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Growth Performance of Broilers Fed Different Levels of Prebiotics

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Abstract:- This study sought to: determine the effects of prebiotics on the daily gain, gain in weight and feed efficiency of broilers; Evaluate the feed cost to produce a kilogram broiler; Determine the morbidity and mortality rates among treatment groups; Determine the digestibility of feeds; Evaluate the consistency of manure and urine output; and to Assess the economics of adding prebiotics in broiler production. One hundred fifty broilers were randomly distributed in five treatments and replicated three times with ten birds per replicate given the following treatment diets: Treatment 1 no prebiotics; 2% prebiotics; 3% prebiotics; 4% prebiotics; and 5% prebiotics. The average initial, final, weekly weights and gain in weight did not differ significantly (P> 0.05%). Feed consumption and feed efficiency did not differ significantly (P >0.05), Feed cost to produce kilogram broiler in Treatment 1 was lower than those given 2-5% prebiotics (P> 0.05%) (P >0.01). Mortality and morbidity rates did not differ significantly (P >0.05). Broilers fed 2% prebiotics obtained the highest mean of 27.48% for consistency of manure and highest protein digestibility of 50.49. Broilers given 2% prebiotics had the highest net return of Php. 1052.

Keywords: *Broilers, Prebiotics, Feed Efficiency, Digestibility, Growth.*

I. INTRODUCTION

Poultry farming has increased throughout the world, especially in developing countries. This increasing trend is expected because of the increasing demand for poultry products due to the increasing population. Poultry farming is one of the sources of income of Filipino farmers as recorded by the Bureau of Agricultural Statistics where around 70% of the total population of poultry is coming from the backyard raisers.

Broiler raising is a segment of the poultry industry. It is very popular because a broiler reaches marketable weight in a relatively short period of time. Nowadays as early as 28 days, broilers can weigh from 1.5 to 2.0 kilograms. It is said to be the most developed among the animal industries. Among the types of meat, chicken are most preferred by the consumers regardless of religion and beliefs. It is also an efficient meat producer and grows faster than other farm animals raised for food.
(http://en.wikipedie.org/wiki/broiler).

One of the feed additives that can be added to the ration of broilers is prebiotics. Prebiotics are defined as a non-digestible food ingredient that beneficially affects the host by selectively stimulating the growth and/or a limited number of bacteria in the colon (Gibson and Robertfroid, 1995). In other words, prebiotics are meant to provide a substrate for beneficial gastrointestinal microbes. Large amounts of bacteria are present in the small intestines of monogastrics and are potentially capable of utilizing these indigestible carbohydrates as source of energy.

In poultry farming, enteric diseases are an important concern because of lost productivity, increased mortality, and the associated contamination of poultry products for human consumption (human food safety). With increasing concerns about antibiotic resistance, there is increasing interest in finding alternatives to antibiotics for poultry production. Prebiotics is one of those that have potential to reduce enteric disease in poultry and subsequent contamination of poultry products. Proposed mechanism by which prebiotics act include competition for substrates, production of toxic compounds that inhibit pathogens, and competition for attachment sites (Patterson and Burkholder, 2003).

Antibiotics and chemotherapeutics in prophylactic doses have been used in animal feed to improve animal welfare and to obtain economic benefits in terms of improved animal performance and reduced medication costs. However, there are increasing concerns about the risk of developing cross-resistance and multiple antibiotic resistances in pathogenic bacteria in both humans and livestock linked to the therapeutic and subtherapeutic use of antibiotics in livestock and pets. This research aimed to assess whether the supplementation of prebiotics will affect the performance of broilers.

II. OBJECTIVES OF THE STUDY

Generally, this study aime to evaluate the growth performance of broilers fed with different levels of prebiotics added in the diet.

