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Growth performance, carcass characteristics and relative organ weights of Arbor Acres broilers fed diets supplemented with ginger root powder and yeast

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Abstract
Background: This study evaluated the effects of dietary ginger root powder and yeast powder on the growth performance, carcass characteristics and relative organ weights of broiler chickens. Four dietary treatments were used: T1 (control), T2 (1% ginger root powder), T3 (1% yeast powder), and T4 (0.5% ginger + 0.5% yeast powder).
Materials and Methods: Growth performance was assessed based on body weight, feed intake, weight gain and feed conversion ratio, while carcass and organ characteristics were evaluated at 8 weeks.
Results: Dietary treatments significantly ($p < 0.05$) influenced final weight, weight gain and feed conversion ratio, with birds fed the combined supplementation (T4) recording notable improvements. Live, slaughter, dressed and eviscerated weights were also significantly affected. Birds fed 1% ginger and 1% yeast recorded higher live weights than the control. Among carcass cuts, only relative neck weight was significantly influenced, while the major internal organ weights were not significantly affected. Overall, ginger root powder and yeast supplementation improved growth performance and carcass characteristics without adverse effects on internal organ development.
Conclusion: These additives may therefore serve as safe and effective natural feed supplements for enhancing broiler production.

Keywords: Broiler chickens, ginger root powder, yeast powder, carcass characteristics, organ weights, growth performance

Introduction

Poultry production is one of the most important components of the livestock industry, playing a critical role in ensuring national food security, generating income, and providing employment opportunities across rural and urban communities. Poultry meat and eggs are among the most widely consumed sources of animal protein globally due to their affordability, high nutritive value, and accessibility, particularly in developing countries where protein deficiency remains a major concern (Chawla & Patra, 2021 [9]; Abdel-Wareth & Lohakare, 2020). Broiler chickens, in particular, are reared primarily for meat production because of their rapid growth rate, efficient feed conversion ratio, and short production cycle, making them a highly profitable and sustainable source of high-quality animal protein. With the rising human population and the corresponding increase in demand for affordable protein sources, enhancing growth performance, health, and carcass quality of broilers has become a primary focus for poultry farmers, feed producers, and researchers alike. Improving broiler productivity is not only essential for meeting the nutritional needs of the population but also for supporting economic development and ensuring the stability of the poultry value chain (Chawla & Patra, 2021 [9]; Abdel-Wareth & Lohakare, 2020).

Feed supplementation has been widely recognized as an effective strategy to enhance growth performance, health status, and carcass characteristics of broiler chickens. In particular, natural feed additives have gained attention as sustainable and safer alternatives to antibiotic growth promoters, which have been restricted due to concerns about antimicrobial resistance and potential health risks to consumers. These natural additives include herbs and spices, such as ginger (*Zingiber officinale*), garlic (*Allium sativum*), turmeric (*Curcuma longa*), and thyme (*Thymus vulgaris*), which are rich in bioactive compounds with antioxidant, antimicrobial, and digestive-stimulating properties. Other natural additives include probiotics, such as yeast (*Saccharomyces cerevisiae*), *Lactobacillus* spp., and *Bifidobacterium* spp., which enhance gut health, nutrient absorption, and immune responses. Additionally, prebiotics like mannan oligosaccharides and fructooligosaccharides, as well as organic acids and essential oils such as citric acid, oregano oil, and clove oil, have been shown to improve intestinal microflora and overall bird performance (Abdel-Wareth & Lohakare, 2020; Chawla & Patra, 2021) [9].

Ginger (*Zingiber officinale*) is a commonly used medicinal herb known for its bioactive compounds, including *gingerol*, *shogaol*, *terpenoids*, *zingiberene*, and *bisabolene*. These compounds exhibit antioxidant, antimicrobial, and anti-inflammatory properties, which can positively influence poultry growth, feed efficiency, and immune responses. Dietary inclusion of ginger has been shown to improve digestive enzyme activity, nutrient utilization, and carcass characteristics in broilers (Chawla & Patra, 2021) [9]. The dehydration of gingerol to shogaol during processing further enhances its biological activity, making ginger a naturally effective feed additive.

