Variation of meat quality traits among five genotypes of chicken

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ABSTRACT The main objective of this study was to examine the diversity of meat quality traits among 5 chicken genotypes. The genotypes included 2 Chinese native breeds (Wenchang,WCH, and Xianju), 1 commercial broiler line (Avian, AV), 1 commercial layer line (Hy-Line Brown, HLB), and 1 Chinese commercial broiler line (Lingnanhuang, LNH) synthesized by exotic and native breeds, which were slaughtered at their market ages: 16, 7, 16, and 8 wk, respectively. The effects of genotype, muscle type, and sex on meat quality traits were examined. Birds from slow-growing genotypes (WCH, Xianju, and HLB) exhibited higher shear value, inosine-5′-monophosphate concentration, lower cook loss, and more fat than those from fast-growing genotypes (AV and LNH). Chickens from WCH possessed the lowest expressible moisture, cook loss, and the highest lipid (%) among the 3 slow-growing genotypes. The HLB birds were intermediate in expressible moisture and cook loss and lowest in lipid among all genotypes. The LNH cross birds were similar to AV broilers in most meat quality parameters, although they had a lower shear force value and higher fat content than AV broilers. Breast muscle had higher expressible moisture, shear force, protein (%), inosine-5′-monophosphate content, lower cook loss, and lipid (%) than leg muscle. Muscles from male chickens had higher expressible moisture than those from the females. Variability of meat quality characteristics is mainly related to genotype and muscle type differences.

Key words: chicken, native breed, meat quality, fatty acid, inosine-5′-monophosphate

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INTRODUCTION

In China, 3 main meat-type genotypes of chicken are raised: native breeds, standard broilers, and crosses of the broiler with the native or layer stocks. In the 1970s and early years of the 1980s, many local breeds were crossed unrestrainedly with exotics to improve their meat or laying performance, which led them to the brink of extinction. Fortunately, the number of the native chickens has been increasing for the past 20 yr to satisfy the customer demands for more intense flavor and firmness of their meat. Currently, the native chickens are mainly marketed live. This market segment makes up 20% of the poultry market despite a higher retail price than standard broilers. The market of the local chickens is rapidly developing in China by a rate of 5 to 10% per year. The crosses (about 30% of Chinese consumption) are also popular because of their higher growing rate and feed efficiency than local chickens (Li, 2008; Zhang, 2008). The layer birds are similar to the native birds in growing rate and are often crossed with the native birds. The male birds of layer lines and crosses of the native with layer lines are raised as meat birds in China. Little information is known about the meat characteristics of some rare Chinese native breeds and their crosses. We also want to know how modern laying stocks are similar to the old Chinese strains in terms of meat quality traits. The main objective of the current experiment was to determine the diversity of meat quality traits among 5 chicken genotypes at their respective market ages. Chickens from 2 Chinese unique native breeds, 1 commercial broiler stock, 1 commercial layer stock, and 1 line of a local breed-commercial broiler cross were utilized to determine contributions of genotype, sex, and muscle type (leg and breast) to meat quality.

