Differences in fatty acid composition 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 m2/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. 20 carcasses per group were slaughtered and analyzed. We found higher levels of C18:2n6, C18:3n6, C18:3n3 and C22:4n6 in broilers produced organically than in broilers produced conventionally ($P<0.05$). For organic ones, the proportion of SFA and MUFA was significantly lower, while that of USFA and PUFA was significantly higher ($P<0.05$). Organic chickens had a higher proportion of n-3 and n-6 PUFA than conventional chickens ($P<0.05$).

Introduction

An increasing number of consumers demanding health and natural foods have favoured organic livestock farming, which is considered to be environmentally friendly, raising animals in good health, with high welfare standards and resulting in high quality products (Sundrum, 2001). 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). However, there is little information on fatty acid composition between conventional and organic bird. The objective of the study is to compare between organic and conventional chicken, in order to reveal differences on fatty acid composition .

Material and methods

The conventional flocks (20 chicks) were reared and housed in an indoor pen (0.05 m^2/bird), whereas the organic flocks (20 chicks) were reared and housed in an indoor pen (0.13 m^2/bird) instead of 0.07 m^2/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 containing more than 80% certified organic ingredients were produced in accordance with the Korean Organic farming. Calculated nutrient composition and fatty acid composition of the experimental diets are presented in Table 1. All birds were slaughtered at live weight 1.5 kg and breast muscles were sampled for fatty acid analyses. Lipids were extracted from muscle samples (Folch, 1957), matylated and analyzed by a gas chromatography fitted with a fused silica capillary column, omegawax 320 (30 m □0.32 mm ID, 0.25

μm film thickness). The temperature of injection port and detector was 250 and 300℃ respectively.

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

	Conventional diets	Organic diets
SFA (%)	27.74	26.19
USFA (%)	72.26	73.81
MUFA (%)	44.67	40.33
PUFA (%)	27.59	33.48
PUFA n-3 (%)	0.93	1.46
PUFA n-6 (%)	26.66	32.02
PUFAn-6/PUFAn-3 (%)	28.58	21.96
MUFA/SFA (%)	1.61	1.54
PUFA/SFA (%)	0.99	1.28

The symbols used mean as followed: SFA, USFA, MUFA and PUFA refer to Saturated, Unsaturated, Monounsaturated and Polyunsaturated fatty acid, respectively.

Results and discussion

The fatty acid profile of breast muscles between organically and conventionally reared broilers is shown in Table 2. We found higher levels of C18:2n6, C18:3n6, C18:3n3 and C22:4n6 in broilers produced organically than in broilers produced conventionally ($P<0.05$). For organic ones, the proportion of SFA and MUFA was significantly lower, while that of USFA and PUFA was significantly higher ($P<0.05$). In cases of the organic chickens, the proportion of PUFA/SFA was significantly higher, whereas the proportion of PUFA n-6/n-3 ratio and MUFA/SFA was significantly lower ($P<0.05$). From these results, the difference in FA composition between conventional and organic chickens may be due to the consequence of the different feed.

Table 2. Comparison of fatty acid composition (%) of breast muscles between conventional and organic chicken

Items	Conventional (n=20)	Organic (n=20)
C14:0 (myristic)	1.12 ± 0.02^{A}	0.58 ± 0.01^{B}
C16:0 (palmitic)	25.32 ± 0.14^{A}	$20.83\pm0.26^{B.}$
C16:1n7 (palmitoleic)	7.22 ± 0.22^{A}	4.51 ± 0.10^{B}
C18:0 (stearic)	6.05±0.13	5.65±0.30
C18:1n9 (oleic)	46.40 ± 0.32^{A}	36.76 ± 0.24^{B}
C18:2n6 (linoleic)	12.01 ± 0.32^{B}	28.04 ± 0.38^{A}
C18:3n6 (gamma-linolenic)	0.07 ± 0.01^{B}	0.15 ± 0.03^{A}
C18:3n3 (α- linolenic)	0.71 ± 0.02^{B}	2.52 ± 0.05^{A}
C20:1n9 (eicosenoic)	0.19 ± 0.02^{A}	0.07 ± 0.00^{B}
C20:2n6 (eicosadienoic)	0.47 ± 0.03^{A}	0.32 ± 0.01^{B}

C20:3n6 (eicosatrienoic)	0.20±0.03	0.19±0.00
C20:4n6 (arachidonic)	0.21±0.04 [A]	0.13±0.00 [B]
C22:4n6 (satetraenoic)	0.02 ±0.01 [B]	0.24±0.01 [A]
SFA	32.49±0.17 [A]	27.06±0.25 [B]
USFA	67.51±0.17 [B]	72.94±0.25 [A]
MUFA	53.82±0.44 [A]	41.34±0.29 [B]
PUFA	13.69±0.38 [B]	31.60±0.43 [A]
PUFA n-3	0.71±0.02 [B]	2.52±0.05 [A]
PUFA n-6	12.98±0.36 [B]	29.07±0.39 [A]
PUFAn-6/PUFAn-3	18.44±0.36 [A]	11.55±0.15 [B]
MUFA/SFA	1.66±0.02 [A]	1.53±0.02 [B]
PUFA/SFA	0.42±0.01 [B]	1.17±0.02 [A]

[A, B] Means±SE with different superscript within a row with the same muscle are significantly different ($P<0.05$); The symbols used mean as followed: SFA, USFA, MUFA and PUFA refer to Saturated, Unsaturated, Monounsaturated and Polyunsaturated fatty acid, respectively.

Conclusions

Our results demonstrate that organic rearing systems could affect fatty acid composition in chickens. Organically raised ones led to higher levels of PUFA and USFA as well as a higher PUFA n-3, n-6 and PUFA/SFA.

References

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