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Effect of Capsicum Annum L. Powder on Growth Performance of Chicken Broilers

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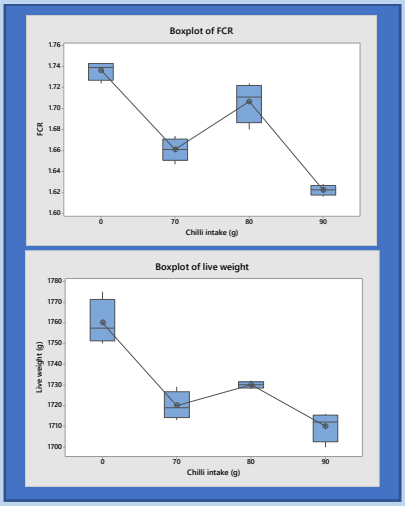
Abstract: Recently, there has been a growing interest in employing different growth promoters to improve the production of poultry meat. Antibiotics are one of the most popular growth promoters. Due to the adverse health implications of using antibiotics, there is increasing interest to find safe and natural alternatives to antibiotics. Therefore, this study aims to assess the effect of chili pepper powder on the growth of chicken broilers. In an open-sided broiler house, a total of 360 one-day-old Ross (600) chicks were randomly assigned to twelve floor pens of comparable size. Chili red pepper powder was added to the feed at 0.0% (control) (T1), 0.5% (T2), 1.0 %(T3), and 1.5 %(T4). The four treatments were assigned to pens completely at random (Completely Randomized Design). Chili red pepper reduced the body weight of broilers compared to the control treatment. Moreover, there was a negative correlation between the intake of hot red pepper and body weight. Feed intake also decreased by inclusion of red pepper. Treatment T4 exhibited a significantly greater feed conversion ratio (FCR) than the control (T1). In comparison to the control treatment, the plucked weights of all treatments (T2, T3, and T4) fed chile red pepper were considerably lower (1595, 1587, and 1577 vs. 1625, p <0.05). At slaughtering age (six weeks), the impact of chili pepper inclusion level on FCR was more noticeable than it was at other ages. Carcass weight and dressing percentage were significantly higher in the control group than in all other treatments. In conclusion, the inclusion of red chili pepper in broiler feed did not show a positive effect on growth performance. It seems that the addition of chili red pepper in the feed lowered the appetite of broiler chicks, which resulted in decreased feed intake.



Keywords: Chili Red pepper, Performance, Antibiotic, Broilers.

INTRODUCTION

Growth promoters are often employed in poultry production and have positive impacts on feed conversion, the growth, and overall health of birds. Antibiotics are common growth promoters in poultry production. For many years, the widespread use of antibiotics in chicken production has been to treat and improve animal health, growth rate, and feed conversion ratio [1]. Yet, the use of antibiotics in animal husbandry is associated with several health risks. Antibiotics are frequently used in the treatment of diseases in humans and animals. However, the European Commission banned their use as growth promoters in animal feed due to the emergence of microorganisms' resistance to them [2]. On the other hand, excluding the use of antibiotics in poultry feed had several adverse implications (e.g., reduction in growth performance and animal health) on poultry production [3].

Accordingly, the scientific community and animal producers are looking for safe alternatives to antibiotics as growth promoters. In this context, a huge number of studies investigated alternative growth promoters such as probiotics, prebiotics, organic acids, medicinal herbs (oregano, basil, and thyme), and essential oils [4-7]. The use of natural derived- products from various botanical parts is particularly gaining popularity. Due to their possible positive effects on feed conversion, birds' development, and overall health, these growth enhancers were frequently employed in poultry [8].

In this context, hot red pepper (containing capsaicin) was investigated as a growth promoter in poultry. Chili pepper (*Capsicum annum L.)* contains many functional ingredients that have a positive impact on human and animal health. Compared to other vegetables, the content of soluble phenolic compounds is very high in chili pepper [1]. It was found that the inclusion of chili peppers reduced the content of cholesterol and fat in the flesh of animals [9] as well as improved the vascular system in animals [10].

