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GROWTH PERFORMANCE OF MEAT MALE QUAILS (*COTURNIX* SP.) OF TWO LINES UNDER TWO NUTRITIONAL ENVIRONMENTS

(Desempenho de machos de codornas (Coturnix sp.*) para corte de duas linhas sob dois ambientes nutricionais)*

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ABSTRACT – Male quails (144) were reared from 1 to 49 days in cages, to evaluate the effect of line (Italian and Japanese), and crude protein level (20 and 26% CP) upon growth performance for meat production. Nine birds were housed per cage, sorted out according to a 2 x 2 factorial scheme in an entirely randomized design with 4 repetitions. Growth performance was evaluated weekly. The Italian line had higher mean body weight, mean gain weight and mean feed intake than the Japanese line. The Italian line showed lower or equal means of feed intake adjusted for body weight, indicating that it had better feed utilization. Mean feed conversion of the italian line was better than that of the Japanese line.

Key words: meat quails, growth performance, protein levels, genotypes, line comparing.

RESUMO – Com o objetivo de avaliar o efeito de duas linhagens (italiana e japonesa) e de dois níveis de proteína bruta (20 e 26% PB) sobre o desempenho para corte foram utilizados 144 machos de codorna, criados em gaiola de 1 a 49 dias. Foram alojadas nove aves por gaiola, sorteadas de acordo com um esquema fatorial 2 x 2 em delineamento inteiramente aleatorizado com quatro repetições. O desempenho foi avaliado semanalmente. A linhagem italiana apresentou maiores peso médio, ganho de peso médio e consumo médio do que a japonesa. O consumo médio relativo e a conversão alimentar da linhagem italiana foram menores, indicando melhor capacidade de utilização do alimento.

Palavras chave: codornas de corte, desempenho, níveis protéicos, genótipos, comparação de linhagens.

Introduction

Until recently quail production in Brazil had the only purpose of serving the consumer market of eggs, so the males were discarded immediately after birth. Although quail meat was already known, its offer was very reduced, being restricted only to the utilization of laying females at the end of production and males wrongly sexed at one-day of age. Recently meat quails began to attract the interest of quail producers, with the perspective of reaching a different range of the consumer market and to enable the productive exploitation of birds of both sexes.

The lack of information concerning this new variety of meat product determines that its production is carried out in an empirical way, based on a prior experience and on technical information upon laying quails. However, it concerns birds of much larger size, which may implicate in different nutritional requirements (BAUMGARTNER, l994). SHRIVASTAV and PANDA (1999) did not observe any advantageons effect of protein levels higher than 23% of crude protein (CP) for laying quails, while RAJINI and NARAHARI (1998) found better body weights up to 21 days and better carcass yield at 42 days for dual-purpose quails of both sexes with diets containing levels of 26 to 28% CP.

MARKS (1993a) reported that the difference in body weight between a line selected to high body weight and a non

selected control line was very small at birth but increased rapidly in the first two weeks of life. Working with two lines selected for high four-week body weight, MARKS (1993b) found a genotype by diet interaction, as the heavier line showed higher body weights with levels of CP higher then 24%, although the lighter line did not have its performance affected by the dietetic protein level.

In quails the heaviest lines have better feed efficiency and feed conversion (LEPORE and MARKS, 1971; DARDEN and MARKS, 1988). MARKS (1993a) observed that in quails selection for body weight improved feed utilization, although total feed intake increased due to the need of maintenance of a larger body mass. The difference of feed intake noted between lines of high and low body weight are more accentuated in the first days of life, even before differences in body weight were established, indicating that there is a high genetic correlation between feed intake and genetic variation of growth rate (MARKS, 1980).

The size difference between the meat variety introduced in Brazil, known as *Italian line*, and the laying variety, known as *Japanese line*, may be noted from the second week of age, however there is not yet zootechnical information that enable characterizing the Italian line or quantifying its superiority in relation to the Japanese one. So, the objectives of this work were to evaluate growth performance from 1 to 49 days of age of male quails from Italian and Japanese lines, fed diets with 20 and 26 % of crude protein, investigate the existence of genotype by diet interaction and determine the best genotype and the best crude protein level for meat production at slaughtering at 49 days of age.