Yeast (*Saccharomyces cerevisiae*), on the other hand, is a probiotic supplement widely used in poultry nutrition. It enhances gut health by stabilizing intestinal microflora, improving nutrient digestibility, and stimulating the immune system. Yeast supplementation has been associated with better growth performance, improved carcass traits, and increased relative organ weights in broilers. Bioactive components such as β-glucans and mannan oligosaccharides contribute to immune modulation and pathogen control, making yeast a safe alternative to antibiotic growth promoters (Abdel-Wareth & Lohakare, 2020; Chawla &

Patra, 2021) [9]. Given the significant positive effects of yeast on growth performance, gut health, and immune function, exploring its combined use with ginger could potentially enhance broiler productivity further, particularly in terms of carcass characteristics and relative organ development.

Carcass characteristics, including dressed weight, eviscerated weight, and the weight of various cut parts, are important indicators of meat yield and quality. Similarly, relative organ weights, such as those of the liver, gizzard, heart, kidney, and spleen, provide insight into the physiological and health status of the birds. Understanding the effects of dietary supplementation with ginger and yeast on these parameters can provide valuable information for optimizing broiler production (Abdel-Wareth & Lohakare, 2020; Chawla & Patra, 2021) [9].

Evaluating growth performance in broiler chickens without assessing their physiological health is incomplete. Supplementation with Ginger (*Zingiber officinale*) and Yeast (*Saccharomyces cerevisiae*) has been shown to beneficially influence serum biochemistry. Ginger reduces serum cholesterol, triglycerides and low-density lipoprotein (LDL) levels while improving antioxidant enzyme activity and increasing total protein concentration (Xu *et al*., 2009). Yeast supplementation enhances the activities of antioxidant enzymes such as superoxide dismutase (SOD) and glutathione peroxidase (GPx), contributing to cellular resilience and oxidative stress reduction (Gao *et al*., 2008) [3]. Incorporating such serum biochemical markers ensures that the evaluation of feed additives captures not only productivity but also the underlying health and metabolic status of the birds.

Despite the individual benefits of ginger and yeast, limited research has investigated their combined effects on growth performance, carcass characteristics and relative organ weights of broiler chickens. It is expected that their combination would produce interactive effects, with ginger providing antioxidant and antimicrobial benefits while yeast improves gut health and nutrient absorption. Such an approach aligns with sustainable poultry production practices and the global shift toward natural feed additives, reducing reliance on antibiotics while improving meat yield and quality (Abbas *et al.*, 2026) [20].

Therefore, this study aimed to assess the impact of dietary supplementation with ginger root powder and yeast powder on carcass characteristics and relative organ weights of broiler chickens, providing valuable information for optimizing broiler production in Nigeria.

Materials and Methods

Location of the study

The research was carried out at the Poultry Unit of the Livestock Teaching and Research Farm of Ambrose Alli University, Ekpoma, Edo State. The experiment lasted for 8 weeks (56 days), covering both the starter (1–21 days) and finisher (22–60 days) phases.

Collection and Preparation of Ginger Root and Yeast Powder

Ginger rhizome was purchased from Kaduna, Kaduna state, Nigeria. The ginger rhizomes was washed, sliced, sundried and ground into powder. The yeast was purchased as commercial active dry yeast from Ekpoma, Edo State, Nigeria.

Management of Experimental Birds

A total of 100 day old broiler chicks were purchased for this experiment. The birds were brooded for three weeks including the two weeks of acclimatization. During brooding, adequate temperature, humiditry and ventilation were ensured. The birds were given multivitamins, prophylactic antibiotics and appropriate vaccines against Newcastle disease and infectious bursal disease according to veterinary prescriptions. The birds were provided access to feed and clean water *ad-libitum*. They were fed broiler starter without additives during the acclimatization and brooding period.

