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*Research Paper*

# Effects of Varying Levels of Fermented *Ipomoea aquatica* Juice Supplementation on Early Laying Performance and Egg Quality Traits of Japanese Quails

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## ABSTRACT

A feeding trial was conducted at the Department of Animal Science-College of Agriculture and Food Science, Visayas State University, Visca, Baybay City, Leyte, Philippines to evaluate the early laying performance and egg quality traits of Japanese quails supplemented with varying levels of fermented *Ipomoea aquatica* juice through the drinking water as an alternative to synthetic supplements and antibiotics which are very detrimental to human health. A total of one hundred twenty, and forty-two days old Japanese quail hens were used as experimental birds from February to March 2016. These were randomly assigned into four treatments replicated three times with ten birds every replication and laid out in a Completely Randomized Design set-up. Data gathered except for Yolk color were subjected to one-way analysis of variance (ANOVA) and comparison of treatment means was done using Tukey's Honest Significant Difference test using version 17.0 of the Statistical Package Social Science software. The Yolk Color was analyzed using the Kruskal Wallis test for non-parametric data. Results revealed that the overall laying performance, egg weight, and egg shape were not affected by fermented *Ipomoea aquatica* juice supplementation through the drinking water. However, eggshell weight and yolk color were significantly affected by the inclusion of different levels of fermented *Ipomoea aquatica* juice supplementation, and the return on investment indicated a promising prospect for raising Japanese quails.
***Keywords:*** Japanese quails, fermented kangkong juice, supplementation, laying performance

## INTRODUCTION

The Japanese quails (*Coturnix japonica* Temminck and Schlegel) are very fascinating, small in size and popular family of birds found all over the world, and mostly used as ornamental animals except the Coturnix and Bobwhite quail species. [1-3] Accordingly, quails are listed as game birds and used in outdoor sports and recreational activities. However, quails are more than just a game bird because they grow well in small cages, economical to keep, mature at 42 days and hens lay 200 eggs in their first year of lay under proper management. The same author cited that quail can produce an egg daily for at least a year and can lay up to 300 eggs a year at an incredibly efficient feed to egg conversion. In the Philippines, the quail eggs are known as "itlog ng pugo", have become popular "street food;" and can be sold boiled or as orange-colored kwek-kweks. Further, there is a high demand for quail eggs and meat in the streets, bars, restaurants, and hotels. The quail eggs can be sold fresh, salted, boiled, pickled, or as "balut", while the meat can be served fried, barbecued, adobo, ginataan or any other ways that chicken may also cook.

Raising quails is a profitable business because it can be started with a much lower capital investment compared to chickens and ducks. It offers short economic cycles that lead to faster returns, and quail hens take less than two pounds of feed to generate a pound of egg compared to nearly three pounds of feed to produce the same weight of egg in poultry. As commercial birds, there is a bright prospect to their being fast growers and multipliers, and efficient converter of feeds to egg and meat. Unlike other poultry species, quails are not delicate and are more resistant to diseases common to poultry, especially chickens. Essentially, the meat of quails has less fat and fewer calories, forming an ideal food for health-conscious consumers. [4,5]

The quail industry in the Philippines has become more than just a backyard business because of its economic cost of production and easy-to-learn techniques to raise. It has proven to be a potential source of organic meat and eggs due to their being vigorous, disease-resistant and hardy enough to survive without the use of synthetic drugs. However, farmers are often beset with high feed cost and lack of available protein supplement especially due to the high protein requirement of quails. Likewise, vitamin and mineral supplements are also expensive. Locally available plants like kangkong (*Ipomoea aquatica* Forssk.) is noted to be an excellent source of carotenoids, iron, manganese, copper, calcium, vitamins B and C and amino acids. [4,6] It has also been reported that fermentation results in better absorption of nutrients. Hence, the potential of fermented kangkong juice as a natural alternative supplement in the drinking water of layer quails was investigated.

## MATERIALS & METHODS

**Preparation of Experimental Quails**

One hundred twenty (120), 42-days old early-laying Japanese quail hens were used in the experiment from February to March 2016, and raised in a quail layer cages at the Poultry Project, Department of Animal Science, Visayas State University, Visca, Baybay City, Leyte.

**Preparation of Cages and Fermented Kangkong Juice (FKJ)**

The grower-layer cages were made of steel and designed with slightly inclined flooring so that eggs will roll to the front of the house for easy egg collection. The feeders, waterers and the preparation of fermented kangkong juice are based on the measurement and ratio as cited by Ampode (2019).