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MATERIALS AND METHODS

Birds

Five genotypes of chicken were selected in the present experiment. Wenchang (**WCH**), a tropical local breed of bantam, originating from Hainan Island in the South China Sea, has a 400-yr history. Xianju (**XJ**), another Chinese native breed originating from Chekiang Province, is noted for its egg production (180 to 200/yr) in China. Avian (**AV**), a standard commercial broiler line of Avian Farms International, was provided by Nanning Chia Tai Livestock & Animal Husbandry Co. Ltd. (Nanning, China). Hy-Line Brown (**HLB**), a standard commercial layer line of Hy-Line International, was provided by Hainan Luoniushan Poultry Co. (Ding'an, China). Lingnanhuang (**LNH**), a Chinese commercial broiler line, was synthesized from local breeds, exotic broiler, and layer lines by the Institute of Animal Science, Guangdong Academy of Agricultural Sciences (Guangzhou, China). All chicks from 5 genotypes were hatched at the Luoniushan hatchery in Ding'an County, Hainan Province. They were sexed, wing-banded, and transported to Luoniushan Poultry Farm in Ding'an, where the trial was conducted. Birds were placed into a 20-pen screen-wall-divided house in a completely randomized design with a 5 × 2 factorial arrangement (5 genotypes, 2 sexes). The sexes were reared separately with 2 replicate pens of 80 birds per genotype and sex combination. The 2 replicate pens lay on the south and north sides of the house, respectively. The stocking density was 10 birds per m^2. Birds were grown in wood shavings bedded floor pens equipped with 2 tube feeders and nipple-type drinkers and were fed corn-soybean-based diets. Birds of WCH, XJ, and HLB were fed with diets A, B, and C from hatch to 6 wk, 7 to 13 wk, and 14 to 16 wk, respectively. Birds of LNH and AV were fed with diets D, E, and F from hatch to 3 wk, 4 to 6 wk, and 7 to 8 wk, respectively (Table 1).

Slaughter and Meat Sample Collection

Birds from each genotype were randomly selected and slaughtered at market ages of 49 d for AV (20 males, 30

Table 1. Ingredient composition (%, wt/wt) and fatty acid composition (% wt/wt of total fatty acids) of diets

	Diets for slow-growing birds[1]			Diets for fast-growing birds[1]		
Item	A (1 to 6 wk)	B (7 to 13 wk)	C (14 to 16 wk)	D (1 to 3 wk)	E (4 to 6 wk)	F (7 to 8 wk)
Ingredient						
Corn	58.41	65.81	70.00	50.64	52.74	58.30
Wheat bran	1.50	5.00	5.00	0.00	0.00	0.00
Soybean meal (43% CP)	31.45	19.91	14.41	35.00	30.86	24.15
Rapeseed meal (38.6% CP)	3.00	5.00	5.00	4.00	3.00	4.00
DL-Methionine (88%)	0.04	0.05	0.10	0.15	0.18	0.13
Salt	0.30	0.30	0.30	0.30	0.30	0.30
Limestone	1.25	1.68	2.00	1.25	1.09	1.54
Dicalcium phosphate	1.28	1.26	1.68	1.92	1.80	1.58
Soya lecithin	1.78	0.00	0.51	4.12	5.00	5.00
Soybean oil	0.00	0.00	0.00	1.63	4.00	4.00
Mineral-vitamin premix	1.00	1.00	1.00	1.00	1.00	1.00
Calculated nutrient content						
ME, kcal/kg	2,800	2,760	2,800	2,900	3,100	3,150
CP	20.0	17.0	15.0	21.0	19.0	17.0
Crude fat	3.69	3.01	3.31	6.20	8.94	9.03
Calcium	0.85	0.98	1.17	1.00	0.90	1.00
Phosphorus	0.60	0.60	0.64	0.70	0.65	0.60
Lysine	0.96	0.74	0.61	1.03	1.15	0.78
Methionine + cysteine	0.72	0.65	0.65	0.85	0.82	0.72
Fatty acid composition[2]						
C10:0	0.04	0.01	0.02	0.05	0.04	0.04
C14:0	0.02	0.02	0.02	0.02	0.02	0.02
C16:0	16.65	14.54	15.43	16.70	15.73	15.76
C16:1	0.01	0.02	0.02			
C18:0	2.57	2.01	2.10	3.08	3.19	3.16
C18:1	24.01	30.21	28.61	20.13	20.20	20.47
C18:2	52.86	50.70	51.11	54.69	55.17	54.99
C18:3	3.63	2.19	2.40	5.20	5.57	5.46
C20:0	0.19	0.26	0.25	0.10	0.07	0.08
C20:1	0.02	0.04	0.03	0.01	0.01	0.01
C22:0	0.01	0.01	0.01			
SFA	19.48	16.85	17.84	19.96	19.06	19.06
MUFA	24.03	30.27	28.66	20.15	20.21	20.49
PUFA	56.49	52.89	53.51	59.89	60.73	60.45
PUFA:SFA	2.90	3.14	3.00	3.00	3.19	3.17

[1]Slow-growing birds: Wenchang, Xianju, and Hy-Line Brown; fast-growing birds: Avian and Lingnanhuang.

