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Analysis of Meat Flavor Compounds in Jinghai Yellow Chicken and Fast-growing Commercial Chicken and their Crossbreed

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Abstract

The aim of this study was to evaluate the inosine 5'-monophosphate (IMP), thiamine, amino acid and fat acid of meat from Jinghai Yellow Chicken and fast-growing commercial chicken and their crossbreed. We choose the same batch of hatching, good condition, healthy 1 day age for Jinghai Yellow chickens (♀, JJ), fast-growing commercial strain (♀, BB) and their crossbreed (BJ), and each kinds of chicken is 200. Each group consisted of four repetitions, and each repetition included the male and the female chickens are 25, respectively. After three groups of chickens were fed to the age of the marketing age (112 d (JJ), 70 d (BB), 70 d (BJ)), 8 chickens were randomly selected from each repetition of each group to slaughter, and breast muscle and thigh muscle were used for analyzing meat flavor and nutrient composition were obtained. Thiamine, inosine 5'-monophosphate (IMP), amino acid (AA), and fatty acid (FA) in breast muscle and thigh muscle of Jinghai Yellow chicken and fast-growing commercial chicken and its crossbreed were compared. Results showed that JJ group and BJ group had a higher level of thiamine than BB group in breast muscle and thigh muscle ($P<0.01$). No differences were obtained in IMPc levels in breast muscle and thigh muscle ($P>0.05$).However, results suggested no consistent differences in meat flavor parameters levels of amino acid and fatty acid among different groups.

Keywords: Inosine 5'-monophosphate; Thiamine; Amino acid; Fatty acid; Chicken

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Introduction

Jinghai Yellow chicken is a high-quality and small-sized chicken species developed in Jiangsu, China, which has good genetic characteristics, including high fertility rate, good meat quality, prematurity and high adaption of rough feed and is for both meat and egg purpose. Jinghai Yellow chicken was bred by Jiangsu Jinghai Industry Group Co., Ltd., Yangzhou University, and Jiangsu provincial Animal Husbandry Station, and was authenticated by National Animal Genetic Resources Committee [1-10]. As the popularity of chicken meat products continues to increase, it is necessary to meet consumers's expectations for better meat quality, including nutrition value and sensory characteristics [8]. Jinghai Yellow chicken's small body size, high quality meat, early maturity, and stress resistance make it suitable for Chinese broiler market. Though Jinghai Yellow chicken has many advantages, the limit of slow growing speed makes it less comparative. In the present study, a new crossbreed was generated by crossing Jinghai Yellow chicken pedigree (♀) with a fast-growing commercial strain (♂). Previous studies had confirmed that meat flavor is dependent on inosine 5'-monophosphate (IMP), amino acid (AA), fatty acid (FA) levels, and breed [1,10], etc. Inosine 5'-monophosphate (IMP), amino acid (AA) and fatty acid (FA) levels as well as thiamine levels in muscle tissues from Jinghai

Yellow chicken were determined to evaluate and compare meat flavor of chosen chickens so as to provide reference for future work of breeding and strain selecting.

