Effects of Fermented Kangkong *(Ipomoea aquatica* Forssk.*)* Juice Supplementation On the Growth Performance of Japanese Quails

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Abstract: Quail raising is said to be the business venture of those with limited capital but who look for high returns in a short period. A feeding trial to assess the growth performance and economic benefits of Japanese quails supplemented with varying levels of fermented kangkong juice through the drinking water was conducted using 120 female Japanese quails at the Department of Animal Science-College of Agriculture and Food Science, Visayas State University, Visca, Baybay City, Leyte, Philippines from January to February 2016. The Japanese quails were randomly assigned to four treatments and replicated three times with ten birds per replication laid out in a Completely Randomized Design set-up. Data gathered were subjected to a one-way analysis of variance (ANOVA) using Statistical Package for Social Science (SPSS) version 17.0 software. Supplementation of fermented kangkong juice (FKJ) into the drinking water of Japanese quails did not significantly affect the growth performance in terms of the results on Bi-monthly weight gain, average daily gain, bi-monthly voluntary feed intake, and cumulative feed conversion ratio. However, the overall result on return above feed and chick cost (RAFCC) disclosed a bright prospect of FKJ supplementation for raising Japanese quails.

Index Terms: Japanese quails, fermented kangkong juice, supplementation, growth performance

I. INTRODUCTION

The Japanese quail (*Coturnix japonica*, Temminck and Schlegel, 1849) locally known as "pugo" is a small and tailless bird that belongs to the order *Galliformes*, family *Phasianidae* and subfamily *Phasianinae* (Karaalp, 2009), and found in many parts of Asia. The rapid multiplication capability of these birds makes their meat and eggs readily available for human consumption. The quail meat is lean, and eggs and meat are low in cholesterol (Tarhyel *et. al.*, 2012). Furthermore, quail meat and eggs are known to be rich in unsaturated fatty acids, phospholipids, vitamins, and essential amino acids. Quail meat is usually boiled or roast with less fats and calories and is a perfect food for health-conscious consumers. Both quail meat and eggs can be included in the diets of children, pregnant mothers, geriatric and convalescent patients. Also, there is no known serious quail disease except for some respiratory problems which do not spread quickly and quails are more resistant and less susceptible to bacterial diseases. Capitan (2003) cited that some quail raisers claimed an ROI of P41 to P66 profit for every P100 invested in the business and that quail enterprise may have a payback period of 6 months.

One of the major problems in quail raising is the high price of feeds that constitute 70-80% of the total operational cost and specific rations for quails are not commonly available in the market (Bitancor, 2008). Thus, quail raisers tend to use broiler feeds despite much higher protein requirement of quails compared with chicken (BAR, 2012). Moreover, the cost of feeds, vitamin-mineral supplements, drugs and biologics cannot be offset because most quail raisers operate on a small-scale basis (Capitan, 2003). Although some reports mentioned that quails are more immune and less prone to bacterial diseases as compared to chicken, still there is a need to boost their immune system. The use of fermented plant juice in the drinking water has been reported to increase microbial activities in gastrointestinal tracts, better absorption of nutrients and hasten manure decomposition when sprayed to animal beddings. In the Philippines, Water Spinach (*Ipomoea aquatica* Forssk.) which is abundantly growing in stagnant streams, fresh water swamps, and pools have been cited as a good source of protein, vitamins and minerals. It is also commonly reported to contain carotenoids, β-sitosterol and glycosides (Chitrajit and Pinak, 2015), hypolipidemic, antimicrobial, purgative, anthelmintic, anti-inflammatory, antiepileptic, CNS depressant, diuretic, and antidiabetic properties. Anadon *et al.*, (2005) reported that fermented plant juice with the aide of live microorganisms has a role in promoting growth rates by improving feed efficiency and speed up manure decomposition when sprayed to poultry and livestock beddings. Hence, this study investigates the potential of fermented kangkong juice supplementation in the drinking water of quails.

II. METHODOLOGY

2.1 Preparation of Experimental Cages

One week before the arrival of chicks, all facilities were cleaned and disinfected to prevent the possible occurrence of diseases. The brooder pen was made of galvanized iron sheets with a dimension of 2 ft x 4.5 ft x 1.0 ft. This was cleaned and disinfected with a commercially available disinfectant before putting the experimental quails for brooding.

After the brooding stage, the quails were transferred to grower-layer cages with recommended standard floor space requirement of 16 inches per bird (Capitan, 2003). The grower-layer cages were made of steel and constructed with slightly inclined flooring so that clean eggs will roll out of the pen for easy collection. Shallow feeders and waterers measuring 91.44

cm (3ft) long, 10.16 cm (4 inches) wide, and 5.08 cm (2 inches) in height were constructed from the PVC water pipe. Provisions for proper ventilation and prevention of extreme cold weather conditions were also provided.

