

CONSEQUENCES OF NEW APPROACH IN PRODUCTION SYSTEM OF LOCAL KURDISH SLOW-GROWING BROILERS

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ABSTRACT

This study was aimed to investigate the effect of new production system of local Kurdish slow-growing broilers with special emphasis on organic technique. A total of 360 one-day-old chicks mixed local slow-growing broiler genotype were distributed randomly into six treatments: (T1) control, feeding *ad libitum* commercial diet (indoor), (T2) feeding *ad libitum* organic (indoor), (T3) feeding commercial % 75+ pasture, (T4) feeding organic % 75+ pasture, (T5) feeding commercial *ad libitum* + pasture, and (T6) feeding organic *ad libitum* + pasture. Each treatment consists of 60 birds with three replicates per treatment, 20 birds replicate. The results indicated that organic group treatment (T6) that fed *ad libitum* feed and pasture had the highest body weight and weight gain. Meanwhile it had the lowest feed intake and better FCR. Fatty acids contents between treatments found to have significant differences for both organic and commercial feed. Significant differences were found when compared treatments to each other. Raising slow-growing chickens under different system and feeding organic feed at a different level have had a potential effect on their performances and profile of fatty acids, and amino acids of their meat. It was concluded that feeding chicken organic feed *ad libitum* and allowing to access to the pasture performed better than all other treatment groups. Significant differences were found among treatments for sensory evaluation. Organic treatments and commercial treatments under same condition were not found any significant differences.

Keywords: organic system, local slow-growing broiler, body weight, FCR, fatty acid profile, amino acids.

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النتائج المتحققة عن استخدام نظم حديثة في الإنتاج لدجاج اللحم المحلي الكردي بطيء النمو

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المستخلص

اجريت هذه الدراسة كمحاولة اولى في اقليم كوردستان و العراق لتحقيق في مدى تاثير نظم انتاج جديدة لدجاج اللحم المحلي بطيء النمو مع التركيز على استخدام في مدى تقنية الانتاج العضوي تم توزيع ثلاثمائة و ستون (360) فرخة عمر يوم من سلالة (محلي بطيء النمو) لدجاج اللحم التجاري بشكل عشوائي على ستة (6) معاملات. المعاملة الأولى (T1) هي معاملة المقارنة التي غذيت بشكل حر على عاف تجاري و ربيت داخل المسكن، المعاملة الثانية (T2) غذيت على علف عضوي بشكل حر و ربيت داخل المسكن المعاملة الثالثة (T3) غذيت على 75% من احتياجات الطير على علف تجاري مع الخروج الى المرعى، المعاملة الرابعة (T4) غذيت على علف عضوي 75% من احتياجات مع الخروج الى المرعى، المعاملة الخامسة (T5) غذيت بشكل حر على علف تجاري مع الخروج للمرعى بينما غذيت المعاملة الخامسة (T6) بشكل حر على علف عضوي مع الخروج للمرعى. كل معاملة تتكون من ستون (60) طير وثلاث (3) مكررات لكل معاملة وبواقع عشرون (20) طير لكل مكرر. النتائج يوضح بأن معاملة مجموعة العضوي (T6) و التي غذيت بشكل حر على العلف العضوي مع الرعي اعطت اعلى وزن حي و زيادة وزنته و كذلك اعطت اقل استهلاك علف (FI) وأفضل معامل تحويل غذائي. هناك فروقات معنوية في محتوى اللحم من الأحماض الدهنية الغير مشبعة (UFA) بين معاملات مجاميع العضوية والتجارية وكذلك بين المعاملات بشكل عام. تربية الدجاج المحلي بطيء النمو تحت نظم الانتاج المختلفة و التغذية العضوية و بمستويات مختلفة (حر و 75%) كانت لها تاثير كبير على الكفاءة و محتوى اللحم من الأحماض الدهنية والأحماض الأمينية. تم الأستنتاج من الدراسة بأن تغذية الدجاج المحلي بطيء النمو بشكل حر والرعي اعطت أفضل كفاءة مقارنة ببقية مجاميع المعاملات، أظهرت التقييم الحسي للحوم بوجود فروقات معنوية بين المعاملات العضوي والتجاري تحت نفس الظروف لم يظهر مجاميع الطيور المرعاة بالنظام اية فروقات معنوية