Materials and Methods

Birds, design, and diets

Six hundred chicks (1 d of age) were obtained from a commercial hatchery, Jiangsu Jinghai Poultry Industry Group Corp., Ltd. (Jiangsu, China), based on similar body weights and standard genotypes. There were three groups, including one Jinghai Yellow chicken group (JJ), one group of fast-growing commercial strain (BB), and their crossbreed (BJ). Each group (JJ, BB, and BJ) is raised from 1 d of age to marketing age, and their marketing age was 112, 70 and 70 d of age, respectively. Each group consisted of 200 chickens comprised of four replicates of 25 males and 25 females each. The feeding trial was conducted under the supervision of Jinghai Poultry Industry Group Co., Ltd. (Jiangsu, China). The birds had 24-h light circles on days 1-7, 16-20 h light circles on days 8-28, and natural lighting on days 29-112. Birds were raised under a stocking density of 14 per m^2 from weeks 0 to 6, 8 per m^2 from weeks 7-16. The birds had 24 h light cycles from week's 0 to 1, 20 h light cycles on week 2, 16 h light cycles from weeks 3 to 4, and natural lighting from weeks 5 to 16. The illumination intensity was 15 lux from weeks 0-2 and 5 lux from weeks 3-16. Temperature was maintained at 27-24°C on week 1, 24-21°C on week 2, 21-18°C from weeks 3 to 4, 18-21°C from weeks 5-6, and at room temperature from weeks 7-16. Natural light and ambient temperature setting conditions are based on the law of the growth and development of birds. The birds were reared under similar environmental and feeding conditions in an open-sided poultry shelter with thick padding and free access to water and feed. The basal diets were designed based on NRC (1994) guidelines; the basal diet ingredients were obtained from Yangzhou Hope Feed Corp. in Yangzhou, China [11] **(Table 1).**

Sampling and processing

At marketing age (112 d, 70 d and 70 d), 192 chickens were randomly selected from the three groups (8 males and 8 females per replicate). These birds have developed and have a full nutrient level to the highest level, which is good for us to do experimental research, so we chose marketing age chickens to evaluate their meat quality and flavor. Following a 12-h fast, the birds were manually stunned and exsanguinated. The birds were scalded for 45 s at 58-60°C, and the carcasses were de-feathered and eviscerated. Breast muscle and thigh muscle from the right side were stored in bags at -20°C.

Meat quality analyses

IMP: To determine the levels of IMP and its metabolites, the supernates (pH=6.5) were gathered after meat samples were homogenized and centrifuged and were analyzed by Waters 515HPLC system (Waters Corp., USA) at a absorbance wavelength of 254 nm for ultraviolet detector. Liquid chromatography was performed on a 5 μm Lichrosorb C_{18} column using a mobile phase composed of 0.05 M triethylamine phosphate (A) and acetonitrile (B) (A:B, 95:5 V/V), at a flow rate of 1 mL min^{-1}. The levels of corrected inosine 5'-monophosphate (IMPc) were calculated from the average contents of ADP, AMP, IMP, INO, and HYP divided by their respective molecular weights and multiplied by the molecular weight of IMP.

Thimaine: Thiamine was determined by high performance liquid chromatography (HPLC) in People's Republic of China national standard (GB/T 9695.27-2008). The determination of thimaine was conducted after the process of hydrolyzation, enzymolysis, and oxidation, by Waters 515HPLC system (Waters Corp., USA) with 365 nm of excitation wavelength and 435 nm of emission wavelength for fluorescence detector. A Lichrosorb C_{18} column (4.6 × 250 mm, 5 μm) and a mobile phase composed of 0.05 M sodium acetate (A, pH 4.5)/methanol (B) (A:B, 65:35 V/V) at a flow rate of 1 mL min^{-1} were adopted.

Amino acid: Amino acid content determination method refer to People's Republic of China national standard (GB/T5009.124.2003), using the Waters 515HPLC system with 248 nm of absorbance wavelength for the ultraviolet detector after the process of acid hydrolysis, vacuum treatment, and redissoluation by hydrochloric acid. The detection used an AccQ column (3.9 × 150 mm, 5 μm) and the mobile phase 0.05 M sodium acetate (A, pH 4.5)/60% acetonitrile (B) with a changing gradient ratio.

Fatty acid: To determine the levels of fatty acids, which refer to People's Republic of China national standard's gas chromatograph method (GB/T 9695.2-2008), the fatty acid methyl esters obtained after the process of saponification and methylation were quantified by Agilent 7890A gas chromatograph (Agilent Corp., USA), using a DB-5 capillary Column (30 m×0.25 mm × 0.25 μm). Nitrogen was used as carrier gas and programmed heating was adopted. All parameters were determined by comparing

