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Response of Native Chicken to Selected Saponin-Containing Herbs Extracts under Partially Ranged System

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Abstract

Phytochemicals such as saponin and tannin may have harmful effects on animal nutrition, but they can also be capitalized to manipulate the physiological function of the animals. This study was conducted to evaluate the effect of saponin-containing herbs extracts on the growth performance of native chicken in terms of feed consumption, weight gain, feed conversion ratio, and water intake. The study also assessed the anthelmintic potential and economic return of the different saponin-containing herbs extract in native chicken. The levels tested were 30 ml each of chili pepper, alugbati, and ginseng extracts per liter of water. Treatments were replicated three times and arranged through a randomized complete block design with age and weight as bases for blocking. Data collected were analyzed using the analysis of variance, and results were interpreted at 5% level of significance. Results showed that feed consumption, feed conversion ratio, gain in weight, and water intake were significantly affected by the various saponin-containing herbs extracts, and a similar pattern of differences was reflected on the fecal examination on the percent reduction of egg count. About 30 ml each of chili pepper, alugbati, and ginseng extracts were effective against gastrointestinal parasite control in native chicken. Moreover, supplementation of 30 ml ginseng extract gave the highest income over feed and supplement cost of Php 23.65. Therefore, chili pepper, alugbati, and ginseng extracts can be added to the drinking water of native chicken at 30 ml/L water to give a positive effect on growth, reduction of fecal egg count, and increased profit.

Keywords*:* saponin-containing herbs extracts, growth, anthelmintic, native chicken, partially ranged system

1. Introduction

Filipino farmers rely on native chicken as one of their major source of eggs and meat. The native chicken's unique ability to produce meat and eggs under nominal management interference and inputs has resulted to its sizable population and popularity. The part of native chicken in agriculture industry and the whole economy is well-acknowledged. Native chicken serves as a basic provider to the constant meat and egg supply as well as income of many local farmers. The meat of this chicken is extremely chosen by some consumers due to its well-defined taste, color and leanness or the carcass characteristics as a whole (Dusaran and Pabulayan, 2005).

Growth enhancers were being added to feeds and water supplement in order to acquire healthier animals and higher production output. One of the most commonly utilized growth promoting substance is antibiotic (Kamra, 2005). Antimicrobials are mainly given to poultry species to efficiently increase the growth of birds, prevent the surge of diseases and better feed utilization. Although great outcome will be acquired with these substances, their usage might pose a negative result to the public as well as to the environment as a whole. It may likewise promote residual issues to animals and may cause local bacterial populations seemly resistant to the antibiotics. This is the reason why antibiotic applications were prohibited in many countries because of the negative results to both animal and human (Ofalia and Ucag, 2016).

The phytogenic extract is now used as new additives to substitute feed antibiotics in animal feeds. Lately, phytochemicals such as saponins, essential oils and condensed tannins are investigated. Out of which, saponin is one of the essential category (Kumar *et al.*, 2017).

Saponins are present in numerous plants; it is characterized as being soapy because of their detergent properties (Madland, 2013; Sahelian, 2016). They have various characteristics which include sweetness and bitterness, foaming and emulsifying, pharmacological and medicinal. Saponins also have powerful hemolytic property, immune-stimulating activity, anti-inflammatory, insecticidal and antimicrobial properties particularly against protozoa, fungi and bacteria (Madland, 2013; Sahelian, 2016; Aban and Bestil, 2016a).

Among the studied plant species that contain saponin are ginseng, alugbati, capsicum, and alliums (Yücekutlu and Bildacı, 2008; Gonzales *et al.*, 2018). Other studies also include soya beans, beans, avocado, papaya, caimito, santol,

ipil-ipil, kakawate, and centrosema (Manuel *et al.*, 2012; Aban and Bestil, 2016a, 2016b). However, some of these plants were not yet tested on animals especially on poultry. Hence, this study was conducted to assess selected saponin-containing herbs extract such as ginseng, alugbati and chili pepper on the growth performance in terms of feed consumption, gain in weight, feed conversion ratio and water intake. It also aimed to determine the anthelmintic potential and economic return of using these herbs in raising native chicken.

2. Methodology

2.1 Experimental Animals

Thirty-six heads of native chickens weighing 400 to 500 g, approximately four to five months old of both sexes, were used in this experiment. They were purchased in the locality of Jamindan, Capiz. The birds were acclimatized one week prior to the conduct of the experiment for them to adapt to the environment and feeds. They were also vaccinated against New Castle Disease that was given intranasally before the study was undertaken.

