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Comparative Histological Study of Glycogen Content in Skeletal Muscles of Quail and Local Chickens Deionized Water

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Abstract

The purpose of the current study is to detect the glycogen content in the skeletal muscles of quail and chickens. Birds were purchased from private commercial fields in the city of Al-Kut and included 10 males' quails 43-45 days old, and 10 male broiler chickens 34-35 days old. Samples of skeletal muscles were taken from the chest and leg areas. Histological sections from these samples were prepared and stained by the periodic acid Schiff's reagent stains to determine the quantity of glycogen. The study results demonstrated a variation in glycogen content in both types of birds. The different quantities of glycogen in skeletal muscle are related to species variation and fibre muscle types.

Keywords: Quail, Muscles, Glycogen.

1. Introduction

The raising of poultry is a fast-growing sector of agriculture that produces a variety of commodities for the world population. Poultry meat and eggs are widely consumed daily in large quantities [1, 2]. The high ease of digestion, assimilability, availability, and inexpensive cost of bird meat are factors in its popularity among customers [3]. Quail farming is emerging as a new kind of diversification in poultry farming, aimed at expanding the variety of flavour options and increasing meat output to meet the growing need for animal protein [4].

Quail production holds a significant position in poultry farming. This pertains to the rate of growth processes, which are five times greater than comparable measures in broiler chickens as well as the earlier egg-laying starting stage. Furthermore, these birds' eggs and flesh have excellent nutritional value [5]. Quail meat and eggs are considered a source of high-quality products due to their balanced diet and outstanding taste. As a result, there is a significant global demand for quail

products [6]. The muscles are an essential component of the body and have a notable capacity for contraction. In aggregate, it constitutes approximately 50 % of the body's bulk. Muscle tissue is classified according to variations in shape and function [7]. Skeletal, smooth, and cardiac muscle are the three types of muscle found in vertebrates [8]. The skeletal muscle is a sizable, metabolically active tissue present in animals that has a fast rate of energy metabolism and protein synthesis [9]. Skeletal muscles consist of different types of muscle fibres that possess distinct biochemical and structural characteristics, which might have an impact on the quality of meat [10]. The different classifications of fibre types have concentrated on one, or a few, sides of the metabolic and contractile processes [11]. There are three primary types of fibres were determined. Red, intermediate, and white fibres.

Red fibres are characterized by elevated levels of enzymes associated with oxidative metabolism and reduced levels of glycolytic enzymes. Additionally, red fibres have a higher concentration of myoglobin compared to white fibres. On the other hand, intermediate fibres possess qualities that lie between those of red and white fibres, and they exhibit both oxidative and glycolytic capabilities [12]. Glycogen is an intricate polysaccharide that is stored in the liver and skeletal muscles of animals and can be rapidly mobilized to provide glucose [13]. When comparing animals of identical body mass, both wild and domestic birds have much higher concentrations of glucose compared to mammals [14]. The glycogen content in skeletal muscle is approximately 1.5 to 1.8 %. While it constitutes 3 to 5 % of the liver's weight. Functions as the main provider of glucose in the bloodstream [15]. Acidification of muscles after death is necessary to convert the muscles into superior-quality meat following slaughter. As blood flow is halted, the ability to buffer changes in pH is significantly decreased, and the anaerobic breakdown of carbohydrates serves as the homeostatic mechanism to produce ATP. As a result, the muscles become more acidic, with pH levels dropping as low as 5.5. This acidity is influenced by the amount of carbohydrates present and the muscles' ability to resist changes in pH [16]. Prior studies have indicated that the amount of muscle glycogen in poultry is one of the main factors influencing the ultimate pH of meat at death, as well as the meat's water-holding capacity and other physical characteristics, such as colour [17].

2. Materials and Methods

2.1 Experimental Design

Birds for this study were collected from private commercial fields in the city of

Al-Kut. These birds included 10 male quails, 43-45 days old, and 10 male broiler chickens 34-35 days old. Through gross examination, it was found that all the birds were healthy, and then all birds were sacrificed by being anesthetized and deadened with chloroform.

