32 |

**GAE, Gallic acid equivalent; CE, Catchin equivalent.**

Antioxidant activities of the ethyl acetate (EA) and water (WA) fractions were evaluated by free radical scavenging assays DPPH and by total antioxidant activity in Table (2). Results showed that the free radical scavenging activities of the EA fractions were found to be better than dried of *A. officinarum*. The DPPH radical scavenging abilities of EA fractions of *A. officinarum* were slightly less than that of gallic acid TAA of two EA fractions also showed better activity than the corresponding WA fractions. The higher antioxidant activity of EA fractions were due to its high amount TPC and TFC.

**Table 2. Evaluation of antioxidant activity of ethyl acetate and water fractions by different methods.**

| Plants | DPPH. (µg/mL) IC50 values | TAA (mg of ascorbic acid/g) |
|---|---|---|
| *A.officinarum EA* | 4.8 | 650.7 |
| *A. officinarum WA* | 14.8 | 150 |
| Gallic acid | 1.4 | 660.4 |
| Ascorbic acid | 7.3 | 155 |

**(EA) ethyl acetate, (WA) water acetate**

Results recorded in Table (3) shows the gross chemical composition of *A. officinarum* (100g) that includes of fat, protein, ash, fiber, moisture and carbohydrates were (2.26, 5.25, 3.22, 17.0,12.4 and 76.9%), respectively. The mineral contentin in (*A. officinarum*) contained substantially high amounts of potassium (K), calcium (Ca) and iron (Fe) (697.21, 129.85 and 0.30 mg/100 g), respectively.

**Table 3. Gross chemical composition and some essential minerals of *Alpinia officinarum*.**

| Fat | Protein | Ash | Fiber | Moisture | Carb. | K | Ca | Fe |
|---|---|---|---|---|---|---|---|---|
| (g/100g dry matter sample) % | | | | | | | | |
| 2.26 | 5.25 | 3.22 | 17.0 | 12.4 | 76.9 | 697.21 mg | 129.85 mg | 0.30 mg |

The impact of *A. officinarum* at different levels on spermatozoa characteristics in adult male rats are illustrated in Table (4). Lead acetate injection to rats significantly (P<0.05) increased in the mean value of serum total abnormal and significant decreased in normal and live level, compared to the healthy group. Moreover, there are a

significant changes at (P<0.05) in the levels of normal, total abnormal and live, between low and high levels of *A. officinarum.* It was obvious that spermatozoa characteristics didn't change for the groups treated with 10% of *A. officinarum* as compared to the healthy group

**Table 4. Effect of *Alpinia officinarum* on spermatozoa characteristics in adult male rats.**

| Parameters Groups | Normal | Total abnormal | Live |
|---|---|---|---|
| | % | | |
| Control (-ve) | 83.16±1.62[a] | 16.83±1.10[d] | 61.66±2.23[a] |
| Control (+ve) | 58.66±2.37[d] | 41.33±2.37[a] | 33.50±2.23[c] |
| A. officinarum (5%) | 67.50±4.52[c] | 32.50±4.52[b] | 43.66±2.17[b] |
| A. officinarum (7.5%) | 71.16±1.86[bc] | 28.83±2.27[bc] | 49.00±2.09[b] |
| A. officinarum (10%) | 75.66±1.35[ab] | 24.33±1.42[cd] | 56.00±2.08[a] |

**Values were expressed as Means ± SE.**
**Values at the same column with different letters are significant at P<0.05.**

Lead acetate injection to rats significantly (P<0.05) decreased in the mean value of serum total testosterone, FSH and LH in rats compared to the healthy group as recorded in table (5). It was observed that, the supplementation with *A. officinarum* at (5, 7.5 and 10%) caused a significant (P<0.05) increase in the concentration of serum total testosterone, FSH and LH in rats, compared to positive control group. There were significant changes in serum level of FSH and LH between all levels of *A. officinarum.*

