Annual Methodological Archive Research Review
http://amresearchreview.com/index.php/Journal/about
Volume 3, Issue 9 (2025)

Online ISSN 3007-3197
Print ISSN 3007-3189

http://amresearchreview.com/index.php/Journal/about

EFFECT OF DIETARY PROBIOTICS ON GROWTH AND HEMATOLOGY OF BROILER CHICKEN

Shayan Jamil
Department of Zoology, Kohat University of Science and Technology, Kohat, KP, Pakistan
Email: shayanafd212@gmail.com

Muhammad Rauf (Corresponding Author)
Department of Zoology, Kohat University of Science and Technology, Kohat, KP, Pakistan
Email: zoologistonline@gmail.com

Shehzad Zareen (Corresponding Author)
Department of Zoology, Kohat University of Science and Technology, Kohat, KP, Pakistan
Email: shehzadzareen1@kust.edu.pk

Sana Ullah
Department of Zoology, Kohat University of Science and Technology, Kohat, KP, Pakistan
Email: usana7172@gmail.com

ABSTRACT

The poultry industry during the past two decades has been one of the most dynamic and ever-expanding sectors in the world. It helps to fill the gap between the requirement and availability of high-quality protein for human consumption. The demand for a higher and safer protein source, free of infectious agents, is increasing. This study aimed to investigate the effects of dietary probiotics on the growth performance, organ development, and hematological markers of broiler chickens. Four treatment groups were established: a control group received no probiotics, and three experimental groups received probiotics at doses of 100 mg/L, 300 mg/L, and 500 mg/L, respectively. Throughout the 22-day trial, measurements were made of body weight, morphometric lengths, organ weights (liver, heart, lung, and gizzard), and significant hematological parameters (RBC, Hb, PLT, and WBC). The findings demonstrated a dose-dependent improvement in body weight and organ development, with the most significant gains observed in the 500 mg/L group. Furthermore, when probiotic doses increased, morphometric measurements such as organ and body lengths continuously improved. The RBC and Hb levels in the 300 mg/L group remained relatively constant, suggesting that this would be the optimal dose for supporting both development and physiological health. Hematological analysis showed different reactions. These results indicate that probiotic supplementation,

Annual Methodological Archive Research Review
http://amresearchreview.com/index.php/Journal/about
Volume 3, Issue 9 (2025)

Online ISSN 3007-3197
Print ISSN 3007-3189
http://amresearchreview.com/index.php/Journal/about

particularly at levels of 300–500 mg/L, may be a helpful strategy to enhance broiler performance. The study emphasizes the importance of balanced dosing to prevent potential hematological abnormalities. This work contributes to the growing body of research showing that probiotics are a natural growth promoter for chickens.

Keywords: Broiler chicken, probiotics, growth performance, organ weight, hematology, poultry health.

INTRODUCTION

The poultry industry during the past two decades has been one of the most dynamic and ever-expanding sectors in the world (Narrod et al., 2007). It helps to fill the gap between the requirement and availability of high-quality protein for human consumption (Wu et al., 2014). The demand for a higher and safer protein source, free of infectious agents, is increasing (Henchion et al., 2017). However, during intensive growth, the poultry industry has constantly been confronted with challenges in the form of various diseases (Hafez & Attia, 2020). Among these conditions, the significant economic losses are due to infectious diseases, which could be caused by viruses, bacteria, fungi, protozoa, and the cost of preventive medication (Fonkwo, 2008). This led to increased use of antibiotics in the poultry industry for therapeutic, prophylactic, and growth promotion purposes (Rahman et al., 2022). The presence of antibiotic residues in poultry meat and eggs may have deleterious effects on human consumers (Mund et al., 2017). Probiotics are being considered to fill this gap, and already some farmers are using them in preference to antibiotics (Leistikow et al., 2022).

However, the extensive and negligent use of antibiotics in livestock feed has resulted in serious public health problems (Lee et al., 2001). Antimicrobial resistance (AMR) in dangerous bacteria and the potential transfer of resistant genes from animals to humans are currently major global concerns (Ferri et al., 2017). In response to these concerns, many countries have banned or severely limited the use of antibiotics in chicken production. As a result, there is an increasing demand for safe and sustainable alternatives that may maintain or even boost broiler productivity without compromising food safety or animal welfare (Haque et al., 2020).

Over the years, the word probiotic has been used in several different ways. It was initially used to describe substances produced by one protozoan that were stimulated by another (Huang et al., 2004). However, it was later used to describe animal feed supplements that had a beneficial effect on the host animal by affecting its gut flora (Rodriguez et al., 2007). Crawford defined probiotics as “a culture of specific living micro-organisms (primarily Lactobacillus spp.) which implants in the animal to ensure the effective establishment of intestinal populations of both beneficial and pathogenic organisms (Rahman et al., 2004).

The first investigator in the area of fermentation and probiotics was Elie Metchnikoff, who worked at the Pasteur Institute in Paris. He reported the existence of increased human longevity among Bulgarian peasants who drank large amounts of soured milk. This strengthened Metchnikoff's belief that the lower gut and overall health would be affected by microbes from the soured milk. Following this realization, he tested cultures of milk that were fermented by the Lactobacillus genus. For

Annual Methodological Archive Research Review
http://amresearchreview.com/index.php/Journal/about
Volume 3, Issue 9 (2025)

Online ISSN 3007-3197
Print ISSN 3007-3189
http://amresearchreview.com/index.php/Journal/about

instance, Lactobacillus bulgaricus later became the strain popular for fermenting yoghurt. Furthermore, scientific experts concluded that properties, benefits and purposes of identified probiotics are individualized and specific to each strain. Also, unique strains ingested by the host have induced effects, which may cause other reactions in the body. For instance, Bifidobacterium can release metabolic end products, such as acetate and lactate. This can decrease both gram-positive and gram-negative pathogenic microbes. More research needs to be completed to learn about the metabolic effects induced by bacteria such as Bifidobacterium. Sources of probiotics vary, but they can be isolated from milk, fermented foods, faeces or the gut microbiota of different animals. The two primary sources of probiotics isolated from traditional fermented products are species of lactic acid bacteria and Bifidobacterium, but many other probiotic sources can be identified and used commercially. Species of lactic acid bacteria have become popular for human, animal and poultry use because they can improve the ability to digest lactose if the individual is lactose-intolerant. These lactic acid species have other proposed benefits, but none have been thoroughly proven. Still, suggested benefits include the prevention of certain cancers, decreased intestinal infections and decreasing serum cholesterol levels (Abd El-Hack et al., 2020).

Probiotic nutritional supplements have been linked to superior growth performance in broiler chickens (Bai et al., 2013). As demonstrated by greater survival rates, better feed conversion ratios (FCR), and increased body weight gain, according to numerous studies (Mengistu et al., 2020). Additionally, by improving gut architecture and barrier function, probiotics have been demonstrated to lower the occurrence of gastrointestinal illnesses, including necrotic enteritis (Obianwuna et al., 2023).

Probiotics have an impact on hematological parameters, which are important markers of the physiological, metabolic, and immunological health of poultry, in addition to their impacts on growth (Żbikowski et al., 2020). Hematological profiles—comprising red blood cells (RBCs), white blood cells (WBCs), hemoglobin (Hb), packed cell volume (PCV), and differential leukocyte counts—are commonly used to measure the health and stress levels of chickens in response to food and environmental changes. Higher WBCs imply improved immune function, while higher RBCs and Hb, for instance, and indicate improved oxygen-carrying ability and general vitality (Obeagu et al., 2024). Probiotics have been shown to have a positive impact on these metrics, most likely as a result of their ability to lower oxidative stress and boost systemic immunity (Feng et al., 2020).

Despite the growing body of research on the use of probiotics in poultry worldwide, few studies have been carried out locally, especially in developing countries where specific environmental, genetic, and managerial characteristics are present. By investigating the impact of dietary probiotics on the hematological parameters and growth performance of broiler chickens, this study aims to close that gap. The study's findings will help the growing trend to raise chickens without the use of antibiotics. They may provide helpful guidance to chicken producers who want to employ probiotic-based feeding methods.

Because of the emergence of antimicrobial resistance, the abuse of antibiotics in chicken feed has sparked worries about public health. Finding and validating efficient substitutes is crucial given the increasing regulatory constraints and consumer demand

Annual Methodological Archive Research Review
http://amresearchreview.com/index.php/Journal/about
Volume 3, Issue 9 (2025)

Online ISSN 3007-3197
Print ISSN 3007-3189

http://amresearchreview.com/index.php/Journal/about

for poultry products free of antibiotics. Although there is evidence to support the use of probiotics in poultry, further research is necessary to discover the best way to use them due to variability in probiotic strains, doses, and combinations. Furthermore, the need for this research is highlighted by the paucity of local studies on the effects of dietary probiotics on the hematological parameters and growth performance of broiler chickens.