Several active ingredients of hot red pepper have been shown to have chemo-preventive and chemotherapeutic benefits [3]. These include flavonoids, capsaicinoids, and capsinoids. Recent studies tracking poultry performance have also produced

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these beneficial effects [11]. Vitamin C from chili peppers helps to improve growth by lowering heat stress [12].

One main active ingredient of capsicum oleoresin, which is made from red pepper (*Capsicum spp*.), is capsaicin. It has been shown to have analgesic, antioxidant, and antibacterial properties [13]. The elimination of antibiotics as growth promoters has resulted in issues with animal performance, a rise in the feed conversion ratio (feed to meat ratio), and an increase in some animal illnesses [4].

In the last few decades, there was progressive development in broiler production in Palestine, and it became the most important sector in animal production. The expense of feed and health care is one of the biggest issues facing broiler growers in Palestine. The majority of poultry ration ingredients are imported. Finding local feed supplies is necessary to reduce production costs, enhance animal health, and provide healthier meat and eggs. Since antibiotics are no longer used in animal feeding due to their contribution to microbial resistance, other growth promoters must be identified. Chili red pepper is widely grown in Palestine, and it is available at reasonable prices. Therefore, the aim of this study is to evaluate the impact of including different levels of hot red pepper powder in broiler feed on growth parameters.

MATERIALS AND METHODS

Study location and experimental design: The study was carried out at the farm of Deir Elgusun, Tulkarm, Palestine. In total, 360 one-day-old Ross (600) chicks were bought from the Palestine Poultry Company, a small local hatchery in Tulkarm, Palestine. The study was arranged in a completely randomized design (CRD). A conventional broiler house (open-sided) was divided into twelve floor pens of similar size. The 360-chicks were then randomly assigned to the twelve pens (30 chicks per pen). Each of the four feed treatments (T1, T2, T3, and T4) was randomly assigned to three pens (90 chicks per treatment).

Feed rations: Chili red pepper powder was added to the feed at 0.0% (control), 0.5%, 1.0%, and 1.5%, representing treatments T1, T2, T3, and T4, respectively. Feed and water were freely given to the chicks throughout the experimental period.

The chicks were reared on ten cm-deep wood shavings. Every day, litter moisture content was controlled; damp areas were eliminated, and fresh shavings were placed as needed. After seven days at 32 °C, the house temperature was dropped by 2.5 °C per week. The chicks received a standard light schedule, which included 24 hours of light for the first four days followed by 23 hours of light and 1 hour of darkness after that.

Table 1 displays the ingredients of the starter and grower feeds that were provided to broilers. Ad libitum feeding of starter and growth diets was done from week 1 to week 3 and week 4 to week 6, respectively. The Palestine Poultry Company provided the feed components. A standard cement mixer was used to mix all of the diets. Every week, body weight and feed consumption of chicks were measured. On the last day of each week, at the same time of day, the weights of the birds in treatment were recorded.

Table (1): Composition of the starter and grower feed (per kilo) that was employed in four treatments.

	T1 (0% chili pepper powder)		T2 (0.5% chili pepper powder0		T3 (1% chili pepper powder)		T4 (1.5 chili pepper powder)	
Ingredients (g)	**Starter**	**Grower**	**Starter**	**Grower**	**Starter**	**Grower**	**Starter**	**Grower**
Yellow corn	316	351	316	351	316	351	316	351
Soybean meal	330	279	330	279	330	297	330	279
Wheat	220	220	215	215	210	210	205	205
Sunflower	50	60	50	60	50	60	50	60
Chili pepper	0	0	5	5	10	10	15	15
Oil	41	52	41	52	41	52	41	52
DCP	16.5	14	16.5	14	16.5	14	16.5	14
Limestone	13	11.5	13	11.5	13	11.5	13	11.5
NaCl	2	2	2	2	2	2	2	2
Premix	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
DL-methionine	2.5	1.9	2.5	1.9	2.5	1.9	2.5	1.9
L- lysine	4.5	4	4.5	4	4.5	4	4.5	4
Threonine	1	0.4	1	0.4	1	0.4	1	0.4
Sodium bicarbonate	1	1	1	1	1	1	1	1
Calculated composition								
Crude protein	220	200	220	200	220	200	220	200
Lysine	110	110	110	110	110	110	110	110
Methionine	55	56	55	56	55	56	55	56
Ca	100	110	100	110	100	110	100	110
Available P	46	47	46	47	46	47	46	47
ME, MJ/ kg ration	704	718	704	718	704	718	704	718

