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Impact of testosterone on testicular growth and structure in chickens

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Abstract- Testosterone plays a vital role in the development and function of the testes in chickens. This study aimed to investigate the effects of exogenous testosterone on testicular morphology, weight, and histological characteristics in male chickens. A total of 25 white cockerels (weighing 800-1100 grams) were randomly selected and divided into experimental groups. Five birds were used as a baseline control, while the remaining 20 were divided into two main groups: Group A (control) and Group B (testosterone-treated). Group A was further divided into two subgroups (A1 and A2), receiving subcutaneous injections of olive oil for 30 and 90 days, respectively. Similarly, Group B was divided into two subgroups (B1 and B2), receiving testosterone injections (5 ml per bird dissolved in olive oil) for 30 and 90 days, respectively. Histological examination and weight analysis of the tests were conducted post-treatment. Results showed that testosterone administration influenced testicular development, with notable differences in seminiferous tubule structure, spermatogonia arrangement, and vascularity. Birds treated with testosterone for 90 days exhibited enlarged seminiferous tubules and increased cellular density compared to controls. However, prolonged exposure resulted in slight structural deformations in the tunica albuginea. The study also observed a decrease in average testicular weight in testosterone-treated groups compared to the controls, indicating a possible feedback inhibition mechanism. These findings highlight the impact of testosterone on testicular growth and histology in chickens, suggesting potential applications in poultry breeding and reproductive management. However, prolonged testosterone exposure may lead to adverse structural changes. Further research is recommended to explore the long-term physiological and reproductive consequences of testosterone supplementation in poultry.

Keywords: Testosterone, testicular development, histology, poultry, reproductive physiology, seminiferous tubules.

INTRODUCTION

Testosterone is a key androgenic hormone responsible for the development, growth, and function of male reproductive organs in vertebrates, including chickens.[1] In male chickens, testosterone is primarily produced by the testes and plays a crucial role in spermatogenesis, secondary sexual characteristics, and reproductive behavior. It stimulates the maturation of seminiferous tubules, promotes sperm production, and influences traits such as comb and wattle growth[2], which are essential for mating success.

The levels of testosterone in chickens can vary based on age, breed, and environmental conditions. While optimal testosterone levels enhance fertility and testicular development, excessive administration can lead to

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aggression and potential physiological alterations, whereas deficiency may impair reproductive performance.[3] Understanding how testosterone affects testicular morphology and function is crucial for improving poultry breeding programs and reproductive management strategies.[4]

This study aims to investigate the effects of exogenous testosterone on the testes of chickens by analyzing changes in testicular weight, structure, and histological characteristics. By comparing control and testosterone-treated groups over different durations, the study provides insights into how testosterone modulates testicular development. The findings may have significant implications for poultry farming, particularly in managing reproductive health and optimizing breeding efficiency.

METHODS

Subject

To investigate the effects of testosterone on testicular development in chickens, a total of 25 white cockerels (weighing 800-1100 grams) were randomly selected from a local poultry farm and housed in laboratory cages. The study was divided into control and experimental groups to assess changes in testicular weight, morphology, and histology over different treatment durations.

Testicular Weight and Morphology Assessment

Five birds were dissected at the start of the experiment to establish baseline testicular weight and morphology. The remaining 20 birds were divided into Group A and Group B. Group A was further subdivided into two groups, receiving subcutaneous injections of olive oil (0.2 ml per bird) for 30 and 90 days. Group B was subdivided into two groups, receiving testosterone (5 ml per bird dissolved in 4 c.c. olive oil) for 30 and 90 days, respectively shown in Table-1. After the treatment period, the birds were euthanized, and their testes were carefully dissected and weighed.

Histological Analysis

The testes were fixed in Carnoy's solution, dehydrated, embedded in paraffin, and sectioned at 10 µm thickness. The sections were stained with methyl green pyronin and examined under a microscope to assess changes in seminiferous tubules, spermatogonia, tunica albuginea, and epithelial cell structure.

RESULTS

Testicular Weight and Morphology

The average testicular weight varied across the groups. The group-A showed a slight increase in testicular weight over time, with values of 4.67g (30 days) and 5.35g (90 days). However, testosterone-treated groups group-B exhibited a reduction in testicular weight, measuring 4.23g (30 days) and 4.298g (90 days) shown in Table-1. Despite these variations, the consistency of the testes remained soft across all groups. The reduction in testicular weight in testosterone-treated birds suggests a possible inhibitory feedback mechanism affecting endogenous testosterone production.

