Performance, Carcass Traits and Economic Availability of Muscovy Ducks Fed on Different Nutritional Plans in Different Housing Densities

ABSTRACT

The present study aimed to evaluate ducks on performance, carcass traits and economic availability, fed on different phases of nutritional plans and in different housing densities. Two hundred and forty Muscovy ducks of creole lineage were used, distributed in boxes with water and food ad libitum. The experimental design was completely randomized in a factorial arrangement of 3x2 with three nutritional plans (3, 4 and 5 phases) and two housing densities (2 and 3 birds/m²) with four replicates. The ducks had weekly performance evaluations, and after 90 days, four birds in each treatment were slaughtered for evaluation of carcass traits. Differences (p<0.05) were observed on performance, carcass traits and economic analysis. The nutritional plans with 3 phases showed better results for feed intake and weight gain, as well as provided lower total cost production and higher operating profit. Ducks in higher densities showed smaller feed intake, weight gain, higher pro-ventricle weight and better results for total meat production, crude income and operating profit. In summary, nutritional plans with reduced phases (3 phases) and extensions of energy-protein relationships showed better results for ducks on performance and carcass traits in densities of 3 birds/m². More studies are necessary to determine other nutritional requirements for ducks in housing for a better nutritional and management control.

INTRODUCTION

In the Poultry Industry, ducks have the peculiar feature to provide a range of final products that goes from the meat and egg production, feathers for ornamental purposes, liver with fat for production of pates to many other products for a market increasingly on the rise, but little explored in Latin America (Avicultura industrial, 2005). In Brazil, duck meat consumption is restricted to 13 grams/habitant/year. In China, for example, this consumption is 1.5 kg/habitant/year and in Europe remains at 1 kg/habitant/year. Duck meat is also very consumed in the United States and in countries with Arabic ethnicity, such as Egypt and Saudi Arabia (Wawro et al., 2004; Avicultura Industrial, 2005).

There are few researches regarding on how to manage ducks, most of them are related to the nutritional aspect, and some have suggested only technical recommendations. For example, the current recommendation (Coates & Ernst, 2000) suggested that the density of ducklings in the first two-weeks should be ½ m²/bird, and increased up to at least 1 m²/bird in the first four-weeks, and if birds remain in the housing after one month, give them at least 2 m²/bird. Moreira (1993) recommended setting the free-range stocking of 1 bird/m² when their weight reaches 3.0 to 3.5 kg (females) and 4.5 to 5.5 kg (males) with slaughter age ranging from 3 to 6 months. And together with
the density, the physiological and ethological features 
should be taken into consideration. O’Driscoll & Broom 
(2011) reported that more water was needed in the 
housing ambient for improvement of the duck’s health 
aspects.

Moreover, the quality of poultry meat has become 
increasingly important, since sensory features as 
appearance and meat tenderness are required by the 
consumer (Beraquet, 1999), and these are strongly 
related to all of the the phases of bird management.

The nutritional factor is important not only in raising 
ducks system, but also for all poultry production. The 
feed cost is one of the limiting factors in animal 
production, and only in the poultry sector, it represents 
approximately 70% of the total production cost (Cruz, 
2016).

According to Togashi (2000), the poultry production 
in some regions of Brazil is limited due to low grain 
availability. This means that the nutritional study is very 
essential for poultry production to reduce the feed 
cost and, consequently, the cost of production. The 
increasing demand for a better feed control in poultry, 
added to the high cost and increase of bird consumption 
in the world market, are factors that motivated 
researchers to seek alternatives for a conventional 
concept used in modern poultry management system, 
especially in poultry feed.

Considering the above, the present study aimed to 
evaluate the performance, carcass traits and economic 
availability of ducks on different phases of nutritional 
plans and housing densities.

**MATERIAL AND METHODS**

The study was conducted in the facility of Poultry 
Sector, Department of Animal and Plant Production 
(DPAV), Faculty of Agrarian Sciences (FCA), Federal 
University of Amazonas (UFAM), located in the south 
sector of the university campus, Manaus, in the State 
of Amazonas, Brazil.