Objectives of the Study

To evaluate the effect of dietary probiotics on the growth performance (weight gain, feed intake) of broiler chickens.

To assess the impact of probiotics on hematological parameters such as RBC, WBC, Hb, and PCV in broiler chickens.

MATERIALS AND METHODS

Introduction

This chapter outlines the methodology used to assess how dietary probiotics affect the hematological parameters and growth performance of broiler chickens. Data collection, statistical analysis, feed formulation, bird management, and experimental design are all covered.

Sample Collection

A total of 25 one-day-old chicks were collected from the poultry farm in District Peshawar and brought to the laboratory. Acclimatization was conducted at the laboratory of the Department of Zoology, KUST. Sterilized cages were used. All 25 one-day-old chicks were vaccinated on the same day.

Experimental Site

The study was carried out in a laboratory. The establishment offered a regulated setting ideal for experimentation and broiler rearing.



Annual Methodological Archive Research Review
http://amresearchreview.com/index.php/Journal/about
Volume 3, Issue 9 (2025)

Online ISSN 3007-3197
Print ISSN 3007-3189

http://amresearchreview.com/index.php/Journal/about

Figure 1: Dietary supplementation of **Probiotic to Broiler Chickens**

Probiotic Supplementation

Probiotic formulations that are sold commercially were employed. The strains and inclusion rates were determined using literature support and manufacturer recommendations.

Housing and Management

The chicks were raised in deep litter enclosures with comparable sanitary and environmental settings. Lighting, ventilation, humidity, and temperature all adhered to accepted management procedures. Water and food were available to birds at all times.

Diet Preparation

A probiotic named Actiflor containing S .boulardii (fungus) was bought from Umer Pharmacy, Peshawar.

Three types of solution (w/v) with different concentrations of 100 mg/litre, 300 mg/litre and 500 mg/litre, respectively, were prepared in three different bottles.

Experimental Birds and Design

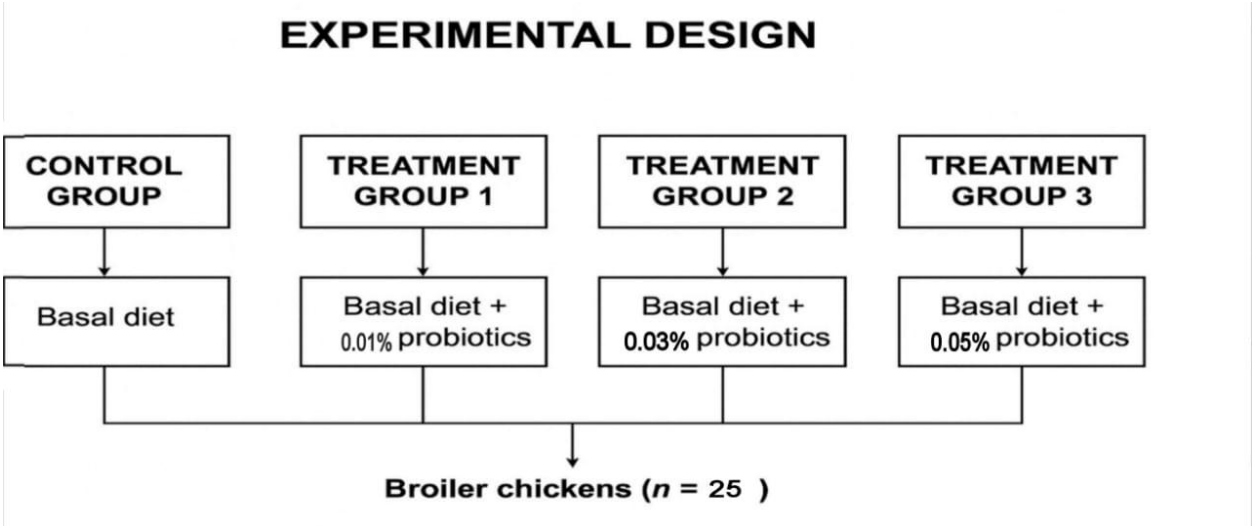


Figure 2: Experimental design for probiotic supplementation to broiler chickens

The following dietary groups were assigned to the birds:

- T0 (Control): Probiotic-free basal diet.
- T1: 100mg/l + basal diet.
- T2: 300mg/l + basal diet.
- T3: 500mg/l + basal diet.

Rearing

The four groups of broiler chicks were reared for 22 days at the Zoology Department, KUST. Feed was provided 24 hours.

Annual Methodological Archive Research Review
http://amresearchreview.com/index.php/Journal/about
Volume 3, Issue 9 (2025)

Online ISSN 3007-3197
Print ISSN 3007-3189

http://amresearchreview.com/index.php/Journal/about

Dissection and Morphometry

After 22 days of the feeding trial, twelve broilers (03 from each of the four groups) were euthanized, dissected, and different organs were measured and weighed.

Figure 3A: Dissection of Broiler chicken



Figure 3B:



Morphometricanalysis

Analysis of Blood Profile

The blood samples for hematological parameters were collected into well-labelled and sterilized bottles containing ethylenediaminetetraacetic acid (EDTA) as an anticoagulant.

The samples were investigated for hematological parameters.

Blood was drawn from the wing veins of randomly chosen birds (n = 3) per treatment group) at the conclusion of the trial. Red blood cells (RBCs) and white blood cells (WBCs) were measured in blood.

The following are measured:

RBC concentration,

WBC concentration,

Mean corpuscular haemoglobin (MCH),

Packed cell volume (PCV),

Annual Methodological Archive Research Review
http://amresearchreview.com/index.php/Journal/about
Volume 3, Issue 9 (2025)

Online ISSN 3007-3197
Print ISSN 3007-3189

http://amresearchreview.com/index.php/Journal/about

And haemoglobin (Hb).



Figure 4: Collection of Blood Samples

Growth Performance Parameters
Data on body weight increase (kg),
Data on organ weight increase (g),
Statistical Analysis
SPSS and Excel comparable statistical software was used to examine the data. The mean ± standard deviation (SD) was used to express the results.

Ethical Considerations
The Institutional Animal Care and Use Committee's ethical guidelines (IACUC) were adhered to in all experimental procedures.

RESULTS
The findings of the study on the impact of dietary probiotics on the hematological parameters and growth performance of broiler chickens are presented in this chapter. The results are analyzed and presented in the context of previous research.

Growth Performance and Organ Weights
For all experimental groups, including the control group and those supplemented with 100 mg/L, 300 mg/L, and 500 mg/L of probiotics, the weights of the broilers' bodies, hearts, lungs, gizzards, and livers were measured.

Table 1: Effect of Probiotic Concentration on Growth and Organ Weights in Broilers

Group	Body Weight (Kg) ± SD (% WG)	Heart Weight (g) ± SD (% WG)	Lung Weight (g) ± SD (% WG)	Gizzard Weight (g) ± SD (% WG)	Liver Weight (g) ± SD (% WG)

Annual Methodological Archive Research Review
http://amresearchreview.com/index.php/Journal/about
Volume 3, Issue 9 (2025)

Online ISSN 3007-3197
Print ISSN 3007-3189

http://amresearchreview.com/index.php/Journal/about

Control	0.79 ± 0.015	4.68 ± 0.63	4.10 ± 0.22	24.61 ± 0.29	26.0 ± 1.98
100 mg/L	0.92 ± 0.07 (16.45%)	5.25 ± 0.13 (13.88%)	4.38 ± 0.38 (6.82%)	25.12 ± 1.27 (2.03%)	31.13 ± 2.15 (19.27%)
300 mg/L	1.03 ± 0.06 (30.37%)	5.81 ± 0.37 (26.03%)	4.98 ± 0.11 (21.46%)	25.88 ± 0.31 (30.89%)	31.78 ± 2.40 (21.76%)
500 mg/L	1.05 ± 0.08 (32.91%)	6.81 ± 0.21 (47.72%)	5.23 ± 0.32 (27.56%)	26.21 ± 1.38 (40.24%)	32.15 ± 1.75 (23.18%)

% Weight Gain (WG) values were calculated after comparison with the control group. Data is presented as Mean ± SD (n = 3)

Supplementation with probiotics resulted in a dose-dependent increase in body weight and relative organ weights of broiler chickens compared to the control group. At 100 mg/L, moderate improvements were observed, whereas 300 mg/L and 500 mg/L supplementation produced significant increases. The highest response was recorded at 500 mg/L, with body weight increased by 32.91%, heart weight by 47.72%, lung weight by 27.56%, gizzard weight by 40.24%, and liver weight by 23.18%**.** These results indicate that probiotic supplementation, particularly at higher concentrations, enhances growth performance and organ development in broilers.