➢ *Specifically, it Aimed to:*

- Determine the effects of prebiotics on the average daily gain and feed efficiency of broilers;
- Evaluate the feed cost to produce a kilogram broiler;
- Identify the level of prebiotics that gave the best performance in broilers;

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- Determine the morbidity rates among treatment groups;
- Determine the mortality rates among treatment groups;
- Determine the digestibility of feeds;
- Evaluate the consistency of manure and urine output of all treatment groups.

III. METHODOLOGY

A total of 150 broilers were used in the study to evaluate the performance of broilers fed with different levels of prebiotics in the diet. The chicks were purchased from a reliable source in Naga City.

The broilers were randomly distributed in a Completely Randomized Design (CRD). There were five treatments which were replicated three times with a total of 15 experimental units as shown in Figure 1. Each replicate were contained 10 broiler chicks. The treatments of the study were the following: Treatment 1– control 0% Prebiotics; Treatment 2 - 2% Prebiotics; Treatment 3- 3% Prebiotics; Treatment 4 - 4% Prebiotics; and Treatment 5 – 5% Prebiotics

The treatment diets were given to the birds at the start of the experiment. Feeds and water were made available at all times. The prebiotics that were used in the study is a natural prebiotic polysaccharide derived from marine sourced macro algae for use in the feed industry. It helps modulate the various vital functions & processes of the animal's body. It is essentially a nutrient that enhances the animal's overall performance as to: growth, fertility, reproduction, hatchability to layers, immunity, and resistance against diseases.

The prebiotic contains many potential bioactive components; the constituent that is unique is the polysaccharide fraction that makes up about 52 percent of the dry weight. Within this fraction are important sources of complex, sulfated- polysaccharides that endow this prebiotic with unique characteristics not found in terrestrial plant sources or other common marine plants.

There were five types of ration that were used in this study namely: Treatment 1 was the control (0% Prebiotics), Treatment - 2 with 2% Prebiotics, Treatment - 3 with 3% Prebiotics, Treatment - 4 with 4% Prebiotics and Treatment - 5 with 5% Prebiotics. The ingredients that were used: corn, Rice Bran D1, soybean oil meal, coco oil, biophos, limestone coarse, nutrimass basemix.

Data gathered were subjected to Analysis of Variance (ANOVA). Means with significant differences were further subjected to Duncan's Multiple Range Test (DMRT).

IV. RESULTS AND DISCUSSION

➢ *Average Weight Gain:*

Broilers given Treatment 2 with 2% prebiotics obtained the highest weight gain of 1649.67 g followed by those given Treatment 3, with 3% prebiotics with 1642.21 g. This was followed by those broilers given Treatment 5 with 5% prebiotics with 1640.29 g, Treatment 4 with 4% prebiotics with 1574.09 g and lowest in broilers given feed without prebiotics.

However, the observed numerical differences in the gain in weight showed no significant differences among the treatments as revealed in the Analysis of Variance (ANOVA).

This can be due to the almost similar weights of the broiler chicks at the start of the experiment and the uniformity of the management practices employed in each of the replicates. There is an indication that broilers given 2% prebiotics had slightly higher weight at 35 days and weight gain than the control.

It is also evident, although not significant that at 3%, 4% and 5% inclusion rate of prebiotics, There is a corresponding decrease in final weight and gain in weight of the broilers. This could be an indication that at 2% inclusion rate, this could already produce the desired performance of the broilers and at higher inclusion rates; the performance would be less and would be more costly in terms of feed expenses.

Table 1 Initial, final and weight gain of experimental birds, g

PARAMETERS		**TREATMENT**			
	Control	**2%Preb**	**3%Preb**	**4%Preb**	**5%Preb**
Weight at Day Old [ns]	49.30	48.53	48.90	48.87	48.87
Weight at 35 Day [ns]	1586.05	1698.20	1673.11	1622.96	1640.29
Gain Weight [ns]	1536.75	1649.67	1642.21	1574.09	1591.42

ns – Treatment means are not significantly different from each other

➢ *Average Weekly Weights:*

Average weekly weights was taken by weighing all the birds per replicate divided by the number of birds at first, second, third, fourth and fifth week of the experiment. Table 3 summarizes the weights of the broilers taken at these periods.

