BIBLIOGRAPHY

SOPSOP, JENNIFER G. APRIL 2013. Utilization of Activated Charcoal Containing Wood Vinegar as Feed Additive for Colored Broilers. Benguet State University, La Trinidad, Benguet.

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ABSTRACT

One hundred forty four day-old straight run colored broiler chicks were used. They were divided into three treatments and each was replicated four times with twelve birds per replicate. Analysis of variance for Completely Randomized Design was used to compare treatments means and the Duncan's Multiple Range Test was used to compare the significant differences among the means. The treatments were control (plain commercial feeds), 10g and 20g activated charcoal containing wood vinegar per kg commercial feeds.

It was found that commercial feeds added with 20g activated charcoal had significantly reduced the daily feed intake of broilers although there was no economic advantage gained. On all other growth parameters, the effect of plain commercial feeds and that which was added with 10 or 20 g activated charcoal was relatively the same. It is also concluded that activated charcoal containing wood vinegar has no adverse effect on the health of the birds. Based on the above results, activated charcoal could possibly be added to the ration of colored broilers upon the discretion of the producer as it was exhibited that the growth of the birds was not adversely affected. Additionally, charcoal has been proven to absorb harmful toxins from the body and this effect could still be considered.

INTRODUCTION

Poultry production accounts for the major part of all meat produced in many developing countries, and an integral component of nearly all rural, pre-rural and urban households. Poultry are of considerable significance to rural as well as national economies and an important source of animal protein.

In agricultural countries such as Philippines where most of the Filipinos derive their income from farming, poultry production is one of the major enterprises favorable in the country. Furthermore, there is a high consistent demand for poultry meat due to the increasing human population. However by raising poultry, there are several factors that affect production. These factors could be the lack of financial capital, in availability of the stocks to local conditions, care and management, and the high cost of commercial feeds.

Feed constitutes the highest expense in poultry production. The availability of feed ingredient is one of the greatest challenges to the expansion of poultry enterprises. Commercial broiler feed is expensive and out of the reach to smallholder farmers. The cost of conventional feedstuffs such as corn and protein concentrates of plant origin such as the agro-industrial by-products are increasing and they are generally less available.

Furthermore, the growing awareness of consumers on better food choices make it worthwhile to adopt technologies that aim to reduce the use or even replace synthetic chemicals with plant-derived bio control agents and growth enhancer. Globally changing consumer trends necessitate the need to look for alternative products to minimize the dependence on chemicals in livestock and poultry feeding. Therefore it is interesting to investigate for other feed additives that can enhance the growth of birds. Recently, the

Miyazaki and Midori Pharms Corporation started to produce a feed additive which is now known as activated charcoal containing wood vinegar.

Studies have been conducted in other countries about feeding activated charcoal containing wood vinegar and it was shown to improve the growth of domestic animals such as swine and poultry also as treatment for cryptosporidiosis in calves. This makes it worthwhile to localize the study.

The study benefits not only the researcher, but also other researchers, poultry producers, farmers and those who would like to invest in poultry production. It was conducted to promote the use of activated charcoal containing wood vinegar liquid in improving growth enhancer for poultry. The result of the study serves as a guide in using activated charcoal containing wood vinegar as a feed additive in chicken production. The research would add to the pool of acknowledgement on how to enhance especially the growth performance of slow-growing chicken especially colored broilers for higher income and profit. It may also serve as reference to other researchers to follow- up their researches.

On a general perspective, this research aimed to obtain scientific data indicating the effectiveness of using charcoal and mokusaku to animal production by enhancing healthy growth of animals and improving productivity and product quality. Specifically, the project aspired to determine the effect of charcoal and mokusaku mixture (as part of the total diet) on the gain in weight, feed consumption and feed: gain efficiency, cost per kilogram gain, morbidity and mortality rates; It likewise aimed to interpret and compare the harvest rate, productivity index, and return on investment derived from the different feeding programs.

The study was conducted at the Benguet State University Poultry Project at Balili, La Trinidad, Benguet from November to December 2012.

REVIEW OF LITERATURE

Activated charcoal containing wood vinegar is a product made by mixing activated charcoal and wood vinegar (mokusaku) liquid that contains organic acids, both obtained from the bark of evergreen oak (*Castanopsis cuspidate* and *Quercus acuta*) by carbonization (Tiilikkala *et al.,* 2010).