[2]SFA = saturated fatty acids; MUFA = monounsaturated fatty acids; PUFA = polyunsaturated fatty acids; PUFA:SFA = the PUFA:SFA ratio.

females), 56 d for LNH (16 males, 20 females), and 112 d for WCH (10 males, 60 females), XJ (10 males, 30 females), and HLB (10 males, 20 females), respectively. The number of birds from 2 replicate pens per sex was equal within each strain. They were placed in plastic coops and transported to the processing facility (<45 min). Feed was withheld for 12 h before slaughter. The breast and leg muscles were removed from each carcass at 30 min postmortem, weighed, and chilled on ice. All meat samples were trimmed of skin and visible fat before test. The pectoralis major and thigh muscles from the right side of each carcass were used to determine cook loss and tenderness (shear force value), whereas all breast and leg muscles from the right side of each carcass were used to determine expressible moisture and lipid. As soon as samples for expressible moisture were gathered, the rest of the breast and leg muscles were individually ground. Meat patties were frozen and stored at −20°C until the inosine-5′-monophosphate (**IMP**) and lipids were analyzed (within 1 wk). The extracted lipids from leg meat patties of 8 females per genotype were used to analyze fatty acid.

Expressible Moisture Determination

Expressible moisture was estimated by the method described by Sun and Luo (1993) as follows. A sample with 2.52-cm diameter and 1-cm height was taken from the thickest part of each pectoralis major or thigh muscle of the left side of the carcass. The sample was weighed before it was placed between 2 pieces of medical gauze. Then, 18 pieces of 11-cm-diameter filter paper were laid both upon and below the gauze and 2 Plexiglas plates (Shenzhen Yidong Acrylic Products Co. Ltd., Shenzhan, China) were set separately just outside filter paper. Pressure was applied with a 35-kg weight for 5 min. Initial and final weights were used to calculate percentage of expressible moisture.

Cook Loss Determination

The whole pectoralis major and thigh muscles from the right side of each carcass were individually vacuum-packaged and were stored at 4°C for 24 h before cook loss test. Then a sample (about 50 g) was taken from the thickest part of each muscle, weighed, and placed in a common plastic bag. A thermometer was inserted into the thickest part of each sample to monitor core temperature. Then, the samples were put separately into beakers with water to cook to an internal temperature of 78°C and were maintained at 78°C for 10 min in a preheated circulating water bath. The samples were removed from the bath and cooled on filter paper at room temperature for 30 min. The difference in weight of each sample before and after cooking was expressed as percentage cook loss.

Shear Value Determination

Tenderness was assessed the same day (within 5 h) on the same samples after determination of cook loss was done. A modified objective texture method (Sun and Luo, 1993) was used. Two adjacent columns with 2.5-cm^2 section were taken from each meat sample. Each column was sheared 3 times, and maximum shear force (in kg) was recorded for each cutting. The dual columns were averaged and used to determine shear value for each sample. Columns were sheared perpendicularly to the muscle fibers using a shear tool (Digital Muscle Tenderometer of Model C-LM3, Northeast Agricultural University, Harbin, China). A 25-kg load transducer and a crosshead speed of 5 mm/s were used.