2.2 Samples Collection

Skeletal muscle specimens (5 × 5 ×5 mm) were collected from the chest area (pectorals major muscles) and leg (extensor iliotibial anticus muscles). Samples were preserved in a 10 % formalin solution for 72 hours. Then, rinsed with water between two to three hours and subsequently subjected to various histological techniques, such as dehydration, clearing, infiltration, embedding, cutting, and staining. The periodic acid Schiff's reagent stains were used to determine glycogen content in paraffin sections.

2.3 Methodology Statistic

Slides were captured with a Canon digital camera that was mounted on a Mejia microscope equipped with a 1/2 X photo converter and a 40 X objective lens. The output photographs were examined on an Intel Core I3 computer using Video Test Morphology software (Russian), which has a dedicated feature for measuring area, percentage area, and counting objects.

3. Results and Discussion

The histochemical results of skeletal muscles were used to estimate the glycogen content in the chest and leg regions of quails and chickens after the muscle section was stained with PAS… In quail, the microscopic examination of cross-sections of chest muscles showed the accumulation of a very small amount of glycogen deposits inside the muscle bundles, which appeared in a dark purple color, as shown in (figure 1). While investigating the cross-sections of the leg muscles, it was found that there was no accumulation of glycogen inside the muscle bundles, as shown in (figure 3). The statistical results showed the mean of glycogen deposition in chest and leg muscles as (99, 62), respectively. revealed in surface plots in cross-sections of muscle samples (figure 2) and (figure 4). In chickens, the microscopic examination of cross-sections of chest muscles showed the accumulation of a large amount of glycogen deposits inside the muscle bundles, which appeared dark purple, as shown in (figure 5). While cross-sections of the leg muscles showed an accumulation of little amounts of glycogen that is spread inside the muscle bundles, that appeared in a dark purple colour, as shown in (figure 7). The statistical results showed the mean of glycogen deposition in chest and leg muscles as (155, 146), respectively,

revealed in surface plots in cross-sections of muscle samples (figure 6), and (figure 8). Through microscopic investigation of the quail's muscles, it was observed that the chest muscles are predominantly oxidative fibres. That rely mainly on oxygen for energy, and hence their glycogen amount is low in comparison to leg muscles, which lack glycogen, and this explanation was like that explained through it the type of fibres quail muscles [18]. The differences of glycogen contents in muscle in accordance with fibre types and location of muscle, may be due to the metabolic process which take place in muscles to proving the movement. functions and energy supply. some authors explained this differ [19], glycolytic fibres contain more glycogen than oxidative fibres. Through microscopic investigation of the chicken's muscles, it was observed that the chest muscles are made up of white glycolytic fibres, which depend on the breakdown of sugar to provide energy, unlike the leg muscles, which are made up of two types of fibres, red and white fibres, and this explanation was similar to that of [20], who explained through it the type of fibres that make up the chicken's muscles. The results of the current study showed the different content of glycogen in both species of birds in the study. The glycogen content in the skeletal muscles of the quail group was lower in comparison with the skeletal muscle of the broiler chicken group. This finding was like the previses study mentioned by Nasr and co-workers [21]. The different quantities of glycogen in skeletal muscle are related to species variation and fibre type. This view was supported by Mir et.al [17].

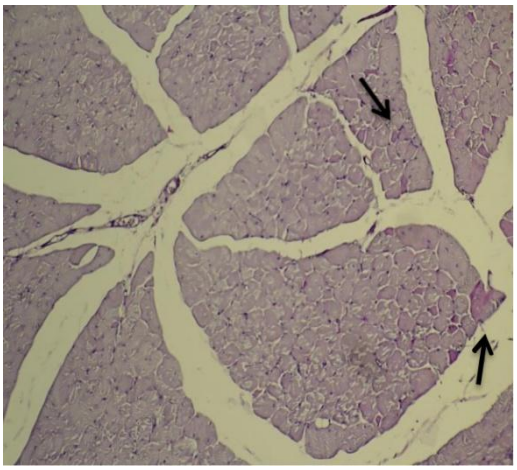

Figure 1: Photomicrograph of skeletal muscle of chest area of quail, cross section of chest muscle show appeared the little glycogen (black arrows) distribution in the skeletal muscle was stained dark purple colour glycogen. PAS stain, 200 X.

