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Research Article

Bolstering The Growth of Broiler Chicken with Bio-Stimulant as Supplement in Drinking Water

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ABSTRACT

The most popular domestic animals in poultry raising are birds, such as chickens, geese, turkeys, and ducks. This study aims to bolster the growth performance of broiler chicken by supplementing bio-stimulant in the drinking water. This was conducted last January 1 to February 7, 2024 at Bacolod City, Philippines. The total number of birds used for this study was 80 broiler chickens. The researchers gathered data on the broiler chicken's weight, average daily gain, and feed conversation ratio within 35 days. The researchers used a complete randomized design (CRD) with four treatments replicated four times. All the data gathered were statistically computed, and subjected to analysis of variance (ANOVA) in CRD using STAR 2.0.1. Results show that supplementing drinking water with 0.30% BSS mixtures had the heaviest weight of broiler chickens with 0.6984 kg, 1.3321 kg, and 1.7764 kg at weeks 3, 4, and 5, respectively. The same concentration implied broiler chickens' highest average daily gain (ADG) weight with 0.0998 kg, 0.1903 kg, and 0.2538 kg at weeks 3, 4, and 5, respectively. Significant results were also shown by the same concentration with the lowest feed conversion ratio (FCR) at 1.47, 1.36, and 1.34 at weeks 3, 4, and 5, respectively. Based on the results of the study it recommends supplementing the drinking water of broiler chickens with BSS at a concentration of 0.30%.

Keywords: *Bio-stimulant, Average weight gain, Feed conversion ratio, Natural raising, Ad libitum*

Introduction

The most popular domestic animals in poultry raising are birds, such as chickens, geese, turkeys, and ducks. Many cultures worldwide use them in farming and various animals that were breed and genetically adapted over generations to live beside humanity (Nielsen et al, 2022).

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Broiler chickens are mainly raised for meat production rather than egg-laying purposes. These poultry, often white, are selectively bred to attain giant sizes and robust health, typically with a higher proportion of breast meat to meet consumer preferences. They exhibit rapid growth rates and offer a cost-effective source of protein and calories (Göransson et al., 2020).

In chicken production, efficiency is determined by striking a balance between animal welfare, intestinal health, and nutrition. The animal nutrition sector has looked for innovative ways to maximize output rates in response to growing customer demand for antibiotic suppression of animal feed for growth.

Based on this idea, probiotics—living microorganisms (yeast and beneficial bacteria) for animal health—have been used. The objective of the experiment was to evaluate the production of probiotics (De Lima Almeida Paz et al, 2019).

Welfare of broilers fed different doses of broiler chickens are sourced from the same hatchery and are typically delivered in the same shipment to ensure optimal consumer safety. They are housed in spacious structures that accommodate up to 25,000 birds, allowing for social interaction, movement, and feeding (Giersberg et al, 2020).

Chicken remains the preferred meat among Filipinos, with per capita poultry consumption holding steady at 14.05 kg over the past two years, slightly lower than the 2019 figure of around 14.96 kg (Yıldız & Duru, 2019).

Though effective in boosting growth and output, the high-intensity method of raising broiler chickens can result in welfare concerns like leg abnormalities, stress, and fear reactions (Tainika et al, 2023). Nevertheless, employing slow-growing breeds and reducing stocking densities can notably enhance welfare measures.

Broiler chickens are also one of the most well-known animals to raise on the farm; broiler chickens do not always roam freely around the farm (Fijalovych et al, 2019). Aside from laying eggs, broiler chickens are also grown for their meat. These broiler chickens are frequently white, bred to be big and highly healthy, and have more breast meat for the consumer market.

Breeds of broiler chicken expand quickly and provide a lot of protein and calories (Trishyna & Gulyaev, 2020). While slower-growing breeds achieve slaughter weight at about fourteen weeks of age, most commercial broiler chickens reach slaughter weight between four and six weeks of age.

Moreover, these broiler chickens have been selectively developed to possess desirable characteristics (Maharjan et al, 2021). The welfare of broiler chickens presents a multifaceted challenge, with intricacies shaped by many factors, including growth rate, production methodologies, and the conditions in which they are raised (Tainika et al, 2023).