- *Weight of Broilers at First Week Feeding Period:*

It can be noted that during the first week of feeding period as shown in Table 3, broilers fed Treatment 3 with 3% prebiotics were heavier with 143.62 g followed by Treatment 2 with 2% prebiotics, 134.96 g; Treatment 5 with 5% prebiotics, 134.01 g and those with no prebiotics, 131.68g and lowest in Treatment 4 with 4% prebiotics,

125.87 g.

However, these slight differences failed to show any significant differences as revealed in the Analysis of Variance (ANOVA). This means that the responses of the animals to the treatment diets were comparable in all treatment diets and were not enough to show significant results.

It is interesting to note at this stage that the inclusion of prebiotics did not exert significant difference on the weight at first week of the experimental period. This may also mean that the broiler chicks did not experience significant amount of stress in the addition of different levels of prebiotics. Hence, there is no significant difference in the weight of the broilers at this stage.

Table 2 Average Weekly Weight (g) of Broilers Fed with different levels of Prebiotics.

	WEEK [ns]				
TREATMENT	**1**	**2**	**3**	**4**	**5**
T1 – 0% Preb	131.68	309.30	1056.91	1133.88	1586.05
T2 – 2% Preb	134.96	323.51	1089.17	1218.21	1698.20
T3 – 3% Preb	143.62	341.99	1102.66	1197.00	1673.11
T4 – 4% Preb	125.87	307.19	974.70	1182.22	1622.96
T5 – 5% Preb	134.01	337.38	1058.85	1161.33	1640.29
Total	670.14	1619.37	5282.29	5829.64	8220.61
Mean	134.03	323.87	1056.46	1178.53	1644.12

ns – Treatment means are not significantly different from each other

- *Weight of Broilers at Second Week Feeding Period:*

During the second week of feeding period, broilers given 3% prebiotics had an average weight of 341.99 g while those given 5% prebiotics had 337.38 g followed those given 2% prebiotics with 323.51 g, the control with 309.30g and lowest with 4% prebiotics with 307.19 g.

These numerical differences were not did not show significant differences as revealed in the Analysis of Variance (ANOVA). This means that the weight of broilers at two weeks feeding period was similar and that the levels of prebiotics did not exert significant influence on this parameter.

- *Weight of Broilers at Third Week Feeding Period:*

After three weeks of feeding period, it can be noted that once again that broilers given 3% prebiotics had the highest average weight of 1102.66 g, followed by those given 2% prebiotics with 1089.17 g; 5% prebiotics with 1058.85 g and lowest in broilers given 4% prebiotics with 974.70% g. Broilers fed ration without prebiotics weighed 1056.91g.

These results as revealed in the Analysis of Variance (ANOVA) failed to show significant differences among treatment means. This means that the treatments given prebiotics have the same performance with those animals that were not given prebiotics.

- *Weight of Broilers at Fourth and Fifth Week Feeding Period:*

There is a similar trend on the weight gain of the broilers during the fourth and fifth week of feeding period. During the fourth week, broilers given 2% prebiotics obtained the highest weight of 1218.21 g followed by 3% prebiotics with 1197.00 g; 5% prebiotics had 1161.33 g ; 4% prebiotics had 1182.22 g and lowest in the control with 1133.8g.

These differences were not shown to be significant as revealed in the Analysis of Variance (ANOVA). This means that the treatments given with prebiotics had a comparable or similar performance with the animals without prebiotics.

On the fifth week of feeding, broilers fed with 2% prebiotics obtained the highest weight of 1698.20 g followed by 3% prebiotics with 1673.11 g; 5% prebiotics had an average weight of 1640.29 g; 4% prebiotics had 1622.96 g and the lowest was noted in the control group with 1586.05 g.

