LAYING PERFORMANCE OF ItikPINAS *(Anas platyrynchos Linnaeus)* AS AFFECTED BY GARLIC *(Allium sativum)* POWDER IN DRINKING WATER

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ABSTRACT

The laying performance, egg quality, egg classification, and income over feed cost of Improved Philippine Mallard duck (ItikPINAS) were examined as influenced by garlic powder in drinking water for six weeks. Forty-eight ducks (42 females and 6 males), aged thirteen months, were divided into two treatments: one with the supplementation of 1g garlic powder (GP) in every 4 liters of water (250 ppm) and the other without garlic powder (control) in drinking water. Each treatment consisted of three replicates, with eight ducks (7 females and 1 male) per replication. The results showed that there was a significant (P = 0.03) difference in average egg weight where higher values were attained by ducks with GP (77.67 g ± 0.64) than the control (75.64 g ± 0.43). The supplementation of garlic powder in drinking water, however, did not affect egg production, feed intake, FCR, egg mass, livability, egg quality, and egg classification. However, the ItikPINAS with GP in drinking water had numerically higher income over feed cost than those without. GP in drinking water can be considered in raising ItikPINAS. Further studies on increasing the level of GP and long feeding duration also merit consideration to substantiate the findings.

Keywords: Phytogenic, garlic powder, ItikPINAS, egg weight, egg production

INTRODUCTION

Poultry and livestock species are continuous in their improvement and development through the process of selection to enhance their production capacity (Svitáková *et al.*, 2014). Animal production is influenced by a variety of factors, including their diet. Phytogenics also referred to as phytobiotics are promising additives that can improve their productivity while remaining safe and natural.

Phytogenics are known as natural growth promoters. They are acquired from herbs, spices, and different kinds of plants. Phytogenics are intentionally added to animals' feed or drinking water for their antioxidant, antimicrobial, and antiviral properties (Bölükbaşi *et al.*, 2009). Previous studies reported that they can enhance digestion, nutrient absorption as well as the removal of pathogens in the gastrointestinal tract.

Garlic (*Allium sativum*) is one of the most valued phytogenics nowadays. It is well-known and considered a spice and herbal remedy for a variety of diseases and infections

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worldwide (Konjufca *et al.*, 1997). This study aims not only to improve the production performance of ItikPINAS but also to minimize the use of antibiotics, as garlic is claimed to have immune-enhancing properties and stress-relief effects. For these reasons, there have been several investigations into garlic as a Phytogenic Feed Additive (PFA). However, some areas are yet to be explored in the use of garlic in poultry production.

MATERIALS AND METHODS

Experimental Ducks and Treatments

A total of 48 ItikPINAS Kayumanggi, aged 13 months, were used in the study. They were randomly distributed into two treatments as indicated below. Each treatment had three replicates with eight ducks per replicate (1 male: 7 females):

Without GP - ItikPINAS (IP) without garlic powder (GP) in drinking water

With GP- ItikPINAS (IP) with GP in drinking water (250 ppm)

Preparation of Drinking Water with Garlic Powder

A commercial garlic powder (Brand: NG Garlic Allicin) was used. The initial trial was done before the actual study. This trial was intended to ensure that the GP could dissolve in water and be consumed by the ducks. It was prepared daily by dissolving it in drinking water at an inclusion rate of 1 g per 4 l of water. The mixture was offered in a basin as their only drinking water from 7:00 am to 4:00 pm for six weeks. The mixture was replaced by fresh pure drinking water after 4:00 pm.

General Care and Management

Housing. The ducks were raised under complete confinement in an open-sided litter floor house with adequate feeding and water facilities. The height of the building from floor to ceiling is 2 m and the floor area per pen is 1.2 m x 2.5 m. Three cm rice hulls were used as litter materials.

Feeding. A commercial duck layer diet (Table 1) was weighed at 5:30 a.m. and 3:30 p.m., and offered at 6:00 a.m. and 4:00 p.m. in a round feeder, respectively. Feed refusals were collected and weighed from the feeder and buckets every week. The feed was offered ad libitum.

Table 1. Duck layer pellet guaranteed analysis.

Item	Amount
Crude protein, % (Min.)	18.00
Crude fat, % (Min.)	5.00
Crude fiber, % (Max.)	6.00
Moisture, % (Max.)	12.00
Calcium, %	3.30-3.70
Phosphorus, % (Min.)	0.70

Data Gathered

The following data were gathered and computed:

Egg production. Eggs produced were recorded on a group basis. Percent egg production was determined on a duck-day basis by dividing the total number of eggs produced by the number of duck-days, then multiplied by 100.