Table 1 Nutrient composition and ingredients of the basal diet*

Nutrients	Age (weeks)	
	0-6	7-16
ME (kcal/kg)	2,810	2,880
CP (%)	19.32	17.10
Calcium (%)	0.90	0.80
Available phosphorus (%)	0.47	0.45
Lysine (%)	0.06	0.04
Methionine (%)	0.50	0.50
Methionine+proline (%)	0.82	0.65
Components		
Wheat (%)	6.00	6.00
Corn (%)	57.99	61.34
Soybean meal (%)	31.80	24.50
Limestone (%)	0.90	0.90
Methionine (%)	0.15	0.12
Lysine (%)	0.06	0.04
Calcium hydrogen (%)	1.80	1.70
Sodium chloride (%)	0.30	0.30
Choline chloride (%)	0.10	0.10
Additive (%)	1.00	1.00

*Nutrient composition was provided by Yangzhou Hope Feed Co. (Yangzhou, China)

with the retention time of the standard chromatogram and the concentration was calculated using the peak area.

Statistical Analysis

Data were analyzed with ANOVA using SAS 8.0. Data were expressed as mean ± standard error of mean (SEM); differences between groups were considered significant at $P<0.05$ and extremely significant at $P<0.01$.

Results and Discussion

Thiamine, AA, and IMP level

The levels of thiamine, AA, and IMP in breast and thigh muscles were summarized in **Tables 2 and 3**. Kawai et al. [7] reported that meat quality depends on the nutrition elements (e.g., amino acid, fatty acid, and nuclear acid), meat condition (e.g., muscle pH value), and flavor elements (e.g., thiamine, IMP). In terms of Thiamine, in breast muscles, JJ was observed to have the highest level of thiamine than the rest ($P<0.01$); JJ and BJ had higher level thiamine than BB in breast muscle and thigh muscle ($P<0.01$). This may due to genetic differences. Jayasena et al. [4] reported that different breeds/strains contained different levels of flavour precursors leading to various types and concentrations of volatile compounds. Thiamine is an important bioactive compound which produces nitrogen-containing volatile compounds when heated. These degradation products contribute to the flavor of meat. Results indicated that pedigree JJ and the crossbreed BJ had higher level of thiamine than BB which may indicate better performance of meat flavor.

Table 2 Levels of amino acid, IMP, and thiamine in breast muscle of different chicken groups*.

Compounds	Group		
	JJ	BJ	BB
Aspartic acid	$1.67^{B} \pm 0.27$	$2.00^{A} \pm 0.22$	$2.05^{A} \pm 0.31$
Serine	0.79 ± 0.09	0.76 ± 0.99	0.80 ± 0.06
Glutamic acid	2.60 ± 0.30	2.51 ± 0.26	2.11 ± 0.20
Glycine	0.81 ± 0.10	0.80 ± 0.08	0.80 ± 0.06
Histidine	0.95 ± 0.16	1.03 ± 0.14	1.08 ± 0.15
Arginine	$1.14^{a} \pm 0.16$	$1.03^{b} \pm 0.08$	1.09 ± 0.10
Threonine	1.18 ± 0.32	1.09 ± 0.27	1.25 ± 0.10
Alanine	0.77 ± 0.16	0.69 ± 0.08	0.73 ± 0.04
Proline	$0.57^{a} \pm 0.11$	$0.49^{b} \pm 0.07$	0.54 ± 0.04
Cysteine	0.07 ± 0.01	0.06 ± 0.00	0.07 ± 0.01
Tyrosine	$0.60^{B} \pm 0.12$	$1.02^{A} \pm 0.09$	$1.02^{A} \pm 0.07$
Valine	0.93 ± 0.11	0.91 ± 0.06	0.93 ± 0.06
Methionine	1.16 ± 0.26	1.24 ± 0.09	1.29 ± 0.11
Lysine	$1.59^{a} \pm 0.17$	$1.42^{b} \pm 0.15$	$1.56^{a} \pm 0.02$
Isoleucine	0.90 ± 0.10	0.87 ± 0.09	0.92 ± 0.07
Leucine	1.94 ± 0.27	1.97 ± 0.16	2.06 ± 0.14
Phenylalanine	0.85 ± 0.10	0.85 ± 0.06	0.87 ± 0.06
TAA†	19.55 ± 1.85	18.78 ± 1.82	18.69 ± 1.50
EAA	10.51 ± 1.03	10.41 ± 0.90	9.98 ± 0.73
DFAA	7.00 ± 0.69	7.03 ± 0.68	7.28 ± 0.62
IMPc ($mg \cdot g^{-1}$)	2.33 ± 0.61	2.29 ± 0.69	2.31 ± 0.80
Thiamine($mg \cdot 100g^{-1}$)	$0.14^{A} \pm 0.04$	$0.08^{B} \pm 0.05$	$0.04^{C} \pm 0.01$

