Central Mindanao University
Journal of Science
ISSN Print: 0116-7847 ISSN Online: 2704-3703

Growth and Profitability of Broilers with Vermimeal on Ration Under Two Management

Marcos Bollido

Agriculture Department and other Related Programs, Northwest Samar State University
Gomez Ext, Calbayog City, Samar, Philippines

ABSTRACT

The study was conducted to evaluate the growth and profitability of broilers in the different levels of vermi (*Eisenia fetida*) meal ration under two management systems. 120 day old chicks were tested in Randomized Complete Block Design with 4 treatments: commercial feeds, 2% vermi meal (vm)+local ingredients(li), 3% vm+li, 5% vm+li in three replications. Result revealed that total confinement (TC) had higher body weight (bw) and weight gain (wg) with a difference of 35.60 grams and 36.90 grams respectively compared to that of free-range (FR) that had lesser feed consumption (fc) with a difference of 81.10 grams and high in net income and ROI. Infeed ration, fc increased when given a higher percentage of vm, and it was significantly different from the commercial feeds (cf). In 3 different levels of vm, though they did not have a significant difference to each other, the 2% level of vm was comparable to cf and showed a difference in terms of bw 296.70 grams in TC; 326.00 grams in FR. In wg 296.67 grams in TC and 370.97 grams in FR in both management systems. Consequently, 2% level vm had an optimum result in final body weight, wg, and high in feed conversion.

Keywords: vermi, free- range, total confinement, profitability

INTRODUCTION

Broiler chickens (*Gallus gallus domesticus*), or broilers, are gallinaceous domesticated fowls, bred and raised specifically for meat production. They are a hybrid of the egg-laying chickens, both being subspecies of the red jungle fowls (*Gallus gallus*). Typical broilers have white feathers and yellowish skin.

Broiler production is one of the most progressive enterprises in the Philippines today. The poultry industry began as a backyard enterprise but has shifted to the formation of large integrated contract farming operations. (Kruchten, 2002).

The industry is mostly dependent on protein feedstuffs which are imported at a high cost. However, backyard raisers, farmers resort to feeding their broilers with commercial feeds but not appropriate to the ages of their birds due to limited capital to purchase the feeds needed. (Ravindran & Blair, 1993).

Broiler production is raised in confinement due to its inherent characteristics of being very susceptible to the harsh environment. They tend to be adapted if they are gradually exposed to the prevailing conditions, feeding, and other management systems.

The trend of today is to produce broiler with little alteration of their usual habitat such as from confining the broilers to a free-range system. This is done to minimize the housing cost usually incurred in production. Another way is to alter the feeding management by using indigenous but nutritious feed ingredients rather than feeding them with costly commercial feeds, (Ravindran & Blair, 1993). The nutritional value of vermi meal was emphasized on the study of (Istiqomah, L. et al., 2016) that the composition of vermi meal was: Moisture 9.03, Crude Protein 63.06, Ether Extract 18.5, Crude Fiber 0.19, Nitrogen Free Extract 12.41, Organic Matter 94.16 and Ash 5.81. Bahadori et al. (2014) used of 2%, 3%, 4%, and 6% vermi meal on broilers showed that heart weight was not affected in none of the vermi meal percentages while the breast weight was only affected by 2% and 3% of the treatments.

Studies of raising broilers partly in the free-range system and feeding them with indigenous materials such as vermi meals are considered highly nutritious. Vermi utilization is very limited in Samar province, and even in the Philippines as a whole; hence, this study is proposed.

Generally, this study aimed to determine the growth performance and profitability of broilers raised under two management systems with vermi meal in their diet. Specifically this study aimed to: identify the growth performance of broilers with vermi meal supplementation in their diet raised under free- range and in total confinement system in terms of: body weight, weight gain, feed consumption, feed conversion ratio (FCR), water consumption, and dressing percentage; calculate the production, profitability and the return of investment of broilers raised under two management systems and with vermi meal; measure the level of vermi meal incorporation in the feed for broiler growth and profitability performances; and compare the interaction

Corresponding author:
Marcos Bollido
Email Address: markbollido@yahoo.com
Received 6th March 2019; Accepted 24th July 2019

of the levels of vermi meals in the diet of the broilers with the two management systems of raising.