الكلمات المفتاحية: النظام العضوي، دجاج اللحم بطيء النمو، وزن الجسم، كفاءة التحويل الغذائي، الأحماض الدهنية، الأحماض الأمينية

INTRODUCTION

Commercial poultry husbandry has been changing since consumers demand poultry products changed, and this lead to increase development in the poultry industry (22). In the last two decades, consumers around the world are more concern about raising birds, regarding the use of synthetic chemicals, antibiotics and animal welfare. Free-range and organic chicken meat is those products preferred by many consumers because they believe the quality and sensory of these products are superior (26). Under these two systems (free-range and organic) birds allowed to access freely into a pasture that is to behave naturally for foraging, feed selection and activity, thus improving animal behavior. Although, the amount of accessing outdoor for the organic system under different regulation that practice currently is not defined well. Therefore, the amount of pasture consumption and nutritional value from foraging associated with the type of pasture vegetation and the system in use (17). The modern meat chicken production is used fast growing genotypes and conventional systems due to providing birds with a comfortable environment in confined house, highly nutritional feed, and veterinary attention. Birds reach markets in just six weeks with high breast meat. However, selecting fast-growing broiler for meat production negatively affected the sensory and quality of meat (8). While the slow-growing broiler genotypes under organic system required a longer time minimum of 81 days, its slaughter age could differ from country to another, in France the age of slow-growing birds restricted to minimum 84 days of age, conversely, in the United States organic and fast-growing broiler production utilize mostly the same under conventional system (17). Variety of factors affecting broiler meat quality such as, genotypes, feed types, slaughter age, bird activity, accessing outdoor, and adoption to the outdoor environment (10). In practice, slow-growing has more potential to be rose under the organic system and mostly all regulation of organic suggest breeds that have better resistance to disease and well adapted to the outdoor environment. Even though slow-growing birds are less efficient than fast-growing, but it appears to be more suitable for

the organic system (8,12 and14) compared three types of broiler genotypes and fed on the same feed for 81 days, observed that slow-growing breast meat was tougher. Studies reported by increasing slaughtered age the high content of protein (24) and lower lipid (6) and more flavorful (12). The study was aimed to assess the influence of organic system on growth performance, and meat quality of local Kurdish slow-growing chickens.

MATERIALS AND METHODS

This experiment was conducted in poultry facilities of Agriculture College-Salahaddin University/ Erbil - Kurdistan region - Iraq. This experiment was carried out using completely randomized designs (CRD) with three replicates. A total of 360 one-day-old chicks local Kurdish slow-growing broiler reared in 18 boxes, 2×2 m (indoor for the first 14 days of bird's age and each box represented a replicate contains of 20 chicks. Birds were divided into 6 treatment groups, each with three replicates. First treatment: as control (T1) consumed *ad libitum* commercial feed, second treatment (T2): birds consumed *ad libitum* organic feed, third treatment (T3): birds consumed %75 commercial feed + pasture, fourth treatment (T4): birds consumed %75 organic feed + pasture, fifth treatment (T5): birds consumed *ad libitum* commercial feed + pasture, while sixth treatment (T6): birds consumed *ad libitum* organic feed + pasture. All birds assigned to the same condition for the first two weeks of bird's age and fed *ad libitum* on two types of feed (commercial and organic) according to their treatments. On day 15th birds had free access to pasture through a hole from indoor to the outdoor. The outdoor area measured 2 × 10 m (1 m²/bird) for each box and separated by fence. The outdoor area designed to provide bird a natural behavior and covered with alfalfa (*Medicago sativa*). The commercial feed formulated to cover bird's requirement of crud protein (CP) and metabolized energy (Me). Commercial Group treatments were fed a starter from 0-4 weeks a commercial ration (CP 23.00, ME 2950 kcal/kg) then grower from 4-8 weeks a commercial ration (CP 21.00, ME 3050 kcal/kg) and finisher from 8-12 weeks a commercial ration (CP 19.00, ME 3010 kcal/kg). Organic group

