

EFFECT OF MEAT-BONE LEFTOVER MEAL ON EGG PRODUCTION OF JAPANESE QUAILS (*COTURNIX COTURNIX JAPONICA*)

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ABSTRACT

The study examined the impact of meat-bone leftover meal (MBLM) leftovers on the egg production of Japanese quails (*Coturnix coturnix japonica*). Meat-bone leftover refers to the meat and bones were collected from restaurants, hotels, and event centers, then crushed and dried to create the MBLM. Four diets were formulated, replacing soybean meal with MBLM at levels of 0%, 5%, 7.5%, and 10%, with the 0% diet serving as the control. A total of 200 five-week-old female quails were divided into four groups of 50, with five replicates of 10 quails each, using a completely randomized design and reared on their respective diets for 14 weeks. Key metrics, including initial and final weights, feed intake, and egg production, were recorded, with hen-day egg production (HDEP) calculated as well. By the end of the experiment, quails on the control diet, as well as those on the 5% and 7.5% MBLM diets, exhibited lower body weight changes (BWC) and higher total feed intake (TFI), while quails on the 10% MBLM diet showed higher BWC and lower TFI. Notably, those on the 10% MBLM had the highest HDEP from weeks 7 to 11, followed by those on the 7.5% MBLM, whereas the control group had lower HDEP values. However, from weeks 17 to 19, the quails on the 10% MBLM diet showed lower HDEP, while those on the 5% and 7.5% MBLM diets had higher HDEP comparable to the control. The diets containing 5% and 7.5% MBLM promote better egg production in older quails and are therefore recommended.

Keywords: Japanese quails, meat-bone, eggs production, soybeans, diet

INTRODUCTION

The lack of traditional feed sources and ineffective solutions to address this issue significantly hampers livestock development in many developing nations. As a result, these countries often resort to importing costly animal protein to meet demand, making it unaffordable for average consumers (Sudik, 2024). Quails, being small poultry animals, require less feed to produce meat and eggs compared to other poultry species. They can be raised using locally available resources, which may not be suitable for chickens. For instance, mature quails consume about 20 grams of feed per day; thus, a flock of 100 laying quails requires roughly a ton of feed over seven weeks. In contrast, the same quantity of feed would be consumed by 100 laying hens in just one week (NRC, 1994). A significant amount of meat and bone leftover is produced in restaurants, hotels, and similar establishments, often ending up in landfills and there is a lot of protein and nutrients hiding in it that can be used in animal feed (NRC, 1994). For example, Ireland generated an estimated 750,000 tonnes of food waste in 2022 (Weatherford *et al.*, 1999). Although studies have explored the impact of meat and bone meal (MBM) on chicken diets (Shirley and Parsons., 2001; Drewyor and Waldroup, 1998) there is limited research on its effects on quail diets. Previous research indicated that MBM inclusion did not negatively impact turkey and broiler diets (Rizzi, 2023). Meat and bone meal for poultry helps them get all the nutrients they need to grow, lay and reproduce (Rizzi, 2023). This study aims to investigate the influence of meat-bone meal leftovers on the egg production of Japanese quails (*Coturnix coturnix japonica*).

MATERIALS AND METHODS

The research was carried out at the Teaching and Research Farm of the Federal University, Gashua, Yobe State. Fresh meat and bone leftover were sourced from local restaurants, hotels, and food vendors, then dried and ground into meat-bone leftover meal (MBLM) using a mortar and pestle. Four diets (T1, T2, T3, and T4) were created, each containing approximately 18.5% crude protein and 3025 kcal/kg of energy, with soybean meal replaced by varying percentages of MBLM: 0%, 5%, 7.5%, and 10%. The diet with 0% MBLM served as the control (Table 1). Two hundred five-week-old female Japanese quails were obtained from the Teaching and Research Farm and divided into four groups corresponding to each treatment, with each group consisting of 50 quails divided into 10 replicates. The quails were housed in hutches that included feeders and drinkers and were provided with their specific diets and water ad libitum throughout a 14-week experimental period. The hutches and feeders were cleaned daily, and droppings were regularly removed. The weights of all quails were recorded at the start and end of the trial to assess body weight changes. Feed intake was calculated by measuring the difference between the

amount supplied and the leftovers. Eggs were collected from each replicate three times daily at 10 am, 2 pm, and 6 pm.