Time and Place of the Study

The study was conducted at the Northwest Samar State University- San Jorge Campus, barangay Erenas, San Jorge, Samar, from March 2018 to April 2018.

METHODOLOGY

Housing of the Experimental Birds

Brooding cages both for free range and total confinement were separately made. Growing cages for confinement and areas for a free-range group of broilers were prepared following the caging and space density requirements. Required brooding and rearing management were employed for the protection and safety of the experimental birds. Free-Range requires 2.4 sq. meter per bird, five birds per treatment requires 12 sq. meter area (2mx6m cage), a total of 144 sq. meter for 60 birds. Total Confinement requires 1.0 sq. foot per bird, five birds per treatment needs five sq. feet area (2 ft. x 2.5 ft. cage), a total of 60 sq. feet for 60 birds.

Preparation of the Experimental Diets

An agrivet supplier produced commercial feeds. Chick booster contains 22% CP, chick starter with 16% CP, and broiler finisher with 14% CP. The formulated feeds were composed of ground yellow corn, rice bran (D1), Soybean meal, copra meal, and vermi meal. The diets were formulated based on the broiler nutritional requirements propose. The experimental broilers were fed 50 grams per bird per day with chick booster in 14 days and 75 grams with chick starter in 14 days and 110 grams with broiler finisher also in 7 days. Birds received feeds and water in ad libitum throughout the experimental period. The 120 heads broilers and the different experimental feeds were weighed to determine the growth performance and profitability with vermi meal supplementation in their diet raised under free range and in total confinement system in terms of body weight, feed consumption, Feed Conversion Ratio (FCR), water consumption, dressing percentage. The researcher determined the minimum level of vermi

Table 1

The Composition of Experimental Diets with a Different Level of Vermi Meal (VM) as Feed during the Brooding and Growing Stage (kg)

Feed Ingredients	Chick Booster			Chick Starter			Broiler Finisher		
	2% VM	3% VM	5% VM	2% VM	3% VM	5% VM	2% VM	3% VM	5% VM
Rice bran D1	21.14	21.14	21.14	33.14	33.14	33.14	35.34	35.34	35.34
Ground yellow corn	42.28	42.28	42.28	46.39	46.39	46.39	49.47	49.47	49.47
Copra meal	10.03	9.50	8.23	4.12	3.37	3.28	2.47	3.02	1.22
Soybean meal	19.20	18.73	18.00	9.00	8.75	6.84	5.37	3.82	3.62
Vermi meal	2.00	3.00	5.00	2.00	3.00	5.00	2.00	3.00	5.00
Molasses	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Oil	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Salt	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25
DL-Methionine	0.55	0.55	0.55	0.55	0.55	0.55	0.55	0.55	0.55
Vitamin Premix	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Limestone	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
Dicaphos	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60
Lysine	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45
Total	100	100	100	100	100	100	100	100	100

meal for broiler growth performance, the profitability of broilers in the minimum level of vermi meal, and compared the minimum level of vermi meal for broiler growth performance and profitability. Then, the researcher also determined the production, profitability and the Return on Investment (ROI) of broilers based on current market price.

Experimental Birds, Design, and Treatments

A total of 120 broiler chicks were used and randomly divided into two groups of management systems and four feeding treatments. The study involved eight (8) treatment combinations in a 2x4 factorial experiment and distributed using Randomized Complete Block Design (RCBD). At the brooding stage, the chicks were distributed to two study areas corresponding to two (2) management systems; the total confinement and free-range systems. Each management system has 60 chicks distributed to four (4) Treatments and three (3) replications. Thus, each treatment replicates allotted five (5) heads of broiler chicks.