Chili red pepper powder was added to the feed at 0.0% (control), 0.5%, 1.0%, and 1.5%, representing treatments T1, T2, T3, and T4, respectively.

Preparation of the chili pepper meal: The chili pepper meal was gathered from the neighborhood marketplace. In Kadoorie Agricultural Research Center, it was ground after being dried for a day at 65°C in an oven. Table 2 displays the crude protein, crude fiber, crude fat, and crude ash levels of the chili pepper powder, which were measured using techniques recommended by the Association of Official Analytical Chemists [14]. Using an air oven, the moisture content was calculated by measuring the amount lost during drying. The quantity of ash was determined by using a muffle furnace to burn the sample for four hours at 525 °C. Fat was determined using petroleum ether extraction method. A fiber was measured by quantification of the amount of nondigestible carbohydrates (total crude fiber) by weighing the sample's residual weight following acidic digestion in H2SO4 solution at 90 °C and alkali digestion in NaOH solution at 90 °C. The Kjeldahl approach was used to determine the

protein content. Prior to being included in the feed, the chili pepper meal was kept in plastic bags.

Table (2): Chemical analysis of chili pepper meal as dry matter basis

Chemical analysis	Chili pepper meal
Crude protein (%)	13.65
Crude fiber (%)	14.45
Crude fat (%)	1.6
Crude ash (%)	1.2

Growth performance: Weekly measurements of body weight and feed intake were made, and feed conversion ratio and body gain were then computed.

Feed consumption (gram/bird/week): The amount of feed consumed was determined weekly for each treatment. The remaining quantity of feed was weighed at the end of the week and deducted from the initial weight of feed. Feed consumption was calculated by dividing the amount of feed consumed by the number of birds in each pen.

Body weight and gain (gram/bird/week): Body weight was recorded at the start of the experiment and then once again at the same time every week for ten randomly selected chicks. By subtracting the live weight at the start of the week from the live body weight of the next week, the gain in weight was determined.

Feed conversion ratio (grams feed/gram gain): The quantity of feed consumed per unit of body gain (average weekly feed consumption (g)/average weekly gain (g)) was used to compute feed conversion ratio each week.

Visceral organs and carcass cuts: Ten randomly-selected birds per pen were manually killed at 42 days of age by partially cutting the neck and cutting the carotid arteries. Each bird was weighed and numbered before slaughter.

Dressing, giblets, and fat pad% were then measured as follows:

Dressing% = Carcass weight/Live weight *100

Giblets% = Liver + gizzard + heart weight/live weight*100

Fat Pad% = Fat Pad weight/live weight*100

By dividing the eviscerated weight by the live weight, the carcass yield was determined. In addition to being weighed and expressed as a percentage of live body weight, the visceral organs (liver, gizzard, heart, proventriculus, and small intestine) and abdominal fat were closely inspected for any signs of pathological damage or lesions. The percentage of carcass weight was used to measure the carcass portions.

Statistical analysis: The data were analyzed by ANOVA using the general linear procedure of SPSS software 24.0 (IBM, Armonk, NY, USA). Differences among treatment means in measured parameters were tested using the LSD procedure and considered significant when $p < 0.05$.