Lipid Contents and Fatty Acid Composition Analyses

Total lipid (%) was determined by ether extraction (AOAC, 1990) using 3 replicate samples for each of the breast and leg muscles. The extracted lipids from leg meat of 8 females per genotype were stored at −20°C until the fatty acids were determined using a gas chromatograph (HP6890, Agilent, Waldbronn, Germany) equipped with a flame ionization detector and an HP capillary column (30 m × 0.25 mm i.d., HP19091-136, Hewlett Packard, Newtown, PA) with a 0.25-μm film thickness of stationary phase. The gas chromatography conditions were as follows: injected temperature and detector temperature, 240°C; carrier gas, helium; split ratio, 1:80; temperature program, from 140 to 240°C by an increase of 6°C/min; and sample volume injected, 1 μL. The fatty acids were identified by matching their retention times with those of their relative standards, as well as by mass spectrometry (HP5973, Agilent) of each peak.

IMP Analysis

Three duplicate samples were used to determine the IMP concentration of each of breast and leg muscles from 8 female birds per genotype by the method described by Li and Chen (1998). Meat and standard IMP (Sigma, St. Louis, MO) samples were subjected to HPLC (Agilent 1100 Series Systems, with UV detector) for determination of nucleotide contents. The conditions set for HPLC were as follows: ZORBXSB-C18 column (4.6 × 150 mm i.d., 5-μm particles), 18-min mobile phase gradient of 0.1 *M* phosphate buffer (pH 6.0) and methanol (70:30) in 0.1 *M* phosphate buffer pH 6.0, 1 mL/min flow rate, injection volume of 20 μL, and measurement of eluent absorbance at 254 nm. The peaks of the individual nucleotides were identified using the retention time for standards and the concentration of IMP was calculated using the area for each peak.

Table 2. Least squares means of BW, carcass weight, and carcass composition

Genotype[1]	BW[2] (g)	Carcass weight[3] (g)	Breast weight[4] (g)	Breast yield[5] (%)	Leg weight[4] (g)	Leg yield[5] (%)	Abdominal fat[5] (%)
WCH	1,477 ± 20^{d}	879 ± 14^{d}	154 ± 4^{d}	17.6 ± 0.3^{c}	245 ± 5^{c}	27.8 ± 0.3^{b}	6.8 ± 0.3^{a}
XJ	1,589 ± 22^{c}	934 ± 15^{c}	169 ± 5^{c}	18.1 ± 0.3^{c}	278 ± 5^{b}	29.7 ± 0.3^{a}	4.9 ± 0.3^{b}
HLB	1,471 ± 23^{d}	861 ± 16^{d}	170 ± 5^{c}	19.8 ± 0.3^{b}	236 ± 6^{c}	27.4 ± 0.3^{b}	2.6 ± 0.4^{cd}
LNH	1,689 ± 20^{b}	1,039 ± 14^{b}	190 ± 4^{b}	18.3 ± 0.3^{c}	271 ± 5^{b}	26.1 ± 0.3^{c}	3.4 ± 0.3^{c}
AV	2,009 ± 16^{a}	1,369 ± 12^{a}	358 ± 3^{a}	26.2 ± 0.2^{a}	356 ± 4^{a}	26.0 ± 0.2^{c}	2.0 ± 0.3^{d}
P-value	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001

[a–d]Means ± SEM within the same column with no common superscript differ ($P < 0.05$).

[1]WCH = Wenchang (10 males, 60 females); XJ = Xianju (10 males, 30 females); HLB = Hy-Line Brown (10 males, 20 females); LNH = Lingnanhuang (16 males, 20 females); AV = Avian (20 males, 30 females).

[2]Body weight before slaughter after feed deprivation for 12 h.

[3]Without giblets, head, and feet.

[4]Total breast or leg muscles without skin and bone.

[5]Yield of breast, leg, or abdominal fat expressed as a percentage of carcass weight.

Statistical Analysis

Data were analyzed by multifactorial ANOVA using the PROC GLM procedure of SAS software (SAS Institute Inc., Cary, NC). The effects of genotype, sex, muscle type, and pairwise interactions on physicochemical characteristics were examined. For BW and carcass traits, genotype, sex, and their interaction effects were considered in linear models. For IMP contents, effects of genotype, muscle type, and genotype × muscle type interaction were embraced in an analyzed model. For fatty acid composition, only genotype effect was analyzed. Pairwise comparisons of means were performed by Scheffe test using the least squares means statement of the GLM procedures of SAS and $P < 0.05$.