**Table 5. Effect of *Alpinia officinarum* on sex hormones in adult male rats.**

| Parameters Groups | Total testosterone (ng/ml) | FSH (Iu/l) | LH (Iu/l) |
|---|---|---|---|
| Control (-ve) | 1.78±0.04[c] | 12.82±0.83[d] | 1.42±0.11[d] |
| Control (+ve) | 0.78±0.08[d] | 7.94±0.61[e] | 0.86±0.10[e] |
| *A. officinarum* (5%) | 2.40±0.21[bc] | 16.38±0.89[c] | 1.95±0.07[c] |
| *A. officinarum*(7.5%) | 3.00±0.13[b] | 19.89±0.68[b] | 2.26±0.10[b] |
| *A. officinarum* (10%) | 5.23±0.57[a] | 23.72±0.49[a] | 2.69±0.12[a] |

**Values were expressed as Means ± SE.**
**Values at the same column with different letters are significant at P<0.05.**

Table (6) revealed the impact of *A. officinarum* on serum MDA and SOD in adult male rats. Results illustrated that positive control group had a significant increase in the level of serum MDA and significant decrease in SOD (p<0.05) compared to the healthy group. The supplementation with *A. officinarum* decrease significantly serum MDA and increased (P<0.05) the mean level of serum SOD in compared to the positive control group. There were a significant differences in serum level of MDA and SOD between all levels of *A. officinarum*. The best results for the concentrations of SOD and MDA were recorded at the group which fed on diet supplemented with10% of *A. officinarum*.

Data in Table (7) showed the impact of *A. officinarum* at different levels on liver functions in rats. Lead acetate injection to rats significantly (p<0.05) increase in the mean value of serum AST, ALT, and ALP compared to the healthy control group. However, the supplements based on a levels of *A. officinarum* significantly decreased (P<0.05) the mean standard of serum liver enzymes compared to the control positive group. No significant changes (P≤0.05) in the amount of serum AST between treated groups, however there is a significant changes in serum ALT and ALP between low and high amount of *A. officinarum*. It was obvious that the mean level of serum AST, ALT and ALP didn't change for the groups which treated with 10% of *A. officinarum* as compared to normal control group. So that *A. officinarum* have no side effects on liver functions.

**Table 6. Effects of *Alpinia officinarum* on malondialdehyde (MDA) and Superoxide Dismutase (SOD) in adult male rats.**

| Parameters Groups | MDA (nmol/ml) | SOD (µ /dl) |
|---|---|---|
| Control (-ve) | 8.87±0.84[d] | 76.87±1.33[a] |
| Control (+ve) | 30.22±1.89[a] | 18.91±2.40[e] |
| *A. officinarum* (5%) | 22.72±1.15[b] | 31.41±0.89[d] |
| *A. officinarum* (7.5%) | 14.88±1.36[c] | 47.57±1.68[c] |
| *A. officinarum* (10%) | 10.01±0.77[d] | 60.75±2.28[b] |

**Values were expressed as Means ± SE.**
**Values at the same column with different letters are significant at P<0.05.**

**Table 7. Effect of *Alpinia officinarum* on liver functions in adult male rats**

| Parameters Groups | AST (µ/L) | ALT (µ/L) | ALP (µ/L) |
|---|---|---|---|
| Control (-ve) | 96.83±2.98[c] | 37.16±1.42[c] | 245.13±7.36[b] |
| Control (+ve) | 119.51±1.83[a] | 57.36±2.53[a] | 310.00±6.43[a] |
| *A. officinarum* (5%) | 108.60±3.41[b] | 44.23±1.22[b] | 302.06±4.61[a] |
| *A. officinarum* (7.5%) | 100.00±4.32[bc] | 40.83±1.55[bc] | 297.33±4.41[a] |
| *A. officinarum* (10%) | 102.71±4.71[bc] | 38.13±1.96[c] | 253.24±12.43[b] |

