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Research Article

The Effects of Using Ginger in the Diet on Growth Performance and carcass traits of Japanese Quails

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Abstract. This study aimed to evaluate the effects of dietary supplementation with ginger (*Zingiber officinale*) powder on the growth performance and carcass characteristics of Japanese quail at the Bamiyan province of Afghanistan. A total of 160 seven-day-old Japanese quails were randomly assigned to a completely randomized design consisting of five dietary treatments, with two replicates per treatment and 16 birds per replicate. The experimental diets included a control diet without ginger powder and four diets supplemented with ginger powder at levels of 0.2%, 0.4%, 0.6%, and 0.8%. Feed and water were provided *ad libitum* throughout the experimental period. The results indicated that dietary supplementation with ginger powder had no significant effect ($p > 0.05$) on feed intake or final live body weight. However, significant effects ($p < 0.05$) were observed on body weight gain, feed conversion ratio, dressed carcass weight, breast yield, and thigh yield. These findings suggest that

dietary supplementation with ginger powder can improve growth performance and carcass characteristics in Japanese quail.

Keywords: Japanese quail, ginger powder, growth performance, carcass characteristics, feed conversion ratio

INTRODUCTION

Antibiotics have long been used as feed additives in poultry production because of their ability to improve growth performance, productivity, and feed conversion efficiency. As antimicrobial growth promoters, antibiotics have been shown to enhance growth and reduce the incidence of disease in poultry (7). However, concerns regarding the emergence of antibiotic-resistant pathogenic bacteria and the presence of antibiotic residues in poultry products led the European Commission to ban the use of antibiotic growth promoters in animal feed (2). Consequently, increasing attention has been directed toward natural alternatives, particularly medicinal herbs, to improve poultry health and productivity. Herbal feed additives have been reported to enhance immune function, reduce intestinal pathogen colonization, and improve growth performance without the adverse effects associated with antibiotics (6). Numerous studies have demonstrated that herbal growth promoters improve body weight gain and feed conversion ratio (FCR) in poultry (15, 18). In addition, dietary supplementation with ginger has been reported to improve the productive performance of Japanese quail (17). Ginger (*Zingiber officinale*), a perennial herb belonging to the family *Zingiberaceae*, is widely used worldwide as both a culinary spice and a traditional medicinal plant (4). Ginger rhizomes contain a variety of biologically active compounds, including gingerols, shogaols, zingiberene, bisabolene, gingerdiol, gingerdione, diarylheptanoids, and essential oils, which are responsible for its characteristic aroma, pungent flavor, and diverse pharmacological properties (3, 11, 13). Among these compounds, gingerol and zingiberene are considered the principal bioactive constituents and have been shown to stimulate digestive secretions, enhance digestive enzyme activity, regulate gastrointestinal pH, and promote beneficial intestinal microflora. The potential of ginger as a natural alternative to antibiotic growth promoters has attracted considerable research interest. Previous studies have indicated that dietary ginger supplementation may enhance feed palatability, stimulate appetite, improve nutrient digestibility and absorption, and increase gastric enzyme secretion, thereby promoting growth and feed utilization in poultry (4). Furthermore, ginger possesses a wide range of biological activities, including antioxidant, antibacterial, anti-inflammatory, antiseptic, antiparasitic, and immunomodulatory effects. Its antioxidant activity is primarily attributed to gingerol-related compounds and diarylheptanoids (13). Ali et al. (1) and Incharoen and Yamauchi (8) reported that ginger improves blood circulation, stimulates gastric secretion, and enhances intestinal motility, which may collectively contribute to improved growth performance and overall health in poultry. Therefore, the present study was

conducted to evaluate the effects of dietary supplementation with ginger powder on the growth performance and carcass characteristics of Japanese quail.

Materials and Methods

The current study was conducted in a Poultry farm, Nili, Daikundi, Afghanistan. A total of 160 seven-day-old Japanese quail (Coturnix coturnix japonica) were randomly assigned to five dietary treatments in a complete randomized design for 35 days, each of which was replicated two times with 16 quail per replicate. One of the groups was fed a basal diet only (control) and others were fed a basal diet supplemented with 0.2, 0.4, 0.6, and 0.8% of ginger powder of diet. The diets were supplied from Saih Darah Bamyan livestock Services company. The ginger powder used in the experiment was purchased from local market; next, it was mixed with basal diet. Quail were fed ad libitum and had free access to water throughout the whole experiment.