Factor A: Management System
- A1- Total confinement (TC)
- A2- Free range (FR)

Factor B: Levels of Vermi Meal in the Diet
- Bo- Commercial feeds (control)
- B1= 2% vermi meal & 98% other ingredients
- B2= 3% vermi meal & 97% other ingredients
- B3= 5% vermi meal & 95% other ingredients

Treatment Combinations
- A_1B_0= TC fed with commercial feeds
- A_1B_1= TC fed with 2% vermin meal & 98% other ingredients
- A_1B_2= TC fed with 3% vermi meal & 97% other ingredients
- A_1B_3= TC fed with 5% vermi meal & 95% other ingredients
- A_2B_0= FR fed with commercial feed
- A_2B_1= FR fed with 2% vermi meal & 98% other ingredients
- A_2B_2=FR fed with 3% vermi meal & 97% other ingredients
- A_2B_3=FR fed with 5% vermi meal & 95% other ingredients

The Layout for the Total Confinement System

A_1B_1	A_1B_0	A_1B_2	A_1B_1	A_1B_3	A_1B_0
A_1B_2	A_1B_3	A_1B_0	A_1B_3	A_1B_1	A_1B_2

The Layout for the Free-range System

A_2B_1	A_2B_0	A_2B_2	A_2B_1	A_2B_3	A_2B_0
A_2B_2	A_2B_3	A_2B_0	A_2B_3	A_2B_1	A_2B_2

Feeding Management Practices

Feed Diets

The formulated chick booster mash, chick starter mash, and broiler finisher mash were fed to the experimental broilers in the different growing stages. In the first two weeks, the birds were fed with formulated chick booster mash (21.70% CP). The next two weeks' birds were fed with starter mash (15.90% CP), in the last one week, they were fed with broiler finisher mash (14.10% CP). The control birds were fed with commercial ration until the end of the study.

Feeding System and Schemes

The experimental birds were fed with formulated feeds following the recommended daily ration based on stages of broiler production. The experimental broilers were fed 50 grams per bird per day with chick booster in 14 days and 75 grams per bird per day with chick starter in 14 days and 110 grams per bird per day with broiler finisher also in 7 days, with a total of 35 days growing period. Three times feeding in a day were applied to all birds under study. Ad libitum feeding and giving water were observed in both commercial and formulated feeds.

Feeds Formulation

Aside from the commercial feeds used in this study as control, a formulated feeds with three levels of vermi meal was used to produce Chick Booster Mash (CBM), Chick Starter Mash (CSM) and Broiler Finisher Mash (BFM). The level of vermi meal is 2% vermi meal in 98% other ingredients, 3% vermi meal in 97% other ingredients, and 5% vermi meal in 95% other ingredients. Each type of formulated broiler feeds was divided in three levels of vermi, one (1) part contents 2% level, 3% level & 5%, level respectively. The formulated feeds were subjected for analysis; 300 grams from every type of feeds per sample were collected. Each type of feed sample comprised 100 grams from formulated feeds into each level of vermi. The feed formulation using the different ingredients was computed using the Pearson Square Method and Trial and Error Method. The quantity of feed formulated was based on the age of broilers and the type of feeds such as CBM, CSM, and BFM.

These formulated rations had undergone an analysis of Crude Protein using Automated Kjeldahl Method (Bunchi) by the Department of Science and Technology (DOST)-Food and Nutrition Research Institute Service Laboratory, Taguig, Metro Manila.

Management of Experimental Birds

Before the arrival of chicks, all facilities, and equipment including the area, were disinfected to prevent any disease-causing organisms.

Brooding of day-old chicks lasted for 14 days. The cages were covered, especially at night time, to maintain the required temperature. Old newspapers were used as litter materials during brooding for birds under total

confinement and rice straw for the birds under free-range. Water was provided to the birds regularly, and daily replacement of unconsumed water was done and measured. Proper sanitation and management were observed during the entire duration of the study.

Analysis of Data

All observations in each parameter were subjected to Analysis of Variance (ANOVA) for a factorial experiment in a Completely Randomized Design (CRD). The researcher also used the Statistical Tool for Agricultural Research (STAR), Plant Breeding Genetics and Biotechnology Biometrics and Breeding Informatics, Version 2.0.1 (2014) of IRRI. Treatment means were compared using the Least Significance Difference (LSD) at 5% level of significance.

RESULTS AND DISCUSSION

Body Weight

Table 2 shows the different management systems of the broiler did not significantly affect its body weight in 35 days of this study. Numerically, however, the total confinement (1,053.80 grams) had achieved the higher final weight relative to free-range (1,018.20 grams) with a value of 35.60 grams difference. This could be due to the more energy consumed by the birds in roaming in the free- range area.