**Values were expressed as Means ± SE.**
**Values at the same column with different letters are significant at P<0.05.**

Lead acetate injection to rats significantly (P<0.05) increased the level of TC, TG, LDL-c and VLDL-c, while the level of HDL-c was significantly (P<0.05) decreased, compared to the healthy control group as recorded in table (8). The supplementation with different levels of *A. officinarum* (5, 7.5 and 10%) had significant decrease (P<0.05) the levels of TC, TG, LDL-c, and VLDL-c and significant increment (p<0.05) in HDL-c level, compared to the positive group. No significant changes in the levels of TC, TG, HDL-c, LDL-c and VLDL-c between medium and the high levels of *A. officinarum*. Moreover, No significant changes in the levels of HDL were observed among the treated groups.The greatest decrease of lipid profile are recorded for group which fed on supplemented diet at the concentration of 10% of *A. officinarum*.

**Table 8. Effect of *Alpinia officinarum* on lipid profile in adult male rats.**

| Parameters Groups | TC (mg/dl) | TG (mg/dl) | HDL-c (mg/dl) | LDL-c (mg/dl) | VLDL-c (mg/dl) |
|---|---|---|---|---|---|
| Control (-ve) | 81.35±2.53[a] | 67.31±3.14[a] | 55.38±1.87[a] | 14.50±2.02[b] | 13.46±0.62[a] |
| Control (+ve) | 84.00±2.30[a] | 63.26±2.37[ab] | 37.08±0.98[c] | 34.26±1.66[a] | 12.65±0.47[ab] |
| *A. officinarum* (5%) | 68.15±3.16[b] | 59.75±1.87[b] | 43.06±1.95[b] | 13.13±1.89[b] | 11.95±0.37[b] |
| *A.officinarum*(7.5%) | 65.86±1.39[bc] | 47.96±1.21[c] | 45.71±1.29[b] | 10.55±1.44[bc] | 9.59±0.24[c] |
| *A.officinarum* (10%) | 59.96±2.49[c] | 45.26±1.18[c] | 44.63±1.69[b] | 6.28±0.74[c] | 9.05±0.23[c] |

**Values were expressed as Means ± SE.**
**Values at the same column with different letters are significant at P<0.05.**

## Discussion

Infertility is one of the serious issues which the both male and female related variables are not yet unmistakably comprehended (Nassiri *et al*., 2009). These days it has been perceived that few infections are caused because of oxidative stress (Poljsak *et al*., 2013). Regardless of numerous accomplishments in modern medicine, side effects of synthetic chemical drugs are as yet the primary issue. Thus, there are growing interests to use of herbal medicine due to it possessing lower side effects.Therefore, this study was intended to investigate the ability of *A. officinarum* to improve sex hormones of adult male rats.

The current results revealed that *A. officinarum* contains bioactive compounds and antioxidant activity.These results are agreed with Abdullah *et al*., 2015; Basri *et al*., (2017) and Rachkeeree *et al*., (2018) who found that *A. officinarum* is rich in bioactive compounds such as flavonoids, phenolic acids, alkaloids and contains various flavones such as galangin, alpinin and kaempferol.

Lim, (2016) and Sharma *et al*., (2018) showed that *A.officinarum* is a famous medical plant by anti-oxidant, anti-serotonergic, anti-cancer and antidiabetic activities. Comparative results were obtained by Zhang *et al*., (2015) indicated that polyphenols are well-known natural antioxidants with several biological properties. These findings recommend that these plants could be a promising wellspring of bioactive mixes having therapeutic potentials.

Galangin, a flavonol of flavonoids, seems, by all accounts, to be the overwhelming constituent in all pieces of *A. officinarum* appearing antioxidants properties with several biological properties (Zhai *et al*., 2014; Zhang *et al*., 2014; Tan *et al*., 2015 and Honmore *et al*., 2016).