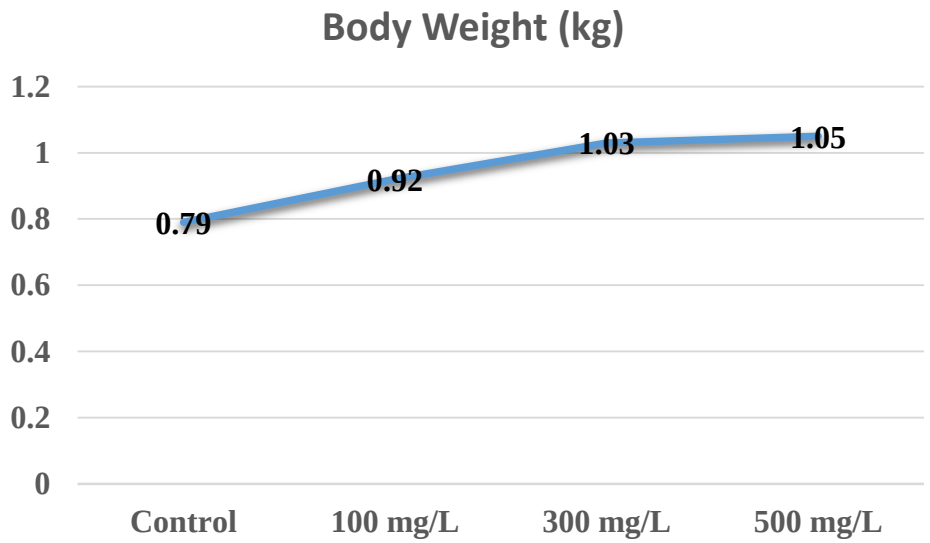


Figure 5: Effect of probiotic supplementation on body weight (kg) of broiler chickens.

The body weight of broiler chickens showed a progressive improvement with increasing levels of probiotic supplementation. In the control group, the average body weight was 0.79 kg, while supplementation at 100 mg/L increased the weight to 0.92 kg (16.45% increase). A further rise was recorded at 300 mg/L, where body weight reached 1.03 kg (30.37% increase). The highest weight was observed at 500 mg/L, measuring 1.05 kg, which corresponds to a 32.91% improvement over the control group. These findings indicate that probiotic supplementation exerts a positive effect

Annual Methodological Archive Research Review
http://amresearchreview.com/index.php/Journal/about
Volume 3, Issue 9 (2025)

Online ISSN 3007-3197
Print ISSN 3007-3189

http://amresearchreview.com/index.php/Journal/about

on the growth performance of broilers. The trend suggests a dose-dependent response, with the most pronounced improvement occurring at 500 mg/L. However, the difference between 300 mg/L (1.03 kg) and 500 mg/L (1.05 kg) was relatively small, indicating that the growth-promoting effect may approach a plateau at higher doses.

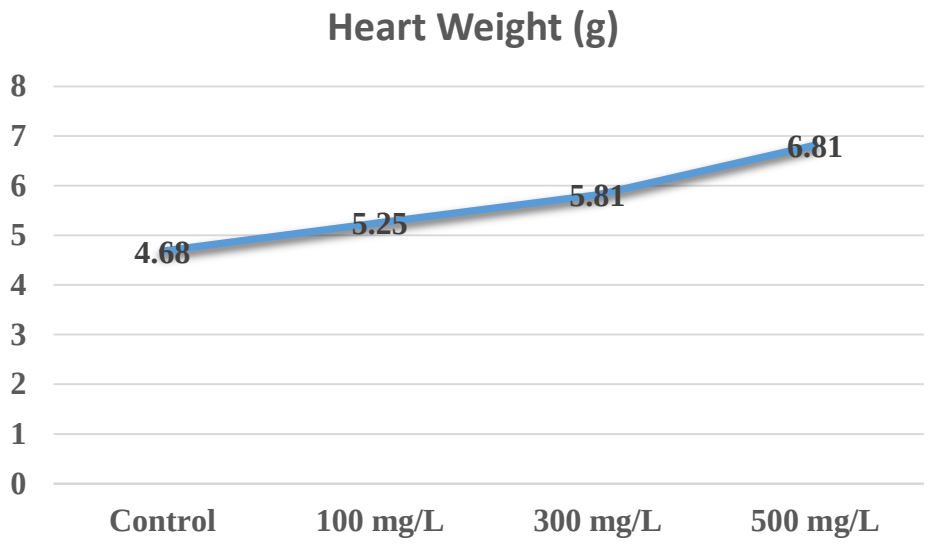


Figure 6: Effect of probiotic supplementation on heart weight (g) of broiler chickens

The heart weight of broiler chickens showed a gradual and consistent increase with probiotic supplementation. In the control group, the average heart weight was 4.68 g. When supplemented with 100 mg/L probiotics, the heart weight slightly increased to 5.25 g (13.88% increase). A more noticeable rise was observed at 300 mg/L, where heart weight reached 5.81 g (26.03% increase). The maximum weight was recorded at 500 mg/L, with a value of 6.81 g, corresponding to a 47.72% improvement over the control group. This trend suggests a dose-dependent effect, with higher concentrations of probiotics exerting a more substantial impact on heart development. The continuous rise from control to 500 mg/L indicates that probiotic supplementation enhanced not only growth performance but also cardiac development, possibly due to improved nutrient absorption and better physiological efficiency.

Annual Methodological Archive Research Review
http://amresearchreview.com/index.php/Journal/about
Volume 3, Issue 9 (2025)

Online ISSN 3007-3197
Print ISSN 3007-3189

http://amresearchreview.com/index.php/Journal/about

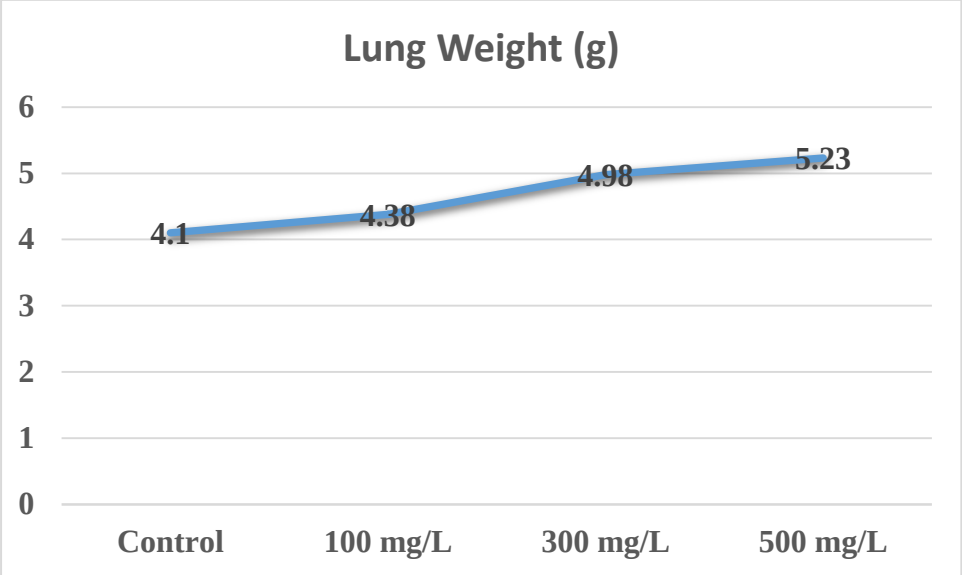


Figure 7: Effect of probiotic supplementation on lung weight (g) of broiler chickens.

The lung weight of broiler chickens showed a consistent increase with rising levels of probiotic supplementation. In the control group, the mean lung weight was 4.10 g. With 100 mg/L probiotics, the value slightly increased to 4.38 g (6.82% increase). At 300 mg/L, lung weight rose further to 4.98 g (21.46% increase). The highest value was recorded at 500 mg/L, where lung weight reached 5.23 g, representing a 27.56% increase compared to the control group. This upward trend demonstrates that probiotic supplementation had a dose-dependent effect on lung development. The continuous improvement suggests that probiotics may enhance respiratory efficiency and overall physiological growth by improving gut health, nutrient absorption, and metabolic functions. Although the increase from 300 mg/L to 500 mg/L was more prominent than lower doses, the results also indicate that lung growth—like body and heart weight—responds positively to higher probiotic concentrations.