Vertical integration within the broiler sector has bolstered efficiency by consolidating production, processing, and marketing activities under unified ownership and management (Choi et al, 2023).

Poultry raising has a significant role in society; it helps humanity generate income and employment since it is a great business. It is a primary consumption in the market as people are fond of eating eggs or chicken meat at their table (Gholami-Ahangaran et al, 2021).

The three pillars of success in chicken production are controlling illnesses and pests, lowering death rates, and increasing output. Studies show that achieving this winning combination may involve using effective microorganisms, a unique mix of bacteria, fungi, and yeast (Pliego et al, 2020).

Chickens raised within modern production systems are typically smaller and contribute less than 2% to egg and meat production. However, there has been a gradual increase in the proportion of exotic breeds in recent years. Despite introducing these breeds to enhance egg production, challenges persist due to inadequate feed quality and management practices (Litigebew et al, 2021).

Across the globe, various feed additives and supplements are commonly utilized to enhance productivity within the sector. One such supplementation method involves the incorporation of effective microorganisms (EM) into feed and water, with some farmers, particularly in countries like Japan, opting for this approach over antibiotics. EM comprises a mixture of dif-

ferent microbes, including photosynthetic bacteria, actinomycetes, yeast, lactobacillus, and fungi (Baxter et al, 2020).

It has been employed to enhance egg and meat production in chicken farming. Suggests that dietary supplementation with probiotics, such as EM, can increase egg production and improve feed conversion efficiency. In regions like South Africa, EM has been utilized to boost productivity in integrated animal units and poultry farms.

When implemented within rearing sheds, EM aids in disease suppression and helps regulate ammonia levels generated by chicken droppings, enhancing air quality within poultry houses. Incorporating effective microorganisms can enhance chickens' current low productivity levels. Including EM in the diet, chickens experience boosted immune function and productivity (El-Hack et al, 2020).

Adding EM to feed and water facilitates the proliferation of beneficial microorganisms within the birds' gastrointestinal tract, thereby improving digestion efficiency and potentially reducing feed costs, consequently leading to increased profitability (Atsbeha & Hailu, 2021).

The genetic modification applied in broiler chicken breeding programs has attained unprecedented levels unmatched by any other animal species, revolutionizing the efficiency of the chicken meat industry in generating high-quality protein (Choi et al, 2023). By carefully selecting traits for enhanced performance, there have been significant improvements in feed efficiency and weight gain, leading to alterations in broiler strains' growth curves and nutritional needs.

This mastery and progress in genetic enhancement have fostered a competitive and specialized market for chicken meat genetics, wherein each breeding company establishes its unique selection criteria, resulting in strains that, while similar, possess distinct characteristics (Underwood et al, 2021).

It was discovered that although the supplementation of effective microorganisms did not notably affect production metrics, carcass traits, or meat quality, it did optimize blood glucose levels and crop pH (Park & Sun, 2020).

Noted no significant disparities in growth or carcass attributes but highlighted the efficacy of adding metalloprotease to feed for liver development. Conversely, both observed favorable impacts of probiotic supplementation on intestinal microflora composition, indicating a decrease in harmful microbes and an increase in beneficial bacteria. These insights imply that while effective microorganisms might not directly influence the production or meat quality, they can contribute to maintaining healthy intestinal microflora in broiler chickens (Gheorghe et al, 2021).

Studies examining the application of liquid fertilizer containing effective microorganisms in broiler chicken farming have yielded encouraging findings (Kushnir et al, 2023). When probiotic supplements are added to broiler feed, the availability of essential amino acids—lysine, histidine, arginine, threonine, valine, methionine, and isoleucine—is increased in comparison to the control group.

With the probiotic supplement, there was an increase in the absorption of Ca, P, Mg, and Mn. The probiotic supplement application in the diet of broiler chickens increased the pre-slaughter live weight by 16.7%, the un-gutted body weight by 15.0% and the gutted body weight by 17.3%.

A probiotic supplement improved the body's absorption of minerals and amino acids in broiler chickens and improved the digestibility of feed ingredients (Poberezhets et al, 2021). Broiler chicken growth is affected by several factors, such as breeding conditions, feeding routines, and the maturation of sensory organs, as observed (Trishyna & Gulyaev, 2020). Various studies illustrated diverse microorganisms' valuable effects on broiler chickens' growth and well-being (Kushnir et al, 2023).

