RESEARCH ARTICLE Agricultural Science Digest, Volume 41 Issue 2: 364-369 (June 2021)

Growth Performance and Profitability of Broilers Supplemented with Vermi Meal under Free Range Management System

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10.18805/ag.D-278

ABSTRACT

Background: Poultry rearing systems and feeding have been the emphasis of broiler raisers to in able to meet the costumers demand for high-quality products. In this study, free range management have been introduced that allows the birds to enjoy their natural habitat while utilizing vermi meal as supplemented to commercial feeds.

Method: Evaluated the growth performance and profitability of broilers fed with different levels of vermi meal. Treatments represent T1- 100% Commercial Feeds (CF), T2- 2% Vermi Meal (VM)+98% CF, T3- 3% VM+97% CF, T4- 5% VM+95% CF. Treatment means having significant differences were subjected to Least Significant Difference at 5 % level of significance.

Result: Vermi meal did not influenced the weight gain, feed intake, feed consumption and dressing percentage of broiler chicken. However numerically, final weight and weight gain in T4 containing 5% VM was higher than T1 with commercial feed a difference of 66. 66 grams and 67.60 grams respectively. Birds of T4 with 5% inclusion of vermi meal showed higher in most parameters compared to the group fed with commercial feed. Consequently, 5% level of vermi meal had an optimum result in final weight, gain weight, feed conversion ratio, feed consumption, live weight and carcass weight.

Key words: Broilers, Free range, Growth, Profitability, Supplementation, Vermi meal.

INTRODUCTION

Most remote parts of the Philippines raised broiler chicken (*Gallus gallus domesticus*) as source of income and food. Poultry rearing systems have been the focus of scientific research for many years as a result of costumer demand for high-quality products and legal poultry welfare requirements. Along with the fact that the poultry meat market is dominated solely by price competitiveness, this been radically transformed the market into one equally dominated by both price and quality competitiveness (Bogosavjevk-Boskovic *et al*. 2010).

Bancos (2010) outlined major advantage of organic poultry production over intensive production, including a lower risk for human health, higher welfare and better conditions for broilers, environmental preservation and cost-effectiveness. In the study of Bogosavljevic-boskovic *et al*. (2012) lower final body weight and poor feed conversion efficiency was observed in free-range systems compared to intensive rearing. Conversely, better meat quality traits, most notably in terms of chemical composition of meat, were observed in non-intensive and organic broilers.

The effect of free-range raising on performance, carcass attributes and meat quality of broiler chicken were observed and found that, the higher body weight and lower mortality were characteristic of broiler reared indoors on deep litter compared to broiler reared in free range (Połtowicz and Doktor 2011).

The meat of the birds reared under free-range system is preferred by the consumers due to better sensory quality attributes. This rearing system is also a probable alternate to the conventional system and thigh meat of the male birds reared under free-range system is preferred by the consumers due to better sensory quality attributes (Javid *et al.,* 2019).

Stadig *et al.* (2017) revealed that free-range access for broiler chickens can benefit animal welfare because the birds have access to a more natural environment and more opportunities to perform natural behaviors than in indoor systems.

Some alternatives that can be utilized as substitute for soybean meal, fishmeal and meat meal in poultry diet. One such potential alternatives is vermi (Bahadori 2015 and Rezaepour, 2014). The diversity of vermi or earthworms from rice field recorded higher number followed by turmeric field. The investigation reveals the impact of different agricultural practices on the soil faunal diversity and its importance in the context of soil organic matter (Akilan and Nanthakumar, 2017).

Sultan *et al.* (2010) indicted that poultry diet has been put at 60-80% of total cost in production and high quality feed

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How to cite this article: Bollido, M.E. (2021). Growth Performance and Profitability of Broilers Supplemented with Vermi Meal under Free Range Management System. Agricultural Science Digest. 41(2): 364-369. DOI: 10.18805/ag.D-278.

Submitted: 08-05-2020 **Accepted:** 17-07-2020 **Online:** 10-11-2020

to remain competitive. Bahadori *et al.* (2017) emphasized that vermi or earthworm meal is superior to fish meal in term of protein content.

The impact of its result for the development and growth of bird was noticed, that vermi meal have good potential as an animal feed in the basis of their protein amino acids, omega-3 fatty acid (Bahadori *et al*. 2017).