Annual Methodological Archive Research Review
http://amresearchreview.com/index.php/Journal/about
Volume 3, Issue 9 (2025)

Online ISSN 3007-3197
Print ISSN 3007-3189

http://amresearchreview.com/index.php/Journal/about

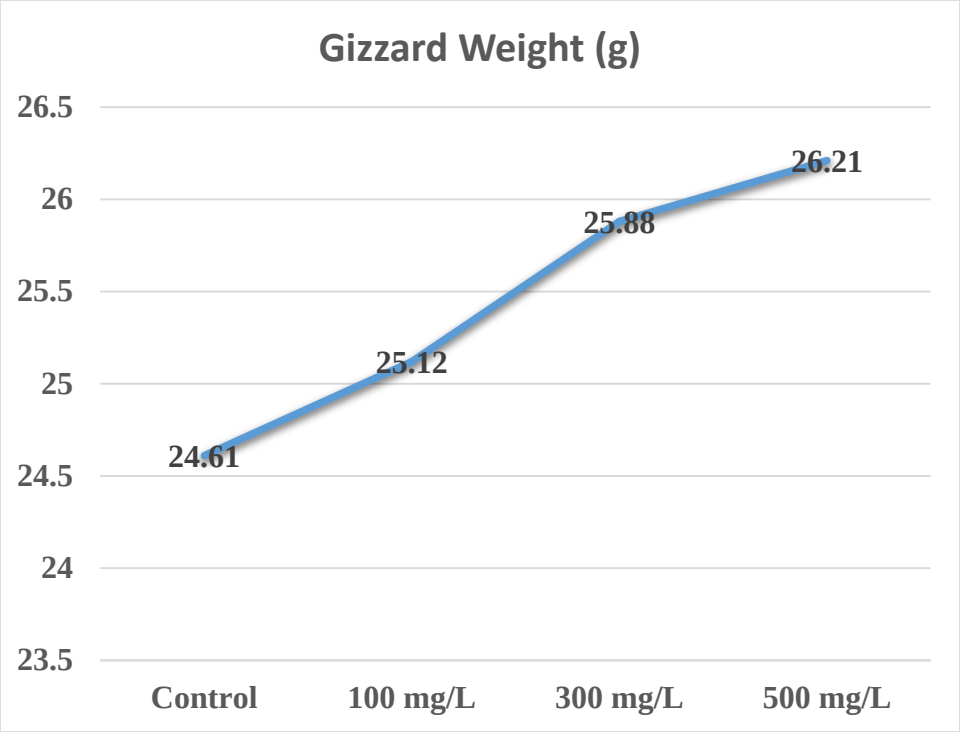


Figure 8: Effect of probiotic supplementation on gizzard weight (g) of broiler chickens

The graph presents the influence of varying treatment concentrations on gizzard weight. The control group exhibited the lowest mean gizzard weight (24.61 g), which was taken as the baseline reference. A slight but measurable increase was observed at 100 mg/l (25.12 g). At 300 mg/l, the gizzard weight increased further to 25.88 g, while the highest mean value was recorded at 500 mg/l (26.21 g). The results demonstrate a clear **dose-dependent trend**, in which gizzard weight rises progressively with increasing treatment concentration. This pattern strongly suggests that the treatment has a positive effect on gizzard growth and development. Such effects may be attributed to enhanced muscular activity, improved nutrient utilization, or stimulation of digestive function. Overall, the findings indicate that the treatment significantly enhances gizzard weight compared to the untreated control group, supporting its potential role in improving digestive organ development.

Annual Methodological Archive Research Review
http://amresearchreview.com/index.php/Journal/about
Volume 3, Issue 9 (2025)

Online ISSN 3007-3197
Print ISSN 3007-3189

http://amresearchreview.com/index.php/Journal/about

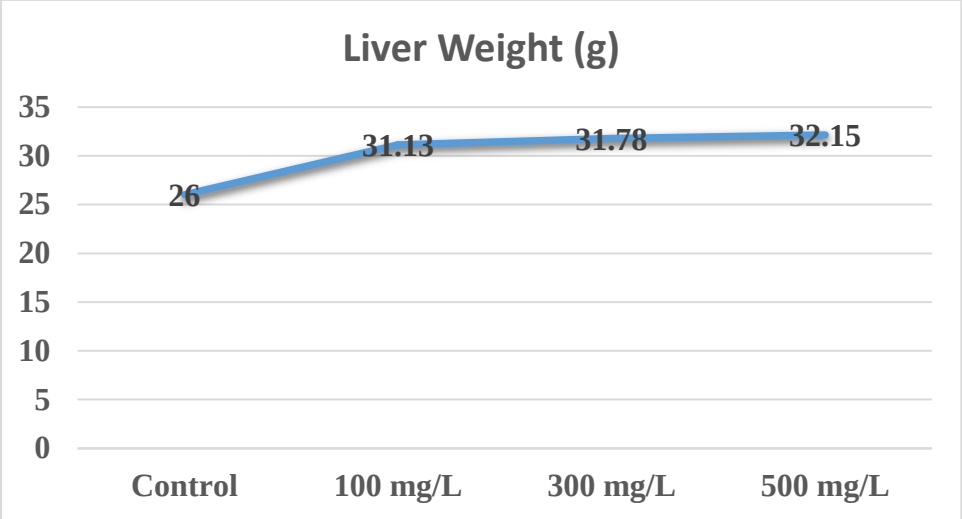


Figure 9: Effect of probiotic supplementation on liver weight (g) of broiler chickens

The graph illustrates the effect of different treatment concentrations on liver weight. The control group exhibited the lowest mean liver weight (26.0 g). A slight increase was observed at 100 mg/l (31.13 g), followed by a further rise at 300 mg/l (31.78 g). The maximum liver weight was recorded at 500 mg/l (32.15 g). The data demonstrate a clear dose-dependent response, as liver weight progressively increased with higher treatment concentrations. This suggests that the treatment exerts a positive influence on liver growth and development, possibly by enhancing metabolic activity or stimulating protein synthesis. Overall, the findings indicate that the treatment significantly improves liver weight compared to the control group, highlighting its potential role in supporting the physiological and metabolic functions of the liver.

Morphometric Parameters

To evaluate the broilers' morphometric growth, measurements of their body length, heart length, lung length, gizzard length, and liver length were taken.

Table 2: Effect of Probiotic Concentration on Morphometric Parameters of Broilers

Group	Body Length (cm) ± SD (% LG)	Heart Length (cm) ± SD (% LG)	Lung Length (cm) ± SD (% LG)	Gizzard Length (cm) ± SD (% LG)	Liver Length (cm) ± SD (% LG)
Control	13.23 ± 0.21	2.81 ± 0.43	2.51 ± 0.26	3.92 ± 0.32	5.91 ± 0.05
100 mg/L	14.18 ± 0.03 (7.18%)	2.93 ± 0.48 (4.27%)	2.62 ± 0.24 (4.38%)	4.31 ± 0.47 (9.94%)	6.12 ± 0.22 (3.55%)

Annual Methodological Archive Research Review
http://amresearchreview.com/index.php/Journal/about
Volume 3, Issue 9 (2025)

Online ISSN 3007-3197
Print ISSN 3007-3189

http://amresearchreview.com/index.php/Journal/about

300 mg/L	15.25 ± 0.18 (15.26%)	3.41 ± 0.13 (11.74%)	2.81 ± 0.11 (11.95%)	4.90 ± 0.01 (25.51%)	6.51 ± 0.42 (10.15%)
500 mg/L	15.40 ± 0.82 (16.40%)	4.12 ± 0.40 (46.61%)	3.21 ± 0.04 (27.88%)	5.32 ± 0.08 (35.71%)	7.21 ± 0.01 (21.82%)

% length gain (LG) values were calculated after comparison with the control group. Data is presented as Mean ± SD (n = 3)