RESULTS AND DISCUSSION

The results related to the effect of chili red pepper on live weight at different rearing times are shown in Table 3. In general, there were significant differences in live weights between treatments. Overall results showed that the inclusion of chili red pepper in poultry feed significantly reduced the live weights of the birds compared to the control (in particular from week 2 to 6). Overall, our findings showed that the live weights of birds in the control treatment were significantly higher than in other treatments. There was a significant negative correlation between chili pepper intake and live weight (Table 3). In general, these results may be attributed to a reduction in feed intake (see Table 5) and an increase in feed conversion ratio (Table 6) as the level of chili pepper increased. In this context, previous studies showed that feeding poultry with chili pepper improved growth performance [15]. Other studies showed that the addition of hot pepper to poultry feed had no impact on growth performance [16, 17]. Our results were in agreement with Dozier III et al. [18], who found a negative impact on body weight. El-Husseiny et al. [19] observed similar results on body weight.

The effect of chili pepper on the growth performance depends on the content of capsaicinoids and other related functional components. Jeeatid et al. [20] found that the content of capsaicinoids was associated with light intensity and the type of cultivars. Body weight increased by the addition of chili pepper (1.5% to 3%) to the feed of poultry [15]. Similar results were observed by several studies [21, 22]. In our study, the inclusion level of chili pepper was lower than mentioned in these studies. Overall, the differences in the results between studies may be attributed to differences in the composition and hygienic conditions of the chili pepper used [20]. It is possible that the small ratios of hot peppers added to experimental broiler diets in earlier studies weren't sufficient to accurately depict the mechanism of action [23]. No detrimental effects on quail production performance were observed when 1.0% black pepper was added to the diet [24], while Sayeed et al. [25] observed an effect on growth performance when black pepper was added to quail diet at a 2% level. On the other hand, Özer et al. [26] found that including low-dose hot red pepper into the cock diet within the first five months decreased weight gain compared to control.

Table (3): Effects of different inclusion levels of chili pepper in the feed on live weight at different rearing intervals.

Parameters	T1 Mean± SD	T2 Mean± SD	T3 Mean± SD	T4 Mean± SD
LW1	118±2.8^{a}	120±7.5^{a}	115±5.3^{a}	105±3.3^{b}
LW2	270±5.1^{a}	260±5.1^{b}	250±5.6^{c}	245±2.9^{c}
LW3	425±8.2^{a}	420±7.1^{ab}	410±7.5^{cb}	400±8.2^{c}
LW4	820±10.8^{a}	790±4.1^{b}	730±7.1^{c}	700±5.6^{d}
LW5	1190±5.7^{a}	1150±7.2^{b}	1130±10.8^{c}	1100±5.1^{d}
LW6	1760±10.8^{a}	1720±6.7^{b}	1730±1.6^{b}	1710±7.1^{c}
Starter	425±8.2^{a}	420±7.1^{ab}	410±7.5^{cb}	400±8.2^{c}
Grower	1190±5.7^{a}	1150±7.2^{b}	1130±10.8^{c}	1100±5.1^{d}

M = mean, n = 90/treatment, SD =standard deviation. Different letters in the same row indicate significant differences ($p < 0.05$). Chili red pepper powder was added to the feed at 0.0% (control), 0.5%, 1.0%, and 1.5%, representing treatments T1, T2, T3, and T4, respectively. "W" indicates week.

The correlations between chili red pepper intake and live weight of birds at different rearing periods are shown in Table 4. Overall results showed that there were significant negative correlations between chili pepper intake and live weight of birds. These results were in agreement with previous results obtained by our study (Table 4). It seems that the inclusion of chili pepper reduced feed intake.

Table (4): Correlation between chili pepper intake and live weight of birds at different rearing intervals.

	LW1	LW2	LW3	LW4	LW5	LW6
Chili red pepper intake	0.127	0.777**	0.426*	0.842**	0.870**	0.895**

**Correlation is significant at p<0.01

*Correlation is significant at p<0.05. "L" indicates live weight and "W" indicates week.

