Differences in meat quality between organically and conventionally produced broiler muscles

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Abstract

This study compared organically reared chickens with conventionally reared ones with regard to fatty acid composition traits. The conventional and organic flocks with an average age of 40 days were raised in an indoor pen. Stocking densities of conventional and organic ones were 0.05 and 0.13 m^2/bird, respectively. The conventional diet was formulated with common ingredients whereas the organic ingredients containing more than 80% certified organic ingredients were produced in accordance with the Korean Organic farming Standard. Twenty carcasses per group were slaughtered and analyzed. Only crude ash were higher in the conventional than in the organic one (P <0.05). The organic ones had higher cooking loss and WHC (P <0.05). For shear forces, organic ones had lower than conventional pigs (P<0.05). The breast and thigh muscles of organic ones showed a higher CIE a*, b* value and myoglobin content compared with the conventional ones (P<0.001).

Introduction

The recent crises such as Avian Influenza in relation to livestock production, have frightened the consumers and some turn towards organic meat. Organic food can be defined as the product of a farming system which avoids the use of synthetic fertilizers, pesticides, growth promoters, and additives. Many consumers pay a premium to purchase boneless chicken breasts and make value judgements related to animal welfare standards or organic production. Consumers demand organic chicken through value systems favoring natural production, but may consider such products superior over conventional system with an environment friendly image (McEachern and Willock, 2004). The different feeds, used in organic and conventional production systems, may influence quality in chicken. However, there is little information on the meat quality between conventional and organic bird. Consequently, introduction of organic poultry production systems calls for establishment of quality assurances that ensure production of high quality meat, as demanded by the organic consumer. The objective of the study is to compare between organic and conventional chicken, in order to reveal differences on meat quality traits.

Materials and Methods

The conventional flocks (20 chicks) were reared and housed in an indoor pen (0.05 m2/bird), whereas the organic flocks (20 chicks) were reared and housed in an indoor pen (0.13 m2/bird) instead of 0.07 m2/bird. All flocks were housed only in indoor area for 40 days until slaughtering. Chickens were fed ad libitum the diets and water. The conventional diet was formulated with common ingredients whereas the organic ingredients containing more than 80% certified organic ingredients. Calculated nutrient composition of the experimental diets are presented in Table 1. All birds were slaughtered at similar live weight

(approximately 1.5 kg) at the commercial poultry slaughterhouse. All birds were slaughtered at live weight 1.5 kg and sampled for analyses. Samples of chicken breasts and thighs were removed and stored at 4□. Percentage moisture, crude protein , crude fat and ash of the breasts muscle were determined by using methods of the AOAC procedure (1996). Muscle pH was measured using portable needle-tipped combination electrode (NWK binar pH-K21 CE, Germany). Meat color was measured using Minolta Chroma Meter CR-300 after 30 min blooming at room temperature. The myoglobin contents were calculated by modified method of Krzywicki (1979). WB-shear force and shear force were measured on cooked samples described by Wheeler et al. (2000) and Instron(model 4465). Water-holding capacity (WHC) was determined using the procedure of Honikel et al. (1994). Sensory profiling by a trained sensory panel (8 assessors) was performed on breast samples with six-point assessment scheme.

Table 1. Calculated nutrient composition of the experimental diets for organic chickens

	Conventional diets	Organic diets
Crude protein (%)	21	20
Crude fat (%)	3	5
Ash (%)	10	5
Crude fiber (%)	6	5
Ca (%)	0.96	0.8
P (%)	1.4	0.6
Methionline + Cystein (%)	0.8	0.7
Calrorie (cal/g)	3,050	2,950

Results and discussion

Proximate composition and meat characteristics of breast muscles between conventional and organic chickens are presented in Table 2. Moisture, crude fat and protein were not different between the two groups (Table 2). Only crude ash were higher in the conventional than in the organic one ($P < 0.05$). Meat quality characteristics of breast muscles between conventional and organic chickens did not differ with regard to pH value (Table 2). The cooking loss and WHC were higher in organic broilers than in conventional ones ($P<0.05$). WHC had lower in organic broiler, but cooking loss was higher. Comparisons of meat color and myoglobin content of breast and thigh muscles between two production systems are shown in Table 3. The breast and thigh muscles of the organically reared broilers showed a higher CIE a* (red) and b* (yellow) value than that of the conventionally reared ones, while the breast ones of the organically raised broilers showed a lower L* (lightness) values ($P<0.001$).

Table 2. Comparison of meat characteristics of breast muscles between conventional and organic chicken

	Conventional (n=20)	Organic (n=20)
Proximate composition		
Moisture (%)	76.08±0.08	76.15±0.11
Crude fat (%)	0.29±0.09	0.17±0.01
Crude protein (%)	22.47±0.14	22.75±0.11
Crude ash (%)	1.17±0.03 ^{A}	0.94±0.01 ^{B}
Physico-chemical analysis		
pH	6.13±0.04	6.20±0.05
Cooking loss (%)	18.29±0.34 ^{B}	21.57±0.37 ^{A}
Shear force (N)	1.58±0.04 ^{A}	1.34±0.04 ^{B}
WHC (%)	62.56±0.43 ^{B}	63.99±0.38 ^{A}
Juiciness	4.43±0.10	4.40±0.08
Tenderness	4.74±0.08	4.74±0.09
Aroma	4.56±0.06	4.56±0.06

$^{A, B}$ Means±SE with different superscript within a row with the same muscle are significantly different (P<0.05)

Table 3. Comparison of meat color and myoglobin content of breast and thigh muscles between conventional and organic chicken [a]

Items	Breast (n=20)		Thigh (n=20)	
	Conventional	Organic	Conventional	Organic
CIE L*	54.14±0.67^{A}	52.09±0.44^{B}	57.73±1.01	55.76±0.66
a*	3.31±0.20^{B}	3.90±0.14 ^{A}	5.12±0.23 ^{B}	5.92±0.15 ^{A}
b*	1.90±0.18 ^{B}	5.38±0.30 ^{A}	1.49±0.21 ^{B}	4.76±0.24 ^{A}
Myoglobin content (mg/g)	0.35±0.01^{B}	0.44±0.01^{A}	0.64±0.01^{B}	0.75±0.01^{A}

$^{A, B}$ Means±SE with different superscript within a row with the same muscle are significantly different (P<0.001)

Conclusions

Our results demonstrate that organic rearing systems could affect meat quality and fatty acid composition in chickens. Organically raised ones led to a higher CIE a*, b* value and myoglobin content than conventionally raised ones. The cooking loss and WHC were higher in organic broilers than in conventional ones. In conclusion, the organic feeding in comparison to conventional feeding may lead to differences in meat quality of chickens.

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