2.2 Brooding and Rearing Management

Upon the arrival of the day-old quail chicks, these were placed in the brooding pen. During the whole duration of the brooding period, old newspapers were used as beddings or litter that were regularly changed for a dry and clean pen. Two 50watt electric bulbs were provided as a source of artificial heat until the time when they were able to regulate their body temperature. The chicks were fed with commercial booster mash during the whole duration of the brooding period (14 days).

On the 15th day of brooding, the chicks were transferred to the grower-layer cages, and the standard feeding program for quails was followed. From day 15 to 35, 17 grams per head per day starter mash was given, and from Day 36 until the end of the experiment, 23 grams per head per day laying mash was provided (BAR, 2012). The daily feed allowance was given 6:00 in the morning and 3:00 in the afternoon.

The experimental drinking water was started on Day 15, and given twice a day to ensure freshness during the whole duration of the study. Proper sanitation, cleanliness and daily removal of dung to get rid of flies and foul odor were regularly practiced.

2.3 Preparation of Fermented Kangkong Juice (FKJ)

Fresh kangkong leaves and stems were used as plant material for the fermented kangkong juice. For every three (3) kilos of chopped Kangkong, one (1) kilogram molasses was added based on the formula cited by Miller (2003). The molasses serve as a source of food for the microbial population that performs the fermentation process and the weak alcohol produced during fermentation extracts chlorophyll and other plant components. Chopped kangkong stem and leaves were mixed with molasses and placed into a clean clay pot to about ¾ full. All containers were properly labeled, covered and stored in a cool and dry area for seven (7) days to allow anaerobic fermentation process. After fermentation, this was strained using a net bag to separate plant residues from the liquid juice. The juice was placed in a clean, sterilized and covered glass bottle to prevent unwanted contamination. The fermented kangkong juice was added at various levels and mixed properly to the drinking water at various levels and mixed thoroughly before giving to the experimental birds.

2.4 Experimental Treatments

The experimental treatments were as follows:

T_0 - 1000 ml Drinking water (Control)
T_1-1000 ml Drinking Water+10 ml Fermented Kangkong Juice
T_2- 1000 ml Drinking water + 20 ml Fermented Kangkong Juice
T_3- 1000 ml Drinking water + 30 ml Fermented Kangkong Juice

Table 1. The nutritional value of fermented kangkong juice

NUTRIENTS	UNIT	VALUE
Crude Protein	%	15.94
Phosphorus	%	0.654
Potassium	%	2.248
Calcium	%	0.390
Cupper	mg/kg	13.5
Zinc	g/kg	38.900
Iron	mg/kg	304.400

2.5 Data Analysis

The data gathered was subjected to a one-way analysis of variance (ANOVA) using the software version 17.0 of the Statistical Package for Social Sciences (SPSS).

III. RESULTS AND DISCUSSION

3.1 Weight Gain

Results revealed no significant difference in bi-monthly weight gains of quails at weeks 2 and 4. Although not significant, weight gain at week 2 and 4 was highest in quails supplemented with 30 ml FKJ (51.10 and 79.97 g) followed by 10 ml FKJ (46.6 and 75.53 g), 20 ml FKJ (45.87 and 74.70 g) and Control without FKJ (44.63 and 71.5 g), respectively. It should be noted that quails supplemented with FKJ in the drinking water generally obtained heavier gain in weight compared to the Control or without FKJ probably attributed to the additional crude protein supplied by FKJ supplementation. Moreover, FKJ contained 15.94% crude protein. Result confirmed with Anadon *et al.* (2005) and Abela (2007) who cited that live microorganisms in fermented juices and probiotics can aide for the better utilization of feed nutrients.

Table 2. The cumulative bi-monthly weight gain (g)

Treatment	Week	
	2	4
T_0 (Drinking water, control)	44.63	71.50
T_1 (Drinking water + 10 ml FKJ)	46.60	75.53
T_2 (Drinking water + 20 ml FKJ)	45.87	74.70
T_3 (Drinking water + 30 ml FKJ)	51.10	79.97
p-value	0.409^{ns}	0.128^{ns}

^{ns} *Column means are not significant*

3.2 Average Daily Gain

The cumulative bi-monthly average daily gain (ADG) of Japanese quails was not significantly affected by varying levels of fermented kangkong juice (FKJ) in the drinking water. Although not significant, ADG at week 2 and 4 were highest in quails supplemented with 30 ml FKJ (3.65 and 5.71g) followed by 10 ml FKJ (3.33 and 5.40g), 20 ml FKJ (3.28 and 5.34g) and Control or without FKJ (3.19 and 5.11g), respectively. Despite the short duration of the experiment, results manifested generally heavier ADG in quails supplemented with FKJ in the drinking water compared with the Control or without FKJ. Results are consistent with the findings of Richter *et al.* (2000), Cmiljanic *et al.* (2001), Banday and Risam (2002), and Raceviciute-Stupeliene *et al.* (2007) that showed significantly higher weight gain in birds with live microorganisms in drinking water compared to 100% pure drinking water.