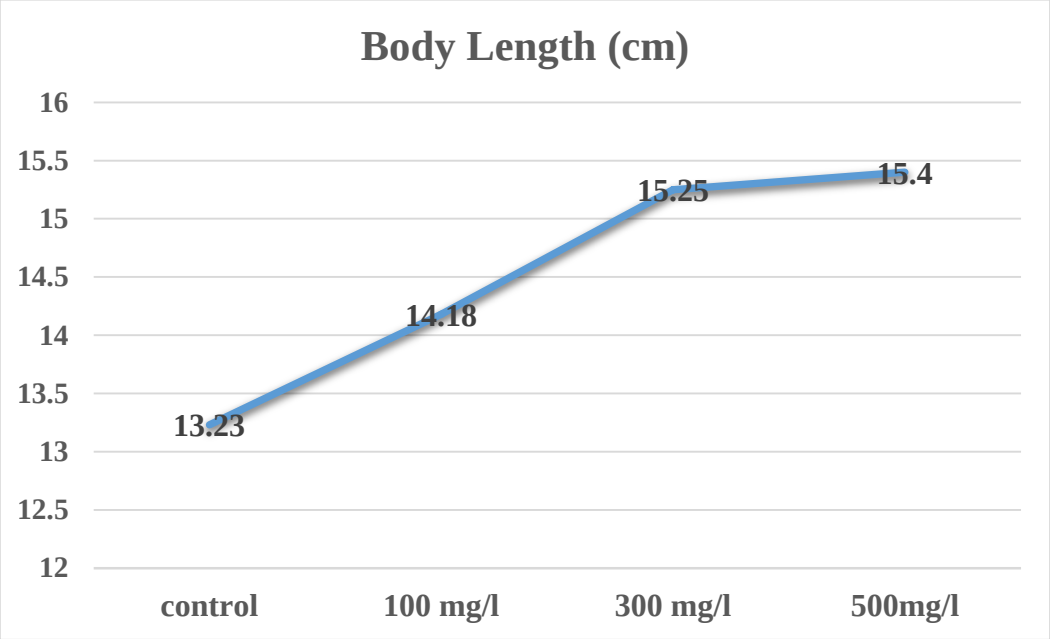


Figure 10: Effect of probiotic supplementation on body length (cm) of broiler chickens

The study revealed a clear influence of treatment concentration on body length. In the control group, the mean body length was the lowest (13.23 cm). With the introduction of treatment at 100 mg/L, body length increased to 14.18 cm, showing a positive growth response. A further increase was observed at 300 mg/L, where body length reached 15.25 cm, marking the most significant growth improvement compared to control and 100 mg/L groups. At the highest concentration of 500 mg/L, body length slightly increased to 15.40 cm. However, the difference between 300 mg/L and 500 mg/L was minimal, suggesting that growth tends to plateau at higher concentrations. Overall, the findings indicate that treatment promotes growth in body length up to an optimal level, after which additional concentrations do not produce proportionally greater effects.

Annual Methodological Archive Research Review
http://amresearchreview.com/index.php/Journal/about
Volume 3, Issue 9 (2025)

Online ISSN 3007-3197
Print ISSN 3007-3189

http://amresearchreview.com/index.php/Journal/about

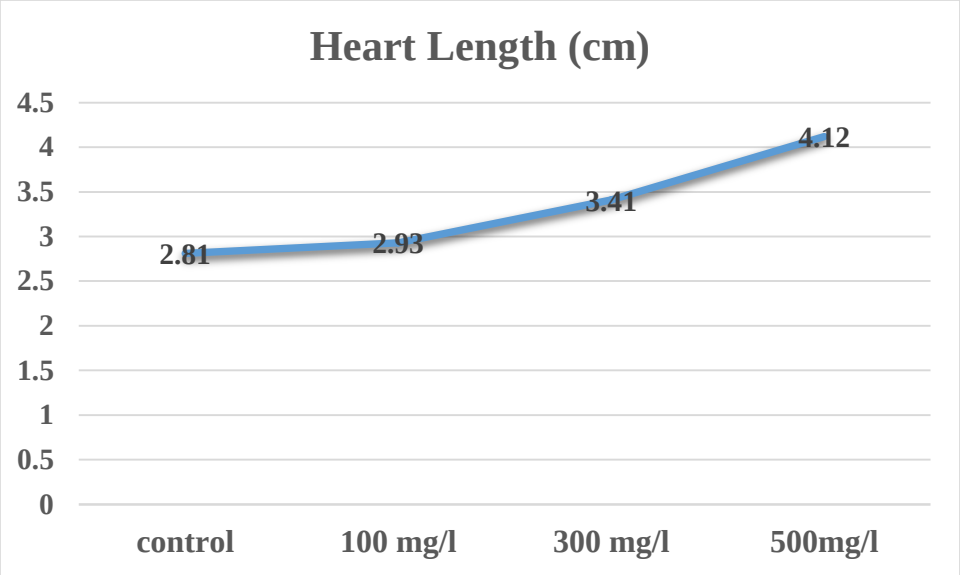


Figure 11: Effect of probiotic supplementation on Heart length (cm) of broiler chickens

The graphical representation clearly shows a progressive increase in the measured parameter with increasing treatment concentrations when compared to the control. The control group exhibited the lowest value (2.81). A slight elevation was observed at 100 mg/L (2.93), indicating only a marginal effect at this dose. At 300 mg/L, the value increased more distinctly to 3.41, showing a stronger response. The maximum value was recorded at 500 mg/L (4.12), which represents the highest stimulatory effect among all the treatments. Overall, the findings demonstrate a dose-dependent relationship, where higher concentrations consistently produced greater responses. This trend suggests that the treatment exerts a positive and concentration-dependent effect on the studied parameter.

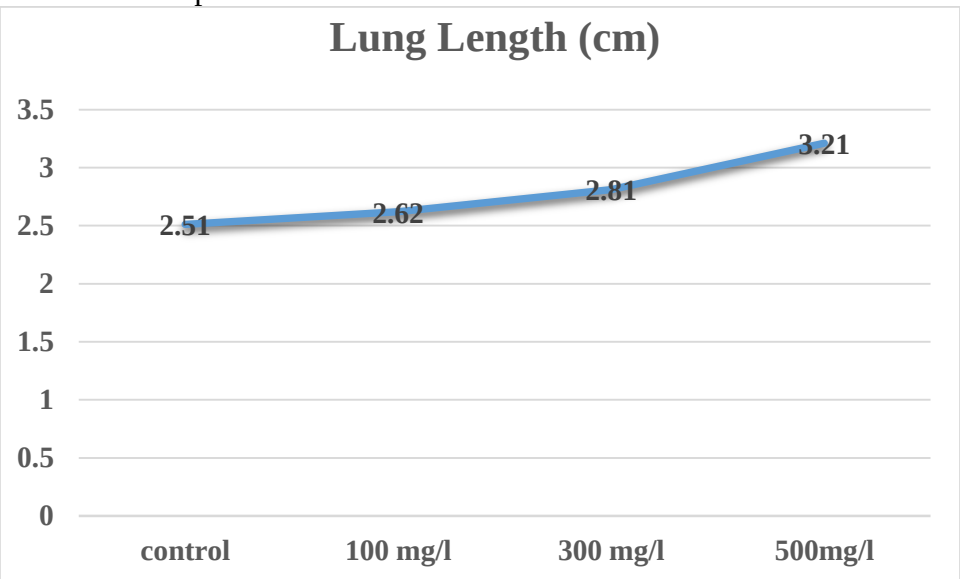


Figure 12: Effect of probiotic supplementation on lung length (cm) of broiler chickens

Annual Methodological Archive Research Review
http://amresearchreview.com/index.php/Journal/about
Volume 3, Issue 9 (2025)

Online ISSN 3007-3197
Print ISSN 3007-3189

http://amresearchreview.com/index.php/Journal/about

The effect of different concentrations of treatment on lung length is presented in the graph. The control group exhibited the lowest lung length measurement (2.51 cm). At 100 mg/L, a slight increase was observed (2.62 cm), suggesting a minimal effect at lower concentration. A more noticeable increase occurred at 300 mg/L, where the lung length reached 2.81 cm. The maximum length was recorded at 500 mg/L (3.21 cm), indicating the strongest effect among all tested groups. Overall, the results clearly demonstrate a dose-dependent increase in lung length, with higher concentrations consistently promoting greater growth. This indicates a positive correlation between treatment concentration and lung development.