Experimental Design and Data Collections

The experiment was designed in a completely randomized design (CRD). A total of 100 birds were allotted to four dietary treatments in a group of sixteen (16) birds per treatment. Each treatment was replicated three times with eight birds per replicate. Treatment 1 (T_1) served as control and was commercial feed without additive; Treatment 2 (T_2) contained 125 g of ginger powder per 12.5 kg of commercial feed, Treatment 3 (T_3) contained 125 g of yeast per 12.5 kg of commercial feed while Treatment 4 (T_4) contained 65 g ginger powder + 65 g yeast per 12.5 kg of commercial feed.

Parameters Measured

Proximate Analysis of Experimental Diets

Samples of the experimental diets were subjected to proximate analysis to determine their nutrient composition, following the standard methods of the Association of Official Analytical Chemists (AOAC, 2019) [15]. Parameters determined included crude protein, crude fibre, ether extract (fat), ash, moisture, and nitrogen-free extract (carbohydrate).

Moisture content was determined by oven-drying samples at 105 °C until a constant weight was obtained. Ash content was measured by incinerating samples in a muffle furnace at 550°C for six hours. Crude protein was estimated using the Kjeldahl method, which determines total nitrogen and multiplies it by a conversion factor of 6.25. Crude fiber was assessed by sequential digestion of samples with dilute acid and alkali, followed by ashing of the residue. Ether extract (crude fat) was determined by Soxhlet extraction using petroleum ether as a solvent. Nitrogen-free extract (NFE), which represents the carbohydrate content, was calculated by difference (i.e., 100 – [moisture + ash + crude protein + crude fiber + ether extract]) (Akinola *et al.*, 2021; Igwe *et al.*, 2022) [17, 18]. These analyses ensured that the experimental diet was nutritionally balanced and that variations in proximate composition due to ginger and yeast supplementation could be accurately quantified.

Growth Performance: This includes Weekly body weight (g), Weekly feed intake (g) and Feed conversion ratio (FCR). The body weight was measured using sensitive scale of 0.1 g sensitivity. The feed intake was calculated by subtracting the feed leftover at end of the day from the feed given at the beginning of the day. The feed conversion ratio was calculated as the ratio of weight gain to feed intake.

Carcass Analysis

On the last day of the feeding trial, two birds from each treatment group (n=8) were selected based on their average

live weight, giving a total of eight birds for carcass characteristics. The selected broilers were fasted for twelve hours, with only access to drinking water. Each of the birds were tagged and weighed to determine the live weight prior to slaughter. Then, the birds were dipped in hot water (scalding) for approximately one minute to facilitate feather removal, and the plucked weight was recorded. The plucked birds were then eviscerated, and the eviscerated weights were recorded. The carcasses were subsequently divided into different cut-parts, including the back, breast muscle, drumsticks, head, neck, shanks, thighs, and wings. Internal organs, such as the gizzard, heart, kidney, liver, and lungs, were carefully excised, blotted free of blood and weighed using a sensitive scale.

The dressing percentage was calculated using the formula:

$$\text{Dressing percentage} = \frac{\text{Dressed weight}}{\text{Live weight}} \times 100\%$$

The weights of the organs and carcass cut-parts were recorded and expressed relative to the eviscerated weight of each bird.

Statistical Analysis

The data obtained at the end of the experiment were subjected to one-way Analysis of Variance (ANOVA) and differences in mean were separated using Duncan's Multiple Range Test (DMRT) at 5% level of probability. All statistical procedures were according with the aid of SAS package to (SAS, 2008).

Ethical treatment of animals' statement

All procedures and activities undertaken in this study were reviewed and approved by the Animal Care and Use Committee of Ambrose Alli University, Ekpoma, Edo State, Nigeria, and were conducted in accordance with the Committee's established guidelines.