Table (3) showed the gross chemical composition of *A. officinarum* which contained fat, protein, ash, fiber, moisture and carbohydrates. Regarding the mineral content, Results also showed that *A. officinarum* have a high level of K, Ca and Fe. These results agreement with Wong *et al*., (2009); Indrayan *et al*. (2009) and Jaju *et al*., (2010) who found that, the rhizome was determined as moisture 12.5 %, protein 4.44 %, carbohydrate 78.9 %, fat 1.14 %, fibre 18.6 %, ash 3.04 % and ascorbic acid. Kasarkar and Kulkarni, (2012) mentioned that, rhizomes is a good source rich in vitamin (A, B), minerals (K, Ca), essential oils and antioxidant.The rhizome of galangal is widely utilized as a spice for food flavoring due to its characteristic fragrance and pungency. Galangal rhizome is also being used in traditional medicine (Shetty and Monisha, 2015 and Chouni and Paul, 2018).

Testosterone is known to be fundamentally engaged with the improvement of sperm cells Arikawe *et al*., (2012). Our outcomes were in a similar line with the finding by Islam *et al*., (2000); Esposito *et al*., (2004) and Al-Qarawi, (2005) mentioned that the extract of *A. officinarum* had a direct effect on the testes resulting in an increase in the number of spermatozoa, motility and level of testosterone production.

The results of preliminary phytochemical studies showed that the presence of polyphenolics are the most reported phytoconstituents showing a wide range of pharmacological effects including antioxidant activity and can improve the fertility potential of male (Srividya *et al*., 2010 and Nampoothiri *et al*., (2015).

Ravichandran, (2013) found that oral administration of *A. officinarum* has been reported to increase the sperm motility and sperm counts in male mice without any spermatotoxic effect. Mazaheri *et al*., (2014) mentioned that the application of *A. officinarum* has also significantly increased the sperm rate, viability and motility in male rats. Also, Shahdadi *et al*., (2014) and Fedder *et al*., (2014) indicate that *A. galanga* may enhance male fertility by elevating sperm quality, increase sperm percentage, viability, motility and testosterone hormone, and this extract did non causes an expansion in testicles weight of rats.

Low sperm count and motility and high rate abnormal spermatozoa level each have been associated with reduced fertility Raji *et al*., (2003). Also, Wang *et al*., (2003) showed that a positive relationship between oxidative stress-induced sperm damage and increased caspase-induced apoptosis in men with infertility. Several studies (Rimessi *et al*., 2016; Urquiza-Martinez and Navarro, 2016 and Ojo *et al*., 2017) have demonstrated that oxidative stress in the seminal fluid, causes decreased sperm quality.

Flavonoids compounds separated from *A. Officinarum* played a role in the protection against oxidative stress by promoting the expression of antioxidative proteins (Kacey *et al*., 2016). Also, Kolangi *et al*., (2019) noticed that *A. officinarum* can be effective in the improvement of sperm quality, sperm percentage and sperm count without causing adverse effects. It might be attributed to its antioxidant and scavenging activity against the ROS via its phytochemical mainly including galangin (Mahfouz *et al*., 2009; Kaushik *et al*., 2011 and Li *et al*., 2012).

Malondialdehyde is a by product of lipid peroxidation. Increased lipid peroxidation is considered as responsible factor for these changes in men infertile (Hesham *et al*., 2008). Also, our results were in a similar line with the finding by Kaushik *et al*., (2013) who found that, the extract (200 mg/kg) of *A. galanga* rhizomes decreased MDA and glutathione signifycantly and increased SOD and catalase in the rats.

Similar results were obtained by Jedlinska *et al*., (2006) and Tremellen, (2008) announced that the antioxidant effect as the major reason for sperm quality improvement. These results are agreed with (Lombardo *et al*., 2011; Zini and Al-Hathal, 2011 and Gharagozloo and Aitken, 2011). As of late, an oral supplement of various antioxidants was appeared to decrease the number of immotile sperm (Wirleitner *et al*., 2012).

The obtained results revealed that, supplementation with different levels of *A. officinarum* improved of liver functions. These results agreed with Hemabarathy *et al*., (2009) observed that the hepatoprotective impact of the extract of *A. galanga* at 200 and 400 mg kg-1 treated paracetamol induced hepatotoxicity in rats. Alajmi *et al*., (2018) and Karunarathne *et al*., (2018) revealed that the oral administration of galangal extract did not produce any significant changes in ALT, AST levels indicating that there is no adverse impact of galangal on hepatocyte functions of rats.