Table 1: Ingredients and composition of the experimental diets used for the study

Ingredients	0%MBLM	5%MBLM	7.5%MBLM	10%MBLM
Maize	51.03	51.46	51.50	51.80
Soybean meal	27.50	26.13	6.88	2.75
Leftover meat-bone	0.00	1.38	20.63	24.75
Wheat offal	11.00	12.00	12.36	12.5
Fish meal	3.22	3.00	2.69	2.45
Bone meal	3.60	2.44	2.35	2.15
Limestone	3.00	3.00	3.00	3.00
Premix	0.25	0.25	0.25	0.25
Lysine	0.25	0.20	0.20	0.20
Methionine	0.15	0.15	0.15	0.15
Total	100	100	100	100
Nutrients (%)				
Crude protein	18.50	18.51	18.53	18.54
Energy (kcal/kg)	3025.10	3025.09	3025.11	3025.27
Lysine	1.05	1.08	1.10	1.12
Methionine	0.40	0.44	0.46	0.47
Calcium	2.91	2.92	2.93	2.94
Phosphorus	0.98	0.99	1.02	1.04
Crude fibre	4.01	3.54	3.43	3.20

MBLM= Meat-bone leftover meal

Hen-day Egg production (HDEP) was calculated as follows:

$$\text{HDEP} = \frac{\text{Total number of eggs laid on a day}}{\text{Total number of hens}} \times 100 \quad (\text{Bozkurt et al., 2004}).$$

Note: HDEP was determined per day per treatment and the average HDEP per week was reported.

Data collected were subjected to analysis of variance (ANOVA) using SPSS (version 25) statistical tool. Significant different in treatment per week was separated using Duncan multiple range test.

RESULTS AND DISCUSSION

Table 2 presents the body weight and feed intake of quails fed diets containing varied levels of meat-bone leftover meal. The results showed significant differences ($p < 0.05$) based on the treatment given. The control diet, 5%MBLM and 7.5%MBLM, resulted in similar changes in body weight and feed intake. Conversely, the 10%MBLM diet led to greater body weight changes and reduced total feed intake. This indicates that the energy and essential nutrients like amino acids, fats, and minerals were sufficiently available in the 10%MBLM diet (Table 1) that boosted growth rate and early commencement of production. Meat and bone meal serves as a high-quality source of protein, fat, calcium, and phosphorus, but contributing significantly to metabolizable energy when compared to other macronutrients (Drewyor and Waldroup, 1998).

Table 2: Body weight and feed intake of quails fed diets containing varied levels of meat-bone leftover meal

Parameters	0%MBLM	5%MBLM	7.5%MBLM	10%MBLM	±SEM	p-value
Body weight (g)	109.33 ^b	111.06 ^b	119.41 ^b	131.39 ^a	8.75	0.988
Total feed intake (g)	1960.46 ^a	1962.05 ^a	1958.37 ^a	1938.18 ^b	11.16	0.457

^{a,b} in a row are significant different ($p < 0.05$).

Table 3 presents hen-day egg production (%) by laying quail hens. The results revealed significant differences ($p < 0.05$) during weeks 7 to 10 and weeks 17 to 19. The 10%MBLM diet exhibited the highest hen-day egg production (HDEP) at 7 and 8 weeks, while the control showed the lowest. Similarly, the highest HDEP was recorded for the 10%MBLM and 7.5%MBLM diets in weeks 9, 10, and 11, with the control diet again showed the lowest. No significant differences in HDEP were observed from weeks 12 to 16. However, in the final three weeks of the study, the control, 5%MBLM, and 7.5%MBLM diets produced higher HDEP compared to the 10%MBLM diet. The initial spike in egg production for the 10%MBLM diet suggests that these quails experienced faster growth and increased body weight, which may have contributed to the decreased egg production later, as it is known that heavier birds tend to lay fewer eggs. In contrast, Bozkurt *et al.* (2001) noted increased HDEP with a