treatments received certified organic feed from DSA Agrifood Products kirikkale- Turkey (ISO 22000:2005) (Starter feed from 0-4 weeks CP 22.00, ME 2928 kcal/kg, Grower feed from 4-8 weeks CP 20.19, ME 2975 kcal/kg and Finisher feed from 8-12weeks CP 18.56, ME 3016 kcal/kg).

Studies traits

Body weight, body weight gain, feed intake and feed conversion ratio, were weekly observed and recorded. The average weights of one day old chicks were 35 ± 5 gm, birds and diets were weekly weighted to determine body weight gain (BWG), feed intake (FI) and feed conversion ratio (FCR). Twelve birds per treatment were fasted for 12 hours before slaughter and then slaughtered by manual exsanguination. The age at slaughter was 42 days for control group and 84 days for other groups.

Chemical analysis

To determine fatty acid profile and amino acid profile in the meat, muscle samples of 100gm from breast and thigh were taken equally per carcass and mixed well then dried in oven (75 C0 for 24 hours). All dried samples were kept in deep freezer at -18 C0 till were analyzed. Amino acids and fatty acids profiles were analyzed according to (4) method. Amino acids profile analyzed by Biochrom30 analyzer and fatty acids analyzed by Gas chromatograph with FID detector. Biochrom 30 analyzer and fatty acids analyzed by Gas chromatograph with FID detector Regional Center of Food and Feed Laboratories – Agriculture Research Center- Egypt. The samples for sensory evaluation were taken from breast and thigh of each carcass (12 birds per treatment) and deep frozen at -18 °C until day of assessment. For paneling test samples were thawed at 4 °C overnight and all samples were offered to trained panelists from food science department- Salahaddin University- Agriculture College in two form of testing: first, roasted without spices and salted, second: cooking samples in water. The samples sliced into equal pieces and roasted in oven at 180 °C and for the second type of test samples were cooked in water till the internal temperature of meat got 80 °C. A nine of trained panelists performed the sensory evaluation and samples (roasted and cooked) randomly offered to

these panelists. The trial was performed into two sessions, in each session panelists tasted six samples and scored four traits (aroma and flavor, tenderness, juiciness, and overall acceptances). The Scale was pointed from 1 to 5, score 5 referring to high better flavor and aroma, very tender, very juicy, and score 1 refers to no flavor and aroma, tough meat, very dry (16). Experimental data analyzed by using SAS program (23), according to the CRD design and analysis of variance were calculated. Significant differences were detected between treatment groups by proceedings of Duncan's Multiple range tests, a level of $p \leq 0.01$ was considered statistically significant.

RESULTS AND DISCUSSION

Live body weight, body weight gain, Feed intake, and FCR

The final live body weight of birds for treatment groups were various and there were significant differences among treatment groups (Table 1). The control group reared for 6 weeks, the remaining treatment groups reared for 84 days. The results showed that the chicken weight of the control group (indoor) raised for 42 days (1657.62 g) was significantly different with that of the organic group (indoor) (1339.54g), third and fourth treatment groups being 1378.34 and 1411.99g, respectively. The highest average body weight (1734.61g g) was recorded from the T6 group fed on *ad libitum* organic and had free access to the pasture, but it was not statistically differences with control and groups with *ad libitum* fed on commercial and pasture. While the second group (T2, indoor) of birds that fed on organic the average body weight was 1339.54g had the lowest average body weight among all groups organic and commercial with and no significant differences ($p \leq 0.01$) were found between this group and the third (T3), fourth (T4) groups. Overall, it can be concluded that the average body weight of treatments groups (T5 and T6) were higher than the other groups, particularly birds of the treatment six (T6) had the largest body weight. Unlike most of the findings in the literature, which were reported the higher final live body weight of birds that reared in total indoor and controlled environment compared to free-range. Results of (5, 9 and 17) showed that