Fasila (2012) showed that powdering method of earthworm by using formic acid addition had higher amino acid balance than vermi or earthworm and the essential amino acid of vermi meal was dominated by histidine and isoleucine.

The results of proximate analysis showed that vermi or earthworm meal contained crude protein 66.88%, crude fiber 7.68%, ash 11.39%, ether extract 9.31% and moisture 17.38%. Therefore, it can be concluded that vermi or earthworm can be replaced for basal diet of poultry feed as a source of protein (Kasye, 2016).

Feed conversion ratios were improved by 12.64% and 22.45%, when 3% and 5% vermi or earthworm powder, respectively. Supplementing the diet with 5% vermi powder had no negative effects on the growth of pullets and increased antioxidant enzyme activities in the liver. The dietary supplementation with 1%, 5% earthworm powder is safe for broiler pullets (Zang *et al*., 2018).

Thus, the study was undertaken with an objective to evaluate the effect of vermi meal supplementation on growth performance and profitability of broiler under free-range management system.

MATERIALS AND METHODS

Place and time of the study

This study was conducted at Northwest Samar State University, Erenas Village, San Jorge, Samar, Philippines from March to April 2019.

Housing of Broilers

The brooding and growing cages were constructed based on the number of treatments and replicates. The free-range system was constructed with cages measured to 1.4 square feet per broiler in compartment. The free-range area was prepared by division using a net (each measured 2m × 6m per compartment) to access the broiler from outside for foraging using a short tunnel under the wall from indoor pens to grass.

Vermi meal supplementation

The powdered vermi meal was purchased base on the amount needed in whole duration of the study. Vermi meal were mixed to commercial feeds based on percentage requirements.

Experimental design

A total of sixty broilers were used for this experiment. The broiler chicks were randomly selected and divided into twelve groups of replicates with 5 broilers each. The replicates were distributed using Complete Randomize Design (CRD) and assigned to each of the four treatments. The Following treatments were designated as follows.

Treatment 1- Commercial feeds
Treatment 2 - 2% of vermi meal plus 98% commercial feeds
Treatment 3 - 3% of vermi meal plus 97% commercial feeds
Treatment 4- 5% of vermi meal plus 95% commercial feeds

Broiler and experimental procedure

One-day-old broiler chicks were placed in brooding cage (Fig 1). pens with free access to a grass paddock during 35 days of experimental period (Fig 1).The diet were consisting of chick booster, chick starter and finisher diet were formulated. A feeding strategy of 50g chick booster for first two weeks, the third and fourth week broiler were 80g of chick starter and 120g finisher for the last week of experimental period.

Statistical analysis

The data was subjected to an analysis of variance (ANOVA). Treatment means having significant differences were subjected to Least Significant Difference (LSD) at 5% level of significance. Statistical analysis was carried out using Statistical Tool for Agricultural Research (STAR) version 2:0:1 2014 by Biometrics and Breeding Informatics, PBGB Division International Rice Research Institute, Los Banos Laguna.

RESULTS AND DISCUSSION

Water and feed consumption of broilers

The average water and feed consumption of broilers are shown in Table 1. The vermi meal supplementation of 2%, 3% and 5% did not significantly influence the rate of water and feed consumption. It showed that supplementation of



Fig 1: Brooding and growing stage of broiler chicken.

vermi meal at either 2, 3 or 5 percent were just comparable to each other. This result may be due to the percentage of feed mixture (commercial feed + vermi meal) wherein so close in terms of ration percentage, thus the overall palatability or quality of the feed mixture apparently similar as reported by Prayogi *et al*. (2011). The effect of feed with 2% 4%, 6 % level vermi meal did not significantly affect the amount of feed intake. The supplementation of vermi meal in contiguous amount did not affect the feed palatability, hence it did not affect the feed consumption. This means that substitution of vermi meal in at a range of 2-6% result in same quantity of feed consumption.

Table 1: Average Water and feed consumption of broilers in 35 days.

Treatments	Water consumption (ml)	Feed consumption (g)
T1- control	6231.00	2009.93
T2- 2% vermi meal	6216.00	2126.47
T3- 3% vermi meal	6165.33	2091.53
T4- 5% vermi meal	6221.67	2195.37
CV (%)	4.94	7.05

Means in a column with or without common letter designation were not significantly different, based on LSD Test at p<0.05.