Material and Methods

The research was conducted at Setor de Animais Silvestres of Faculdade de Medicina Veterinária e Zootecnia – UNESP, *campus* Botucatu-SP. A totoal of 144 male quails were grown from 1 to 49 days of age, 50% of which from the Japanese line (laying purpose) and 50% from the Italian line (meat purpose). One day old chicks were placed in wood cages, measuring 0,50 m (length) x 0,60 m (width) x 0,60 m (height). Each cage was provided with bed of kindling wood, a feeder tray and a drinking of pressure cup type. Each cage was warmed with an incandescent lamp of 100 w up to 21 days. Nine birds per cage were sorted, according to a 2 x 2 factorial scheme (2 lines x 2 protein levels), in an completely randomized design, with four repetitions, giving a total of 16 cages. Population density was of 400 cm² / bird. Two experimental rations were used containing, respectively, 20 and 26% CP and 2900 kcal of metabolizable energy, based on NRC (1994) recommendations for growing Japanese quails. Birds were watered and fed *ad libitum* during all the experimental period. The ration was given two to three times a day, according to the age of birds.

TABLE 1 – MEAN WEEK BODY WEIGHT (GRAMS), FROM 1 TO 49 DAYS OF AGE OF MALE QUAILS FROM TWO LINES (ITALIAN AND JAPANESE), BOTUCATU (SP). (n=144)

	Line		
Age	Italian	Japanese	d[1] (%)
1day	6,8[a] ± 0,3	6,0[b] ± 0,2	13,3
7 days	25,5[a] ± 1,0	21,4[b] ± 1,7	19,2
14 days	57,6[a] ± 1,16	43,8[b] ± 1,7	31,5
21 days	95,9[a] ± 4,9	66,0[b] ± 3,3	45,3
28 days	135,3[a] ± 5,0	87,4[b] ± 4,8	54,8
35 days	167,6[a] ± 7,5	101,4[b] ± 6,1	65,3
42 days	177,2[a] ± 8,2	101,4[b] ± 3,4	74,8
49 days	180,2[a] ± 6,7	103,1[b] ± 2,0	74,8

[1]Mean percent difference between lines = $\left(\bar{x}Italian - \bar{x}Japanese\right) \times 100 / \bar{x}Japanese$

Different letters indicate significant differences (p<0,05) between line means.

Performance was evaluated by recording the initial body weight of the birds, daily controling of mortality and weekly recording up to 49 days of body weight and feed intake, making possible the calculation of weight gain and of the feed conversion [FC = feed intake /gain weight. Adjusted feed intake was calculated to allow comparing of both lines in equal conditions at all ages (Adjusted FI = Feed intake x 100 / Body weight).

Data were statistically analyzed by the GLM procedure of the SAS program (1989) and the mean contrasts were realized by the Tukey´s test.

Results and Discussion

There was no mortality during the experiment. None of the variables showed genotype by protein level interaction.

Mean week body weight (TABLE 1) displayed only line effect (p<.001). There were line differences at all ages (p<.05). Italian line superiority increased with age, reaching its maximum at 42 days. This observation is in agreement with literature (MARKS, 1993a; OGUZ, 1996). The differences described by MARKS (1993a) were higher than those found in the current study, probably because the meat line utilized by Marks was the result of a long term selection for high body weight.

Line effect upon body weight at different ages is reported by numerous authors (LEPORE and MARKS, 1971; DARDEN and MARKS, 1988; MARKS, 1993a; OGUZ, 1996; MINVIELLE *et al.*, 1999). Body weight means obtained in this work are consistent with literature, both for non selected Japanese line and for high body weight selected lines.

Mean weekly weight gain (TABLE 2) showed only line effect (p<.001) up to 35 days. The Italian line had higher gains, and the difference between lines increased with age. A protein effect upon mean weight gain was not detected at any age (p>.20). Nevertheless, RAJINI and NARAHARI (1998), working with dual-purpose quails, found higher weight gain from zero to three weeks with diets containing high protein (28% CP). However the compensatory gain provided by 24 and 26% CP levels in the subsequent period, from three to six weeks, made it impossible to detect an effect of protein level when considering the whole experimental period, from zero to six weeks.