broilers kept indoor were heavier than those had access to the pasture. The results showed significant ($P \leq 0.05$) increased in mean of body weight, weight gain, average feed consumption and the feed conversion ratio, for the birds of treatments T3 and T4 in comparison with control treatment (T1). (1). Also, the same results documented in the literature by (26) who observed quail's performance in two types of system indoor %100 and free-range. The reasons for these results had been linked to the bird's activity, quality of nutrition intake and environment, which birds could performance better in an indoor system, as a result, can have higher body weight. Results of this study agreed with those of (19,22) and 27) were they reported that broiler had had higher final body weight in the free-range system compared to the broiler in indoor broiler. The reason might be related to better performance of birds in the outdoor system are birds are less stressful due to perform their natural behavior, consequently, their performance could be better (9). Results of the feed intake were showed that there were significant differences ($p \leq 0.01$) among all treatment groups. The highest consumption of feed was recorded in treatment group T2 (indoor + feed organic) and averaged (9290.9 g feed/bird) during the entire time of the experiment, and then followed by treatment group T3 (8759.8 g feed/bird) and treatment group T5 (7636.9g feed/bird), which were both fed on commercial feed at different level. The control group (indoor + *ad libitum* commercial feed) had lower feed intake (7407.0 g feed/bird) compared to all other treatment groups except

treatment group T6 (free access to pasture + *ad libitum* organic feed) that had lowest feed consumption among all over the treatments (6118.1g feed/bird). (14) Explained that ambient temperature and photoperiod length have a potential effect on the feed intake and bird's performance, the longer photoperiod, the higher feed intake. Also, lower ambient temperature lead to higher consumption of feed. However, our results did not show the great impact of the environment on feed intake as it shows in the Ttable.2, where treatment group T6 had lowest feed intake, and other treatments with access to pasture have had lower feed intake comparing to the treatment that kept indoor with the same feed type. In terms of feed conversion, significant differences ($p \leq 0.01$) were found among all treatment's groups. Results showed that the significant ($p \leq 0.01$) improvement in body weight, weigh gain, feed conversion, Feed conversion ratio, carcass yield without giblet) (25) The highest value of feed conversion was recorded from the chicken of the treatment group T2 (indoor + *ad libitum* organic feed) 6.94, then 6.36 for the T3 treatment group. No significant differences were found between treatments control, T4 and T5 being averaged 4.47, 4.82 and 4.49, respectively. Treatment group T6 (free access to pasture + *ad libitum* organic feed) expressed the best of feed conversion of 3.53. In the literature, it was reported that feeding on commercial feed and access to the pasture could lead to having lower feed conversion (7and 20). But our finding indicated that birds fed organic feed with access to pasture had lowest feed conversion.

Table1. The final live (LBW) body weight (BW), Feed intake (FI) and feed conversion (FCR) for different feeding treatments

¹ Treatment groups	Parameters			
	live Body Weight (g)	Body Weight Gain (g)	Feed Intake (g)	FCR
T1	1657.6 a	1617.6a	7407.0 d	4.47 c
T2	1339.5 b	1299.5b	9290.9 a	6.94 a
T3	1378.3 b	1338.3b	8759.8 b	6.36 b
T4	1411.9 b	1371.9b	6799.6 e	4.82 c
T5	1703.1 a	1663.1 a	7636.9 c	4.49 c
T6	1734.6 a	1694.6a	6118.1f	3.53 d
² SEM	73.26	73.26	484.41	0.53

a, b, c, d Means followed by different letters in the columns are significantly different ($p \leq 0.01$). ¹T1 (control) commercial feed *ad libitum* (indoor), T2 Organic feed *ad libitum* (indoor), T3 commercial feed % 75 + pasture, T4 organic feed % 75 + pasture, T5 commercial feed *ad libitum* + pasture, T6 organic feed *ad libitum* + pasture).²SEM, standard error of the means (pooled).