These differences were not shown to be significant as revealed in the Analysis of Variance (ANOVA). This means that the treatments given with prebiotics had a comparable or similar performance with the animals without prebiotics.

However, looking the difference from the first week of feeding up to the fifth week, broilers given 2% prebiotics gave a 1563.24 g gain in weight followed by 3% prebiotics with 1529.49 g; 5% prebiotics with 1506.28 g; 4% prebiotics gave with 1497.09 g. The broilers without prebiotics added a meagre 1454.37 g gain in weight. This clearly indicates that the apparent effect of prebiotics can be obtained by giving 2% of prebiotics to broilers. Hatemink (1995) stated that prebiotics can be used as potential alternatives to growth promoting antibiotics. This effect also corroborate the research of Hooge (2004) that the commercially available prebiotics MOS (Bio-MOS) improved the growth performance of broilers compared to the negative control. Li *et al* (2008) also stated that FOS improved broilers gain in weight for about 5-8%.

- *Feed consumption, Feed Conversion Ratio (FCR), Feed Cost per Kilogram of Broiler:*

Table 3 shows the feed consumption, feed conversion ratio and feed cost per kilogram of the experimental birds after 35-day feeding period.

- *Feed Consumption:*

Broilers given 2% prebiotics obtained the lowest feed consumption of 26, 716.67 g with a feed conversion ratio of 1.58 kg followed by those given with 3% Prebiotics with 27,683.33 g with an FCR of 1.66 kg. This was followed by those given with 5% prebiotics had an average feed consumption of 27,850.00 g and had an FCR of 1.70 kg while those given with 4% prebiotics had an average feed consumption of 27,766.67 g and with 1.70 kg of FCR and those without prebiotics had the highest feed consumption of 27,393.33 g and had an FCR of 1.73 kg. These differences were not shown to be significant as revealed in the Analysis of Variance (ANOVA). This means that broilers given with 2-5% prebiotics have comparable feed consumption and feed conversion ratio with those birds without prebiotics added in the diet.

However, looking the difference of the feed consumption, broilers given with 2% prebiotics had an average feed consumption of 26,716.67 g while those birds without prebiotics added in the diet had the highest feed consumption of 27,393.33 g.

- *Feed Conversion Ratio:*

Broilers given with 2% prebiotics obtained the better feed conversion ratio of 1.58 kg followed by those given with 3% Prebiotics with 1.66 kg. This was followed by those given with 5% prebiotics had a Feed Conversion Ratio of 1.70 kg while those given with 4% prebiotics had 1.70 kg and the highest feed conversion ratio of 1.73 kg was note in broilers fed without prebiotics.

These differences were not shown to be significant as revealed in the Analysis of Variance (ANOVA). This means that broilers given with 2-5% prebiotics have comparable feed conversion ratio with those birds without prebiotics added in the diet.

However, looking the difference of the Feed Conversion Ratio, broilers given with 2% prebiotics had a feed conversion ratio of 1.58 kg while those birds without prebiotics added in the diet had the better Feed Conversion Ratio of 1.73 kg.

This is the same in the research of Yang *et al.* (2009) that incorporated different levels of prebiotics improved feed conversion ratio by 2-6%. It also corroborates with the result of Nagrampa (2012) that layers given prebiotics and probiotics had better efficiency of 1.82.

- *Feed Cost per Kilogram of Broiler:*

Table 3 shows the feed cost per kilogram of broilers fed with different levels of prebiotics. The cost was taken by multiplying the price of feeds per kilogram with the feed conversion ratio. Broilers without prebiotics in the diet posed the least amount of Php42.70 per kilogram. This was followed by those given with 2%, 3%, 4% and 5% prebiotics with Php54.72. Php65.55, Php75.95, and Php83.99 per kilogram of broilers respectively.