Results and Discussion

Growth Performance of Broiler Chickens Fed Diets with Ginger Root Powder and Yeast Powder

Table 1 showed the growth performance of Arbor acre broiler chicken fed diets supplemented with ginger root powder (T_2), Yeast powder (T_3) and combination of ginger root and yeast powder (T_4) while T_1 served as control diet without the supplement. The results showed that the Average initial weight (AIN) did not show significant ($P>0.05$) differences across the treatment groups. The values ranged from 2939.29 ± 5.99 g in T1 to 2963.33 ± 46.6 g in T3 and T4. The final weight (AFWT) showed significant ($P < 0.05$) variation among the treatment groups with the highest value observed in T_4 (3760.00 ± 10.0 g), followed by T_3 (3366.67 ± 16.9 g) and T_2 (3333.33 ± 16.9 g), while T1 had the lowest value (3273.33 ± 23.3 g. The average weight gain (AWTG) results also showed significant ($P < 0.05$) differences with broilers fed T_4 had the highest average weight gain (113.81 ± 3.43 g), followed by T_3 (57.62 ± 8.85 g), T_2 (59.09 ± 7.23 g), and the least value in T_1 (47.73 ± 4.18 g). In addition, the average feed intake (AFINT) varied significantly ($P < 0.05$) across the groups. The broiler chickens placed on T_1 and T_2 had the highest feed intake (155.00 ± 2.87 g and 156.67 ± 4.41 g, respectively), while T_3 and T_4 had lower feed intake (150.00 ± 2.87 g and 140.00 ± 5.00 g, respectively). The Feed Conversion Ratio (FCR) showed significantly ($P < 0.05$) highest in broiler chickens offered T_1 (3.29 ± 0.22) followed by T_2 (2.76 ± 0.46), T_3 (2.75 ± 0.48) and the least in T_4 (1.233 ± 0.07).

Table 1: Growth Performance of Broiler Chickens Fed Diets with Ginger Root Powder and Yeast Powder

Parameter	T_1 (control)	T_2 (GRP)	T_3 (YP)	T_4 (GRP&YP)
Average initial Weight	2939.29 ± 5.99	2919.69 ± 110.6	2963.33 ± 46.6	2963.33 ± 18.6
Average Final weight	3273.33 ± 23.3^{b}	3333.33 ± 16.9^{b}	3366.67 ± 16.9^{b}	3760.00 ± 10.0^{a}
Average Weight Gain	47.73 ± 4.18^{b}	59.09 ± 7.23^{b}	5762 ± 8.85^{b}	113.81 ± 3.43^{a}
Average Feed Intake	155.00 ± 2.87^{a}	156.67 ± 441^{a}	150.00 ± 2.87^{b}	140.00 ± 5.00^{b}
Feed Conversion Ratio	3.29 ± 0.22^{a}	2.76 ± 0.46	2.75 ± 0.48^{a}	1.233 ± 0.07^{b}

[abc]Means in the same row with different superscripts are significantly different ($P<0.05$)

KEY: GRP: Ginger Root Powder; YP: Yeast Powder

Carcass Characteristics of Broiler Chickens Fed Diets Supplemented with Ginger Root Powder and Yeast Powder

The carcass characteristics of broiler chickens fed diets supplemented with ginger root powder and yeast powder are presented in Table 2.

The results showed that live weight was significantly ($p < 0.05$) affected by the dietary treatments. Birds in T_2 (4.600 kg) and T_3 (4.500 kg) recorded significantly ($p < 0.05$) higher live weights compared to T_1 (2.950 kg), while T_4 (3.700 kg) had intermediate values. A similar pattern was observed for slaughter weight, dressed weight, and eviscerated weight, where T_2 and T_3 consistently recorded significantly higher values than T_1.

Dressing percentage did not differ significantly ($p > 0.05$) among the treatments, although T_4 (94.779%) had the highest numerical value.

Among the cut-parts, neck weight was significantly ($p < 0.05$) influenced by the treatments, with T_2 and T_4 showing higher values compared to T_1. However, wing, thigh, drumstick, shank, breast, and back weights were not significantly ($p > 0.05$) affected by the dietary treatments.

