EFFECT OF PROBIOTICS, PREBIOTICS AND SYNBIOTIC ON GROWTH PERFORMANCE OF BROILER UNDER DIFFERENT STOCK DENSITY

H. I. Aziz* **D.J. Al-Hawezy**
Lecturer **Assit. Prof.**
Dept. of Animal Resources – Coll. of Agric. Engine. Science – Salahaddin University- Erbil
haval.aziz@su.edu.krd

ABSTRACT

This study was conducted to evaluate probiotic, prebiotic and synbiotic on the broiler growth performance, reread under different stock density. A total of 448 Ross 308 broiler reared for 6 weeks and divided into two groups normal density and high density . For each stock density birds were fed standard diet (T1), standard diet + 0.15g probiotic powder/ kg diet(T2), standard diet + 0.15g prebiotic powder/ kg diet(T3) and standard diet + 0.15g synbiotic powder/ kg diet (T4). All dietary additives had no significant differences (p≤ 0.01)on the body weight gain, feed intake and feed conversion ratio at 6 weeks of age. However, body weight was different significantly compared to the control group. Dietary synbiotic enhanced the body weight, body weight gain and feed conversion ratio. Broiler reared at high density had significantly affect body weight, body weight gains and feed intake. It was concluded that birds fed diet supplemented with synbiotic and reared at high density showed the highest (p≤ 0.01)body weight and body weight gain when compared with the other groups.

Keywords: stock density; synbioti , reread , standard diet , body weight , symbiotic.

مجلة العلوم الزراعية العراقية -2021 :52 (5):1126-1138 **عزيز والحويزي**

تأثير المعزز الحيوي, السبق الحيوي والخليط التأزري على أداء النمو فروج اللحم تحت نظام كثافة مختلف

هةفال اسماعيل عزيز **دلير جمال خورشيد الحويزي**
مدرس **استاذ مساعد**
قسم الثروة الحيوانية – كلية الزراعة – جامعة صلاح الدين–اربيل

المستخلص

تم اجراء هذه الدراسة لتقيم تأثير المعزز الحيوي, السبق الحيوي والخليط التأزري على أداء ونمو فروج اللحم المرباه تحت نظام كثافات مختلف. تمت تربية 448 فرخة روص 308 بعمر يوم واحد لمدة 42 يوما وقسمت الى مجموعتين نظام كثافة عادي ونظام كثافة عالي. وتم تغذية كل نظام كثافة بأربعة علائق معاملة(1) سيطرة(علف القياسي), معاملة (2) علف القياسي +0.15 معزز الحيوي /كغم, معاملة (3)علف القياسي +0.15 السابق الحيوي /كغم , معاملة (4)علف القياسي +0.15 خليط التأزري /كغم. مع كل هذه الاضافات لم تلاحظ أية فروقات معنوية على الزيادة الوزنية والعلف المستهلك وكفاءة التحويل الغذائي لحد (6) أسابيع من أعمارها. وعلى ايه حال لوحظ فروقات معنوي في اوزان الجسم قياسا بمجموعة المقارنة. العليقة العادية على مسحوق الخليط التأزري قد حفزت وحسنت وزن الجسم والزيادة الوزنية الحاصلة وكفاءة التحويل الغذائي. افراخ المرباه تحت نظام كثافة عالي لوحظ فيها تأثيرات معنوية في وزن الجسم والزيادة الوزنية واستهلاك العلف نستنتج من ذلك ان افراخ التي تناولت مسحوق الخليط التأزري و المرباه تحت نظام كثافة عالي اظهرت اعلى وزن الجسم وزيادة الوزنية مقارنة بمجموعة اخرى

الكلمات المفتاحية: فروج اللحم, أداء ونمو, المعزز الحيوي, السابق الحيوي, نظام كثافة مختلف, الخليط التأزري

Received:13/9/2020, Accepted:9/12/2020

INTRODUCTION

During the evolution of modern chicken production, there have been several changes in the nutritional requirements associated with a healthy feed product. In fact, in recent years, several food additives have been applied as replacements for antibiotic growth promoters. The most recent of these additives are prebiotics,probiotics and synbiotics (13). Probiotics, based on (12) definition, "are live microbial feed supplement that beneficially affects the host animal by improving its intestinal microbial, however, beneficial effects of probiotic on broilers including: performance (22); improving feed intake, digestion and absorption(29). Prebiotic is a non-digestible food ingredient that can be utilized by intestinal microflora, which beneficially affects the host. The beneficial effects of prebiotics on performance, feed conversion ratio (9). The mixture of prebiotics and probiotics as named synbiotics may apply to the synergistic effect on growth and colonies multiplication of beneficial microorganism which ultimately exert positive effect on the health of the intestine and absorption of the nutrient in the host (10). Stocking density may affect the performance, health and welfare of broiler chickens. The appropriate stocking densities depend mainly on the inputs and outputs prices and thus on the cost-benefit analysis (21). A high stocking density reduces the production cost and produces more kilograms of chicken per area up to a certain extent, with an increasing profitability (23). However, there are some negative points using high stocking density that increase the stress on broilers and effect on growth performance, problem of leg weakness (31; 8). In an attempt to reduces the negative influence of stress in poultry farm several dietary approaches have been used, including probiotics. Because of the positive effects of prebiotics on gut microbiota, it is possible that dietary supplementation with prebiotics can help the birds overcome any deficiency and concomitantly increase their tolerance to stress (15). Numerous studies reported effect of different prebiotics, probiotics and synbiotic on the performance of commercial broilers however their interaction with different stocking densities are still neglected and require further investigations. Therefore, the present study was conducted to evaluate the Effect of probiotics, prebiotics and their combination in growth performance of broiler under different stock density.

