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Influence of Phytoestrogens on the Morphometric Parameters of Reproductive Organs in Chickens for Enhanced Egg Production

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Annotation: This article investigates the effects of phytoestrogen compounds on the morphological and morphometric changes of the reproductive organs in chickens. During the experiment, differences between the phytoestrogen-treated group and the control group were analyzed. The results demonstrated that phytoestrogen compounds have a positive impact on the size, weight, and functional activity of reproductive organs. This study serves to explore the potential use of phytoestrogens for improving reproductive parameters in chickens.

Keywords: Phytoestrogen, chicken, reproductive organs, morphometry, productivity, ovary, testis, uterus, vascular network, hormonal balance, Ferula asafetida, Ferula narthex, Ferula.

INTRODUCTION

In our country, one of the pressing issues in the development of the poultry industry is to increase the production volume of poultry products in order to meet the population's demand for high-quality and environmentally safe food. This goal requires the use of scientifically grounded optimal technologies that take into account the biological characteristics of poultry.

Phytoestrogens are naturally occurring plant-derived compounds known to have beneficial effects on the reproductive system of birds. Compared to synthetic hormones, the use of phytoestrogens is

considered safer and more environmentally friendly.

According to this study, dietary supplementation with quercetin significantly enhances productivity in laying hens. The addition of 0.4 g/kg quercetin increased egg production rate and improved feed conversion ratio, though it did not affect average egg weight or daily feed intake. Quercetin supplementation was found to elevate levels of reproductive hormones (estradiol, progesterone, FSH, LH) and growth-related factors (IGF-1, GH). Additionally, it positively influenced certain reproductive organ parameters, including magnum and isthmus capacity, as well as follicular development. Quercetin also modulated the expression of apoptotic genes, affecting cellular death processes. Overall, quercetin plays a beneficial role in improving egg production by exerting estrogen-like biological activity in laying hens [6].

Therefore, studying the effects of phytoestrogens on enhancing reproductive performance in chickens is of great importance. Such research not only contributes to increasing productivity in poultry farms but also supports the health and reproductive well-being of birds.

Some species of the *Ferula* plant, which are rich in phytoestrogens, include:

1. **Ferula asafetida** – This medicinal plant is rich in phytoestrogens and is traditionally used in herbal medicine. Its roots and resin contain a range of bioactive substances, particularly those that help modulate estrogen levels. One of the key active components—asafoetida—exerts estrogen-like effects and helps regulate hormonal balance.
2. **Ferula narthex** – This species also contains significant amounts of phytoestrogens. Its roots and stems are used in the treatment of various health conditions, including those related to the reproductive system. Compounds with phytoestrogenic activity in this plant support the reproductive function in chickens.
3. **Ferula foetida** – This plant is another source of phytoestrogens, and its extract is sometimes used for supporting women's health due to its estrogen-enhancing effects.