Two hundred and forty Muscovy ducks (Cairina 
Moscharadomesticus) of creole lineage were used 
distributed in boxes with water and food ad libitum. 
The experimental design was completely randomized 
in a 3x2 factorial design with three nutritional plans 
(P1 with 3 phases (1-35 days; 36-70 days and 71-90 
days), P2 with 4 phases (1-28 days; 29-49 days, 50-72 
days and 73-90 days) and P3 with 5 phases (1-14 days; 
14-28 days, 29-63 days, 64-76 days and 77-90 days)), 
and two housing densities (2 birds/m² and 3 birds/m²) 
with 4 replicates (8 ducks in boxes with 2 birds/m² and 
12 ducks in boxes with 3 birds/m²).

The experimental diets were formulated according 
the production stages and nutritional plans (Table 1), 
according to the nutritional requirements and reference 
values for broilers (Rostagno et al., 2011) adapted to 
ducks.

The birds started the experimental period with 
1-day of age and were evaluated at 90 days. Weekly, 
in the experimental phase, the birds were weighed to 
obtain the performance variables. The feed intake was 
determined by the quotient between the total feed 
take and the quantity of poultry. The weight gain was 
determined by the total weight of each plot divided 
by the number of birds plot, and feed conversion 
was determined by relation between the amount of 
feed consumed and the weight gain in addition to 
considering the final weight of the experiment.

At 90 days of age, after 12 hours of fasting, four 
ducks of each treatment were randomly selected, 
identified and weighed. Next, these were electrically 
stunned (40 V, 50 Hz), with the birds slaughtered 
by a cut in the jugular vein. The carcasses were 
immersed into hot water (60°C for 62s), plucked 
eviscerated according Mendes & Patricio’s 
(2004) recommendations, and the carcass yield was 
determined in relation to live weight. Edible viscera 
(heart, gizzard, pro-ventricle and liver) were separated 
and individually weighed to measure the yields.

In economic analysis, the fixed costs consisted of 
labor, facilities and equipment depreciation (Martins et 
al., 2006). The feed cost was considered only as the 
variable cost. For analysis of the production cost per 
kilogram of meat the feed intake was considered and 
the production per treatment. The feed cost considered 
the nutritional plans cost per kg (P1 = US$ 0.35/kg; P2 
= US$ 0.44/kg; e P3 = US$ 0.52/kg). For live weight 
of duck in Manaus/AM considering a cost of US$ 
3.71/kg (according to the current value of the dollar 
in R$ 2,69). Crude Income (CI) and Operating Profit 
(OP) were used with economic indicators according to 
Martin et al. (1998).

Data were submitted to analysis of variance and 
means compared by Tukey test at 5% of significance 
using the statistical program SAS (2008).

**RESULTS AND DISCUSSION**

The results of performance of ducks are show in Table 
2. Differences were observed in feed intake, weight gain 
and feed conversion (p<0.05), among nutritional plans 
and feed intake and weight gain (p<0.05) between 
housing densities. However, no interaction (p>0.05)
between nutritional plans and housing densities could be observed. Nutritional plans with three phases and higher densities showed a positive influence on duck growth, with a direct relationship between the lower feed intake and reduction on feed conversion, with similar results observed by Feijó et al. (2016).

Graças et al. (1990), affirms that a reduction in feed intake can be caused by increased in housing density, with less physical space, the birds have difficult access to feeders for these. However, according to the results of Garcia et al. (2002) and Cruz et al. (2013), increasing housing density can promote greater results of meat/m², therefore, an alternative to increase the productive and economic performance of poultry production. Moreover, to formulate an ideal diet, that is, to present maximum performance and economic results, it’s necessary to deeply understand the nutritional poultry requirements (Trindade Neto et al., 2009), as proposed in this study, from the results that demonstrated the better nutritional energy-protein relations for ducks.

