Philippine Journal of Arts, Sciences, and Technology (2018) Vol.3: 20-24

Phytobiotics on Growth Performance, Carcass Yields, and Meat Sensory Evaluation of ZamPen Native Chicken

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Abstract

Phytobiotics are plant-derived materials which may be incorporated into the diet of livestock to improve their nutrient digestibility and absorption. Phytobiotics also help eliminate pathogens in the gut. This study aimed to determine the effect of phytobiotics on growth performance, carcass yields, visceral characteristics, and meat sensory evaluation of Zampen native chickens. A total of 75 heads of Zampen chicken were subjected to a water supplement experiment subdivided into five (5) treatments. These treatments were water-soluble antibiotic, guyabano, moringa, chili, and turmeric powder in water supplements at three replications in a Randomized Complete Block Design, under 60 days trial. Results revealed that phytobiotics significantly ($P<0.05$) influenced the weight gain, average daily gain, and meat sensory evaluation at a certain age of the Zampen chickens. The weight gain and average daily gain significantly ($P<0.05$) increased at the last period of the experimentation. Meat sensory attributes, tenderness, flavor, and overall acceptance significantly differ among treatments. However, phytobiotics did not affect the carcass and gastrointestinal characteristics ($p>0.05$) substantially. Thus, natural phytobiotics can be used as an alternative to water-soluble antibiotics as growth promotants for native chicken.

Keywords: Phytobiotics, Moringa oleifera, guyabano, chili, turmeric, ZamPen chicken

Introduction

Philippine native chicken has been the primary source of meat and eggs for Filipino farmers (World Poultry, 2000). With increasing population come higher demands for meat. However, this industry has always been confronted with challenges and constraints to productivity during intensive growth, resulting in heavy economic loss to the poultry producers. Among these conditions are low growth performance and infectious diseases. With the pressure to produce a large volume of poultry meat products, poultry raisers opt to use antibiotic and growth promoters, which may pose a severe implication on the quality of the poultry products. The ever-increasing consumers' awareness and their concern over antibiotic residues in poultry products that are dangerous to health serves an impetus in looking for an alternative to antibiotic growth promoters.

The ZamPen native chicken is a purified breed of native chicken in Zamboanga Peninsula, Philippines, with faster growth than other native chickens. It is suitable for free-range conditions as natural foragers entail lesser feeding costs and are appropriate for commercial free-range poultry rearing (PCAARRD-WESMAARRDEC, 2017).

Plant herbs have the properties to increase animal's health performance. Compared to synthetic antibiotics or inorganic chemicals, plant-derived products are natural, less toxic than antibiotics, and typically residue-free. Phytogenic effects have been proven in poultry for feed palatability and quality (sensory aspects), growth promotion, gut function, and nutrient digestibility (Paraskeuas et al., 2017). Antibiotic growth promoters are replaced or substituted with plant-derived compounds.

In this context, alternatives to AGP are very important. Herbs, spices, and various plants have received increased attention as possible alternatives to AGPs since they are considered natural products (Alloui et al., 2014; Hernandez et al., 2004). This study was conducted to address the dearth of information on the phytobiotic effects of these alternatives to AGP on the growth and carcass quality of ZamPen native chickens.

The goal of the study was to examine how ZamPen native chicken treated with different phytobiotics performed in terms of growth, carcass yields, visceral features, and meat sensory evaluation.

Methodology

Study area

The study was conducted at Purok 1, Katipunan, Guipos, Zamboanga Del Sur for a period of two months.

Materials, Facilities, and Other Equipment

The study utilized guyabano, moringa, turmeric, and chili powder. There were 15 partitioned rearing pens to house the experimental stocks. The weight of the birds was measured using a digital weighing scale. Water and feeds were provided in each pen through waterers and feeding troughs. Nipa, lumber,

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Table 1. Proximate analysis of natural phytobiotics (g/100g) used in the study

Phytobiotics	*Crude Protein*	*Ash*	*Fat, Total*
Guyabano powder	13.51	6.34	2.65
Moringa powder	23.41	10.26	1.40
Chili powder	11.72	6.14	9.35
Turmeric powder	9.34	6.60	2.46

bamboo and net, and other materials were used in constructing the house of the native chickens.