Feed intake was significantly affected by the addition of red chili pepper (Table 5). The addition of chili red pepper reduced significantly the feed intake, in particular in treatment (T4). It was clear that the effect of chili pepper on feed intake was stronger in the early period of rearing (W1-4) than in the late period of rearing (W5-6). Feed intake was decreased by increasing the inclusion levels of chili pepper in broiler feed in both starter and grower periods. Our results were in agreement with previous studies. Several researchers found that hot pepper reduced feed intake [18, 27]. The reduction in feed intake was attributed to the change in the feed taste [28]. On the other hand, some researchers found that hot peppers led to an increase in the feed intake [15]

Table (5): Effects of different inclusion levels of chili pepper in the feed-on-feed intake at different rearing intervals.

Feed intake (g)	T1 Mean±SD	T2 Mean±SD	T3 Mean±SD	T4 Mean±SD
W1	5.1^{a}±160	2.8^{b}±150	4.3^{b}±150	3.5^{c}±140
W2	2.9^{a}±315	5.0^{b}±300	3.5^{b}±305	4.3^{c}±280
W3	4.1^{a}±375	5.1^{b}±350	4.5^{c}±340	2.4^{d}±330
W4	3.5^{a}±680	5.7^{b}±660	2.9^{c}±650	7.1^{d}±630
W5	8.1^{a}±860	5.7^{a}±850	8.5^{b}±820	5.1^{c}±800
W6	5.1^{a}±990	2.8^{a}±990	5.9^{a}±990	3.5^{b}±980
Starter	4.1^{a}±375	5.1^{b}±350	4.5^{c}±340	2.4^{d}±330
Grower	8.1^{a}±860	5.7^{a}±850	8.5^{b}± 820	5.1^{c}±800

M = mean, *n* = 90/treatment, SD =standard deviation. Different letters in the same row indicate significant differences ($p < 0.05$). Chili red pepper powder was added to the feed at 0.0% (control), 0.5%, 1.0%, and 1.5%, representing treatments T1, T2, T3, and T4, respectively. "W" indicates week.

The results related to the effects of different inclusion levels of chili pepper on feed conversion ratio (FCR) at different rearing intervals are shown in Table 6. Treatment T4 had a significantly higher feed conversion ratio (FCR) compared to the control group (T1) at all rearing intervals. The effect of inclusion levels of chili pepper on FCR was more apparent at slaughtering age (six weeks) than in other periods. At slaughter age, all treatments exhibited significantly higher FCR compared to the control. By considering the starter period, there were no significant differences in FCR between treatments except treatment T4. Regarding the grower period, FCR in treatments T2, T3 and T4 was significantly higher than in treatments T1. Some authors observed a positive impact for hot pepper on FCR [15, 17, 29, 30] while other authors did not find significant impact [31]. On the other hand, the inclusion of hot pepper poultry feed showed a negative impact on FCR when birds were reared at stocking densities ranging from 13.5 to 21.5 birds/m2 [18].

Table (6): Effects of different inclusion levels of chili pepper in the feed on feed conversion ratio (FCR) at different rearing intervals.

FCR	T1 Mean±SD	T2 Mean±SD	T3 Mean±SD	T4 Mean±SD
W1	1.26±.04c	1.27±.02c	1.36±.03b	1.43±.04a
W2	1.70±.03b	1.75±.05b	1.75±.01b	1.82±.03a
W3	1.91±.04b	1.91±.04ab	1.92±.04ab	1.97±.01a
W4	1.64±.02d	1.87±.01c	1.98±.02b	2.05±.01a
W5	1.94±.1c	2.01±.02b	2.00±.01b	2.05±.01a
W6	2.05±.1c	2.09±.02b	2.09±.01b	2.12±.01a
Starter	1.66±.03b	1.64±.02b	1.65±.04b	1.74±.02a
Growers	1.89±.01c	1.99±.03b	2.02±.04b	2.07±.01a

M = mean, *n* = 90/treatment, SD =standard deviation. Different letters in the same row indicate significant differences ($p < 0.05$). Chili red pepper powder was added to the feed at 0.0% (control), 0.5%, 1.0%, and 1.5%, representing treatments T1, T2, T3, and T4, respectively. "W" indicates week..

