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EFFECT OF ADDING DRIED GINGER RHIZOMES TO DIETS ON SEMEN QUALITY AND FERTILITY RATE IN AGED LOCAL COCKS UNDER EGYPTIAN HOT SUMMER CONDITION.

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ABSTRACT: The present study aimed to investigate the effect of different levels of ginger powder (GP) in Aged local cocks diets on semen quality and fertility rate under Egyptian summer hot condition. Eighty one 60-week-old Mandarah local cocks were utilized in a completely randomized design and were randomly assigned to 3 treatment groups (3 replicates of 9 cocks each) in an individual cages to receive 0.0, 2.5, or 5.0 g ginger root powder (GP) per kg diet for 12 successive weeks (60 to 72 weeks of age). The obtained results showed that dietary GP improved semen ejaculation volume, sperm motility, sperm cell concentration and live spermatozoa. Both levels of GP significantly ($P\leq0.01$) decrease the percentage of sperm total saturated fatty acid and significantly ($P\leq0.05$) increased the percentage of sperm total unsaturated fatty acid of seminal plasma as compared with the control group. Also, Omega 6: Omega 3 ratio was lower in the cocks fed 5.0 g GP/kg diet compared with those under 0 and 2.5 g GP/kg diet groups. Total antioxidant capacity (TAC) significantly ($P\leq0.05$) increased. However, Malondialdehyde (MDA) level and sperm abnormalities (%) were significantly ($P\leq0.05$) lowered in cocks treated with GP than untreated ones. Cocks fed 2.5 or 5.0 g GP resulted in a significant ($P\leq0.05$) increase in fertility rate and hatchability/total eggs rates being 5.55, 14.28% and 14.05, 22.90 % respectively. While, hatchability/ fertility eggs and total embryonic mortality (%) were not affected. Add GP resulted in a significant improvement in the values of follicle-stimulating hormone (FSH), Luteinizing hormone (LH), and testosterone concentrations. It could be concluded that, supplementation of the cocks diet with 2.5 or 5.0 g ginger root powder (GP) per kg diet can be recommended for improving semen quality of and fertility rate especially with the fertility weakness in aged local cocks.

Keywords: Aged cocks, Ginger, Semen quality, fertility rate.

INTRODUCTION

One of the major issues on breeding in farm animals is infertility, and approximately 30% of the problems relate to the males (Khaki et al., 2009). Reproduction is the most important requirements of poultry breeding, while sperm fertilizing ability is the basis of successful reproduction. The reproductive potentials of poultry male birds (cocks) are determined largely by the quality of the semen it produces (Glori and Isaendoi, 2015). A high ambient temperature impairs spermatogenesis and leads to low fertility through a decline of the sperm count, motility, and fertilization rate, as well as, an elevation of abnormal sperm in domestic animals (Mieusset et al., 1992). Overproduced radical oxygen species that is induced through heat stress has been shown to cause oxidative stress and lead to apoptosis in spermatogenic cells, particularly in spermatocytes (Paul et al., 2008). Moreover, large amounts of radical oxygen species have been shown to interfere with the integrity of sperm DNA and thereby influence embryo development (Paul et al., 2008). In poultry, an environmental temperature of 32 to 35°C has been shown to cause poor fertility through impairing sperm penetration, uterovaginal sperm storage, seminal plasma, and intracellular ion concentrations (Karaca et al., 2002). High content of polyunsaturated fatty acid (PUFA) in sperm plasma membranes predisposes the sperm to lipid peroxidation by reactive oxygen species, which is associated with male infertility (Surai et al., 2001). The antioxidant capacity of sperm is low, but enzymatic and nonenzymatic in seminal plasma antioxidants protect sperm by scavenging reactive oxygen species (Zhao et al., 2011).

Ginger (Zingiber officinale) rhizome is used worldwide as a spice (Khan et al., 2012) and has been traditionally used as a medical treatment for several ailments including gastrointestinal illness (Ali et al., 2008). The ginger rhizome contains several biologically active compounds such as gingerol, shogaols, gingerdiol, and gingerdione (Zhao et al., 2011), and its medicinal effects notable as it possesses antioxidants, antibacterial, anti-inflammatory, antiseptic, anti-parasitic and immunomodulatory properties (Ali et al., 2008). Ogbuewu et al. (2014) observed that ginger is a good source of micronutrients and it contains pharmacological active compounds that could be useful in animal production. Ginger was used in animal feed and poultry as antioxidants and as a stimulant for growth (Omage et al., 2007). In addition, it was found that ginger has the properties of sex hormones and androgenic hormones (Kamtchouing et al., 2002). Ginger powder (GP), which is high in antioxidative compounds, was fed to aged breeder roosters to improve their reproductive performance, GP improved sperm forward motility, live sperm percentage, and sperm plasma membrane integrity also resulted in a decrease in the percentage of abnormal spermatozoa (Akhlaghiet al., 2014). Zhao et al. (2011) found enhancements in laying performance, serum and egg antioxidant statuses in Hy-Line brown laying hens fed ginger powder (GP) for 10 weeks. In spite of the fact that, these specialists utilized supplementary GP at a level of 20 g/kg of diet. The same author, demonstrated that GP at levels of 10.0to 15.0 g/kg of diet increased egg mass and best-improved serum and yolk antioxidant status The ginger oil's has a role in the conservation and protection of the DNA from oxidation by hydrogen peroxide (H_2O_2) and the protection from the harmful effects of the reactive oxygen species (Yang et al., 2006). Therefore, the present study aimed to study the effect of Ginger powder to diets on semen quality and fertility rate in Aged Mandarah cocks under Egyptian hot summer condition.

MATERIALS AND METHODS

The present study was carried out at the Inshas Poultry Research Station, Animal Production Research Institute, Giza, Egypt, duration the period from June, until August, 2016.

