Effect of treated giant taro (*Alocasia macrorhiza*) tuber powder on growth performance of broiler quails

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Abstract

A study was conducted to determine the effect of treated giant taro (*Alocasia macrorhiza*) tuber (GTT) in the diet on growth performance of broiler quails during grower-finisher stage. The experimental design used was randomized complete block design (RCBD) which utilized a total of 72 mixed sex quails. From day 21 to day 42, the quails were offered either one of the following dietary treatments: (T1) Basal diet containing no treated GTT powder, (T2) Basal diet containing 0.5% treated GTT powder, and (T3) Basal diet containing 1% treated GTT powder. Quails fed experimental diets containing 0.5% or 1% GTT showed no significant ($p>0.05$) difference on body weight, body weight gain, feed intake, feed conversion ratio and mortality rate compared to the control of no GTT mixed in the diet.. In conclusion, supplementation of giant taro tuber up to 1% in the diet did not improve the growth performance of quails.

Keywords: *Alocasia macrorhiza*, quails, growth performance, tuber, powder

Introduction

Giant taro or Elephant Ear or its scientific name, *Alocasia macrorhiza* is commonly used as a household decorative plant. It synonymous names are *Arum macrorhizum* Linn, *Colocasia indica Kunth Enum*, *Alocasia indica Schott*, and *Arum indicum Lour*. (Willd). It is known as Keladi Birah Hitam in Malaysia, Bira in Java , Indonesia, Biga in Philippines, Ray cay in Vietnam, Hai yu in China, Maanaka in India, and Ape Keoke in Hawaii, USA (Merrill, 1934). It is a tall succulent herbaceous plant that can reach up to 4.5 m and was originated from Philippines. All parts of *A. macrorhiza;* leaf, tuber, rhizome, stem, and root showed pharmacological activities, including antioxidant activity (Mulla *et al*., 2009; Madal *et al*., 2010), antinociceptive and anti-inflammatory activities (Mulla *et al*., 2010), hepatoprotective activity (Mulla *et al*., 2010), trypsin/chymotrypsin inhibitor (Sumathi and Pittabiraman, 1977; Argall *et al*., 1994; Vivek Srivastava *et al*., 2012), antimicrobial activity (Wang and Ng, 2003), hemagglutinating activity (Wang and Ng, 2003), antitumor activity (Ke *et al*., 1999) and lymphocyte activity (Kamboj et al., 1995).

Analysis of *Alocasia macrorhiza* tuber from Java was reported to contain 8.25% moisture, 46.35% starch, 13.16% nitrogen, 8.92% ash, and glucose, fructose, compesterol, β-sitosterol, cholesterol and phytosterol like compound (0.7%) having melting 139-141˚C. In India, its tuber juice is used in the treatment of gout and rheumatism. The juice of the tubers is also given in the treatment of anasarca (generalized edema), piles and habitual constipation. Ash of tubers is given to soothen aphthae in the mouth. The tuber is pungent, cooling and useful in reducing inflammation and disease of the abdomen and spleen. Antioxidants from *A. macrorhiza*

tuber can protect lipoproteins in plasma from oxidation and produce a significant increase in plasma antioxidant capacity (Vivek Srivastava *et al*., 2012). In Philippines, the ensiled foliage (stems and leaves) of giant taro species has high potential as a protein source to balance pig diets based on rice byproducts (Ngo and Preston, 2010). In Indonesia, it can be used as human food, animal fodder and traditional herbal medicine (Kumoro *et al*., 2014). In Malaysia, it is mostly used as a decorative plant at homes and roadside landscape. It can grow well in cultivated land, waste places, old gardens, mesic valleys, low moist disturbed area and secondary forests, along streams and riverbanks from sea level to 600-800 m in tropical and subtropical warm climates (Smith, 1979; Wagner *et al*., 1999; Acevedo-Rodriguez and Strong, 2005; Manner, 2011). In Sabah, this common herb can be found mostly in Kota Belud area.

However, all parts of the plant (leaves, stems and tubers) are considered toxic and can be injurious to humans and animals (Lewis *et al*., 2007; Avadhesh Joshi *et al*., 2015). The toxins include calcium oxalate and sapotoxin (a neurological poison) (Lewis *et al*., 2007) and the main toxic ingredient is insoluble calcium oxalate (Joshi *et al*., 2015). Lewis *et al*. (2007) reported that there is no danger of systemic oxalate poisoning because Ca oxalate is insoluble. The safe level of calcium oxalate for human consumption is 71 mg/ 100 g and the researchers recommend soaking the giant taro corm chips in sodium bicarbonate solution to reduce the calcium oxalate prior to use (Nwosu *et al*., 2010; Kumoro *et al*., 2014).