Meat fatty acids

The results in the Table 3 show a fatty acid in the chicken meat. The results reveal clearly seen that significant differences among treatment groups for each type of fatty acids are existing. While the differences did not significant for saturated fatty acid (Palmitic) between treatment groups T3, T4, and T5 which were averaged 25.91, 26.03 and 28.27, respectively. The highest content of palmitic acid was recorded in T6 (*ad libitum* organic feed + pasture) 29.9 %, while treatment that fed *ad libitum* organic feed and not access to the pasture had the lowest content of Palmitic in their meat (21.7%). Another saturated fatty acid is Stearic, comparing to the control group (indoor + *ad libitum* commercial feed) 5.8% which was the lowest value among all groups. The T6 treatment group was showed a content of nearly double amount of Stearic being 10.4. Mono-unsaturated fatty acids (MUFA) content vary among treatments and revealed significant differences ($p \leq 0.01$). The highest content found in T5 (4.3%) which differed significantly with T6 3.8, and both groups were growing under similar condition with different feed, the former fed on commercial feed and the last fed on organic. No significant differences were found in treatment among

birds fed %75 of organic feed + pasture 39.1% and birds that fed on *ad libitum* of commercial feed + pasture (39.31), these two treatments had a higher content of Oleic among other than groups. Linoleic and Linolenic acids are known as polyunsaturated fatty acids (PUFA) and their content in each treatment groups were varied. Lenoleic acid content in meat of T2 (indoor + *ad libitum* organic feed) was highest 25.1% and significant difference compared to other treatment groups, nevertheless, T6group was fed *ad libitum* organic feed + pasture had the lowest content of Lenoleic 14.6%.The summation of PUFA, MUFA, n-3 and n-6 were varying in groups. The highest content of total PUFA was 28.68 in T2 (indoor + *ad libitum* organic feed), total MUFA recorded in T5 (*ad libitum* commercial feed + pasture) 44.23, n-3 (1.63) control group, and total n-6 (26.94) in T2. According to (21) the fatty acid content in the meat affected by different factors such as breeds, and they reported different content of PUFA in two types of breeds. (10) assumed that the bird's activity and pasturing might have an effect on the meat fatty acid profiles. Birds age also have an effect on fatty acid profiles (24).