Histological Analysis

Microscopic examination revealed structural differences between the control and testosterone-treated groups shown in Table-2, 3, 4 & 5. In the normal and

Table 1: Average weight and consistency of testes in untreated and treated Birds

Group		Testes (In gm)	Consistency
Normal (Baseline)		4.936	Soft
Group-A (Olive oil treated)	30 Days	4.67	Soft
	90 Days	5.35	Soft
Group-B testosterone treated	30 Days	4.23	Soft
	90 Days	4.298	Soft

Table 2: Histological appearance of Testes of normal chicken

Number of chickens	Study criteria	Seminiferous tubules	Spermatogonia	Tunica albuginea	Epithelial cells
05	General appearance	Clearly distinguished	Clearly distinguished	Clearly distinguished	Clearly distinguished
	Morphology	Highly coiled	Type A and Type B present	Fibrous connective tissue	Columnar cells
	Arrangement	Well organized	Circular	Well organized	Well organized

Table 3: Histological appearance of Testes of control chicken of short (30 days) and long (90 days) duration

Total number of chickens	Criteria of study	Seminiferous tubules	Spermatogonia	Tunica albuginea	Epithelial cells
10	Structure/Cell structure	Intact	Small rounded	Double layer orthogonal	Columnar
	Cytoplasm and nuclei	Visible	Visible	Visible	Visible
	Vascularity	Present	Present	Present	Present

Table 4: Histological appearance of Testes of testosterone treated chicken of short (30 days) duration

Total number of chickens	Criteria of study	Seminiferous tubules	Spermatogonia	Tunica albuginea	Epithelial cells
05	Structure/Cell structure	Intact but slightly enlarged	Small rounded	Double layer orthogonal	Columnar
	Cytoplasm and nuclei	Visible	Visible	Visible	Visible
	Vascularity	Present	Present	Present	Present

Table 5: Histological appearance of Testes of testosterone treated chicken of long (90 days) duration

Total number of chickens	Criteria of study	Seminiferous tubules	Spermatogonia	Tunica albuginea	Epithelial cells
05	Structure/Cell structure	Intact but enlarged	Large rounded	Double layer orthogonal, slightly deformed in few	Columnar
	Cytoplasm and nuclei	Visible	Dense	Visible	Visible
	Vascularity	Densely Present	Present	Present	Present

control groups, the seminiferous tubules were well-organized, highly coiled, and displayed distinct spermatogonia and epithelial cell layers. In contrast, testosterone-treated birds showed enlargement of the seminiferous tubules, with an increased presence of rounded spermatogonia. Birds treated for 90 days exhibited slight deformations in the *Tunica albuginea*, indicating prolonged hormonal influence. Vascularity remained present in all groups but was denser in testosterone-treated birds, particularly in the 90-day group.

DISCUSSION

The results indicate that exogenous testosterone administration influences testicular weight and histological structure in chickens. While group-A birds exhibited a natural increase in testicular weight over time, testosterone-treated birds showed a decline in weight, particularly after prolonged exposure (90 days). This reduction may be attributed to negative feedback inhibition of endogenous testosterone production[5], as reported in previous studies on avian endocrinology[6]. Excessive testosterone can suppress gonadotropin secretion, leading to reduced testicular growth and function.[7]

Histological analysis revealed notable structural changes in testosterone-treated birds, including enlargement of seminiferous tubules and increased spermatogonia density. However, prolonged exposure resulted in slight deformations in the tunica albuginea, indicating potential testicular stress. Similar findings have been observed in testosterone-treated poultry, where prolonged exposure altered testicular histoarchitecture and spermatogenesis.[8] The increased vascularity in testosterone-treated groups suggests enhanced metabolic activity, which may support early-stage spermatogenesis but could lead to structural instability over time.

CONCLUSION

This study highlights the significant effects of exogenous testosterone on the testes of chickens, influencing both testicular weight and histological structure. While control birds exhibited normal growth, testosterone-treated birds showed reduced testicular weight, likely due to negative feedback inhibition. Histological alterations, including enlarged seminiferous tubules and increased vascularity, were observed, with prolonged exposure leading to structural deformations.

These findings suggest that while testosterone influences testicular development, excessive or prolonged administration may have adverse effects. Future research should focus on optimizing testosterone supplementation in poultry breeding to enhance reproductive efficiency while minimizing potential negative consequences on testicular health.

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