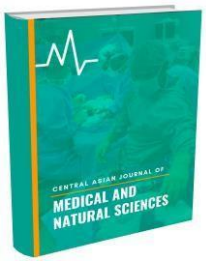

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Article

Effect of Whey Powder on Physiological and Biochemical Stability in Broiler Chickens

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Abstract: The object of this article is to evaluate the impact of dietary supplementation with whey powder (WP) on physiological and biochemical parameters in growing broiler chickens. The results suggest that with whey powder in diet, the total protein content and metabolic process are activated for stability of physiology on broiler chickens. This work aimed to evaluate the physiological-biochemical status of broiler chickens fed a diet containing whey powder during the growth period. The experiment was completed for 42 days with a total of 100 one day old Cobb-500 broiler chicks divided into four treatment groups: (T1, T2, and T3) supplemented with whey powder at the rate of40, 60 and 80mg/kg feed respectively as compared to straight plane diet. The birds were all offered a commercial standard basal diet ad libitum, with access to water and feed at all times. Biochemical Analysis: Biochemical profiles including total protein, albumin, glucose, cholesterol, triglycerides and liver enzymes such as AST and ALT were all measured in blood. Physiological sign, including the heart rate, breath rate and body temperature, were also recorded.

Keywords: Whey Powder, Broiler Chickens, Physiological Stability, Biochemical Parameters, Protein Metabolism, Liver Enzymes, Metabolic Balance, Growth Rate, Stress Resistance

1. Introduction

In recent years, the use of natural sources with high biological value in the poultry industry has become a focal point of scientific research worldwide. In particular, there has been a growing trend toward the application of biologically active feed additives to enhance growth performance, ensure physiological stability, and increase stress resistance in broiler chickens [1].

Whey powder (WP) is a high-biological-value, protein-rich component obtained during the processing of dairy products. It contains a balanced complex of lactalbumin, lactoferrin, immunoglobulins, essential amino acids, B-group vitamins, and minerals, all of which play a crucial role in activating metabolic processes in the animal body. Due to its rapidly digestible protein fractions and bioactive peptides, whey powder stimulates anabolic processes, making it an important factor in accelerating the growth rate of broiler chickens [2].

In the Republic of Uzbekistan, extensive scientific and practical efforts have been undertaken in recent years to enhance the export potential of poultry products, supply the domestic market with high-quality animal protein, and develop feed resources that substitute imports. These objectives are reflected in the "New Uzbekistan – 2030" development strategy, which emphasizes the introduction of innovative technologies in

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agriculture, including the expanded use of biologically active substances in livestock production [3-4].

From this perspective, studying the effect of whey powder on the physiological and biochemical stability of broiler chickens is of significant importance not only for improving poultry productivity but also for establishing scientific foundations for the production of environmentally friendly, healthy, and high-quality poultry meat. The relevance of this research lies in the fact that dietary supplementation with whey powder improves metabolic balance, optimizes blood biochemical parameters, and activates natural defense mechanisms against physiological stress in broiler chickens [5].

Main Part

Feed quality, and particularly protein source, is one of the factors directly affecting the physiological-biochemical equilibrium in body of broiler chickens during growth. Proteins are the main plastic structural material, which dictate tissue growth and regeneration. However, adding feed additives having the potential to increase protein quality of broilers diets will have a large effect on health and production performance.

Whey powder has one of the high digestibility coefficients relative to other sources of protein. It includes quickly metabolized proteins such as lactalbumin and whey protein, which make it is easier for amino acids to be absorbed into the blood plasma and transported to muscles. Furthermore, the lactoferrin found in whey powder can bolster immune system operation and demonstrate anti-oxidative and antibacterial characteristics so as to mitigate the impact of stress factor [6-7].

Diet inclusion of whey powder improved growth performance, feed efficiency, as well as blood biochemistry for broilers chickens based on the results. These adaptations maintain metabolic homeostasis while coordinating the activities of various physiologic systems [8].