The vinegar liquid called activated charcoal containing wood vinegar showed antiprotozoan activity against *Cryptospiridosis parvum* oocysts (Watarai and Kiowa 2008; Tiilikkala *et al.,* 2010). Calves that were fed milk enriched with activated charcoal containing wood vinegar showed recovery from diarrhea 1 d after the start of treatment. Mixture of charcoal and wood vinegar was proved to be useful as an aqua feed as well as a useful component in chicken feed (Tiilikkala *et al.,* 2010).

Pyroligneous acid, also called wood vinegar or mokusaku, is an aqueous liquid produced from slow pyrolysis of hardwood (Tiilikkala *et al.,* 2010). Mokusaku is composed of a lot of organic chemical substances. It is a liquid obtained from oil, juices, sap and other liquid contents of organic materials such as wood, coconut shell, bamboo, grass, and other plants after being heated in a chamber. When these organic materials are heated, their liquid content evaporates as steams (gas, smoke). The steam passes through a tube (cooling chamber) where it will be allowed to cool. When the steam is cooled, the vapor will turn into liquid (condensation processed). Studies in Japan have shown that there could be more than 300 chemical substances. However, contents of these substances are dependent on the materials to be heated as well as the burning/ carbonizing process and the timing collecting cooled steam from the tube (Yokomori, 2011).

Tiilikkala *et al.*, (2010), the efficacy and use of wood vinegar in agriculture: fungicide, pesticides, repellents and insecticides, herbicide and plant growth enhancer, as feed stuff for swine cattle and chicken, and wood preservatives- It possesses antifungal and antioxidant properties as well as potential to be used as natural preservative in wood industries. Extracts are easily available, inexpensive and believed to be non-toxic to the environment. The same products have been used as disinfection, antibacterial and deodorization materials in agriculture and horticulture.

He also mentioned that the main organic components of wood vinegar are methanol and acetic acid. Other components are acetone, methyl acetone, acetaldehyde, ally alcohol, furan and furfural, and formic, propionic and butyric acids.

Yokomori, (2009) also mentioned that Japanese farmers have been using wood vinegar to improve crop and livestock production. They use it as: (1) foliar spray, particularly for fungus (grey molds), (2) insecticide when mixed with pepper, (3) enhancer for compost-making, (4) soil conditioner to improve the soil when mixed with charcoal, and (5) feed supplement or additive for livestock feeds.

He cited that in chicken egg production, farmers claimed that their hens improved their egg-laying performance, had better rearing characteristics, and improved their hatching efficiency. It also improved the quality of eggs such as better taste, reduced cholesterol content and had harder egg shells.

Activated charcoal is estimated to reduce absorption of poisonous substances up to 60%. It works by adsorbing chemicals, thus reducing their toxicity (poisonous nature), through the entire length of the stomach and small and large intestines (GI tract). Activated

charcoal itself is a fine, black powder that is odorless, tasteless, and nontoxic (Cunha, 2012).

Charcoal House LLC (2006) cited the Food and Fertilizer Technology Center of the Asia Pacific Region in cooperation with Kwang Hwa Jung National Livestock Research Institute in Korea recommending the rate and usefulness of bamboo charcoal added to the feed as follows as follows:

Livestock	Amount added to feed mix	Usefulness
Milk cows	1-2%	Prevention of mastitis Increased milk production Reduction of somatic cells in milk Prevention of calculus occurrence Prevention of stomach twist
Fattening cattle	1-1.5%	Improved meat quality
Pigs	1-5%	Reduction in mortality Reduction in bad smell and fly occurrence Better feed conversion and less leftover feed
Laying chickens	1-1.5%	Increased laying rate Longer laying period Increased egg weight
Broiler chickens	1%	Higher survival rate over 4-day shipping period General reduction in mortality

They also mentioned that because animals are increasingly subjected to contaminated water and feed many small and large farmers are following an age-old practice of mixing charcoal either into drinking water or the feed. This practice is widely followed in Europe with commercial activated charcoals specifically designed to be added to cattle and poultry feed. The activated charcoal supplement is able to absorb many toxins from water-borne organisms or toxins from decomposing feeds. An added benefit is the marked reduction in

waste odors. Kutlu *et al*., (2001) as cited by Padacdac (2010) observed that charcoal supplementation induce a small reduction in feed intake, egg production and feed conversion ration of broilers.

