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PRODUCTIVE PERFORMANCE AND QUALITY OF THE QUAIL EGG (COTURNIX COTURNIX JAPAN) IN LAYING STAGE, PASTAZA PROVINCE, ECUADOR.

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Graphical Abstract

Table 1. Chemical composition of balanced Bioaliment in quail for the laying stage.

Chemical analysis of balancing	
Crude protein (min.), %	22
Fat (min.), %	5
Crude fiber (max.), %	4
Ash (max.), %	10
Humidity (max.), %	12

Source: (Bioalimentar, 2019)

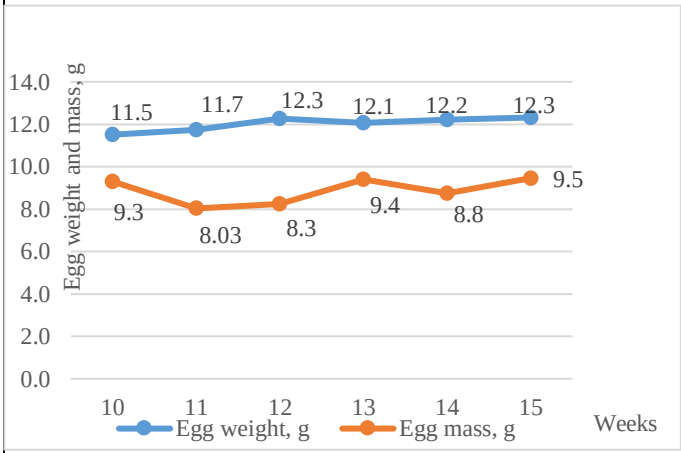

Figure 1. Behavior of egg weight, egg mass in Japanese quail per week

Abstract.

This research was carried out at the Amazon Research, Postgraduate and Conservation Center (CIPCA) Poultry Program, of the Amazon State University, Ecuador and aimed to "Evaluate the productive behavior and quality of quail egg (Coturnix coturnix japan) on stage of posture", for which 72 quail were used, with 69 days (week 10) of age; Each experimental unit (cages) housed 18 quails, in which the variables of posture percentage, egg weight, egg mass, food consumption, food conversion and water consumption as productive indicators were evaluated. For egg quality, 72 eggs were evaluated for 6 weeks, which were measured weekly for shape index, yolk index, egg whites index and Unit Haugh.

A Fully Randomized Design (DCA) with four replications was used. The statistical analysis applied was an ANOVA and for the differences the test of Tukey means comparisons was used, at a statistical significance ($p < 0.05$). The productive indicators did not show significant

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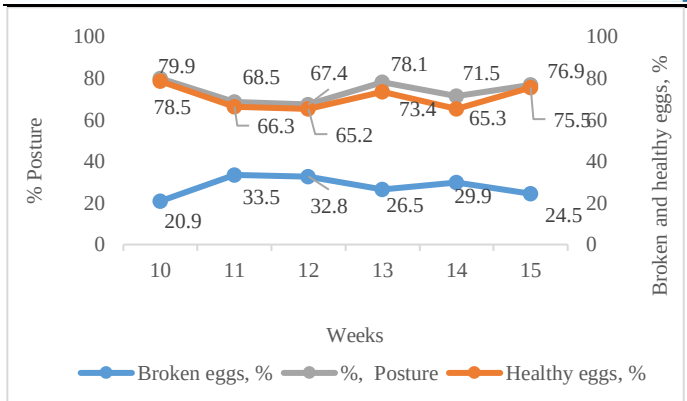

Figure 2. Behavior of broken, healthy eggs and laying percentage in japan quail per week.

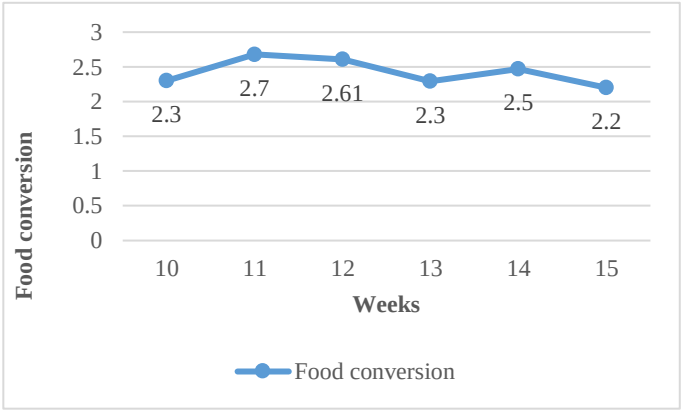

Figure 3. Behavior of the conversion of food in japan quail per week.