They demonstrated that employing a feed additive containing spore-forming bacteria from the Bacillus genus resulted in heightened growth and enhanced carcass yield. Similarly, it noted that administering the probiotic "Biomass" inhibited the proliferation of harmful microorganisms while fostering the development of beneficial bacteria within the intestinal microflora of broiler chickens (Kochish et al, 2020).

Bio-stimulants are diverse natural or biologically derived substances, including humic

acids, seaweed extracts, beneficial microorganisms, and various organic compounds. (cited by Oñal and Andrade, 2024 on their book). Including the 3 other studies conducted by the group of Oñal all in 2024.

They are composed of 80 microorganisms from 10 including lactic acid bacteria, actinomycetes, and yeasts (Philippot et al, 2019).

This study aims to examine the effect of adding an organic bio-stimulant orally to bolster the body weight of broiler chickens. The study will encourage the farmers the use of indigenous supplement so as to reduce the use of synthetic materials for food sustainability and peoples health.

It is also the aim of the research to contribute to the pool of knowledge in searching for other materials to sustain food productivity

Objective of the Study

The study aimed to bolster the growth of broiler chicken growth by supplementing bio-stimulants in drinking water.

1. To determine the effect of bio-stimulant on the growth performance of broiler chicken in terms of body weight.
2. To determine the difference in the weight gain of broiler chicken using a bio-stimulant in terms of feed conversion ratio.

Research Design and Treatments

This study is laid out in Complete Randomize Design (CRD), the use of CRD is the standard design for agricultural experiments where similar experimental units are grouped into blocks. There were four treatments including the control and each treatment was replicated four times.

Treatments

T1- 100% water
T2- 100% commercial vitamins (RR)
T3- 0.30% BSS
T4- 0.15% BSS

Limitation of the Study

The study was conducted at the University of Negros Occidental-Recoletos, Inc. School of Agriculture, Bacolod City, Philippines, last January 1 to February 7, 2024. A total of eighty (80) birds were utilized in this study.

Care and Management of Birds

Securing of Bio-stimulant.

The bio-stimulant was secured from the School of Agriculture of the university,

Preparation of Broiler Chicken

a. The researcher purchased day-old broilers from a respected breeder.
b. The birds spent seven days in an electrically heated brooder.
c. They had unrestricted access to feed, water, and illumination.
d. After a seventh day of brooding, the birds were fed experimental diets, during which they were continuously provided commercial feeds and vitamins.

Application of Bio-stimulant to Drinking Water

a. After seven days, the treatment started by mixing bio-stimulants with water as additive.
b. The birds were divided equally into sixteen cages to record the data accurately.
c. With four treatments and four replications, every replication has five samples, for a total of twenty birds per treatment.
d. Birds were randomly assigned to four different treatments.
e. The birds were observed and provided with BSS until the 35 days.

Data Gathered

1. Initial body weight
2. Weekly body weight
3. Average body weight gain
4. Feed conversion ratio

Results and Discussions

Initial and Weekly Body Weight

Table 1 presents the weight of broiler chicken as supplemented with commercial vitamins and bio-stimulant (BSS) at different concentrations. Supplementing BSS on the daily water consumption of broiler chickens significantly increases the weight of the birds from week 3 to week 5.

Weight at 1-2 weeks (Initial data at 14 days)

Initial weight was taken at 14 days as shown in Table 1. The initial average weekly weight of broiler chicken shows no significant difference among treatments. Among the treatments, T4 had the highest initial weight at 0.2898 kg followed by T3 with 0.2835 kg, respectively. The above-mentioned treatments used BSS as a supplement for the drinking water of the birds. Treatment 2 (commercial vitamin) had an average initial weight of 0.2827 kg and T1 which supplied merely water as drinking materials had the lowest initial weight of 0.2686 kg only.

Weight at 3 weeks (15-21 days)

Three (3) weeks thereafter, drinking water fortified with BSS and commercial vitamins shows highly significant results in terms of accumulated body weight as compared to chicken supplied with merely water only.