Meanwhile, vermi levels had significantly affected the final weight of broilers 35 days after harvest, both from total confinement and free-range. In terms of experimental diets, commercial feeds had a remarkably heavier body weight in both management systems (total confinement and free-range). Indicating such in both management systems, the influence of commercial feeding had shown no difference to the bodyweight performance of broilers. On the other hand, comparable results were observed from different vermi levels from both management systems. It showed that a 2% level of vermi meal was enough to feed the broiler because an optimum level in terms of body weight, weight gain, and feed conversion ratio were already met using the percent described of application. As studied by Kasye, M. B. (2016) the highest body weight increased to 1.3 kg on a diet with 2% vermi meal, the results again indicated that inclusion of earthworm meal in the diets at high levels of earthworm meal (2%) produced body weight values that were equal or superior to those produced by concentrated based diet.

Table 2

Body Weight of Broilers in 35 days as Affected by Different Levels of Vermin Meal Subjected to Total Confinement and Free-range

Factors	Body Weight (grams)
Factor A. Management System	
Total confinement	1,053.80 $_a$
Free range	1,018.20 $_a$
Factor B. Broiler ration	
A_1B_0	1,304.0 $_a$
A_1B_1	928.7 $_b$
A_1B_2	1,007.3 $_b$
A_1B_3	975.3 $_b$
A_2B_0	1,292.0 $_a$
A_2B_1	908.7 $_b$
A_2B_2	966.0 $_b$
A_2B_3	956.0 $_b$
Interaction (A x B)	NS

Means in a column followed by a common letter were not significantly different, based on LSD Test at p<0.05

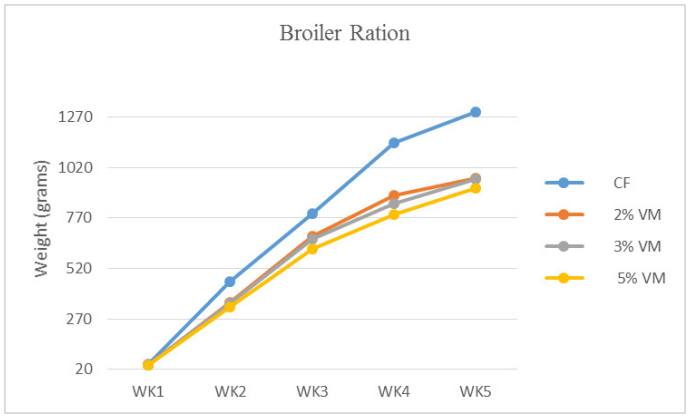

Figure 1. The Average Weight of Broilers in a Different Ration

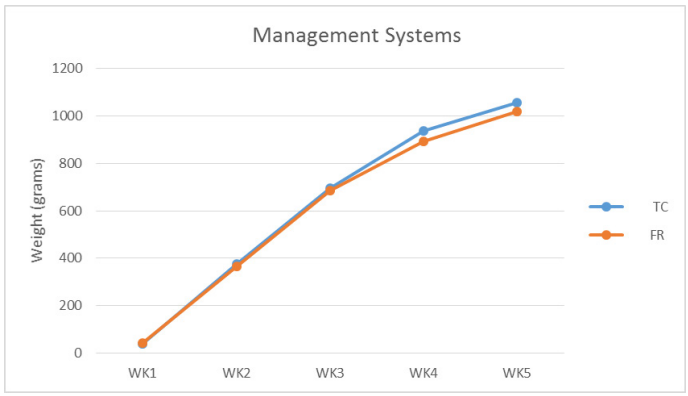

Figure 2. The Average Weight of Broilers under Two Management Systems

Average Weight Gain of Broiler

Table 3 shows that the average weight gain of broiler after harvest was not significantly influenced by the management system. However, the total confinement had numerically heavier broiler weight gain at an average difference of 36.90 grams which was consistent with the study of Wang et al. (2009) that the body weight and weight gain of broilers in the free-range treatment were significantly lower than those chickens raised in the indoor treatment.

Regardless of the management system, the average weight gain of broiler after harvest was significantly

affected by the different broiler ration. The commercial feeds had significantly heavier weight gain from both free-range and total confinement as compared to the different levels of vermi meal. However, the levels of vermi meal were comparable with each other. The results showed that at an increasing rate of application from 2% to 5% vermi meal, it had inversely affected the broiler weight gained to decrease further. It indicated that the 2% levels of vermi meal were the optimum percentage rate to be applied in the broiler to attain a stable broiler production. Accordingly, hens fed with a diet containing 2% vermi meal gave slightly higher body weight gain than those fed with diet without in other treatments (Kasye, 2016).