This study aimed to assess the effect of dietary supplementation with different levels of *Salvia officinalis* and/or *Origanum majorana* on productive performance, ovarian follicular development, lipid peroxidation, antioxidative status, and egg quality in laying hens. Two hundred and ninety-four 45-week-old Bovans brown hens were allocated into seven groups, with seven replicates of six hens each. The first group was fed with the basal considered as a control (A); the second (B) and third (C) groups were provided with the same control diet further supplemented with 0.5 and 1 kg/ton *Salvia officinalis*, respectively; the fourth (D) and fifth (E) groups received the control diet further supplemented with 0.5 and 1 kg/ton *Origanum majorana*, respectively; while the sixth (F) and the seventh (G) groups were offered a diet supplemented with 0.5 kg/ton *Salvia officinalis* and 0.5 kg/ton *Origanum majorana* and 1 kg/ton *Salvia officinalis* and 1 kg/ton *Origanum majorana*, respectively. No significant effects were observed in the final body weight (BW) and feed intake (FI) of the laying hens. In the diets supplemented with *Salvia officinalis* and *Origanum majorana*, the egg weights for groups C, F, and G had significantly higher values only compared to group D. The supplementation of the diets with *Salvia officinalis* and/or *Origanum majorana* significantly ($p < 0.05$) increased the Follicle stimulating hormone (FSH), luteinizing hormone (LH), and estradiol estrogenic hormone concentration, except for *Origanum majorana* at both levels with regard to estradiol. The dietary utilization of *Salvia officinalis* and *Origanum majorana* did not significantly alter the plasma glutamic oxaloacetic transaminase (GOT) and glutamic pyruvic transaminase (GPT), total protein, albumin, globulin, and High density lipoprotein (HDL) parameters. Cholesterol, glucose, triglyceride, and Low density lipoprotein (LDL) were decreased ($p < 0.05$) in the birds fed with *Salvia officinalis* and/or *Origanum majorana* supplemented diets. Moreover, at both doses, the dietary supplementation with *Salvia officinalis* and *Origanum majorana* decreased ($p < 0.05$) the yolk cholesterol and liver Malondialdehyde (MDA) levels. In addition, the dietary enrichment with *Salvia officinalis* and/or *Origanum majorana* decreased ($p < 0.05$) the palmitoleic and stearic fatty acids' egg yolk concentration. In contrast, the yolk linoleic

fatty acid concentration was significantly increased by *Salvia officinalis* and/or *Origanum majorana*. In conclusion, dietary supplementation with *Salvia officinalis* and/or Origanum positively affected productive performance, ovarian follicular development, antioxidant activity, hormonal status, and steroidogenesis in Bovans brown laying hens [7].

During the production period of laying hens, the number of cracked eggshells increases and the skeleton becomes brittle. Both these problems are related to ageing of the hen and cause economic problems for egg producers and impaired animal welfare. This study investigated key factors in the shell gland and duodenum related to eggshell quality and bone strength in laying hens during the production period. Five Lohmann Selected Leghorn (LSL) and five Lohmann Brown (LB), common hybrids in commercial egg production, were euthanized at 21, 29, 49 and 70 weeks (wk) of age. Blood samples for analysis of total calcium were taken at euthanization. Right femur and humerus were used for bone strength measurements and tissue samples from shell gland and duodenum were processed for morphology, immunohistochemical localisation of oestrogen receptors (ERα, ERβ), plasma membrane calcium ATPase (PMCA) and histochemical localisation of carbonic anhydrases (CA). Eggs were collected for shell quality measurements [8].

RESEARCH OBJECTIVE

To recommend the use of phytoestrogen compounds for enhancing reproductive capacity and accelerating physiological maturation in chickens by studying morphometric changes in their reproductive organs.

RESEARCH TASKS

1. To determine the growth dynamics of the reproductive organs in chickens during postnatal ontogenesis;
2. To analyze physiological norms of changes in body weight and linear parameters of chickens from 15 to 570 days of age;
3. To study the age-related changes in ovarian weight and morphometric parameters of the ovaries in chickens.

Materials and Methods

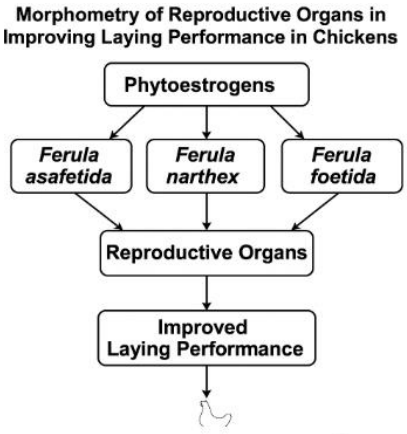
In our study, the morphometric analysis of the reproductive system in chickens focused on evaluating parameters such as the length of the ovary and uterus, as well as other linear dimensions of reproductive organs.

