

Replacing corn with Germinated Wheat in broiler chicken diets and its effect on carcass Traits and dressing percentage

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Abstract:

This study was conducted to determine the effect of replacing corn with germinated and non-germinated Wheat, either completely (100%) or partially (50%), in the diets of broiler chickens at the main and secondary carcass cuts, on dressing percentage, and on the weight of eaten and uneaten offal. One hundred and twenty one-day-age Rss308 chicks were used and randomly distributed into five treatments with three replicates per treatment (8 chicks/replicate). The treatments included treatment (T1), fed a standard diet; treatment (T2), replacing 50% of corn with non-germinated Wheat; treatment (T3), replacing 50% of corn with Germinated Wheat and treatments (T4) and (T5), replacing 100% of corn with non-germinated Wheat and Germinated Wheat, respectively. The experiment lasted 42 days. The results showed a significant improvement ($P \leq 0.05$) in birds' weight before slaughter, it was significantly higher for treatments (T3) and (T5), reaching (1991.67 and 1989.00) grams per bird, respectively. Similarly, ($P \leq 0.05$) there was a significant difference in post-slaughter weights, with (1691.00 and 1740.67) grams per bird, respectively, for the same two treatments. Treatments (T3), (T4), and (T5) also showed a significant difference in the dressing percentage, reaching (89.52, 83.66, and 89.84)%, respectively. Furthermore, treatments (T3) and (T5) showed a significant difference ($P \leq 0.05$) in the main cut weights (breast and thigh), with breast weights (559.33 and 570.66) grams, respectively. Similarly, thigh weight was recorded at 460.00 and 450.33 g respectively for the two treatments mentioned. Neck weight showed a significant increase ($P \leq 0.05$) in treatment T3, reaching 55.67 g compared to the control treatment (57.33 g). Likewise, both spleen and thymus gland weight showed significant increases ($P \leq 0.05$) in the treatments where germinated and non-germinated Wheat were fully or partially replaced with corn. The thymus gland weights for treatments T3, T4, and T5 were 0.362, 0.397, and 0.345 mg per bird, respectively, indicating improved bird health and disease resistance.

Keywords: Germinated Wheat, carcass Traits, dressing percentage

Introduction:

Poultry diets are among the most important factors for the success of the poultry industry, as they constitute 60-70% of the total breeding and production costs [15]. Feed is the main source of energy, protein, minerals, and vitamins necessary for the growth of broiler chickens [8]. With the increasing global demand for poultry products as a high-quality protein source, the need to improve feeding methods and techniques has grown. This

includes enhancing the quality and composition of diets, using feed alternatives [19], adding feed additives, and replacing expensive diet components with less costly alternatives [6] without compromising animal health or meat quality [13]. Corn is a key component of poultry feed, but due to its limited production, reliance on imports, and high cost, researchers have sought to replace it with various grains unsuitable for human consumption, such as wheat [1]. This is

achieved through processing such as fermentation [12] enzyme addition [17] and the addition of organic acids [4]. The study aimed to improve the nutritional value of wheat by increasing protein and carbohydrate content and reducing the inhibitory effects of wheat using Germinated Wheat technology and partially or completely replacing corn in broiler chicken diets. This was achieved by using Germinated Wheat technology and partially or completely replacing corn in the diet without harming animal health or meat quality. Germinated Wheat is a good alternative due to its energy, protein, and essential amino acid content; however, its use (non-germinated wheat) is limited because it contains nutritional inhibitors such as xylanes, phytates, and others that hinder the digestion and absorption of essential nutrients and minerals for bird growth [1]. Therefore, the experiment was designed to study the effects of adding germinated and non-germinated Wheat on the main cuts. [3,14] Secondary in Broiler chickens.

Materials and Methods

I. Germination: The germination process was conducted according to Al-Kaiesy (2000) and Muhammad (2000). In brief, it involves washing and soaking the seeds for 14 hours, then placing them on a canvas cloth, covering them with another piece, and ensuring sufficient moisture to complete the germination process. This takes place at a temperature of 25°C for 120 hours. The resulting seed is then collected, dried for 5 days under sun, ground, and added to the feed.

II. Chemical Analysis: Chemical analysis of germinated and non-germinated seeds was conducted at the Scientific Research commission /Agricultural Research Center. The protein, fat, and carbohydrate percentages before germination were 10.28%, 2.2%, and 76.14%, respectively. After germination, the percentages were 11.81%, 1.89%, and 77.775%, respectively.