RESULTS AND DISCUSSION

Effects of genotype on BW, carcass weight, and carcass composition were highly significant (Table 2). As expected, BW, carcass weight, and breast weight were highest for AV broilers, intermediate for LNH birds, and lowest for WCH, XJ, and HLB chickens. The slow-growing genetic groups, WCH, XJ, and HLB birds, had higher leg yields than the other 2 fast-growing groups. The highest abdominal fat (%) was observed in the traditional group, WCH chickens, which might be related to its adaptation to the tropical climate and the dietary preferences of local people for fat birds. The AV broilers had market weight about 25% lower compared with those reared under commercial conditions (Nanning Chia Tai Livestock & Animal Husbandry Co. Ltd), which might be mainly due to the ME and CP levels of their feed being lower than breeder recommendations as a result of formulating these rations for both the AV and LNH birds (Table 1). Providing fewer feeds limited the introduction of variation due to feed source but did affect final BW of AV birds. Because the main objective was to examine meat quality parameters, this slowed growth was not considered detrimental to the results of the study.

Cook loss and expressible moisture are 2 important measurements for water-holding capacity. The trend was found that water-holding capacity was lowest for fast-growing broilers (AV and LNH), intermediate for layers (HLB), and highest for local breeds (WCH and XJ) (Table 3). The HLB layers had the lowest lipid (%) and abdominal fat (%) (Table 2) in the 3 slow-growing genotypes (WCH, XJ, and HLB), which showed that they were much thinner than native birds. Ji et al. (2007) reported that older birds (112 d of age) had more fat in muscle than the younger birds (42 to 70 d of age). In this study, however, LNH crosses (56 d of age) had more lipid than the older slow-growing birds (112 d of age). This means that the genotype effect on fat deposition could go beyond age influence in some cases.

The pectoralis major and thigh muscles of LNH cross birds had a lower shear force than the AV broilers (Table 3), which might be interpreted by the difference in muscle fiber size. It was shown that muscle fibers from fast-growing lines of chickens have larger fiber diameters than slow-growing lines and larger fiber diameters are often associated with meat toughening (higher shear force; Essen-Gustavasson, 1993; Mahon, 1999). The AV broilers grew faster and had more mass of leg and breast muscles than LNH crosses (Table 2), suggesting that they may possess more large-diameter fibers than the latter. Collagen cross-linking increases with age and is often associated with increased toughness (Shrimpton and Miller, 1960; Fletcher, 2002). The older slow-growing birds (WCH, XJ, and HLB, 112 d of age) had higher shear force than the fast-growing birds of AV (49 d of age) and LNH (56 d of age), which could be explained by the differences in collagen cross-linking.

Significant differences were found between breast and leg muscles for all meat physiochemical characteristics (Table 3). The leg muscle was lower in expressible moisture but higher in cooking loss than the breast muscle. The higher cook loss of leg muscle might be associated with its higher lipid content because part of the lipid could be lost during cooking (McKee, 2002). The meat

Table 3. Effects of genotype, sex, muscle type, and their interactions on physicochemical characteristics

Factor	Expressible moisture (%)	Cook loss (%)	Shear value (kg)	Lipid (%)
Genotype[1]				
WCH	23.69[d]	15.89[d]	2.65[a]	1.42[b]
XJ	26.88[c]	22.72[c]	2.80[a]	1.26[b]
HLB	29.08[b]	24.95[b]	2.95[a]	0.96[c]
LNH	29.76[ab]	26.38[a]	1.75[c]	1.60[a]
AV	31.15[a]	26.69[a]	2.13[b]	1.28[b]
Muscle type				
Leg	24.08[b]	24.13[a]	2.11[b]	1.85[a]
Breast	32.14[a]	22.52[b]	2.80[a]	0.76[b]
Sex				
Male	28.83[a]	23.15	2.48	1.27
Female	27.39[b]	23.51	2.43	1.34
Source of variation				
Genotype	**	**	**	**
Muscle type	**	*	**	**
Sex	*	NS	NS	NS
Genotype × muscle type	**	NS	NS	NS
Genotype × sex	**	**	NS	NS
Sex × muscle type	NS	NS	NS	NS

[a–d]Least squares means within the same column with no common superscript differ ($P < 0.05$) for genotype, muscle type, and sex, respectively.