**Rearing Management**

A recommended 16 hours of light per 24-hour day period was provided by using two 7-watts LED bulbs during night time (from 6 P. M. to 10 P. M.) and 12-hour of the daylight period. The standard feeding program of layer quails was followed. The daily feed allowance of 23 grams of laying mash per head was given 6:00 in the morning and 3:00 in the afternoon. The experimental drinking water was given twice a day to ensure freshness during the whole duration of the study.

Provisions for proper ventilation and prevention of extreme cold weather conditions were provided. Moreover, proper sanitation and cleanliness were also observed, and daily removal of dung to get rid of flies and a foul odor was strictly implemented.

**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

**Data Gathered**

1. Weekly Egg Production (%) – is the number of egg produced per week.
2. Egg Weight, (g) - individually weighed using a digital weighing scale.
3. Egg Quality Traits:

a. Shell weight, (g) - eggshell with shell membrane was weighed using the digital weighing scale.
b. Yolk color – under the white background, yolk color was evaluated using the ROCHE Yolk color Fan.
c. Egg Shape Index (%) - length and width of the egg was first measured using a Vernier caliper then egg shape index will be determined using the formula:

$$\text{Egg shape index} = \frac{\text{Width of egg (mm)}}{\text{Length of egg (mm)}} X\ 100$$

4. Return and Above Feed Cost (RAFC) = was calculated using the formula:

RAFC = (Total no. of eggs produced x Price of eggs/ piece) – (Total feed consumed x Price/kg feed)

**Determination of Egg Quality Parameters**

Three eggs were randomly collected from each treatment, and egg collection was done daily until 35 days. Individual weighing of egg samples using digital balance, measurement of the width (mm) and length (mm) using Vernier caliper, egg yolk color evaluation using the ROCHE Yolk color Fan and weighing of eggshell were done on fresh egg samples.

## RESULTS AND DISCUSSION

### Egg Production

The weekly egg production performance of Japanese quails was not significantly affected by fermented kangkong juice (FKJ) supplementation. Although not significant, results showed slightly higher mean egg production in layer quails supplemented with 20 ml FKJ (76.76%) followed by 30 ml FKJ (76.57%), 10 ml FKJ (76.38%) and Control or without FKJ (73.52%). The overall results manifested slightly better egg production on Japanese quails supplemented with fermented kangkong juice (FKJ) through the drinking water.

**Table 1. Average weekly egg production (%) of Japanese quails supplemented with varying levels of fermented kangkong juice (FKJ) in the drinking water**

| Treatment | Week | | | | | Mean |
|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | |
| $T_0$ = 1000 ml Drinking water (Control) | 70.00 | 76.67 | 75.71 | 67.14 | 78.10 | 73.52 |
| $T_1$ = 1000 ml Drinking Water + 10 ml FKJ | 65.71 | 81.43 | 80.48 | 75.71 | 78.57 | 76.38 |
| $T_2$ = 1000 ml Drinking Water + 20 ml FKJ | 67.62 | 85.71 | 78.10 | 74.76 | 77.62 | 76.76 |
| $T_3$ = 1000 ml Drinking Water + 30 ml FKJ | 63.33 | 80.48 | 79.05 | 76.19 | 83.81 | 76.57 |
| *p-value* | .947$^{ns}$ | .539$^{ns}$ | .920$^{ns}$ | .534$^{ns}$ | .893$^{ns}$ | .839$^{ns}$ |

$^{ns}$ Column means are not significant

### Egg Weight

Similarly, the average weekly egg weight of Japanese quails was not significantly affected by fermented kangkong juice (FKJ) supplementation (Table 2). Despite the insignificant result, slightly higher mean egg weight was observed in layer quails supplemented with 30 ml FKJ (8.97 g) followed by 20 ml FKJ (8.94 g), 10 ml FKJ (8.88 g) and Control or without FKJ (8.84 g). The overall results manifested a slightly increasing trend for the mean egg weight of Japanese quails supplemented with fermented kangkong juice (FKJ) through the drinking water. This finding suggests a bright prospect for fermented kangkong- juice (FKJ) supplementation on Japanese quail layer production through the drinking water.