Eighty-one 60-week-old Mandarah local cocks were utilized in a completely randomized design and were randomly assigned to 3 treatment groups (3 replicates of 9 cocks each) in individual cages to receive 0.0., 2.5, or 5.0 g of ginger root powder (GP) per kg diet for 12 successive weeks (60 to 72 weeks of age). Feed and water were permitted ad libitum. This experimental work was planned to study the influence of dried ginger rhizomes addition to the diet on semen quality and fertility rate in aged local cocks under Egyptian hot summer condition. Cocks were fed a commercial diet (16.07% CP and 2837 Kcal / kg diet) up to 74 weeks of age according to Feed Composition Tables for animal and poultry feedstuffs used in Egypt (2001) are shown in Table 1. Every cock received 135 g of diet/day at 60 weeks of age, up to152 g/d at the end of the experiment. Cocks were healthy, examined against diseases and immunizations. A total of 243 hens of the same strain that had no previous male bird contact were also used to provide data on sperm assay, fertility, and hatchability. To eliminate Age-related hen subfertility and to obtain the highest number of hatching eggs during a 7-day-long collection period, hens at 30 weeks of age were used and fed on a diet 2770 kcal of ME/kg, and 16.03, 3.29, and 0.39 % CP, calcium, and available phosphorus, respectively in individual cages. Ginger powder purchased from local markets and stored at 22 to 25°C in airtight plastic bags away from sunlight before dietary mixing. The ginger powder containing 3252 Kcal of gross energy, 8.12% and 5.45% of crude protein (CP) and Ether extract (EE), respectively. Chemical composition of ginger powder was summarized in Table (2) and its analysis by the Regional Center for Food & Feed (RCFF), Agric. Res. Center, Dokki, Giza, Egypt.

The average minimum and maximum ambient temperatures during summer season ranged between 26.37 and 34.98 ^{0}C, relative humidity from 34.28 to 76.52% and temperature-humidity index (THI) from 23.94 to 33.47 % under Inshas, Sharkia Province, Egypt (Table 3). THI was estimated according to the formula by Marai et al. (2000) as follows:

THI=db ^{o}C-{(0.31-0.31 RH) (db ^{o}C -14.4)}, where db ^{o}C = bulb temperature in Celsius and RH= RH%/100. The values obtained indicate the following: <22.2 = absence of heat stress; 22.2 to <23.3 = moderate heat stress: 23.3 to <25.6 = severe heat stress and 25.6 and more = extreme severe heat stress.

Cocks were habituated to abdominal massage response (2 week period from 58-60 weeks of age) for semen collection according to Zhang and Zheng (2002) and were subjected to their test diets for 12 more weeks. Seminal characteristics were evaluated every month between 60 and 72 weeks of age, except the profile of TAC in the seminal plasma, which was assessed towards at the end of the trial (72 weeks of age).

Immediately after semen collection (5 cocks per treatment), semen ejaculate volume was measured in graduate collecting tubes. Sperm motility: A drop of semen with the aid of a micro-pipette was placed on a pre warmed microscope slide, which was then covered with a glass cover slip and examined at a magnification of ×400. Several fields were examined and an estimate to the nearest 10% of the motile sperm was made. The motility determination was carried out by taking into consideration subjective measurements based on the judgment of individuals making the determination and finding the average motility. Motility of semen samples was expressed as the percentage of motile spermatozoa having moderate to rapid progressive movement and cells that

are motile under their own power (Ommati et al., 2013). At least 10 microscopic fields were examined for each semen sample. Sperm viability and abnormality were assessed utilizing eosin-nigrosin staining. For sperm concentration estimation, a droplet of diluted semen (1:200 in distilled water) semen was tenderly put on both councils of a Neubauer hemocytometer and the number of spermatozoa was determined microscopically (Ommati et al., 2013). Live and abnormal sperm concentrations were recognized as rates of the total (200) sperm.

Semen was collected (at 12 p.m.) in 5 mL transparent graduated, pooled semen tests from each of 27 replicate groups of cocks were utilized to inseminate 81 individual hens having a place with each of 27 comparing replicate groups (243 total hens). Immediately after semen collection, pooled semen was inseminated into laying hens. The insemination was performed twice a week during the last month of the experiment.

At the end of the experiment, semen samples (common sample) from 27 cocks/ treatment were centrifuged at 3000 rpm for 30 min to separate the spermatozoa and seminal plasma and stored at −20°C until analysis. The seminal plasma was used assay by TAC, MDA activities and fatty acids. Seminal TAC and MDA levels were measured according to the method described by Benzie (1996) and Rao et al. (1989), respectively. The fatty acids of sperm plasma were analyzed according to Christie (1982).

At the end of the experimental period, 150 eggs from every treatment were collected and incubated. After hatching, the chicks were checked and non-hatched eggs were broken to decide the rates of fertility and hatchability. Fertility was calculated as the rate of fertile eggs from the total number of set eggs, while the hatchability was calculated as the hatched chicks from the total fertile eggs. All information about hatchability rate was subjected to arcsine square, attached the change rate before the examination. The relative humidity and temperature in the incubator was 55% and 37.5 °C during the period from 1-17 day. On the 18^{th} day of incubation, the eggs were moved separately into hatching nests and then placed in the hatchery for the remainder of the incubation period at 65% relative humidity and 37.2ºC. Unhatched eggs were broken and examined microscopically to determine the age of the embryo at death and classified them into early (0 to 6 d), mid (7 to 17 d), or late (18 to 21 d plus pipped) mortality classes.

At the end of the experimental period, blood samples were withdrawn from Jugular vein of four cocks in each treatment in tubes. Blood was centrifuged for 20 minutes at 3000 rpm and serum samples were stored at -20°C until the day of the analysis. LH and FSH hormones were determined in serum using rat-specific ELISA Kits (Cusabio Biotech Co., Ltd, Wuhan, China). While, testosterone was determined in serum using the RIA testosterone Kit, direct. Beckman Coulter Company.

Data were analyzed by the least square analysis of variance using the General Linear Model Procedure (SAS, 2003). All percentages, data were transferred to percentage angle using arcsine equation before subject to statistical analysis. Significant differences among means were tested using Duncan Multiple New Range Test (Duncan, 1955), at 5% level of significance using the following model:

$Y_{ij} = \mu + N_i + e_{ij}$

Where Y_{ij} = any observation, μ = Overall mean., N_i = Effect of treatment (i = 1….3)., e_{ij} = Experimental random error.

