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Original Research Article

The Chemistry Effects of Garlic on Hormones In Male Rabbits

Osama. H. Aldeeb[1]; Eman, G. A. Allafi[1]; Nosiba. E. Bohtera[2] and Fayrouz. A. Khaled[2*]
[1]*Biomedical Science Department, Faculty of pharmacy, Omar Al-Mokhtar University, El -Beida-Libya*
[2*]*Chemistry Department, Faculty of Science, Omar El-Mokhtar University, El -Beyda-Libya*

*Corresponding Author
FAYROUZ. A. KHALED

Abstract: Garlic contains more than 200 chemicals. It contains sulfur compounds (allicin, alliin and agoene), volatile oils, enzymes (allinase, peroxidase and miracynase), carbohydrates (sucrose and glucose), and minerals (selenium). It also contains amino acids (cysteine, glutamine, isoleucine and methionine), which help to protect cells from the harms of free radicals, bioflavonoids (quercetin and cyanidin, allistatin I and allistatin II and vitamins C, E and A), which help to protect us from oxidation agents and free radicals. Results indicated that treatment withgarlic caused significant ($P<0.05$) increase in body weight (BW) and relative weight of, brine, testes,testosterone, T_3 and T_4. While, decrease the levels of FSH, LH, estradiol and progesterone in plasma compared to control animals.

Keywords: Garlic, TBARS, hormone andrabbits

INTRODUCTION

Medicinal plants have been a good source of new pharmacologically active molecules. For example, natural products could be a potential alternative for controlling the pathogen associated with diseases [1]. Recently, antibiotics and most drugs on the market have shown unwanted symptoms and the emergence of resistant pathogenic microorganisms, toxic effects related to these drugs, and withdrawal issues restricting their use in many countries [2]. Therefore, much attention has been paid to the herbal extracts and pharmacologically active molecules extracted from different plant species that are used previously in the traditional medicine [3]. Many plant species have been reported to exert pharmacological properties due to their phytoconstituents such as glycosides, alkaloids, saponins, steroids, flavonoids, tannins, and terpenoids (e.g., monoterpenes, diterpenes, and sesquiterpenes). Nowadays, eighty percent of the world's populations depend on traditional medicines as an essential source of their primary health care [4]. Medicinal plant extracts and their constituents also possess various biological activities including virucidal, bactericidal, fungicidal, anti-inflammatory, analgesic, sedative, spasmolytic, and local anesthetic activities among others [5]. Garlic (Allium sativum L.; Family: Amaryllidaceae) is an aromatic herbaceous annual spice and one of the oldest authenticated and most important herbs that have been used from ancient times as traditional medicine [6]. It is considered the second broadly used Allium species with onion (Allium cepa L.), which is used as a remedy against several common diseases such are cold, influenza, snake bites, and hypertension [7]. Allium species and their active components are reported to reduce the risk of diabetes and cardiovascular diseases, protect against infections by activating the immune system and have antimicrobial, antifungal, anti-aging as well as anti-cancer properties which confirmed by epidemiological data from human clinical studies [8]. Garlic has been used for cooking purposes as a spice that can flavor foods during the cooking process. As well, it possesses therapeutic purposes including the treatment of lung disorders, whooping cough, stomach disorders, cold, earache, and assists in preventing cardiovascular disease [6]. While aged garlic extract (AGE), prepared from aged garlic is a folk herbal remedy that has been shown to enhance the immune system and thus inhibit cancer and heart disorders. Raw garlic and its transformed products have been reported to contain various sulfur compounds that have been included in several types of preparations [9]. Moreover, quercetin, the major flavonoid isolated from garlic, was found to interact with some medications such as vitamin E and C modify the in vitro as well as the in vivo transferases and cytochrome P450 isozymes activity[10]. Garlic increases antioxidant defence mechanism in animals [11]. Supplementation of garlic oil at 0.5 g/kg of diet has a positive effect on testes weight, antioxidant status, and testosterone hormone in rabbits [12]. [13] reported that garlic improved the immunity responses and lowered the lipid profile in blood, lipid peroxidation in liver, and increased hepatic antioxidant activity in treated rabbits. The major bioactive components in garlic such as Allicin are mainly responsible for the positive effects of garlic [14]. Productive and reproductive performances as well as physiological parameters were improved significantly by addition of garlic powder to rabbit diet [15].[16] reported that significant increase observed in the activities of antioxidant enzymes and selenium level could possibly be associated with consumption of high garlic diet by the rabbits. Garlic as well increased testicular