Sasso chickens are native chickens of France; they grow faster, with delicious and tender meat and strong disease resistance. Sasso Chickens are free-range, affordable, and easy to raise which proves to be a profitable livelihood venture. They graze around the field, or backyard running around, and eating grass, corn, leaves and other natural ingredients. Because they are being naturally grown free-range style, you are assured of a clean chicken meat with less cholesterol and fat. Sasso chickens can be raised as broiler and are good layers too when they reach six months of age. Sasso hens lay naturally brown, tasty, nutritious and with less cholesterol eggs (RAFID, 2006).

Inocencio (1999) mentioned that Sasso chicken also look like some of the native chicken in the Philippines but are bigger and fast growing. In a growing period of 60 days, the birds will normally attain weight of 1.5 to 2 kilograms. Like the Philippine native chicken, the meat is tender and juicy.

A high feed consumption may lead to a higher protein intake which may be responsible for the improved growth and feathering (Schaible, 1970) as cited by Abahan (2002). Body composition of the birds has been shown to be influenced by breed, sex, age and dietary manipulation (Bunan, 1993). He also said that feed efficiency is an important determinant of profitability in broiler production. Gatmaitan (1985) as cited by Aucena (1997) mentioned that there is no standard ration for any class of swine and poultry. The formula can be adjusted if there is a change in the price of feed ingredient or when one ingredient becomes more readily available than others, the requirement has to be satisfied.

MATERIALS AND METHODS

Materials

The materials that were utilized in the study are 144 heads of straight-run day-old colored broilers ; commercial feeds (CF), activated charcoal containing wood vinegar; brooding-rearing cages, feeders, waterers, sacks, incandescent bulbs (100 watts), old newspaper sheets, pails, disinfectants; weighing scale; record book, pen and digital camera.

Methods

Pre-experimental phase. General cleaning of the house was done two weeks before the chicks arrive. All adhering dirt and fecal droppings in the cages were scrapped and brushed off as well. After dry cleaning, thorough wetting was done to loosen up whatever residue left. This was followed by scrubbing with a detergent sanitizer solution (detergent powder diluted in water). Feeders, watering devices and jute sacks for curtains and dividers were likewise washed in detergent solution.

Rinsing with water under high pressure was done to ensure that all facilities are thoroughly clean. The cages were divided using jutes sacks into 12 pens following recommended space requirements. The heating lamps were also installed in the pens.

Disinfection followed after the house and equipment dry. The ceiling, walls and floors including the feeders and drinkers were sprayed with disinfectant then allowed to dry. A second disinfection was done after 2 days using an organic disinfectant. The disinfected poultry house was closed and all unnecessary entry was prevented until the chicks arrived.

Brooding and rearing management. Pre-heating of the brooders was done by turning on the bulbs one hour prior to expected placement of the chicks. Feeds and water mixed with dextrose were readily available. Newspapers laid on top of each other to about ten layers were used as bedding material and feed receptacles which allowed the chicks to familiarize themselves with the feeds before feeders were introduced on the second week. The optimum brooding temperature requirement was followed throughout the brooding stage. The brooding pens also served as rearing pens to minimize unwanted stress incurred when the chicks are transferred.

Experimental design and treatment. The experimental birds were weighed at day-old to obtain their initial weight, and were distributed at random into three treatments following the Completely Randomized Design (CRD). Each treatment was replicated four times with 12 birds per replication, making a total of 48 birds per treatment. The three treatments are the following:

T_0 - control (commercial feeds (CF) + antibiotic premix)

T_1 – 10 g activated charcoal containing wood vinegar per kg CF (Figure 1a)

T_2 – 20 g activated charcoal containing wood vinegar per kg CF (Figure 1b)