MATERIALS AND METHODS

Birds and management

This study was carried out in farm of commercial breeding. Using 448 Broiler Ross 308, for 6 weeks. The two levels of stocking density were used include the experimental which are normal stock density with a groups number of 192 broiler reared in normal stock density (12 bird/m^2) and subjected in to four treatments 48 and four replicates per each (12 chicks) and high stock density with a number of 256 broiler reared in high stock density (16 bird/m^2) and subjected into four treatments (64 chicks) and four replicates in each (16 chicks), broiler were reared under same environment conditions, pen measured as 2×2×1.2m,width × length × height, respectively. covered with (5) cm depth of wood shaving litter. vitamin solution at concentration 0.1% were as drinking water introduced at chicks arrival, and after that the chicks were fed and water were provided throughout the experimental period). Circular plastic feeders and waters of (45) cm diameter were used during the first week of age, and afterwards long metal feeders used to provide proper feeding area to each bird treatment, the height of the feeder were adjusted according to age at the back height le of the bird. The experiment consists for each normal and high stock density four dietary which are T1= control (standard diet), T2= standard diet + 0.15g probiotic powder/ kg diet, T3= standard diet + 0.15g prebiotic powder/ kg diet and T4= standard diet + 0.15g synbiotic powder/ kg diet.

Feeding system

Vitamins solution introduced at arrival, then the chicks were fed three types of rations starter (from 1 day – 10 day), grower (from 11-24day) and finisher (from 25 – 42 day). The experimental broiler starter, grower and finisher basal diets composition were show in Table 1.

Table 1. Experimental diet composition

Feed stuff	Starter	Grower	Finisher
Corn	195	100	118
Soybean meal %48	341	285	250
Wheat	400	540	558
Limestone	15	16	14
Preconex-breeder	25	25	`25
Dicalcium phosphate	6	4	3
Anzym	1	1	1
Anti oxidant	1	1	1
Faty Acid	16	28	30
Total	1000	1000	1000
Chemical analyses			
Protein %	23	21.5	20
Metabolizable energy (kcal/kg)	3000	3100	3150
Methionine %	0.47	0.45	0.44
Lysine %	1.19	1.07	0.99
Calcium %	0.81	0.78	0.71
Phosphorus % available	0.45	0.41	0.39

Composition of Local Prebiotic or Iraqi Probiotic and Synbiotic Use in the Diet

Table 2. Types of bacteria in probiotic

Type of bacteria	Number of bacteria per gram of product
Lactobacillus acidophilus	10^8
Bacillus subtilis	10^9
Bifidobacterium	10^8
Saccharomyces cervisiae	10^9

Table 3. The nutritional information of Jerusalem artichoke inulin which was used as a prebiotic source in the experiment

Items	Jerusalem Artichoke /100 g2
Carbohydrates (g)	81.02
Digestible (Sugars) (g)	6.54
Non-digestible (Inulin) (g)	74.48
Proteins (g)	7.43
Fats (g)	0.40
Dietary fibres (g)	74.48
Moisture (g)	5.56
Gross energy (kcal/g)	0.4
Minerals - Ash (g)	5.59

The chemical composition was analyzed in the lab Nutrition-Plymouth University (3).

Live body weight and body weight gain

birds were weighted weekly by , digital balance (sorter balance).

The weight gain was calculated using the equation:

Weight gain (g) = B.w at the end of the week - B.w at the beginning of the week (4).

Feed consumption and feed conversion ratio(FCR)

Feed intake in each pen or replicate was recorded and measured weekly and feed conversion ratio was calculated by the following equation.

$$FCR = \frac{\text{Feed intake during a period}}{\text{Weight gain during the same period}}$$

Statistical analysis

The experiment followed a two (stock density) and four (levels of treatment) factorial arrangement in a completely randomized design. All data obtained were analyzed using a generalized linear model of SAS (28). Significant differences between treatment means were compared using Duncan test at a probability of 0.01.