*Data are mean ± SEM of 32 males and 32 females per group (n=64). The groups of chicken tested include one pedigree bird group of Jinghai Yellow chicken (JJ), one group of fast-growing commercial strain (BB), and their crossbreed (BJ). Below is the same.

[abAB]Means in the same row with no common superscript differ ($P<0.05$ *or* $P<0.01$).

†TAA: Total Amino Acid; EAA: Essential Amino Acid; DFAA: D elicate Flavor Amino Acid. IMPc: Corrected Inosine 5'-monophosphate

Table 3 Levels of amino acid, IMP, and thiamine in thigh muscle of different chicken groups*.

Compounds	Group		
	JJ	BJ	BB
Aspartic acid	$1.65^{B} \pm 0.56$	2.09 ± 0.39	$2.18^{A} \pm 0.27$
Serine	0.80 ± 0.19	0.83 ± 0.11	0.87 ± 0.09
Glutamic acid	2.59 ± 0.70	2.71 ± 0.35	2.86 ± 0.30
Glycine	0.83 ± 0.23	0.82 ± 0.12	0.88 ± 0.09
Histidine	$0.76^{B} \pm 0.21$	$1.16^{A} \pm .46$	0.84 ± 0.12
Arginine	1.25 ± 0.37	1.34 ± 0.21	1.38 ± 0.21
Threonine	0.97 ± 0.18	1.02 ± 0.20	0.97 ± 0.09
Alanine	0.69 ± 0.20	0.74 ± 0.18	0.72 ± 0.07
Proline	0.59 ± 0.16	0.62 ± 0.15	0.62 ± 0.06
Cysteine	0.10 ± 0.08	0.08 ± 0.01	0.10 ± 0.01
Tyrosine	$0.64^{B} \pm 0.19$	$1.10^{A} \pm 0.26$	$1.07^{A} \pm 0.10$
Valine	0.85 ± 0.21	0.98 ± 0.25	0.92 ± 0.08
Methionine	1.22 ± 0.31	1.44 ± 0.43	1.28 ± 0.12
Lysine	1.33 ± 0.60	1.70 ± .046	1.62 ± 0.16
Isoleucine	0.88 ± 0.28	0.96 ± 0.22	0.94 ± 0.81
Leucine	1.84 ± 0.45	2.23 ± 0.56	2.15 ± 0.17
Phenylalanine	0.80 ± 0.18	0.96 ± 0.24	0.90 ± 0.07
TAA†	$17.87^{b} \pm 4.43$	$20.85^{a} \pm 3.09$	20.35 ± 1.47
EAA	$8.68^{b} \pm 2.16$	$10.49^{a} \pm 2.16$	9.65 ± 0.73
DFAA	7.03 ± 1.94	7.70 ± 1.01	8.03 ± 0.79
IMPc ($mg \cdot g^{-1}$)	1.37 ± 0.59	1.44 ± 0.45	1.47 ± 0.40
Thiamine ($mg \cdot 100g^{-1}$)	$0.18^{A} \pm 0.05$	$0.18^{A} \pm 0.04$	$0.07^{B} \pm 0.02$

*Data are mean ± SEM of 32 males and 32 females per group (n= 64).

[abAB]Means in the same row with no common superscript differ ($P<0.05$ *or* $P<0.01$).

