Desempenho e qualidade do ovo de poedeiras leves avaliadas em diferentes períodos pós-muda

Performance and egg quality of laying hens evaluated in different periods postmolt

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RESUMO

O objetivo deste estudo foi avaliar o desempenho e a qualidade dos ovos de poedeiras em diferentes períodos pós-muda. O período experimental durou 105 dias, dividido em cinco períodos de 21 dias. Foram utilizadas 150 poedeiras Hisex White com 84 semanas de idade distribuídas em um delineamento experimental inteiramente casualizado com os tratamentos constituídos pelos estágios pós-muda (início = 21 dias, meio = 63 dias e final = 105 dias). Os resultados foram avaliados pelo teste de Tukey a 5%. Observou-se uma redução significativa (p<0,05) na eficiência alimentar e, consequentemente, no desempenho, principalmente devido ao aumento no consumo de ração e conversão alimentar e redução na produção de ovos e massa de ovo. As poedeiras no estágio inicial do período pós-muda produziram ovos mais pesados (p<0,05), com maiores porcentagens de suas estruturas principais. Com o aumento da idade das poedeiras, houve uma redução significativa (p<0,05) em suas principais estruturas, principalmente na gema e na casca. Ovos de poedeiras no estágio inicial do período pós-muda apresentaram melhor (p<0,05) qualidade interna e externa. Com o aumento da idade das aves pós-muda, houve uma redução significativa (p<0,05) na qualidade do ovo, especialmente na qualidade externa. Em conclusão, os resultados deste estudo indicaram que no estágio inicial do período pós-tensão apresentou melhor desempenho e qualidade dos ovos. A longo prazo, as aves pós-muda apresentaram uma redução significativa em seu desempenho e qualidade dos ovos.

Palavras-chave: casca do ovo, desempenho, pós-muda, qualidade do ovo.

ABSTRACT

The objective of this study was to evaluate the performance and egg quality of laying hens at different periods postmolt. The experimental period lasted 105 days, divided into five periods of 21 days. 150 Hisex White laying hens with 84 weeks-of-age were used. The experimental design was completely randomized with treatments constituted by three postmolt stages (early = 21 days, medium = 63 days, and final = 105 days). Performance and egg quality results were evaluated by Tukey test at 5%. There was a significant (p<0.05) reduction on feed efficiency and consequently performance of the hens, especially due to the increase on feed intake and feed conversion ($kg.kg^{-1}$ and $kg.dz^{-1}$) and reduction on egg production and egg mass. Hens in the early stage of postmolt period produced heavier (p<0.05) eggs, with better percentages of its main structures. From increase of hens' age postmolt, there was a significant reduction (p<0.05) in its main structures, especially in the yolk and eggshell. Eggs from hens in the early stage of postmolt period presented better (p<0.05) internal and external quality. From increase of hens' age postmolt, there was a significant reduction (p<0.05) in the egg quality, especially the external quality (parameters related to eggshell). In conclusion, the results of this study indicated that in the early stage of postmolt period presented better performance and egg quality. At long-term, the postmolt hens presented a significant reduction on its performance and egg quality.

Keywords: egg quality, eggshell, performance, postmolt.

INTRODUCTION

Molting is a natural phenomenon in wild and domestic birds, cause a replacement of feathers and involving reproductive quiescence. This period is responsible to a significant decline in egg production provides the equivalent of a ‘reproductive rest’ to the birds (KHAN *et al*., 2011). The low prices of eggs and spent flocks have resulted in interest in replacing the natural molting process with the artificial one called induced molting (BERRY, 2003).

Induced molting has become standard husbandry in many commercial egg operations. The main purpose of molting is to cease egg production in order for the hens to enter a nonreproductive state, which increases egg production and egg quality postmolt (WEBSTER, 2003; DONALDSON *et al*., 2005). Although several successful procedures exist to induce molting in laying hens, most of these techniques differ in several aspects (HUSSEIN, 1996).

The most effective moulting procedures create the least amount of stress, produce a rapid moult, and bring the flock back into egg production quickly. As a result, numerous studies have recognized the need for more information about molting procedures, timing and duration of the molting period, reproductive organ responses, bird behaviour, and nutritional requirements post molting (WOLFORD, 1984; HUSSEIN, 1996).

Schmidt *et al*. (2011) reported that molt programs normally improve the quality of the eggs, and extend the egg production more 25 to 30 weeks, presenting around 85% of efficiency. According to Gongruttananun *et al*. (2017), the molted hens return to egg production at a slow rate after receiving re-adequate diets, and then rapidly increased during the postmolt period. Hormonal changes are typically associated with molting, where the hen responds using physical, chemical, anatomical, and physiological mechanisms at its disposal to maintain a better productive status by the most possible period (FREEMAN, 1987; KOELKEBECK & ANDERSON, 2007).

Considering the above, the purpose of this study was to evaluate the performance and egg quality of laying hens at different periods postmolt.