Most of the previous studies concentrated in utilizing the giant taro as protein or energy source (Diarra *et al*., 2016) as animal feed but limited information was available in terms of its herbal medicinal value especially for poultry species. Due to the many important pharmacological properties of giant taro, therefore, the objective of the present experiment was to determine the effect of supplementing treated giant taro tuber at different levels in diets on growth performance of broiler quails during grower-finisher stage.

Materials and Methods

Preparation of treated giant taro tuber

A total of 30 kg giant taro root tubers were collected in Sandakan area near Faculty of Sustainable Agriculture, Sandakan Campus. Once arrived in Sandakan Campus, the tubers were immediately processed by discarding the skin and the flesh cut into slices, washed using tap water, and soaked in a basin containing 2% w/v of sodium bicarbonate solution for 20 min at an ambient temperature (Kumoro *et al*., 2014). Next, they were thawed and allowed to evaporate at room temperature of ?? for 30 min before dried in an oven at 65±1˚C for 24 to 72 h or until constant weight obtained (AOAC, 1984). The giant taro sample then was ground into powder using a laboratory grinder. The powder was sealed in zip-lock plastic bags and stored in a cool and dry place prior to use.

Laboratory analysis

Approximately 100 g of feed samples for each dietary treatment were used for proximate analysis according to the methods of AOAC (1984). The nutrient and anti-nutrient contents of giant taro tuber powder were also analyzed.

Animal, housing and experimental design

A total of 100 seven day-old quail chicks of mixed sex, *Coturnix coturnix japonica*, were purchased from Department of Veterinary Service, Bantayan, Tuaran, Kota Kinabalu, Sabah. The chicks were sexed, wing-banded, individually weighed, and allocated randomly to the three treatments.

Each cage measuring 24" length, 18" width, and 19" high and was located in an open-type house at Poultry Research Unit, Livestock Farm, Faculty of Sustainable Agriculture, Universiti Malaysia Sabah. All chicks were given drinking water and were fed *ad libitum* with commercial broiler starter feed from day 7 to 21. ND and IBD vaccines were given when the quails were 7 and 14th day old.

At 21 days of age, all quails were weighed individually to reach the uniformity before the experiment began. The experiment was conducted in randomized complete block design (RCBD) using 72 quails selected based on their body weight. The quails were divided equally into three dietary treatments; each treatment consisting of mixed sex quails with each sex had 3 replicates.

Table 1. Nutrient and anti-nutrient composition of treated giant taro tuber powder

Components	(%)
Dry matter	9.00
Moisture	91.00
Ash	6.81
Crude fiber	0.90
Crude protein	0.93
Ether extract	0.22
Saponin	15.54
Alkaloid	4.83

All data were on dry matter basis

Table 2. Composition of experimental broiler grower-finisher diets supplemented with giant taro tuber (GTT)

Ingredients (%)	T1(0%)	T2 (0.5%)	T3 (1%)
Ground yellow corn	60.00	59.50	59.00
Soybean meal dehulled	25.00	25.00	25.00
Fish meal	7.00	7.00	7.00
Wheat pollard	3.00	3.00	3.00
Crude palm oil	2.40	2.40	2.40
Limestone	1.30	1.30	1.30
Fine Salt	0.25	0.25	0.25
Mineral Premix[1]	0.25	0.25	0.25
Vitamin Premix[2]	0.25	0.25	0.25
Lysine 99%	0.20	0.20	0.20
DL-Methionine 98%	0.15	0.15	0.15
Dicalcium Phosphate	0.10	0.10	0.10
Choline Chloride	0.10	0.10	0.10
Giant taro tuber	0.00	0.50	1.00

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Ingredients (%)	T1(0%)	T2 (0.5%)	T3 (1%)
Lab analysis:			
DM (%)	86.83	86.78	86.91
Ash (%)	5.70	6.44	6.19
CP (%)	18.68	17.69	18.50
CF (%)	3.60	3.58	3.61
EE (%)	3.29	3.81	4.98

[1]Mineral premix (per kg): selenium 0.2 g; iron 80 g; manganese 100 g; zinc 80 g; copper 15 g; potassium chloride 4 g; magnesium oxide 0.6 g; sodium bicarbonate 1.5 g; iodine 1 g; cobalt 0.25 g.
[2]Vitamin premix (per kg): vitamin A 50IU; vitamin D 10 IU; vitamin E 75 g; vitamin K3 20 g; vitamin B1 10 g; vitamin B2 30 g; vitamin B12 0.1 g; D-calcium pantothenate 60 g; nicotinic acid 200 g; folic acid 5 g; biotin 235 g.
DM=Dry Matter, CP=Crude Protein, CF=Crude Fibre, EE=Ether Extract

Dietary treatments

Starting from day 21 onwards, the birds were fed with either one of the three dietary treatments (Table 2), namely; (T1) basal diet containing no treated giant taro tuber powder, (T2) basal diet containing 0.5% treated giant taro tuber powder, and (T3) basal diet containing 1% treated giant taro tuber powder. All diets were isonitrogenous and isocaloric formulated to meet or exceed the NRC (1994) requirements for quails and were offered in mash form.