Housing and cages for the experimental stocks

A two-by-three-meter housing made of native materials such as bamboo, nipa, and round timber was constructed. The native chickens were provided with a ranging area of $1m^2/$ bird as recommended by Philippine National Standard for Free Range chicken and they were kept inside the house at night. Each block was divided into five (5) pens with five (5) birds each pen. The study raised 75 straight-run experimental two-month-old hardened chicks of ZamPen native chicken with good health conditions. These chickens were acquired from a reliable source at the JHCSC Research Center in Dapiwak, Dumingag, Zamboanga del Sur.

Preparation and administration of the Phytobiotics

Pure guyabano, moringa, chili, and turmeric powder were purchased at Dumingag, Zamboanga del Sur.The proximate analysis of the different natural phytobiotics used in the study was analyzed by the Regional Standards and Testing Laboratories, Department of Science and Technology X (DOST X) and is presented in Table 1.

Preparation of the animals and experimental diets

From the beginning until the end of the study, five (5) grams of different phytobiotics were mixed with per liter of water according to the treatments, and were given to the birds daily. The birds were given cracked yellow corn mixed with corn bran as their feeds throughout the study.

Evaluation of growth, carcass, and visceral characteristics

All of the birds' initial weights were recorded before supplementation commenced. The weight and average daily gain were measured and computed at weekly intervals.

At the end of the study (60 days), 15 birds were randomly selected per treatment group. These birds were weighed and slaughtered. Slaughtering was performed by severing the jugular vein with a sharp knife without anesthetizing. The slaughtered birds were de-feathered using hot water, and the dressing weight was recorded. The lengths and weights of the gastrointestinal organs (proventriculus and intestines) were measured after the viscera were removed.

Meat sensory evaluation for meat quality

At the end of the experiment, the birds were kept separately and fasted for 12 hours. Before slaughtering, the live weights of the birds were recorded. To evaluate the quality of collected chicken meat, samples were subjected to sensory evaluation by a panel of five (5) members. A meat sample was used to make the flesh piece (chest and thigh). To make a brine solution, two percent salt was added to the water.

In a pressure cooker, the samples were cooked in the brine solution for 15 minutes. After cooking, the samples were separated from the solution and cooled to room temperature. Five (5) judges were selected for the sensory evaluation. A nine-point hedonic scale was used to evaluate the sample for tenderness, flavor, juiciness, and overall acceptance.

Statistical design and analysis

The data were subjected to Analysis of Variance (ANOVA) in Randomized Complete Block Design using Statistical Tool for Agricultural Research (STAR) version 2.0.1 2014 Biometrics and Breeding Informatics, PBGB Division International Rice Research Institute, Los Banos, Laguna. Honest Significant Difference (HSD) or Tukey's test was used to compare the differences among treatment means.

Results and Discussion

Weight Gain

The weight gain within the sampling period of ZamPen chickens was obtained by deducting the weight of the previous period from the present sampling period. Table 2 presents the weight gains of Zampen Native chickens between two sampling periods. Imposed natural phytobiotics revealed no significance among treatment means at weeks 1 to 8. However, at 9^{th} week of administration, imposed natural phytobiotics differ significantly ($P < 0.05$). The chickens supplemented with chilli powder, a natural phytobiotic, got the heaviest weight gain of 66 g in one week which was comparable with chickens supplemented with synthetic water-soluble antibiotic (control) and with turmeric powder supplementation. Several studies have shown that plant extracts such as capsaicin, improved the digestibility values of diets in broilers (Hernandez et al., 2004).

Secondly, it may be argued that though the quality of CP in chili powder diets was inferior, the improved digestion arising from capsaicin compensated for the adverse effects associated with the poor protein quality of the diets supplemented with chili powder. This finding also supports the findings of Puvača et al. (2015), who found that adding chili powder to chicken feed boosts productivity, which is also in agreement with the previous findings of Alaa (2010), Al-Kassie et al. (2012), and Puvača et al. (2019) with the use of hot red powder in broiler chicken nutrition. Several reports also on standard broilers validated the positive effects of C. longa on broiler growth performance. The beneficial effects of curcumin on broiler growth performance may be due to enhanced secretions of amylase, trypsin, chymotrypsin, and lipase (Durrani et al., 2006).