TABLE 2 – MEAN WEEKLY WEIGHT GAIN (GRAMS) AND MEAN WEEKLY FEED CONVERSION (GRAMS OF FEED /GRAMS OF WEIGHT GAIN), FROM 1 TO 49 DAYS OF AGE, OF MALE QUAILS FROM TWO LINES (ITALIAN AND JAPANESE), BOTUCATU (SP). (n=144)

	weight gain (g)			Feed conversion		
Period	Italian	Japanese	d[1]	Italian	Japanese	d[1]
0 a 7 days	18,7[a] ± 1,0	15,5[b] ±1,7	20,6	1,86[a] ±0,21	2,04[a]±0,19	-8,8
7 a 14 days	32,0[a] ± 0,7	22,4[b] ±2,0	42,9	2,85[b] ±0,36	3,40[a]± 0,17	-16,2
14 a 21 days	39,4[a] ± 3,2	23,2[b] ±2,3	69,8	3,44[b] ±0,20	4,33[a] ±0,36	-20,6
21 a 28 days	39,4[a] ± 5,7	21,4[b] ±2,8	84,1	3,90[b] ±0,515	5,30[a] ±0,91	-26,4
28 a 35 days	32,2[a] ± 9,0	14,0[b] ±5,9	130	7,28[b] ±2,076	10,63[a]±2,78	-31,6
35 a 42 days	9,6[a] ± 13,2	-0,02[a]±6,1	481	17,73[a] ±13,41	141,09[a]±260,76	-87,4
42 a 49 days	3,0[a] ± 3,9	1,7[a] ± 2,3	76,5	11,76[a]±165,70	46,28[a]±141,62	-74,6

[1]Mean percent difference between lines = $\left(\bar{x}Italian - \bar{x}Japanese\right) \times 100 / \bar{x}Japanese$

Different letters indicate significant differences (p<0,05) between line means.

During the last two experimental weeks the variation within treatment increased greatly, so it was impossible to detect any effect both of protein and line upon weight gain. This was due to the sexual maturity which is expressed by male quails as great behavior alterations. At the beginning of puberty begins a competition for social hierarchy, characterized by violent confrontation. The strongest males impose themselves over the weakest in an extremely aggressive way, limiting or

impeding its access to food and water and causing body lesions in the back and head, causing even death. However, even dominant males display frequently a reduction in their weight caused by the excess of activity (persecuting and fighting) and by the reduction of time dedicated to feeding. Japanese males fed the 26% CP ration showed an accentuated weight loss in the penultimate week. Some birds had a body weight loss of approximately 10% in a week. OLIVEIRA (2001) showed that when birds are created for a longer period, this situation usually have its peak between 49 and 56 days of age. After this, a certain normality is re-established, as hierarchical relations are defined. In this experiment there were no deaths nor great body injuries because of a low population density per cage and an early slaughter age, at 49 days.

Japanese males presented a more intense decline of the weight gain than those of the Italian line. In the Japanese line there was a decrease of about 34% in weight gain from 21-28 day period to that of 28-35 day, while the decrease observed in the Italian line in the same period was only of 18%. In the subsequent period the decline was of 100% and 70% for each line, respectively. This may indicate a higher sexual precocity of the Japanese line or may be simply the expression of its minor growth potential.

The mean week feed intake (TABLE 3) did not show effect of protein level (p>.10). These results may be considered in agreement with those of PANDA and SHRIVASTAV (1978), as they reported increase of feed intake in consequence of increasing crude protein level only when extreme levels were considered (from 18% CP to 27 and 30% levels). On the other hand, OLIVEIRA (2000) observed linear effect of crude protein level (varying from 18 to 26%, with variation of 2%) upon males mean weekly feed intake up to 27 days, but not forward. However the rations utilized by these authors were the result of a factorial combination of five protein levels with three energy levels (2800, 3000 and 3200 kcal of metabolic energy).