2.2 Experimental Treatment and Design

The study was conducted with four treatments as followed: Treatment A- pure drinking water (control); Treatment B- 30 ml alugbati extract/L of drinking water; Treatment C- 30 ml chili pepper extract/L drinking water; and Treatment D- 30 ml ginseng extract/L drinking water. The treatments were set in a randomized complete block design (RCBD) with three blocks with age and weight as bases for blocking. The different treatments were mixed with drinking water for the whole duration of the study.

2.3 Preparation of Experimental Site

The poultry house was constructed using bamboo slats, nipa, and coconut lumber. A net was set up in the experimental area as a perimeter fence in the partially ranged area of the native chicken. Measuring two square meters per bird, the experimental site was cleaned and disinfected to prevent the entry of disease-causing microorganism. Similarly, all equipment employed in this study such as waterer and feeding troughs were cleaned with water and soap. Electric bulbs were properly installed to provide light at night time all throughout the duration (30 days) of the study.

2.4 Collection and Preparation of Saponin-Containing Herb Extracts

Results from the preliminary study conducted by Gonzales *et al.* (2018) were the bases of selecting the herbs to be tested in this study. Chili pepper (*Capsicum annum*), alugbati (*Basella alba*), and ginseng (*Jatropha podagrica* Hook) were found to have saponin using froth test analysis. The rise of foam or honeycomb froth (cm) using a test tube were 2.8 cm for chili pepper, 3.8 cm for alugbati and 3.2 cm for ginseng.

Leaves of the selected herbs were collected from Milan, Jamindan, Capiz. The freshly collected saponin-containing herbs were washed with tap water to remove the adhering debris and then air dried for 30 min. A 1:1 ratio was followed in extracting the juice such as 1 kg of leaves were mixed in 1 L of water. It was then placed in a juicer to get the extract. After extracting the juice, this was preserved in the refrigerator for two days until it was consumed.

2.5 Feeding the Experimental Birds

Ad libitum feeding management with commercial grower ration was given during the entire duration of the study. Feeding was done twice a day at 6:00 AM and 5:00 PM. The refused feeds were collected and recorded every morning before feeding the birds to determine the total and average feed consumption of each treatment. In addition, the total amount of feed given was noted.

2.6 Data Gathered

2.6.1 Mean Feed Consumption

Daily weighing of feeds (kg) was done before they were given to the bird. The mean feed consumption was obtained by subtracting the leftovers from the total weight of the feed given. The difference was divided into the total number of birds in each replicate to represent the amount of feed consumed.

2.6.2 Mean Initial Weight

Prior to the distribution of the birds to their assigned cages, body weight was determined using the weighing scale. Total weight per replication was divided over the number of birds to obtain the mean initial weight (kg).

2.6.3 Mean Final Weight

Mean final weight (kg) was obtained at the end of experiments. Total weight per replication was divided by the number of birds to attain the final weight.

2.6.4 Mean Gain in Weight

The mean gain in weight (kg) was determined by calculating the difference between the mean final weight and the mean initial weight of the experimental birds.

2.6.5 Mean Feed Conversion Ratio (FCR)

Mean *FCR* was determined by dividing the mean feed consumption over the mean gain in weight of native chicken using the formula below.

$$FCR = \frac{Mean\ feed\ consumption\ (kg)}{Mean\ gain\ in\ weight\ (kg)} \quad (1)$$

2.6.6 Mean Water Intake

Mean water intake (L) was determined by measuring the amount of water given to the birds for the day and by deducting the amount left in the watering trough before giving fresh water in the morning on a succeeding day. The daily intake was divided by the number of birds per replicate to represent the mean water intake of the experimental birds.

2.6.7 Quantitative Fecal Examination

The Modified McMaster Technique (Soulsby, 1982; Hossain, 2009) was employed to obtain the total fecal egg count, which includes the use of a sugar flotation fluid to separate eggs from fecal material in a counting chamber (McMaster Slide). The McMaster chamber was prepared by wetting it with water and then gently tapping it on a paper towel to remove the excess water. The test tube containing the fecal slurry was rocked back and forth for thorough mixing. A pipette was utilized to draw up enough suspension from the tube to fill one chamber of the McMaster slide. The rocking and pipetting procedure were allowed to stand for 1 to 2 min to allow any egg to float to the top. An electronic compound microscope of 100x power objective was utilized to count the nematode eggs within 60 min as drying or crystal

formation of the sample in the chamber may happen. Multiplying the total egg count (for both chambers) by a factor of 100 was done in determining the number of eggs per gram of feces (Seivwright *et al.*, 2004).