†TAA: Total Amino Acid; EAA: Essential Amino Acid; DFAA: Delicate Flavor Amino Acid.

IMPc: Corrected Inosine 5'-Monophosphate

Amino acids were considered to be important flavor precursors in meat as the product from its reaction with reducing sugar contributed to the formation of meat flavor [12]. Thus the amounts and types of amino acids in muscle may reflect the flavor of meat. The level of free amino acids in the present study may indicate the meat of Jinghai Yellow chicken and its crossbreed could meet the needs of consumers to some degrees. According to the results, no differences were found in the level of total amino acids (TAA), essential amino acids (EAA), and delicate flavor amino acid (DFAA) in breast muscle, and there were also no consistent disparities in the level of individual amino acid. In thigh muscle, the level of TAA and EAA in BJ was significant higher than JJ ($P<0.05$). The results in this study showed that different groups of chicken performed differently in the level of amino acid in different muscles. BJ was considered superior to other chicken groups in the levels of amino acids in thigh muscles. However, the present study suggested that amino acid showed no consistent

difference in the level of different amino acids among different chickens. This may due to differences in endogenous proteolytic activity.

In this study, IMP levels were expressed as IMPc to correct for IMP turnover. No differences were obtained in IMPc levels in breast muscle and thigh muscle ($P>0.05$). According to Maga and Yamaguchi [6], IMP was a major nucleotide in dead muscle, and was even more important as a flavor enhancer in natural meat. IMP could degrade into active ribose and ribose phosphate, which participates in the Maillard reaction in meat during meat processing, producing a variety of volatile flavor elements.

Fatty acid

Fatty acid profile in breast muscle and thigh muscle were summarized in **Table 4 and 5**. Fatty acids were important components in energy metabolism, membrane formation, and signaling processes [5,13]. In breast muscle, JJ had higher levels of C18:2, C20:1, C20:2 and PUFA compared with BB and BJ ($P<0.05$ or $P<0.01$). BJ performed better in levels of unsaturated fatty acids, e.g., C15:0, C17:0, and C24:0 ($P<0.05$ or $P<0.01$) and was extremely higher in the level of C22:6 compared with other groups ($P<0.01$). The crossbreed showed difference in different fatty acids compared with the parents and there is a decrease trend in the levels of unsaturated fatty acids and an increase in levels of saturated fatty acids. However, further researches should focus on the effects of fluctuation of fatty acids on meat flavor.

Table 4 Fatty acid levels in chicken breast muscle expressed as percentage of total fatty acid*.

