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Laying Performance of Japanese Quail Fed Ration with Different Levels of Golden Apple Snail Meal (*Pomacea canaliculata*) as Substitute to Fishmeal

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Abstract— *Five different levels of Golden Apple Snail Meal (GASM) as fishmeal substitute in laying Japanese quail ration were tested on the basis of total number of eggs produced, average weight of egg produced, feed conversion ratio and cost and return analysis including ROI, in a Randomized Complete Block Design experiment with 5 treatments which were replicated 4 times and 10 birds per replication. Results revealed that Treatment 1 (100% Fishmeal + 0% GASM) produced the highest average number of eggs in 15 months period with 436, but is not significantly different from Treatment 2 (75% Fish meal + 25 GASM) and Treatment 3 (50% Fishmeal + 50% GASM) with 432.50 and 427.50 respectively. However, Treatment 4 (25% Fishmeal + 75% GASM) and Treatment 5 (100 % GASM) had significantly lesser average number of eggs than Treatments 1, 2 and 3, and Treatment 4 is significantly higher than Treatment 5, with 252.75 and 192.50 respectively. No significant difference was observed on the average weight of quail eggs produced in five treatments while birds in treatments 1, 2, and 3 had significantly better feed conversion ratio than treatments 4 and 5. GASM can be a partial substitute to fishmeal in laying quail ration up to 50%. Beyond this the laying performance of Japanese quail declines.*

Keywords— *Fish meal, Fed ration, Golden apple snail meal, Japanese quail.*

I. INTRODUCTION

The golden apple snail (GAS), (*Pomacea canaliculata*) is a freshwater gastropod native to South America. This snail was introduced in three areas in the Philippines, namely: from Taiwan to Lemery, Batangas in 1982; from Florida, U.S.A. to Makati, Metro Manila in 1983; and from Argentina to Asturias, Cebu in 1984. Private and government agencies introduced GAS in the Philippines as a means of livelihood and to enrich the protein source in the human diet [1].

Few years after their introduction, GAS became an aquaculture species and mass production were observed throughout the country. Eventually, they became a serious rice pest and have been implicated in the drastic decline of edible native apple snail (NAS), They damage young rice seedlings, causes poor crop stand, yield losses, additional expenses, and lethal effects on synthetic commercial molluscicides including the unaccounted environmental costs where bodies of water are the main recipients of the run-off of various formulations of nonspecific molluscicides [2]. Filipino farmers became aware of GAS as pest of rice in 1986, when they were first reported damaging 300 ha. of rice crops in Region 2 (Manila Bulletin, August 25, 1988). Six years after its introduction in the Philippines, GAS invaded about 3.6% of the total area planted to rice [3].

GAS can be used not only as human food but also an animal feed. As feed, it could possibly replace meat meal or fishmeal in animal diet. The protein content of 62.5% is comparable to the CP value of Peruvian fish meal which is 61.2% and a little bit lower only than meat meal with 66% CP [4]. GAS is also a good source of mineral as indicated by the contents of calcium (35%) and phosphorous (1.22%) and high source of energy (3,336 kcal/ kg).

The golden apple snail as substitute for native kuhol for human food is not very popular. Nevertheless, their importance as a source of non-conventional feedstuff cannot be ignored. High cost of the conventional feedstuffs was causing poultry raisers to experience economic losses. Fishmeal for example, as main source of good quality protein was expensive, since majority of the supply of these feedstuffs are being imported. The use of Golden Apple Snail Meal (GASM) seems to be a logical approach in reducing the price of animal feed. In the quail raising industry in the Philippines, feed constitute 70-80% of the total operational cost.

Golden snail meal could be used as substitute for fishmeal in layer ration, and responsible for uniformity of nutrients being deposited in the eggs of layers. Golden snail meal could replace fishmeal in ration of layers without affecting the total egg production.

This paper focused on utilization of GASM as Fishmeal substitute with the view of reducing the cost of production in laying Japanese quail ration. Specifically, the research aimed to find out the influence of different levels of GASM on the laying performance of Japanese quail including average number of eggs, weight of egg produced and feed conversion ratio; and to determine the most economical level of GASM in the laying quail ration.

II. MATERIALS AND METHOD

An experimental enclosure was prepared to accommodate the cages designed specifically for the single factor experiment in Randomized Complete Block Design (RCBD) with five treatments and replicated four times. Nine laying quails were provided as experimental birds per replication. The treatments are T_1 = home-mixed ration with 100% Fishmeal and 0% GASM, T_2 = home-mixed ration with 75% Fishmeal and 25% GASM, T_3 = home-mixed ration with 50%

Fishmeal and 50% GASM, T_4 = home mixed ration with 25% Fishmeal and 75% GASM and T_5 = 0% Fishmeal and 100% GASM.

The GASM was produced by cooking the snail and removing the meat from the shell. The meat was dried and ground into a meal form. The shells were likewise ground but not mixed with the GASM. The shells were incorporated into all treatments ration to supply additional calcium after the actual formulation of feed was done, using different feedstuffs including different levels of GASM.

The home-mixed ration was prepared by weighing the ingredients properly and mixed to contain 20% crude protein including those supplemented with the different levels of GSAM. The feed ingredients used for home-mixed feed include ground yellow corn, fine rice bran, soybean oil meal, fish meal, GASM, bone meal, ground limestone, vitamin and mineral premix and coconut oil. Coconut oil was added to all rations as additional source of energy and to lessen the dustiness of the home-mixed feed. Preparation of home-mixed feeds were done weekly, and the feeds were stored in a dry and well-ventilated area.

