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Growth Performance and Carcass Traits of Broiler Reared in Conventional and Organic Conditions

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ABSTRACT

This experiment was conducted to compare the growth and some carcass characteristics of broiler chickens reared in conventional and organic methods. Totally 360 days-old broiler chicks were divided into 6 groups randomly with 3 replicates. Treatment groups were conventional, Organic Control (OC), *ad libitum* Organic+Pasture (Adlib OP), 80% Organic+Pasture (OP 80), 70% Organic+Pasture (OP 70), 50% Organic+Pasture (OP 50). Growth performance of conventional (6 weeks) and organic groups (10 weeks) was investigated. Birds reared under condition of conventional and organic were slaughtered at the end of 6 and 10 weeks of age, respectively. Feed restriction and diet consumed by the birds had impacts ($p<0.01$) on growth performance, feed consumption, feed efficiency and carcass traits. The average body weights of conventional, Adlib OP, OP 80, OP 70 and OP 50 groups were 2305.4, 1935.4, 3028.6, 2656.7 and 2789.6 g at the end of fattening period, respectively. According to results of this study, it could be said that if organic broiler production has to be done with fast growing birds and feed restriction and access to outside with pasture designed for poultry to contribute nutrient intake would be taken account. Moreover, 70 or 50% feed restriction with shorter rearing period (8 weeks) could also be practiced.

Key words: Broiler, organic, conventional, fattening performance, carcass traits

INTRODUCTION

While the human population of the world shows the continuous increase in the expense of other living things, human-induced negative factors disrupting the ecological balance. From millions of years to the present day as a result of natural selection in many plant and animal species is decreasing with each passing day, while some species are disappeared (Ak, 2005). Excessive pollution is threatening the future of the world and making life more difficult every day to day. The rapid increase of world population increases the people's food needs well. Crop yield was increased about 100% by agricultural production techniques in the early 1960s and it was called Green Revolution briefly (Aksoy and Altindisli, 1998; Bolukbasi and Emsen, 2005). However, the unsustainable development reached to a threshold due to the rapid deterioration of the ecosystem caused by conventional production techniques (Ak, 2005).

Whereas early organic farming was mainly focused on crop production, organic animal production has become an increasingly important sector during the last decade. There has evolved several different methods or systems in poultry production. In the last decade, organic animal production has become an increasingly important sector. Organic animal breeding are based on the same principles as organic plant production (Fanatico, 2006). These systems vary in how the birds are housed, fed and managed. Organic poultry production has many advantages comparing to conventional systems. For example, the humane treatment of animals is taken seriously under organic standards and is supported by animal rights organizations, organic farming practices are environmentally friendly creating less pollution and dangerous wastes (Castellini *et al*., 2002b). Organic meat is the safest choice because it comes from healthy animals raised on healthy land.

Organic production practice at poultry was impacted by consumer demand and insistence. This is especially due to the demand for organic production as well as free-roaming poultry production systems are being developed and studies on alternative production systems are increasing. In developed countries, the productions of organic chicken products are currently growing and have become a rapidly evolving market (Fanatico *et al*., 2005; Fanatico, 2006).

The organic market has grown by 20% annually in the United States for the past decade and poultry products are part of this trend most natural and organic poultry production in the United States utilizes the same fast-growing broiler genotype used in conventional production systems. It is well known that specialty poultry products have a longer history in Europe. One of these specialty poultry production systems in Europe is the French Label Rouge program which requires outdoor access (Fanatico *et al*., 2005). Use of slow-growing genotypes and has captured 30% of the French poultry market despite selling products for twice the price of conventional poultry products (Fanatico *et al*., 2005; Fanatico, 2006). In European organic programs (Mulder and Hupkes, 2007), which mandate a growing period of at least 81 days. However, there is no requirement to use slow growing birds in organic production in Turkey organic program. Looking specifically at poultry, the number of publications is even smaller. Due to this, it is difficult to get a reasonable overview of the current situation in different countries. Because of lack of slow growing genotype and difficulty in finding them in Turkey, research is needed to determine the suitability of fast-growing genotypes for Turkey's organic production system under different feeding and housing.