Items (%)	Group		
	JJ	BJ	BB
C12:0	$0.35^{A} \pm 0.18$	0.27 ± 0.21	$0.09^{B} \pm 0.08$
C14:0	0.74 ± 0.25	0.68 ± 0.26	0.63 ± 0.19
C14:1	$0.12^{B} \pm 0.04$	$0.28^{aA} \pm 0.24$	$0.18^{b} \pm 0.07$
C15:0	$0.09^{C} \pm 0.03$	$0.66^{A} \pm 0.44$	$0.21^{B} \pm 0.25$
C15:1	$0.37^{B} \pm 0.31$	0.69 ± 0.44	$0.93^{A} \pm 0.43$
C16:0	22.66 ± 4.59	$20.28^{b} \pm 10.47$	$26.29^{a} \pm 4.10$
C16:1	$4.56^{B} \pm 1.33$	$3.84^{B} \pm 1.46$	$6.13^{A} \pm 1.13$
C17:0	$0.13^{B} \pm 0.07$	$0.25^{Aa} \pm 0.22$	$0.19^{b} \pm 0.25$
C17:1	0.14 ± 0.05	0.23 ± 0.16	0.15 ± 0.13
C18:0	7.29 ± 1.33	8.42 ± 3.10	8.34 ± 1.43
C18:1	$19.02^{a} \pm 4.32$	$16.45^{b} \pm 6.98$	$19.59^{a} \pm 3.15$
C18:2	$18.66^{aA} \pm 12.73$	$9.21^{B} \pm 7.16$	$13.59^{b} \pm 11.66$
C18:3	0.14 ± 0.04	0.15 ± 0.06	0.12 ± 0.03
C20:0	0.40 ± 0.11	0.42 ± 0.16	0.45 ± 0.14
C20:1	0.56 ± 0.17	1.05 ± 0.60	0.68 ± 0.24
C20:2	$0.50^{A} \pm 0.77$	$0.19^{B} \pm 0.08$	$0.22^{B} \pm 0.08$
C21:0	$0.01^{b} \pm 0.01$	$0.01^{b} \pm 0.00$	$0.03^{a} \pm 0.03$
C20:3	0.37 ± 0.10	$0.25^{B} \pm 0.15$	$0.53^{A} \pm 0.17$
C20:4	2.57 ± 0.60	1.75 ± 1.63	2.46 ± 1.22
C22:0	0.05 ± 0.04	0.10 ± 0.07	0.07 ± 0.05
C22:1	0.05 ± 0.03	0.06 ± 0.01	0.06 ± 0.05
C24:0	$0.17^{B} \pm 0.12$	$0.35^{Aa} \pm 0.17$	$0.25^{b} \pm 0.13$
C22:6	$0.94^{B} \pm 0.75$	$1.80^{A} \pm 0.46$	$0.92^{B} \pm 0.42$
SFA†	31.89 ± 6.28	31.38 ± 13.55	36.64 ± 5.76
MUFA	24.83 ± 5.55	22.61 ± 8.94	27.72 ± 4.11
PUFA	$23.17^{aA} \pm 12.17$	$13.36^{B} \pm 8.75$	$17.85^{b} \pm 10.82$

*Data are mean ± SEM of 32 males and 32 females per group (n=64). ^{abAB}Means in the same row with no common superscript differ ($P<0.05$ *or* $P<0.01$).
†SFA: Saturated Fatty Acid; MUFA: Monounsaturated Fatty Acid; PUFA: Polyunsaturated Fatty Acid.

Table 5 Free fatty acid levels in chicken thigh muscle expressed as percentage of total fatty acid*.

Fatty acid	Group		
	JJ	BJ	BB
C12:0	$0.48^{A} \pm 0.09$	$0.08^{B} \pm 0.04$	$0.03^{B} \pm 0.00$
C14:0	$0.95^{A} \pm 0.08$	$0.66^{B} \pm 0.17$	$0.69^{B} \pm 0.06$
C14:1	$0.18^{b} \pm 0.03$	$0.16^{B} \pm 0.09$	$0.24^{aA} \pm 0.04$
C15:0	$0.12^{b} \pm 0.01$	$0.25^{aA} \pm 0.23$	$0.09^{B} \pm 0.02$
C15:1	0.78 ± 0.39	0.88 ± 0.51	0.81 ± 0.27
C16:0	23.78 ± 1.46	25.20 ± 3.35	24.91 ± 2.08
C16:1	$5.74^{B} \pm 1.08$	$6.11^{B} \pm 1.38$	$9.21^{A} \pm 1.57$
C17:0	0.20 ± 0.05	$0.32^{A} \pm 0.32$	$0.13^{B} \pm 0.03$
C17:1	0.15 ± 0.02	$0.24^{a} \pm 0.22$	$0.13^{b} \pm 0.01$
C18:0	7.65 ± 2.76	8.95 ± 3.46	7.50 ± 1.05
C18:1	21.00 ± 2.09	20.55 ± 6.84	23.55 ± 3.18
C18:2	$17.92^{A} \pm 1.99$	$13.27^{B} \pm 3.33$	$13.32^{B} \pm 3.25$
C18:3	$0.19^{Aa} \pm 0.12$	$0.14^{b} \pm 0.03$	$0.11^{B} \pm 0.01$
C20:0	0.47 ± 0.07	0.50 ± 0.12	0.52 ± 0.09
C20:1	0.85 ± 0.34	1.32 ± 0.80	1.31 ± 0.47
C20:2	0.40 ± 0.15	0.31 ± 0.10	0.30 ± 0.05
C21:0	$0.07^{a} \pm 0.02$	$0.05^{b} \pm 0.03$	$0.07^{b} \pm 0.02$
C20:3	$0.59^{A} \pm 0.07$	$0.44^{B} \pm 0.19$	$0.61^{A} \pm 0.08$
C20:4	$5.09^{a} \pm 1.19$	$3.99^{b} \pm 2.95$	$3.80^{b} \pm 0.72$
C22:0	$0.05^{B} \pm 0.01$	$0.10^{A} \pm 0.06$	$0.05^{B} \pm 0.01$
C22:1	$0.03^{b} \pm 0.01$	$0.07^{a} \pm 0.06$	$0.03^{b} \pm 0.01$
C24:0	$0.30^{B} \pm 0.12$	$0.50^{A} \pm 0.26$	$0.32^{B} \pm 0.10$
C22:6	$1.11^{b} \pm 0.31$	$1.53^{aA} \pm 0.76$	$0.89^{B} \pm 0.30$
SFA†b	34.07 ± 2.73	36.60 ± 5.23	34.30 ± 2.55
MUFA	$28.74^{b} \pm 2.93$	$29.33^{b} \pm 7.04$	$35.28^{a} \pm 4.09$
PUFA	$25.30^{A} \pm 2.73$	$19.68^{B} \pm 5.44$	$19.03^{B} \pm 3.16$