Table 3

Average Weight Gain of Broilers in 35 days as Affected by Different Levels of Vermin Meal Subjected to Total Confinement and Free-range

Factors	Average Weight Gain (grams)
Factor A. Management System	
Total confinement	1,013.00 A
Free-range	1,254.70 A
Factor B. Broiler ration	
A_1B_0	1264.00 $_a$
A_1B_1	885.43 $_b$
A_1B_2	967.33 $_b$
A_1B_3	935.04 $_b$
A_2B_0	1,245.3 $_a$
A_2B_1	868.67 $_b$
A_2B_2	874.33 $_b$
A_2B_3	866.00 $_b$
Interaction (A x B)	NS

Means in a column followed by a common letter were not significantly different, based on LSD Test at p<0.05

Feed Consumption

Table 4 illustrates that the feed consumption of the broiler was significantly influenced by the management system of the broiler. The total confinement (1,761.10 grams) had significantly higher feeds consumption relative to free-range (1, 680.00 grams). The higher feeds consumption experienced by Total Confinement (TC) in comparison with the free-range was mainly due to the broilers focused on feeds ration from TC since no other source of ration was available for them to consume. Unlike, in the free-range area, the birds were more exposed to other ration in which they could freely roam around from the allotted wider space to look for another source of foods and/or access to pasture with various feeds like grasses, insects, worms, minerals from soil and stones. Furthermore, Wang et al., (2018) also revealed that free-range system of growing broiler has many advantages concerning to uncontrolled environmental factors that might influence the feeds uptake of broilers such as temperature, photoperiod, and light intensity which were inherently variable, as a result, giving the broiler with the more favorable feeding condition.

Meanwhile, the different vermi levels had significantly influenced the feed consumption performance of the broiler. The higher feeds consumed observed in the commercial feeds of the total confinement (A1B0), but this did not give consistent results when applied to free-range (A2B0). However, the 5% vermi meal of total confinement (A1B3) had significantly higher feeds consumption than from the rest of the vermi meal treatments. This result showed that at total confinement application of a vermi meal of a 5% predominantly improved the feeding habit of the broiler. This result was also true to the free-range in which the consumption of feeds at 5% level had increased the feeds consumption of broiler. Thus, a 5% level of vermi meal was the optimum level in which the birds had consumed more feed from both the management system but were significantly higher in TC. This result was by the study on quail as reported by Prayogi (2011) in which the 5% level of vermi meal consumption gave an optimum level of feed consumption.

Table 4

Feeds Consumption of Broilers in 35 days as Affected by Different Levels of Vermi Meal Subjected to Total Confinement and Free-range

Factors	Feed Consumption (grams)
Factor A. Management System	
Total confinement	1,761.10 $_a$
Free-range	1,680.00 $_b$
Factor B. Broiler ration	
A_1B_0	1,845.30 $_a$
A_1B_1	1,633.30 $_h$
A_1B_2	1,763.90 $_c$
A_1B_3	1,801.90 $_b$
A_2B_0	1,692.50 $_e$
A_2B_1	1,649.00 $_g$
A_2B_2	1,670.90 $_f$
A_2B_3	1,707.40 $_d$
Interaction (A x B)	S

Means in a column followed by a common letter were not significantly different, based on LSD Test at p<0.05

Feeds Conversion Ratio

Table 5 illustrates that the Feeds Conversion Ratio was not significantly influenced by the management system as the results were comparable to each other. On the other hand, the feed conversion ratio was significantly influenced by the different broiler ration. The 2% vermi meal (A1B1) had a significantly higher feeds conversion ratio but was comparable to 3% and 5% vermi meal, which was observed in total confinement. This result reflects that there was better feeds consumption in vermi meal as compared to commercial feeds from both managements but, in return, produced lower weight gained (Table 3). This result was due to the full availability of nutrients present

in commercial feeds, which satisfied the feeding habit of a broiler. Published by Bahadori et al. (2014), the effect of treatment on some carcass components was not significant (P> 0.05). In total, the results showed that 2% and 3% of vermi meal improved the feed conversion ratio of broiler chickens.

