
# Impact of Adding Chitosan and Probiotic to Broiler Dietary on carcass traits*

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## Abstract

This study aims to examine the impact of adding chitosan and probiotics to the diets of broilers oon the carcass characteristics of broilers. A total of 144 broiler chicks from Ross 308 were used in this study. They were of average weight (43 g). They were divided into 6 treatments with 3 replicates (8 per treatment). The first treatment was without any addition (control treatment), the second was adding 1 g/kg of probiotic, he third was adding 0.5 g/kg of chitosan, the fourth was adding 1 g/kg of chitosan, the fifth was adding 0.5 g/kg of chitosan plus 1 g/kg of probiotic and the sixth was adding 1 g/kg of chitosan plus 1 g/kg of probiotic. The foundation of this study were significant differences ($P \leq 0.05$) in the percentage of carcass refining and superiority of the third treatment, but there were no significant differences in the relative weight of the main cuttings and the relative weight of the secondary cuttings of carcass. For the internal organs (heart, gizzard and liver), there were significant differences ($p \leq 0.05$) in the relative weight of the heart, and the superiority of the fifth treatment. As for the relative weight of the gizzard, the third treatment was significantly superior ($p \leq 0.05$). The fourth treatment was significantly superior ($p \leq 0.05$) to the rest of the treatments for the relative weight of the liver. There were no significant differences in the relative weight of uneaten viscera.

Key words: *chitosan, probiotic, broilers, carcass, trait.*

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## Introduction

The yields of poultry are one of the main protein sources, they are simply digestible, also, it high in essential nutrients and minerals [1]. Poultry has been raised on a large commercial scale, and meat production is higher if we compare it with other animal products [2]. This interesting side of poultry farming agrees with the use of multiple feed additives in order to increase production, activate growth, and protect against infection with viruses and microbes [3]. Chitosan, is a non-food additive, it uses in poultry diets, it is not harmful to animal or human health; chitosan is a multiunit form of glucosamine, it makes up the lump of the external skeleton of aquatic organisms like shrimp and crabs [4,5]. Chitosan really effects on broilers' productivity performance, also, it acts as an antibacterial and antifungal agent, so it improves the health of the small intestine, improves digestion and absorption [5, 6]. Probiotics are the other and most popular food additive alternative to antibiotics [7, 8]. It basically is a microorganism this microorganism must be one of the types of poultry' intestinal bacteria [8]. It provide nutrients, aid in digestion, and constrain harmful bacteria [9]. Some reports showed that many aids could be gained by adding chitosan and probiotics to the diets of broilers. [10] The addition of chitosan to the diet of broilers was no significant differences in the relative weight of the main cuttings. Qiu et al. indicated that the addition of probiotics positively affected on the carcass characteristics [11]. In addition, Al-Salihi indicated that the addition of probiotics to the diets of broiler has a significant difference in the percentage of carcass refining but there was no significant differences in the relative weight of the main cuttings [7]. In addition, [12] found that adding chitosan to the diets of broilers showed no significant differences in the relative weight of the main cuttings.

## Materials and methods

A total of 144 Ross 308 unsexed broiler chicks Kosar hatcheries provided a regular weight of 43 grams at one day of age. The chicks were randomly assigned to 6 treatment groups, in 3 replicates (8 per group). The first treatment involved no additives (control treatment), the second treatment included 1 g/kg of probiotic, the third treatment included 0.5 g/kg of chitosan, the fourth treatment included 1 g/kg of chitosan, the fifth treatment included 0.5 g/kg of chitosan plus 1 g/kg of probiotic, and the sixth treatment included 1 g/kg of chitosan plus 1 g/kg of probiotic. Chicks were raised in separate wire cages for 35 days on a floor that was covering by sawdust 3–5 cm thick. The food (in the form of powder) was provided to the chicks and water was provided for chicks' ad libitum consumption. Two birds were taken from each treatment at the end of the trial to calculating the percentage of carcass. The live birds were considered individually by a sensitive digital scale, before the birds were slaughtered in Kosar's typical abattoir. The head, feathers and the legs were removed, and before the edible internal organs (heart, gizzard and liver) were separated. The other interior organs were also separated. The carcass was pondered individually to calculate the percentage of carcass without the eaten internal organs. The results was calculated according to the equation indicated by Becker et al. (1979) ;

The percentage of carcass% = Carcass tare weight (g) / Live body weight (g) *100

The relative weight of the carcass parts = Carcass cut weight (g) / Carcass weight (g) * 100

The relative weight of the eaten viscera= The organ's weight ( g) / Live body weight (g)*100

The relative weight of the uneaten viscera= Viscera weight (g) / Live body weight (g)*100

The relative weight of abdomen fat= Fat weight (g)/ Carcass weight (g) *100

Chitosan was imported from China, and it is a white (starch-like) substance. The German-origin Miaclost probiotic was obtained from Kosar firm.