RESULTS AND DISCUSSION

Body weight

Data in Table 4 shows means of live body weight of supplement of diet during the entire period of experiment 1-6 weeks according to the stoking density and interaction between supplement and stocking density. The overall means ranged from 46.33g to 2537.54g, the supplements had highly significant ($p \leq 0.01$)effect on live body weight at all weeks except 2nd week of age . The dietary synbiotic were improved live body weight compared with control group at all weeks except 2nd and 4th weeks of age . Prebiotic showed significant ($p \leq 0.01$)increases in their live body weight at first week of age. The present study was in agreement with the finding of Hussein etal.(16) they found that the dietary supplementation of broiler chicks (Ross 308) with probiotic the final body weight was found to increase significantly ($p < 0.01$) in the entire supplemented group at 35 days of age when compared with the positive control group. Whereas the result disagreed with the finding of Sarangi, et al. (27) who observed that using prebiotic, probiotic and synbiotic in feed of chicken did not affect the body weight, until day 42 of age. The improved live body weight of broiler chicks, observed herein, could be due to increased absorption and utilization of nutrients. Added probiotic can also improve the balance between the useful and pathogenic bacteria in the gastrointestinal tract in favor of the host animal, non-pathogenic bacteria may depress FCR and growth in chickens due to competition with the host for the nutrients in the intestinal tract or via reducing the absorptive surface area (20). The stocking density had highly significant ($p \leq 0.01$)effect in live body weight at 2nd, 3rd and 6th week of age but no significant differences in live body weight between stoking density at 1st , 4th and 5th week of age. High stocking density were found to be statistically higher than normal density at all weeks except 2nd and 4th week of age in growth. The results were in agreement with the finding of Altaf etal.(6) found that examining three stocking densities (0.046, 0.056, 0.065m2) of Ross308 broiler they observed that body weight were birds reared at 0.065m2 stocking density showed the highest ($p \leq 0.05$) body weight followed by those reared at 0.056m2 and 0.046m2. Under normal density low body weight recorded might be due to more activity of the birds in low stocking density.

Data in Table 4 presents interactions between supplement and stocking density. There are highly significant differences ($p \leq 0.01$)among all interactions between supplement and stocking density. Also interaction between synbiotic and high stocking density was higher of body weight compared to control group at all weeks except 2nd week of age, but no significant differences found between supplement with high density camper with control group at 2nd and 4th week of age. The results were in agreement with the finding of Mahmoud and El-Rayes.(21) The effects of interaction between stocking density and probiotic supplementation were significant on live body weight and bodyweight gain of broiler. The results were in contrast with the finding of Cengiz et al.(8) they noticed that the effects of interaction between stocking densities and probiotic, on the performance of Ross 308 broiler chicks indicated that weight gain was no significantly ($P < 0.001$) effect during d 0 to 42 of age.

Table 4. Effect of density, treatments and their interactions on body weights of broiler (g).

Factor	BW /g week1	BW /g week2	BW /g week3	BW /g week4	BW /g week5	BW /g week6
Overall mean	136.94	398.59	815.07	1388.55	1969.69	2537.54
Socking density						
Normal	135.57±1.69 a	404.58±3.18 a	804.01±5.67b	1399.90 ± 12.32 a	1969.58 ± 10.98 a	2494.58 ± 12.36 b
High	137.97±1.24 a	394.97±2.67b	823.36±5.07 a	1380.04 ± 5.48 a	1969.77 ± 7.29 a	2569.77 ± 7.61a
Supplement						
Control	124.28 ± 1.25 c	401.16 ± 4.24 a	827.23 ± 7.50ab	1383.66 ± 11.28 b	1971.96 ± 8.69 b	2545.27 ± 8.98 b
Probiotic	140.09 ± 1.88 b	394.02±4.24a	782.59 ± 7.72c	1338.66 ± 9.59c	1922.77 ± 14.13 c	2486.52 ± 19.30 c
Prebiotic	136.70 ± 1.84 b	398.93 ± 3.38 a	814.38 ± 5.49b	1418.57 ± 13.77 a	1954.11 ± 11.26bc	2505.45 ± 9.95c
Synbiotic	146.70 ± 1.83 a	400.27 ± 4.66 a	836.07 ± 7.84 a	1413.30 ± 11.55ab	2029.91 ± 11.18a	2612.95 ± 11.68a
Interaction						
Normal control	120.42±2.04e	411.46±3.57 a	836.46±8.77 a	1394.79 ± 14.98b	1958.54 ± 17.82cde	2546.67 ± 11.81bc
Normal probiotic	147.50±2.57b	383.33±7.64 d	762.50±12.9d	1290.21 ± 9.81c	1917.08 ± 24.55e	2360.00 ± 24.95d
Norma Prebiotic	138.33±4.01c	407.71±6.11ab	791.25±4.92c	1470.63 ± 28.67a	1976.67 ± 18.05cd	2507.08 ± 14.38c
Norma Synbiotic	136.04±1.99c	415.83±5.61a	825.83±10.6ab	1443.96 ± 23.22a	2026.04 ± 21.91ab	2564.58 ± 20.74 b
High control	127.19±1.38 d	393.44±6.66bcd	820.31±11.33abc	1375.31 ± 16.27b	1982.03 ± 7.09bc	2544.22 ± 13.14bc
High Probiotic	134.53±2.24c	402.03±4.30abc	797.65±8.63bc	1375.00 ± 11.50b	1927.03 ± 16.83 de	2581.41 ± 11.51b
High Prebiotic	135.47±1.22c	392.34±3.37bcd	831.72±7.59 a	1379.53 ± 4.12b	1937.19 ± 13.82cde	2504.22 ± 13.86c
High Synbiotic	154.69±1.85a	388.59±6.29cd	843.75±11.10a	1390.31 ± 8.62 b	2032.81 ± 10.95a	2649.81 ± 9.22a

a, b, c, d Means followed by different letters in the columns are significantly different ($p \leq 0.01$).