Data and sample collection

Body weight, body weight gain, feed intake, feed conversion ratio and mortality rate were the parameters measured. Body weight and feed intake were recorded weekly. Average daily gain, daily feed intake and feed conversion ratio were calculated based on weekly body weight and weekly feed intake. Mortality was recorded and expressed as the percentage of the number of birds at the commencement of the experiment. At 42 days of age, all quails were slaughtered according to the method of halal procedure.

Statistical analysis

Data were analyzed by two-way ANOVA following the GLM procedure of SAS 9.4 (SAS, 2009). Significant differences among treatments means were determined at $p<0.05$ by Duncan's Multiple Range Test (DMRT). Mortality was determined by Chi Square Test.

Table 3. Growth performance of broiler quail fed with different levels of treated giant taro tuber powder at 42 days of age (Mean±SE)

	T1 (%)		T2 (0.5%)		T3 (1%)	
Parameters	Male	Female	Male	Female	Male	Female
FBW (g/bird)	245±5.7	274±5.1	253±8.0	266±4.8	249±2.9	262±8.0
ADG (g/bird/d)	5.92±0.23	7.25±0.24	6.28±0.40	6.81±0.22	6.16±0.12	6.66±0.03
FI (g/bird/d)	30.2±0.9	31.2±0.4	29.7±1.3	30.0±0.77	28.8±0.61	29.7±0.14
FCR	4.32±0.16	5.09±0.13	4.42±0.20	4.76±0.34	4.48±0.24	4.66±0.15
Mortality Rate (%)	0.00	0.00	0.00	0.00	0.00	0.00

FBW=Final body weight, ADG=average daily gain, FI=feed intake, FCR=feed conversion

Results and Discussion

Growth Performance

The growth performance of broiler quail fed with giant taro tuber is presented in Table 3. Supplementation up to 1% giant taro tuber in quail diets did not significantly ($p>0.05$) improve performance, in terms of body weight, body weight gain, feed intake and feed conversion ratio when compared amongst the dietary treatments. However, there was no mortality recorded amongst the quails in the different treatments.

Saponin has been claimed to reduce feed intake and inhibit growth rate of poultry and showed toxicological effects with the level in diets. However, in this experiment, 15% saponin (Table 1) content in treated giant taro tuber did not influence the performance of quail. In contrast, other researchers noted that it has been used as a feed additive to promote better growth rate and feed efficiency (Yejuman et *al*., 1998), lower serum cholesterol level (Udea and Shigemizu, 1998), reducing the emission of ammonia from animals' excreta (Johnson *et al*., 1981; Al-Bar *et al*., 1993), assist the absorption of nutrients (Semen *et al*., 1973) and improve carcass quality (Miah *et al*., 2003). In this study, alkaloid content in each diet was not determined. The presence of 4.83% alkaloid (Table 1) content in giant taro tuber might have affected the alkaloid content in the diets. Thus, it did not enhance the growth performance of broiler quails. In another study, addition of natural alkaloid sanguinarine from herbal plant, *Macleaya cordata* in the diet at the level of 30 mg/kg, did not significantly ($p>0.05$) improve final body weight and feed utilization (Zdunczyk *et al*., 2010). Similarly, the inclusion of individual extract of cinnamon, glove, oregano and red paper in broiler diet at 200 mg/kg did not influence performance (Barreto *et al*., 2008). Diarra *et al*. (2016) suggested that 10% *A. macrorhiza* root meal can be used to replace dietary maize as energy source without any adverse effect on laying performance, however, 20% replacement could decrease hen-day and egg weight.

Conclusion

Supplementing up to 1% of giant taro (*A. macrorhiza*) tuber powder in the diet did not improve the body weight, average daily gain, feed intake, and feed conversion of broiler quails. However, no mortality was recorded during the experimental period. This suggests that at these levels the inclusion of the giant taro herb did not initiate positive responses on growth performance of broiler quails during the grower-finisher stage.

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