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THE EFFECTS OF CRICKET MEAL (*Gryllus sigillatus*) ON THE MEAT QUALITY, GROWTH AND INTERNAL MORPHOLOGY OF BROILER CHICKENS

Introduction

Environmental stewardship is a priority to the agricultural industry. Issues associated with the production of feed, such as water usage, soil degradation and greenhouse gas emissions could be mitigated with the use of cricket meal as a protein source. Crickets show considerable variation in their nutritional content based on species, growing conditions and diet but on average contain (on a dry matter basis) about 60% crude protein and 16% crude fat. This ingredient has the potential for use in broiler chicken diets. As well, the cricket exoskeleton contains two compounds- chitin and melanin - both of which have exhibited antimicrobial properties. As the poultry industry moves away from the use of growth promoting antibiotics, this feed component could be very useful towards improved bird health. Producing a high-quality product for the consumer is a goal when raising broiler chickens. Thus, the colour, texture and cook yield of chicken must be favorable. This is the first study to evaluate the effect of crickets on meat quality of broiler chickens.

Objective

The objective of this research was to examine the influence of feeding cricket meal on the growth, internal morphology, and meal quality of broiler chickens compared to a medicated and non-medicated control diet.

Industry Impact

Research results demonstrate that cricket meal inclusion of up to 20% of the diet does not have a detrimental impact on the growth, internal gut health, and meat quality of broiler chickens, indicating that it could be a viable protein replacement in broiler diets. Further research is required to determine if dietary inclusion over 20% will produce similar results.

Dried crickets displayed by Marilyn Roberts. Photo credit: Stephanie Collins

Trial

Six hundred and twenty-four mixed sex Ross 308 broilers were randomly placed in 24 pens and the pens were randomly allocated to one of 6 diet treatments (four replications per treatment). The diet treatments included: non-medicated (NM) and medicated (M) control, and non-medicated diets with an inclusion of cricket meal (CM) at 5%, 10%, 15% or 20%.

Average daily feed intake, average daily gain, feed conversion ratio, protein efficiency ratio and mortality were calculated weekly by recording feed intake and bird weight.

On days (D) 13, 20, and 35, three birds/pen were randomly selected and euthanized for intestinal health, as indicated by the presence or absence of intestinal lesions (based on a 0 (none) – 6 (heavy with lesions) scale).

On D35, meat quality was evaluated, testing for raw breast weight, raw breast and liver colour (L* a* b* scoring), breast texture (raw and cooked), breast cook loss.

Results

- Birds fed the 20% CM had the highest D7 and D14 body weights compared to those fed 5% CM, 0% NM, and 0% M (Table 1).
- At D21, birds fed 20% CM weighed more than those fed 5, 10 and 15% CM and 0% M (Table 1).
- At D28, birds fed 20% CM weighed more than those fed 5% CM (Table 1).
- At D35, birds fed 10% CM weighed more than those fed 5% CM (Table 1).
- Broilers fed all treatments had similar average daily feed intakes throughout the trial (Table 1).
- Average daily gains were similar for all treatments throughout the trial except for the 5% CM treatment, which resulted in less weight gain than the other treatments.
- Feed conversion ratios were similar for broilers fed all experimental diets (Table 1).
- Protein efficiency ratios (PER) for the treatments were similar except the PER of birds fed 5% CM, which was higher than all the other treatments (Table 1).
- There was no significant difference between treatments for intestinal health, as indicated by the presence or absence of intestinal lesions, but broilers fed the 20% CM diet had the highest frequency of 0 scores (0-6 scale) in comparison with all other treatments.
- Birds fed the 10% CM diet had a higher % cook loss (breast meat; 35.5%) than those fed the NM control diet (31.9%), but there was no significant difference among any of the other treatments.
- When meat quality was assessed, there was no difference in the breast weight, breast or liver colour, or breast meat texture (raw and cooked) among broilers fed any of the experimental treatments.

Conclusion

Cricket meal (CM) did not influence the texture and colour of the breast meat, but the 10% CM diet did affect the cooking loss of breast meat. Results indicate no detrimental dietary impact on growth, meat quality, and internal morphology when CM is included at a dietary inclusion level up to 20% in a non-medicated broiler chicken diet. Further research would be required before feeding dietary inclusion levels of CM >20%.

Table 1. Production performance of broiler chickens fed diets containing cricket meal (CM) at increasing dietary inclusion levels

	0% NM	0% M	5% CM	10% CM	15% CM	20% CM
Average Weight (g)						
D7	136.7^{b}	125.8^{b}	127.5^{c}	143.0^{ab}	147.3^{a}	149.9^{a}
D14	362.6^{bc}	349.0^{c}	306.8^{d}	383.0^{ab}	390.8^{ab}	405.8^{a}
D21	767.9^{abc}	756.2a^{bc}	689.4^{c}	745.6^{bc}	808.7a^{b}	834.3^{a}
D28	1377.6^{a}	1345.0^{ad}	1253.9^{b}	1390.1^{a}	1363.9^{a}	1376.2^{a}
D35	2095.6^{a}	2043.5^{ab}	1933.4^{b}	2063.5^{a}	2024.9^{ab}	2049.3^{ab}
Total Average Daily Feed Intake (g)						
	93.4	90.4	84.8	91.0	85.3	86.9
Total Average Daily Gain (g)						
	58.8^{a}	57.3^{a}	54.2^{b}	57.8^{a}	56.8^{a}	57.4^{a}
Total Feed Conversion Ratio						
	1.59	1.58	1.57	1.57	1.50	1.51
Total Protein Efficiency Ratio						
	2.7^{b}	2.7^{b}	3.5^{a}	2.5^{b}	2.6^{b}	2.7^{b}

$^{a-d}$Rows with different letters differed significantly (P<0.05).

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Data from: Fisher, H. 2019. Evaluation of broiler chickens (*Gallus gallus domesticus*) digestibility, organ weights, growth parameters, and carcass quality when fed cricket meal (*Gryllus sigillatus*) an emerging feed source. MSc thesis. Dalhousie University.

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