### Table 1 – Ingredients and nutritional composition of experimental diets

<table>
<thead>
<tr>
<th>Nutritional Plans</th>
<th>Nutritional Plan 1</th>
<th>Nutritional Plan 2</th>
<th>Nutritional Plan 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ingredients</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Corn (8,76%)</td>
<td>62.040</td>
<td>72.791</td>
<td>75.790</td>
</tr>
<tr>
<td>Soybean Meal (46%)</td>
<td>34.150</td>
<td>23.443</td>
<td>20.761</td>
</tr>
<tr>
<td>Limestone</td>
<td>0.910</td>
<td>1.139</td>
<td>0.795</td>
</tr>
<tr>
<td>Dicalcium Phosphate</td>
<td>1.798</td>
<td>1.580</td>
<td>1.321</td>
</tr>
<tr>
<td>Salt</td>
<td>0.350</td>
<td>0.350</td>
<td>0.350</td>
</tr>
<tr>
<td>DL-Methionine 99%</td>
<td>0.252</td>
<td>0.197</td>
<td>0.142</td>
</tr>
<tr>
<td>Vit./Min Supplement</td>
<td>0.500¹</td>
<td>0.500²</td>
<td>0.500³</td>
</tr>
<tr>
<td>Soybean oil</td>
<td>0.340</td>
<td>2.000</td>
<td>0.952</td>
</tr>
<tr>
<td>Total</td>
<td>100.00</td>
<td>100.00</td>
<td>100.00</td>
</tr>
</tbody>
</table>

### Table 2 – Performance of ducks fed on different phases of nutritional plans in different housing densities.

<table>
<thead>
<tr>
<th>Factors</th>
<th>Variables</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nutritional Plans</td>
<td>Feed intake (g)</td>
</tr>
<tr>
<td>3 phases</td>
<td>8,876.92a</td>
</tr>
<tr>
<td>4 phases</td>
<td>8,735.74a</td>
</tr>
<tr>
<td>5 phases</td>
<td>10,027.01b</td>
</tr>
<tr>
<td>Densities</td>
<td>Weight gain (g)</td>
</tr>
<tr>
<td>2 birds/m²</td>
<td>2,753.36a</td>
</tr>
<tr>
<td>3 birds/m²</td>
<td>2,751.22a</td>
</tr>
<tr>
<td>Effect</td>
<td>Feed conversion (kg/kg)</td>
</tr>
<tr>
<td>Nutritional plans</td>
<td>3.25ab</td>
</tr>
<tr>
<td>Densities</td>
<td>3.54a</td>
</tr>
<tr>
<td>Interaction</td>
<td>4.27a</td>
</tr>
<tr>
<td>CV (%)</td>
<td>2.72</td>
</tr>
<tr>
<td>Nutritional plans</td>
<td>Slaughter Weight (kg)</td>
</tr>
<tr>
<td>3 phases</td>
<td>2.47</td>
</tr>
<tr>
<td>4 phases</td>
<td>2.68</td>
</tr>
<tr>
<td>5 phases</td>
<td>2.84</td>
</tr>
</tbody>
</table>

CV - Coefficient of variation; * Means followed by lowercase letters in column differ in 5% by Tukey test (p<0.05); ns - not significant.
& Silva, 1998). In general, the formulation of poultry diets in thermo neutral environment seeks to meet the requirements of crude protein (CP), metabolizable energy (ME), vitamins and minerals. However, this may contain excess of essential amino acids (Cella, 2001), and there may be potential unbalances in feed composition.

The results for the carcass traits are shown in Table 3. Differences weren’t observed for carcass yield, feathers, legs and fat \( (p>0.05) \) between nutritional plans, housing densities and interaction. It was observed that nutritional plans with more phases, regardless of the density used, showed better results for carcass traits, with similar results observed by Lisboa et al. (1999), Figueiredo et al. (1999), Araújo et al. (1999), Takahashi (2006) and Santos et al. (2012) that studied different commercial lineages of broilers and didn’t observed significant differences in relationship of management and carcass traits.

<p>| Table 3 – Carcass traits of ducks fed on different phases of nutritional plans in different housing densities. |</p>
<table>
<thead>
<tr>
<th>Factors</th>
<th>Variables</th>
<th>Nutritional Plans</th>
<th>Densities</th>
<th>Effect</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Carcass (%)</td>
<td>Feathers (%)</td>
<td>Legs (%)</td>
<td>Fat (%)</td>
</tr>
<tr>
<td>Nutritional Plans</td>
<td>68.00</td>
<td>12.08</td>
<td>3.09</td>
<td>1.94</td>
</tr>
<tr>
<td>Densities</td>
<td>3 phases</td>
<td>4 phases</td>
<td>5 phases</td>
<td>2 birds/m²</td>
</tr>
<tr>
<td>68.48</td>
<td>70.76</td>
<td>69.44</td>
<td>71.44</td>
<td>70.76</td>
</tr>
<tr>
<td>3.09</td>
<td>3.32</td>
<td>3.01</td>
<td>3.16</td>
<td>2.85</td>
</tr>
<tr>
<td>1.94</td>
<td>2.08</td>
<td>1.69</td>
<td>1.53</td>
<td>2.08</td>
</tr>
<tr>
<td>CV (%)</td>
<td>9.71</td>
<td>9.71</td>
<td>9.71</td>
<td>9.71</td>
</tr>
</tbody>
</table>