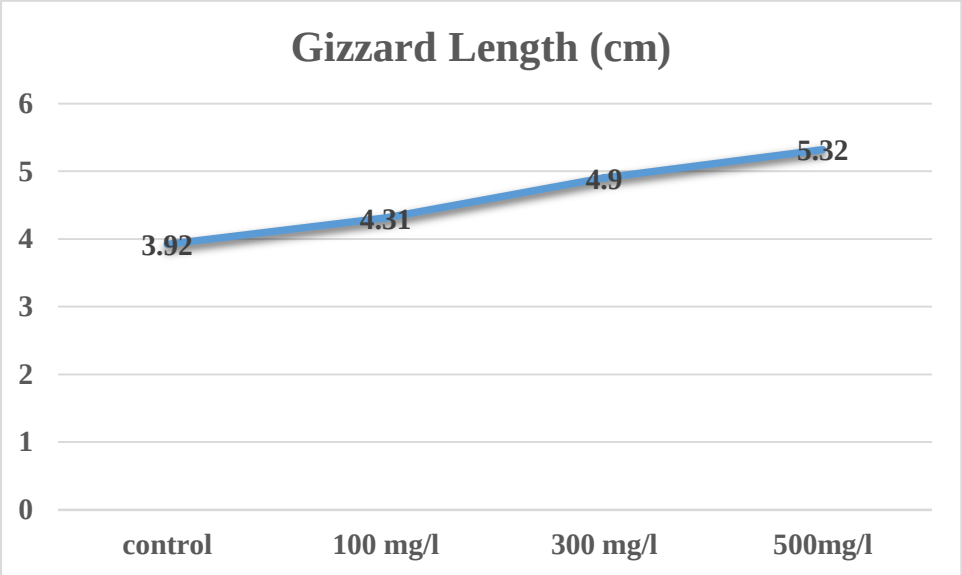


Figure 13: Effect of probiotic supplementation on gizzard length (cm) of broiler chickens

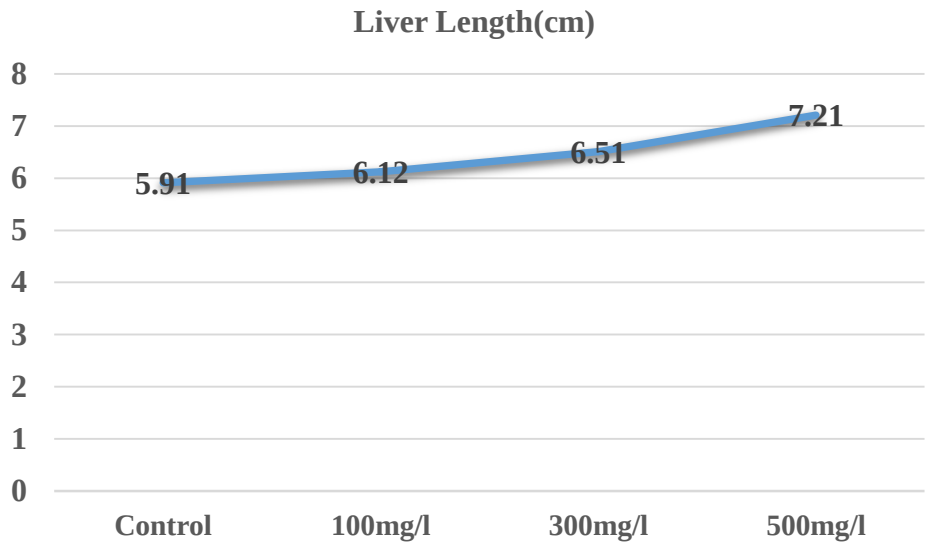
The graph illustrates the effect of different treatment concentrations on gizzard length in broilers. The control group recorded the lowest gizzard length (3.92 cm). A gradual increase was observed with higher treatment doses, where 100 mg/l increased the length to 4.31 cm, 300 mg/l further enhanced it to 4.90 cm, and the maximum value was recorded at 500 mg/l with 5.32 cm. This progressive increase suggests a dose-dependent effect, indicating that dietary supplementation positively influenced gizzard development. The findings highlight the potential role of treatments in promoting digestive organ growth, which may ultimately improve feed utilization and overall performance of broilers.

Annual Methodological Archive Research Review
http://amresearchreview.com/index.php/Journal/about
Volume 3, Issue 9 (2025)

Online ISSN 3007-3197
Print ISSN 3007-3189

http://amresearchreview.com/index.php/Journal/about

Figure 14: Effect of probiotic supplementation on liver length (cm) of broiler



chickens

The effect of different concentrations of treatment on liver length is shown in the figure. The control group exhibited the smallest liver length (5.91 cm). At 100 mg/L, a slight increase was recorded (6.12 cm). A more noticeable rise occurred at 300 mg/L, where the liver length reached 6.51 cm. The maximum value was observed at 500 mg/L (7.21 cm), representing the highest growth among all groups. Overall, the results reveal a clear dose-dependent increase in liver length, with higher concentrations producing progressively greater responses. The 500 mg/L concentration was the most effective, suggesting a strong positive influence of the treatment on liver growth.

Hematological Parameters

To evaluate the internal physiological health of the broilers, hematological analyses were performed.

Table 3: Hematological Parameters in Broilers across Treatments

Group	RBC ($\times 10^6$/µL)	Hb (g/dL)	PLT ($\times 10^3$/µL)	WBC ($\times 10^3$/µL)
Control	2.38	9.3	37	64.9
100 mg/L	1.35	6.4	26	50.8
300 mg/L	2.41	9.4	12	64.4
500 mg/L	2.21	8.05	14	81.1

Annual Methodological Archive Research Review
http://amresearchreview.com/index.php/Journal/about
Volume 3, Issue 9 (2025)

Online ISSN 3007-3197
Print ISSN 3007-3189

http://amresearchreview.com/index.php/Journal/about

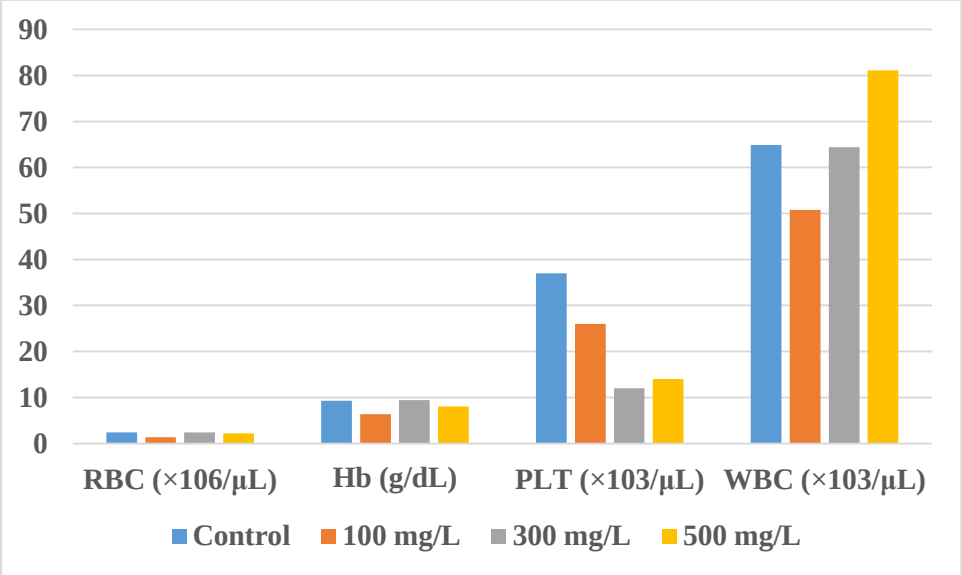


Figure 15: Effect of Dietary Probiotics on Hematological Indexes of Broiler Chickens

The hematological profile showed differential responses under the influence of various treatment concentrations. Red blood cell (RBC) counts remained relatively stable across all groups, with only slight and non-significant variations compared to the control, suggesting that the treatment had little effect on erythropoiesis. Similarly, hemoglobin (Hb) concentrations showed minimal changes between groups, indicating that oxygen-carrying capacity was largely unaffected. In contrast, platelet (PLT) counts showed a clear decreasing pattern with increasing concentrations of treatment. The control group exhibited the highest platelet count, while a gradual reduction was observed at 100 ng/l, 300 mg/l, and 500 mg/l. This reduction may indicate that the treatment exerts a suppressive effect on thrombopoiesis or platelet activity. (WBC) counts demonstrated the most prominent change. The control group showed the lowest WBC count, whereas treatment groups exhibited progressively higher values, with the maximum observed at 500 mg/l. This strong dose-dependent increase suggests that the treatment may enhance immune responses by stimulating leukocyte production, thereby potentially improving the animal's defense mechanism against infections. Overall, the hematological results suggest that while RBC and Hb levels remain unaffected, platelet counts decline and WBC counts rise with increasing concentrations. These findings indicate that the treatment primarily influences immune function and blood cell dynamics rather than oxygen transport.