MATERIALS AND METHODS

This study was conducted at University of Yüzüncü Yýl, Agricultural Faculty Research Farm from May to July, 2008. The facility was a window-sided house with a concrete floor. A thermostatically controlled electrical heater was used and gas brooders along the length of the house provided additional heat during brooding. Indoor pens measured 1.8×3.6 m and contained two water and two hanging tube feeder. Ground predators were excluded by electric net fencing and overhead predators were excluded by netting over the yards. After 15 days of age, green grass was offered to free-range groups while they are inside the pens. For free-range treatments, outdoor access from these pens was provided after 3 weeks of age during daylight hours through a single doorway measuring 50×50 cm. The outdoor pens each measured 7×2 m. Birds were confined to indoor pens at night except Adlib OP. Indoor pens and pens with outdoor access were interspersed in the same building with pens randomly assigned. All pens contained new pine wood shavings and 23 and 16 h of light was provided for conventional and organic groups at the beginning to end of trial, respectively. Totally 360 1-day- old Ross male+female chicks after wing banded with number were randomly assigned to one of six groups with three replicates. Conventional (C, 15 birds m^2) and the organic control group (OC, 10 birds/m^2) (Demiryurek and

Bozoglu, 2007) were kept inside pens and access to feed and water was freely available and all diets were formulated to contain adequate nutrient levels. The third group (Adlib OP) was kept in one side open house with a yard with 2.5×6 m, the sides and over of the yard was covered with net fencing and consumed organic diet and grass in pasture *ad libitum*. The other treatment groups had access to outside during the day light. After three weeks of age, the fourth (OP 80), fifth (OP 70) and sixth (OP 50) groups were consumed diet 80, 70 and 50% of organic control groups consumed, respectively. All the birds of organic groups were consumed same diet based on certificated corn and soybean meal (IMO Institut Für Marktökologie GmbH-TR-OT-002-Ý-0108-732 Lot Certifica). The ration was made to meet needs of dry matter, energy and other nutrient requirement of birds. The conventional groups were fed by commercial broiler diets. The diets consumed by conventional and organic groups are given in Table 1.

Composition of the pasture was included alfalfa, grass, sainfoin, vetch, wheat and barley plants. During the grazing season, nutrient analysis of pasture in dry matter base were 14.85, 2.4, 31.5, 9.6, 87% and 1900 kcal kg^{-1}, for crude protein, crude fat, crude fiber, crude ash, dry matter and ME, respectively.

Birds and feed were weighted weekly with 0.1 g sensitivity for determination of weight gain, feed intake and feed efficiency. Weight gain and feed efficiency were adjusted for mortality and birds slaughtered at 6 and 10 weeks of age for conventional and organic groups, respectively. In this study, the analysis of weight, weight gain and feed efficiency did not include the effect of gender because birds were fed as mixed sex groups. All birds were commercially processed at the slaughterhouse of Agricultural Faculty of Yüzüncü Yýl University. Feed was withheld for 10 h before slaughter and chickens were weighed individually at the plant, in where the birds were identified as male or female. In each treatment group 12 male and 12 females were randomly