2.6.8 Income-Over-Feed and Supplementation Cost

To obtain the average net profit, the expenses on feeds and supplements per replicate were subtracted from the calculated value of the prevailing live weight price and were divided by the number of birds per replicate.

2.7 Statistical Analysis of Data

All the data that were gathered from the various parameters tested except for the income-over-feed and supplementation cost which was analyzed using analysis of variance (ANOVA) for an RCBD. The least significant difference (LSD) test was used to compare differences among treatment means.

3. Results and Discussion

3.1 Mean Feed Consumption

Table 1 shows that birds supplemented with 30 ml chili pepper extract in drinking water consumed the highest amount of feeds with a mean of 1.66 kg. The lowest feed consumption was obtained by both birds supplemented with 30 ml ginseng extract and 100% pure drinking water with the mean of 1.09 kg.

The ANOVA shows that the differences among treatments were highly significant. This indicates that various saponin-containing herbs influenced the feed consumption of native chicken. LSD further revealed that the birds supplemented with 30 ml alugbati extract and 30 ml chili pepper extract were significantly higher in feed consumption compared to other treatments. Moreover, birds from the control treatment and 30 ml ginseng extract were comparably lower in feed consumption.

Table 1. Mean feed consumption, weight gain, feed conversion ratio and water intake of native chicken supplemented with saponin-containing herbs extract

Treatment	Feed Consumption	Weight Gain	Feed Conversion Ratio	Water Intake
Pure drinking water	1.09^{b}	0.26^{b}	4.21^{bc}	2.92^{b}
30 ml chili pepper extract/liter water	1.66^{a}	0.35^{a}	4.75^{ab}	3.20^{a}
30 ml alugbati extract/liter water	1.65^{a}	0.32^{a}	5.13^{a}	3.20^{a}
30 ml ginseng extract/liter water	1.09^{b}	0.31^{a}	3.34^{c}	2.11^{c}
CV (%)	3.32%	7.82%	10.17%	9.60%
Computed F-value	154.30**	7.20*	8.14*	13.44**
Tabular F-value	4.76	4.76	4.76	4.76

3.2 Mean Gain in Weight

The data shows that native chicken supplemented with 30 ml chili pepper extract obtained the heaviest weight with a mean of 0.35 kg. On the other hand, the lowest mean of 0.26 kg was obtained by the birds given with pure drinking water (Table 1). The treatment means were different at 5% level of significance. LSD test further revealed that the birds supplemented with 30 ml chili pepper, alugbati, and ginseng extract was comparably higher in weight gain compared to birds given with pure drinking water only.

As reported by Murray *et al.* (2003), the positive effects of herbs on the body weight and general performance were caused by combined indispensable fatty acids present in some herbs.

On other hand, reports of Wang and Bourne (1998) for pigs, and Lee *et al.* (2004) and Manzanilla *et al.* (2004) for birds show that herb extracts with secondary metabolites have the ability to stimulate enzymatic action and enhance the utilization of the nutrients from the diet. Also capsaicin enhanced the enzyme secretion in the digestive tract; thus, improving the digestion and enhancing the nutrient availability (Hernandez *et al.*, 2004). Moreover, in the study of Aban and Bestil (2016a), saponin and tannin inhibit the growth of protozoa in the rumen, thus favors the growth of good bacteria and resulted to a better feed utilization and digestion.

3.3 Mean Feed Conversion Ratio

The mean feed conversion ratio reveals that the birds supplemented with 30 ml ginseng extract gave the best feed conversion ratio with a mean of 3.34 kg. The birds supplemented with 30 ml alugbati extract got the poorest feed conversion ratio with a mean of 5.13 kg (Table 1).

The effect of the saponin containing herbs extract on the feed conversion ratio of chicken was significant at 5% level based on ANOVA. LSD test further revealed that the birds supplemented 30 ml ginseng extract and control were comparably higher in feed conversion ratio. Moreover, birds supplemented with 30 ml alugbati and chili pepper extracts were statistically lower and comparable mean feed conversion ratio. Furthermore, birds given with alugbati extract and birds supplemented with 30 ml chili pepper extract were comparably lower in feed conversion ratio.