DISCUSSION

The present study was conducted to evaluate the effect of different concentrations of probiotics on the growth performance, organ development, and hematological parameters of broiler chickens. The results demonstrated a clear dose-dependent response in body weight, organ weights, and body/organ lengths, along with significant alterations in blood parameters, indicating the beneficial role of probiotics in enhancing growth and physiological status.

Annual Methodological Archive Research Review
http://amresearchreview.com/index.php/Journal/about
Volume 3, Issue 9 (2025)

Online ISSN 3007-3197
Print ISSN 3007-3189

http://amresearchreview.com/index.php/Journal/about

The findings revealed that probiotics supplementation improved body weight significantly compared to the control group. At 100 mg/L, the body weight increased moderately (+16.45%), while at 300 mg/L and 500 mg/L, the increases were more pronounced (+30.37% and +32.91%, respectively). This indicates that probiotics enhanced nutrient digestion and absorption, which promoted better weight gain. These results are consistent with previous studies reporting that probiotics improve intestinal microflora balance, reduce pathogenic bacterial load, and thereby enhance feed efficiency and growth performance in broilers by using bacterial species strains of probiotics (Mountzouris et al., 2010).

Organ development is a key indicator of overall health and metabolic activity. In the present study, heart, lung, gizzard, and liver weights increased significantly with probiotic supplementation. The maximum increments were observed in the 500 mg/L group, particularly in heart (+47.72%) and gizzard (+40.24%) weights. Similarly, organ lengths such as gizzard (+35.71%) and liver (+21.82%) showed remarkable improvements at higher concentrations.

The increase in organ weights and lengths may be attributed to enhanced metabolic activity, improved nutrient utilization, and increased enzymatic activity stimulated by probiotics. A well-developed digestive tract ensures better breakdown and assimilation of feed, while improved liver function enhances metabolism and detoxification. Previous reports also confirm that probiotics stimulate organ growth and improve the structural and functional capacity of digestive and metabolic organs (Kabir, 2009).

Hematological values serve as important indicators of physiological and immune status. In this study, RBC and hemoglobin levels were slightly improved at 300 mg/L, suggesting better oxygen transport capacity and overall health status. However, at 100 mg/L, there was a reduction in RBC (1.35×10^6/µL) and Hb (6.4 g/dL), which could be due to initial stress or adaptation response to probiotics.

White blood cell (WBC) counts were significantly elevated in the 500 mg/L group (81.1×10^3/µL), indicating improved immune responsiveness. Probiotics are known to enhance the activity of lymphocytes and macrophages, thereby strengthening the immune system. Platelet counts were reduced at higher doses, which may reflect altered hematopoiesis but remained within acceptable physiological ranges for broilers. These findings align with the work of (Pelicano et al., (2004) and Ashayerizadeh et al., (2009), who reported improved hematological and immune responses in broilers supplemented with probiotics.

The overall growth-promoting and health-enhancing effects observed in this study support previous reports that probiotics act as natural growth promoters by maintaining intestinal microbial balance, and enhancing immune responses. Similar findings have been reported by (Jin et al., (1997) and Kalavathy et al., (2003), who documented improved performance and blood profiles in broilers fed probiotic-supplemented diets.

The discussion highlights that probiotic supplementation has a positive influence on growth performance, organ development, and hematological parameters of broiler chickens. Higher concentrations (300–500 mg/L) were most effective in promoting body weight gain, organ growth, and immune status, demonstrating the potential of probiotics as a safe and efficient alternative to antibiotic growth promoters in poultry

Annual Methodological Archive Research Review
http://amresearchreview.com/index.php/Journal/about
Volume 3, Issue 9 (2025)

Online ISSN 3007-3197
Print ISSN 3007-3189

http://amresearchreview.com/index.php/Journal/about

production.

CONCLUSION

Assessing the effects of dietary probiotic supplementation on broiler chickens' morphometric measurements, organ development, growth performance, and hematological parameters was the aim of the current study. According to the findings, probiotics considerably enhanced the broilers' growth, well-being. The inclusion of probiotics resulted in an increase in body weight, liver and heart size, and overall morphometric development when compared to the control group. With increasing probiotic dosages, morphometric parameters like body length, gizzard length, and liver size demonstrated significant increases.

However, the results from the hematological parameters were more complicated. While some treatment groups show healthy RBC and Hb level, other groups showed differences that could suggest either excessive or insufficient activation of the circulatory or immune systems. These results emphasize the need for an optimal dosage threshold.

RECOMMENDATIONS

The optimal balance between broiler growth performance and hematological stability can be achieved by supplementing with probiotics at a dose of 300 mg/L.

Additional Research: To better understand the long-term impacts of probiotic use in chickens, particularly regarding immunological regulation and disease resistance, more research is required.

To prevent any blood-related adverse effects, poultry farmers might think about adding probiotics to their feed regimens. However, they must carefully manage the amount.

Broader Parameters Microbial gut investigation, meat quality assessment, and economic feasibility studies should all be part of future research.

References

Abd El-Hack, M. E., El-Saadony, M. T., Shafi, M. E., Qattan, S. Y., Batiha, G. E., Khafaga, A. F., ... & Alagawany, M. (2020). Probiotics in poultry feed: A comprehensive review. Journal of animal physiology and animal nutrition, 104(6), 1835-1850.

Abdel-Hafeez, H. M., Saleh, E. S., Tawfeek, S. S., Youssef, I. M., & Abdel-Daim, A. S. (2016). Effects of probiotic, prebiotic, and synbiotic with and without feed restriction on performance, hematological indices and carcass characteristics of broiler chickens. Asian-Australasian journal of animal sciences, 30(5), 672.

Adriani, L., Kumalasari, C., JONI, M., & LATIPUDIN, D. (2022). Effect of powder probiotic on the leukocyte, heterophil and lymphocyte level on laying hens. Scientific Papers. Series D. Animal Science, 65(1).

Al-Kassie, G. A. M., & Witwit, N. M. (2010). A comparative study on diet supplementation with a mixture of herbal plants and dandelion as a source of prebiotics on the performance of broilers. Pakistan Journal of Nutrition, 9(1), 67-71.

Anukam, K. C., & Reid, G. (2007). Probiotics: 100 years (1907–2007) after Elie

Online ISSN 3007-3197
Print ISSN 3007-3189

Metchnikoff's observation. Communicating current research and educational topics and trends in applied microbiology, 1, 466-474.

Arsène, M. M., Davares, A. K., Andreevna, S. L., Vladimirovich, E. A., Carime, B. Z., Marouf, R., & Khelifi, I. (2021). The use of probiotics in animal feeding for safe production and as potential alternatives to antibiotics. Veterinary world, 14(2), 319.

Ashayerizadeh, O., Dastar, B., Shargh, M. S., Ashayerizadeh, A., & Mamooee, M. (2009). Influence of antibiotic, prebiotic and probiotic supplementation to diets on carcass characteristics, hematological indices and internal organ size of young broiler chickens.

Awad, W. A., Ghareeb, K., Abdel-Raheem, S., & Böhm, J. (2009). Effects of dietary inclusion of probiotic and synbiotic on growth performance, organ weights, and intestinal histomorphology of broiler chickens. Poultry science, 88(1), 49-56.

Bai, S. P., Wu, A. M., Ding, X. M., Lei, Y., Bai, J., Zhang, K. Y., & Chio, J. S. (2013). Effects of probiotic-supplemented diets on growth performance and intestinal immune characteristics of broiler chickens. Poultry science, 92(3), 663-670.

Bejaoui, B., Sdiri, C., Ben Souf, I., Belhadj Slimen, I., Ben Larbi, M., Koumba, S., ... & M'hamdi, N. (2023). Physicochemical properties, antioxidant markers, and meat quality as affected by heat stress: a review. Molecules, 28(8), 3332.

Cohle, S. D., Saleem, A., & Makkaoui, D. E. (1981). Effects of storage of blood on stability of hematologic parameters. American Journal of Clinical Pathology, 76(1), 67-69.

Dylag, K., Hubalewska-Mazgaj, M., Surmiak, M., Szmyd, J., & Brzozowski, T. (2014). Probiotics in the mechanism of protection against gut inflammation and therapy of gastrointestinal disorders. Current Pharmaceutical Design, 20(7), 1149-1155.

Ferri, M., Ranucci, E., Romagnoli, P., & Giaccone, V. (2017). Antimicrobial resistance: A global emerging threat to public health systems. Critical reviews in food science and nutrition, 57(13), 2857-2876.