Table 3 Feed Consumption (g), Feed Conversion Ratio (kg) and Feed cost per kilogram of Broilers (P) Fed with different Levels of Prebiotics

TREATMENT	Feed Consumption ^{ns}	FCR ^{ns}	Feed Cost/Kg of Broiler^{s}
T1 – 0% Preb	27,393.33	1.73	42.70^{a}
T2 – 2% Preb	26,716.67	1.58	54.72^{b}
T3 – 3% Preb	27,683.33	1.66	65.55^{c}
T4 – 4% Preb	27,766.67	1.71	75.95^{d}
T5 – 5% Preb	27,850.00	1.70	83.99^{e}
Total	137,410.00	8.40	322.90
Mean	27,482.00	1.68	64.58

ns – Treatment means are not significantly different from each other s - Treatment means are significantly different from each other

- *Values within the same column with different superscript differ significantly (P≥ 0.01):*

Table 3 shows that feed cost per kilogram broiler significantly differed among treatments (P≥ 0.01). Treatment 1 showed the lowest cost which is significantly lower than those given prebiotics even though 2% prebiotics had the better feed efficiency than control. This is due to the fact that the feed cost per kilogram of treatments with prebiotics is most costly compared to control. Similarly, feed cost per kilogram of 2% prebiotics at P34.65 is obviously the reason as it is more expensive than control feed cost per kg at P 24.91.

The differences in the costs of the five treatments depended on the additional cost of prebiotics which is 500 per kilogram. The costs of the treatments given with prebiotics were higher.

- *Morbidity and Mortality Rate:*

Table 4 shows the morbidity and mortality rate of the experimental birds after a 35day feeding period.

- *Morbidity:*

Morbidity rate was computed by dividing the number of broilers with slow growth and incidence of those with colds. Broilers in control group had the highest morbidity rate of 6.67% followed by those broilers given with 4 and 5% prebiotics with 3.33% while those broilers in treatments 2 and 3 did not experienced any occurrence of disease.

Broilers in control group had the highest morbidity rate because they suffered colds caused by the sudden changed

of weather during the first and second weeks of the study and even broilers given with 4 and 5% prebiotics experienced the same phenomenon.

Broilers given with 2 and 3% prebiotics did not experience any occurrence of disease. Bailey *et al.* 1991 stated that the supplementation of 0.4% FOS improved the health of the animals; therefore the lesser amount of prebiotics was the most effective level given to the animals. Subject to the Analysis of Variance (ANOVA), these differences were not shown to be significant.

Table 4 Morbidity and Mortality Rate of Broilers Fed with Different Levels of Prebiotics

PARAMETERS	TREATMENT					
	Control	2%Preb	3%Preb	4%Preb	5%Preb	Mean
Morbidity ^{ns}	6.67	0	0	3.33	3.33	2.67
Mortality ^{ns}	6.67	3.33	3.33	0	3.33	3.33

ns – Treatment Means are Not Significantly Different from Each Other

➢ *Mortality:*

Mortality rate of birds was computed by dividing the number of dead birds per treatment group by number of birds in the treatment group. Broilers without prebiotics supplementation had the highest mortality rate of 6.67% followed by those broilers given with 2, 3 and 5% prebiotics had 3.33% while those broilers given with 4% prebiotics do not have mortality.

Colds were the cause of death by those broilers in control group while those given with 2, 3 and 4% prebiotics were a victim of predators. These differences were not shown to be significant as revealed I the Analysis of Variance (ANOVA). This means that all treatments given with prebiotics had similar results with the control group.

This result was in line with findings of Fadil *et a*l., (2013) who reported that dietary Gum Arabic as natural perbiotic supplementation for broilers had no significant effect on the mortality rate.

➢ *Consistency of Manure and Urine Output:*

Consistency of manure and urine output was determined by getting manure samples from the broilers, weighed them and subjected for dry matter determination in an oven at 70 degrees Centigrade for 24 hours until constant weight was obtained.