III. Design Experiment: This experiment was conducted at the poultry farm of the Animal and Fish Resources Department, Agricultural Research Center, Scientific Research commission, from October 15, 2025, to November 30, 2025. One hundred and twenty-one-day-old Ross 308 broiler chickens were used, raised in pens and divided into five treatments (3 replicates per treatment) with eight chicks per replicate. The average initial weight per bird was 41 grams. Enrofloxacin was administered on the first day to prevent omphalitis (inflammation of the navel). Ad-libitum feed was then provided, supplemented with four levels of wheat. The experimental diet (control diet) for the first treatment was prepared as shown in Table 1. The second treatment included 30% non-germinated Wheat and 30% corn. The third treatment included 30% Germinated Wheat and 30% corn. The fourth treatment included T5 involved adding 60% non-germinated Wheat and completely replacing it with corn. At the end of the experiment, broiler chickens were weighed, and three birds per treatment were slaughtered to obtain the post-slaughter weight, main and secondary cut weights, and the dressing percentage, calculated according to the equation provided by [5].

Dressing percentage (excluding internal organs) = {Cleaned carcass weight (g) / Live weight (g)} * 100.

The weights of the heart, liver, gizzard, breast, thigh, wings, neck, and back were also recorded.

IV. Statistical analysis of the experimental results was performed using the SAS statistical software (2001). The effect of the treatments on the studied traits was determined using a Complete Randomized Design (CRD). The means of each trait were compared using Duncan's multiple range test at a probability level of ($P \leq 0.05$) to determine the significance of the differences between them. Averages (Duncan, 1955).

Table (1) Calculated percentages and chemical composition of the diet used in the study

components	T1	T2	T3	T4	T5
corn	60	31	31	5	5
Wheat	-	30	30	60	60
Soybean meal (CP) (44%)	28	25	25	21	21
Protein concentrate (1)	10	10	10	10	10
Oil	1	3	3	3	3
Calcium carbonate (limestone)	1	1	1	1	1
Table salt	0.3	0.3	0.3	0.3	0.3
Total	100				
Calculated chemical analysis (2)					
Metabolizable energy (kcal/kg)	2946	2984	2984	2962	2962
Crude protein %	21.54	21.79	21.79	21.47	21.47
Methionine + Cysteine %	0.64	0.80	0.64	0.80	0.80
Lysine %	0.81	0.80	0.80	0.80	0.80
Available phosphorus %	0.62	0.62	0.62	0.62	0.62

The chemical composition of the experimental diets was calculated based on N.R.C. (1994).

Results and Discussion:

Table (2) indicates a significant superiority ($p \leq 0.05$) in treatments T5 and T3 (50% and 100% replacement with Germinated Wheat), where these treatments recorded live weights of (1991.67 and 1989.00) g/bird, respectively, and post-slaughter weights of (1691.00 and 1740.67) g/bird, and dressing percentages of

(89.52% and 89.84%), respectively, compared to T1 (control treatment) and T4 and T2 (non-Germinated Wheat treatments), which recorded live weights of (1877.33, 1881.33, and 1855.67) g/bird, post-slaughter weights of (1510.00, 1696.00, and 1616.33) g/bird, and dressing percentages of (82.14%), 85.74% and 83.66% respectively.

Table (2) Effect of replacing Germinated Wheat partially or completely with corn on the dressing percentage of broiler chickens at 42 days of age (mean $\pm$ standard error).

treatments	live body weight (g)	Weight slaughter (g) after	Dressing percentage
T1	1877.33 $\pm$ 303.33 ab	1510.00 $\pm$ 151.16 b	82.14 $\pm$ 4.53 b
T2	1881.33 $\pm$ 136.51 b	1696.00 $\pm$ 107.70 b	85.74 $\pm$ 1.29 a
T3	1991.67 $\pm$ 204.48 a	1691.00 $\pm$ 173.27 a	89.52 $\pm$ 0.29 ab
T4	1855.67 $\pm$ 212.10 b	1616.33 $\pm$ 175.12 a	83.66 $\pm$ 1.12 ab

T5	1989.000 ±286.56 a	1740.67 ±249.76 b	89.84 ±0.13 ab
Significant level	*	*	*

T1 Control treatment (no additives), T2 Addition of 30% non-germinated Wheat + 30% corn, T3 Addition of 30% Germinated Wheat + 30% corn, T4 Replacement of 60% non-germinated Wheat, T5 Replacement of 60% Germinated Wheat. Different letters within the same column indicate significant differences between treatments. * means significant differences. N/A means no significant differences.