Table 1: Composition and nutrient content of diets used in the experiment

	Conventional			Organic			
Ingredients	Ration 1 week (1-2) (%)	Ration 2 week (3-5) (%)	Ration 3 week (6) (%)	Ration 1 week (1- hf) (%)	Ration 2 week (2-4) (%)	Ration 3 week (5-7) (%)	Ration 4 week (8-10) (%)
Corn	55.62	60.50	65.20	52.00	54.00	62.00	65.00
Soybean meal	31.38	30.70	25.80	38.70	37.00	28.80	27.80
Fish meal	6.00	-	-	-	3.00	3.00	-
Oil	3.89	4.50	4.70	4.00	3.70	3.90	4.90
Limestone	1.08	1.50	1.50	-	-	-	-
DCP	1.13	1.50	1.50	2.00	2.00	2.00	2.00
Salt	0.35	0.30	0.30	0.30	0.30	0.30	0.30
Vit.-Mineral[a]	0.35	0.16	0.16	-	-	-	
Calculated nntrient content (%)							
ME (kcal kg^{-1})	3150.00	3146.00	3200.00	3102.80	3100.00	3202.00	3280.00
Protein	23.00	20.00	18.00	23.70	23.10	20.20	18.08
Ca	1.00	0.95	0.95				
P (Total)	0.70	0.42	0.41				
Methionine	0.42	-	-				
Lysine (%)	1.37	1.10	0.96				

[a]Added per kg: Vit. A 11.000 IU; Vit. D 32.000 IU; Vit. B1 2.5 mg; Vit. B2 4 mg; Vit. B6 1.25 mg; Vit. B12 0.01 mg; a-tocopheryl acetate 50 mg; biotin 0.06 mg; Vit. K 2.5 mg; niacine 15 mg; folic acid 0.30 mg; pantotenic acid 10 mg; choline 600 mg; Mn 60 mg; Fe 50 mg; Zn 15 mg; I 0.5 mg; Co 0.5 mg

chosen and slaughtered. Automated equipment was used for scalding and picking, however, vent opening and evisceration were done by hand. Birds were scalded at 53°C for 120 sec. Carcasses were prechilled at 12°C for 15 min and chilled (immersion) at 1°C for 45 min. After being chilled, the carcasses were aged at on 1°C for 6 h in a room and separated for their components parts. Yields of carcass, breast, back, wings, legs (thighs and drumstick) were recorded (Sarica *et al.*, 2009). The gastrointestinal tract, from the esophagus to the anus and organs were carefully excised.

Statistical analysis: The data were analyzed by SAS packet program. Data collected in this study completely randomized design were subjected to an analysis of variance and treatment means were separated using Duncan's multiple range test. The level at which differences were considered significant was $p<0.05$ (SAS, 1999).

RESULTS

Market weights of birds in conventional production are about 2000 to 2500 g at 42 days, which result in a 1300 to 1600 g carcass. However, slow growing birds reach the market weight 63 to 81 days, depending on the diets (Gordon and Charles, 2002; Fanatico *et al.*, 2005). The growth rates of birds under condition of this trial were accurately estimated. Adlib OP, OP 70, OP 50 and OP 80 reached the very similar market weight in 49, 53, 55 and 58 days, respectively. Even though organic control got at market weight at the end of trial, whereas birds of conventional groups reached market weight in 42 days (Table 2). The live weights of traditional group were significantly ($p<0.01$) higher than the other groups at the end of 6 week age (Table 2). Feed restriction in broiler production was practiced with different ways but not in broiler production so far. Quantitative feed restriction with outside access in this study had advantage to the organic control but not to Adlib OP in terms of live weight gain. The conventional group was always heavier ($p<0.01$) than all of organic groups through 6 wk of age. Among the organic groups, the highest body weight at the end of trial was observed in Adlib OP (3211.6 g) then in OP 70 (2876.1 g), OP 50 (2789.6 g) and OP 80 (2656.8 g) and the lowest body weight was observed as 1935,5 g in the OC group (Table 2). These ranks were similar at the 6th wk of age (Table 2). At the slaughtering time, live weights of organic groups were higher than conventional one except females of OC. Mean live weights of the male birds of the OC were as heavier as conventional group's, however, it was lighter than other organic groups at the slaughtering age (Table 3).