Table 5 shows that broilers fed with 2% prebiotics obtained the highest mean of 27.48% in terms of consistency of manure and urine output followed by those fed with 3% prebiotics with a mean of 24.06%. This was followed by birds given with 4% prebiotics with 23.70% and followed by those given with 5% prebiotics with 23.54% while the lowest was obtained by those birds without prebiotics added in their diet with a mean of 23.95%.

The observed numerical differences were not shown to be significant as revealed in the Analysis of Variance (ANOVA). This means that all treatments given with prebiotics had similar results with the control group. However, there is an indication of the trend that there is a higher dry matter content of the manure and urine.

Table 5 Consistency of Manure and Urine Output of Broilers Fed with different levels of Prebiotics, %

	REPLICATE ^{ns}				
TREATMENT	1	2	3	Total	Mean
T1 – 0% Preb	21.68	26.40	20.78	68.86	22.95
T2 – 2% Preb	31.24	27.19	24.02	82.45	27.48
T3 – 3% Preb	23.78	24.44	23.97	72.19	24.06
T4 – 4% Preb	22.43	25.55	23.12	71.1	23.70
T5 – 5% Preb	26.00	22.16	22.41	70.62	23.54
Grand Mean					24.35

Ns – Treatment Means are Not Significantly Different from Each Other

➢ *Coefficient Crude Protein Digestibility:*

Digestibility of crude protein was determined by recording the feed consumption and fresh fecal excretion of broilers for 24 hours. The samples were dried in an oven with 60 degrees Centigrade for 24 hours. Dried weights of fecal sample were also noted. Amount of nutrients in feed consumption and feces were calculated by multiplying the results of the proximate analysis to the feed consumption and dried fecal excretion respectively.

As can be seen in table 6, it was clearly indicated that the highest crude protein digestibility was found to be exhibited in treatment 2 (2% prebiotics) with 77.49 followed by treatment 5 (5% prebiotics) with 75.14. Treatment 3 (3% prebiotics) had a crude protein digestibility of 62.98 followed by treatment 4 (4% prebiotics) with 50.77 while the lowest was noted in treatment 1 (control) with 50.61. The result of the present study is in contradict with the research of Nagrampa (2012) who reported that the coefficient of digestibility for crude protein is highest in treatment with 0.05% probiotics with 76.23% while the

lowest digestibility coefficient was found in treatment with prebiotics with 60.27%. Sinovec and Markovic, (2005) explained that oligosaccharides like MOS, are able to produce volatile fatty acids which stimulate peristalsis and decrease the time to pass through the intestines resulting to negative effects on digestibility. However, treatment with prebiotics had the highest crude fat digestibility(Nagrampa, 2012).

According to those who have studied use of MOS extensively, MOS may not work well with the first flock it was used with but cumulative effects over several flocks should be expected because it alters the microflora in the house as well as in birds (O'Keefe, 2005).

Table 6 Coefficient Protein Digestibility of the Experimental Ration

	REPLICATE				
TREATMENT	**1**	**2**	**3**	**Total**	**Mean**
T1 – 0% Preb	52.18	50.81	48.83	151.82	50.61
T2 – 2% Preb	75.50	78.29	78.68	232.47	77.49
T3 – 3% Preb	62.44	62.91	63.60	188.95	62.98
T4 – 4% Preb	49.45	54.13	48.73	152.31	50.77
T5 – 5% Preb	75.11	76.38	73.94	225.43	75.14
Grand Mean					63.40

V. CONCLUSIONS

Based on the results of the study, the following conclusions are made; Prebiotics did not exert a significant effect on the growth performance of broilers at 35-day old; The level of prebiotics that gave the best performance in broilers was 2% inclusion rate; An inclusion of 2% prebiotics had the highest coefficient protein digestibility of 77.49; and the feed cost to produce a kilogram live weight of broiler was lowest in diet without prebiotics as compared to those added with prebiotics.

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