Germinated Wheat is one of the most important procedures for increasing its nutritional value, as wheat contains many nutrient inhibitors. Sprouting reduces the activity of these inhibitors, increases crude protein, and improves its quality due to the increase in free amino acids [7]. This may be due to the fact that the germination process increases the activity of certain enzymes, such as proteases and lipases [16] or to an increase in free amino acids like leucine, phenylalanine, and threonine [10] which are more easily and quickly absorbed in the bird's digestive tract. Alternatively, the increase in live weight may be due to the increased activity of antioxidants (tocopherols and beta-carotene), which positively impacts the bird's health [2]. This aids in the building of body proteins and the efficient utilization of ingested nutrients. All of this is reflected in the post-slaughter weight and dressing percentage. This is evident in the T5 and T3 treatments, which recorded the highest dressing percentages. This aligns with the findings of Al-Fayyad and Naji [5] who indicated that the dressing percentage increases with increasing live weight of the birds. Our study results are also consistent with those of [13] who recorded an increase in live weight and dressing percentage in birds

fed a diet where wheat replaced corn after various treatments. While T2 and T4, which received non-germinated wheat instead of corn in diet, recorded non-significant ($p \leq 0.05$) data in compared with control group (T1).

To detect the effect of partially or completely replacing Germinated Wheat with corn on the weights of the main (breast and thigh) and secondary (neck, wing, and back) carcasses of Broiler chickens, Table (3) mention the experiment data. A significant difference ($P \leq 0.05$) was observed in the weight of the breast cut in treatments T3 and T5, which recorded (559.33 and 570.66) g respectively, compared to the control treatment T1 and the non-germinated Wheat treatments T2 and T4. Similarly, the weight of the thigh cut showed a significant difference ($P \leq 0.05$) in the same two treatments mentioned above, T3 and T5, recording (460.00 and 450.00) g respectively, compared to the control treatment T1, which recorded 397.33 g, and treatments T2 and T4, which recorded (440.33 and 425.33) g respectively. The neck weight in treatment T3 (55.67) also showed a significant difference ($P \leq 0.05$) compared to the other treatments. In the treatments, wing and back weights did not show any significant difference ($P \leq 0.05$) compared to the control treatment.

Table (3) shows the effect of partially or completely replacing Germinated Wheat with corn on the weights of the main (breast and thigh) and secondary (neck, wing, and back) carcasses of Broiler chickens at 42 days of age (mean $\pm$ standard error).

treatments	Breast weight	Thigh weight	Neck weight	Wing weight	Back weight
T1	450.66 $\pm$ 60.36 b	397.33 $\pm$ 60.25 b	57.33 $\pm$ 1.45 b	125.67 $\pm$ 1.86	255.22 $\pm$ 21.12
T2	475.33 $\pm$ 37.16 ab	440.33 $\pm$ 2.72 ab	60.67 $\pm$ 0.17 ab	141.33 $\pm$ 22.37	286.60 $\pm$ 33.58
T3	559.33 $\pm$ 66.33 a	460.00 $\pm$ 51.73 a	55.67 $\pm$ 11.7 a	160.00 $\pm$ 18.87	258.97 $\pm$ 24.89
T4	488.33 $\pm$ 74.82 ab	425.33 $\pm$ 52.61 ab	59.67 $\pm$ 4.91 ab	151.00 $\pm$ 6.02	251.60 $\pm$ 6.01
T5	570.66 $\pm$ 90.08 a	450.33 $\pm$ 41.57 a	57.67 $\pm$ 8.17 b	162.00 $\pm$ 22.06	260.34 $\pm$ 95.19
Significant level	*	*	*	N.S	N.S

T1 Control treatment (no additives), T2 Add 30% non-germinated Wheat + 30% corn, T3 Add 30% Germinated Wheat + 30% corn, T4 Replace 60% non-germinated Wheat, T5 Replace 60% Germinated Wheat. Different letters within the same column indicate significant differences between treatments. * means significant differences. N/A means no significant differences.