Body weight gain

Results in Table 5 refer to effect of supplement, density and their interactions on weekly body weight gain / bird of broiler (g). The treatments had no significant effect ($p \leq 0.01$) in weight gain at all week except 1st and 5th week of age. The dietary supplementation with synbiotic showed increased numerical on body weight gain compared with control group at 1st, 4th, 5th and 6th week of age. The results were in agreement with finding of Salehimanesh, et al.(26) , they reported that using additives of prebiotic, probiotic and synbiotic in the broiler rations did not affect significantly t body weight gain. The result was in contrast with the finding of Hussein et al.(17) found that the dietary supplementation of broiler chicks (Ross 308) with probiotic the body weight gain body weight gain were found to increase significantly ($p < 0.01$) in the entire supplemented group at 35 days of age when compared with the positive control group. The increased body weight gain in chicks fed synbiotic may be due to improvement of digestibility and availability for many nutrients such as proteins and fats and carbohydrates as well as some mineral elements and vitamins. It was noted that many of the beneficial bacteria and yeast that used to simulating digestible enzyme that enhance the effect of endogenous enzyme that produces naturally within the gastrointestinal tract (7). There were no significant differences among stocking density on body weight gain in all week of study except 6th week of age and also increase numerical high density compared with normal density at all weeks except 2nd and 4th week of age . The result was in agreement with the finding of Cengiz et al.(8) they noticed that the effects of two stocking densities, including 10 and 20 birds/m^2, were compared on the performance of Ross 308 broiler chicks indicated that weight gain was significantly higher ($P < 0.001$) in birds at low stock density than those at high stock density during d 0 to 42days. But, the result was in contrast with the finding of Rashidi et al.(25), they showed that body weight gain was affected negatively by increasing density in the growing period (7.6%, $p < 0.01$). Also, the results of this study showed that there were significant interactions among all treatments with the stocking density on body weight gain from all week of experiments except of 3rd week of age. In another hand the dietary synbiotic with high density increase numerical compared with control group at all week except 2nd and 4th week of age. The present study was in agreement with the report of Kridtayopas et al.(19) The study investigated the effect of prebiotic and symbiotic under high density on body weight gain. During the finisher phase, the body weight gain of the high stock density and high stock density prebiotic groups was significantly lower than the normal stocking density group ($P < 0.05$), and the body weight gain of the high stock density synbiotic group was higher than the high stock density prebiotic group ($P < 0.05$). The result disagreement with finding of Cengiz et al. (8) study was effect of dietary probiotic supplementation and stocking density on the performance, there were no significant effect interaction probiotic with stoking density on body weight gain.

Table 5. Effect of density, treatments and their interactions on weekly body weight gain / bird of broiler

Factor	BWG 1 week	BWG 2 week	BWG 3 week	BWG 4 week	BWG 5 week	BWG 6week
Overall mean	90.39	262.57	384.34	574.72	579.71	562.5
Socking density						
Normal	88.82±3.04a	269.01±7.61a	339.43±12.97a	592.76±22.63a	569.69±16.27a	525.0±15.85b
High	91.97±2.93a	256.14±7.21a	429.26±9.76a	556.68±11.65a	589.73±13.94a	600±12.32a
Supplement						
Control	77.69±2.51b	278.65±11.47a	425.94±12.76a	556.67±17.42a	585.23±19.12ab	575.16±12.02a
Probiotic	94.10±3.17a	251.67±12.24a	387.40±23.06a	552.53±25.47a	589.45±22.11ab	548.65±41.41a
Prebiotic	91.11±2.76a	263.13±6.15a	411.46±14.49a	613.60±34.02a	531.85±21.3b	548.73±14.38a
Synbiotic	98.70±4.35a	256.85±10.82a	432.58±13.41a	576.10±22.81a	612.29±14.83a	577.47±18.86a
Interaction						
Normal control	74.81±4.54d	291.04±10.09a	425.0±20.23a	558.33±26.48b	563.75±18.75abc	588.13±9.94bc
Normal probiotic	100.14±3.05ab	235.83±18.95b	379.17±48.19a	527.71±45.05b	626.87±31.85ab	442.92±11.63e
Norma Prebiotic	91.23±5.94bc	269.38±9.28ab	383.54±8.83a	679.38±42.27a	506.04±35.66c	530.42±26.96d
Norma Synbiotic	89.1±3.09bc	279.79±6.67a	410.0±8.83a	605.63±36.97ab	582.09±12.36abc	538.54±20.58cd
High control	80.56±1.84cd	266.25±20.26ab	426.88±18.71a	555.0±26.72b	606.72±32.35ab	562.19±21.53bcd
High Probiotic	88.05±3.63c	267.50±13.17ab	395.63±10.7a	577.35±24.24b	552.04±18.28bc	654.38±20.41a
High Prebiotic	90.99±0.54bc	256.88±8.02ab	439.38±19.56a	547.82±27.01b	557.66±20.05bc	567.04±3.85bcd
High Synbiotic	108.29±4.19a	233.91±12.31b	455.16±20.54a	546.57±21.91b	642.50±16.32a	616.41±15.06ab

a, b, c, d Means followed by different letters in the columns are significantly different ($p \leq 0.01$)