Average Daily Gain

The average daily gain in weight (ADG) was calculated using the difference in weight between two sample periods and the number of days needed to achieve the same weight gain. The ADG results computed at different sampling periods are presented in Table 3. Imposed natural phytobiotics revealed no significant differences among treatment means at weeks 1 to 8. However, at week 9, the weight of the chickens supplemented with synthetic water-soluble antibiotic differs significantly ($P< 0.05$) with the weight of the chickens supplemented with moringa and guyabano, but was comparable with the weight of the chickens supplemented with chili and turmeric powder. The Zampen chickens supplemented with synthetic antibiotics gained the highest weight gained daily at 9.42 g. It can be surmised that ZamPen chickens grow slowly in the first two months and then starts peaking if they are not slaughtered early. It was noted that the daily gains in the first eight (8) weeks barely reached a gram a day and suddenly rose in week 9.

Carcass Yields and Visceral Characteristics

Carcass yields obtained after evisceration are recorded in Table 4. Bigger chickens before slaughter tend to have bigger carcass yields, higher dressed weight, and eviscerated weights, while those whose live weights were small tend to yield smaller carcass, smaller dress weight, and eviscerated weight. The natural phytobiotics did not affect the Zampen chickens' fasting weights, which varied from 1,201 g to 1,532 g, dressed weights of 1,007 g to 1,378 g, and eviscerated weights of 805 g to 1,058 g. Fresh weight of the small intestine decreased with increasing length after the supplementation of phytobiotics. It is interesting to note that while the length of the small intestine increased with the supplementation of phytobiotics, the weight of the same intestine decreased. The advantage of having a longer small intestine is the efficiency of fluids and nutrients absorption of the breakdown of feed ingested by animals. It increases the surface for absorption because of the presence of villi and microvilli in the intestinal wall. The study of Singh et al. (2018) concluded that curcumin reduces the resting tone of the intestine and this may be the reason for the increase in length of the intestine in albino rats. This implies that neither moringa, guyabano, turmeric, nor chili powder affected the carcass yields and visceral characteristics of the chickens. Natural phytobiotics also produced carcasses that were comparable to chickens administered with water-soluble antibiotics, according to the study. This means that natural phytobiotics can be used in place of synthetic antibiotics without compromising carcass and visceral yields.

Meat sensory evaluation of cooked meat in terms of tenderness, flavor, juiciness, and overall acceptance are illustrated in Table 5. The meat sensory evaluation of Zampen native chicken results indicated that tenderness and the flavor of meat revealed highly significant effects with the supplementation of different phytobiotics ($P<0.01$) and overall acceptance of ($P<0.05$). Chilli powder and turmeric powder, and guyabano powder and moringa were closely comparable except for water-soluble antibiotics in meat tenderness and overall acceptance. For meat flavor, the chicken supplemented with turmeric powder significantly differs from those supplemented with other phytobiotics except for chili powder. However, phytobiotics did not greatly influence the juiciness of the meat of native Zampen Chicken.

The above findings are consistent with the findings of Wang et al. (2015), who found that including Curcumin in the basal diet of broiler chickens reduced excess reactive oxygen species production, improved the antioxidant defense system, and improved the color and water-holding properties of broiler meat. Kanani et al. (2017) had earlier reported that the inclusion of turmeric powder at 0.5 % in the broiler chicken diet increased the water holding capacity (WHC) of their meat. Further, water absorption capacity (WAC) or water holding capacity (WHC) has a direct bearing on the color and tenderness of the meat and it is among the most important functional properties of raw meat. The above results of the sensory evaluation are also in agreement with the findings of Ratika et al. (2016), who found that meat from a chicken fed with turmeric- supplemented diet had better texture, flavor, and overall acceptability. This implies that turmeric powder is good for poultry meat tenderness, flavor, and its overall acceptance. Also, the leaves of *Moringa oleifera* are reported to contain rich amounts of phenolic that retard oxidative degradation of lipids and thereby improve the quality and nutritional value of food. These natural antioxidants are considered to be safer than synthetic antioxidants and have greater application potential for consumers' acceptability, palatability, stability, and shelf-life of meat products (Jung et al., 2010).

Conclusions

Results revealed that phytobiotics significantly (P¡0.05) influenced the weight gain and average daily gain at a certain age of Zampen chicken. The weight gain and average daily gain significantly ($P<0.05$) increased at the last period of experimentation.