Regarding the weights of edible internal organs in the carcass, Table (4) shows the effect of germinated and non-germinated Wheat, indicating numerical differences between the treatments compared to the control treatment

Table (4) Effect of partially or completely replacing Germinated Wheat with corn on the weights of edible internal organs (liver, heart, gizzard) of 42-day-old broiler chickens (mean $\pm$ standard error).

treatments	liver,	heart	gizzard
T1	48.67 $\pm$ 6.93	10.00 $\pm$ 1.02	32.66 $\pm$ 1.45
T2	60.33 $\pm$ 10.71	15.00 $\pm$ 2.31	31.66 $\pm$ 3.66
T3	51.33 $\pm$ 8.35	12.67 $\pm$ 1.45	32.67 $\pm$ 1.20
T4	51.33 $\pm$ 7.42	12.00 $\pm$ 1.00	30.00 $\pm$ 1.15
T5	56.33 $\pm$ 7.88	12.33 $\pm$ 1.45	29.00 $\pm$ 1.00
Significant level	N.S	N.S	N.S

T1 Control treatment (no addition), T2 Addition of 30% non-germinated Wheat + 30% corn, T3 Addition of 30% Germinated Wheat + 30% corn, T4 Replacement of 60% non-germinated Wheat, T5 Replacement of 60% Germinated Wheat. Different letters within the same column indicate

significant differences between treatments. * means significant differences. N/A means no significant differences.

Tables (3) and (4) show that the germination of wheat increases protein content and reduces the effect of nutritional inhibitors, leading to improved weight gain in broiler chickens. This, in turn, improves carcass Traits, both primary and secondary cuts, and edible offal. This aligns with the findings of [18] who reported improved carcass Traits and edible offal in broiler chickens fed diets containing wheat, barley, and oats treated with various methods to enhance their nutritional efficiency. This improvement may be attributed to the fact that germination breaks down or reduces polysaccharides, which could explain the significant increase in primary and secondary cuts, edible offal, and dressing percentage (Abd-Algafar et al., 2024). As for

Table (5) Effect of replacing Germinated Wheat partially or completely with corn on the weights of immune organs (spleen, thymus, gland of Fabricius) of Broiler chickens carcasses at 42 days of age (mean $\pm$ standard error).

treatments	spleen	thymus	gland of Fabricius
T1	2.67 b $\pm$ 0.66	0.199 b $\pm$ 0.02	2.33 $\pm$ 0.67
T2	2.67 b $\pm$ 0.66	0.300 ab $\pm$ 0.03	2.33 $\pm$ 0.33
T3	3.67 ab $\pm$ 0.88	0.362 a $\pm$ 0.07	3.00 $\pm$ 1.00
T4	2.68 b $\pm$ 0.33	0.397 a $\pm$ 0.08	3.33 $\pm$ 0.67
T5	4.00 a $\pm$ 0.02	0.345 a $\pm$ 0.14	3.67 $\pm$ 0.33
Significant level	*	*	N.S

T1 Control treatment (no addition), T2 Addition of 30% non-germinated Wheat + 30% corn, T3 Addition of 30% Germinated Wheat + 30% corn, T4 Replacement of 60% non-germinated Wheat, T5 Replacement of 60% Germinated Wheat. Different letters within the same column indicate significant differences between treatments. * means significant differences. N/A means no significant differences.

The improvement in the health of birds fed a diet containing 100% Germinated Wheat instead of corn was evident through the increased weight of uneaten internal organs

(spleen, thymus, and gland of Fabricius), which are important immune organs in the bird's body [11]. Our study's results are consistent with those of [9] who indicated an improvement in the immune status of birds fed Germinated Wheat subjected to various

treatments. They also agree with Abd-Algafar et al. [1] who indicated that treating wheat with fermentation breaks down the nutritional inhibitors of grains and stimulates immunity, especially humoral immunity, within the bird's body, which is reflected in the weight gain of the immune organs (spleen, thymus, and gland of Fabricius) in our study.

Conclusion:

From the results obtained in our study, we observe that the complete or partial replacement of corn with Germinated Wheat improves the primary carcass Traits (breast and thigh) and secondary carcass Traits (neck, wings, and back), as well as the dressing percentage. It also improves the birds' immune status, as evidenced by the observed increase in the weights of immune organs (spleen, thymus, and bursa of Fabricius). This, in turn, improves the birds' overall health.

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