Table 2. Quail Egg Quality Behavior.

Indicators	Weeks					
	10	11	12	13	14	15
Shape index	78,9±3,3	76,1±5,2	77,6±6,3	77,11±3,7	76,0±3,5	78,1±2,8
Bud index	44,8±4,4	43,4±3,4	45±3,4	44,8±4,3	42,6±3,8	45,8±3,4
Clear index	7,2±1,3	6,9±1,0	6,9±1,02	6,7±0,9	7,0±1,08	7,4±0,9
Haugh	81,7±5,0	81,1±5,3	82,13±5,8	81,7±5,1	81,1±4,6	81,9±5,2

differences for p <0.05 per week, however, among the cages, except for food and water consumption. The ratio of feed conversion and egg mass to percentage of posture was higher at weeks 10, 13 and 15. The quality manifest form indexes from 76.05 to 80%, indicating that they are elliptical and can be accepted in the market. The yolk index and Haugh expressed good quality and freshness of the egg with 0.42 and 81.6% respectively. The quality of the eggs in the different weeks is very good, favoring the commercialization process, when it creates added value to quail products.

Keywords: Quail, Egg quality, posture, parameters, productive

Introduction

In the Ecuadorian Amazon region, specifically in the Pastaza province, in the last three years, quail farming has begun to develop as an economic and food sustenance. However, this option for producers still lacks further development, since they do not know the benefits and properties of the egg, as well as how to manage the hatchling to obtain a quality laying and bird for consumption; Therefore, research related to productive behavior, quail farming, conservation and the quality of its meat and egg by-products are scarce. In this context, there is no information about the management of the broodstock, regulations and parameters that relate the measures of conservation of the quality of quail eggs for human consumption under the conditions of this ecosystem, so the studies can serve as a point of reference for the producer, consumer and distributor. Quail eggs are an excellent product, so it is soughted to implement new strategies to increase sales in the market. This species has the characteristics of being easily adaptable and having good productive capacity, reaching three eggs every two days on average; which makes it very productive, goodness that must be used to the maximum (Cossion, Romero and Montenegro, 2017).

This investigation tries to evaluate the productive yield in the first stage of laying of the quail and the quality of the egg in the conditions of the Amazon; helping to provide information to small and large producers.

Materials and Methods

Location

The experimental worked was carried out at the Amazon Research, Postgraduate and Conservation Center (CIPCA). Located in the Ecuadorian Amazon region, in the Province of Pastaza and Napo, in the Canton of Santa Clara and Carlos Julio Arosemena Tola at a height of 580-990mnm (Gonzales, 2016). It presents a humid tropical climate, with average temperatures ranging between 25-30 ° C and a relative humidity of 80% (SIG-UEA, 2019).

Preparation of the experiment area

Disinfection carried out before starting the experiment, using disinfectants, detergent and chlorine with plenty of water, with a 30% lime mixture. The cages were divided into 4 with their respective feeders, troughs and beds of wood shavings, with a thickness of 10 cm. 72 female quail were worked, with an average weight of 110 g, distributed to 18 per cage. Quail were bought in the mountain areas at 21 days of age. They adapted for 10 days to the conditions of the experimental area with strict care to avoid the effect of climate change (cold to warm), so vitamins and dewormed were applied. The quail were evenly distributed in each cage and weighed.

Feeding Management

The food and water supply was made twice a day (in the morning and afternoon), dividing the daily ration to avoid food losses, the quantity of food supplied daily was weighed with a precision balance, in order to obtain information on consumption. The quail diet based on corn, soybean paste, extruded whole soybeans, rice by-products, corn gluten, wheat by-products, corn DDG, palm oil, and dehydrated alfalfa flour. It is also included in the concentrate essential minerals, vitamins and amino acids. These foods have growth promoters, antifungals and prebiotics. Table 1 shows the chemical composition of balanced Bioaliment in quail for the laying stage.

Productive indicators

The indicators measured were: Percentage of weekly laying, weight and mass of the egg, feed consumption, feed conversion and healthy and broken eggs.

External and internal quality parameters of the egg

It was used the methodology of Spain, (2014) for the evaluation of external and internal egg quality. Twelve eggs were evaluated, by week selected at random, and the following indicators were determined: shape index, yolk index, albumin index and Haugh units.