RESULTS AND DISCUSSION

Dietary GP resulted in a remarkable enhancement of semen ejaculate volume being 0.45, 0.45 and 0.43 (ml), sperm motility was 73.68, 72.30, and 68.83%, sperm concentration 3.81, 3.92 and 3.36 and live sperm, 77.66, 78.40 and 71.26 (%) for the 2.5 or 5.0 g GP/kg diet, and control

treatment groups, respectively. While, sperm abnormalities (%) were significantly ($P \leq 0.05$) lower in cocks treated with GP than untreated one. This increase in sperm motility and sperm cell concentration could be due to the protective effect of GP. Besides, these protective effects are reflected by the decrease of malonaldehyde level and increase in total antioxidant capacity (Table 4). This result might be due to that ginger is a strong anti- oxidant substance and may either alleviate or prevent the generation of free radicals. Ginger powder, also, contains high antioxidative compounds, was fed to Aged breeder roosters improved their reproductive performance; sperm forward motility, live sperm percentage, and sperm plasma membrane integrity. These were associated with a decrease in the percentage of abnormal sperm (Akhlaghi et al., 2014). Ginger contains several phytochemical compounds which have biological activities such as antioxidatant, antimicrobial and other pharmacological effects (Zhao et al. 2011). Oxidants and antioxidants have attracted widespread interest in nutrition research, biology and medicine. It has turned out to be obvious that the steady era of expert oxidants, including oxygen free radicals, is a fundamental characteristic of high-impact life (Sies, 1991). An unsettling influence on the master oxidantlantioxidant system has been defined as oxidative stress Responsive Oxygen Species (ROS) is exceptionally receptive atoms positioned as free radicals inferable from the nearness of one unpaired electron, such as, a superoxide particle (O^-_2), Nitrogen Oxide (NO) and hydroxyl radical (HO^-). Despite the fact that normally introduce in the life form, they are chiefly bound to cell compartments and counteracted common cancer prevention agent particles, like, glutathione, glutathione peroxidase, superoxide dismutase, vitamin E and vitamin C, act as free radical eliminating (Aruoma et al. 1994). Sperm motility is an important production trait because rooster's fertility is about phenotype (Froman and Kirby, 2005). Etchu and Egbunike (2002) declared that nutrition has long ago been established to influence the secretory functions of the accessory sex organs, the results of which constitute the seminal plasma. Shanoon (2011) reported an increase in seminal volume, sperm concentration and sperm motility in roosters that received GP (5.0 and 10.0 kg/ton) in their diets when comparing with the control group. Saeid et al. (2011) reported that adding ginger at 50.0 mg/kg diet and 100 mg/kg diet for 28, 32, 36, 40 and 44 successive wk significantly ($P<0.05$) increased semen ejaculate volume, sperm-cell concentration, sperm motility, while dead and abnormal spermatozoa in cocks treated with ginger groups decreased as compared with the control one. Similarly to that reported by Etchu and Egbunike (2002).

Results in Figures (1 ,2,3 and 4) show that sperm motility, sperm-cell concentration and live sperm were significantly ($P<0.01$) decreased, while sperm abnormalities increased with the advanced age of cock's. The differences of sperm motility (%) and sperm-cell concentration ($X\ 10^9$/ml) between 60 and 64 weeks cocks were {76.11 and 73.49 (%), 3.93 and 4.16 ($X\ 10^9$/ml), respectively} were not significant; but, its motility and concentration reduced significantly in 68 and 72 weeks of age. These outcomes were as per discoveries of Shanmugam et al. (2014) repeated in 65 weeks Dahlem Red strain roosters 0.36 ml and 3.57 ($X\ 10^9$/ml), but lower than the volume and spear-cell concentration reported at the young age of 42 weeks 0.48 ml and 4.8 ($X\ 10^9$/ml) in the same population. Rosato et al. (2006) in Turkey indicated that there were negative correlation between age of toms and motility and viability of spermatozoa. Kotlowska et al. (2005) and Rosato et al. (2006) demonstrated that with ageing, spermatozoa concentration reduced. Likewise, Fuerst-Waltl et al. (2006)

reported that sperm concentration was diminished as bulls aging. Also, Tabatabaei et al. (2010) found that sperm motility and viability rates reduced significantly with ageing of roosters. The explanation of reduced semen quality with ageing is not clear. The peroxidation in PUFAs of the n-3, n-9 and n-6 series arrangement is responsible for the changes of viability, motility and fertilizing ability of spermatozoa (Rosato et al., 2006). Likewise, Cerolini et al. (1997) demonstrated that adjustments in the extents of different spermatozoa lipid parts might be connected with decreasing the fertility of male chickens. Free fatty acids and cholesterol esters increase continuously with ageing.

Sperm fatty acids, as well as, the total saturated, mono-unsaturated, polyunsaturated, n-6, and n-3 fatty acids of seminal plasma in Aged Mandarah local cocks fed dried ginger powder (GP) are summarized in Table 5. The addition of 2.5 or 5.0 g GP/kg diet significantly ($P \leq 0.01$) decreased sperm total saturated FA and significantly ($P \leq 0.05$) increase sperm total unsaturated FA of seminal plasma as compared to control group in Aged Mandarah local cocks. Percentages of total saturated FA was 37.53 in the 0 GP treatments compared to 32.52 and 29.10 in the 2.5 or 5 g GP/kg diet treatment groups, respectively. The percentages of total unsaturated FA were 54.22 in the GP 0 treatment group while it was 61.53 and 65.09 in the 2.5 or 5.0 g GP/kg diet treatment groups, respectively. Among the saturated FA, the percentages of C14:0 Myristic acid, C16:0 Palmitic acid, C18:0 Stearic acid and C20:0 Arachidic acids were decreased in GP-fed cocks. The percentage of monounsaturated fatty acids (n-9), especially C18:1 Oleic acid in 2.5 g GP/kg diet -fed cocks were lower than in 5 g GP/kg diet and control group. However, polyunsaturated fatty acids (n-6) especially C22:4 Docosatetraenoic and polyunsaturated fatty acids (n-3) especially C22:6 Docosahexanoic acid were increased in the GP-fed cocks. Omega6:Omega3 fatty acid ratios were lower in the 5.0 g GP/kg diet group compared with that in both the control (0 GP) and 2.5 g GP/kg diet groups. These results are in agreement with those of Akhlaghi et al. (2014) who found that the cocks fed GP resulted decreased and increased in sperm saturated and unsaturated FA, respectively. The Omega6:Omega3 fatty acid ratio of sperm was decreased in the GP30 group in comparison with control. The most abnormal amounts of sperm C20:4 (n-6) and C22:6 (n-3) FA were recorded in the GP15 and GP30 treatments, respectively. A higher percentage of sperm C22:4 (n-6) FA was found in GP-fed roosters. Biochemical changes in the plasma membrane are not only a simple result of dietary variation (Surai et al., 2001). Dietary PUFA can be joined into sperm either straightforwardly or after different cell adjustments, including the extension and desaturation of Sertoli cells (Retterstol et al., 2001). Chicken spermatozoa naturally have a high PUFA content, with C20:4n-6 and C22:4n-6 being the principle PUFA (Kelso et al. 1997). These 2 PUFA adds to the layer's high smoothness and adaptability, which are required for sperm motility and its combination with the oocyte (Surai et al., 2001). Despite the fact that n-6 PUFA represents the major natural constituents of avian spermatozoa, the n-6:n-3 ratio might be crucial to optimal fertility (Kelso et al., 1997). The extent of PUFA in sperm and its resulting impacts on the rate of lipid peroxidation is not just an imperative figure sperm survival amid in vitro stockpiling, yet it can likewise influence in vivo sperm practicality (Surai et al., 2001). The higher extent of unsaturated FA in the sperm of the GP-encouraged chickens may have added to their higher richness rate taking after manual sperm injection utilizing new semen.