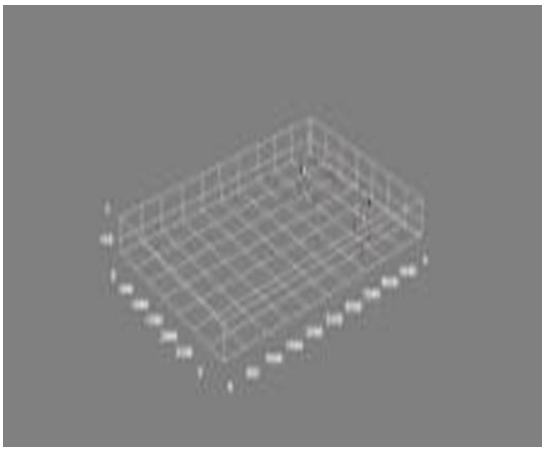

Figure 2: surface plot show of cross section in skeletal muscles fibres of the chest area in quail.

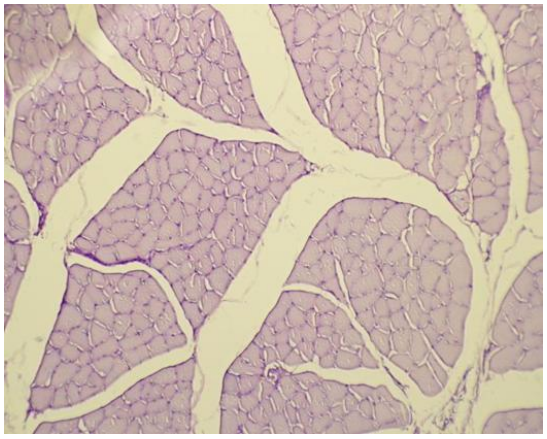

Figure 3: Photomicrograph of skeletal muscle of leg area of quail, cross section of leg muscle show appeared the no glycogen distribution in the skeletal muscle. PAS stain, 200 X.

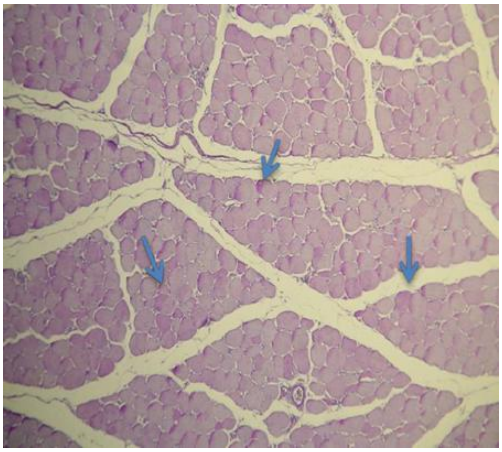

Figure 5: Photomicrograph of skeletal muscle of chest area of chicken, cross section of chest muscles shows gradual increase in the distribution of glycogen (blue arrows). PAS stain, 200X.

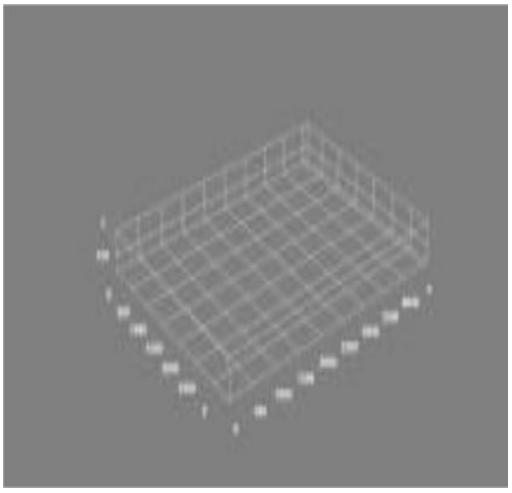

Figure 4: surface plot show of cross section in skeletal muscles fibres of the leg area in quail.