The fully randomized applied design (DCA) with four replications. Data was tabulated in Excel and processed by SPSS (statistical package version twenty-one in Spanish). An analysis of variance (ANOVA) was performed and Tukey's multiple mean comparison test, with statistical significance ($p < 0.05$), was applied to the differences obtained.

Results and Discussion

The ANOVA analysis did not show significant differences for the productive indicators per week (Figures 1, 2 and 3). Figure 1 expresses the behavior of the mass and weight of the egg. The mass showed superiority in week 10, 13 and 15, with values of 8.03; 8.25 and 8.75 g for weeks 11, 12 and 14;

while it was lower in week 10, 13 and 15 (9.3; 9.41; 9, 46 g); This variability per week could be related to the percentage of posture variable that presented similar behavior. The indicator weight showed an increase until week 12 of 0.76 g. Week 13 had a slight decrease, which could be related to the changes in the house causing the birds to become stressed; however, consumption was not affected.

Valdivieso (2019) has reported similar weights (11 to 12g) when evaluating the effect of microencapsulated sodium butyrate in quail eggs.

Soto (2004) states that the age of the layers and its interaction with the egg storage temperature have a significant effect on weight.

With respect to the mass of the egg Quintrel (2017), I obtain lower masses than those of these results, with an average of 7.18 g. However, it indicates for layers of 34 and 56 weeks masses that range between 8.4 and 10.9 g, showing the effect of age.

The behavior of the variables broken eggs, healthy percentage and posture they presented in Figure 2. The relationship between broken and healthy eggs is direct, so the highest number of healthy eggs observed in weeks 10, 13 and 15 and in the same way; it represents the minimum amount of broken eggs. The greatest egg break occurred in week 11 and 12 with 33.5 and 32.7% of total production.

The posture had a positive behavior in weeks 10, 13, 14 and 15 with 79.9; 78.1; 71.47 and 76.9% respectively; the response coinciding with healthy eggs for weeks 10, 13 and 15. Torres (2019) indicates that the laying percentages have a direct relationship with the diet and the age of the hen, reporting 56.7 to 64.6%.

Figure 3 shows the feed conversion. This showed in weeks 10, 13 and 15 the best feed / egg conversion (2.2; 2.29 and 2.3) respectively. In general, this indicator was favorable throughout the stage of the experiment. In experiments with basal diets with vitamins and bicarbonate and with Morera flour at different levels, Castañeda and Ñañez (2016) and Perdomo et al., (2019) obtained higher conversions; 3.54 - 3.67 and 2.9 to 4.2 respectively, so there was less convergence of the food in the egg. In this investigation, a direct relationship was observed between the conversions, egg mass and posture percentage.

The shape index (Table 1) is the ratio of the width and length of the egg, the results indicate that they were higher than 76.05%, a favorable indicator for its acceptance and commercialization. Caballero and Bucade (2011) establishes index less than 60% are classified as elongated eggs, with 70% normal and 100% considered round. According to Pazmiño (2013), he expresses that the shape indexes for eggs with elliptical shape are between 70 to 75%, so according to this criterion, in this research, eggs approach an elliptical shape, which allows better acceptance in the market for its commercialization, by reducing the risk of breakage.

The yolk index determines the freshness and quality of the egg, it indicates good quality when it is around 0.35 to 0.65. These results show yolk indices ranging from 0.42 to 0.45, this indicates great consistency of the yolk; observing the best results in week 10, 12, 13 and 15. Villacis and Vizhco (2016) obtained similar results with bud indexes of 0.44 and 0.46. In this regard, García et al., (2013) point out that when it is greater than 0.65 it has excellent quality, between 0.65 to 0.35 good quality and less than 0.35 poor quality.

Clear rates in all weeks are higher 6.92. Spain (2014) when evaluating the quality of the quail egg (Coturnix coturnix japonica) for commercialization, obtained results between 4.22 and 3.87 lower than these results, this author also states that fresh eggs between 0 to 3 days must present clearing indexes with an average of 6.34.

Haugh's Units were similar in each week, indicating very good quail egg quality. Rosario and Nieves (2015) found similar results with 86.20 to 87.20.

When evaluating the effect of conservation times of 0, 5, 10, 15 and 20 at room temperature, on free range hens in the Ecuadorian Amazon, Ramirez, González, Andrade and Torres (2016) reported Haugh's Units of 73.94 97, 67, these differences are related to the increase in the conservation time, affecting its quality.

Conclusions

Behavior of quail egg quality indicators at different laying weeks.

The Haugh Units and shape index were higher than 80 and 76%, which denotes elliptical shaped eggs with very good quality.

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