Table 2: Effect of dietary treatments vermi in broilers in 35 days.

Treatments	Initial weight (g)	Final weight (g)
T1- control	49.07	1326.67
T2- 2% vermi meal	45.00	1314.00
T3- 3% vermi meal	48.33	1324.67
T4- 5% vermi meal	48.13	1393.33
CV (%)	4.29	4.09

Means in a column with or without common letter designation were not significantly different, based on LSD Test at p<0.05.

Table 3: Average gain weight and average feed conversion ratio (FCR) in 35 days of broilers**.**

Treatments	Gain weight (kg)	Feed conversion ratio (Kg)
T1- control	1277.60	1.62
T2- 2% vermi meal	1269.00	1.61
T3- 3% vermi meal	1276.33	1.60
T4- 5% vermi meal	1345.20	1.63
CV (%)	4.34	3.3

Means in a column with or without common letter designation were not significantly different, based on LSD Test at p<0.05.

According to the study of Nalunga, (2019) birds with 3% vermi or earthworm had the highest body weight gain, followed by birds with 5%. The highest food consumption was with 0% vermi and 1% with the least food consumption with 7% vermi meal. There was a significant difference in the food consumption for week 4 and week 6.

Initial weight and final weight of broilers

The initial and final weight of broilers are shown in Table 2 and Fig 2. It showed that the experimental subjects were evenly distributed as attributed by its initial weight of sampled chickens were similar among treatments. The final weight of broilers was not affected by the supplementation of vermi meal at 2, 3 or 5% mixture. The comparable weight of the chickens can be directly correlated to the feed intake showed no significant differences on the feed consumption relative to the treatments tested. In addition, protein content of feeds is the major source nutrient for growth and developing tissue of the broilers. Rezaeipour *et al*. (2014) reported that protein efficiency percentage increased with level of earthworm meal at 5 to 10% numerically but was not significant. The study of Reaipour *et al*. (2014) found out that growth performance of broilers fed diets containing vermi meal is equal to that fed with fishmeal.

Weight gain and feed conversion ratio (FCR) of broilers

Vermi meal supplementation of feeds at lower concentration (2, 3, or 5 %) did not significantly increased the average gain of weight of broiler and were comparable to control (pure commercial feeds) consequently the feed conversion ratio was also not significantly different among treatments (Table 3). As Rezaeipour *et al*. (2014) revealed that among 5 and 10% earthworm meal, the protein consumption at 5% level of earthworm meal was minimal. Prayogi (2011), also stated that vermi meal inclusion by 0, 5, 10 per cent in broiler diet, was no significant effect in the body weight gain of broilers, but the use of 15% give a significantly effect in compared to the other treatment due to protein intake and





Fig 2: Weighing upon arrival and weighing during harvesting of broiler chicken.

protein efficiency as mention in body weight of broilers. Furthermore, Sofyan *et al*. (2010) showed that vermi significantly led to gain weight and improved feed conversion ratio in broiler chicken.

Live weight, carcass weight and dressing percentage of broilers

The effect of commercial feeds supplemented with varying levels of vermi meal on live weight, carcass weight and dressing percentage of broilers are shown in Table 4. The results indicated that vermi meal supplementation at lower concentration had no significant effects due to the similarity of carcass, live weight and dressing percentage relative to each treatment (0%, 2%, 3% and 5 % vermi meal). According to Prayogi, (2011) vermi or earthworm increase protein on gizzards which make them gain weight. The feed that is rich in protein causes a definitely higher acidity in the gizzard than the food lower in protein.

Table 4: Live weight, carcass weight and dressing percentage of broilers in 35 days.

Treatments	Live weight (kg)	Carcass weight (kg)	Dressing percentage (%)
T1- control	1.52	1.14	74.96
T2- 2% vermi meal	1.45	1.09	75.09
T3- 3% vermi meal	1.55	1.15	74.27
T4- 5% vermi meal	1.54	1.12	72.75
CV (%)	3.13	2.44	4.11

Means in a column with or without common letter designation were not significantly different, based on LSD Test at $p<0.05$.

The comparative effects can also be correlated on the feed-water consumption of chickens that were comparable among treatments as it confers that growth and development of broilers depends on the nutrient consumed.