Table2. Fatty acids composition of broiler meat

Fatty acids	¹ Treatments						² SEM
	T1	T2	T3	T4	T5	T6	
C8:0 Caprylic acid	0.67 ^b	1.67 ^a	0.00 ^c	0.00 ^c	0.00 ^c	0.00 ^c	0.15
C14:0 Myristic acid	0.61 ^{abc}	0.48 ^c	0.69 ^{ab}	0.55 ^{bc}	0.60 ^{abc}	0.79 ^a	0.03
C15:0 Pentadecanoic	0.14 ^{bc}	0.00 ^c	0.00 ^c	0.28 ^{ab}	0.16 ^{bc}	0.44 ^a	0.03
C16:0 Palmitic	26.39 ^c	21.75 ^e	25.91 ^d	26.03 ^d	28.27 ^b	29.94 ^a	0.81
C16:1w7 Palmitoleic	4.17 ^b	2.85 ^e	3.45 ^d	2.97 ^e	4.38 ^a	3.68 ^c	0.15
C17:0 Heptadecanoic	0.27 ^b	0.00 ^c	0.29 ^b	2.97 ^a	0.26 ^b	0.31 ^b	0.25
C16:3w4 Hexagonic	0.00 ^b	0.00 ^b	0.00 ^b	0.00 ^b	0.00 ^b	0.12 ^a	0.01
C18:0 Stearic	5.86 ^e	7.56 ^b	7.70 ^b	8.10 ^b	7.13 ^c	10.42 ^a	0.68
C18:1 w9 Oleic	38.54 ^b	31.56 ^d	30.22 ^e	39.19 ^a	39.31 ^a	36.99 ^c	1.15
C18:2 w6 Linoleic	19.39 ^c	25.18 ^a	24.71 ^b	19.10 ^d	17.46 ^e	14.63 ^f	1.00
C18:3w3 Linolenic	1.54 ^a	1.34 ^b	1.71 ^a	0.99 ^c	1.17 ^b	0.79 ^d	0.08
C18:3w6 Gamma Linolenic	0.00 ^b	0.00 ^c	0.00 ^b	0.14 ^a	0.00 ^b	0.00 ^b	0.03
C20:1w9 Gadolic	0.26 ^a	0.00 ^c	0.31 ^a	0.31 ^a	0.17 ^b	0.16 ^b	0.05
C20:1w7 9-eicosaenoic	0.22 ^c	0.36 ^b	0.52 ^a	0.00 ^d	0.00 ^d	0.00 ^d	0.11
C20:4w6 Archidonic	0.67 ^c	1.59 ^a	1.13 ^b	0.61 ^c	0.28 ^d	0.54 ^c	0.02
C22:6w3 Docosahexaenoic (DHA)	0.13 ^{bc}	0.31 ^a	0.25 ^{ab}	0.14 ^{bc}	0.00 ^c	0.12 ^{bc}	0.03
C18:2w4	0.23 ^a	0.00 ^b	0.00 ^b	0.20 ^a	0.28 ^a	0.00 ^b	0.02
C20:2w6 Eicosadieoic	0.14 ^b	0.17 ^a	0.19 ^a	0.17 ^b	0.00 ^b	0.00 ^b	0.03
C20:1w11 Eicosaenoic acid	0.13 ^a	0.00 ^b	0.00 ^b	0.16 ^a	0.00 ^b	0.00 ^b	0.17
C22:1w9 Erucic acid	0.14 ^b	0.00 ^c	0.00 ^c	0.30 ^a	0.20 ^a	0.33 ^a	0.01
C18:1w7 Vaccinic	0.14 ^c	2.57 ^a	1.19 ^c	0.00 ^c	0.00	0.00	0.02
C22:1w11 Docosenoic acid	0.00 ^c	0.28 ^a	0.25 ^a	0.26 ^a	0.17 ^b	0.26 ^a	0.02
C22:5w3 Clupandonic (DPA)	0.00 ^b	0.22 ^a	0.18 ^a	0.00 ^b	0.00 ^b	0.00 ^b	0.02
C22:4w6 Docosatetraenoic	0.00 ^b	0.00 ^b	0.22 ^a	0.12 ^a	0.00 ^b	0.00 ^b	0.03
∑ MUFA	43.6	37.62	35.94	43.19	44.23	41.33	
∑ PUFA	22.01	28.68	28.18	22.31	18.91	15.81	
∑ UFA	56.61		64.12	65.29		57.14	
∑ n-3	1.67	1.65	1.96	1.13	1.17	0.91	
∑ n-6	20.34	26.94	26.03	20.16	17.9	15.61	

a, b, c, d small letters in same row are significantly different ($p \leq 0.01$). ¹T1 (control) commercial feed *ad libitum* (indoor), T2 Organic feed *ad libitum* (indoor), T3 commercial feed 75 % + pasture, T4 organic feed % 75 + pasture, T5 commercial feed *ad libitum* + pasture, T6 organic feed *ad libitum* + pasture). ²SEM, standard error of the means (pooled).