[1]WCH = Wenchang (10 males, 60 females); XJ = Xianju (10 males, 30 females); HLB = Hy-Line Brown (10 males, 20 females); LNH = Lingnanhuang (16 males, 20 females); AV = Avian (20 males, 30 females).

NS: $P > 0.05$; *$P < 0.05$; **$P < 0.01$.

from females had a lower expressible moisture (%) than males, whereas other physiochemical traits were unaffected (Table 3).

Fatty acid profiles for the leg muscles of each genotype were compared (Table 4). Older birds ordinarily had more fatty acid constituents than younger birds, 13 kinds of fatty acids for WCH and XJ birds, 11 kinds for HLB birds, and 8 kinds for LNH and AV broilers, respectively. The slow-growing birds (WCH, XJ, and HLB) were similar to the fast-growing birds (LNH and AV) in most nonessential fatty acids except C20:4, even if they were different in diet (especially C18:0, C18:1, C20:0, and C20:1; Table 1) and age. This can be explained by the previous conclusions that nonessential fatty acids can be made by essential fatty acids or through de novo synthesis (Enser, 1999).

It was reported that polyunsaturated fatty acid (**PUFA**) content in meat can be increased via increasing its concentrations in diet (Sanz et al., 1999; López-Ferrer et al., 2001). The diets for LNH and AV birds had more essential fatty acids (2 PUFA: C18:2 and C18:3) compared with those for the 3 slow-growing

Table 4. Fatty acid composition (% wt/wt of total fatty acids) of the total lipid extractable from leg muscle of female chickens from 5 genotypes[1] (n = 8 per genotype)

Fatty acid[2]	WCH	XJ	HLB	LNH	AV	*P*-value
C12:0	—[3]	—	0.04	—	—	
C14:0	0.52[c]	0.69[bc]	0.24[c]	1.06[b]	1.80[a]	0.00
C15:0	0.02	0.04	0.03	—	—	0.48
C16:0	22.58[b]	21.73[b]	23.17[b]	29.14[a]	25.24[b]	0.00
C16:1	5.05	5.11	3.78	5.60	5.69	0.37
C16:2	0.03	0.07	—	—	—	0.23
C17:0	0.07[b]	0.28[a]	0.15[b]	—	—	0.00
C18:0	10.37[ab]	9.86[ab]	10.70[a]	8.66[b]	8.92[b]	0.06
C18:1	35.95[a]	32.49[ab]	35.86[a]	31.97[ab]	29.05[b]	0.07
C18:2	21.05[b]	21.33[b]	22.50[ab]	21.18[b]	25.30[a]	0.08
C18:3	1.01[b]	1.30[b]	0.87[b]	1.21[b]	2.74[a]	0.00
C20:1	—	0.18	—	—	—	
C20:2	0.04[b]	0.24[a]	—	—	—	0.01
C20:3	0.08	—	—	—	—	
C20:4	3.19[b]	6.67[a]	2.66[b]	1.16[c]	1.25[c]	0.04
SFA	33.56[bc]	32.60[c]	34.33[bc]	38.86[a]	35.96[ab]	0.06
MUFA	41.0[a]	37.78[b]	39.64[ab]	37.57[b]	34.74[c]	0.07
PUFA	25.40[b]	29.61[a]	26.03[b]	23.55[b]	29.29[a]	0.06
PUFA:SFA	0.76[b]	0.91[a]	0.76[b]	0.61[c]	0.81[ab]	0.06

[a–c]Means within a row with no common superscript differ ($P < 0.05$).