Daily feed consumption. The feeds given to the ducks were carefully monitored. The initial weight of buckets filled with feeds was taken (feed in) as well as the final weight (feed out). This was done weekly before feeding the ducks. The amount of feed consumed per duck (average daily feed consumption, ADFC) was computed by taking the difference between feed in and feed out and dividing by the number of duck-days. The total feed consumption was consequently computed as ADFC × feeding period.

Feed conversion ratio (FCR). The FCR was computed by dividing the total feed intake for a particular period by the weight of eggs produced for the same period.

Egg mass. The egg mass was computed by multiplying the % egg production by the average egg weight.

Livability. Livability was monitored on a daily basis. The total number of mortality during the feeding trial was deducted from the initial number of ducks allocated for the experiment.

Egg composition and quality. A total of 48 eggs were used for the egg composition and egg quality determination for two weeks. The average egg weight was determined first, and the egg closest to the average weight was chosen as a sample per replication. Eggshell weight, albumen height, and weight, yolk color, and yolk weight were obtained. Sample eggs were carefully opened and egg contents were placed on a flat surface for the determination of albumen height and yolk color.

Table 2. Classification of duck eggs by weight.

Classification	Weight Range (g)
Jumbo	84 and above
Extra Large	75-83
Large	66-74
Medium	57-65
Small	48-56
No weight	Less than 47

Source: Berdos (2018)

Yolk color score and weight. The DSM color fan was used for the yolk color score, while the digital caliper was used for albumen and eggshell thickness measurements. Yolk and albumen weights were determined using a digested weighing scale. Furthermore, the egg shells were weighed after two days of drying them at room temperature.

Albumen height. The height of the albumin was measured using a digital caliper and was taken as the average of three points measured at the level of the thick part of the albumen.

Egg weight. Eggs collected were individually weighed daily using a digital weighing scale. The data were summarized every week and the mean egg weight was computed.

Egg size and classification. The total eggs produced in a day were classified based on the classification of duck eggs (Table 2) in the study by Berdos (2018). Soft-shelled eggs were not included in the classification.

Economic Analysis

Income over feed cost. The income over feed cost (IOFC) was computed as:

IOFC = Sale value of eggs, Php – (Feed cost, Php + garlic powder, Php)

The sale value of the eggs was computed by multiplying the total number of eggs produced by the current price of eggs in the market. The feed cost was determined by multiplying the total feed consumed by the ducks for the feeding period with the cost per kg of feed.

Statistical Analysis

Production data were statistically analyzed using a *t*-test of Microsoft Excel 2016™. The treatment means were tested for significant differences at 5% alpha level. Also, the Standard Error of the Mean (SEM) was determined.

RESULTS AND DISCUSSION

Production Parameters of Laying Ducks

The performance of ItikPINAS with and without garlic powder in drinking water is presented in Table 3. There were no significant (P>0.05) differences between the treatments in any of the production parameters except, for average egg weight which was superior in group with GP.

Table 3. Mean (± SEM) production parameters of laying ducks (ItikPINAS) with and without garlic powder (GP) in drinking water.

Performance	Without GP	With GP	P-Value
Hen-day, %	77.89±0.52	82.61±6.68	0.26
Feed intake, g/day	170.61±3.07	166.59±1.43	0.15
FCR, kg	2.88±0.06	2.75±0.12	0.19
Average egg weight, g	75.64±0.43	77.67±0.64	0.03*
Egg mass, g	58.91±0.27	63.75±4.84	0.18
Livability, %	100.00±0.00	95.24±4.76	0.19

The data showed the influence of the GP on egg weight. This finding was consistent with Omer *et al.*, (2019), who reported increased egg size due to garlic. It is worth to consider the nutritional impact of GP on egg weight. Garlic is a rich source of methionine and cysteine. These amino acids are used above the recommended level in the layer industry to enhance egg weight (Reeve *et al.*, 1993). Corollary to these, Omer *et al.*, (2019) showed that garlic and onion powder significantly increased (P<0.05) the egg weight of the hen. Moreover, Mahmoud *et al.*, (2010) observed that garlic juice supplementation improved layers performance in terms of egg weight (P<0.05). Also, Yalçın *et al.*, (2006) reported that egg weight increased when laying hens were supplemented with garlic powder.

The improvement in most production parameters for the groups with GP appeared to be associated with the essential compounds from garlic. Allicin ($C_6H_{10}OS_2$) is 70% of these compounds (Cavallito and Bailey, 1944) which has immune-enhancing, antioxidant, stress relief, and tonic effects. It was plausible that the responses to the GP were due to one or combined effects of these benefits from the allicin of garlic. Canogullari *et al.*, (2010) also reported that 1% garlic powder supplementation in laying quails enhanced their production parameters. Furthermore, Khan *et al.*, (2007) observed that egg production and feed consumption were improved during the six weeks in which 0, 2, 6, or 8% garlic powder was fed to laying hens.