One of the many benefits of whey powder is that it can help the body use other dietary proteins more efficiently. Furthermore, the proportion of essential amino acids found in whey powder (such as lysine, methionine, threonine, and valine) promotes protein synthesis and energy metabolism in tissues. Considering these results, the optimum inclusion level of whey powder in broiler diets is assumed between 40–80 mg/kg body weight

2. Materials and Methods

The experiment was carried out during 42 days at the poultry laboratory of Samarkand State University of Veterinary Medicine, Livestock and Biotechnology. One day-aged 100 Cobb-500 X broiler chicks were used in the experiment. The chicks were randomly allocated into 4 group as follows:

Group 1 – control group (no whey powder supplementation),

Group 2 – diet supplemented with 40 mg/kg of whey powder (WP),

Group 3 – diet supplemented with 60 mg/kg of WP,

Group 4 – diet supplemented with 80 mg/kg of WP.

A basal diet composed of Soybean meal, Corn and Fish meal was offered to all the birds. The diet was also fortified with vitamin and mineral premixes. The experimental mice of all groups were maintained on ad libitum feed and drinking water throughout the study.

Five chicks per group were randomly selected for biochemical analysis and blood samples from the vena brachialis. Total protein (biuret method), albumin (bromocresol green method), glucose was measured in blood plasma using the glucose oxidase–peroxidase method, while cholesterol and triglycerides were analysed

spectrophotometrically by enzymatic methods. Enzyme activities of AST and ALT were determined as well.

Heart rate, respiration and body temperature values were determined every 14 days using the VetTest 8008 analyzer. Statistical analysis was performed using Statistica 10.0 software and differences were considered significant at $P \leq 0.05$.

3. Result and Discussion

Results analysis showed significant differences among the four whey powder groups in physiological and biochemical variables measured. Specifically, total blood protein and albumin levels in broiler chicks of group 3 (60 mg/kg WP) were increased by 9.3% and 6.5%, respectively, as compared to the control group, showing significant improvement of protein metabolism [9-10].

Liver enzyme (AST and ALT) activity in groups supplemented with whey powder stayed within the physiological range and was 8–10% lower than that of the control group. It may imply better detoxification technology inside the liver cells, and liver well-function [11].

The level of blood glucose was 4.72mmol/L in the control group, and 5.05 mmol/L in Group3, which provided a favorable condition for energy metabolism. Meanwhile, the lowered contents of serum cholesterol and triglyceride indicated that lipid metabolism in experimental groups was steady [12-13].

Physiological measurements indicated that heart rate was lower by 3 to 4 beats per min and there were no differences for the respiratory frequency in the whey powder–supplemented groups. Average rectal body temperature was 41.9°C in the control group and slightly lower (41.6°C) in Group3. These slight variations might mean in the heat homeostasis regulation and stress resistance of broiler chicks supplemented with whey powder [14-15].

The combined analyses of the results prove that supplementation with whey powder at an optimal dose (in particular, 60 mg/kg) contributes to preservation of metabolic balance and stability of physiological systems. It was observed to have beneficial effects on growth performance and body weight gain of broiler chickens.

Results

Dietary supplementation of broiler feed with whey powder in the dose of 60 mg/kg led to elevation of total protein and albumins, thus initiating synthesis processes and metabolism.

1. Decreased levels of liver enzymes (AST and ALT) demonstrate increased detoxification.
2. Both glucose and lipid biomarkers were still in normal physiological levels, reflecting efficient energy homeostasis.
3. Physiological stability is supported by the normal heart rate, body temperature, and respiratory rate.
4. Optimal whey powder supplementation (60 mg/kg) maintains physiological and biochemical homeostasis in broiler chickens, which implies a scientific basis for optimizing productivity and meat quality.

4. Conclusion

Whey powder is considered as aneco-friendly, high-biological-value source of protein and has important scientific values and practical implications in the poultry industry. Results of the present study confirmed that diet containing whey powder at 60 mg/kg enhance physiological and biochemical stability in broiler chickens, activates protein metabolism, provides support for immune function and augment liver activity.

Therefore, it can be suggested that this supplement has an effective role in improving growth performance and productive performance of broiler chickens.

In addition, the observed results serve as a science-based rationale to produce domestic environmental friendly biological feed additives from local processed dairy industry by-products supporting import substitution and sustainable poultry farming.

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