testosterone after supplementation and associated with the inhibition of Leydig steroidogenic enzyme expression and Sertoli cell markers, which are capable of inducing apoptosis in testicular germ cells, characterised by increased levels of active Caspase 3 [17]. [18] had also reported that garlic enhances testicular function and could be used to enhance fertility. The reason for the contrary observations is not very clear, but it may be related to extract, dosage and species of the garlic used. LH and FSH are gonadotropic hormones of the anterior pituitary gland, while testosterone is produced and secreted by Leydig cell. The steroid hormone expression is dependent on LH, and the gonadotropic hormones are directly involved in the regulation of spermatogenesis [19].

MATERIALS AND METHODS

In this study garlic was used. Garlic oil was purchased from public market for medicinal herbs in Al-Bayda city. Mature male New Zealand White rabbits (age of 6 months and initial weight of (1.892 ± 50.79 Kg) were used. Animals were individually housed in cages and weighed weekly throughout 6- weeks experimental period. Feed and water were provided ad libtum. Rabbits fed pellets which consisted of 30 % berseem (Trifolium alexandrinum) hay, 25 % yellow corn, 26.2% wheat bran, 14 % soybean meal, 3 % molasses, 1 % $CaCl_2$, 0.4 % NaCl, 0.3 % mixture of minerals and vitamins, and 0.1 % methionine. The vitamin and mineral premix per kg contained the following IU/gm for vitamins or minerals: vit A-4000,000, vit D3-5000, 000, vit E-16,7 g, K-0.67 g, vit B1-0.67 g, vit B2-2 g, B6-0.67 g, B12-0.004 g, B5-16.7 g, Pantothinc acid-6.67 g, Biotein-0.07 g, Folic acid-1.67 g, Choline chloride-400 g, Zn-23.3 g, Mn-10 g, Fe-25 g, Cu-1.67 g, I-0.25 g, Se-0.033 g, and Mg-133.4 g (Rabbit premix produced by Holland Feed Inter. Co.). The chemical analysis of the pellets [20] showed that they contained 15.8 % crude protein, 11.3 % crude fiber, 3.7 % ether extract, 7.2 % ash, 92.9 % organic matter and 62.4 % nitrogen free extract % as DM basis. Ten mature male rabbits were randomly divided into two equal groups (each five rabbits) as follows: Group I: Rabbits were used as control daily for 6successive weeks. Group II: Rabbits were treated with garlic. Garlic was given daily by gavage at a dose of 40 mg/kg B.W, [21] for 6 successive weeks. Body weight of each animal was recorded weekly throughout the 6-week of the experimental period. The weight measurements were carried out in the morning before access to feed and water. At the end of treatment period, all animals of each group were slaughtered. Weights of testis were also recorded. These organs were individually identified and kept frozen (–20°C) until assays performed. Blood samples were collected from the ear vein of all animals every other week throughout the 6-weeks experimental period. Blood samples were obtained in the morning before accesses to feed and water and placed immediately on ice. The blood samples were collected in tube containing heparin to obtain plasma. Testosterone, Estradiol and Progesterone hormone concentration was assayed by using commercial kit that was supplied by Coat – A – Count testosterone RIA, from Diagnostic Systems Laboratories (DSL), from Texas, USA. Follicle Stimulating Hormone (FSH), Luteinizing hormone (LH) levels, Thyroxine (T_4) and Triiodothyronine (T_3) hormone concentrations were assayed by using commercial kit that was supplied by Coat - A - Count, from Los Angeles, USA. **Statistical Analysis.** Where applicable, statistical analysis was carried out in Minitab software (version17)/ Graph Pad prism8; statistical significance was assessed using ANOVA analysis with Tukey multiple comparison test after detection normal distribution to the data and appropriate $P < 0.05$ consider significant.

RESULTS

The changes in body weight (BW),brine weightand testes weight of male rabbits throughout the 6-week experimental period of rabbits treated with garlic were summarized in (Table 1). Overall means indicated that treatment with garlic alone significantly ($P<0.05$) increased BW, testes weight compared to control.