Table 2: Carcass Characteristics of Broiler Chickens Fed Diets Supplemented with Ginger Root Powder and Yeast Powder

Parameter	T_1 (G/Y, 0%)	T_2 (GRP, 1%)	T_3 (YP, 1%)	T_4 (MGYP, 0.5:0.5%)
Live weight	2.950 ± 0.65^{b}	4.600 ± 0.10^{a}	4.500 ± 0.08^{a}	3.700 ± 0.30^{ab}
Slaughter weight	2.800 ± 0.60^{b}	4.400 ± 0.10^{a}	4.375 ± 0.08^{a}	3.550 ± 0.25^{ab}
Dressed weight	2.750 ± 0.65^{b}	4.300 ± 0.10^{a}	4.200 ± 0.82^{a}	3.500 ± 0.20^{ab}
Eviscerated weight	2.145 ± 0.29^{b}	3.628 ± 0.02^{a}	3.512 ± 0.07^{a}	2.933 ± 0.23^{a}

Dressing percent	92.874 ± 1.57	93.475 ± 0.14	93.327 ± 0.12	94.779 ± 2.28
Head	2.397 ± 0.34	2.168 ± 0.28	2.107 ± 0.12	2.176 ± 0.00
Neck	3.436 ± 0.18^{b}	4.436 ± 0.05^{a}	4.142 ± 0.19^{ab}	4.363 ± 0.19^{a}
Wing	8.289 ± 0.93	6.869 ± 0.02	7.314 ± 0.44	7.095 ± 0.17
Thigh	10.278 ± 0.58	12.193 ± 0.89	11.860 ± 0.43	10.840 ± 0.13
Drumstick	9.391 ± 0.69	9.415 ± 0.09	9.687 ± 0.18	9.158 ± 0.22
Shank	3.065 ± 0.37	3.074 ± 0.12	3.175 ± 0.16	3.118 ± 0.21
Breast	14.928 ± 14.89	11.029 ± 0.00	0.028 ± 0.00	0.032 ± 0.00
Back	12.428 ± 0.09	12.853 ± 0.27	12.469 ± 0.39	12.743 ± 0.01

^{abc}Means in the same row with different superscripts are significantly different (P<0.05)

KEYS:

T_1 (G/Y, 0%) = Control (Basal diet)

T_2 (GRP, 1%) = Ginger root powder

T_3 (YP, 1%) = Yeast powder

T_4 (MGYP, 0.5:0.5%) = Ginger root powder and yeast powder

Relative Organ Weights of Broiler Chickens Fed Diets Supplemented with Ginger Root Powder and Yeast Powder

The relative organ weights of broiler chickens fed the experimental diets are presented in **Table 3**. The results revealed that liver, kidney, heart, gizzard (full and empty), spleen, and intestine weights were not significantly ($p > 0.05$) affected by the dietary treatments. However, lung weight was significantly ($p < 0.05$) influenced by the treatments. Birds in T_1, T_2, and T_4 had similar lung weights, which were significantly higher than those in T_3.

The absence of significant differences in most organ weights indicates that supplementation with ginger root powder and yeast powder did not adversely affect internal organ development, suggesting that the diets were safe for the broiler chickens.

Table 3: Relative Organ Weights of Broiler Chickens Fed Diets Supplemented with Ginger Root Powder and Yeast Powder

Parameter	T_1 (G/Y, 0%)	T_2 (GRP, 1%)	T_3 (YP, 1%)	T_4 (MGYP, 0.5:0.5%)
Liver	2.248 ± 0.03	1.264 ± 0.84	1.613 ± 0.41	1.917 ± 0.14
Kidney	0.507 ± 0.15	0.544 ± 0.01	0.544 ± 0.03	0.423 ± 0.05
Heart	0.463 ± 0.10	0.424 ± 0.00	0.428 ± 0.02	0.473 ± 0.00
Gizzard (full)	2.766 ± 0.02	2.714 ± 0.35	2.457 ± 0.22	2.721 ± 0.22
Gizzard (empty)	1.711 ± 0.07	1.715 ± 0.37	1.617 ± 0.17	1.892 ± 0.17
Spleen	0.093 ± 0.04	0.130 ± 0.00	0.105 ± 0.02	0.109 ± 0.01
Intestine	4.397 ± 1.35	5.681 ± 0.90	5.746 ± 0.29	5.204 ± 0.32
Lungs	0.745 ± 0.01^{a}	0.673 ± 0.03^{a}	0.615 ± 0.04^{b}	0.659 ± 0.04^{a}

^{abc}Means in the same row with different superscripts are significantly different (P<0.05)