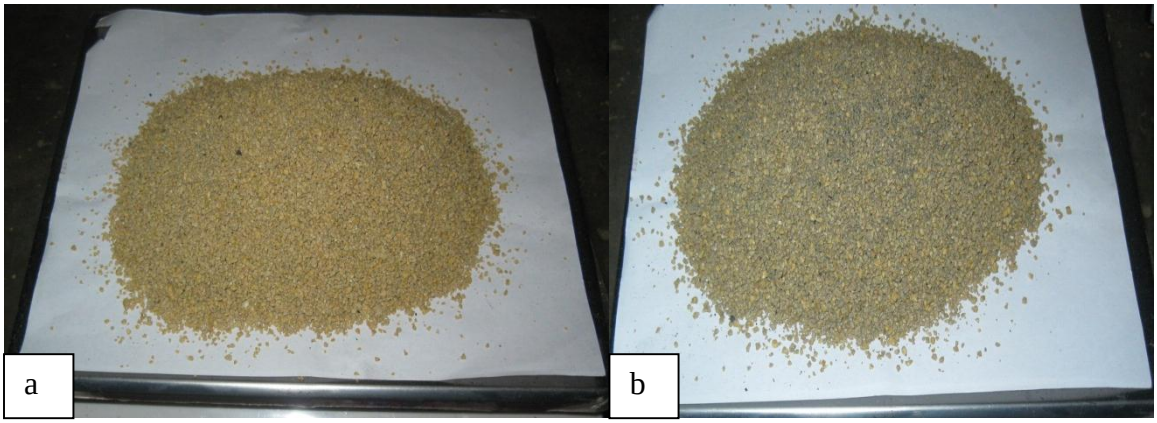

Figure 1. The experimental rations: (a) 10g activated charcoal per kg ration and (b) 20g activated charcoal per kg ration

Procurement of the activated charcoal and wood vinegar mixture. Activated charcoal containing wood vinegar (Figure 2) was provided by the Japanese Agricultural Exchange Cooperation (JAEC). The additive was added to the ration of the birds at 1% and 2% of the ration based on manufacturer's recommendation.

Lighting management. Sufficient light was provided to the birds to maximize their growth potential. The intermittent lighting program was adopted by giving continuous light for two weeks of brooding then shifted to 16 hours light and 8 hours dark period starting on the first day of the 2nd week. The dark period was from 10 o'clock in the morning to 5 o'clock in the afternoon. The lights were turned on only at 5:00 PM.

Figure 2. Sample of activated charcoal containing wood vinegar

Water management. Water was provided *ad libitum* to all birds from the start to the end of the study (day 1 to 56). On the first seven days, antibiotic premix was added to the drinking water of all the birds. On the first day of the second week, the birds under treatments 1 and 2 received plain water while the birds in the control group continued to drink water with antibiotics.

Feed management. Feeds were given evenly on the newspaper matting. Feeding troughs were introduced on the second week. The feeders were checked every 6 hours to ensure that feeds were always available. All the chicks were fed with booster ration from 1 to 22 days, then grower-finisher ration from 23 to 56 days which is the culmination of the study. Activated charcoal containing wood vinegar was incorporated in the ration of the designated birds (T_1 and T_2) from the first day until the end of the study. Figure 4 and 5 present an overview of the birds in their respective group assignments.

Figure 3. Initial weight of birds at day-old (a) and final weights of birds at 56 days old (b)

Figure 4. Overview of the birds in the control diet

Figure 5. Overview of birds given activated charcoal containing wood vinegar

Data Gathered

1. Initial weight (kg). This was the weight of the chicks at day – old (Figure 3a).

2. Weekly body gain in weight (kg). This refers to the weekly weight increment of the birds while feeding on the experimental diets.

3. Final weight (kg). This was taken by weighing the birds individually at the end of the study when they are 56 days of age (Figure 3b).

4. Feed offered (kg). This refers to the total amount of feeds consumed by the birds from the start until the end of the experiment. This was taken by adding all the feeds offered to the birds after the left-overs have been subtracted.

5. Feed leftover (kg). This refers the amount of feed left in the feeders and collected daily for the 56 days of experimental feeding.

6. Mortality. This refers to the number of dead birds during the experiment.

7. Morbidity. This refers to the number of birds that got sick during the duration of the study.

8. Feed cost (Php). This refers to the prevailing cost of commercial ration at the time of the study.

Data Computed

1. Total gain in weight (kg). This was computed by subtracting the initial weight from the final weight.

2. Average daily gain (kg). This was obtained by using the formula:

$$\text{Average daily gain} = \frac{\text{Total gain in weight}}{\text{56 days (feeding trial)}}$$

3. Total feed intake. This was obtained by adding the amount of feed offered after the feed left-over had been subtracted.

4. Average daily feed intake (kg). This was the amount of feeds consumed by each birds daily which is computed by dividing the total feed intake by the total number of feeding days.

5. Feed conversion ratio. This was obtained by dividing the total feed intake by the total gain in weight.

6. Feed cost required to produce a kilogram gain in weight (PhP). This was obtained by multiplying the cost of one kilogram feed mixture.