TABLE 3 – MEAN WEEKLY FEED INTAKE (GRAMS), AND MEAN WEEKLY FEED INTAKE ADJUSTED FOR BODY WEIGHT[1] (GRAMS) FROM 1 TO 49 DAYS OF AGE, OF MALE QUAILS FROM TWO LINES (ITALIAN AND JAPANESE), BOTUCATU (SP). (n=144)

	Feed intake			Adjusted feed intake¹		
Period	Italian	Japanese	d²	Italian	Japanese	d²
0 a 7	$35,1^{a} \pm 3,8$	$31,3^{b} \pm 2,3$	12,1	$137,5^{a} \pm 15,5$	$146,2^{a} \pm 10,2$	-6,0
7 a 14	$91,5^{a} \pm 2,0$	$76,0^{b} \pm 7,5$	20,4	$159,0^{b} \pm 3,5$	$173,2^{a} \pm 12,7$	-8,1
14 a 21	$135,6^{a} \pm 12,2$	$100,0^{b} \pm 8,8$	35,6	$141,4^{b} \pm 10,4$	$151,3^{a} \pm 9,4$	-6,5
21 a 28	$151,7^{a} \pm 10,7$	$111,7^{b} \pm 8,9$	35,8	$112,2^{b} \pm 7,3$	$128,2^{a} \pm 12,5$	-12,5
28 a 35	$219,8^{a} \pm 24,3$	$135,8^{b} \pm 20,6$	61,9	$131,6^{a} \pm 17,0$	$133,8^{a} \pm 17,3$	-1,6
35 a 42	$304,2^{a} \pm 25,8$	$166,1^{b} \pm 15,9$	83,1	$171,9^{a} \pm 14,2$	$163,7^{a} \pm 13,0$	5,0
42 a 49	$302,2^{a} \pm 39,2$	$149,6^{b} \pm 24,0$	102,0	$168,1^{a} \pm 23,5$	$145,3^{a} \pm 24,2$	15,7

[1]Feed intake adjusted for 100g of live body weight = feed intake x 100 / live body weight.
[2]Mean percent difference between lines = $\left(\bar{x}Italian - \bar{x}Japanese\right) \times 100 / \bar{x}Japanese$
Different letters indicate significant differences (p<0,05) between line means.

A strong line effect was observed upon this variable (p<.001). The Italian line presented higher feed intake at all ages what is in agreement with the literature (MARKS, 1980; DARDEN and MARKS, 1988). MARKS (1980) affirmed that increase of water and feed intake are correlated responses to selection for growth rate. The difference between lines accentuated with age.

Nevertheless, when it was considered adjusted mean feed intake (TABLE 3) it was observed that the Italian line had a smaller intake or equal to that of the Japanese line at all ages. The observed trend for higher feed intake of the Italian line from 35 days on seems to confirm a higher sexual precocity of the Japanese males.

Considered together, the results

obtained for this variable and those for mean weight gain seem indicative that the Italian line has a better capacity of feed utilization, as it presented a higher growth although consuming less for each 100 g of body weight. This observation is in agreement with the results reported by MARKS (1991; 1993a; 1996).

An effect of protein level was seen only in the period of 35 to 42 days ($p<.05$), being higher the mean of 26% CP level. However, this isolated observation did not follow the trend noted from 21 days on ($p>.05$), which indicated an adjusted feed intake slightly superior of the diet of 20% CP.

Feed conversion (TABLE 2) showed line effect ($p<.001$), favoring the Italian quails, that showed lower feed conversion ($p<.05$) between 7 and 35 days. After this age the variable lost its biological meaning, since, as discussed previously, the weight gain drastically decreased or ceased because of the competition for social dominance, having even occurred weight losses in several individuals.

Conclusions

Performance results obtained indicatet the potential of the Italian line as meat producer, due to its weight superiority, higher than 70% compared to Japanese line, at adult age. Italian line possesses higher mean weight gain and better feed conversion. The better utilization of the food consumed allows the adjusted feed intake of the Italian line to be lower than that of the Japanese line. This offers a good economical perspective, as it indicates that feed cost to produce one kilogram of quail meat is lower for the Italian line than for the Japanese one. Since Italian quails can utilize the same infrastructure as Japanese ones, the other production costs can be maintained constant, without additional expenses.

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