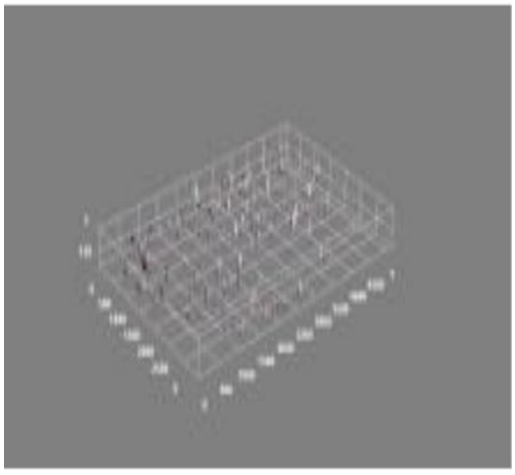

Figure 6: Surface plot show of cross section in skeletal muscles fibres in the chest area of chicken.

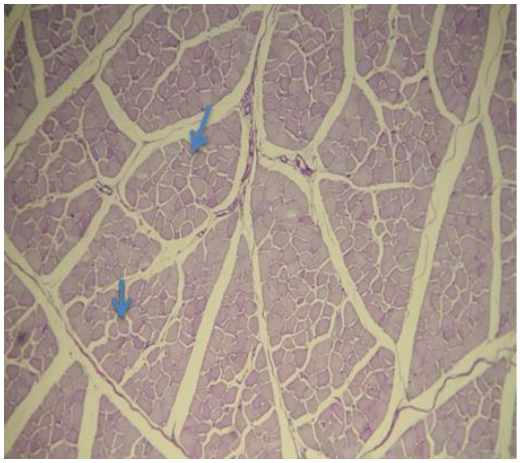

Figure 7: Photomicrograph of skeletal muscles of leg area of chicken, cross section of leg muscle shows gradual decrease in the distribution of glycogen (blue arrows). PAS stain, 200X.

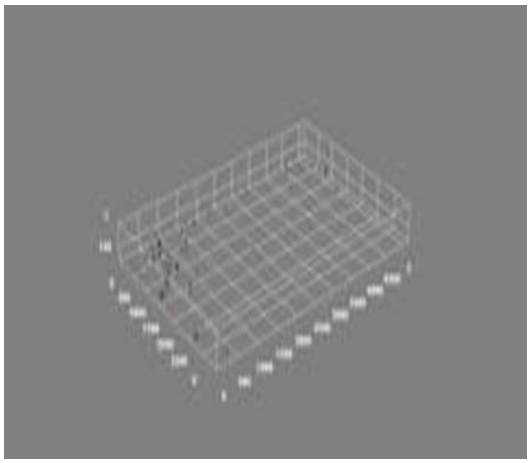

Figure 8: Surface plot show of cross section in skeletal muscles fibres in the leg area of chicken.

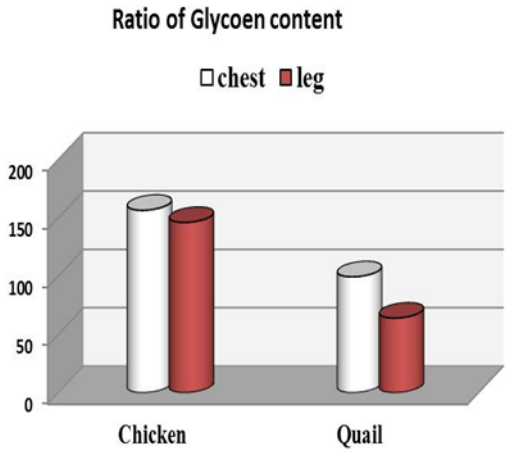

Figure 9: The Ratio of glycogen content in chest and leg areas of the skeletal muscles in quail and chicken.

4. Conclusion

The staining of periodic acids Schiff's reagent stain appeared to indicate the glycogen content in muscle samples for both types of birds; the quail muscles showed less glycogen than the chicken muscles. The different quantities of glycogen in skeletal muscle were related to species variation and fibre type.

5. References

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