TAC and MDA activities of the seminal plasma are presented in Table 6. TAC was

significantly (P<0.05) higher with the addition of ginger at a level of 2.5 g GP/kg diet (0.356) and 5 g GP/kg diet (0.322) as compared with control group (0.238). Concentration of MDA level was significantly (P<0.05) lower with 2.5 g GP/kg diet (1.723) and 5 g GP/kg diet (1.290) compared to control group (2.730) at the end of the experimental period (Table 6). Ginger is a strong anti-oxidant substance and may either mitigate or prevent the generation of free radicals. It is considered a safe herbal medicine with only few and insignificantly adverse/side effects (Ali et al., 2008). Oxidants and antioxidants have attracted widespread interest in nutrition research, biology and medicine. It has become bright that the connected bearing of pro-oxidants, including oxygen chargeless radicals, is a capital aspect of aerobic activity (Sies, 1991). Results are agreement with the findings of Amr and Hamza (2006) who approved that Zingiber officinale improve the activities of testicular antioxidant enzymes and restore sperm motility of cisplatin-treated rats. Ginger rhizome contains an advanced array of both antioxidative (Sekiwa et al., 2000) and androgenic action (Kamtchouing et al., 2002). Moreover the TAC was assayed in this abstraction to appraise the overall enzymatic and nonenzymatic antioxidant aegis systems in the seminal plasma (Zhao et al., 2011). Also, Akhlaghi et al. (2014) found that TAC of the seminal plasma was greatly improved by dietary GP, TAC was 0.57, 0.96, 0.91 in the GP0 , GP15 and GP30 birds respectively.

The fertility, hatchability/total eggs, hatchability/fertile eggs and embryonic mortality rate as affected by Mandarah local cocks fed dried ginger powder (GP) are presented in Table 7.

Cocks fed 2.5 or 5.0 g GP resulted in a significant (P≤0.05) increase in fertility rate and hatchability/total eggs rates being 5.55, 14.28% and 14.05, 22.90 % respectively. While, hatchability/ fertility eggs and total embryonic mortality (%) were not affected. A similar trend was reported by MohammadSaeid, (2012), who specified that a lot of active materials exists in the crushed ginger and celery seeds has enhanced the hatching rate. Ginger contains components like flavonoids, limo in and vitamins E and C (Shalaby and Zorba, 2010) and in addition of the great amount of feed elements, minerals and vitamins that are considered important in the growth of the embryos (Lu, 2003). Abbas et al. (2014) watched tangible improvement in the characteristics of embryos and hatched chicks in treatments with ginger and celery seeds by 0.25 and/or 0.50 each comparing with control. Akhlaghi et al. (2014) found that fertility values of 500 Aged Cobb breeder roosters in the GP 0, GP15, and GP30 treatment groups were 79.3, 88.1, and 86.7%, respectively, taking after a 14-week-long feeding period. Hatchability, chick quality, and embryonic mortality were not influenced by dietary GP, and the higher extent of unsaturated FA in the sperm of rooster t fed GP diets may be lead to their higher fertility rate. Nonetheless, it should be kept in mind that the spermatozoa may be more defenseless to lipid peroxidation if put away in vitro (Surai et al., 2001). Cerolini et al. (1997) proposed a decrease in the extent of C20:4n-6, C22:4n-6, and C22:6n-3 in sperm with maturing. They likewise found a positive relationship exists between fertility rates and C20:4n-6 or C22:4n-6 content.

FSH, LH and Testosterone hormone concentration are presented in Table 8. Results showed the 2.5 or 5.0 g GP/kg diet, supplementation significantly (P≤0.01) increased of sexual hormones in Aged Mandarah local cocks, which showed that ginger powder can enhanced by the ability of FSH, LH and Testosterone to produce more spermatozoa compared to the control. Dietary GP resulted in an improvement in FSH (0.402, 0.436 and 0.244 (mg/ 100ml)), LH (0.310, 0342, and 0.206) and

testosterone (2.056, 2.166 and 1.534) for the 2.5 or 5 g GP/kg diet, and the control treatment groups, respectively. These results are in agreement with the findings of Saeid et al. (2011) who reported that adding ginger at 50.0 mg/kg diet and 100 mg/kg diet for 28, 32, 36, 40 and 44 consecutive wk significantly ($P<0.05$) increased LH, FSH and testosterone serum level in these groups as compared with the control group. Khaki et al. (2009) suggested that higher serum total testosterone levels, sperm viability, and sperm motility resulted from the feeding of GP. Amr and Hamza (2006) reported that in animal models that Zingiber officinale has protective effects against cisplatininduced testicular damage and oxidative stress in rats. Ginger rhizome contains a wide variety of both antioxidative (Sekiwa et al., 2000) and androgenic activity (Kamtchouing et al., 2002). The major active phenolic ingredients isolated from Zingiber officinale (Zingerone, Gingerdiol, Zingibrene, gingerols and shogaols) have antioxidant activity (Zancan et al., 2002; Kamtchouing et al., 2002; Jorsaraei et al., 2008). Others reported that Zingiber officinale extracts have a potent androgenic activity in male rats (Amr and Hamza, 2006). Shanoon , (2011) reported that the ginger addition of GP (5.0 and 10.0 kg/ton) for twenty consecutive weeks resulted in a significant ($P\leq0.05$) increase of LH, FSH and Testosterone concentration in the serum.

IN CONCLUSION

it can be recommended for addition of ginger root powder in the cocks diet at levels of 2.5, or 5.0 g to enhance of semen quality and fertility. Further detailed studies are required to establish the reproductive efficiency of Aged local cocks under Egyptian hot summer condition.

Table (1): Composition and calculated analysis of the basal experimental diet.