7. Morbidity rate. This was computed by dividing the number of sick birds by the initial number multiplied by 100.

8. Mortality rate. This was obtained by dividing then number of dead birds from the start until the end of the experiment by the total number of birds at the start of the study multiplied by 100.

9. Harvest rate (%). This was computed using the following formula:

$$HR = \frac{\text{Number of harvested birds}}{\text{Initial number of birds}} \quad X\ 100$$

10. Productivity index (%). This was computed using the following formula

$$PI = \frac{\text{Live body weight (kg)}}{\text{Feed conversion ratio}} \quad X\ 100$$

11. Return on Investment (ROI). This was computed using the formula:

$$ROI = \frac{\text{Total sales} - \text{Total cost of production}}{\text{Total cost of production}} \quad X\ 100$$

Data Analysis

The data gathered were subjected to analysis of variance for Completely Randomize Design (CRD). Comparison of treatments was done using the Duncan's Multiple Range Test (DMRT).

RESULTS AND DISCUSSION

Initial and Final Weight

Table 1 shows that the birds were homogenous in weight at the start of the study as confirmed by the statistical analysis. After 56 days of feeding on the trial diets, the birds in all the treatments were also comparable in weight. This shows that adding 10 or 20 g of activated charcoal containing wood vinegar neither enhanced nor adversely affected the final weight of the birds. This could mean that no advantage was derived from utilizing the said product as feed additive. However, it could also mean that there was no significant harmful effect attributed to the use of such product. Furthermore, the uniform management administered and the homogeneity of the birds at the start of the study contributed to this outcome.

Gain in Weight

Figure 2 illustrates the growth patterns in the three treatments. Some appreciable differences were observed in the weekly weight increments. At seven, 35 and 56 days of age, all the birds had more or less similar weight gain while on the 14^{th}, 21^{st} and 28^{th} days of age, the birds in the control group and the birds fed with 10 g activated charcoal per kilogram of commercial feed were heavier than the birds fed with 20g activated charcoal. Table 2 shows the total and average daily gain in weights of the birds. Statistical analysis showed no significant differences in all the treatments in terms of total and average daily gain. This implies that all the birds gained more or less the same weights in total and had comparable daily gaining ability.

Results show that the ration containing 10g activated charcoal per kilogram has induced the same effect as the plain commercial feeds. The growth trend of the chicken was not detrimentally affected and as stated by Inocencio Farms (1999), colored chicken normally attain a weight of 1.5 to 2.0 kilograms in a 60-day grow-out period. The figures gathered from this study are well within this range.

Table 1. Initial weight at day-old and final weight at 56 days old

TREATMENT	**BODY WEIGHT (kg)**	
	INITIAL	FINAL
Commercial feeds	0.0403[a]	1.894[a]
10g Activated charcoal containing wood vinegar per kg CF	0.0395[a]	1.829[a]
20g Activated charcoal containing wood vinegar per kg CF	0.0400[a]	1.873[a]