There was an improvement in the feed conversion ratio of birds given with the saponin-containing herbs extracts. The enhanced feed conversion efficiency (FCE) could be due to the digestibility of dietary protein in the small intestine (El-Gendi *et al.*, 1996). Moreover, Bedford (2000) mentioned that the better FCE may be promising because of improved digestibility of nutrients since herbs and other similar commodities can regulate and even limit the growth and colonization of some pathogenic and non-pathogenic bacteria in the chicken gut. Likewise, in the study of Wheeler and Fields (1993), chicken given with herbal medicines revealed improved feed conversion ratio.

3.4 Mean Water Intake

Mean water intake shows that the highest water intake was obtained by the birds supplemented with 30 ml chili pepper and alugbati extracts with a mean of 3.20 L, followed by the birds given with pure drinking water with a mean of 2.92 L. The lowest water intake was obtained by the birds supplemented with 30 ml ginseng extract with a mean of 2.11 L (Table 1).

The addition of saponin-containing herbs extracts influenced the water intake of native chicken at 1% level of significance. LSD test further revealed that the birds supplemented with 30 ml alugbati and chili pepper extracts were comparably higher in water intake, followed by birds given with pure drinking water. Birds supplemented with 30 ml ginseng extract were found statistically lower in water intake.

3.5 Mean Percent Reduction of Fecal Egg Count

Mean percent reduction of egg count on the native chicken is presented in Table 2. Extracts from various saponin- containing herbs significantly affected the percent reduction of fecal egg count at 1% level of significance. The highest reduction of fecal egg was noted on birds given 30 ml ginseng extract based on the LSD test. This was statistically followed by the birds supplemented with 30 ml chili pepper and alugbati with the mean of 29.59% and 22.57%, respectively. Moreover, the control treatment was found to have an increased number of fecal egg count.

Table 2. Mean percent reduction of egg count and income-over-feed and supplementation cost of native chicken supplemented with saponin-containing herbs extract

Treatment	Percent Reduction of Egg Count	Income-Over-Feed and Supplementation Cost (Php)
Pure drinking water	-11.55^{d}	17.37
30 ml chili pepper extract/liter water	29.59^{b}	17.21
30 ml alugbati extract/liter water	22.57^{c}	11.81
30 ml ginseng extract/liter water	61.75^{a}	25.24
CV (%)	6.69%	
Computed F -value	1027.66**	
Tabular F-value	4.76	

(-) negative sign shows that there was an increase in egg count were no reduction of fecal count rather there was an increased

Leung and Foster (1996) stated that herbal extracts act as antioxidants, antibacterial, anti-fungal, and anti-protozoal. Likewise, they provide an additional improvement in bird's performance. Moreover, some metabolites such as tannin, saponin, isoprene derivatives, glucosinates and flavonoids exhibit action on the physiological and chemical function of the digestive tract as well as regulate the microbial population in animal's gut (Horton *et al.*, 1991; Barrata *et al.*, 1998; Jamroz *et al.*, 2003; Omar *et al.*, 2016). In addition, Lee *et al.* (2003) stated that feeds containing highly digestible ingredients control the increase of bacteria in the intestines of chicken. This is due to the unavailability of substrate for bacterial growth; thus, decreasing the antimicrobial characteristics of plant extracts.

3.6 Income-Over-Feed and Supplementation Cost

Income-over-feed and supplementation cost (Php) of native chicken supplemented with various saponin-containing herbs is presented in Table 2. The table shows that it was more profitable when birds were supplemented with 30 ml ginseng extract, which realized a net profit of Php 25.74 per head. This was followed by birds given with pure drinking water and birds supplemented with 30 ml chili pepper extract having a net profit of Php 17.37 and Php 17.21, respectively. The least income was obtained from birds supplemented with 30 ml alugbati extract having a net profit of Php 11.81.

The result of this study showed that the diets comprising ginseng extract were more profitable than the control diet. Abaza *et al.* (2008), Moustafa (2006), and Omar *et al.* (2016) agreed on this result that herbal extracts enhanced the economic status of raising broilers.

4. Conclusion

The feed consumption, feed conversion ratio, gain in weight, and water intake was significantly affected by various saponin-containing herbs. All saponin-containing herbs (30 ml chili pepper, alugbati, and ginseng) extracts were effective against the control of gastrointestinal parasite in native chicken. Supplementation of 30 ml ginseng extract gave the highest net profit. Chili pepper, alugbati and ginseng extracts at 30 ml/liter of water can be added to the drinking water of native chicken.

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