KEY:

T_1 (G/Y, 0%) = Control (Basal diet)

T_2 (GRP, 1%) = Ginger root powder

T_3 (YP, 1%) = Yeast powder

T_4 (MGYP, 0.5:0.5%) = Ginger root powder and yeast powder

Discussion

Growth Performance of Broiler Chickens Fed Diets with Ginger Root Powder and Yeast Powder

The growth performance of broiler chickens in response to dietary supplementation with ginger root powder and yeast powder was assessed by examining parameters such as initial and final weight, weight gain, feed intake, and feed conversion ratio (FCR). The results indicated that these additives significantly influenced the weight gain, final weight, and feed conversion efficiency, with a pronounced effect observed in T_4. The initial weight of broilers did not show significant differences between treatment groups, suggesting that the dietary treatments did not influence the birds' starting size which further implies there was no bias in selection or allocation of the different treatments to experimental birds. This finding is in consistent with previous studies that report similar initial weights among poultry birds before the introduction of dietary treatments (Yalçin *et al.*, 2020) [7]. This uniformity in initial weight across groups ensures that any subsequent differences observed in growth parameters could be attributed to the dietary treatments rather than initial size discrepancies. Significant differences in final body weight were observed, with T_4 outperforming all other groups. This result aligns with findings from previous research that indicates the positive impact of ginger supplementation on the growth of broilers. Ginger contains bioactive compounds such as gingerols and shogaols, which are known to improve digestion and nutrient absorption (Radwan *et al.*, 2018) [4]. Additionally, yeast powder is recognized for its probiotic properties, promoting gut health and enhancing nutrient utilization (Cao *et al.*, 2019) [2]. The combination of ginger root powder and yeast powder in T_4 may have synergistically boosted the birds' growth by improving their digestive efficiency and metabolic activity, leading to a higher final weight.

The weight gain data followed a similar pattern, with T_4 showing significantly higher weight gain compared to the other treatment groups. This supports the notion that dietary supplements such as ginger and yeast can stimulate growth in poultry by improving nutrient absorption and increasing feed efficiency. Studies have shown that ginger supplementation can enhance protein synthesis and accelerate growth in chickens by modulating metabolic pathways (Asad *et al.*, 2018) [19]. Yeast, particularly when used as a dietary supplement, has been shown to improve growth performance by enhancing the digestibility of feed ingredients and stimulating gut microbial populations that

aid in nutrient breakdown (Brosnan and Brosnan, 2009) [1]. Feed intake did not exhibit clear-cut differences as weight gain, but a notable pattern was observed. Higher feed intake was recorded in T_1 and T_2 compared to T_3 and T_4, which had lower feed consumption. However, the differences in feed intake alone do not fully explain the differences in weight gain or final weight. This could be due to the improved feed efficiency in T_3 and T_4, where the chickens converted their feed into body mass more effectively. The combination of ginger and yeast may have enhanced the birds' appetite regulation or gut health, which led to more efficient feed utilization, despite lower intake. This suggests that the birds in T_3 and T_4 were better at utilizing nutrients, a phenomenon often observed with probiotics and phytogenic feed additives (Tancharoen *et al*., 2017) [5]. The feed conversion ratio (FCR) is a critical indicator of feed efficiency in poultry farming. T_4, which received the combination of ginger root powder and yeast powder, had the best FCR, indicating superior feed utilization efficiency. A lower FCR suggests that the chickens in T_4 required less feed to achieve a unit of weight gain, which is a desirable trait in commercial poultry production. This finding is consistent with several studies that have shown that the inclusion of yeast or ginger in poultry diets can significantly improve feed conversion efficiency. Yeast supplementation has been shown to improve gut health and nutrient absorption, leading to better feed utilization (Yalçin *et al.*, 2020) [7]. Similarly, ginger has been reported to stimulate the secretion of digestive enzymes and improve metabolic processes, thus enhancing feed conversion (Radwan *et al.*, 2018) [4].