During the overall experimental period, weights of quail were measured on days 7, 14, 21,28,35 and 42. Feed supplied and feed leftover were recorded daily. feed intake and feed conversion ratio were calculated at the end of experiment. At the end of experiment, 2 quail per experimental group (one bird per replicate) were randomly selected and slaughtered for the determination of carcass traits.

All data generated were subjected to a one-way analysis of variance (ANOVA) and treatment means with significant differences were compared using Duncan multiple range test by SPSS (26) package. Differences of $P < 0.05$ were considered to be statistically different.

RESULT AND DISCUSSION

The results presented in the table (1) indicate that dietary supplementation with ginger powder at different inclusion levels (0, 0.2, 0.4, 0.6, and 0.8%) influenced several growth-performance parameters of Japanese quail. Significant differences among treatments were determined by the different superscript letters within each row at $P \leq 0.05$. Initial body weight differed significantly among the treatments, ranging from 27.83 to 33.94 g. The highest initial body weight was recorded in birds receiving 0.2% ginger (33.94 g), whereas the control group had the lowest value (27.83 g). The 0.4, 0.6, and 0.8% treatments were statistically similar to each other (31.66, 30.83, and 31.55 g, respectively), but differed from the control and the 0.2% treatment. This initial variation should be considered when interpreting subsequent growth responses.

For live body weight, numerical differences were observed among treatments, with values ranging from 194.70 to 201.00 g. The highest live body weight was obtained with 0.6% ginger (201.00 g), followed by 0.2% (200.38 g), 0.4% (199.50 g), and the control (198.60 g), while the lowest value was observed at 0.8% ginger (194.70 g). However, because no superscript letters are assigned to these means, no statistically significant difference is reported for live body weight. Thus, ginger supplementation did not significantly alter final live body weight under the conditions of the experiment, although the 0.6% treatment produced the highest numerical value.

Body-weight gain was significantly affected by ginger supplementation ($P \leq 0.05$). The control treatment recorded the highest weight gain (170.77 g), statistically comparable with the 0.6% treatment (170.17 g). The 0.4% treatment (167.84 g) was intermediate and statistically similar to both the 0.2% treatment (166.44 g) and the higher-performing treatments. The lowest body-weight gain was recorded at 0.8% ginger (163.15 g), which was significantly lower than the control and 0.6% treatments. These results indicate that increasing ginger supplementation did not progressively improve growth; rather, the response appeared to decline at the highest inclusion level.

A significant effect was also observed for feed intake ($P \leq 0.05$). Feed consumption was highest in the 0.8% ginger treatment (512.42 g), which was statistically comparable with the control (507.07 g). Conversely, the lowest feed intake occurred at 0.2% ginger (479.84 g), followed by 0.4% (485.13 g) and 0.6% (486.85 g). The reduced feed intake at the intermediate ginger levels did not result in a corresponding reduction in body-weight gain, suggesting that birds receiving 0.2–0.6% ginger may have utilized their feed relatively efficiently.

The feed conversion ratio (FCR) differed significantly among treatments ($P \leq 0.05$). Since a lower FCR indicates better feed efficiency, the 0.6% ginger treatment produced the most favorable result, with an FCR of 2.86. This was statistically similar to the 0.2% (2.88) and 0.4% (2.89) treatments. The control group had a moderately higher FCR of 2.97, whereas the 0.8% treatment exhibited the poorest feed efficiency, with an FCR of 3.14. Therefore, although birds receiving 0.8% ginger consumed the greatest amount of feed, this increased consumption was not efficiently converted into body weight.

Overall, the results suggest that 0.6% ginger powder was the most promising supplementation level for improving feed-use efficiency and maintaining high body-weight gain. It produced the highest numerical live body weight (201.00 g), one of the highest body-weight gains (170.17 g), and the lowest FCR (2.86). In contrast, the 0.8% inclusion level appeared excessive, as it resulted in the lowest body-weight gain and the highest FCR despite having the greatest feed intake. However, because initial body weight was significantly different among treatments, interpretation of final growth performance should be made cautiously. In a subsequent experiment, equalizing initial body weight among experimental groups or statistically adjusting for initial body weight would provide a stronger assessment of the independent effect of dietary ginger supplementation.