Table 2: Mean body weight (g) of the birds of organic and conventional groups as mixed (male+female) at different ages

	Treatment groups						
Weeks	Conventional	Organic control	Adlib OP	OP 80	OP 70	OP 50	Sign. level
0	47.5±0.9	47.6±0.9	48.0±1.2	47.9±0.9	48.0±0.8	47.4±1.1	NS
2	493.2±7.3a	339.9±7.7cd	356.9±7.7bc	337.2±7.6d	371.0±7.6b	338.1±7.6d	**
4	1241.5±22.7a	865.0±23.8d	867.0±23.8d	886.4±23.7cd	1018.9±23.6b	959.9±23.4c	**
6	2307.4±36.3a	1435.3±38.0de	1702.0±38.0b	1403.6±37.9e	1618.5±37.9c	1538.9±37.4e	**
8		1733.6±62.6d	2614.3±60.5a	2034.0±49.3c	2283.7±50.1b	2174.4±48.6bc	**
10		1935.5±78.1d	3211.6±68.6a	2656.8±61.6c	2876.1±62.5b	2789.6±60.7bc	**

Values with different letters in the same row are significantly different. a,b,c,d,e: Different letter in same lane is differ. **: $p<0.01$, NS: Non significant

Table 3: Carcass traits of the birds reared under conventional or organic conditions

		Treatment groups (weeks)						
Traits	Gender	Conventional (6)	OC (10)	Adlib OP (10)	OP 80 (10)	OP 70 (10)	OP 50 (10)	Sign level
Slaughtering	M	2779±74a	2846±215a	3622±22b	2826±215a	3387±214c	2859±214a	**
weight (g)	F	2388±56a	1916±83a	28300±83b	2612±83b	2630±83b	2614.6±82b	**
	M+F	2583±48a	2381±114a	3226±114b	2719±114c	3009±114d	2737±113c	**
Carcass	M	2114±40a	2129±161a	2814±161b	2138±161c	2577±161a	2243±161a	**
weight (g)	F	1782±41a	1388±58a	2181±58b	1990±58c	1994±58a	1906±58a	**
	M+F	1948±31a	1758±84a	2497±84b	2064±84c	2286±83b	2074±83c	**
Leg (g)	M	625±16a	627±47a	774±47b	630±47a	770±47a	639±47a	**
	F	447±16a	408±16a	580±16b	565±16b	559±16b	527±15b	**
	M+F	536±15a	517±24a	677±24b	598±24c	664±24b	583±24c	**
Breast g)	M	677±23a	596±58a	829±58b	569±58a	703±58c	622±57.86a	**
	F	594±22a	406±21a	683±21b	586±21c	613±21d	571±21.44c	**
	M+F	635±16a	501±30a	756±30b	578±30c	658±30c	596±30c	**
Wing (g)	M	208±7a	244±12b	310±12b	242±12b	297±12c	260±12d	*
	F	182±7b	176±7a	234±7c	224±7c	225±7c	228±7c	*
	M+F	195±5a	210±8b	272±8d	233±8c	261±8d	244±8c	*
Abdominal fat (g)	M+F	44.6±4.5b	32.4±4.7a	43.0±4.7b	37.2±4.7c	43.9±4.8b	32.2±4.7a	**

Values with different letters in the same row are significantly different. *: $p<0.05$, **: $p<0.01$, NS: Non significant, F = Female, M = Male

Carcass traits of the birds were summarized in Table 3. In this trial, the live weights of the males were heavier than the females at the end of trial ($p<0.05$). A sex effect on body weight is usually observed in poultry; males are heavier than females. It is similar for carcass traits. At the age of slaughter of conventional and organic group, 42 and 70 day, respectively. The female-to-male carcass weight ratio of the Adlib OC and C birds was only 65.2% (1388/2129) compared with 84.39% (1782/2114) in the inside birds. Among the outdoor access groups, the female-to-male carcass weight ratio of Adlib OP, OP 80, OP 70 and OP 50 were 77.5 (2181/2814), 93.1(1990/2138), 77.4 (1994/2577) and 85.0% (1906/2243), respectively. Mean carcass weights of organic groups were higher than conventional group except OC due to female birds. Mean carcass weights of the male birds of the OC were as heavier as conventional group's, however; it was lighter than other organic groups. In terms of parts yield, the females had higher percentages of breast meat yields than males ($p<0.05$), whereas males have higher percentages of leg and carcass yields ovarally. Percentage of wing yield of males is almost as same as females. Organic broilers, as expected, showed lower growth performance but at both ages, the amount of abdominal fat was significantly lower in comparison with the control birds (Table 3).