The relative weight of visceral fat= Fat weight (g)/ Carcass weight (g) *100

These performances were calculated according to the method of [13].

**mode of action of chitosan**

Protects the gastric mucosa and enhances the activity of the enzyme pepsin, This is due to the nature of the membrane consisting of glycoprotein the negatively charged residue of sialic acid with the presence of positively charged chitosan, the interaction between the mucosa and chitosan leads to an increase in mucosal strength. It increases the height and density of villi and improves the internal environment of the small intestine, thus increasing the absorption of forage materials[14[

**mode of action of probiotic**

. It sticks to the cells lining the intestines and blocks the receptors for pathogenic bacteria, and it can make organic acids such as lactic acid, which has a toxic effect on pathogenic microorganisms which leads to improving the health status of birds and thus increasing productivity [15]

## Results

**The percentage of carcass %:**

We note from table (2) that there was a significant superiority (P≤ 0.05) between T3 and T2 only, the treatment T3 was superior with T2, the highest percentage of carcass in this treatment, it was (75.11), there was no significantly differences among other treatments. This study agrees with [7].

**The relative weight of the carcass parts:**

We note from table (3) that there were no significant differences (P≤ 0.05) in the relative weight of the carcass main parts (breast, drumsticks and thighs) but the highest relative weight of breast, drumsticks and thighs was the third treatment T3. We note from table (4) that there were no significant differences (P≤ 0.05) in the relative weight of the carcass secondary part ( head neck, wings and back). This study agrees with [16].

**The relative weight of the eaten viscera:**

We note from table (5) that the treatment T5 significantly differences (P≤ 0.05) with the treatment T6 but there were no significantly differences among other treatments regarding to the relative weight of the heart. Regarding to the relative weight of the gizzard, the treatment T3 significantly differences (P≤ 0.05) with the treatments T2 and T6. Also, the treatment T4 significantly differences (P≤ 0.05) with the other treatments that regarding to the relative weight of the liver. This study agrees with [12].

**The relative weight of the uneaten viscera:**

We note from table (6) that there were no significant differences (P≤ 0.05) in the relative weight of the abdomen fat and visceral fat, but the treatment T5 significantly differences (P≤ 0.05) with the other treatments regarding to the uneaten viscera. This study agrees with [17].

Table 1: Diets used in the experiment and the calculated chemical composition (kg).

| Components (%) | Starterdiet (1-11 day) | Growthdiet (12-21 day) | Finisherdiet (22-42 day) |
|---|---|---|---|
| Wheat | 377.25 | 327.25 | 588.85 |
| Bran | 100 | 100 | 100 |
| Soya bean meal | 320 | 272 | 165 |
| Yellow Maize | 150 | 200 | 100 |
| Vegetarian Oil | 10 | 10 | 10 |
| Premix | 10 | 8 | -- |
| Methionine | 1.3 | 0.25 | 1 |
| Lysine | 1 | 1.2 | 2 |
| Choline | 1 | 1 | 0.5 |
| Threonine | 0.5 | 1.2 | 0.8 |
| Enzyme | -- | 0.5 | 0.5 |
| Anti-coccidiosis | 1 | 0.5 | 0.25 |
| Toxbond fort | -- | 1 | 1 |
| Genex | -- | -- | 0.5 |
| Limestone | 18.25 | 17 | -- |
| Calcium | 8 | -- | -- |
| Salt | 1.6 | -- | -- |
| Between finisher | -- | -- | 7 |
| Crude protein | 22% | 21% | 20% |
| M.E. | 3000 | 3100 | 3175 |
| Energy:protein | 1:15000 | 1:14761 | 1: 15875 |