All treatments (T2, T3, T4) fed with chili red pepper had significantly lower plucked weight (1595, 1587, and 1577 vs. 1625, $p<0.05$) than the control treatment (T1), respectively (Table 7). A similar pattern was also observed for live weight. Birds in the control treatment showed heavier carcass weight and higher dressing yield than other treatments. Regarding dressing%, our results were in agreement with Abdo et al. [27] who observed a decrease by addition of hot pepper. On the contrary, it was found that inclusion of hot red pepper to broiler diet improved dressing percentage. El-Husseiny et al.[19] observed similar results of dressing%. Eldeeb et al. [29] showed that enriching broiler feed with capsicum improved carcass weight. In addition, many researchers revealed that the inclusion of red pepper in broiler feed had no impact or reduced the percentage of dressing [32].

Table (7): Effects of different inclusion levels of chili pepper in the feed on plucked, live, and carcass weight as well as dressing% at different rearing intervals.

Parameters	T1 Mean±SD	T2 Mean±SD	T3 Mean±SD	T4 Mean±SD
Plucked weight (g)	2.7^{a}±1625	2.9^{b}±1595	2.9^{c}±1587	3.7^{d}±1577
Live weight (g)	10.8^{a}±1760	6.7^{bc}±1720	1.6^{b}±1730	7.1^{c}±1710
Carcass weight (g)	1.6^{a}±1205	2.7^{b}±1170	2.9^{c}±1160	2.7^{c}±1160
Dressing (%)	$.49^{a}$±68.46	$.42^{b}$±67.73	$.06^{b}$±67.62	$.40^{b}$±67.83

M = mean, *n* = 90/treatment, SD =standard deviation. Different letters in the same row indicate significant differences ($p < 0.05$). Chili red pepper powder was added to the feed at 0.0% (control), 0.5%, 1.0%, and 1.5%, representing treatments T1, T2, T3, and T4, respectively. "W" indicates week.

The effect of different levels of chili red pepper on organ weights and organ yields is shown in Table 8. Except for the liver, the inclusion of red chili pepper in chicken feed resulted in a significant reduction in the weight of organs as well as in the yield in comparison to the control. In this context, it was found that the liver, heart and abdominal fat decreased by the addition of hot pepper in poultry feed [27]. Several studies showed that the inclusion of red pepper in broiler feed had no impact or reduced the weights of heart, liver, gizzard, and abdominal fat [32].

Table (8): Effects of different inclusion levels of chili pepper in the feed on the weight and yield of organs as well as abdominal fat at 6 weeks of slaughtering age.

Weight (g)/%	T1 Mean±SD	T2 Mean±SD	T3 Mean±SD	T4 Mean±SD
Liver	$.9^{b}$±41.1	1.1^{b}±41.2	$.4^{a}$±42.7	$.4^{b}$±41.2
Heart	$.2^{a}$±11.5	$.2^{c}$±10.9	$.2^{bc}$±11.2	$.1^{ab}$±11.3
Gizzard	$.2^{a}$±18.6	$.2^{b}$±17.7	$.3^{b}$±17.4	$.1^{c}$±16.9
Abdominal fat	$.21^{a}$±29.2	$.17^{b}$±28.4	$.5^{b}$±27.9	$.2^{c}$±27.2
Liver (%)	$.06^{c}$±3.43	$.08^{b}$±3.53	$.02^{a}$±3.64	$.02^{b}$±3.55
Heart (%)	$.01^{ab}$±.95	$.01^{b}$±.94	$.01^{ab}$±.95	$.01^{a}$±.97
Gizzard	$.02^{a}$±1.54	$.01^{b}$±1.47	$.02^{b}$±1.44	$.00^{c}$±1.40
Abdominal fat (%)	$.01^{a}$±2.42	$.01^{b}$±2.35	$.04^{b}$±2.31	$.01^{c}$±2.26

M = mean, *n* = 90/treatment, SD =standard deviation. Different letters in the same row indicate significant differences ($p < 0.05$). Chili red pepper powder was added to the feed at 0.0% (control), 0.5%, 1.0%, and 1.5%, representing treatments T1, T2, T3, and T4, respectively. "W" indicates week.