Sivakumar *et al*., (2010) and Sivakumar and Anuradha, (2011) showed that galangin can reduce kidney and liver injury. Also, Xia *et al*., (2010); Shiv Kumar and Alagawadi, (2011); Iyer *et al*., (2013) and Kumar and Alagawadi, (2013) showed that galangin exerted improved the liver functions and lipid profile in serum.

Our results were in the same line with the finding by Shin *et al*., (2004); Jantan *et al*., (2005); Sivajyothi *et al*., (2008) and Srividya *et al*., (2010) observed that the rhizomes

of *A. officinarum*, significantly reduces serum (TG) (TC) and increased the serum levels of (HDL) in hyperlipidemic mice. The results suggested the capability of *A. officinarum* in various lipid disorders particularly atherosclerosis.

Also, our results were in agreement with Prathapan *et al*., (2012) and Kaushik *et al*., (2013) demonstrated that the rhizomes of *A. galanga* lowered TC, TG and LDL, but increased HDL. Verma *et al*., (2015) mentioned that methanolic extract of aerial parts of *A. galanga* was effective in improveing lipid profile in diabetic rats. Nampoothiri *et al*., (2017) showed that EA fractions of *A. officinarum* significantly inhibited the LDL oxidation, which indicated that they can prevent the oxidation and also are able to reduce the infectious effects caused by the oxidation of LDL cholesterol.

## CONCLUSION

*A. officinarum* demonstrated as a beneficial impact on semen parameters in terms of sperm morphology and improving infertility, due to its antioxidant components. This plant may be promising in enhancing sperm healthy parameters without causing adverse effects. Due to these beneficial biological activities, these plants could be used in the development of functional foods and nutraceuticals after detailed in vivo and clinical trials.

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## تأثير عشبة الخولنجان على الهرمونات الجنسية وبعض الصفات البيوكيميائية فى ذكور فئران التجارب البالغين

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على الرغم من التقدم العلمي ، ظلت العديد من العلاجات في علاج العقم عند الذكور مبهمة. لذلك أجريت هذه الدراسة لفحص تأثير عشبة الخولنجان على الهرمونات الجنسية وكذلك مستويات مضادات الأكسدة ومستويات الدم البيوكيميائية في فئران التجارب. تم تغذية عدد 40 من ذكور الفئران البيضاء الذين تتراوح أوزانهم من (220 ±10جم) على النظام الغذائى الأساسي لمدة اسبوع ، ثم تم تقسيم الباقى إلى خمس مجموعات وكل مجموعة تضم 8 فئران وكانت كالتالى : المجموعة الضابطة السالبة (-ve) تغذت على النظام الغذائي الأساسي فقط ، والمجموعات الأربعة الأخرى تم حقنهم ب 200 ملجم / وزن الجسم من خلات الرصاص لتقليل الخصوبة . تم اختيار مجموعة واحدة منهم كمجموعة ضابطة موجبة ، بينما كانت المجموعات الثلاثة الأخرى المتبقية تتغذى على النظام الغذائي الأساسي المستكمل مع عشبة الخولنجان المجففة بنسب (5 ، 7.5 ، 10 %) لمدة 8 أسابيع على التوالى . أشارت النتائج إلى أن الوجبات الغذائية المدعمة بالخولنجان أدت الي حدوث تأثيرات وقائية بسبب حدوث ارتفاع معنوي ($P<0.05$) فى مستويات هرمون التستوستيرون الكلي في الدم وهرمون (FSH) وهرمون (LH) ومستوى (SOD) مع انخفاض مستوى MDA بشكل معنوى. وبالإضافة الى ذلك تم تحسين وظائف الكبد ومستوى الدهون فى الدم بشكل ملحوظ بالمقارنة بالمجموعة الضابطة الموجبة. في النهاية: توضح النتائج التي توصلنا إليها أدلة علمية لإثبات دورعشبة الخولنجان في الخصوبة عند ذكور الفئران لخصائصها القوية المضادة للأكسدة والمنشطة للذكورة.