Table 1. Effects of Ginger addition on growth performance of Japanese quail

Traits	Ginger powder levels (%)				
	0	0.2	0.4	0.6	0.8
Initial body weight(g)	27.83c	33.94a	31.66b	30.83b	31.55b
Live body weight(g)	198.6	200.38	199.5	201	194.7
Body weight gain(g)	170.77a	166.44b	167.84ab	170.17a	163.15c
Feed intake(g)	507.07a	479.84c	485.13b	486.85b	512.42a
Feed conversion ratio	2.97b	2.88c	2.89c	2.86c	3.14a

[a, b,c] Means within the same row with different superscript letters are significantly different at (P≤0.05)

The results presented in the table (2) indicate that dietary supplementation with ginger powder at levels of 0, 0.2, 0.4, 0.6, and 0.8% produced variable effects on the carcass characteristics of Japanese quail. Live body weight was not significantly affected by ginger supplementation (P>0.05), although the highest numerical value was recorded at 0.6% ginger (201.00 g) and the lowest at 0.8% (194.70 g). In contrast, dressed weight was significantly influenced (P≤0.05), with the highest value observed at 0.8% ginger (127 g), compared with 117 g in the control and 0.4% treatments.

Table 2. The effect of ginger feeding on the productive performance of cattle.

Treatments	Primary Weight (gr)	Finally Weight (gr)	Additional Weight (gr)	Feeding	Times to Feeding
T_1 (0)	30.83	200.6	169.77	507.07	2.98
T_2 (0.2)	30.94	200.38	169.44	479.84	2.83
T_3 (0.4)	31.66	199.5	167.84	485.13	2.89
T_4 (0.6)	31.83	201	170.17	486.85	2.9
T_5 (0.8)	31.55	194.7	163.15	512.42	3.14
$CD_{0.05}$	**0.41**	**26.63**	**18.51**	**36.32**	**0.021**

The results indicate that in table (1) dietary supplementation with ginger produced variable effects on the productive performance of cattle, with responses depending on the level of ginger inclusion. The initial or primary body weight ranged from 30.83 g in T1 (0% ginger) to 31.83 g in T4 (0.6% ginger), while T3 had an intermediate value of 31.66 g. The relatively small variation in initial body weight suggests that the experimental groups were generally comparable at the beginning of the feeding period, although the reported $CD_{0.05}$ of 0.41 g indicates that differences greater than this value may be statistically significant.

The final body weight varied among treatments, with the highest value recorded in T5 (0.8% ginger; 512.42 g), followed by T1 (0% ginger; 507.07 g). The lowest final weight was observed in T2 (0.2% ginger; 479.84 g). Thus, the 0.8% ginger treatment produced the greatest final body weight numerically, suggesting a potentially positive effect of higher ginger supplementation on growth performance.

The additional weight also showed considerable variation. The highest value was observed in T5 (163.15 g), whereas the lowest was recorded in T3 (167.84 g); T1, T2, and T4 showed values of 169.77, 169.44, and 170.17 g, respectively. If these values indeed represent weight gain, the numerical pattern does not correspond directly with the final-weight pattern. This discrepancy strongly suggests that the table headings or the order of the columns may have been incorrectly transcribed. Therefore, the original experimental dataset should be checked before publication.

The feeding-time parameter ranged from 2.83 in T2 (0.2% ginger) to 3.14 in T5 (0.8% ginger). The increase at the highest ginger level may indicate an improvement in feeding-related performance or intake behavior; however, the biological meaning of this variable cannot be determined confidently without knowing its exact unit and

definition. The $CD_{0.05}$ value for this parameter was 0.021, indicating that even relatively small differences among treatment means could potentially be statistically significant.

Table 3. Effects of Ginger addition on carcass traits of Japanese quail

Traits	Ginger powder levels (%)				
	0	0.2	0.4	0.6	0.8
Live body weight(g)	198.6	200.38	199.5	201	194.7
Dressed weight(g)	117d	121c	117d	123b	127a
Breast (with bone)	35.89%b	37.19%a	34.18%c	33.33%bc	31.49c
Thigh	22.07%b	22.31%ab	23.93a	22.76a	23.04a
Liver	5.98ab	2.47c	5.12b	4.87b	6.29a

[a, b,c] Means within the same row with different superscript letters are significantly different at ($P \leq 0.05$)

Breast proportion also differed significantly among treatments, with the highest value recorded at 0.2% ginger (37.19%) and the lowest at 0.8% (31.49%). Thigh proportion was significantly improved by ginger supplementation, particularly at 0.4%, which produced the highest value (23.93%). Liver weight also varied significantly among treatments, ranging from 2.47 at 0.2% to 6.29 at 0.8% ginger.

Overall, the effects of ginger were dependent on the inclusion level, and no single treatment produced the best response for all carcass traits. The 0.8% level increased dressed weight but was associated with reduced breast proportion and increased liver value, whereas moderate supplementation levels, particularly 0.2–0.6%, produced a more balanced carcass response. These findings suggest that moderate dietary ginger supplementation may be more suitable for improving overall carcass characteristics of Japanese quail than the highest inclusion level.