The results on carcass and relative organ weights clearly showed that supplementation significantly improved live weight, slaughter weight, dressed weight, and eviscerated weight, especially in birds fed T_2 (1% ginger) and T_3 (1% yeast), compared to the control group (T_1). This indicates that both ginger and yeast individually can enhance overall growth and carcass development, supporting previous findings that phytogenic and probiotic additives promote better performance in broilers (Qorbanpour *et al.*, 2018; Sahoo *et al.*, 2022) [11, 12].

The improved carcass traits observed in T_2 is likely due to the bioactive compounds in ginger root powder, such as gingerols and shogaols, which are known to stimulate digestive enzyme activity, improve nutrient absorption, and provide antioxidant benefits (Sahoo *et al.*, 2022) [12]. By improving digestion and reducing oxidative stress, ginger root powder enables birds to convert feed into body mass more efficiently, which explains the higher carcass weights. On the other hand, yeast supplementation in T_3 enhances intestinal health by promoting beneficial microflora and improving nutrient digestibility (Buba *et al.*, 2024; Elijah *et al.*, 2025) [8, 10]. These effects likely contributed to the higher live and slaughter weights observed in T_2 and T_3 birds compared to the control.

Qorbanpour *et al.* (2018) [11] reported that combining multiple feed additives does not always result in additive benefits. Consistent with this, the combination of ginger root powder and yeast powder in T_4 did not show the same level of improvement in carcass traits as the individual supplements. This suggests that at the inclusion levels used, interactions between the additives may have limited their effectiveness.

Dressing percentages were comparable across all treatments (92.87–94.78%), indicating that although body weight increased, the proportion of carcass relative to live weight remained stable. This suggests that the supplements mainly improved overall growth rather than altering carcass composition, which is important because consistent dressing percentages reflect balanced development of carcass components (Singh *et al.*, 2024) [14].

Most internal organs, including liver, kidney, heart, gizzard, spleen, and intestine, were not significantly affected by the dietary treatments. This indicates that the supplements did not cause any abnormal enlargement or physiological stress, supporting the safety of ginger and yeast at the levels used (Qorbanpour *et al.*, 2018) [11]. The minor differences observed in lung weight may reflect slight physiological adaptations to increased metabolic demand in rapidly growing birds rather than any negative effects.

A notable observation was that, certain carcass parts, such as the breast muscle, showed smaller increases in some treatments, particularly T_3 and T_4. This suggests that while overall growth improved, nutrient partitioning among different muscle groups may vary depending on the type and combination of supplement. Such variation emphasizes the need for careful optimization of inclusion levels to achieve specific carcass objectives.

Therefore, these findings demonstrate that dietary supplementation with ginger root powder and yeast powder can effectively enhance growth and carcass performance in broiler chickens without negatively affecting organ development. Birds receiving individual supplements at 1% inclusion (T_2 and T_3) showed the most pronounced improvements, highlighting the potential of these natural feed additives as safe, effective growth promoters in poultry production. Additionally, the results underline the importance of evaluating both individual and combined effects of supplements to optimize growth performance and carcass quality.

Conclusion

The inclusion of ginger root powder and yeast powder in broiler chicken diets had a significant impact on the growth performance including body weight, feed conversion ratio of Arbor acre broiler chicken. The combination of these two supplements in treatment T_4, improved the final weight, weight gain, and feed conversion ratio (FCR). The results on carcass analysis showed that supplementation with ginger root powder or yeast powder as in T_2 and T_3 significantly improved live weight, slaughter weight, dressed weight, and eviscerated weight compared to the control. The combination of the two additives in T_4 did not produce the same level of improvement, suggesting possible interaction effects at the inclusion levels used. Dressing percentages remained similar across all treatments, indicating proportional carcass development relative to live weight.

Most internal organs, including liver, kidney, heart, gizzard, spleen, and intestine, were not significantly affected by the dietary treatments, which indicates that the additives were safe and did not cause organ enlargement or physiological stress. Minor variations were observed in the neck, lungs, and breast muscle, suggesting selective effects on specific organs or carcass parts.

Therefore, the study demonstrated that dietary supplementation with ginger root powder and yeast powder

can enhance growth performance and carcass yield without negatively affecting organ development in broiler chickens.

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