**Table 2. Average weekly egg weight (g) of Japanese quails supplemented with varying levels of fermented kangkong juice (FKJ) in the drinking water**

| Treatment | Week | | | | | Mean |
|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | |
| $T_0$ = 1000 ml Drinking water (Control) | 8.68 | 8.79 | 8.91 | 8.90 | 8.92 | 8.84 |
| $T_1$ = 1000 ml Drinking Water + 10 ml FKJ | 8.58 | 8.80 | 8.96 | 8.82 | 9.25 | 8.88 |
| $T_2$ = 1000 ml Drinking Water + 20 ml FKJ | 8.62 | 8.86 | 8.95 | 9.06 | 9.21 | 8.94 |
| $T_3$ = 1000 ml Drinking Water + 30 ml FKJ | 8.71 | 8.88 | 8.99 | 9.10 | 9.15 | 8.97 |
| *p-value* | 0.877$^{ns}$ | 0.922$^{ns}$ | 0.979$^{ns}$ | 0.729$^{ns}$ | 0.430$^{ns}$ | 0.738$^{ns}$ |

$^{ns}$ Column means are not significant

## Egg Shape Index

Egg shape index is an egg quality parameter that is crucial for egg crushing strength. Result revealed an insignificant difference in the shape index of Japanese quail eggs supplemented with fermented kangkong juice (FKJ) through the drinking water (Table 3). In this study, the Control or without FKJ supplementation showed a slightly higher average egg shape index (82.35%) followed by 30 ml FKJ (82.14%), 10% FKJ (81.69%) and 20 ml FKJ (81.25%). Moreover, the overall result disclosed high egg shape index values which are beyond the optimal range of 70-77%, and rounded and elongated or elliptic eggs that fall above and below the optimal values have a higher tendency to break easily. Further, the egg shape index is more closely associated with hen's genotype and age.

**Table 3. Average egg shape index (%) of Japanese quails supplemented with varying levels of fermented kangkong juice (FKJ) in the drinking water**

| Treatment | Week | | | | | Mean |
|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | |
| $T_0$ = 1000 ml Drinking water (Control) | 81.66 | 80.96 | 84.51$^{ab}$ | 81.85 | 82.77 | 81.66 |
| $T_1$ = 1000 ml Drinking Water + 10 ml FKJ | 82.25 | 81.64 | 83.72$^{ab}$ | 80.66 | 80.18 | 82.25 |
| $T_2$ = 1000 ml Drinking Water + 20 ml FKJ | 81.21 | 80.41 | 83.17$^{b}$ | 80.35 | 81.11 | 81.21 |
| $T_3$ = 1000 ml Drinking Water + 30 ml FKJ | 82.07 | 81.22 | 85.16$^{a}$ | 80.77 | 81.50 | 82.07 |
| *p-value* | 0.771$^{ns}$ | 0.230$^{ns}$ | 0.040$^{*}$ | 0.183$^{ns}$ | 0.724$^{ns}$ | 0.771$^{ns}$ |

$^{ns}$ Column means are not significant

* Column means with no common superscripts are significantly different (P< 0.05)

## Egg Yolk Color

The average yolk color of Japanese quail eggs was significantly affected by different levels of fermented kangkong juice (FKJ) supplementation through the drinking Results revealed highly significant difference (P< 0.01) on the mean egg yolk color showing comparable yolk colors on 30 ml FKJ (5.65) and 20 ml FKJ (5.30). Among the treatments supplemented with FKJ, the 10 ml FKJ (5.09) was slightly pale compared with the 20 ml (FKJ). It should be noted that when the level of FKJ supplementation into the drinking water was increased, the egg yolk color also became more intense yellow. This is attributable to high carotenoids, lutein and pro-vitamin A in the kangkong plant. [7,8] Further, the primary determinant of yolk color is the xanthophyll or plant pigment. [9]

**Table 4. Average yolk color of eggs of Japanese quails supplemented with varying levels of fermented kangkong juice (FKJ) in the drinking water**

| Treatment | Week | | | | | Mean |
|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | |
| $T_0$ = 1000 ml Drinking water (Control) | 4.89 | 4.92$^{c}$ | 4.40$^{c}$ | 4.32$^{c}$ | 4.39$^{b}$ | 4.58$^{c}$ |
| $T_1$ = 1000 ml Drinking Water + 10 ml FKJ | 5.38 | 5.30$^{b}$ | 4.95$^{b}$ | 4.98$^{b}$ | 4.83$^{b}$ | 5.09$^{b}$ |
| $T_2$ = 1000 ml Drinking Water + 20 ml FKJ | 5.46 | 5.60$^{ab}$ | 5.11$^{ab}$ | 5.25$^{ab}$ | 5.06$^{b}$ | 5.30$^{ab}$ |
| $T_3$ = 1000 ml Drinking Water + 30 ml FKJ | 5.62 | 5.71$^{a}$ | 5.56$^{a}$ | 5.47$^{a}$ | 5.89$^{a}$ | 5.65$^{a}$ |
| *p-value* | 0.068$^{ns}$ | 0.032$^{*}$ | 0.019$^{*}$ | 0.025$^{*}$ | 0.037* | 0.002** |

