Productivity of japanese quails in relation to body weight at the end of the rearing phase

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ABSTRACT. Two experiments were conducted at different times with the objective of investigating how the body weight of Japanese quails at the end of the rearing period may alter the performance during the laying phase. In both experiments, the birds were distributed in five treatments according to their body weights, which were obtained at 42 and 35 days of age for the first and second experiments respectively, and the following categories were considered for said experiments: very light, light, average, heavy and very heavy. For both experiments, the treatments were distributed in a randomized block design, at eight repetitions per treatment for the first one and six for the second one, both at 18 birds per repetition. During the first experiment, sexual maturity, laying percentage, marketable egg percentage, average egg weight and egg mass, in second experiment, feed consumption, final body weight, eggs per bird present, laying percentage, average egg weight, egg mass and alimentary conversion were evaluated. The results obtained show that Japanese quails whose body weight is lower than 140 grams at 42 days of age, or lower than 120 grams at 35 days of age show significantly worse productive results during the laying phase.

Keywords: body development, egg production, quail production, sexual maturity.

Produtividade de codornas japonesas em função do peso corporal ao final da fase de recria

RESUMO. Dois experimentos foram conduzidos para investigar como o peso corporal de codornas japonesa ao final do período de recria pode alterar os parâmetros de desempenho durante a fase de postura. Nos dois experimentos as aves foram distribuídas em cinco tratamentos em função do peso corporal, estes foram obtidos aos 42 e aos 35 dias de idade, para o primeiro e segundo experimento respectivamente. Para ambos os experimentos foram consideradas as classes: muito leves, leves, peso médio, pesadas e muito pesadas. Os tratamentos foram distribuídos em delineamento em blocos ao acaso, com oito repetições por tratamento para o primeiro experimento e seis repetições por tratamento para o segundo experimento, ambos com 18 aves por repetição. No primeiro experimento, foram avaliados a maturidade sexual, a porcentagem de postura, a porcentagem de ovos comercializados, o peso médio dos ovos e massa de ovos. No segundo experimento foram avaliados o consumo de ração, o peso corporal final, os ovos por ave presente, a porcentagem de postura, o peso médio dos ovos, massa de ovos e a conversão alimentar. Os resultados mostram que codornas com peso corporal inferior a 140 gramas aos 42 dias de vida, ou inferior a 120 gramas aos 35 dias de vida, pioram significativamente os resultados produtivos durante o período de postura.

Palavras-chave: peso corporal, produção de ovos, coturnicultura, maturidade sexual.

Introduction

In Brazil, the production of quails, especially those destined for egg production, showed a significant increase, associated with the production of laying hens or on small farms as an alternative activity (Rizzo, Guandolini, & Amoroso, 2008). The reason for this success is explained by the quality and high nutritional value of the eggs, which has resulted in widespread acceptance in the consumer market. In addition to the nutritional value of the eggs, quails are precocious birds and display a high egg production ratio (Kaur, Mandal, Singh, & Narayan, 2006; Barreto et al., 2007).Their breeding is characterized by taking place in reduced areas, needing low initial investments and producing quick returns on investments (Leandro et al., 2005).

Nevertheless, this expansion has met with barriers, including a lack of information in relation to

management, nutritional levels and environment. Because of this, producers have started adopting techniques recommended for commercial laying birds, which hinders the obtaining of the best economic results (Silva et al., 2004). There are management and nutritional guides for commercial laying birds and broiler chickens, where the producer may, for instance, consult the standard weight for the strain at a certain age, with the finality of evaluating the development of their lot and correct any possible problems before they may compromise the profitability of said lot. However, these instructions do not exist for quails, which makes it necessary to carry out studies that result in guidelines that help producers obtain the best possible genetic potential from these birds.

The fact that the productive age start is closely related to the average body weight is well known (Brody, Siegel, & Cherry, 1984). The weight of the birds and their development during the growth phase are factors that influence the weight of the first eggs (Braz et al., 2011). Studies also show that higher the uniformity of the lot during the rearing period, the higher egg production and the laying persistence during the adult phase will be. It is also important to observe the adequate weight of the quails at the end of the rearing period, as they are light birds, and small variations in their body weight might result in an inadequate physical input for the maturing of their reproductive system at the start of the laying period (Lima, Toledo, Melo, & De Souza, 2011), as well as the persistence of their laying during their whole life.

In this way, the objective of this experiment was to establish what the optimum body weight of Japanese quails is at the end of the rearing period, in addition to verifying how body weight variations at the end of the rearing period may alter productive performance indicators during the course of the laying period.

Material and methods

Two experiments were conducted at different times in the installations of the Sao Paulo State University (UNESP), College of Veterinary Medicine and Animal Science, coturniculture sector.

For both experiments, the feed was formulated based on corn and soybean meal, in accordance to National Research Council [NRC] (1994) recommendations, and supplied *ad libitum* throughout the entire experimental period. The illumination program started at the same time as the laying stage, supplementing the natural photoperiod with 30 minutes of artificial light a week, until such a time as 15 daily light hours were obtained, these were maintained throughout the entire egg production phase. In both experiments the birds were housed in metallic cages with dimensions 1.0 x 0.33 x 0.15m, in stocking density 0.187 cm^2 $bird^{-1}$.