Production cost and net income

The cost of production per broiler described that vermi meal has the highest cost in all expenses (Table 5). It is shown that 43.06% was part of vermi meal in overall cost of the study due to its import purchased and followed by feed cost (33.55%).

Similarly, the cost of production keeps increasing as a result of the cost of feed ingredients particularly in protein sources and about 70% of total cost can be attributed to feeding cost (Donkoh *et al*. 2016).

In variable cost, it was found that dietary mixtures with vermi meal has the higher cost than control. The highest cost among treatments was obtained by T4 (5% vermi meal) and more than three times higher than control, followed by T3 (3% vermi meal) and T2 (with 2% vermi meal). This implies that more percent of inclusion of vermi meal, higher the cost of production. The profit per broiler was relying on selling price of dressed chicken (140 pesos per kilo), internal parts, drumstick and feet were included in selling. The higher revenue was noted in T3 (235.57 pesos) compared to other treatments which may be due to dressed chicken that higher than T4, T2 and control that shown in (Table 5), although the carcass weight was comparable in each treatment. T1 was the second higher revenue, followed by T5 and the lowest revenue was described in T2 (172.64 pesos) among treatments.

Table 5: Production cost and net income per broilers in 35 days.

Cost item (PhP)	Treatments				Percentage of cost
	1	2	3	4	
Variable cost:					
Feed cost	79.8	78.3	77.42	75.96	33.55
Vermi meal powder	0	79.8	120	200	43.06
Broilers	45	45	45	45	19.39
Housing disinfectant	0.83	0.83	0.83	0.83	0.16
Electric bill	3.33	3.33	3.33	3.33	1.43
Total variable cost	128.96	207.26	246.58	325.12	97.59
Fixed cost under Depreciation:					
Housing/cages and labour	4.2	4.2	4.2	4.2	1.81
Weighing scale	0.93	0.93	0.93	0.93	0.40
Total fixed cost	5.13	5.13	5.13	5.13	2.21
Total cost	134.09	212.39	251.71	330.25	100
Selling price:					
Dressed chicken 140/kg	159.6	152.6	217	156.8	
drumstick and feet 100/kg	6.39	6.36	6.43	6.51	
Internal parts:					
Gizzard 175/kg)	4.79	6.11	4.85	5.17	
heart and liver 175kg)	7	7.57	7.29	6.23	
Revenue	177.78	172.64	235.57	174.71	
Profit	43.69	-39.73	-16.14	-155.54	
ROI (%)	32.58	-18.71	-6.41	-47.10	

Net income

The profit of each treatment per broiler also shown in Table 5. It is described that T1 (100% commercial feeds) has the highest net income compared to other treatments. Treatments that supplemented with vermi meal has lower net income. In the study of ÖZTÜRK and KÖSE (2017) Poultry farming, approximately 70% to 75% of the operating costs is from feeds, of which about 15% are animal proteins. The protein requirement of poultry is provided by feed stuff. Limited production opportunities and price increases have led to the need to use alternative feed additives that can be substituted for these products. The study suggests that earthworms, rich in essential amino acids and a high digestible protein source can be used as substitutes as a source of alternative protein. From the study, it was found that higher import charges of vermin meal resulted in higher feed cost, which ultimately lowered the net income in groups supplemented with vermi meal.

CONCLUSION

The supplementation of vermi meal did not significantly influenced the growth performance of broilers particularly the feed consumption, body weight gain, feed conversion ratio (FCR), carcass weight and dressing percentage of broilers. However numerically, final weight and weight gain in T4 containing 5% VM was higher than T1 with commercial feeds with a difference of 66. 66 grams and 67.60 grams respectively. Consequently, 5% level of vermi meal had an optimum result in final weight, gain weight, feed conversion ratio, feed consumption, live weight and carcass weight.

Further research on the vermi meal supplementation using high concentration of vermi meal up to 10, 15 and 20%. Next study vermi must be cultured by researcher to avoid purchasing vermi meal. Using vermi meal as supplementation could be utilized from local markets and could be cultured by farmer to lessen the cost of production.

ACKNOWLEDGEMENT

The author is thankful to Northwest Samar State University, who provided the technical assistance and likewise the support and encouragement of my colleagues in Agriculture Department to work hard for the successful results of the research.

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