2%MBLM diet, and Damron *et al.* (2021) found that incorporating MBLM up to 6.0% did not adversely affect laying hen performance. It was found that 5-7%MBLM could effectively replace soybean meal without negatively impacting egg production. Additionally, reductions in bone meal, limestone, and fish meal did not adversely affect egg production when using 5-7%MBLM as earlier reported by He *et al.* (2023). According to He *et al.* (2023) soya is a plant-based protein source that is often used in chicken feed. It is a traditionally good source of protein for poultry, however meat and bone meal usually have higher levels of calcium and phosphorus, which are especially important for laying chickens.

Table 3: Hen-day egg production (%) by laying quail hens

Age (week)	0%MBLM	5%MBLM	7.5%MBLM	10%MBLM	±SEM	p-value
7	7 ^c	8 ^c	10 ^b	15 ^a	3.56	0.475
8	15 ^d	22 ^c	25 ^{bc}	30 ^a	6.27	0.556
9	35 ^c	40 ^b	47 ^a	50 ^a	6.78	0.594
10	45 ^c	55 ^b	60 ^a	62 ^a	7.59	0.606
11	55 ^b	60 ^{ab}	65 ^a	67 ^a	5.38	0.633
12	65	67	70	72	3.11	0.070
13	70	73	75	76	2.65	0.54
14	75	79	77	76	1.71	0.056
15	79	80	80	81	0.82	0.018
16	85	82	87	81	2.75	0.026
17	87 ^a	85 ^a	88 ^a	75 ^c	5.94	0.319
18	88 ^a	85 ^a	90 ^a	75 ^c	6.66	0.722
19	88 ^a	86 ^a	91 ^a	72 ^b	8.42	0.607

^{a,b,c,d} in a column are significant different (p<0.05).

CONCLUSION

It was observed that the diet containing 10%MBLM expressed higher egg production than the control diet at commencement of production, but it yielded lower egg production as the quails advanced in age. However, towards the expiration of the experiment (from week 17 to 19), diets containing 5 and 7.5%MBLM maintained high production comparable to the control diet. Therefore, 5-7.5%MBLM is recommended for laying quails' hens.

REFERENCES

- Bozkurt, M., Alçiçek, A. and Çabuk, M. (2004). The effect of dietary inclusion of meat and bone meal on the performance of laying hens at old age. *South African Journal of Animal Science*, 34(1): 31-36.
- Damron, B. L., Ouart, M. D. and Christmas, R. B. (2001). Rendered whole-bird layer mortality as an ingredient in layer diets. *Journal of Applied Poultry Research*, 10: 371-375.
- Drewyor, M. E. and Waldroup, P.W. (1998). Utilization of high levels of meat and bone meal in broiler diets. *Poultry Science*, 77(1): 30.
- He, z., Zhan, X., Cao, S., Wen, X., Hou, L., Liu, S., Zheng, H., Gao, K., Yang, X., Jiang, Z. and Wang, L. (2023). Effect of miscellaneous meal replacements for soybean meal on growth performance, serum biochemical parameters, and gut microbiota of 50–75 kg growing pigs. *Animals (Basel)*. 2023 Nov; 13(22): 3499. <https://doi:10.3390/ani13223499>
- NRC (1994). Nutrient requirements of poultry. National Academies Press
- Rizzi, C. (2023). A Study on Egg Production and Quality According to the Age of Four Italian Chicken Dual-Purpose Purebred Hens Reared Outdoors. *Animals (Basel)*, 13(19): 3064. <https://doi:10.3390/ani13193064>
- Shirley, R. B. and Parsons, C. M. (2001). Effect of ash content on protein quality of meat and bone meal. *Poultry Science*, 80: 626-632.
- Sudik, S. D. (2024). Nutritional composition of roselle seed cake (*Hibiscus sabdariffa*) and its effect on broiler chickens. *Slovak Journal of Animal Science*, 57 (2): 55–64.
- Weatherford, P. W. and Cherry, T. E. (1999). Comparison of five animal proteins in commercial broiler diets. *Poultry Science*, 78(1): 1-5.