[1]WCH = Wenchang; XJ = Xianju; HLB = Hy-Line Brown; LNH = Lingnanhuang; AV = Avian.

[2]SFA = saturated fatty acids; MUFA = monounsaturated fatty acids; PUFA = polyunsaturated fatty acids; PUFA:SFA = the PUFA:SFA ratio.

[3]—: not detectable.

strain birds, but only the AV broilers had higher levels of C18:2 and C18:3 than the slow-growing birds (Table 4). Furthermore, the XJ birds had higher contents of essential fatty acids and total PUFA than did WCH and HLB birds, even if they were fed with the same set of diets. The same scenario was observed in the group of AV and LNH birds. This demonstrated that the influence of genotype on contents of PUFA (especially C18:2 and C18:3) was of importance. The AV broilers and the XJ birds grew faster (higher BW) within their respective diet group (Table 2), they ate more, and would have had enough energy and protein to make nonessential fatty acids through de novo synthesis instead of consuming essential fatty acids.

Inosine-5′-monophosphate is a flavor precursor and its degradation results in formation of ribose in meat (Manabe et al., 1991; Kawai et al., 2002). In the current study, it was found that the leg muscles of the 3 slow-growing genotypes, WCH, XJ, and HLB birds, had higher IMP concentration than those of LNH and AV broilers (Table 5). The AV broilers had the lowest IMP contents in breast muscles among 5 genotypes. Because the 5 strains of birds belong to 3 age groups, respectively, the differences in IMP content among genotypes may be explained by the effects of genotype, age, or their interaction. Chen et al. (2002a) reported that IMP contents decreased continuously with increasing age in muscles of Taihe Silkies (Chinese native chickens) from 2 to 28 wk of age. If that was true in the current study, WCH, XJ, and HLB birds would have more IMP in muscles at 7 or 8 wk of age. Some Chinese native strains were also found to have higher IMP contents in breast and leg muscles than those of standard commercial broilers at the same age (Chen et al., 2002b,c; Song et al., 2002; Su et al., 2002).

In all genotypes, IMP content of breast muscle was significantly higher than that of leg muscle ($P < 0.05$), ranging from 2.5- (AV) to 3.4-fold (LNH) great values (Table 5). A similar trend of IMP in leg and breast muscles was found in previous studies (Song et al., 2002; Chen et al., 2005; Vani et al., 2006).

Overall, the slow-growing birds exhibited lower cook loss, expressible moisture, higher shear value, and more fatty acids than did fast-growing birds. Compared with the HLB layer line, the Chinese native breeds (WCH and XJ) had reduced cook loss and expressible moisture, higher muscle lipid content, and average fatty acid composition and IMP content. The LNH cross birds were similar to AV birds in most meat quality parameters, although they had a lower shear force value, higher lipid (%), but lower relative content of essential fatty acids than AV birds. Variability of meat quality traits is mainly related to genotype differences. To identify the effects of genotype and age on meat characteristics, further research could be conducted using fewer commercial and specialty lines and multiple ages.

Table 5. Inosine-5′-monophosphate content (mg/g) in fresh muscles from female birds of 5 genotypes (n = 8 for each muscle type per genotype)

Genotype[1]	Leg muscle	Breast muscle	*P*-value
WCH	1.52 ± 0.15^{a}	3.59 ± 0.39^{a}	0.008
XJ	1.44 ± 0.12^{a}	3.39 ± 0.23^{a}	0.005
HLB	1.35 ± 0.10^{a}	3.69 ± 0.25^{a}	0.001
LNH	0.97 ± 0.12^{b}	3.25 ± 0.22^{a}	0.008
AV	0.95 ± 0.13^{b}	2.40 ± 0.21^{b}	0.041

[a,b]Means ± SEM within a column with no common superscript differ ($P < 0.05$).

[1]WCH = Wenchang; XJ = Xianju; HLB = Hy-Line Brown; LNH = Lingnanhuang; AV = Avian.

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