Means with the same superscript are not significantly different (P≥ 0.05) DMRT

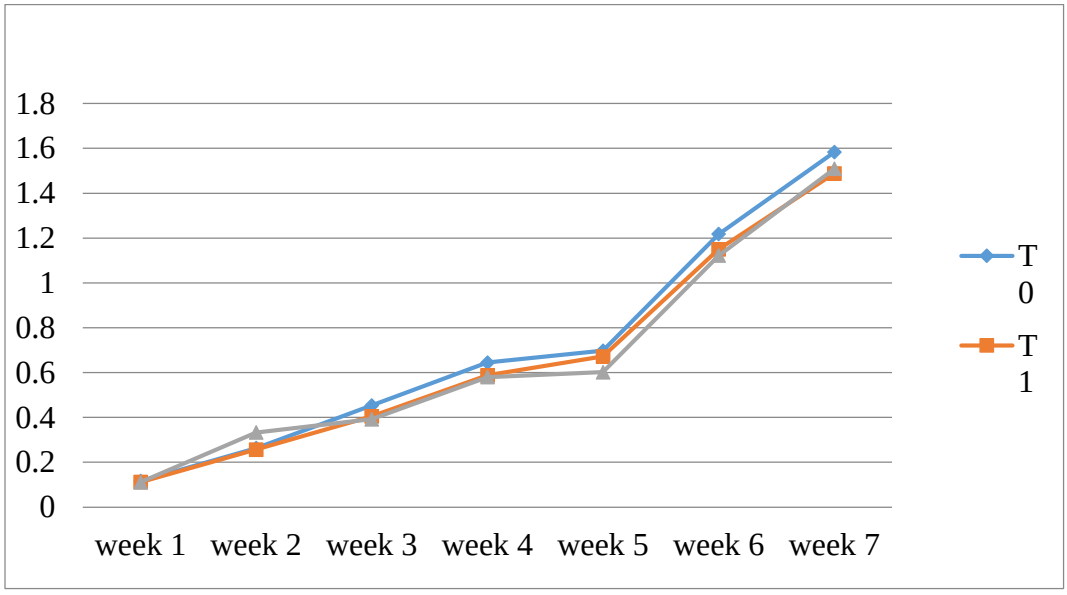

Figure 1. The growth pattern from 7 to 56 days of age of the birds

Total and Average Daily Feed Intake

Table 3 shows the total feed intake of the birds in each treatment taken at the end of the study by summing the total feed offered. Statistical analysis revealed that there were no significant differences among the treatments in total feed consumption. This shows that the amount of feed consumed by the birds was not affected by the incorporation of activated charcoal containing wood vinegar in the diet. This could mean that the palatability of the diets was not affected by the addition of activated charcoal containing wood vinegar.

In terms of daily feed intake, there were noticeable differences detected by analysis of variance. The birds given commercial feeds only and those given 10 g activated charcoal had higher intake daily compared to those fed with 20 g activated charcoal.

This supports the observation of (Kutlu *et al*., 2001) as cited by Padacdac (2010) that charcoal supplementation tend to induce a small reduction in the feed intake, egg production and feed conversion of broilers.

Table 2. Gain in weight of the birds from 1-56 days of age

TREATMENT	**GAIN IN WEIGHT (kg)**	
	TOTAL	AVERAGE
Commercial feeds	1.854[a]	0.033[a]
10g Activated charcoal containing wood vinegar per kg CF	1.789[a]	0.032[a]
20g Activated charcoal containing wood vinegar per kg CF	1.833[a]	0.033[a]

Means with the same superscript are not significantly different (P≥ 0.05) DMRT

Table 3. Total and average daily feed intake

TREATMENT	FEED CONSUMPTION (kg)	
	TOTAL	DAILY
Commercial feeds	5.010[a]	0.089[b]
10g Activated charcoal containing wood vinegar per kg CF	4.760[a]	0.089[b]
20g Activated charcoal containing wood vinegar per kg CF	4.796[a]	0.086[a]

Means with the same superscript are not significantly different (P≥ 0.05) DMRT

Feed Conversion Ratio

Bunan (1993) said that feed efficiency is an important determinant of profitability of broiler production. The feed conversion ratio of the birds at 56 days of age is presented in Table 4. This represents the efficiency of the birds to convert feed into meat or body gain in weight. Although there was a slight improvement in the FCR of the birds given 20 g activated charcoal, the numerical difference was not enough to cause a significance as revealed by analysis of variance. This finding implies that the birds ate more or less same amount of feeds to produce a kilogram increase in body weights. The inclusion of activated charcoal containing wood vinegar did not affect the feed: gain efficiency of the birds.

Feed Cost Required to Produce a kg Gain in Weight

Presented in Table 5 is the feed cost required to produce a kilogram gain in weight. Results showed that there were highly significant differences in all treatments. Birds given 10g and 20g activated charcoal containing wood vinegar attained the highest

Table 4. Feed conversion ratio (FCR)

TREATMENT	FCR
Commercial feeds	2.704[a]
10g Activated charcoal containing wood vinegar per kg CF	2.775[a]
20g Activated charcoal containing wood vinegar per kg CF	2.620[a]

Means with the same superscript are not significantly different (P≥ 0.05) DMRT

Table 5. Feed cost required to produce a kg gain in weight

TREATMENT	FEED COST REQUIRED TO PRODUCE A KG GAIN IN WEIGHT
Commercial feeds	75.677[a]
10g Activated charcoal containing wood vinegar per kg CF	81.855[b]
20g Activated charcoal containing wood vinegar per kg CF	81.561[b]

Means with the same superscript are not significantly different (P≥ 0.05) DMRT

mean of PhP81.855 and PhP 81.561, respectively compared to birds given pure commercial feeds which is PhP 75.667. The additional cost is directly attributed to the cost of the additive.