Heavier chickens were shown on T3 (supplied with drinking water that has the highest concentration of BSS at 0.30%) with an average weight of 0.6984 kg, 4.44% heavier than those supplied with mere water (T1) which has the lowest average weight of 0.6296 kg only. T2 (100% commercial vitamins) followed with 0.6889 kg and T4 (0.15% BSS) has an average accumulated weight of 0.6837 kg. Comparable results were observed among means between T2, T3, and T4.

Weight at 4 weeks (22-28 days)

The superior effect of BSS is shown in the 4th week period as indicated clearly in Table 1. Heavier chickens were observed on T3 (0.30% BSS) with an average body weight of 1.3321 kg which is 12.59% heavier than those supplied with mere water only, which has the lowest weight of 1.1682 kg only. Chicken under T4 (0.15% BSS) is slightly lighter from T3 with an average weight of 1.3153 kg.

Statistically, the mean of T3 and T4 are comparable. Those supplied with commercial vitamins (T3) have the third average weight of 1.2885 kg.

The potent effect of BSS in bolstering the body weight of broiler chickens is observed during this growing period. In descending order: chickens at T3 (0.30% BSS) had the highest average weight difference of almost 1.0 kg, specifically 0.9920 kg from 0.4101 kg during week 3 which is almost double.

Second in terms of weight increment are those from T4 (0.15% BSS) with an average weight difference of 0.9214 kg from 0.3939 kg during week 3. Relatively, birds from T2 (100% commercial vitamins) had a weight difference of 0.8803 kg from 0.4022 during week 3.

Lower weight differences are observed on birds at T4 (water only) with an average increment of 0.8072 kg from 0.3610 kg only during week 3.

Overall, the average weight difference is 0.8827 kg from 0.3918 kg during week 4. Productivity in terms of body weight is observed in this period (week 4) as shown by weight differences among treatments and the diluting of BSS on the drinking water of the flocks is a good timing at this period.

Weight at 5 weeks (29-35 days)

At the 5th week period, chickens had slowed down their weight accumulation, despite a higher statistical difference among treatments. Heavier chickens were gathered for those supplied with drinking water that has a higher BSS concentration.

Chickens at T3 (0.30% BSS) were the heaviest among the 4 treatments with an average weight of 1.7764 kg which is 15.94 % higher than those given by water only with an average weight of 1.5321 kg. Birds at T4 (0.15% BSS) had second average weight accumulations of 1.7300 kg followed by broilers at T2 (100% commercial vitamins) with an average weight of 1.6844 kg, respectively.

Weight increment slows down as well as shown by the weight accumulation difference. Comparing the total weight of week 5 with that of week 4, results indicate that the weight difference of birds at T3 (0.30% BSS) was only 0.4443 kg as compared to the previous period with 0.9220 kg. Relatively for T4 (0.15% BSS) the period difference is 0.4147 kg as compared from the previous with 0.9214 kg while T2 (100% commercial vitamins) weight 0.4015 kg viz-a-viz to 0.8803 kg, and T1 (control) with 0.3639 kg viz-a-viz to 0.8072 kg, respectively.

The weight of the broiler can be bolstered by supplementing the drinking water with a

higher concentration of BSS especially at the 4th week period or at 22-28 days. Relatively this can be extended further up to week 5 (29-35 days) but the weight accumulation slows down at this period already.

Table 1. Weight of broiler chicken per week (kg) as supplemented with bio-stimulant on drinking water.

Treatments	Weight of Broiler Chicken per Week (kilogram)						
	Week 1 and 2 (1-14 days)	Week 3 (15-21 days)		Week 4 (22-28 days)		Week 5 (29-35 days)	
	Initial	Total	*Difference*	Total	*Difference*	Total	*Difference*
	(A)	**(B)**	(B-A)	**(C)**	(C-B)	**(D)**	(D-C)
T1- Control (water only)	0.2686	0.6296[b]	*0.3610*	1.1682[c]	*0.8072*	1.5321[d]	*0.3639*
T2-100% (commercial vitamins)	0.2827	0.6849[a]	*0.4022*	1.2825[b]	*0.8803*	1.6844[c]	*0.4019*
T3- 0.30% BSS	0.2835	0.6984[a]	*0.4101*	1.3321[a]	*0.9220*	1.7764[a]	*0.4443*
T4- 0.15% BSS	0.2898	0.6837[a]	*0.3939*	1.3153[a]	*0.9214*	1.7300[b]	*0.4147*
Mean *(Weekly Difference)*			***0.3918***		***0.8827***		***0.4062***
Mean (Weekly Total)	**0.2812**	**0.6742**		**1.2745**		**1.6807**	
Pr (>F)	0.4302[ns]	0.0019**		0.0000**		0.0000*	
CV (%)	6.41	2.96				1.08	