MATERIAL AND METHODS

This study was conducted in the facilities of Poultry Sector, College of Agrarian Sciences, Federal University of Amazonas, Manaus, Amazonas State, Brazil. The experimental procedures were approved by the Ethics Committee in Use of Animals (protocol number 041/2018) of Federal University of Amazonas, Manaus, Amazonas, Brazil.

The experimental period lasted 105 days divided into five periods of 21 days. Birds were subjected to an adaptation period of seven days to feed and facilities. The aviary had galvanized wire cages (1.00 x 0.45 x 0.50 m), trough feeders, and nipple drinkers. A stocking density of 13.3 birds/m^2 were used, with six birds per cage. Throughout the experimental period, 16 hours of the light/day were provided to the birds (12 hours of natural + 4 hours of artificial), with water and feed *ad libitum*. The temperature and air relative humidity were recorded twice a day (9 and 15 hours) from a digital hygrometer positioned at the height of the cages, obtaining averages results of 29.35 ºC and 63.57% respectively. Egg collection was also performed twice a day (9 and 15 hours).

From 80 to 83 wks of age, hens were submitted to a molt program using nonfeed removal method (BIGGS *et al*.,2003; MAZZUCO & HESTER, 2005) for 28 days. 150 Hisex White laying hens with 84 weeks of age were used. The birds were weighed at the beginning and final of the experimental period, presenting an initial average weight of 1.38±0.0019 kg, and a final average weight of 1.43±0.013 kg. The experimental design was completely randomized with treatments constituted by three postmolt stages (early = 21 days, medium = 63 days, and final = 105 days). Experimental diets (Table 1) were calculated according to the requirements provided by Rostagno *et al*. (2017) using the software SUPERCRAC (2008).

At final of each period, we calculated the feed intake (g/bird/day), egg production (%), feed efficiency (kg of feed used / kg of egg), feed efficiency (kg of feed used / dozen eggs), and egg mass (g).

Furthermore, four eggs to each plot were random selected to evaluate egg weight (g), specific gravity (g/cm^3), yolk (%), albumen (%), eggshell (%), yolk height (mm), albumen height (mm), yolk color, eggshell thickness (μm), and Haugh unit. The eggs were stored to one hour in room temperature, and weighed using an electronic balance (0.01 g). The eggs were placed in wire baskets and immersed in buckets containing different levels of sodium chloride (NaCl) with density variations from 1.075 to 1.100 g/cm^3 (interval of 0.005) to evaluate the specific gravity.

Then, the eggs were placed on a flat glass plate to determine albumen and yolk height, and yolk diameter using an electronic caliper. To separate albumen and yolk a manual separator was used. Each one was placed in a plastic cup and weighted in analytical balance.

Eggshells were washed, dried at oven (50 ºC) to 48 hours, and weighed. Dry eggshells were used to determine the eggshell thickness using a digital micrometer. Average eggshell thickness was analyzed considering three regions: basal, meridional, and apical.

The yolk color was evaluated using a ROCHE© colorimetric fan with a scale of 1 to 15. Haugh unit was calculated using the egg weight and albumen height values in the formula $H_{unit} = 100 \times \log (H + 7.57 – 1.7 \times W0.37)$, where H = albumen height (mm), and W = egg weight (g).

All data collected in this study were analyzed using the GLM procedure of SAS (Statistical Analysis System, v. 9.2) and estimates of treatments were subjected to ANOVA and a subsequently Tukey test. Results were considered significant at $p \leq 0.05$.

RESULTS

In the results of performance (Table 1), it was observed that as increased the period postmolt, there was a significant ($p<0.05$) reduction on feed efficiency and consequently performance of the hens, especially due to the increase on feed intake and feed conversion (kg.kg^{-1} and kg.dz^{-1}) and reduction on egg production and egg mass.

Hens in the early stage of postmolt period produced heavier ($p<0.05$) eggs, with better percentages of its main structures. Medium stage of postmolt period also provided great ($p<0.05$) results of egg weight and yolk percentage. From increase of hens' age postmolt, there was a significant reduction ($p<0.05$) in its main structures, especially in the yolk and eggshell (Table 2).

The results of egg quality pointed out that all egg quality variables were affected ($p<0.05$) by the hens' age postmolt. Eggs from hens in the early stage of postmolt period presented better internal and external quality. From increase of hens' age postmolt, there was a significant reduction in the egg quality, especially the external quality (parameters related to eggshell).

Table 1. Effect of postmolt stages on performance.

Variables	Postmolt stage			Effect	CV (%)
	Early	Medium	Final		
Feed intake, g/bird/day	100.59^{b}	110.79^{a}	112.54^{a}	0.01*	6.40
Egg production, %	83.33^{a}	82.82^{a}	62.95^{b}	0.01*	12.87
Feed conversion, kg.kg^{-1}	2.06^{b}	2.13^{ab}	2.69^{a}	0.01*	6.54
Feed conversion, kg.dz^{-1}	1.60^{b}	1.63^{b}	2.02^{a}	0.01*	5.84
Egg mass, g	53.89^{a}	52.96^{a}	39.72^{b}	0.01*	13.26

CV - Coefficient of variation; * Significant effect (p<0,01).