Gatmaitan (1985) as cited by Aucena (1997) mentioned that there is no standard ration for any class of swine or poultry. The formula can be adjusted if there is a change in the price of the feed ingredient. In this case, the discretions lies on the producer.

Morbidity and Mortality Rate

Morbidity was observed on the birds fed with plain commercial feeds (6.250%) and those birds given 10g activated charcoal containing wood vinegar per kg feeds (4.167%) while the birds given 20g activated charcoal containing wood vinegar were found to be healthy as presented in Table 6. This was observed during the last week of the study where some birds became lame. This lameness resulted to loss of appetite and a slight decrease in body weights of the birds. No certain disease was observed on the birds.

There was no mortality recorded among the treatments. This result showed that the different levels of activated charcoal containing wood vinegar added to the ration had no adverse effect on the health of the birds.

Harvest Rate and Productivity Index

The harvest rate attained in this study was 100%. Since there were no mortality observed among treatments, the initial number of birds at day-old which is one hundred forty four retained until fifty six days which is the culmination of the study.

Table 6. Morbidity rate

TREATMENT	MORBIDITY
Commercial feeds	6.250[a]
10g Activated charcoal containing wood vinegar per kg CF	4.167[a]
20g Activated charcoal containing wood vinegar per kg CF	0.000[a]

Means with the same superscript are not significantly different (P≥ 0.05) DMRT

The mean productivity index of the birds reflects the ration of their average live weight by their FCR. Table 7 shows that the highest productivity index value attained is 70.11% from

the birds fed 20 g activated charcoal per kilogram feed while the lowest productivity index of 64.39% was recorded from the treatment fed with 10g activated charcoal. Statistical analysis shows that there are no significant differences among treatment in terms of their productivity index which could mean that the production efficiency of the birds are relatively the same.

Return on Investment

Table 8 showed the return on investment in the different treatment. It was computed by subtracting the total cost from the sales divided by the total cost and multiplied by 100. Although this was not subjected to statistical analysis, it shows that with 11.88% birds fed with pure commercial feeds gained the highest ROI value of 11.88% followed by the birds given 20g activated charcoal containing wood vinegar per kg feeds (10.79%). Birds given 10g activated charcoal containing wood vinegar obtained the lowest ROI of 6.88%.

Table 7. Productivity index

TREATMENT	PRODUCTIVITY INDEX
Commercial feeds	68.414[a]
10g Activated charcoal containing wood vinegar per kg CF	64.388[a]
20g Activated charcoal containing wood vinegar per kg CF	70.110[a]

Means with the same superscript are not significantly different (P≥ 0.05) DMRT

Other Observations

Fecal droppings of the experimental birds that were given 10g and 20g activated charcoal per kilogram commercial feed were observed to be less odorous than that of the

usual smell of dropping from birds given pure commercial feeds. This supports the observation of Charcoal House LLC (2006) that an added benefit of activated charcoal is marked reduction in waste odor. This observation could further promote the use of activated charcoal containing wood vinegar to minimize air pollution especially for poultry producers raising near a community.

Aside from the fecal droppings, it was observed that the nostrils of the birds fed with activated charcoal were black as a result of inhaling the fine dusty particles.

Table 8. Cost of production and return on investment observed from the birds

TREATMENT	TOTAL SALES (Php)	TOTAL COST (Php)	NET INCOME (Php)	ROI (%)
Commercial feed	15685.55	14020.25	1665.32	11.88%
10g Activated charcoal containing wood vinegar per kg CF	15150.05	14174.24	975.81	6.88%
20g Activated charcoal containing wood vinegar per kg CF	15513.00	14001.75	1511.25	10.79%

SUMMARY, CONCLUSIONS AND RECOMMENDATION

Summary

The study was conducted to determine the effectiveness of using activated charcoal containing wood vinegar given different levels as feed additive for colored broilers. A total of 144 day-old straight-run colored broiler chicks were used in the study. This was conducted at the Benguet State University (BSU) Experimental Poultry House, La Trinidad, Benguet from November 1 to December 26, 2012.

Specifically, the study aimed to determine the effect of charcoal and mokusaku mixture (as part of the total diet) on the body gain in weight of colored broilers; compare the feed consumption, feed: gain efficiency and compute the cost per kilogram gain of the birds as a result of their different feeding regimes; observe differences in morbidity and mortality rates among treatment groups. Also, to interpret and compare the harvest rate, productivity index, and return on investment derived from the different feeding regimes.