* Column means with no common superscripts are significantly different (p < 0.05)

** Column means with no common superscripts are significantly different (p < 0.01)

$^{ns}$ Column means are not significant

## Shell Weight

Shell weight as an egg quality measurement that can be translated to shell thickness, and significantly related to the strength of the eggshell against breakage during transport and storage. The average shell weight of Japanese quail eggs supplemented with varying levels of fermented kangkong juice (FKJ) through the drinking water are presented in Table 5. Results revealed significant differences at week 1 and 3 is indicating generally heavier shell weight on quail eggs from layers supplemented with fermented kangkong juice compared with the Control or without FKJ. Although not significant, the mean shell weight during the end of the experiment displayed slightly heaviest shell weight on the 30 ml FKJ (1.05g). Despite the inconclusive findings due to the short term duration of the experiment, the potential for fermented kangkong juice supplementation to increase shell weight.

**Table 5. Average shell weight (g) of Japanese quails eggs supplemented with varying levels of fermented kangkong juice (FKJ) in the drinking water**

| Treatment | Week | | | | | Mean |
|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | |
| $T_0$ = 1000 ml Drinking water (Control) | 1.06[c] | 1.00 | 0.94[b] | 0.99 | 1.13 | 1.06[c] |
| $T_1$ = 1000 ml Drinking Water + 10 ml FKJ | 1.10[ab] | 1.04 | 0.95[ab] | 0.96 | 1.04 | 1.10[ab] |
| $T_2$ = 1000 ml Drinking Water + 20 ml FKJ | 1.11[a] | 1.00 | 0.98[ab] | 1.06 | 0.71 | 1.11[a] |
| $T_3$ = 1000 ml Drinking Water + 30 ml FKJ | 1.07[bc] | 1.02 | 1.00[a] | 1.03 | 1.14 | 1.07[bc] |
| *p-value* | 0.006** | 0.506[ns] | 0.038[*] | 0.161[ns] | 0.238[ns] | 0.006** |

[*] Column means with no common superscripts are significantly different ($p < 0.05$)
[**] Column means with no common superscripts are highly significantly different ($p < 0.01$)
[ns] Column means are not significant

## Return Above Feed Cost

The return above feed cost (RAFC) of Japanese quails as affected by different levels of fermented kangkong juice (FKJ) are presented in Table 6. Although not significant, the highest mean RAFC was obtained on 30 ml FKJ (7.27 PhP) followed by 10 ml FKJ (7.41 PhP), 20 ml FKJ (7.09 PhP) and Control or without FKJ (6.75 PhP). Despite the short term duration of the experiment, the overall result on RAFCC of raising Japanese layer quails supplemented disclosed a bright prospect of FKJ supplementation through the drinking water.

**Table 6. Return above feed and chick cost (Php) on Japanese quails supplemented with varying levels of fermented kangkong juice (FKJ) in the drinking water**

| Treatment | Week | | | | | Mean |
|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | |
| $T_0$ = 1000 ml Drinking water (Control) | 5.97 | 6.88 | 7.92 | 5.50 | 6.96 | 6.75 |
| $T_1$ = 1000 ml Drinking Water + 10 ml FKJ | 5.31 | 7.53 | 8.56 | 6.66 | 7.04 | 7.41 |
| $T_2$ = 1000 ml Drinking Water + 20 ml FKJ | 5.59 | 9.30 | 7.09 | 6.63 | 6.92 | 7.09 |
| $T_3$ = 1000 ml Drinking Water + 30 ml FKJ | 5.07 | 7.45 | 7.27 | 6.80 | 7.80 | 7.27 |
| *p-value* | 0.949[ns] | 0.259[ns] | 0.917[ns] | 0.515[ns] | 0.866[ns] | 0.757[ns] |

[ns] Column is not significant

## CONCLUSIONS AND RECOMMENDATIONS

The overall laying performance (average weekly egg production, average weekly egg weight and return above feed cost) and the average egg shape index of Japanese quails were not significantly affected by fermented kangkong juice supplementation through the drinking water. Despite the short term duration of the experiment, the potential for FKJ supplementation is highly significant for the egg yolk color, and eggshell weight.

Based on egg yolk color and return above feed cost, the 30 ml FKJ supplementation into the drinking water of Japanese quails is highly recommended. Due to the short term duration of the study, a similar study should be conducted to assess the long-term effect of FKJ supplementation on egg production and egg quality traits, and to establish the optimum level of FKJ incorporation into the drinking water of Japanese layer quails.

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