Table 3. The cumulative bi-monthly average daily gain (g)

Treatment	Week	
	2	4
T_0 (Drinking water, control)	3.19	5.11
T_1 (Drinking water + 10 ml FKJ)	3.33	5.40
T_2 (Drinking water + 20 ml FKJ)	3.28	5.34
T_3 (Drinking water + 30 ml FKJ)	3.65	5.71
p-value	0.409^{ns}	0.125^{ns}

^{ns} Column means are not significant

3.3 Voluntary Feed Intake

Supplementation of fermented kangkong juice in the drinking water did not significantly affect the cumulative bi-monthly voluntary feed intake of quails at weeks 2 and 4. However, slightly higher voluntary feed intake was observed in the Control or without fermented kangkong juice (234.03g and 499.53g and this were followed by 30 ml FKJ (233.37g and 496.0g), 20 ml FKJ (233.2 and 496.57g), and 10 ml FKJ (233.13 and 489.37g), respectively. Supplementation with FKJ in the drinking water of quails demonstrated an increasing trend in voluntary feed intake with an increasing level of FKJ, however still quails without supplementation tend to consume more feeds.

Table 4. The cumulative bi-monthly voluntary feed intake (g)

Treatment	Week	
	2	4
(Drinking water, control)	234.03	499.53
(Drinking water + 10 ml FKJ)	233.13	489.37
(Drinking water + 20 ml FKJ)	233.20	496.57
(Drinking water + 30 ml FKJ)	233.37	496.00
p-value	0.911^{ns}	0.717^{ns}

^{ns} Column means are not significant

3.4 Feed Conversion Ratio

Supplementing fermented kangkong juice (FKJ) in the drinking water of Japanese quails did not significantly affect the feed conversion ratio at weeks 2 and 4. Although not significant, Japanese quails supplemented with FKJ showed better FCR compared with the Control in the drinking water. Results indicated slightly better FCR 4.58 and 6.21 with quails given 30 ml FKJ in the water and quails under Control or without FKJ (5.33 and 7.01) showed the least FCR. The FKJ supplementation perhaps contributed to the better utilization of feed nutrients. Raymane (2000) and Cavit (2003) confirmed that live microorganisms promote growth rates by improving feed efficiency with subsequent animal health improvements (Philips and Philips, 1996). Likewise, live microorganisms have positive effects on the physiological functions of the gastrointestinal tract that reflected better digestion, nutrient absorption, and metabolism.

Table 5. The cumulative feed conversion ratio

Treatment	Week	
	2	4
T_0 (Drinking water, control)	5.33	7.01
T_1 (Drinking water + 10 ml FKJ)	5.03	6.48
T_2 (Drinking water + 20 ml FKJ)	5.10	6.65
T_3 (Drinking water + 30 ml FKJ)	4.58	6.21
p-value	0.427^{ns}	0.089^{ns}

^{ns} Column means are not significant

3.5 Return Above Feed and Chick Costs

Results indicated highest RAFCC in quails supplemented with 10 ml FKJ (17.92 PhP) followed by the Control or without FKJ (17.74 PhP), 30 ml FKJ (17.70 PhP) and 20 ml FKJ (17.25). Despite the short term duration of the experiment, the overall result on RAFCC of raising Japanese quails supplemented disclosed a bright prospect of FKJ supplementation.

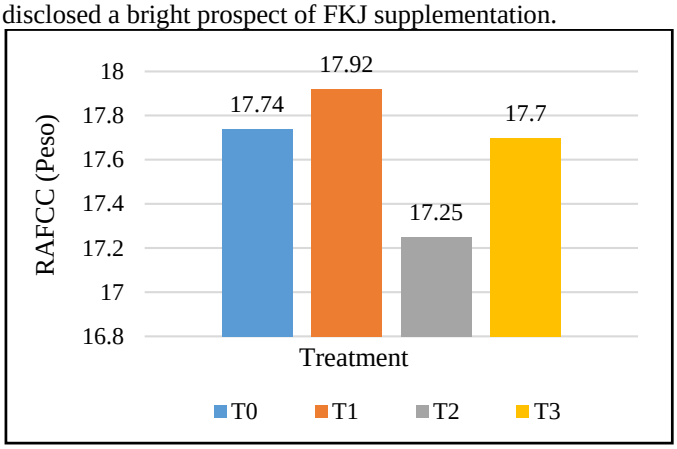

Figure 1. Return above feed and chick cost (Php) of Japanese quails supplemented with varying levels of FKJ

IV. CONCLUSION AND RECOMMENDATION

Supplementation of fermented kangkong juice into the drinking water did not significantly affect the growth performance of the Japanese quails. However, the overall result on return above feed and chick cost disclosed a bright prospect of FKJ. A similar study should be conducted to assess the long-term effects of FKJ supplementation and establish the optimum level of FKJ incorporation into the drinking water of quails.

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