Table 5

Feeds Conversion Ratio (FCR) of Broilers in 35 days as Affected by Different Levels of Vermin Meal Subjected to Total Confinement and Free-range

Factors	FCR(grams)
Factor A. Management System	
Total confinement	0.20 $_{a}$
Free-range	0.19 $_{b}$
Factor B. Broiler ration	
A_1B_0	0.16 $_{c}$
A_1B_1	0.23 $_{a}$
A_1B_2	0.21 $_{ab}$
A_1B_3	0.22 $_{ab}$
A_2B_0	0.15 $_{c}$
A_2B_1	0.20 $_{b}$
A_2B_2	0.20 $_{b}$
A_2B_3	0.20 $_{b}$
Interaction (A x B)	NS

Means in a column followed by a common letter were not significantly different, based on LSD Test at p<0.05

Water Consumption

The water consumption of the broiler was significantly influenced by the management system of the broiler (Table 6). The total confinement had a significantly higher volume of water consumption relative to the free-range. The higher volume of water consumption influenced by the total confinement was mainly due to the broilers' concentration to drink more water since they had no other supply of water to deal with. Meanwhile, in contrast to broiler raised in free-range resulted in significantly lower water holding capacity (P < 0.05). The causes were due to the temperature fluctuation, especially the relatively high temperature which had affected the water content of the muscle of the birds (Wang et al., 2009).

However, the different ration of broiler had significantly influenced the water consumption of broiler. The commercial feeds in total confinement (A1B0), and 3% vermi meal in free-range (A2B2) showed a significantly higher water consumption as they were comparable from each other. Table 4 shows the higher consumption of water in A1BO may be attributed to the higher volume of feeds consumed by broiler (as shown in Table 4). It indicated that broiler consumption of feeds was directly proportioned to water consumption. Whereas, in different vermi meals, there was a higher volume observed in A2B2, which indicated that 3% vermi meal in a free-range.

There was a significant interaction between the management system and different ration of broiler in which the commercial feeds in the total confinement area or vice versa had a higher rate of water consumption.

Table 6

Water Consumption of Broilers in 35 days as Affected by Different Levels of Vermin Meal Subjected to Total Confinement and Free-range

Factors	Water Consumption (liter)
Factor A. Management System	
Total confinement	4.03 $_{a}$
Free-range	3.95 $_{b}$
Factor B. Broiler ration	
A_1B_0	4.23 $_{a}$
A_1B_1	4.00 $_{b}$
A_1B_2	4.02 $_{b}$
A_1B_3	3.88 $_{c}$
A_2B_0	3.76 $_{d}$
A_2B1	3.79 $_{d}$
A_2B_2	4.21 $_{a}$
A_2B_3	4.04 $_{b}$
Interaction (A x B)	S

Means in a column followed by a common letter were not significantly different, based on LSD Test at p<0.05

Dressing Percentage

The dressing percentage of the broiler was significantly influenced by the management system of the broiler (Table 7). The total confinement had significantly higher in meat recovery which attributed to the volume of water consumption (A1) than the free-range (A2). This attributed that total confinement contained more moisture and fat in the meat. It was emphatically confirmed by (Boskovic et al., 2010) that the free-range rearing system was more favorable than an extensive indoor system, as it resulted in higher protein content and a lower fat content of white and dark chicken meat.

Regardless of the management system, the dressing percentage of broiler was significantly influenced by the different broiler ration. The treatment of commercial feeds was significantly higher than with a 2% level of vermi meal but was comparable with 3% and 5% level of vermi meal. However, the difference among treatments was just numerically small. The higher recovery of weight or dressing percentage of broiler in commercial feeds may be attributed to the content of fat and water of the meat as birds had higher water consumption (Table 6).