Composition (per 100 Kg)	Diet	
	Cocks	**Hens**
Yellow corn	67.50	66
Soybean meal (44% CP)	18.84	19.05
Corn gluten meal (60% CP)	1.00	2.59
Wheat bran	9.02	2.50
Dicalcium phosphate	1.70	1.50
Limestone	1.20	7.60
Salt	0.39	0.30
Vit. & Min. Premix**	0.30	0.30
DL-Methionine	0.05	0.16
Total	100	100
Calculated analysis:**		
Crude protein (CP); %	16.07	16.03
ME; kcal/kg	2837	2770
Ether extract	2.87	2.86
Crude fiber	3.81	3.09
Calcium	0.91	3.29
Av. Phosphorus	0.44	0.39
Lysine	0.75	0.73
Methionine	0.32	0.44
Methionine + cystine	0.62	0.74

* Vitamins and mineral premix provides per 3kg: Vit. A 12000 IU; Vit. D3 2000 IU; Vit. E. 10mg; Vit. k3 2mg; Vit.B1 1mg; Vit. B24mg; Vit. B6 1.5 mg; Pantothenic acid 10mg; Vit.B12 0.01mg; Folic acid 1mg; Niacin 20mg; Biotin 0.05mg; Choline chloride (50% choline) 500 mg; Zn 55mg; Fe 30mg; I 1mg; Se 0.1mg; Mn 55mg; ethoxyquin 3000 mg.

**Calculated analysis was, according to Feed Composition Tables for animal and poultry feedstuffs used in Egypt (2001).

Table (2): Chemical composition (%) of ginger powder

Component	%	Component	%
4- Hydroxypridine	5.76	Cyclosativene	0.97
2- Coumaranone	10.16	2-Pyrrolidinophenol	1.57
Hexanal	4.35	Isolongifolene, 4,5,9,10-dehydro-	0.48
Benzoic acid,3,5-dimethyl-,methyl ester	1.11	2-Bornanone, ethoxycarbonylhydrazone	0.34
2-({Bis(2-aminoethyl)amino} methyl) phenol	0.49	4-(2-Hydroxyethylamino)-3-nitrocoumarin	0.51
(-)-Thujylideneglycine, ethyl ester	0.98	Bornate	3.19
D-Limonene	0.53	Methylthiouracil	18.56
α-Citral	0.49	Perillartine	1.19
1,6-Didhydrocarveol	0.44	Caffeic acid phenethyl ester	15.41
4-Acetamido-2-methallylphenol	0.49	Euvitol	18.15
phenol, 2,2-(ethanediylidenedinitrilo)di-	8.89	Piperazine, 2,5-dimethyle-, trans-	1.97
Ylangene	1.43	Levallorphan	1.34
Pyridoxal	1.20		

Table (3): Means of air temperature, relative humidity and temperature-humidity index (THI) during summer season according to Egyptian Meteorological Authority

Summer season	Air temperature (°C)		Relative humidity (%) (RH)		Temperature-humidity index (THI)	
	Minimum	Maximum	Minimum	Maximum	Minimum	Maximum
June	26.17±0.54	38.7±0.57	17.87±1.28	75±3.36	23.17	36.82
July	26.52±0.29	32.94±0.1	42.59±0.99	77.13±1.21	24.36	31.63
August	26.42±0.38	33.3±0.16	42.39±1.04	77.42±1.59	24.27	31.98
Averages	26.37±0.41	34.98±0.27	34.28±1.1	76.52±2.05	23.94	33.47

Table (4): Semen quality in Aged Mandarah local cocks fed dried ginger powder

Items	Ginger powder level/kg diet			Sig.
	GP 0.0	GP 2.5	GP 5.0	
Semen ejaculate volume (ml)	0.43±0.01	0.45±0.01	0.45±0.01	NS
Sperm motility (%)	68.83±1.33^{b}	72.30±1.36^{ab}	73.68±1.41^{a}	*
Sperm-cell concentration (X 10^9/ml)	3.36±0.09 ^{b}	3.81 ±0.09^{a}	3.92 ±0.10^{a}	**
Live spermatozoa (%)	71.26 ±1.41^{b}	77.66 ±1.26^{a}	78.40 ±1.30^{a}	**
Sperm abnormalities (%)	17.78±0.43 ^{a}	13.45 ±0.37^{b}	13.60 ±0.37^{b}	*

Means having different letters in the same column are significantly (P<0.05) different

Table (5): Some sperm fatty acids in Aged Mandarah local cocks fed dried ginger powder(GP).

Items	Ginger powder level/kg diet			Sig.
	GP 0	GP 2.5	GP 5.0	
Fatty acid[1] (%)				
Saturated fatty acids				
C14:0 Myristic acid	2.36±0.17^{a}	1.98±0.19^{ab}	1.57±0.18^{b}	*
C16:0 Palmitic acid	15.45±0.88 ^{a}	12.76±0.85 ^{ab}	11.45±0.97 ^{b}	*
C18:0 Stearic acid	18.73±1.13	16.91±1.18	15.32±0.82	NS
C20:0 Arachidic acid	0.99±0.06 ^{a}	0.87±0.04 ^{ab}	0.76±0.05 ^{b}	*
Mono-unsaturated fatty acids (n-9)				
C16:1 Palmitoleic acid	1.24±0.06 ^{c}	1.62±0.10 ^{b}	1.87±0.06 ^{a}	**
C18:1 Oleic acid	12.54±0.69	11.63±0.52	12.3±0.51	NS
C20:1 (n-9) Gondoic acid	2.68±0.28	2.39±0.46	2.35±0.40	NS
C22:3 (n-9)Dihomo Mead acids	3.62±0.41	3.50±0.5	3.40±0.27	NS
Polyunsaturated fatty acids (n-6)				
C18:2 Linoleic acid	3.64±0.43	2.91±0.16	2.76±0.25	NS
C20:2 Eicosadienoic acid	1.55±0.16	1.34±0.14	1.44±0.18	NS
C20:4 Arachidonic acid	8.73±0.69 ^{b}	13.29±0.54 ^{a}	13.88±0.67 ^{a}	**
C22:4 Docosatetraenoic	16.45±0.94 ^{b}	20.81±0.78 ^{a}	22.39±0.67 ^{a}	**
Polyunsaturated fatty acids (n-3)				
C22:5 Docosapentaenoic acid	1.78±0.07 ^{b}	1.92±0.04 ^{b}	2.13±0.05 ^{a}	**
C22:6 Docosahexanoic acid	1.99±0.10^{b}	2.12±0.12^{b}	2.57±0.13^{a}	*
Omega6:Omega3 ratio	8.09±0.36^{b}	9.51±0.25^{a}	8.64±0.29^{ab}	*
Total saturated fatty acid	37.53±1.9 ^{a}	32.52±2.25 ^{ab}	29.1±0.09 ^{b}	**
Mono-unsaturated fatty acids (n-9)	20.08±0.51	19.14±1.38	19.92±0.59	NS
Polyunsaturated fatty acids (n-6)	30.37±0.02 ^{c}	38.35±0.24 ^{b}	40.47±0.07 ^{a}	**
Total unsaturated fatty acid	54.22±0.65	61.53±1.53	65.09±0.82	*