Fonkwo, P. N. (2008). Pricing infectious disease: The economic and health implications of infectious diseases. EMBO reports, 9(S1), S13-S17.

Forchielli, M. L., & Walker, W. A. (2005). The role of gut-associated lymphoid tissues and mucosal defence. British Journal of Nutrition, 93(S1), S41-S48.

Ghadban, G. S. (2002). Probiotics in broiler production–a review. European Poultry Science, 66(2), 49-58.

Hafez, H. M., & Attia, Y. A. (2020). Challenges to the poultry industry: current perspectives and strategic future after the COVID-19 outbreak. Frontiers in veterinary science, 7, 516.

Haque, M. H., Sarker, S., Islam, M. S., Islam, M. A., Karim, M. R., Kayesh, M. E. H. & Anwer, M. S. (2020). Sustainable antibiotic-free broiler meat production: Current trends, challenges, and possibilities in a developing country perspective. Biology, 9(11), 411.

Henchion, M., Hayes, M., Mullen, A. M., Fenelon, M., & Tiwari, B. (2017). Future protein supply and demand: strategies and factors influencing a sustainable

Online ISSN 3007-3197
Print ISSN 3007-3189

equilibrium. Foods, 6(7), 53.

Horrocks, S. L. (2012). The effects of probiotic and eimeria on gut morphology and humoral immunity in broilers (Doctoral dissertation).

Hoseinifar, S. H., Dadar, M., & Ringø, E. (2017). Modulation of nutrient digestibility and digestive enzyme activities in aquatic animals: the functional feed additives scenario. Aquaculture Research, 48(8), 3987-4000.

Jin, L. Z., Ho, Y. W., Abdullah, N., & Jalaludin, S. (1997). Probiotics in poultry: modes of action. World's Poultry Science Journal, 53(4), 351-368.

Jin, L. Z., Ho, Y. W., Abdullah, N., & Jalaludin, S. (1997). Probiotics in poultry: modes of action. World's Poultry Science Journal, 53(4), 351-368.

Kalavathy, R., Abdullah, N., Jalaludin, S., & Ho, Y. W. (2003). Effects of Lactobacillus cultures on growth performance, abdominal fat deposition, serum lipids and weight of organs of broiler chickens. British poultry science, 44(1), 139-144.

Khan, R. U., & Naz, S. (2013). The applications of probiotics in poultry production. World's Poultry Science Journal, 69(3), 621-632.

Leach, J. D., Rastall, R. A., & Gibson, G. R. (2006). Prebiotics: past, present and future. Prebiotics: Development and Application, 237-248.

Lee, M. H., Lee, H. J., & Ryu, P. D. (2001). Public health risks: Chemical and antibiotic residues-review. Asian-Australasian Journal of Animal Sciences, 14(3), 402-413.

Leistikow, K. R., Beattie, R. E., & Hristova, K. R. (2022). Probiotics beyond the farm: Benefits, costs, and considerations of using antibiotic alternatives in livestock. Frontiers in Antibiotics, 1, 1003912.

Lutful Kabir, S. M. (2009). The role of probiotics in the poultry industry. International journal of molecular sciences, 10(8), 3531-3546.

Mengistu, S. B., Mulder, H. A., Benzie, J. A., & Komen, H. (2020). A systematic literature review of the major factors causing yield gap by affecting growth, feed conversion ratio and survival in Nile tilapia (Oreochromis niloticus). Reviews in Aquaculture, 12(2), 524-541.

Mishra, B., Mishra, A. K., Mohanta, Y. K., Yadavalli, R., Agrawal, D. C., Reddy, H. P., ... & Panda, J. (2024). Postbiotics: the new horizons of microbial functional bioactive compounds in food preservation and security. Food Production, Processing and Nutrition, 6(1), 28.

Mountzouris, K. C., Tsitrsikos, P., Palamidi, I., Arvaniti, A., Mohnl, M., Schatzmayr, G., & Fegeros, K. (2010). Effects of probiotic inclusion levels in broiler nutrition on growth performance, nutrient digestibility, plasma immunoglobulins, and cecal microflora composition. Poultry science, 89(1), 58-67.

Mund, M. D., Khan, U. H., Tahir, U., Mustafa, B. E., & Fayyaz, A. (2017). Antimicrobial drug residues in poultry products and implications on public health: A review. International Journal of Food Properties, 20(7), 1433-1446.

Narrod, C., Tiongco, M., Costales, A., Theime, O., & Pilling, D. (2007). Global poultry sector trends and external drivers of structural change. Poultry in the 21st century: Avian influenza and beyond. Rome, Italy: Food and Agriculture Organization, 21-48.

Online ISSN 3007-3197
Print ISSN 3007-3189

Obeagu, E. I., Igwe, M. C., & Obeagu, G. U. (2024). Oxidative stress's impact on red blood cells: Unveiling implications for health and disease. Medicine, 103(9), e37360.

Obianwuna, U. E., Agbai Kalu, N., Wang, J., Zhang, H., Qi, G., Qiu, K., & Wu, S. (2023). Recent trends on mitigative effect of probiotics on oxidative-stress-induced gut dysfunction in broilers under necrotic enteritis challenge: a review. Antioxidants, 12(4), 911.

Pelicano, E. R. L., De Souza, P. A., De Souza, H. B. A., Leonel, F. R., Zeola, N. M. B. L., & Boiago, M. M. (2004). Productive traits of broiler chickens fed diets containing different growth promoters. Brazilian Journal of Poultry Science, 6, 177-182.

Petschow, B., Doré, J., Hibberd, P., Dinan, T., Reid, G., Blaser, M., ... & Sanders, M. E. (2013). Probiotics, prebiotics, and the host microbiome: the science of translation. Annals of the New York Academy of Sciences, 1306(1), 1-17.

Popova, T. (2017). Effect of probiotics in poultry for improving meat quality. Current opinion in food science, 14, 72-77.

Raheem, A., Liang, L., Zhang, G., & Cui, S. (2021). Modulatory effects of probiotics during pathogenic infections with emphasis on immune regulation. Frontiers in immunology, 12, 616713.

Rahman, M. R. T., Fliss, I., & Biron, E. (2022). Insights in the development and uses of alternatives to antibiotic growth promoters in poultry and swine production. Antibiotics, 11(6), 766.

Ramakrishna, B. S. (2013). Role of the gut microbiota in human nutrition and metabolism. Journal of gastroenterology and hepatology, 28, 9-17.

Reis, J. A., Paula, A. T., Casarotti, S. N., & Penna, A. L. (2012). Lactic acid bacteria antimicrobial compounds: characteristics and applications. Food Engineering Reviews, 4(2), 124-140.

Sachdeva, A., Tomar, T., Malik, T., Bains, A., & Karnwal, A. (2025). Exploring probiotics as a sustainable alternative to antimicrobial growth promoters: mechanisms and benefits in animal health. Frontiers in Sustainable Food Systems, 8, 1523678.

Wu, G., Fanzo, J., Miller, D. D., Pingali, P., Post, M., Steiner, J. L., & Thalacker-Mercer, A. E. (2014). Production and supply of high-quality food protein for human consumption: sustainability, challenges, and innovations. Annals of the New York Academy of Sciences, 1321(1), 1-19.

Yeo, J., & Kim, K. I. (1997). Effect of feeding diets containing an antibiotic, a probiotic, or yucca extract on growth and intestinal urease activity in broiler chicks. Poultry Science, 76(2), 381-385.

Zalán, Z., Németh, E., Baráth, Á., & Halász, A. (2005). Influence of growth medium on hydrogen peroxide and bacteriocin production of Lactobacillus strains. Food technology and Biotechnology, 43(3), 219-225.

Żbikowski, A., Pawłowski, K., Śliżewska, K., Dolka, B., Nerc, J., & Szeleszczuk, P. (2020). Comparative effects of using new multi-strain synbiotics on chicken growth performance, hematology, serum biochemistry and immunity. Animals, 10(9), 1555.

Zhang, A. W., Lee, B. D., Lee, S. K., Lee, K. W., An, G. H., Song, K. B., & Lee, C.

Annual Methodological Archive Research Review
http://amresearchreview.com/index.php/Journal/about
Volume 3, Issue 9 (2025)

Online ISSN 3007-3197
Print ISSN 3007-3189

http://amresearchreview.com/index.php/Journal/about

H. (2005). Effects of yeast (Saccharomyces cerevisiae) cell components on growth performance, meat quality, and ileal mucosa development of broiler chicks. Poultry science, 84(7), 1015-1021.