Feed consumption is given in Table 4 . The birds of C, OC and Adlib OP consumed feed as *ad libitum* during 0-6 weeks of age; however, the birds of OP 80, OP 70 and OP 50 just consumed feed as *ad libitum* during 0-3 weeks of age. The highest feed was consumed by C group among the *ad libitum* feed consumed groups during 0-6 weeks of age. The feed consumption differences between C and the other *ad libitum* were significant ($p<0.05$) but the differences between OC and Adlib OP were not. Due to quantitative feed restriction OP 80, OP 70 and OP consumed lesser feed in respect to the restriction percentage.

Table 4: Cumulative feed consumption (g/bird) of the birds at different ages

Weeks	Conventional	OC	Adlib OP	OP 80	OP 70	OP 50
0-1	169.1±11.3d	172.7±11.4c	182.7±11.3b	160.60±11.4e	206.1±11.4a	160.6±11.3f
0-2	522.1±9.1a	399.2±9.1bcd	393.0±9.1d	411.33±9.1bc	426.1±9.1b	379.1±9.1d
0-3	1131.3±17.6a	942.9±17.6c	931.2±17.6c	1012.80±17.6b	1061.9±17.6b	1023.2±17.6b
0-4	1818.1±30.9a	1794.7±30.9ab	1696.9±30.9b	1740.10±30.9ab	1698.2±30.9b	1477.6±30.9c
0-5	2722.7±41.6a	2648.3±41.6a	2672.7±41.6a	2467.40±41.6b	2334.6±41.6c	1832.1±41.6d
0-6	3825.0±56.1a	3496.8±56.1b	3557.6±56.1b	3049.20±56.1c	2843.7±56.1d	2295.8±56.1e
0-7		4518.7±52.6b	5026.6±52.6a	3872.20±52.6c	3578.5±52.6d	2820.3±52.6e
0-8		5497.3±70.1b	6532.5±70.1a	4712.20±70.1c	4313.3±70.1d	3344.8±70.1e
0-9		6455.7±98.5a	8175.4±98.5b	5552.20±98.5c	5048.2±98.5d	3869.4±98.5e
0-10		7155.7±124.7a	9544.4±124.7b	6112.20±121.7c	5538.2±121.7d	4219.4±121.7e

Values with different letters in the same row are significantly different at $p<0.05$

Table 5: Feed Conversion Rate (FCR) of the birds at different ages

Weeks	C	OC	Adlib OP	OP 80	OP 70	OP 50	Sign. level
0-1	0.98a	1.08b	1.15c	1.02a	1.27d	1.02e	**
0-2	1.06a	1.16bc	1.09a	1.22b	1.15c	1.13c	**
0-3	1.28a	1.62be	1.55c	1.78d	1.61ec	1.69f	**
0-4	1.47a	2.06b	1.92cd	1.97bd	1.66e	1.55a	**
0-5	1.67a	2.23b	2.05cd	2.12bd	1.78a	1.45e	**
0-6	1.66a	2.41b	2.11c	2.17cd	1.75a	1.50a	**
0-7		2.98a	2.28b	2.18bc	1.76d	1.49e	**
0-8		3.15a	2.42b	2.30bc	1.88d	1.55e	**
0-9		3.45a	2.66b	2.26bc	1.88cd	1.49d	**
0-10		3.70a	2.88b	2.29c	1.92cd	1.53d	**

Values with different letters in the same row are significantly different. **: $p<0.01$

Feed Conversion Rate (FCR) is given in Table 5. Higher FCR was observed in OC and Adlib OP than C at 0-6 weeks of feeding period (Table 5). The highest and the lowest FCR among the treatment groups were in OC and OP 50, respectively. Furthermore, the FCR of Adlib OP, OP 80 and OP 70 were 3.15, 2.30 and 1.93 at the end of trial, respectively.