The scientific research was conducted in the laboratory of the Department of Anatomy, Histology, and Pathological Anatomy at Samarkand State University of Veterinary Medicine, Animal Husbandry and Biotechnology. Chickens of the egg-laying line were selected as experimental animals at the following ages: 15, 35, 85, 120, 168, 280, 420, and 570 days. The birds were slaughtered, exsanguinated, and their reproductive organs were carefully removed and weighed using an analytical balance. The linear measurements and weights of the ovaries were recorded according to standard morphometric techniques.

The numerical values of macro- and micrometric indicators obtained from the study were processed using variation statistical methods with the help of Microsoft Excel software.

Results

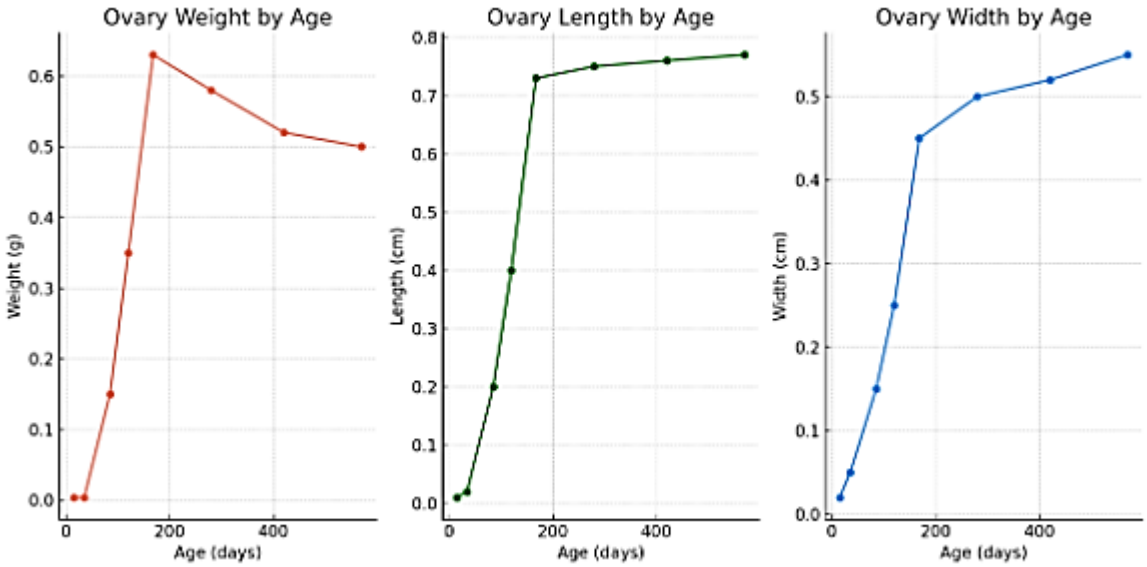
During the study, morphometric measurements of the reproductive system organs were performed across each age group.



The results show that the average ovary weight at 15 to 35 days of age was 0.004 grams. By 168 days of age, this indicator had increased to 0.63 grams, followed by a decline in later stages. On average, ovary weight increased 336.17 times during this period.

The length of the ovary demonstrated a clear correlation with age, showing an intensive growth trend. Between 15 and 35 days of age, ovary length increased from 0.01 cm to 0.02 cm, indicating a 1.31-fold increase. By 168 days, the length had increased by 0.72 cm. Later, the rate of change became less significant, resulting in an overall 9.57-fold increase in ovary length during the study period.

When analyzing ovary width, it was observed that the growth continued from 15 to 168 days of age. From 15 to 570 days of age, the ovary width increased on average 21.23 times. The most intensive growth occurred between 15 and 168 days of age.



Conclusion

The development of reproductive organs and the attainment of sexual maturity in chickens are closely associated with increases in the morphometric parameters of the ovaries. These changes reflect the dynamic physiological transitions chickens undergo—ranging from preparation for egg-laying, to the active egg-laying phase, and eventually to a decline in reproductive activity.

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