Experiment I

720 Japanese quails acquired at one day of age from the VICAMI® hatchery were used. The experimental period took place between the months of November 2013 and February 2014, with three cycles of 28 day, starting with the laying period.

All the birds were weighed individually at 42 days of age to calculate the average weight of the lot, and from there on, to establish the weight classes for the composition of the treatments, these were as follows: very light: birds whose weight was 10% below the lot's average (120 to 124 g); light: birds whose weight was 5% below the lot's average (126 to 130 g); average weight: birds of average weight between 133 and 137 g; heavy: birds whose weight was 5 % above the lot's average (140 to 144 g) and very heavy: birds whose weight was 10% above the lot's average (147 to 151 g). After defining the treatments, these were distributed in a randomized block design, with five treatments (weight classes) and eight repetitions of 18 birds each.

The weighing was carried out on the day of the transfer of the birds from the rearing shed to the production shed, in order to easily manipulate the birds and to avoid causing them stress.

The productive indicators were: sexual maturity age; obtained from the number of days elapsed until the obtaining of a 50% laying rate; laying percentage, an average obtained on a weekly basis calculated through the relation between the number of eggs produced according to the average number of birds per repetition; percentage marketable eggs, obtained through the percentage number of eggs produced minus the percentage losses for breakages; average egg weight, obtained through the weekly weighing of all the eggs produced in each repetition, expressed in grams, and egg mass, obtained by multiplying the average laying percentage by the average weight of the eggs.

Experiment II

For the second experiment, 540 Japanese quails acquired at one day of age from the VICAMI® hatchery were used. At 35 days of age, all the birds were transferred to the production installations and separated into five weight categories. Like in the previous experiment, the birds were weighed individually to calculate the average weight of the lot, and from there on, to establish the weight classes

for the composition of the treatments, these were as follows: very light: birds whose weight was 10% below the lot's average (< 108 g); light: birds whose weight was 5% below the lot's average (109 to 114 g); average weight: birds of average weight between 115 and 120 g; heavy: birds whose weight was 5% above the lot's average (121 to 126 g) and very heavy: birds whose weight was 10% above the lot's average (> 127 g). After defining the treatments, these were distributed in a randomized block design, with five treatments (weight classes) and eight repetitions of 18 birds each. The experimental period lasted 22 weeks, between August and December 2014.

The productive indicators evaluated were feed intake, an average obtained on a weekly basis through the relation between the amount of feed consumed for each repetition based on the average number of birds, expressed in grams bird^{-1}; final weight, obtained at the end of the experimental period by weighing all the three repetition per experiment birds, expressed in grams; eggs per bird present, calculated by adding the eggs produced during the experimental period: laying percentage, an average obtained through the relation between the number of eggs produced weekly in relation to the average number of birds per repetition; average egg weight, obtained through the weekly weighing of all the eggs produced in each repetition, expressed in grams; egg mass, obtained by multiplying the average laying percentage by the average weight of the eggs. Alimentary conversion: obtained through the relation between feed intake and average weight of the eggs or egg dozens produced, expressed in feed g g^{-1} of eggs and kg of feed dozen eggs^{-1}.

Statistical analysis

The data was evaluated using the Statistical Analysis System. [SAS] (2008) program, subject to ANOVA, and the averages compared according to the *Tukey* test at 5% probability. The variables that do not present a normal distribution were transformed by the log10 function for their analysis.

Results and discussion

Experiment I

The results of the productive performance of Japanese quails with different weight classes at 42 days of age are presented in Table 1.

The fact that there was a significant effect on the weight of the birds at the end of the rearing period in all the evaluated characteristics was observed, with the exception of marketable eggs, which produced similar results in all the treatments.

In relation to the time needed to reach sexual maturity, it is noted that very heavy and heavy birds

reached the mark at between 44 and 49.5 days of age respectively, that is to say, two and seven days after having been transferred to the production shed, whereas it took the other birds ten more days to achieve that laying percentage. The composition of the body at the end of the breeding phase determines alterations in productive indicators such as physiological and sexual maturity in commercial laying birds (Neme et al., 2006). Despite this not having been measured during the course of this study, heavy and very heavy birds are possibly in possession of a higher quantity of body fat, which serves as a layer for the creation of reproductive hormones and consequently, a more precocious start of the laying period when compared to light or very light birds.

Table 1. Productive development of Japanese quails in the different weight classes at 42 days of age.

Treatments	SM	LP	ME	EW	EM
Very light (120-124 g)	52.67 A	76.80 B	99.92	9.92 B	7.62 B
Light (126-130 g)	54.37 A	75.01 B	99.83	9.83 B	7.37 B
Average (133-137 g)	53.13 A	77.09 B	99.85	9.99 B	7.69 B
Heavy (140-144 g)	49.50 B	81.35 A	99.87	10.10 AB	8.22 AB
Very heavy (147-151 g)	44.00 C	80.90 A	99.92	10.40 A	8.39 A
CV (%)	*29.68*	*5.54*	*0.12*	*2.08*	*7.24*
P-value	< 0.05	< 0.05	0.56	< 0.05	< 0,05

The averages followed by different letters in the column differ according to the Tukey test (p < 0.05). CV: coefficient of variation; SM: sexual maturity (days); LP: laying percentage (percentage laying bird^{-1}); ME: percentage marketable eggs; EW: average egg weight (g); EM: egg mass (g).