*Means followed by the same letter are not significantly different from each other, **highly significant, *significant, ns=not significant*

Administration of bio-stimulant probiotics to broiler chickens is believed that the beneficial bacteria can colonize the gut, out-compete harmful pathogens, and promote a healthy microbial balance. These can enhance the bird's ability to utilize and digest nutrients from feed efficiently, leading to improved growth rates, feed conversion ratios, and overall performance.

Studies show that bio-stimulant probiotics can have additional benefits, like reducing the occurrence of digestive disorders, enhancing the immune response, and improving carcass quality in broiler chickens. However, it is essential to understand the effectiveness of probiotics depending on the specific dosage, the strain used, and management practices (El-Hack et al., 2020).

Average Daily Weight Gain

The effect of the bio-stimulants orally administered thru drinking water to four treatment groups of broiler chickens was assess by computing the total weight less the initial weight and were divide to the number of days in order to determine the Average Daily Gain (ADG) as shown on Table 2. This table utilizes the data from Table 1.

Higher statistical differences on the effect of BSS on the daily weight gain of broiler chicken as a supplement to drinking water is clearly transcribed in Table 2 as well.

ADG at week 3 (15-21 days)

A comparable result is shown between T3 (0.30% BSS) and T2 (100% commercial vitamins) with an average daily gain (ADG) weight of 0.0998 kg and 0.0978 kg, respectively. The same comparable results are also implied between T4 (0.15% BSS) and T2 (100% commercial vitamins) with 0.0977 kg and 0.0978 kg, respectively. Those under T1 (water only) had the lowest ADG of 0.0899 kg.

ADG at week 4 (22-28 days)

A comparable result is also shown between T3 (0.30% BSS) and T4 (0.15% BSS) with an average ADG weight of 0.1903 kg and 0.1879 kg, respectively. For T2 (100% commercial vitamins) the ADG weight is at 0.1832 kg. On the other hand, the ADG weight of the broiler under T1 (water only) with 0.1669 kg. ADG weight of birds is maximized by supplementing the drinking water with BSS, especially during this period.

ADG at week 5 (29-25 days)

Relative to the accumulated weight of broiler chickens as shown in Table 1, the highest ADG weight of birds is those at T3 (0.30% BSS) with 0.2538 kg, followed by birds at T4 (0.15% BSS) with an average ADG weight of 0.2471 kg, respectively. Birds at T2 (100% commercial vitamins) had an ADG weight of 0.2406 kg and birds at T1 (water only) had an ADG weight of 0.2189 kg, respectively.

Table 2. Weight gain of broiler chicken per week (kg) as supplemented with bio-stimulant on drinking water.

Treatments	**Weight Gain of Broiler Chicken per Week (kilogram)**					
	Week 3 (15-21 days)		Week 4 (22-28 days)		Week 5 (29-35 days)	
	Daily Average	*Week Total*	Daily Average	*Week Total*	Daily Average	*Week Total*
T1- Control (water only)	0.0899^{c}	*0.6296*	0.1669^{c}	*1.1682*	0.2189^{d}	*1.5321*
T2-100% (commercial vitamins)	0.0978^{ab}	*0.6849*	0.1832^{b}	*1.2825*	0.2406^{c}	*1.6844*
T3- 0.30% BSS	0.0998^{a}	*0.6984*	0.1903^{a}	*1.3321*	0.2538^{a}	*1.7764*
T4- 0.15% BSS	0.0977^{b}	*0.6837*	0.1879^{a}	*1.3153*	0.2471^{b}	*1.7300*
Mean *(Weekly Weight Gained)*		***0.6742***		***1.2745***		***1.6807***
Mean (Daily Weight Gained)	**0.0963**		**1.821**		**0.2401**	
Pr (>F)	0.0002**		0.0000**		0.0000*	
CV (%)	3.02		1.56		1.12	