Egg Quality and Composition

The effects of garlic powder on egg quality are presented in Table 4. There were no significant differences in egg quality and composition and classification of eggs between ItikPINAS with and without GP in their drinking water.

Table 4. Mean Egg quality and composition of laying ducks (ItikPINAS) with and without garlic powder (GP) in drinking water

Performance	Without GP	With GP	P-Value
Albumen height, mm	7.62±0.18	7.55±0.19	0.40
Albumen weight, g	37.13±0.37	36.9±0.36	0.33
Eggshell thickness, mm	0.36±0.01	0.34±0.01	0.19
Eggshell weight, g	8.26±0.06	8.13±0.12	0.16
Yolk weight, g	26.85±0.68	27.43±0.41	0.25
Yolk color, DSM units	9.33±0.14	9.54±0.22	0.22

The lack of statistically significant differences across all parameters suggests that the inclusion of garlic powder in the drinking water does not have a substantial impact on the measured egg quality and composition in ItikPINAS laying ducks. This result was consistent with the study of Yalçın *et al.*, (2006) that supplementation of garlic powder had no significant effect on the egg composition such as yolk weight, eggshell index, egg breaking strength, egg albumen index, egg yolk index, and egg Haugh unit. Omer *et al.*, (2019), also reported no significant effect of garlic and onion powder on the shape index, Haugh unit, albumin, shell percentages, and thickness.

Egg Classification

Table 5 shows the mean egg classification of eggs from the group with or without GP. There was no significant ($P>0.05$) significant difference between the two groups in any of the egg classifications. However, there was a preponderance of jumbo and extra large eggs from the group with GP compared to the group without GP.

The preponderance of jumbo and extra large eggs from the group with GP relates well with the observed increase in egg weight due to GP as presented and decreased in the preceding section. The same reasons for the beneficial effects of GP relative egg weight mentioned in the section are plausible explanations for the observation of egg classification.

Table 5. Classification of eggs from laying ducks (ItikPINAS) with and without garlic powder in their drinking water

Classification	Without GP	With GP	P-Value
Jumbo (≥84g), %	8.77±2.69	12.55±3.51	0.22
Extra Large (75-83g), %	54.32±9	52.48±1.83	0.43
Large (66-74g), %	35.55±7.83	32.54±3.78	0.37
Medium (57-65g), %	1.22±1.22	2.32±1.21	0.28
Small (48-56g), %	0.16±0.16	0	0.19
Extra small (<47g), %	0	0.12±0.12	0.19

Economic Analysis

The income over feed cost from ItikPINAS with or without garlic powder in drinking water is presented in Table 6. Sales and cost parameters were not different (P<0.05) between the two groups. However important numerical differences were observed.

Table 6. Mean (± SEM) income over feed cost (IOFC) from laying ducks (ItikPINAS) with or without garlic powder (GP) in their drinking water

Parameters	Without GP	With GP	P-Value
Egg produced, pcs	32.71±0.21	34.41±2.88	0.29
Sale value of eggs[1], Php	196.26±9.16	206.46±59.02	0.44
Total feed consumed, kg	7.16±2.15	6.99±0.05	0.15
Garlic powder[2], Php	-	2.88	
Feed cost[3], Php	150.78±18.95	149.67±8.81	0.15
IOFC, Php	45.48±0.29	56.79±2.88	0.29

[1]Source: Price for duck egg was Php 6.00 per piece
[2]Source: Price for garlic powder was Php 21 per kg
[3]Source: Price for feeds was Php 1050 per bag

The ItikPINAS with GP in their drinking water had numerically higher sale value of eggs due to numerically more eggs laid. There was also numerically lower feed cost even when the price of the garlic powder was included. In related studies, Narayan (2017) reported that poultry with garlic powder was the most beneficial on net return compared to the group without. Also, Oleforuh-Okoleh *et al.*, (2014) noted that broiler chickens treated with ground ginger and garlic in water-based infusion had the highest revenue and net return; also, gave the least cost-benefit ratio. The findings suggest the economic benefits of GP inclusion in the drinking water of ItikPINAS, realized from the higher sale value of eggs and lower cost of feed associated with improvement in FCR.

CONCLUSION

Based on the results, garlic powder supplementation via drinking water for ItikPINAS

may be considered a viable management strategy. However, the study recommends further exploration on different dosage of GP supplementation and feeding durations.

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