Table 7

Dressing Percentage of Broilers in 35 days as Affected by Different Levels of Vermin Meal Subjected to Total Confinement and Free-range

Factors	Dressing Percentage (grams)
Factor A. Management System	
Total confinement	70.67 $_a$
Free range	68.58 $_b$
Factor B. Broiler ration	
A_1B_0	71.33 $_a$
A_1B_1	70.33 $_{ab}$
A_1B_2	70.67 $_{ab}$
A_1B_3	70.33 $_{ab}$
A_2B_0	69.33 $_{bc}$
A_2B_1	68.00 $_c$
A_2B_2	68.33 $_c$
A_2B_3	68.67 $_c$
Interaction (A x B)	NS

Means in a column followed by a common letter were not significantly different, based on LSD Test at p<0.05

Production, Profitability, and Return of Investment

The cost and return analysis of raising broiler were affected by the management systems and different rations (*Table 8*). The study revealed that the broilers in the free-range had 16.38% ROI, which was higher compared to total confinement with 2.07%. This result was seconded by the result of (Minh, 2005), which implies that free-range chicken systems are sustainable and economical for both local and improved chicken breeds. Economic benefits were 12 to 36 % higher compared to total confinement.

In the different ration or the different levels of vermi, results showed that broilers fed with 2% vermi (B1) had higher net income and return of investment. The results could be concomitant to the expenses in operation in both management systems. The final weight, in comparison with the two management systems, revealed that free-range produce was sold at a higher price than the produce from total confinement (*see Table 8*).

Table 8

Production, Profitability and the Return of Investment of Broilers in 35 Days Raised under Two Management Systems and with Vermi Meal Supplementation

Management Systems	Production Cost (PHP)	Profit (PHP)	Return of Investment (ROI)
TOTAL CONFINEMENT (TC)			
A_1B_0 (15 heads)	2,607.00	58.25	2.23%
A_1B_1(15 heads)	2,804.00	53.00	1.89%
A_1B_2 (15 heads)	2,804.00	59.00	2.10%
FREE-RANGE (FR)			
A_2B_0 (15 heads)	2,804.00	458.25	16.34%
A_2B_1 (15 heads)	2,804.00	455.50	16.24%
A_2B_2 (15 heads)	2,804.00	463.75	16.549%
A_2B_3 (15 heads)	2,804.00	459.25	16.38%

Management Systems Profitability

The result revealed that broilers in the Free-Range Management System (459.19php) had a significantly higher profit than those in the total confinement management system (55.75), t (6) = -181.29; p = <.0005.

Table 9

Difference in the Profitability of Broilers between Total Confinement and Free-range Management Systems

Management System		*t*	p-value	Interprelation
TC	55.75			
Profitability		-181.29	<.0005	Significant
FR	459.19			

**tested at .05 level of significance.*

Management Systems Growth Performance

There was a statistically significant difference in the growth performance of broilers between the two management systems, $F(5,2)=68.8$; p = .014; Wilk's Λ = .006; Partial η^2 = .994.

Table 10

Difference in the Growth Performance of Broilers Between Total Confinement and Free-range Management Systems

Management System	*F*	Wilk's Λ	Partial η^2	p-value	Interpretation
Total Confinement/ Free-Range	68.79	.006	.994	.014	Significant

**tested at .05 level of significance*

The minimum level of vermi meal incorporation in the feed for broiler growth and profitability performances

In this study, different levels of vermi meal; 2%, 3% & 5% were combined with different local ingredients such as rice bran, copra meal, soybean meal, ground yellow corn, and other micro-ingredients. The growth of broilers in the different level of vermi meal was comparable to each other. Numerically, broilers with the 2% vermi meal had a high growth performance in both management systems. Profitability performance of broilers and the ROI showed high in 2% level of vermi meal in both management systems.

Level of the interaction of level meal in the diet of broilers in two management systems

There was an interaction effect between the

management system and different broiler ration on the feeds consumption of broiler (*Table 4*). The significant difference of total confinement in each different level of broiler ration was observed in the commercial feeds or vice versa. This implicitly meant that broilers in total confinement consumed feed well when using commercial feeds as ration. On the other hand, regarding the influence of different levels of vermi meal, the significant difference of total confinement in each different level of broiler ration was observed in 5% level of vermi meal application and vice versa. The results of interaction indicated that 5% vermi level was more preferred by the birds indicating that it attracted more birds compared to 2%and 3% vermi meal.