Table 4. Effect of ginger feeding on carcass traits.

Treatments	Life Weight (gr)	Body Weight (gr)	Bust (%)	Leg (%)	Liver (%)
T_1 (0)	200.3	117	35.89	23.07	5.98
T_2 (0.2)	200.38	121	3719	22.31	2.47
T_3 (0.4)	199.5	117	34.18	23.93	5.12
T_4 (0.6)	201	123	33.33	22.76	4.78
T_5 (0.8)	194.7	127	31.49	22.04	6.29
$CD_{0.05}$	**23.74**	**19.94**	**6.09**	**4.92**	**0.05**

Table 4. presents the effects of dietary ginger supplementation at 0, 0.2, 0.4, 0.6, and 0.8% on live body weight, body weight, breast yield, leg yield, and liver percentage. Overall, the results indicate that ginger supplementation produced variable and dose-dependent responses in carcass characteristics, although the

available $CD_{0.05}$ values suggest that not all observed numerical differences necessarily represent statistically significant treatment effects.

Live weight varied only slightly among treatments, ranging from 194.70 g in T5 (0.8% ginger) to 201.00 g in T4 (0.6% ginger). The control treatment (T1) recorded 200.30 g, while T2, T3, and T4 recorded 200.38, 199.50, and 201.00 g, respectively.

The difference between the maximum and minimum values was approximately 6.30 g, indicating relatively limited variation in live body weight. Numerically, the 0.6% ginger treatment produced the highest live weight, whereas the 0.8% treatment resulted in the lowest value. This suggests that increasing ginger supplementation beyond 0.6% did not provide an additional advantage in live weight and may even have been associated with a slight decline.

Body weight ranged from 117 g in T1 and T3 to 127 g in T5. T2 and T4 recorded 121 and 123 g, respectively. There was therefore a progressive numerical increase in body weight from the control to the highest ginger supplementation level:

The highest body weight was observed at 0.8% ginger supplementation, representing an increase of approximately 8.5% relative to the control [(127 – 117)/117 × 100]. This pattern suggests a potentially beneficial effect of ginger on carcass/body weight at the higher supplementation level. Nevertheless, the decline at 0.4% followed by an increase at 0.6 and 0.8% indicates that the response was not strictly linear.

Breast yield was 35.89% in T1, 37.19% in T2, 34.18% in T3, 33.33% in T4, and 31.49% in T5, assuming the T2 value is 37.19% rather than 3719.

The highest breast percentage was therefore obtained with 0.2% ginger supplementation (37.19%), while the lowest was observed at 0.8% ginger (31.49%). Relative to the control, T2 increased breast yield by approximately 3.6%, whereas T5 decreased it by approximately 12.3%.

The maximum leg yield occurred at 0.4% ginger supplementation, whereas the minimum occurred at 0.8%. Compared with the control, T3 showed an increase of approximately 3.7%, while T5 showed a decrease of approximately 4.5%.

Thus, moderate ginger supplementation appeared to produce the most favorable numerical response for leg yield. However, the relatively narrow range among treatments suggests that ginger had a comparatively limited influence on this trait.

Liver percentage showed considerable numerical variation, ranging from 2.47% in T2 to 6.29% in T5. The values were 5.98, 2.47, 5.12, 4.78, and 6.29% for T1–T5, respectively.

The lowest liver percentage occurred at 0.2% ginger, whereas the highest occurred at 0.8% ginger. Compared with the control, T2 decreased liver percentage by approximately 58.7%, while T5 increased it by approximately 5.2%.

CONCLUSION

Dietary ginger supplementation influenced several growth performance and carcass characteristics of Japanese quail, with responses varying according to inclusion level. Although live body weight was not significantly affected, ginger significantly influenced body-weight gain, feed intake, feed conversion ratio, dressed

weight, breast and thigh proportions, and liver weight ($P \leq 0.05$). The 0.6% ginger treatment produced the most favorable overall growth response, characterized by high body-weight gain and the lowest FCR (2.86). Conversely, 0.8% ginger resulted in excessive feed intake, reduced weight gain, poorer feed efficiency, and lower breast proportion, despite increasing dressed weight. Therefore, moderate ginger supplementation, particularly 0.6%, appears more suitable for improving overall production performance of Japanese quail.

Conflict of interest statement

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Data availability statement

The authors declared that all the data used in the preparation of this manuscript will be available upon reasonable request from the corresponding author

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