The different treatments were as follows: T_0- plain commercial feeds (CF); T_1-10g activated charcoal containing wood vinegar per kilogram CF; T_2-20g activated charcoal containing wood vinegar per kilogram CF.

Analysis of variance found no significant differences in all treatments means for final weight, total and average daily gain, total feed consumption, feed conversion ratio, productivity index, morbidity rate, and mortality rate. total and average gain in weight, final and initial weights.

Due to the additional cost for the feed additive, feed cost required to produce a kilogram gain in weight of the birds were significantly higher in the groups fed with activated charcoal than the groups fed with plain commercial feed. Significant differences among

treatment were also revealed on the average daily feed intake where there was a reduction in the group fed with 20g activated charcoal.

In terms of ROI, the birds fed with pure commercial feeds gained the highest followed by the birds given 20g activated charcoal containing wood vinegar per kg feeds 10.79%. The birds given 10g activated charcoal containing wood vinegar obtained the lowest with 6.88%.

Conclusions

Based on the result of the study, it is concluded that commercial feeds added with 20g activated charcoal had significantly reduced the daily feed intake of broilers although there was no economic advantage gained. On all other growth parameters, the effect of plain commercial feeds and that which was added with 10 or 20 g activated charcoal was relatively the same. It is also concluded that activated charcoal containing wood vinegar has no adverse effect on the health of the birds.

Recommendation

Based on the above results, activated charcoal could possibly be added to the ration of colored broilers upon the discretion of the producer. Although no economic advantage was gained, the growth of the birds was not adversely affected and was comparable to those fed plain commercial feeds. Additionally, charcoal has been proven to absorb harmful toxins from the body and this effect could still be considered.

LITERATURE CITED

ABAHAN, Z. C. 2002. Growth Performance and Carcass characteristics of Sasso chicken given Different Feed Ration. Undergraduate Thesis. Benguet State University, La Trinidad, Benguet. P. 4.

AUCENA. M. T. 1997. Evaluation of Hog Grower Ration Formulated at Farmers Level. Undergraduate Thesis. Benguet State University, La Trinidad, Benguet. P. 4.

BUNAN, T. A. 1993. Body fat Deposition and its Manipulation in the Broiler Chicken. Don Severino Agricultural Colleges. Res. J. 7:16-19.

CHARCOAL HOUSE LLC. 2006. Animal Feed Supplement. Retrieved data October 2012 from http://www.buyactivatedcharcoal.com/animal_feed.

CUNHA, J. P. 2012. Activated Charcoal. Retrieved data October 2012 from http://www.emedicinehealth.com/activated_charcoal/article_em.htm.

INOCENCIO, A. P. 1999. Country incorporated handbook. Retrieved data March 2013 from http.//www.bir.sasso.Ani.Delhi. Pp. 322-323.

PADACDAC, E. T. 2010. The Effect of Bamboo Charcoal on the Growth Performance of Broilers. Undergraduate Thesis. Benguet State University, La Trinidad, Benguet. P. 4.

REGIONAL AGRICULTURE AND FISHERIES INFORMATION DIVISION. 2006. Raising Sasso Chicken. Department of Agriculture-5. San Agustin, Pili, Camarines Sur. Retrieved data October 2012 from http://www.bicol.da.gov.ph / News/techno guide/ sasso_chicken.html.

TIILIKKALA, K., FAGERNAS, L. and TIILIKKALA, J. 2010. History and Use of Wood Pyrolysis Liquids as Biocide and Plant Protection Products. Retrieved data October 2012 from http://www.benthamscience.com/open/toasj/articles /V004/SI0085TOASJ/111TOASJ.pdf.

WATARAI, S., TANA, and KOIWA, M. 2008. Feeding Activated Charcoal Bark Containing Wood Vinegar Liquid (Nekka- Rich) is Effective as Treatments FOR Cryptosporidiosis in Calves. Retrieved data October 2012 from http://www.ncbi.nlm.nih.gov/pubmed/18349239.

YOKOMORI, M. 2011. Farmers in Benguet Practice Savers Technology. P. 1 and 3.

YOKOMORI, W. 2009. Manual: Organic Farming Technology in Japan. Koibuchi College of Agriculture and Nutrition. P. 5.