Feed intake

Data in Table 6 refers to effect of supplement, density and their interactions on weekly feed intake / bird of broiler (g). The supplements had a highly significant affect ($p\leq 0.01$)in feed intake at 1st, 3rd and 4th week of age. But no significant effect in feed intake at 2nd, 5th and 6th week of age, however supplement group higher statistically feed intake than control group. The result was in agreement with the finding of Pourakbari et al.(24) they noticed that the dietary supplementation probiotic at level (0.005%, 0.01%, 0.015% and 0.02%) of broiler Ross 308, there result were showed significant increase on feed intake compared with control group when they used 0.01 Probiotics in feed while the response of feed intake was mostly quadratic ($P<0.01$) compared with the control .But, the result was in contrast with the finding of Silva et al.(30), suggested that the dietary supplementation of Cobb chicks with probiotic had no significant effect on feed intake and feed conversion rate when compared with control at 42 days of age. The result could be due to feeding probiotic that causes a morphological change in digestive tract thought increasing the villi high and crypt depth the mucosal enzyme activity is closely associated with a number of enterocytes per villi therefore greater digestive enzyme activity has been noted in the higher villi(14). The prebiotic may provide nutrients effectively stimulates the growth of beneficial microflora in the small and large intestine and the result would be better balance of bacterium population (5). These new bacteria population produce different digestive enzymes which add to existing broiler endogenous enzymes and improved digestibility of nutrients in digestive tract (7). The stocking density had highly significant ($p\leq 0.01$) effect in feed intake at all weeks except at 1st and 3rd week of age. Birds in high stocking density had significantly ($P\leq 0.01$) higher feed intake compared with normal stocking density except at 1st and 4th weeks of age. Our result is agreement with previous result obtained by Cengiz et al.(8) noticed that the effects of two stocking densities, including 10 and 20 birds/m^2, were compared. on the performance, of Ross 308 broiler chicks indicated that Feed intake was significantly decreased on d 0 to 42 in birds at high stock density ($P < 0.001$) in comparison with those at low stock density. In contrast ,results are not in agreement with finding of Rashidi et al. (25), showed that Feed intake was not significantly affected parameters throughout the experimental period broiler chickens when density increased from 12 to 18 bird/m^2. The interaction of supplement and stocking density was significantly different in the most weeks of experiment. The interaction supplement under high density significantly increase feed intake compared with supplement with normal density at 5th and 6th week of age , and also synbiotic under high density increases feed intake compared with control group at 1st, 3rd and 4th week of age. the present study was in agreement with the finding of Altaf et al. (6) , they found that examining three stocking densities (0.046, 0.056, 0.065m^2) of Ross 308 broiler they observed that feed intake the birds supplemented with synbiotic as growth promoter and reared at 0.065m^2 stocking density showed the lowest ($p\leq 0.05$) feed intake compared to the other groups.

Table 6. Effect of density, treatments and their interactions on weekly feed intake / bird of broiler (g).

Factor	feed intak/bird week1	feed intak/bird week2	feed intak/bird week3	feed intak/bird week4	feed intak/bird week5	feed intak/bird week6
Overall mean	120.43	298.3	644.91	810.31	1020.88	1109.8
Socking density						
Normal	120.58 ± 1.83a	279.37 ± 4.79 b	641.80 ± 5.38a	822.15 ± 8.39 a	977.80± 8.04 b	1045.31 ± 6.44 b
High	120.29 ± 1.59a	317.40 ± 6.31a	648.03 ± 6.40 a	798.08 ± 4.64b	1063.96 ± 20.20 a	1174.29 ± 8.81 a
Supplement						
Control	124.62 ± 0.91 a	304.50 ± 17.8 a	639.76± 3.49b	787.30± 3.41b	1040.09 ± 20.48a	1113.00 ± 35.63 a
Probiotic	119.13 ± 2.43b	291.24 ± 2.47a	618.46 ± 2.82c	786.82 ± 4.53b	989.49 ± 18.28a	1088.79 ± 14.8a
Prebiotic	112.26 ± 0.94 c	300.00 ± 3.78a	642.67 ± 2.70 b	834.93 ± 10.6 a	1030.81 ± 6.54a	1133.40 ± 22.89a
Synbiotic	125.73 ± 1.14a	297.80 ± 11.11a	678.77 ± 3.17 a	831.27 ± 5.31 a	1023.13± 45.64 a	1104.02 ± 26.05a
Interaction						
Normal control	124.25 ± 1.83 a	257.44 ± 2.69e	631.91 ± 3.03cd	789.13 ± 6.57ef	986.95 ± 7.84bcd	1019.56 ± 8.84f
Normal probiotic	119.14 ± 5.21 ab	291.30 ± 3.96c	622.22 ± 3.97de	795.55 ± 5.73de	942.22 ± 7.25d	1051.11 ± 7.20 e
Norma Prebiotic	112.67 ± 0.88bc	300.00 ± 6.49c	638.63 ± 4.01bc	861.36 ± 7.20a	1018.18 ± 8.75abcd	1074.41 ± 9.96 d
Norma Synbiotic	125.00 ± 1.98 a	268.75 ± 2.68d	674.46 ± 4.50 a	842.55 ± 5.59b	963.83 ± 6.67cd	1036.17 ± 7.65ef
High control	125.00±0.64a	351.56 ± 2.01a	647.62 ± 2.59b	785.48 ± 3.00ef	1093.22 ± 3.80a	1206.45 ± 5.11 a
High Probiotic	119.11±0.76 ab	291.17 ± 3.56c	614.70 ± 3.46e	778.08 ± 3.49f	1036.76± 4.32abcd	1126.47 ± 5.33c
High Prebiotic	111.76±1.80 c	300.00± 4.98c	646.72 ± 2.68b	808.50 ± 3.26cd	1043.43±4.08abc	1192.39 ± 5.26ab
High Synbiotic	126.47±1.34a	326.86 ± 2.41b	683.07 ± 3.77a	820 ± 4.21c	1082.42 ± 85.63 ab	1171.87 ± 6.37b