Researchers affirm that the management is directly related to the carcass results for broilers, but, that doesn’t mean that it will always influence the carcass results, cuts or visceras of the birds. Hellmeister Filho et al. (2004) didn’t observe differences in carcass traits of free-range broilers when compared to management with or without access to picket. Almeida & Zuber (2000) who also study free-range broilers didn’t observe the effect of management system on carcass traits.

The results of edible visceras are show in Table 4. Differences weren’t observed for liver, gizzard, pro-ventricle and heart weights \( (p>0.05) \) between nutritional plans, housing densities and interaction. However, it was observed that lower densities provided better numerical results of edible visceras (gizzard, liver and heart), and didn’t negatively affect these carcass traits.

<p>| Table 4 – Edible visceras of ducks fed on different phases of nutritional plans in different housing densities. |</p>
<table>
<thead>
<tr>
<th>Factors</th>
<th>Variables</th>
<th>Nutritional Plans</th>
<th>Densities</th>
<th>Effect</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Liver (g)</td>
<td>Gizzard (g)</td>
<td>Pro-ventricle (g)</td>
<td>Heart (g)</td>
</tr>
<tr>
<td>Nutritional plans</td>
<td>46.25</td>
<td>72.50</td>
<td>100.00</td>
<td>150.00</td>
</tr>
<tr>
<td>Densities</td>
<td>2 birds/m²</td>
<td>3 birds/m²</td>
<td>Nutritional plans</td>
<td>Densities</td>
</tr>
<tr>
<td>44.16</td>
<td>40.00</td>
<td>0.42 m</td>
<td>0.52 m</td>
<td>0.33 m</td>
</tr>
<tr>
<td>71.66</td>
<td>67.50</td>
<td>0.06 m</td>
<td>0.39 m</td>
<td>0.06 m</td>
</tr>
<tr>
<td>91.67</td>
<td>108.33</td>
<td>0.23 m</td>
<td>0.16 m</td>
<td>0.07 m</td>
</tr>
<tr>
<td>141.67</td>
<td>141.67</td>
<td>0.67 m</td>
<td>0.08 m</td>
<td>0.06 m</td>
</tr>
<tr>
<td>CV - Coefficient of variation; ns - not significant.</td>
<td></td>
<td></td>
<td></td>
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</tbody>
</table>

Despite of peculiar characteristics between species, slow-growing broilers tend to have characteristics very similar to those observed in the management systems currently used for ducks. But, it is very important to highlight the poor literature about the management systems for ducks, with appropriate technical and informative recommendations.

There’s need to work on a management of animals that can meet the growing commercial interest that exists in duck meat, that can be obtained by producing birds with slow development and management in higher input systems, with the objective of attending the niche market made up for a range of consumers, according to the affirmatives of Lewis et al. (1997) and Carrijo et al. (2002).

The results of economic analysis are shown in Table 5. Differences were observed for total production cost and operating profit \( (p<0.05) \) among nutritional plans, and for total meat production, crude income and operating profit \( (p<0.05) \) between housing densities. However, no interaction \( (p>0.05) \) between nutritional plans and housing densities could be observed for economic analysis.

Nutritional plans with reduced phases showed better results in the evaluation of economic performance of ducks, that show how feeding has a significant influence on the financial aspect in poultry production, mainly in the cutting segment, where food cost becomes extremely essential to the development of birds.
The total meat production linear growth with increase of housing density, for example, significantly influenced the meat production by square meter, with similar results observed by Goldflus et al. (1997), who talks about the direct influence of housing densities on performance, carcass traits and financial poultry production.

CONCLUSIONS

In summary, nutritional plans with reduced phases and extensions of energy-protein relationships showed better results for ducks on performance and carcass traits in densities of 3 birds/m². More studies are necessary to determine other nutritional requirements for ducks in housing for a better nutritional and management control.

REFERENCES


Rufino JPF, Cruz FGG, Melo RD, Feijó JC, Damasceno JL, Costa APG

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