Amino acids profile

The results in the table.3 show amino acids % in the chicken meat. Significant differences were found among treatment groups. The ironing % was ranged from 3.18% (T2) to 3.50% (T1), in these treatment groups, birds were kept indoor and fed a different type of feed. Groups that fed organic and pasture had a highest percent Valine (3.85% and 3.46%) for treatment groups that fed on commercial feed plus pasture. Lysine is one of the essential amino acids, its percent in the meat of chicken group that fed organic at the different level were lower compared to the groups that fed o

commercial feed under similar condition, except T6 which had a greater percent of Lysine 6.11% compared to T5 5.93%. It has been reported in the literature three amino acids linked to the chicken meat flavor's, which are threonine, histidine, and cysteine (28). Chicken meat histamine content did not differ significantly among groups. Histamine values were ranged between 2.14 %to 1.97%. Depending on the amino acid content in the meat protein is distinguished acids (18). Amino acids are the precursors of meat smells (28).

Table3. Amino acid profile of broiler meat (percentage content in total protein

Amino acid	¹ Treatments						² SEM
	T1	T2	T3	T4	T5	T6	
Aspartic (ASP)	6.79 a	6.21 c	6.52 b	6.41 b	6.37 ab	6.51 b	0.14
Therionine (THR)	3.50 a	3.18 c	3.40 ab	3.40 ab	3.26 bc	3.37 ab	0.07
Lysine (LYS)	6.56 a	5.72 d	6.22 bc	6.05 bc	5.93 c	6.11 bc	0.07
Phenylalanine (PHE)	3.15 a	2.76 d	2.96 bc	2.94 bcd	2.78 cd	3.10 ab	0.91
Valine (VAL)	3.87 a	3.51 b	3.96 a	3.96 a	3.46 b	3.85 a	0.15
Methionine	2.48 ab	2.41 ab	2.44 ab	2.37 b	2.58 a	2.39 ab	0.18
Cystine (CYS)	0.93 bc	1.20 a	0.89 bc	0.84 c	1.18 a	1.06 ab	0.09
Histidine (HIS)	2.14 a	1.97 a	2.03 a	1.98 a	2.00 a	2.03 a	0.07
Leucine(LEU)	5.88 a	5.11 d	5.62 b	5.64 b	5.35 c	5.58 b	0.12
Tyrosine (TYR)	3.31 a	2.42 d	2.71 bc	2.81 b	2.59 cd	3.35 a	0.10
Isoleucine (ILE)	3.66 a	3.30 c	3.49 abc	3.48 abc	3.36 bc	3.50 ab	0.07
Serine (SER)	3.21 a	2.75 c	3.00 b	3.04 ab	2.68 d	2.89 bc	0.04
Glutamic (GLU)	11.60 a	10.47 d	11.27 b	11.17 b	1.30 e	10.93 c	0.14
Glycine (Gly)	4.56 a	3.75 c	3.88 c	4.10 b	2.82 d	3.87 c	0.11
Alanine (ALA)	5.49 ab	4.35 d	5.47 b	5.66 a	4.20 d	4.56 c	0.13
Arginine (ARG)	5.34 a	4.79 c	4.81 c	4.71 cd	4.55 d	5.02 b	0.04
Proline (PRO)	3.55 a	2.37 c	3.03 b	2.94 b	2.16 d	2.49 c	0.05

a, b, c, small letters in same row are significantly different ($p \leq 0.01$). ¹T1 (control) commercial feed *ad libitum* (indoor), T2 Organic feed *ad libitum* (indoor), T3 commercial feed 75 % + pasture, T4 organic feed % 75 + pasture, T5 commercial feed *ad libitum* + pasture, T6 organic feed *ad libitum* + pasture). ²SEM, standard error of the means (pooled).