a, b, c, d Means followed by different letters in the columns are significantly different ($p \leq 0.01$).

Feed conversion ratio

Data in Table 7 refers to the effect of treatment and stocking density and interaction on feed conversion ratio. The treatments showed no significant differences in feed conversion ratio at all week of age except first week. The dietary supplement improved feed conversion ratio compared with control at all week except third week. The present study was in agreement with the finding of Pourakbari et al. (24) noticed that the best feed conversion was found for birds fed (Protexin) as probiotic at level (0.02% feed) as compared with control at 42 days of age being 1.69 and 1.84, respectively. Whereas the result disagreed with the finding of Abdel-Raheem et al. (1), they found that the addition broiler diets with prebiotic at level (0.5g / kg) had significant effect on feed conversion ratio from 42 days of age, when compared with control. The result could be due to the present of prebiotic that provide nutrients, effectively stimulates the growth of beneficial microflora in the small and large intestine and the result would be better balance of bacterium population (5). These new bacteria population produce different digestive enzymes which add to existing broiler endogenous enzymes (2). Also probiotic which improve absorption of nutrients and depressed harmful bacteria that causes growth depression (11). The microorganisms that are present in the probiotic have been delivered enzymes and other beneficial substances into the intestines (18). Supplementation of *L. acidophilus* or a mixture of *Lactobacillus* cultures to chickens significantly increased ($P<0.05$) the levels of amylase after 40 d of feeding (17). This result is similar to the finding of (7)., who reported that inclusion of a probiotic resulted in significantly higher carbohydrase enzyme activities in the small intestine of poultry. It is well established that probiotics alter gastrointestinal pH and flora to favor an increased activity of intestinal enzymes and digestibility of nutrients (7). In the stocking density not significant effect at all weeks except second week ,however normal density better feed conversion ratio than high stocking density except first week. The results were in agreement with the finding of Rashidi et al.(25) showed that feed conversion rate was not significantly affected parameters throughout the experimental period broiler chickens when density increased from 12 to 18 bird/m2. The results were in contrast with the finding of Altaf etal.(6), they found that examining three stocking densities (0.046, 0.056, 0.065m^2) of Ross 308 broiler they observed that feed conversion ratio were birds reared at 0.065m^2 stocking density showed the significant ($p\leq0.05$) feed conversion ratio followed by these reared at 0.046m^2 during the period of experiment . The interaction of treatment with stocking density was significantly effect on feed conversion ratio at all week except 4^{th} and 5^{th} week of age. However dietary probiotic with high density better than control group at all week for feed conversion ratio. The present results agreed also with these of Mahmoud and El-Rayes.(21), observed there were significant interactions between stocking density and added probiotic on feed conversion ratio of broiler chicks. The best mean of feed conversion ratio was achieved by birds kept at 10 birds/m2 and given 2.0 ml probiotic per liter of water compared with other treatments during the whole experimental periods.

Table 7. Effect of density, treatments and their interactions on feed conversion ratio / bird of broiler