Table 2: The effect of adding chitosan and probiotic to broiler diets on the percentage of carcass%

| Treatment | live weight (g) | Carcass weight(g) | Percentage of carcass% |
|---|---|---|---|
| T1 | 2112.5 ±37.52 c | 1552.68 ±11.30 c | 73. 5 ±1.50 ab |
| T2 | 2322.5 ±59.91 ab | 1677.07 ±13.44 b | 72.21 ±1.77 b |
| T3 | 2266.66 ±51.28 abc | 1702.48 ±17.57 ab | 75.11 ±1.03 a |
| T4 | 2245.83 ±37.20b c | 1648.43 ±13.45 ab | 73.4 ±5.36 ab |
| T5 | 2417.08 ±63.25 a | 1786.22 ±18.04 a | 73.9 ±1.63 ab |
| T6 | 2238.33± 28.9b c | 1643.82± 13.22 ab | 73.44 ± 0.76 ab |

The different letters within the same column indicates that there is a significant difference between the treatments at the level of significance p>0.05, values were Mean ± standard error.

Table 3: The effect of adding chitosan and probiotic to broiler diets on the relative weight of the main carcass parts

| Treatment | Breast% | Drumsticks% | Thighs% |
|---|---|---|---|
| T1 | 37.01 ±0.17 a | 12.68 ±0.27 a | 13.38 ±0.32 a |
| T2 | 37.21 ±0.29 a | 12.62 ±0.12 a | 13.08 ±0.48 a |
| T3 | 38.05 ±0.75 a | 12.82 ±0.48 a | 13.73 ±0.51 a |
| T4 | 37.91 ±0.07 a | 12.26 ±0.01 a | 12.65 ±0.05 a |
| T5 | 37.43 ±0.73 a | 12.01 ±0.39 a | 13.11 ±0.74 a |
| T6 | 37.33 ± 0.79 a | 12.64 ±0.11 a | 12.96 ±0.18 a |

The different letters within the same column indicates that there is a significant difference between the treatments at the level of significance p>0.05, values were Mean ± standard error.

Table 4: The effect of adding chitosan and probiotic to broiler diets on the relative weight of the secondry carcass parts

| Treatment | Head-neck% | Wings% | Back% |
|---|---|---|---|
| T1 | 3.89 ±0.11 a | 9.81 ±0.27 a | 21.25 ±0.59 a |
| T2 | 4.6 ±0.24 a | 9.69 ±0.27 a | 21.35 ±1.27 a |
| T3 | 4.33 ±0.24 a | 10.1 ±0.39 a | 21.94 ±0.95 a |
| T4 | 4.58 ±0.09 a | 9.99 ±0.19 a | 21.65 ±0.08 a |
| T5 | 4.83 ±0.37 a | 10.11 ±0.14 a | 21.35 ±0.13 a |
| T6 | 4.41 ±0.16 a | 10.3 ±0.15 a | 21.91 ±0.59 a |

The different letters within the same column indicates that there is a significant difference between the treatments at the level of significance p>0.05, values were Mean ± standard error.

Table 5: The effect of adding chitosan and probiotic to broiler diets on the relative weight of the eaten viscera

| Treatment | Heart | Gizzard | Liver |
|---|---|---|---|
| T1 | 0.02 ±0.02 ab | 1.14 ±0.05 b | 2.28 ±0.07 b |
| T2 | 0.55 ±0.04 ab | 1.17 ±0.07 b | 2.12 ±0.02 c |
| T3 | 0.61 ±0.03 ab | 1.32 ±0.12 a | 2.28 ±0.14 b |
| T4 | 0.55 ±0.02 ab | 1.2 ±0.07 ab | 2.41 ±0.12 a |
| T5 | 0.62 ±0.03 a | 1.2 ±0.02 ab | 2.28 ±0.06 b |
| T6 | 0.51 ±0.02 b | 1.03 ±0.02 c | 2.28 ±0.13 b |

The different letters within the same column indicates that there is a significant difference between the treatments at the level of significance p>0.05, values were Mean ± standard error.

Table 6: The effect of adding chitosan and probiotic to broiler diets on the relative weight of the uneaten viscera

| Treatment | Abdominal fat | Viscera fat | Uneaten viscera |
|---|---|---|---|
| T1 | 1.04 ±0.16 a | 0.18 ±0.02a | 6.24 ±0.19a |
| T2 | 0.88 ±0.20 a | 0.11 ±0.03a | 6.17 ±0.46a |
| T3 | 0.64 ±0.07 a | 0.13 ±0.01a | 6.21±0.65a |
| T4 | 0.53 ±0.06 a | 0.1 ±0.01a | 6.21 ±0.28 a |
| T5 | 0.78 ±0.02 a | 0.16 ±0.01a | 6.27 ±0.28a |
| T6 | 0.77±0.03 a | 0.15±0.03 a | 6.19±0.56 a |

The different letters within the same column indicates that there is a significant difference between the treatments at the level of significance p>0.05, values were Mean ± standard error.