*Means followed by the same letter are not significantly different from each other, **highly significant, *significant*

Dolinin and Company in 2020, found out that bio-stimulant had a stimulating effect on the liver of chickens and directly contributed to the development of the thymus thus increasing the average body weight gain

The study by Carrasco (2019) shows that a "verChicken gut microbiota" plays a key role in maintaining intestinal health. The microbiota can modulate the host physiological functions required to maintain intestinal homeostasis. It is mainly through competitive exclusion of detrimental microorganisms and pathogens thus preventing colonization and therefore decreasing the expense of energy that birds normally invest in keeping the immune system active against these pathogens.

Carrasco further explained that healthy intestinal microbiota implies energy saving for the host, which translates into an improvement in the productive performance of the birds.

Feed Conversion Ratio

The effect of the bio-stimulants orally administered to four treatment groups of broiler chickens was also assessed by computing the Feed Conversion Ratio (FCR) and it is presented in Table 3. The lowest FCR is the efficient treatment. The result shows a very high significant difference among treatments. Among the treatments broiler chickens supplemented with a higher amount of BSS (0.30%) showed the lowest FCR.

Specifically lower FCR is indicated by broiler at T3 (0.30% BSS) with 1.47, 1.36, and 1.34 for the weeks 3, 4, and 5, respectively. This is followed by broiler at T4 (0.15% BSS) with 1.54, 1.48, and 1.37 for the weeks 3, 4 and 5, respectively. The highest FCR is at T1 (water only) with 1.65, 1.54, and 1.51 for weeks 3, 4, and 5, respectively.

Table 3. Feed conversion ratio of broiler chicken as supplemented with bio-stimulant on drinking water

Treatments	Feed Conversion Ratio (FCR) of Broiler Chicken		
	Week 3 (15-21 days)	Week 4 (22-28 days)	Week 5 (29-35 days)
T1- Control (water only)	1.65[a]	1.54[a]	1.51[a]
T2-100% (commercial vitamins)	1.51[b]	1.46[bc]	1.38[b]
T3- 0.30% BSS	1.47[c]	1.36[bc]	1.34[c]
T4- 0.15% BSS	1.53[b]	1.48[c]	1.37[b]
Mean	**1.54**	**1.46**	**1.40**
Pr (>F)	0.0000**	0.0014**	0.0000**
CV (%)	1.37	4.23	0.0628

*Means followed by the same letter are not significantly different from each other, **highly significant*

El-Hack (2020) suggests that dietary supplementation with probiotics, such as EM, can increase egg production and improve feed conversion efficiency. In regions like South Africa, EM has been utilized to boost productivity in integrated animal units and poultry farms. When implemented within rearing sheds, EM aids in disease suppression and helps regulate ammonia levels generated by chicken droppings, enhancing air quality within poultry houses.

Incorporating effective microorganisms presents an opportunity to enhance chickens' current low productivity levels. By including EM in the diet, chickens experience boosted immune function and productivity.

The group of Pashae Jalal (2024) found out that feeding the broiler chicken with dietary emulsifiers enhances function and nutrient digestibility in broiler chickens thus affecting its FCR including growth.

Conclusion and Recommendations

The supplementation on the drinking water of bio-stimulant at different concentrations resulted in bolstering the body weight and feed conversion ratio performance of broiler chickens. The use of 0.30% concentration of bio-stimulant as a supplement to the drinking water has a highly significant influence on the average gain weight and feed conversion ratio of broiler chickens

Based on the findings, this study recommends the use of 0.30% concentration of bio-stimulant in the drinking water to bolster the weight accumulation and to improve the feed conversion ratio performance of broiler chickens.

The researchers suggest to also include the analysis of meat quality of broiler chicken in future studies.

Furthermore, the possibility of increasing the concentration of BSS is also suggested in future research.

Conflict of Interest

No other group is involved in this study

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