Factor	FCR 1 week	FCR 2 week	FCR 3 week	FCR 4 week	FCR 5 week	FCR 6week
Overall mean	**0.88**	**1.05**	**1.31**	**1.36**	**1.46**	**1.58**
Socking density						
Normal	**0.89 ± 0.03a**	**0.99±0.02b**	**1.30 ± 0.02a**	**1.33± 0.02a**	**1.44±0.02a**	**1.56±0.02a**
High	**0.87 ± 0.02a**	**1.11±0.03a**	**1.32 ± 0.02a**	**1.39 ± 0.01a**	**1.49±0.02a**	**1.60±0.01a**
Supplement						
Control	**1.00 ± 0.02 a**	**1.07±0.06a**	**1.29 ± 0.04a**	**1.34 ± 0.03a**	**1.47±0.02a**	**1.57±0.03a**
Probiotic	**0.85 ± 0.03 b**	**1.05±0.02a**	**1.32± 0.03a**	**1.36 ± 0.03a**	**1.46±0.03a**	**1.58±0.03a**
Prebiotic	**0.82 ± 0.02 b**	**1.03±0.01a**	**1.30 ± 0.02a**	**1.33 ± 0.03a**	**1,49±0.02a**	**1.61±0.02a**
Synbiotic	**0.86 ± 0.02b**	**1.06±0.05a**	**1.32 ± 0.03a**	**1.37 ± 0.03a**	**1,46±0.04a**	**1.56±0.03a**
Interaction						
Normal control	**1.03 ± 0.04a**	**0.93±0.02d**	**1.21 ± 0.03b**	**1.29 ± 0.04a**	**1.43±0.03a**	**1.49±0.02c**
Normal probiotic	**0.81 ± 0.06c**	**1.07±0.03cb**	**1.36 ± 0.05ab**	**1.42 ± 0.03a**	**1.45±0.05a**	**1.62±0.05ab**
Norma Prebiotic	**0.82 ± 0.05c**	**1.01±0.02cd**	**1.32 ± 0.01ab**	**1.31 ± 0.07a**	**1.48±0.04a**	**1.59±0.03abc**
Norma Synbiotic	**0.92 ± 0.03abc**	**0.95±0.03cd**	**1.29 ± 0.04ab**	**1.33 ± 0.06a**	**1.42±0.05a**	**1.52±0.03bc**
High control	**0.98± 0.06ab**	**1.22±0.06a**	**1.38 ±0.06a**	**1.39 ± 0.05 a**	**1.51±0.02a**	**1.65±0.03a**
High Probiotic	**0.89 ± 0.04 cd**	**1.02±0.03cd**	**1.29 ± 0.05ab**	**1.31 ± 0.03a**	**1.47±0.04a**	**1.53±0.02abc**
High Prebiotic	**0.82 ± 0.01c**	**1.05±0.02bcd**	**1.27 ± 0.04ab**	**1.35 ± 0.01a**	**1.50±0.03a**	**1.64±0.03ab**
High Synbiotic	**0.81 ± 0.02 c**	**1.17±0.05ab**	**1.35 ± 0.05ab**	**1.41 ± 0.03a**	**1.49±0.06a**	**1.59±0.04abc**

a, b, c, d Means followed by different letters in the columns are significantly different (p≤ 0.01).

CONCLUSION

This study found that increasing broiler stocking density from 12 to 16 birds/m^2 of floor space with probiotic positively influenced body weight gain ,feed intake and feed conversion ratio compared with control group.

REFERENCES

1. Abdel-Raheem, S.M., S.M. Abd-Allah. and , K.M. Hassanein, 2012. The effects of prebiotic, probiotic and synbiotic supplementation on intestinal microbial ecology and histomorphology of broiler chickens. International Journal for Agro Veterinary and Medical Sciences, 6(4) :.277-289.
2. Afrouziyeh, M., S.H. Hanifian and M. Taghinejad, , 2014. Effects of mannan oligosaccharides on ileal digestibility of nutrients and microbial populations in the ceca of broiler chickens. International Journal Biosci, 5(1), :.373-380.
3. Akoy, R.A.M., 2015. The effects of probiotics, prebiotics and synbiotics on gut flora, immune function and blood characteristics of broilers.
4. Al-Gharawi, J.K.M., A.H. Al-Helali, and LF Al-Zamili, I.F., 2018. Effect of using different ways to provide the iraqi probiotic on some productive traits of broiler. Plant Archives, 18(1), :.1102-1108.
5. Alloui, M.N., W. Szczurek and S.Swiatkiewicz, . 2013. The Usefulness of Prebiotics and Probiotics in Modern Poultry Nutrition: a Review/Przydatnosc prebiotykow i probiotykow w nowoczesnym zywieniu drobiu-przeglad. Annals of Animal Science, 13(1),:p.17.
6. Altaf, M.T., A. Mahmud, and S. Mehmood. 2019. Effects of Supplemented Growth Promoters on Performance and Intestinal Morphology in Broilers Reared under Different Stocking Densities. Brazilian Journal of Poultry Science, 21(4).
7. Beski, S.S.M. and S.Y.T.Al-Sardary, ., 2015. Effects of dietary supplementation of probiotic and synbiotic on broiler chickens hematology and intestinal integrity. International Journal of Poultry Science, 14(1), :.31.
8. Cengiz, Ö., B.H. Köksal, O. Tatlı,. O., Sevim, U., Ahsan, A.G., Üner, P.A. Ulutaş, D., Beyaz, S., Büyükyörük, A., Yakan. And A.G. Önol,. 2015. Effect of dietary probiotic and high stocking density on the performance, carcass yield, gut microflora, and stress

indicators of broilers. Poultry science, 94(10) :.2395-2403.

9. Çınar, M., A.U. Çatlı, K., Küçükyılmaz . and M. Bozkurt 2009. The effect of single or combined dietary supplementation of prebiotics, organic acid and probiotics on performance and slaughter characteristics of broilers. South African Journal of Animal Science, 39(3).

10. De Vrese, M. and A.J. Schrezenmeir, ., 2008. Probiotics, prebiotics, and synbiotics. Food biotechnology, pp.1-66.

11. El-Nagmy, K.Y., A.A. Ghazalah,. and A.S.Bahakim, . 2007. The effect of probiotics supplement on performance of broiler chicks fed diets varying in protein content. In 4th World Poultry Conference, Sharm El-Sheikh, Egypt pp. 27-30 ..

12. Fuller, R., 1989. Probiotics in man and animals. Journal of Applied Bacteriol., 66: 365-378.

13. Hajati, H. and M. Rezaei. 2010. The application of prebiotics in poultry production. International Journal of Poultry Science, 9(3), :.298-304.