The mortality rate in this study was very low; 0, 3, 1, 1, 1 and 0 birds died through experiment in C, OC, Adlib OP, OP 80, OP 70 and OP 50 groups, respectively.

DISCUSSION

Production systems with outdoor access have many factors that affect birds growing. The factors, such as photoperiod, temperature and light are not controlled and inherently variable. Furthermore, broilers raised outdoors have access to pasture and the various forages, insects and worms that may be available. Due to organic diet outdoor access did not have a positive effect on weight gain comparing to conventional groups during the 6 weeks of experiment. These results are expected because the diet contends consumed by organic groups were different than conventional diet. However, Adlib OP groups had significantly higher body weight than the other groups consumed organic diets. It could be expected that the performance of birds of OP 80, OP 70 and OP 50 groups would be inferior to that of birds of OC group because the outdoor birds would be exposed to fluctuating temperature, increased exercise in yard and feed restriction. Lee and Lesson (2001) and Kalpak and Sogut (2009) considered that full body weight recovery could be released more consistently if a number of short restriction periods were used instead of the long ones. In severe feed restriction, birds may not be able to reach an acceptable body weight at the end of rearing period. In this experiment, Body Weights (BW) of feed restricted groups were heavier than OC group. It means that outdoor access had positive effect on BW by covering lock of organic diets in the middle of trail. On the other hand, it is obvious that outdoor access affected BW because performance of Adlib OP groups kept in outside shelter from 3-10 week of age were pretty high when compared to OC. It was just 1 week behind the C group. Since at the end of 7th week, mean BW of Adlib OP was higher than C group's BW of 6th week of age. Lower growth rates and feed efficiencies with outdoor organic treatments than with conventional was reported by Castellini *et al.* (2002b). In this study, some birds (C, OC) were actually exposed to the same temperature fluctuations (20 to 28°C) because the treatments shared a common research facility. In addition, the trial was conducted in the spring and early summer, outdoor temperature ranged from 18 to 30°C during the period. Although, those birds had outdoor access, indoor temperatures only varied from 20 to 28.8°C. The indoor treatments of this study, birds had access to the outdoors and to a relatively controlled indoor environment except Adlib OP. Similar environmental condition was reported by Fanatico *et al.* (2005) that outdoor access did not have an effect on weight gain or yields because all birds were actually exposed to the same temperature fluctuations and the trial was conducted in the spring and early summer when the weather was mild and did not fluctuate widely. Pasture to which poultry generally have access is either designed for ruminants or to be hard wearing (Gordon and Charles, 2002). In a study (Fanatico *et al.*, 2005), the forage was comprised of plants used for lawn and may not have contributed significant nutrients. In the this study, the pasture were designed for poultry to contribute nutrient intake (in dry matter base, 14.85, 2.4, 31.5, 9.6, 87% and 1900 kcal kg^{-1}, for crude protein, crude fat, crude fiber, crude ash, dry matter and ME, respectively). The pasture might have contributed significant nutrients. Slaughtering BW of the birds in this trial were ranged 2381 to 3226 g. Olsen and Rossiter (2001) and Pedersen *et al.* (2003) reported that weight gain of the birds were 2167 and 3230 g at the end of 81 days of trial. These observations are in agreement with our results.