The weight and yield of carcass cuts were significantly affected by the addition of chili red pepper to chicken feed (Table 9). Employing chili red pepper in chicken feed resulted in a reduction in the weight and yield of carcass cuts compared to the control group. These results may be attributed to the reduction in carcass weight and dressing yield by the addition of chili red pepper to chicken feed. Shahverdi et al. [33] revealed that addition of hot red pepper to the broiler diet improved the weight of the liver, drumstick, breast meat, gizzard, heart, and spleen while abdominal fat was decreased.

Table (9): Effects of different inclusion levels of chili pepper in the feed on the weight and yield of carcass cuts up at 6 weeks of slaughtering age..

Weight (g)/%	T1 Mean±SD	T2 Mean±SD	T3 Mean±SD	T4 Mean±SD
Whole breast	4.3^{a}±317	2.1^{b}±309	2.7^{b}±311	2.4^{b}±310
Whole leg	3.5^{a}±183	1.7^{b}±177	1.7^{b}±178	2.7^{b}± 176
Drumstick	1.3^{a}±88	$.81^{ab}$±87	$.5^{b}$±86	1.7^{b}±85
Thigh	2.5^{a}±95	1.2^{b}±90	1.7^{b}±92	1.5^{b}±91
Wing	1.2^{a}±67	1.2^{b}±64	1.3^{b}±63	1.7^{b}±64
Whole breast (%)	$.4^{a}$±26	$.17^{b}$±25	$.2^{b}$±25	$.3^{b}$±25
Whole leg (%)	$.3^{a}$±15	$.1^{b}$±14	$.1^{b}$±14	$.2^{b}$±14
Drumstick (%)	$.1^{a}$±7.3	$.06^{ab}$±7.2	$.1^{b}$±7.1	$.1^{b}$±7.1
Thigh (%)	$.2^{a}$±7.9	$.1^{b}$±7.5	$.1^{b}$±7.6	$.1^{b}$±7.6
Wing (%)	$.1^{a}$±5.6	$.1^{b}$±5.3	$.1^{b}$±5.3	$.1^{b}$±5.4

M = mean, *n* = 90/treatment, SD =standard deviation. Different letters in the same row indicate significant differences ($p < 0.05$). Chili red pepper powder was added to the feed at 0.0% (control), 0.5%, 1.0%, and 1.5%, representing treatments T1, T2, T3, and T4, respectively. "W" indicates week.

CONCLUSION

In conclusion, the inclusion of chili red pepper in chicken feed did not show a positive effect on growth performance. The addition of chili red pepper in broiler feed lowered the appetite of chicks, which resulted in lower feed intake. This may explain the reduction in growth parameters. In general, there was no agreement between the previous studies on the effect of including red pepper in broiler diets on growth performance. The majority of studies showed a positive effect while others showed negative or no effect. These differences may be attributed to differences in rearing conditions (such as cage density, composition of feed, feeding regime, etc.), genotypes, the characteristics of red-hot pepper (the content of functional ingredients such as vitamin C and capsicum), and inclusion level. Further studies are needed to consider all these aspects.

DISCLOSURE STATEMENT

- **Ethics approval and consent to participate:** Not applicable
- **Consent for publication:** Not applicable
- **Availability of data and materials:** All collected data during this study was used to present the obtained findings in the body and illustrations of this manuscript.
- **Author's contribution:** The authors confirm contribution to the paper as follows: study conception and design: SM, IB; theoretical calculations and modeling: SM, IB; data analysis and validation, SM, IB; draft manuscript preparation: SM, IB. All authors reviewed the results and approved the final version of the manuscript.
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