Table 2. Effect of postmolt stages on weight and main structures of the egg.

Variables	Postmolt stage			Effect	CV (%)
	Early	Medium	Final		
Egg weight, g	64.69^{a}	63.98^{a}	62.91^{b}	0.05**	4.08
Yolk, %	60.51^{a}	60.37^{a}	58.73^{b}	0.01*	3.70
Albumen, %	29.07^{a}	28.33^{b}	27.92^{c}	0.01*	4.75
Eggshell, %	10.32^{a}	9.90^{b}	9.23^{c}	0.04**	5.43

CV - Coefficient of variation; * Significant effect (p<0,01); * Significant effect (p<0,05).

Table 3. Effect of postmolt stages on egg quality.

Variables	Postmolt stage			Effect	CV (%)
	Early	Medium	Final		
Albumen height, mm	7.73[a]	7.54[b]	7.54[b]	0.04**	7.37
Yolk height, mm	17.85[a]	16.20[b]	15.72[c]	0.01*	3.71
Egg thickness, µm	0.40[a]	0.40[a]	0.34[b]	0.01*	5.84
Specific gravity, g.cm^{-3}	1,088.15[a]	1,085.50[b]	1,070.05[c]	0.01*	2.89
Haugh unit	86.96[a]	85.62[b]	85.36[b]	0.02**	3.89
Yolk color	6.12[a]	5.82[b]	4.87[c]	0.01*	7.24

CV - Coefficient of variation; * Significant effect (p<0,01); * Significant effect (p<0,05).

DISCUSSION

The results of this study pointed out that the postmolt stage affected the performance and egg quality. After the molting process, the birds tend to presented great performance and egg quality due to ovarian and oviducal regression (GONGRUTTANANUN *et al.*, 2013; GONGRUTTANANUN & SAENGKUDRUA, 2016). However, approaching to 100 weeks, there was a significant reduction on performance and egg quality. Normally, the molt procedure cause a significant increase on performance and egg quality at short-term, and tend to decrease these indexes according the bird get older due to the natural wear caused by constant egg production in industrial scale (WU *et al.*, 2007). Physiologically, there are great wear on oviduct tissues, and difficulty to absorb the nutrients and its transfer to the egg's composition (NEWMAN & LESSON, 1999; BAR *et al.*, 2001; HEFLIN *et al.*, 2018; ELHAMOULY *et al.*, 2019).

Bell and Adams (1992) suggested that age at molting and type of diet provided along this process affected performance of molted hens when feed deprivation methods are applied. It was reported that fasting to induce molting results in cessation of egg production and it varies as a function of the length of time that the hens are fasted (BERRY, 2003; RAFEEQ *et al.*, 2013). In this sense, different strains may to present different responses on performance after molt, especially laying hens and semi-heavy hens (SAID *et al.*, 1984; GONGRUTTANANUN *et al.*, 2017; HU *et al.*, 2019). There is very limited literature about the performance, egg composition, egg solids, egg quality, and profits of postmolt hens (WU *et al.*, 2007), especially at long-term, a period near or exceeding to 100 weeks. An induced molting not only may improve performance and eggshell quality, but also increase profits by optimizing the use of replacement pullets on commercial layer farms (LEE, 1982; BARKER *et al.*, 1981; BELL, 2003; MAZZUCO *et al.*, 2011; GONGRUTTANANUN, 2018) proving the importance to understand its effect at long-term.

Wilson *et al*. (1967) studying several methods of inducing a molt and subsequent rest period, observed that molted hens present a better performance and shell thickness at short-term without affect the egg weight and albumen quality, regardless the molt process used. However, this effect reduce at long-term, where the hens present clear signals of fatigue due to the old age (CHANAKSORN *et al*., 2019).

At final of experimental period, when the hens presented near to 100 weeks, all birds present a gain in the weight. However, the level of sodium in the diet directly influenced this parameter, where laying hens fed diets with the lower sodium level present a significant lower weight gain. Normally, a reduction in body weight in order of 15 to 30% during the molt is necessary to maximize the performance of laying hens at second cycle (BARKER *et al*., 1981).

Normally, the birds lose this weight during the molt period and gain (recover) at a faster rate after the molt (WILSON *et al*., 1967). McDaniel (1985) reported that the lightest birds before molt have a tendency to gain the greatest percent weight from the end of molt to the on set of egg production. In this sense, Buhr and Cunningham (1994) also commented that during the postmolt period the body weight gain increased, with the 15% weight loss groups maintaining a slightly heavier body weight throughout the postmolt period. The same authors affirmed that the molt method directly affect the body weight, performance, and egg quality.

CONCLUSIONS

The results of this study indicated that in the early stage of postmolt period presented better performance and egg quality. At long-term, the postmolt hens presented a significant reduction on its performance and egg quality.

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