1 Other fatty acids were undetectable.

Table (6): Total antioxidant capacity (TAC) and malondialdehyde (MDA) activities in seminal plasma of Aged Mandarah local cocks fed dried ginger powder (GP)

Items	Ginger powder level/kg diet			Sig.
	GP 0	GP 2.5	GP 5.0	
Total antioxidant capacity (mm/L)	0.239±0.012[b]	0.356±0.020[a]	0.322±0.037[a]	*
Malondialdehyde (mm/L)	2.730±0.0932[a]	1.723±0.075[b]	1.290±0.081[c]	**

Means having different letters in the same row are significantly (P<0.05) different

Table (7): Fertility, fertile hatchability percentages and embryonic mortality rates in hatching eggs sired by Aged Mandarah local cocks fed dried ginger powder (GP)

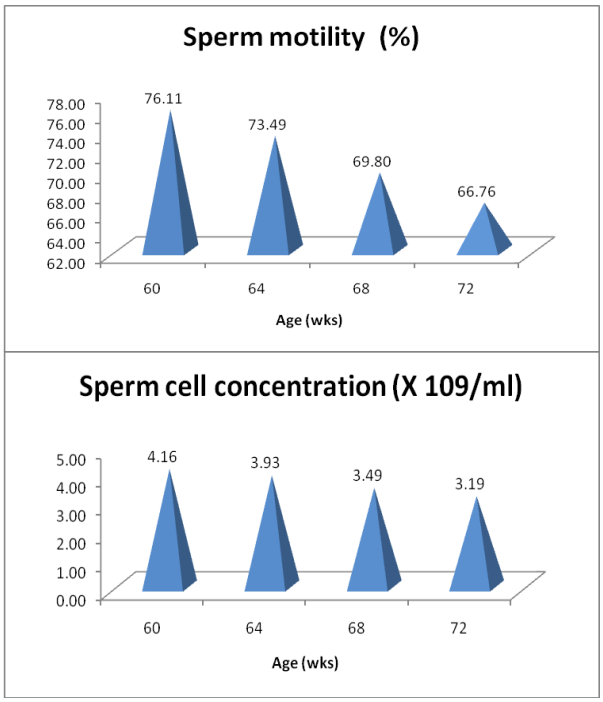
Items	Ginger powder level/kg diet			Sig.
	GP 0.0	GP 2.5	GP 5.0	
Fertility eggs %	77.78±1.75[b]	82.1±0.62[b]	88.89±1.86[a]	**
Hatchability/ Total eggs (%)	62.97±2.14[b]	71.61±2.23 [a]	77.17±2.23 [a]	**
Hatchability/ Fertility eggs (%)	80.94±1.48	87.24±2.98	86.79±0.87	NS
Embryonic mortality[2]				
1 to 6 days	11.92±1.44	9.79±0.8	9.76±0.88	NS
7 to 17 days	2.39±0.06	1.5±0.75	1.38±0.69	NS
18 to 21 days plus pipped	3.96±0.77	1.5±0.75	2.09±1.23	NS
Total embryonic mortality (O– pipping)	18.26±2.12	12.78±1.99	13.22±0.87	NS

Means having different letters in the same column are significantly (P<0.05) different

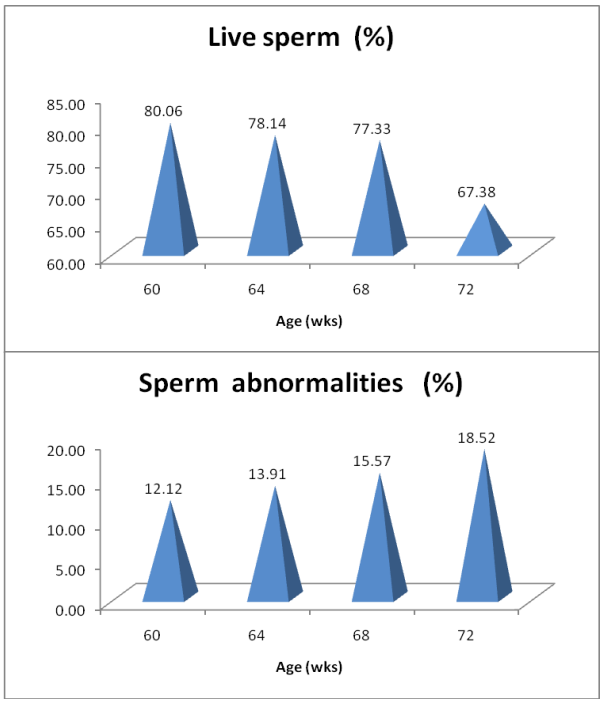
Table (8): Blood FSH, LH and testosterone concentrations in Aged Mandarah local cocks fed dried ginger powder (GP)

Items	Ginger powder level/kg diet			
	GP 0	GP 2.5	GP 5.0	Sig.
Follicle-stimulating hormone (FSH) (mg/100ml)	0.244±0.12 [b]	0.402±0.14 [a]	0.436±0.18 [a]	**
Luteinizing Hormone (LH) (mg/100ml)	0.206±0.13 [b]	0.310±0.008 [a]	0.342±0.022 [a]	**
Testosterone (ng/ml)	1.534±0.038 [b]	2.056±0.046 [a]	2.166±0.54 [a]	**

Means having different letters in the same row are significantly (P<0.05) different



Figures (1 and 2): Effect of time on sperm motility (%) and sperm-cell concentration (X 109/ml) of Aged Mandarah local cocks.



Figures (3 and 4): Effect of time on live spermatozoa (%) and sperm abnormalities (%) of Aged Mandarah local cocks.

REFERENCES

Abbas, A. A.; Aadil, A. Yosif; Ahmed M. Shukur and Falah, H. Ali 2014. Effect of genotypes, storage periods and feed additives in broiler breeder diets on embryonic and hatching indicators and chicks blood parameters. Glob. J. Sci. Res., 2 (4): 105-110.

Akhlaghi, A.; Jafari Ahangari, Y.; Navidshad, B.; Zhandi, M.; Delda, H.; Rezvani, M. R.; Dadpasand, M.; Hashemi, S. R.; Poureslami, R. and Peebles, E. D. 2014. Improvements in semen quality, sperm fatty acids, and reproductive performance in aged Cobb 500 breeder roosters fed diets containing dried ginger rhizomes (Zingiber officinale). Poult Sci., 93 :1236–1243.