Table 1,Average of body weight (g), brine weight and testes weight (g/body weight) during treatment of male rabbits with garlic (means ± SE).

Animal Groups	*Body weight (g)*	*Brine weight (g)*	*Testes weight (g)*
Control (Mean±SE)	1892 ± 50.79^{a}	5.028 ± 0.486^{ab}	4.432 ± 0.486^{ab}
Garlic (Mean±SE)	1918 ± 39.84^{a}	6.590 ± 0.406^{a}	6.880 ± 0.730^{a}

Data are expressed as mean ± SE of 5 rabbit. Within each row, means with different superscript (a, b, c or d) were significantly different at $p<0.05$. Where means superscripts with the same letters mean that there is no significant difference ($p>0.05$).

The effects of garlicon plasma testosterone, estradiol, progesteronethyroxin (T_4),triiodothyronine (T_3), luteinizing hormones and follicale-stimulating during the 6-weeks experimental period are shown in (Table 2 and 3) represents the biweekly mean values of these parameter expressed as absolute values. Garlic caused significant ($P<0.05$) increase in the activity of testosterone, estradiol progesterone, T_3 and T_4 in plasma compared to control. While, decrease the levels of FSH and LH in plasma.

Table 2. Changes in testosterone, progesterone and estradiol of male rabbits treated with garlic.

Animal Groups	*Testosteron (ng/ml)*	*Estradiol (mg/dl)*	*Progesterone (g/dl)*
Control (Mean±SE)	1.570 ± 0.063^{b}	8.414 ± 0.062^{a}	7.683 ± 0.041^{b}
Garlic (Mean±SE)	2.857 ± 0.194^{a}	8.514 ± 0.067^{a}	8.170 ± 0.117^{a}

Values are expressed as means ± SE; n = 10 for each treatment group. Mean values within a row not sharing a common superscript letters (a, b, c, d) were significantly different, $p<0.05$.

Table 3. Changes in Thyroxine (T_4), Triiodothyronine (T_3), Luteinizing Hormone (LH) and Follicle Stimulating hormone (FSH) of male rabbits treated with garlic.

Animal Groups	*Thyroxine T_4 (ng/dl)*	*Triiodothyronine T_3 (ng/dl)*	*Luteinizing Hormone LH (mIU/ml)*	*Follicle Stimulating hormone FSH (mIU/ml)*
Control (Mean±SE)	3.162 ± 0.019^{ab}	1.666 ± 0.044^{b}	0.801 ± 0.018^{a}	0.805 ± 0.009^{a}
Garlic (Mean±SE)	3.471 ± 0.076^{a}	1.992 ± 0.058^{a}	0.708 ± 0.018^{b}	0.824 ± 0.011^{a}

Values are expressed as means ± SE; n = 5 for each treatment group. Mean values within a row not sharing a common superscript letters (a, b, c, d) were significantly different, $p<0.05$.

DISCUSSION

This enhancement in growth rate of rabbits fed garlic supplemented diets compared to the control is in agreement with the findings of [15]who reported increase in weight gain of rabbits. This improvement in growth rate of rabbits fed garlic supplemented diets compared to the control is in line with the findings of [22,23] who reported increase in weight gain of rabbits and broilers fed garlic supplemented diets respectively. Testosterone levels in rabbits treated with garlic (Table 2). Testosterone hormone was significantly higher in garlic-fed male rabbit [24].[25] attributed the garlic-induced increase in testosterone level to the elevation of sex hormone binding globulin, which binds more testosterone, and consequently, oblige the testis to excrete more male sex hormone in plasma.[26] suggested that garlic supplementation might enhance protein anabolism and suppress protein catabolism due to hormonal regulation by the stimulation of steroid hormones, leading to greater testis testosterone content and lower plasma corticosterone concentration.[27]suggested that garlic compounds are responsible for the significant increase in testosterone levels by affecting the performance of steroid generating enzymes, testosterone hormone and its metabolites. They concluded that garlic supplementation likely increases testicular testosterone content due to the stimulation of LH secretion from the pituitary gland, which stimulate the testes to increase its testosterone production.

CONCLUSION

It is well demonstrated that hormones play an important role in the male reproductive system. So, the aim ofthe current

study was to determine effect of garlic on sex hormones levels in rabbits.

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