CONCLUSIONS

Based on the findings of the study, there were strong conclusions that came out, the vermi meal inclusion in the feed of broiler could be optimally given at a 2% level since it significantly increased the broiler's final weight and gain weight, with comparable feed consumption and high Feed Conversion Ratio that of commercial feeds. Water consumption was higher in TC compared to FR, since in FR management broilers can source water from the natural habitat. In TC, significantly higher meat recovery attributed to the volume of water consumption (A1) than the free-range (A2). This attributed total confinement contained more moisture and fat in the meat. In the management aspects, the two systems were not significantly different, although numerically, the total confinement broilers had higher final weight and weight gain.

In the economic aspects, the study revealed that the free-range management system gathered higher in terms of production performance, higher net income, and profitability was attained. In terms of cost and return analysis of raising broiler as affected by the management systems, different rations, and total sales of the live and dressed broilers, the broilers in the free-range had 16.38% ROI while 2.07% only in total confinement.

In the different ration or the different levels of vermi, the broilers fed with 2% vermi were profitable with higher net income.

The interaction effect was observed between the management system and broiler ration based on feed consumption of broiler. The significant difference in weight between treatments was observed in the commercial fed. The influence of different levels of vermi meal was observed in broiler consumption at 5% of the vermi meal.

RECOMMENDATIONS

Based on the conclusions, the following recommendations were drawn. In the three different levels of vermi meal, it revealed that their differences in terms of body weight, weight gain and feed conversion ratio were not significant to each other. Nevertheless, the 2% level of vermi meal was comparable to commercial feeds and had its optimum result. Thus, the study recommends the use of a 2% level of vermi meal for broiler production. The study was not able to submit for analysis the feed formulated samples of the different levels of vermi meal (2% level, 3% level & 5% level) and the vermi meal due to non-availability of laboratory equipment and the distance from research site to the laboratory facilities which is in Luzon. Hence, it is recommended to conduct other studies that should subject the formulated feed in different levels of vermi meal to laboratory analysis. Due to the limitation of this study, it did not cover other parameters. Thus, it is recommended to conduct related researches that include broiler sensory, carcass yield, meat quality/chemical composition.

REFERENCES

Boskovic-Bogosavljevic S., Mitrovic, S., Djokovic, R., Doskovic, V. & Djermanovic, V. (2010) Chemical composition of chicken meat produced in large indoor and-free-range-rearing-systems. *African Journal of Biotechnology*. 9069-9075, 1684-5315 2wa.

Bahadori Z., Esmaylzadeh, L., Amir M., & Torshizi K, (2015). *Biological Forum – An International Journal, 7*(1), 998-1005.

Istiqomah, L., Sofyan, A., Damayanti, E., & Julendra, H. (2016). Amino Acid Profile of Earthworm Meal (Lumbricus rubellus) for Animal Feedstuff. *Journal of the Indonesian Tropical Animal Agriculture, 34*(4). Retrieved from https://doi.org/10.14710/jitaa.34.4.253-257

Kasye, M. B. (2016). Evaluation of Earthworm (Eisenia fetida) as a Protein Supplement for Chicken Production in Haramaya University Poultry Farm. Doctoral dissertation, Haramaya University.

Kruchten, T. (2002). U.S Broiler industry structure. *National Agricultural Statistics Service (NASS)*, Agricultural Statistics Board, U.S.: Department of Agriculture. Retrieved from U.S. Agricultural Statistics Board, June 23, 2012

Minh, D. V. (2005). Effect of supplementation, breed, season and location on feed intake and performance of scavenging chickens in Vietnam. Diss. (sammanfattning/summary) Uppsala: Sveriges lantbruksuniv., Acta Universitatis agriculturae Sueciae, 1652-6880; 2005:101

Prayogi, H. S. (2011). The effect of earthworm meal supplementation in the diet on quail's growth performance in attempt to replace the usage of fish meal. *International Journal of Poultry Science, 10*(10), 804–806. Retrieved from https://doi.org/10.3923/ijps.2011.804.806.

Ravindran, V., & Blair, R. (1993). Feed resources for poultry production in Asia and the Pacific. III. Animal protein sources. *World's Poultry Science Journal, 49*(3), 219-235. DOI:10.1079/WPS19930020.

Wang, K. H., Shi, S. R., Dou, T. C., Sun, H. J., (2009). Effect of a free-range raising system on growth performance, carcass yield, and meat quality of slow-growing chicken. *Poultry Science,88*, 2219–2223. Retrieved from https://doi.org/10.3382/ps.2008-00423.