A**li, B. H.; Blunden, G.; Tanira, M. O.; and Nemmar, A. 2008.** Some phytochemical, pharmacological and toxicological properties of ginger (Zingiber officinale Roscoe): A review of recent research. Food Chem. Toxicol., 46:409-420.

Amr A. and Hamza A.E.A. 2006. Effects of Roselle and Ginger on cisplatin-induced reproductive toxicity in rats. Asian J Androl, 8: 607-612.

Aruoma, A.; Bolognini, L.; Macciantelli D. and Carratelli, M. 1994. The radical Cation of N, N Diethyl para-phenilendiamine: A possible indicator of oxidative stress in biological samples. Res. Chem. Lntermed., 26: 253-267.

Benzie, I.F. 1996. Lipid peroxidation: a review of causes, consequences, measurement and dietary influences. Int J. Food Sci Nutr., 47(3):233–261.

Cerolini, S.; K. Kelso, A.; Noble, R. C.; Speake, B. K.; Pizzi, F. and Cavalchini, L. G. 1997. Relationship between spermatozoa lipid composition and fertility during aging of chickens. Biol. Reprod., 57:976–980.

Christie, W. W. 1982. The analysis of fatty acids, [in:] Lipid analysis, W. W. Christie (Ed.), Pergamon Press, Oxford, 73-90.

Duncan, D. B. 1955. The Multiple Range and Multiple F-Test. Biometrics, 11: 1-42.

Etchu, K.A. and Egbunike, G.N. 2002. Effect of processed sweet potato on the performance of broiler birds in the humid tropics during the rainy season," Trop. Anim. Prod. Invest., 5: 67 -78.

Feed Composition Tables For Animal and Poultry Feedstuffs Used In Egypt 2001. Technical bulletin No.1, central lab for Feed and food; Ministry of Agriculture, Egypt.

Froman, D. P. and Kirby, J. D. 2005. Sperm motility: Phenotype in roosters (Gallus domesticus) determined by mitochondrial function. Biol. Reprod., 72:562–567.

Fuerst-Waltl, B.; Schwarzenbacher, H.; Perner, C. and Sölkner, S. 2006. Effects of age and environmental factors on semen production and semen quality of Austrian Simmental bulls. Anim. Reprod. Sci., 95: 27-37.

Glori B. M., and Isaendoi M. K. 2015. Effect of environment temperature on physiological traits of Nigerian Loghman chickens. Canadian Journal of Scientific Advances, 1: 15-27.

Kamtchouing, P.; Fandio, G.Y.M.; Dimo, T. and Jatsa, H.B. 2002. Evaluation of androgenic activity of Zingiber officinale and Pentadiplandra brazzeana in male rats. Asian J. Androl., 4: 299-301.

Karaca, A.G.; Parker, H.M.; Yeatman, J.B.; McDaniel, C.D. 2002. The effects of heat stress and sperm quality classification on broiler breeder male fertility and semen ion concentrations. Br Poult Sci., 43: 621–628.

Kelso, K. A.; Cerolini, S.; Speake, B. K.; Cavalchini, L. G. and Noble, R. C. 1997. Effects of dietary supplementation with α-linolenic acid on the phospholipid fatty acid composition and quality of spermatozoa in cockerel from

24 to 72 weeks of age. J. Reprod. Fertil., 110:53–59.

Khaki, A.; Fathiazad, F.; Nouri, M.; A. A. Khaki, C. C.; Ozanci, M. Ghafari-Novin, M.T. and Hamadeh, M. 2009. The effects of ginger on spermatogenesis and sperm parameters of rat. Iran. J. Reprod. Med. 7:7–12.

Khaki A, Farnam A, Davatgar Badie A, Nikniaz H. 2012. Treatment Effects of Onion (Allium cepa) and Ginger (Zingiber officinale) on Sexual Behavior of Rat after Inducing an Antiepileptic Drug (lamotrigine) Balkan medical journal. 29(3):236–242.

Khan, R. U.; Naz, S.; Nikousefat, Z.; Tufarelli, V.; Javdani, M.; Qureshi, M. S. and Laudadio, V. 2012. Potential applications of ginger (Zingiber officinale) in poultry diets. World's Poult. Sci. J., 68:245–252.

Kotlowska, M.; Glogowski, J.; Dietrich, G.J.; Kozlowski, K.; Faruga, A.; Jankowski, J. and Ciereszko, A. 2005. Biochemical characteristics and sperm production of turkey semen in relation to strain and age of the males. Poult Sci., 84 (11): 1763–1768.

Lu, P.; Lai, B.S.; Liang, P.; Chen, Z.T.; Shun, S.Q. 2003. Antioxidation activity and protective affection of ginger oil on DNA damage in vitro. J. Zhongguo Zhong., 28: 873- 875.

Marai, I.F.M.; Bahgat, L.B.; Shalaby, T.H. and Abdel-Hafez, M.A. 2000. Fattening performance, some behavioral traits and physiological reactions of male lambs fed concentrates mixture alone with or without natural clay, under hot summer of Egypt. Annals of Arid Zonne, 39 (4): 449-460.

Mieusset, R.; Quintana, Casares P.; Sanchez Partida, L.G.; Sowerbutts, S.F.; Zupp, J.L.; and Setchell, B.P. 1992. Effects of heating the testes and epididymides of rams by scrotal insulation on fertility and embryonic mortality in ewes inseminated with frozen semen. J. Reprod Fertil., 94: 337–343.

MohammadSaeid Z.J. 2012. Effect of adding crushed Ginger and Celery seeds and their combinations to the diets on productive performance and some physiological parameters of two strains of Broiler Breeder Chickens and their progeny performance. Ph.D thesis, University of Anbar, Iraq.

Ogbuewu, I.P. ; Jiwuba, P.D.; Ezeokeke1, C.T.; Uchegbu, M.C.; Okoli1, I.C. and Iloeje, M.U. 2014. Evaluation of phytochemical and nutritional composition of ginger rhizome powder. Int. J. Of Agric. and Rural Dev., Vol. 17 (1): 1663-1670.

Omage, J.J.; Onimisi, P.A.; Adegbite, E.K. and Agunbiade, M.O. 2007. The effect of ginger (Zingiber officinale Roscoe) wastes male on growth performance, carcass characteristics, serum lipid and serum cholesterol profiles of Rabbit Pak. J. Nutr., 6: 359-362.

Ommati, M. M.; Zamiri, M. J.; Akhlaghi, A.; Atashi, H.; Jafarzadeh, M. R.; Rezvani, M. R. and Saemi, F. 2013. Seminal characteristics, sperm fatty acids, and blood biochemical attributes in breeder roosters orally administered with sage (Salvia officinalis) extract. Anim. Prod. Sci., 53:548–554.