Temperature and photoperiod have the potential to influence growth mainly by affecting feed intake. Feed intake is increased at cold temperatures and reduced at hot temperatures and feed intake increases during longer photoperiods (Gordon and Charles, 2002). In this experiment, feed intake and efficiency was affected by either diet content or housing system. Although, feed intake of Adlib OP was higher than OC, lower FCR was observed in Adlib OP at the end of trial. In this experiment, observing the lowest feed intake and efficiency in OP 50 indicates that pasturing with organic feeding is useful in organic broiler production with fast-growing birds. Besides, OP 70 is also applicable according to growth performance of OP 70 at the age of 7 week. In organic broiler production with fast-growing strain, birds might be fed 7 or 8 weeks instead 10 week because BW is over 2000 g, which is good enough for market weight, at that age. Castellini *et al.* (2002b) found lower feed efficiencies with outdoor organic treatments than with conventional. However, feed intake and efficiency were not affected significantly by housing system. According to Andrews *et al.* (1997), the behavior observations of the organic chicks showed more locomotory activity and less resting. Thus, their growth rate and feed efficiency were poorer. Also, the uncontrolled environment conditions in the paddock could have increased their energy requirements with consequent increase of feed conversion. In this study, feed intake and efficiency of organic birds were higher than conventional one. Although, the mobility and stock density of OC were lower than Adlib OP, the FRC was higher than Adlib OP. That is possibly due to lock of nutrient of organic diet. Fanatico *et al.* (2005) reported that active birds are more appropriate for extensive production on pasture than conventional reared birds in order to make use of the forage and to help maintain consumer reliance in the authenticity of free-range production. But activity has a negative impact on feed efficiency, therefore, further affecting production costs in a system that already has higher costs. However, in the present study, feed efficiency of feed restricted groups (OP 50, OP 70) were 1.55-1.88 at the end of 8 week of age, which are acceptable for broiler production.

Variations in temperature, stock density and photoperiod can make reaching precise market weights more difficult and may cause variation in carcass quality (Fanatico *et al.*, 2005). In this experiment, treatments with outdoor access had impacts on carcass, breast, leg and wing yield. Castellini *et al.* (2002b) found that percentages of breast and drumstick meat increased when birds had outdoor access and a lower stocking density in an organic production system. In contrast, Fanatico *et al.* (2005) reported that although stocking density was lower in the treatments with outdoor access, there was no impact of production system on carcass yield. Organic broilers, as expected, showed lower growth performance and abdominal fat but the percentages of breast and leg were similar in comparison with the control birds. The greater motion and restricted organic diet reduced the abdominal fat and favored muscle mass development in agreement with Lewis *et al.* (1997) and Castellini *et al.* (2002a). Also, broilers accessed to outside had less abdominal fat and an increase in breast muscles (Dou *et al.*, 2009). In an experiment, researchers stated that forcing motor activity increased the breast percentage (Lei and Van Beek, 1997).

Mortality has a large impact on profitability. Although, earlier studies have shown that higher mortality in fast-growing birds compared with slow-growing birds (Lewis *et al.*, 1997; Castellini *et al.*, 2002a). There was little difference in mortality in this study and all treatments had less than 5% mortality. Similar result with less than 5% mortality was also reported by Fanatico *et al.* (2005).

CONCLUSIONS

In this experiment, feed restriction and diet consumed by the birds had impacts on growth performance, feed consumption and feed efficiency and carcass traits. According to results of this study, it could be said that if organic broiler production has to be done with fast growing birds, feed restriction and access to outside with pasture has to be taken account. The pasture is also designed for poultry to contribute nutrient intake. Moreover, 70 or 50% feed restriction with shorter rearing period (8 week) could also be practiced. In recent years, consumers are increasingly concerned with how meat animals are raised. Since slow-growing genotypes are designed for outdoor production and may appeal to consumers with a desire for an organic or free-range product. Further research is needed to determine if factors such as consumer preferences, welfare concerns and dietary restrictions impact of the feasibility of raising slow and fast-growing birds in different systems.

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