Lima et al. (2011), show that lighter and heavier birds achieved sexual maturity at the same time. In all probability, this difference in results happened on account of a lower weight interval evaluated by these authors, where lighter birds weighed approximately 120g and the heavier ones weighed 135 g, whereas in this study, the range was of between 120 a and 151 g.

Percentage laying, average weight and egg mass are all also influenced by the weight of the birds at the end of the rearing stage, however, very light, light or average weight birds present lower numbers when compared to the others. It is important to highlight that despite heavy birds having taken longer than the very heavy ones in reaching 50% in egg production, the average production per bird housed in both treatments was the same. Studies show that the ideal weight for Japanese quails aged 31 days is around 105 g (Silva, 2009). An adequate body weight at the end of the rearing and pre-laying phases is of paramount importance so as to guarantee the full development of their reproductive system (ovary and oviduct), maintaining satisfactory egg production levels throughout their reproductive period (Garcia, Mendes, & Pizzolante, 2001).

Experiment II

The productive performance results for Japanese quails with different weight classes at 35 days of age are presented in Table 2.

Table 2. Productive development of Japanese quails in the different weight classes at 35 days of age.

Treatments	FI	BW	NE	LP	EW	EM	AC/m	AC/dz
Very light (< 108 g)	25.46 B	171.28 C	122	86.43	10.12 B	8.78 B	2.90	0.47
Light (109-114 g)	26.09 B	180.44 B	125	87.52	10.32 B	9.06 A	2.88	0.42
Average (115 -120 g)	26.30 B	181.22 B	125	87.81	10.66 B	9.29 A	2.83	0.43
Heavy (121 -126 g)	26.61 B	189.50 AB	122	84.97	10.71 B	9.12 A	2.92	0.45
Very heavy (> 127 g)	30.39 A	194.50 A	124	88.56	11.05 A	9.79 A	3.09	0.48
CV (%)	*9.08*	*6.32*	*5.00*	*3.40*	*3.86*	*5.55*	*6.31*	*12.85*
P-value	<0.05	<0.05	0.80	0.32	<0.05	<0.05	0.09	0.45

The averages followed by different letters in the column differ according to the Tukey test (p < 0.05). CV: coefficient of variation; FI: feed intake (g bird[-1]); BW: final body weight (g); NE: Number of eggs produced in the period; LP: laying percentage (percentage laying bird[-1]); EW: average egg weight (g); EM: egg mass (g); AC/m: conversion by egg mass (g g^{-1}); AC/dz: alimentary conversion per dozen eggs (kg dozen[-1]).

A body weight of 127 grams at 35 days of age negatively influenced the feed consumption, final body weight, egg average weight and mass, however, no negative effects were observed for the other characteristics. Despite contradicting the studies by Hassan et al., (2003) and Lima et al. (2011), the final body weight result presented in this study is an indicator of the fact that birds displaying a body weight that is below the ideal mark at the end of the rearing period are unlikely to reach an adequate production, and this difference will persist throughout the egg production period. In relation to feed consumption and final body mass, it is observed that very heavy birds consumed almost 12% more feed, reaching a body mass by the end of the experimental period that was around 7% above the other classes.

Feed consumption during the laying period is influenced not only by the body weight but also on account of the bird's genetics and the season of the year (Jatoi et al., 2013; Guimarães et al., 2014). These same authors also prove that the genetics of the quails determine differences not only where the body and egg weights are concerned, but mainly in relation to feed consumption. Birds that are considered light (132 g) being up to 13% lower than that of heavier birds (186 g). Notwithstanding weights and ages that are different to those worked on in this study, it is clear that body weight might interfere in relation to feed consumption of Japanese quails.

Birds of the very heavy class produced heavier eggs than all the other classes. However, where the mass of the eggs is concerned, it is observed that only birds classed as very light performed worse in this category. The results for average egg weight show that birds whose body weight was below 127 grams at 35 days of age produced smaller eggs during the laying phase, which contradicts the results obtained by Jatoi et al. (2013), which showed that heavier birds produce heavier eggs, both at the beginning and at the end of the productive period.

For the eggs produced, laying percentage and alimentary conversion variables, no body weight effect (p > 0.05) was observed at the end of the rearing period. In this way, the results conclude that the body weight classes used in this study exert an effect mainly on the feed consumption and average egg weight characteristics, but not much on characteristics such as laying percentage and number of eggs produced per bird, which contradicts what was stated by Lima et al. (2011).

Conclusion

Japanese quails whose body weight is lower than 140 g at 42 days of age, or with a body weight of 120 g at 35 days of age, had lower weight and egg mass over the other weight class during the laying phase.

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