*Data are mean ± SEM of 32 males and 32 females per group (n=64). ^{abAB} Means in the same row with no common superscript differ ($P<0.05$ *or* $P<0.01$).
†SFA: Saturated Fatty Acid; MUFA: Monounsaturated Fatty Acid; PUFA: Polyunsaturated Fatty Acid.

In thigh muscles, C12:0, C14:0, C18:2, C18:3, and C20:3 levels in JJ were significantly higher than BB and BJ ($P<0.01$ or $P<0.05$). C14:1, C16:1, and C20:3 in BB were significantly higher than BJ ($P<0.01$). C15:0, C17:0, C22:0, and C24:0 in BJ were significantly higher than JJ and BB ($P<0.01$ or $P<0.05$). C22:6 in BJ were significantly higher than JJ and BB ($P<0.01$ or $P<0.05$), MUFA in BB were significantly higher than BJ and JJ ($P<0.05$), PUFA in JJ were significantly higher than BB and BJ ($P<0.01$).

In this study, fatty acid levels in breast and thigh muscle were not consistent among the three groups, this may be attributed to genetic factors. Findings of researches conducted over years have shown that genetic factors affect the flavour of chicken meat [4]. However, BB, JJ, and BJ performed well in terms of fatty acids of different saturation in breast and thigh muscle. Evidence

indicated that unsaturated fatty acids (UFA) were protective to organisms as they play important roles in nutrition metabolism, gene regulation, immune response, and disease susceptibility [14]. Former studies showed that high amount of USFA in meat may cause the issue of lipid oxidation during meat processing and storage [3,9] as their lipid oxidation could result in meat off-odors, off-flavors, and warmed-over flavors, and affect the nutritive value, sensory characteristics, and quality of the meat [2]. In general, Jinghai Yellow chicken and its crossbreed performed well in this study. However, it would be important to develop a breed that has higher and balanced FA levels.

Conclusions

In general, Jinghai Yellow chicken and its crossbreed have high levels of meat flavor compounds and are nutritious, also the faster growing speed of the crossbreed (BJ) contributes to the suitability to the market. In future studies, it would be important to develop a crossbreed that has higher and balanced nutrients levels. Future efforts should focus on assessing meat flavor through measurement of sensory characteristics of Jinghai Yellow chicken.

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Disclosure Statement

We declare that there are no commercial relationships that might pose a conflict of interest in connection with the submitted manuscript.

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