In terms of weight before slaughter, dressed weight, eviscerated weight, length, and weight of small intestine, and length and weight of proventriculus, phytobiotic treatment had no significant effect on the carcass characteristics of Zampen native chicken. However, natural phytobiotics performed comparably with water-soluble antibiotics.

The findings of the meat sensory evaluation of Zampen native chicken showed that the addition of several phytobiotics had a substantial impact on tenderness, flavor, and overall acceptance of the meat.

Table 2. Weight gains (g) of ZamPen native chickens after 9 weeks of phytobiotics supplementation

Treatments	*week 1*	*week 2*	*week 3*	*week 4*	*week 5*	*week 6*	*week 7*	*week 8*	*week 9*
Control	30.67	30	22.3	43	26.67	29.67	69	35	66^{a}
Guyabano	20.33	32	17.67	29.33	23.33	22.67	50	28.33	41^{b}
Moringa	24.33	42	24.33	49.33	13.33	20.33	68.67	23.0	38^{b}
Chili	22.67	41	28.33	34.67	20	27.67	67.67	20.67	66^{a}
Turmeric	23.33	21	28	29.33	19.67	37.0	76	14.67	46^{ab}
F test:	ns	ns	ns	ns	ns	ns	Ns	ns	*
c.v.(%)	37.6	37.5	41.4	55.5	56.3	37.4	49.7	28.5	20.68

Means in a column with the same letter are not significantly different at 5% (HSD).

Table 3. Average daily gain (g) of ZamPen native chickens after 9 weeks of phytobiotics supplementation

Treatments	*week 1*	*week 2*	*week 3*	*week 4*	*week 5*	*week 6*	*week 7*	*week 8*	*week 9*
Control	4.38	4.29	3.19	6.14	3.81	4.24	5.0	9.86	9.42^{a}
Guyabano	2.90	4.57	2.52	4.19	0.643	3.24	4.05	7.14	5.86^{b}
Moringa	3.47	6.05	3.48	7.05	3.33	2.91	3.29	9.81	5.38^{b}
Chili	3.24	5.86	4.05	4.95	1.90	4.01	2.95	9.67	9.38^{a}
Turmeric	3.33	3.0	4.0	4.19	2.86	5.29	2.09	10.86	6.62^{ab}
F test:	ns	ns	ns	ns	ns	ns	ns	ns	*
c.v.(%)	37.6	37.4	47.4	55.5	56.3	37.2	28.5	49.7	20.69

Table 4. Carcass yields and visceral characteristics of Zampen native chickens after 9 weeks of phytobiotics supplementation

Treatments	*Weight Before Slaughter(g)*	*Dressed Weight (g)*	*Eviscerated Weight (g)*	*Small Intestine (cm)*	*Small Intestine (g)*	*Proventriculus (cm)*
Control	1287	1125	892	144	0.07	35.0
Guyabano powder	1210	1007	805	129	0.05	31.7
Moringa powder	1247	1108	915	115	0.04	33.3
Chili powder	1215	1063	862	129	0.04	30.0
Turmeric powder	1532	1378	1058	133	0.06	36.0
F test:	ns	Ns	Ns	ns	Ns	ns
c.v.(%)	17.43	17.21	17.49	12.50	27.71	12.61

Table 5. Meat sensory evaluation of ZamPen native chicken after 9 weeks of phytobiotics supplementation

Treatments	*Tenderness*	*Flavor*	*Juiciness*	*Overall Acceptance*
Water Soluble antibiotic (Control)	6.80^{b}b	7.13^{c}	7.00	6.86^{b}
Guyabano powder	7.53^{ab}	7.46^{bc}	7.46	7.46^{ba}
Moringa powder	7.46^{ab}	7.53^{bc}	7.20	7.36^{ab}
Chili powder	8.26^{a}	8.00^{ab}	7.60	7.86^{ab}
Turmeric powder	8.20^{a}	8.40^{a}	8.0	8.20^{a}
F test:	**	**	ns	*
c.v.(%)	4.91	32.32	5.41	4.86

The use of natural phytobiotics (guyabano, moringa, chili, and turmeric) powder can be an alternative to a synthetic antibiotic in water supplements. However, the author recommends to conduct further studies of the same nature and use it with other monogastric animals and determine its effects on the hematological characteristics and gastrointestinal microbiota of the animals.

Acknowledgement

The authors would like to acknowledge the Commission on Higher Education for the support of the study.

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