Soon after the arrival of ready to lay quails and during the first week of feeding, commercial quail laying feeds was used. During the 8th and 9th day of feeding, 75% commercial feeds and 25% home-mixed feed were given to the birds. On the 10th and 11th day of feeding, 50% commercial feeds and 50% home-mixed feeds were given to the experimental birds. Then, on the 12th and 13th day of feeding, 25% commercial feed and 75% home-mixed feeds were provided to the birds. This was done to accustom the birds gradually to their new home-mixed ration. During the 14th day and throughout the 15 months duration of the experiment, 100% home-mixed feeds were given to the experimental birds.

Feeds were given three times a day to ensure the regularity and availability of feeds to the experimental birds. The feeds before given to the experimental animals were weighed and the total feed consumed per treatment was calculated at the end of the experiment. Data on feed consumption was used in the computation of feed conversion ratio of the laying quail, a way to determine the feed required to produce a dozen eggs.

Gathering and recording of eggs were done every 5:00 pm to make sure that all the quails had already laid their egg for the day. The eggs collected were weighed every after the collection and the average weight of eggs was determined per treatment.

Data collected and processed were analyzed using analysis of variance at 5% and 1% levels of significance. Significant results were further analyzed using Duncan's Multiple Range Test (DMRT) at 5% level of significance.

III. Results and Discussion

After 15 months of feeding experiment, highest number of eggs was produced by the quails in Treatment 1 with a mean of 436 followed by treatment 2 and 3 with means of 432.5 and 427.5 respectively, but analysis shows no significant difference among the three treatments. However, treatment 1, 2 and 3 recorded significantly higher averages than treatments 4 and 5 that respectively produced averages of just 252.75 and 192.50. Also, treatment 4 produced significantly higher average number of eggs than Treatment 5 (Table 1). The result is consistent with the report of Kant (2015) that no dietary effects were observed on egg performance parameters especially hen-day production on lower levels of snail meal substitution to Fishmeal [5].

TABLE 1. Average Number of Eggs Produced by Japanese Quails, after 15 months of Laying

Treatment	Mean*
100% FM and 0% GASM	436.00^a
75% FM and 25% GASM	432.50^a
50% FM and 50% GASM	427.50^a
25% FM and 75% GASM	252.75^b
0% FM and 100% GASM	192.50^c

*Means followed by the same superscripts are not significantly different by DMRT at 5% level of significance

With regards to the average weight of eggs after 15-month period, no significant difference was observed among treatments. This means that the different levels of GASM as substitute to FM as source of protein in laying quail ration did not affect the weight of the egg produced. Consistent with the findings of Kant (2015) that the weight of eggs did not affect when fishmeal in layer ration is partially substituted with snail meal [5].

TABLE 2. Average Weight of Japanese Quail Eggs Produced After 15 Months of Laying (grams)

Treatment	Mean*
100% FM and 0% GASM	8.901055^a
75% FM and 25% GASM	8.879920^a
50% FM and 50% GASM	8.879088^a
25% FM and 75% GASM	8.881350^a
0% FM and 100% GASM	8.900000^a

*Means followed by the same superscripts are not significantly different by DMRT at 5% level of significance

The feed conversion ratio of the layer Japanese quail shows insignificant differences in treatments with up to 50% substitution of GASM to FM. The substitution of GASM gave comparable effect on feed conversion efficiency with that of commercial feeds. Higher amount of substitution however, especially more than 50% shows significantly higher FCR, which indicates very low feed conversion efficiency of the laying quails [6].

TABLE 3. Feed Conversion Ratio of Japanese Quail After 15 Months of Laying

Treatment	Mean*
100% FM and 0% GASM	1.100^a
75% FM and 25% GASM	1.200^a
50% FM and 50% GASM	1.320^a
25% FM and 75% GASM	2.690^b
0% FM and 100% GASM	3.775^c

*Means followed by the same superscripts are not significantly different by DMRT at 5% level of significance

Significantly higher Return on Investment was obtained in the 50% substitution of GASM to FM due primarily on the lower feed cost. The overall feed cost of egg production was reduced on the snail meal-based diets as compared to the full fish meal-based diet. However, even if the reduction of feed cost is a very important consideration in quail egg production, the very low egg production in treatments with higher than 50% GASM substitution is detrimental in a Layer Japanese quail business.

TABLE 4. Return on Investment of Japanese Quail After 15 Months of Laying

Treatment	Mean*
100% FM and 0% GASM	22.20[a]
75% FM and 25% GASM	26.51[b]
50% FM and 50% GASM	28.95[c]
25% FM and 75% GASM	-22.60[d]
0% FM and 100% GASM	-39.66[e]

*Means followed by the same superscripts are not significantly different by DMRT at 5% level of significance

IV. CONCLUSION

With the information collated and analyzed, Golden apple snail meal can be a partial substitute to Fishmeal in laying Quail ration. The substitution of 50% GASM to FM will give the highest Return on Investment but the levels of GASM beyond 50 percent significantly lowered the laying performance as well as the Return on Investment, although the different levels of GASM did not significantly affect the weight of the eggs produced.

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