Sensory evaluation

The results in table 4, 5 show sensory evaluation result of two methods of tests roasted and cooked. Aroma and flavor of group treatments fed commercial feed and pasture T3 had the best for roasted method; however there were not significantly differences to other groups, except control group. All roasted samples of treatment groups were comparable for juiciness and could not find significant differences among both types of treatment groups (commercial and organic). Juiciness for meat were scored between 2.6 for control group to 3.5 for T5, most of treatments

did not different significantly, except control group and T5. Also, over all acceptances were not showed differences for commercial and organic groups. The only two treatment groups had significantly differences were control group T1 and T3. The results of sensory evaluation of cooked meat rating reveal in table 5, commercial and organic groups that fed *ad libitum* feed and pasture did not differed significantly for all sensory traits (Aroma and flavor, tenderness, juiciness, and over all acceptances). While, panelists rated control group treatment lowest among all other treatments (12) reported that the differences

did not significant between organic and standard rearing system of broiler. Variation in tenderness value might relate to collagen cross-linking, which is linked to age of birds (13). Cooking types have an effect on flavor and aroma, reaction between meat samples

during cooking, which cause to had special aroma of meat (3and 15) did not find significant difference between organic, free-range, and commercial broiler meat for texture and aroma.

Table 4. The effect of roasted meat on sensory tests

Parameters	flavor and aroma	Tenderness	juiciness	over all acceptance
¹ T1	2.90 ^b	2.60 ^b	2.80 ^a	2.80 ^b
T2	3.40 ^{ab}	2.90 ^{ab}	2.90 ^a	3.30 ^{ab}
T3	3.90 ^a	3.40 ^{ab}	3.30 ^a	3.60 ^a
T4	3.30 ^{ab}	2.80 ^{ab}	2.60 ^a	2.90 ^{ab}
T5	3.20 ^{ab}	3.50 ^a	3.40 ^a	3.40 ^{ab}
T6	3.30 ^{ab}	3.30 ^{ab}	3.10 ^a	3.10 ^{ab}
² SEM	0.13	0.15	0.12	0.12

¹T1 (control) commercial feed ad libitum (indoor), T2 Organic feed ad libitum (indoor), T3 commercial feed 75 % + pasture, T4 organic feed % 75 + pasture, T5 commercial feed ad libitum + pasture, T6 organic feed ad libitum + pasture). ²SEM, standard error of the means (pooled).

Table 5. The effect of cooked on sensory tests

¹ Treatments	flavor and aroma	Tenderness	juiciness	over all acceptance
T1	2.60 ^c	2.70 ^b	2.90 ^c	2.70 ^b
T2	3.30 ^{abc}	3.00 ^b	3.30 ^{abc}	3.20 ^{ab}
T3	3.20 ^{bc}	2.80 ^b	3.20 ^{bc}	3.20 ^{ab}
T4	3.20 ^{bc}	3.10 ^b	3.20 ^{bc}	3.30 ^{ab}
T5	4.00 ^a	4.00 ^a	3.70 ^{ab}	3.90 ^a
T6	3.70 ^{ab}	3.80 ^a	4.00 ^a	3.90 ^a
² SEM	0.19	0.22	0.16	0.19

¹T1 (control) commercial feed ad libitum (indoor), T2 Organic feed ad libitum (indoor), T3 commercial feed 75 % + pasture, T4 organic feed % 75 + pasture, T5 commercial feed ad libitum + pasture, T6 organic feed ad libitum + pasture). ²SEM, standard error of the means (pooled).

Raising slow-growing chickens under different system and feeding organic feed at a different level had a potential effect on their performance and both profile of fatty acids and amino acids of their meat. Feeding chicken ad libitum of organic feed and allowing to access to the pasture performed acceptable than the other conditions. Amino acids and fatty acids contents in meat among treatment groups were varied with significant differences. Sensory evaluation scores were nearly similar for all treatment groups the two types of cooking and significant differences were found among commercial and organic groups.

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