Paul, C.; Murray, A. A.; Spears, N.; Saunders, P.T. 2008. A single, mild, transient scrotal heat stress causes DNA damage, subfertility and impairs formation of blastocysts in mice. Reproduction. 136: 73–84.

Rao, B.; Soufir, J.C.; Martin, M. and David, G. 1989. Lipid peroxidation in human spermatozoa as related to midpiece abnormalities and motility. Gamete Res.; 24 (2): 127– 134.

Retterstol, K.; Haugen, T. B.; Tran, T. N.; and Christophersen, B. O. 2001. Studies on the metabolism of essential

fatty acids in isolated human testicular cells. Reproduction 121:881–887.

Rosato, M.P.; Cinone, M.; Manchisi, A; Meluzzi, A; Iaffaldano, N. 2006. Changes on the quality characteristics of stored semen during reproductive period of Hybrid toms. XII European Poultry Conference; 2006 Sep 10–14; Verona (Italy): World's Poult. Sci. Association (WPSA).

Saeid, J.M.; Shanoon, A.K. and Marbut, M.M. 2011. Effects of Zingiber officinale aqueous extract on semen characteristic and some blood plasma parameters in the broilers breeder male. Int. J. Poult. Sci., 10 (8): 629 – 633.

SAS , (2003). SAS User's Guide: Statistics. Version 8.2, SAS Institute Inc., Cary, NC.

Sekiwa, Y.; Kubota, K. and Kobayashi, A. 2000. Isolation of novel glucosides related to gingerdiol from ginger and their antioxidative activities. J Agric Food Chem., 48: 373-377.

Shalaby, M.A. and Zorba, H. 2010. Protective effect of celery oil, vitamin E and their combination against testicular toxicity in male rats. Global Veter., 5 (2) :122-128.

Shanmugam, M.; Vinoth, A.; Rajaravindra, K.S. and Rajkumar, U. 2014. Evaluation of semen quality in roosters of different age during hot climatic condition. Anim. Reprod. Sci., 145(1-2): 81-85.

Shanoon, A. K. 2011. Effects of Zingiber officinale powder on semen characteristic and blood serum sex hormones concentration in broilers breeder male. Int. J. Poult. Sci., 10:863–866.

Sies, H. 1991. Oxidants and antioxidants. ln: Oxidative Stress. Academic Press, London, pp: 15-22.

Surai, P. F.; Fujihara, N.; Speake, B. K.; Brillard, J. P.; Wishart, G. J. and Sparks, N. H. C. 2001. Polyunsaturated fatty acids, lipid peroxidation and antioxidant protection in avian semen. Asianaustralas. J. Anim. Sci., 14:1024–1050.

Tabatabaei, S.; Batavani, R.A. and Talebi, A.R. 2010. Comparison of semen quality in indigenous and Ross broiler breeder Roosters. J Anim Vet Adv., 8(1): 90-93.

Yang, H.S.; Han, D.K.; Kim, J.R. and Sim, J.C. 2006. toxicity in rat testis and spermatogenesis. J. Korean Med. Sci., 21: 445-451.

Zhang, Y.Y. and Zheng, G.M. 2002. Artificial insemination of Cabot's Tragopan. J. Beijing Normal Univ. Nat. Sci. Ed., 38: 117-122.

Zhao, X.; Zingiber, B.; Yang, W. R.; Yang, Y.; Wang, S. Zingiber Jiang, and Zhang, G. G. 2011. Effects of ginger root (Zingiber officinale) on laying performance and antioxidant status of laying hens and on dietary oxidation stability. Poult. Sci., 90:1720–1727.

الملخص العربي

تأثير إضافة مسحوق الزنجبيل الجاف في العليقة على تحسين جودة السائل المنوي ومعدل الخصوبة في الديوك المحلية المتقدمة في العمر تحت ظروف الصيف المصرية.

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درس هذا البحث تأثير إضافة مستويات مختلفة من مسحوق الزنجبيل في العليقة للديوك المحلية المتقدمة في العمر على جودة السائل المنوي ومعدل الخصوبة تحت ظروف الصيف المصرية. استخدم عدد واحد وثمانون ديك محلي مندرة عمر 60 أسبوع في تصميم عشوائي تام وزعوا عشوائيا الي ثلاث مجاميع ثلاث مكررات/ مجموعه كل مكررة 9 ديك في اقفاص فردية وهي كنترول (بدون إضافة) ، 2.5،5.0 جرام مسحوق جذور الزنجبيل/ كجم عليقة لمدة 12 أسبوع (من عمر 60 الي 72 أسبوع من العمر) .
وأظهرت النتائج تحسن حجم القذفه والنسبة المئوية لحركة الأسبرمات وتركيز الحيوانات المنوية الطبيعية والأسبرمات الحية. وأن كلا من مستويات الزنجبيل خفض معنويا ($P\leq0.01$) النسبة المئوية لمجموع الاحماض الدهنية المشبعه وبالإضافة إلى الزيادة في نسبة الاحماض الدهنية الغير المشبعه ($P\leq0.05$) في البلازما المنوية عند المقارنة مع مجموعه الكنترول. وكشف أيضا ان النسبة بين أوميجا – 6: أوميجا - 3 كانت أقل في المجموعة 5.0 جرام مسحوق جذور الزنجبيل/ كجم عليقة مقارنة بكل من مجموعه الكنترول ، 2.5 جرام مسحوق جذور الزنجبيل/ كجم عليقة. وزيادة مضاد الأكسدة TAC معنويا ($P\leq0.05$) وقلة مستوي MDA و نسبة الحيوانات المنوية الميتة مقارنة مع مجموعة الكنترول. وان تغذية الديوك علي 2.5 أو 5.0 جرام مسحوق جذور الزنجبيل/ كجم لعليقة زاد معدل الخصوبة والنسبة المئوية للفقس بالنسبة للبيض الكلي بنحو 5.55، 14.28٪ و 14.05، 22.90٪ على التوالي ، ووجد ان النسبة المئوية للفقس الي البيض المخصب والنسبة المئوية للنفوق الجنيني لم تتأثر معنويا. وأدى اضافة الزنجبيل الي تحسن كبير في قيم هرمون FSH ، LH وتركيز هرمون التستوستيرون.
الخلاصة: لوحظ ان اضافة 2.5 ، 5.0 جرام مسحوق جذور الزنجبيل/ كجم لعليقة الديوك يمكن التوصية بها لتحسين نوعية السائل المنوي ومعدل الخصوبة، لا سيما مع ضعف الخصوبة في الديوك المحلية المتقدمة في العمر.