14. Harimurti, S. and W. Hadisaputro, 2015. Probiotics in poultry. In Beneficial Microorganisms in Agriculture, Aquaculture and Other Areas (pp. 1-19). Springer, Cham.

15. Hosseini, S.M., H. Nazarizadeh, S., Ahani, and M. Vakili Azghandi, M., 2016. Effects of mannan oligosaccharide and Curcuma xanthorrhiza essential oil on the intestinal morphologyand stress indicators of broilers subjected to cyclic heat stress. Archives Animal Breeding, 59(2) :.285-291.

16. Hussein, E.O., S.H. Ahmed, A.M.., Abudabos, B.M. B., Suliman,,A. El-Hack, E. Mohamed, A.A. Swelum, and A. Alowaimer ., 2020. Ameliorative effects of antibiotic-, probiotic-and phytobiotic-supplemented diets on the performance, intestinal health, carcass traits, and meat quality of Clostridium perfringens-infected broilers. Animals, 10(4), p.669.

17. Jin, H., H. Zhou,.,X. Cheng, R. Tang, M. Munoz and N. Nguyen. 2000. Recombinant respiratory syncytial viruses with deletions in the NS1, NS2, SH, and M2-2 genes are attenuated in vitro and in vivo. Virology, 273(1), :.210-218.

18. Kabir, S.M., 2009. The role of probiotics in the poultry industry. International Journal of Molecular Sciences, 10(8):.3531-3546.

19. Kridtayopas, C., C. Rakangtong, C. Bunchasak, and W. Loongyai, 2019. Effect of prebiotic and synbiotic supplementation in diet on growth performance, small intestinal morphology, stress, and bacterial population under high stocking density condition of broiler chickens. Poultry science, 98(10):.4595-4605.

20. Mahesh, M.S., Mohanta, R.K. and Patra, A.K., 2021. Probiotics in livestock and poultry nutrition and health. In Advances in Probiotics for Sustainable Food and Medicine (pp. 149-179). Springer, Singapore.

21. Mahmoud, R.M. and T.K. El-Rayes, . 2016. Effect of Stocking Density and Probiotic Supplementation on Broiler Performance. Journal of Animal and Poultry Production, 7(12), :.491-497.

22. Mountzouris, K.C., P. Tsirtsikos, E.., Kalamara, S., Nitsch, G.., Schatzmayr, G. and K. Fegeros,. 2007. Evaluation of the efficacy of a probiotic containing Lactobacillus, Bifidobacterium, Enterococcus, and Pediococcus strains in promoting broiler performance and modulating cecal microflora composition and metabolic activities. Poultry science, 86(2),:.309-317.

23. Petek, M., R. Üstüner . and D.. Yeşilbağ, . 2014. Effects of stocking density and litter type on litter quality and growth performance of broiler chicken. Kafkas Univ Vet Fak Derg, 20(5), pp.743-748.

24. Pourakbari, M., A. Seidavi, L., Asadpour. and A. Martínez. 2016. Probiotic level effects on growth performance, carcass traits, blood parameters, cecal microbiota, and immune response of broilers. Anais da Academia Brasileira de Ciências, 88(2),:.1011-1021.

25. Rashidi, N.,M.R. Ghorbani, A. Tatar, . and S. Salari, . 2019. Response of broiler chickens reared at high density to dietary supplementation with licorice extract and probiotic. Journal of animal physiology and animal nutrition, 103(1),:.100-107.

26. Salehimanesh, A.,M. Mohammadi and M. Roostaei- and M. Ali Mehr, ., 2016. Effect of dietary probiotic, prebiotic and

synbiotic supplementation on performance, immune responses, intestinal morphology and bacterial populations in broilers. Journal of animal physiology and animal nutrition, 100(4), :.694-700.

27. Sarangi, N.R., L.K.Babu, C. Kumar, C.R., Pradhan, P.K., Pati, and J.P. Mishra . 2016. Effect of dietary supplementation of prebiotic, probiotic, and synbiotic on growth performance and carcass characteristics of broiler chickens. Veterinary world, 9(3), :.313.

28. SAS. 2007. User's guide. 9.2 ed In Cary, NC: SAS institute.

29. Shahir, M.H., O. Afsarian, S., Ghasemi and G. Tellez. 2014. Effects of dietary inclusion of probiotic or prebiotic on growth performance, organ weight, blood

30. parameters and antibody titers against influenza and newcastle in broiler chickens. International Journal of Poultry Science, 13(2),:.70.

31. Silva, G.V.D., N.D.J.B. Machado, L.W.D., Freitas,., M.F.D. Lima, and R.H. Luchese, . 2018. Performance and carcass yield of female broilers fed with diets containing probiotics and symbiotics as an alternative to growth enhancers. Acta Scientiarum. Animal Sciences, 40.

32. Zhang, H.Y., X.S. Piao,. Q., Zhang, P.., Li,., J.Q. Yi, J.D., Liu, . and G.O. Wang, . 2013. The effects of Forsythia suspensa extract and berberine on growth performance, immunity, antioxidant activities, and intestinal microbiota in broilers under high stocking density. Poultry Science, 92(8),.1981-1988.