## discussion

The significant superiority that appeared in table (2) may be due to the increased utilization of protein by increasing the secretion of the enzyme trypsin in the stomach and thus increasing the utilization of amino acids [16]. The reason for the results in the table (3) and the table (4) may be due to that chitosan works to reduce the digestion of fats in the diet. chitosan increases the viscosity of dry organic matter that must be digested, as well as binds fats, preventing them from digestion and absorption in the intestine. and this effect leads to a reduction in fat deposition in the parts [12].According to the table (5) The reason for obtaining this result may be due to the increase

in the size of the liver as a result of the increase in immunity due to the use of chitosan, which increased the size of the liver within the normal limits, and this increase in weight may be due to the increase in the fat content in the liver, as for the weight of the heart and gizzard it may be due to chitosan, as it is known to increase weight in general, which positively affects the weight of the internal organs [12]. The results of the table (6) due to the fact that chitosan works to reduce the digestion and absorption of fats by binding to fat molecules and converting them into high-viscosity compounds, which leads to impeding the digestion of these fats, and therefore they are excreted outside the body, which leads to a decrease in body fat [18].

## Conclusion

The addition of chitosan and probiotics to the diets of broilers caused a significantly ($P<0.05$) favorable effect. This effect is demonstrated by increased carcass traits. In my opinion T3 and T5 achieved the best result.

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# تأثير اضافة الكايتوسان والمعزز الحيوي الى علائق فروج اللحم على صفات الذبيحة

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**الملخص**

الهدف من هذه الدراسة معرفة تأثير اضافة الكايتوسان chitosan والمعزز الحيوي الى عليقة فروج اللحم على صفات الذبيحة. وفي هذه التجربة تم استخدام 144 فرخة من سلالة Ross 308 غير مجنسة والتي تم تجهيزها من مفاقس شركة كوسار وكانت بوزن ابتدائي (43غم) موزعة على ستة معاملات وكل معاملة بثلاث مكررات بواقع ثمانية افراخ لكل مكرر. وكانت المعاملات كمايلي: المعاملة الاولى: عليقة السيطرة القياسية، والمعاملة الثانية عليقة قياسية مع اضافة 1غم من المعزز الحيوي/كغم من العلف، والمعاملة الثالثة: عليقة قياسية مع اضافة 0,5 غم من الكايتوسان/ كغم من العلف، المعاملة الرابعة: عليقة قياسية مع اضافة 1غم من الكايتوسان/ كغم من العلف، المعاملة الخامسة: عليقة قياسية مع اضافة 0,5غم من الكايتوسان/كغم من العلف بالاضافى الى 1غم من المعززالحيوي/ كغم من العلف، المعاملة السادسة: عليقة قياسية مع اضافة 1غم من الكايتوسان/كغم من العلف بالاضافة الى 1غم من المعزز الحيوي/كغم من العلف. ظهرت فروقات معنوية ($p\leq 0.05$) في نسبة التصافي للذبيحة وبتفوق المعاملة الثالثة بينما لم تظهر فروقات معنوية في الوزن النسبي للقطعيات الرئيسة ( الصدر، عصا الطبال، وقطعة الفخذ) وكذلك لم تظهر فروقات معنوية في الوزن النسبي للقطعيات الثانوية ( الرقبة ، الاجنحة والظهر). اما بالنسبة للاحشاء الداخلية المأكولة ( القلب ، القانصة والكبد) فقد ظهرت فروقات معنوية ($p\leq 0.05$) في الوزن النسبي للقلب بتفوق المعاملة الخامسة اما في الوزن النسبي للقانصة فقد تفوقت المعاملة الثالثة اما الوزن النسبي للكبد فقد تفوقت المعاملة الرابعة. اما في صفة الوزن النسبي للاحشاء الداخلية غير المأكولة (دهن البطن، دهن الاحشاء والاحشاء غير المأكولة) فلم تظهر فروقات معنوية في الوزن النسبي للاحشاء غير المأكولة.

**الكلمات المفتاحية**: الكايتوسان، المعزز الحيوي، فروج اللحم، الذبيحة، صفات.