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NUTRITIVE VALUE OF MEAT FROM PHILIPPINE WHITE MALLARD (*Anas boschas* L.) AND PEKIN (*Anas platyrynchos* L.) DUCKS

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ABSTRACT

Philippine White Mallard duck was compared with Pekin duck for its potential in meat production. A total of 50 ducklings were randomly assigned to 5 pens per treatment after 1 month of brooding. Each pen containing five ducks was considered as a replicate. Ducks were raised until 12 weeks of age and dressed at the end of the growing period. Data were subjected to the Independent Sample *t*-test. Essential amino acid profiles of both duck breeds have no significant differences except for leucine and isoleucine in which higher levels were obtained in Pekin duck meat. Total non-essential amino acid of Pekin duck meat was also significantly higher than the meat from Philippine White Mallard although the individual amino acid did not differ between breeds. Fatty acid composition from the meat of both breeds of duck did not show any significant differences. However, Philippine White Mallard duck was noted to have significantly higher cholesterol content in both skin and lean compared with Pekin ducks. Results showed that nutrient content of meat from both duck breeds were comparable. On the health point of view, Pekin duck meat has an advantage over Philippine White Mallard due to lower cholesterol content.

Keywords: amino acid, cholesterol content, fatty acid, Pekin, Philippine White Mallard

INTRODUCTION

Duck-raising in the Philippines largely focuses on egg production (Chang *et al*., 2005). In fact, a 12.13% increase in total duck egg production was recorded by the Philippine Statistics Authority in 2015. In this regard, the high demand for duck egg is no surprise since these are usually made into the popular Pinoy street delicacies such as *balut* (boiled 14 to 18 day incubated duck eggs) and *penoy* (boiled duck egg with its young embryo dead). Other Pinoy delicacies processes out of duck eggs are century eggs and salted eggs (usually with the shell painted red) which are commonly sold in the market all over the country.

Chang *et al*. (2005) cited low meat quality as the primary reason for the low popularity of duck's meat among Filipino consumers. The meat is described as tough, course-textured and has a fishy smell. This is due to the fact that the common source of duck meat in the country

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is the egg-type ducks that have reached the end of their laying period. The most popular of which are the brown Mallard ducks. To promote production, consumption and utilization of the meat of local duck breeds, there is a need to assess which of the breeds possess high quality meat. The Philippine White Mallard is one of the candidates since it can be found anywhere in the Philippines but has never been popular among the local duck raisers. It is an egg-type breed producing large-size eggs, however, fewer in numbers which is the reason why farmers eliminate them from the flock. Philippine White Mallard duck show better carcass appearance due to its white plumage compared with the brown and black Mallard ducks. However, there is a dearth of published studies on the potential use of Philippine White Mallard for duck meat production. In this study, the Philippine White Mallard was compared with Pekin duck, a meat-type breed, in terms of lipid and amino acid profiles, and cholesterol contents.

MATERIALS AND METHODS

The Philippine White Mallard and the Pekin ducks were the experimental treatments in the study. The ducks were randomly assigned to five (5) pens per treatment. Each pen containing five (5) ducks was considered as a replicate. A complete randomized design (CRD) was used in the experiment.

A total of 50 ducklings (i.e., 25 Philippine White Mallard and 25 Pekin) were randomly distributed on the grower house after one month of brooding. The ducks were fed *ad libitum* with commercial duck rations and were grown for 2 months. They were 12 weeks of age at the end of the feeding period. The grown ducks were transported to the slaughterhouse in the evening to lessen the stress. Proper pre-slaughter management practices were followed in the handling of the ducks. The dressing of the ducks was done following the procedure described by Lambio (2001).

The duck carcasses were chilled overnight at 4°C. Fabrication was done and the carcasses were separated into cut-up parts that include the breast, whole legs, wings and soup bone (i.e. neck and vertebral column). Skin and lean samples from the breast and the legs from each breed were taken and analyzed for amino acid and fatty acid profiles, and cholesterol content.

Meat samples were homogenized and 5 grams were defatted using Soxhlet extraction. The defatted samples were digested in a closed vessel with 6ml 6N HCl for 24 hours at 100°C. The digested sample was neutralized and diluted to volume. The samples were filtered before injection to Amino Acid Analysis System. The AOAC Official Method 999.13 (2002) was used. The High Performance Liquid Chromatography (HPLC) set-up has the following conditions for the determination of the different amino acids: Shimadzu LC System, post column derivitization using o-phthaldehyde, Shimpack Amino-Na Column, and detector (Fluorescence Excitation 348 and Emission 450 nm).

A 0.25 g of fat from skin and meat samples was weighed separately and put in a 50 ml round bottom flask quick fit separately. It was added with 6 ml methanolic sodium hydroxide and attached in reflux condenser and reflux for 8-10 minutes. A 7 ml boron trifluoride was added through the top of the reflux condenser and allowed to continue to reflux for 2 minutes. Five ml of heptane was also added and reflux continued for one minute. The solution immediately cooled in tap water, and saturated sodium chloride was added through swirling. The heptane layer was transferred in a vial. The solution was injected into the Gas

Chromatography (GC) apparatus. For ether extract, AOAC Official Method 920.39 (Crude fat in Animal Feed) (2005) was used. Meanwhile for fatty acid profile, the AOAC-IUPAC Method (1990) on Methyl Esters of Fatty Acids in Oils and Fats was adopted. The gas chromatography set-up has the following conditions for the determination of fatty acids: GC 2010 Shimadzu detector, column (SUPELCO 2560 fused capillary column 100m x 0.25m x µm film thickness), and flame ionization detector.

Five grams of skin and meat samples were weighed separately in 500 ml Erlenmeyer flask. It was added with 40 ml 95% ethanol and 8 ml 50% KOH then was attached in a condenser with stirrer turned on. The reflux was done for 70 ± 10 minutes then 60 ml 95% ethanol was added through the top of the condenser. After 15 minutes, flask was removed from the condenser, covered with a stopper and cooled to room temperature. The method by AOAC 994.10- Cholesterol in Food (HPLC Method) (2012) was adopted. The HPLC set-up has the following conditions to determine the cholesterol contents: Shimadzu Prominence Model using C18 column, mobile phase (acetonitrile-methanol-H2O (50-50-3)), flow rate of 0.7ml/min., and detector (UV 215nm) and column temperature of 50°C.

The data were analyzed using an Independent Sample *t*-test at 5% level of confidence using the SPSS software version 20 and presented as means ± standard deviation.

RESULTS AND DISCUSSION

Table 1 shows that there were no significant differences in the individual essential amino acid contents of meat from the Philippine White Mallard and Pekin except for isoleucine ($P<0.05$) and leucine ($P<0.01$). Due to this, Pekin had significantly higher total essential amino acid content. Leucine and isoleucine have been reported to contribute to the bitter taste of meat (Geraert and Mercier, 2010). It was suggested that low leucine diets be formulated to induce an increase in free glutamic acid content that would overcome the bitter taste in poultry meat.

The total nonessential amino acid was higher in Pekin ($P<0.05$) even though the individual amino acids did not differ. Differences in nonessential amino acid contents were reported by Aronal *et al*. (2012) in their study with Pekin, Cherry Valley and Muscovy ducks. Woloszyn *et al*. (2006) reported differences in the total amino acid compositions among Pekin (A55 and P66 strains), Mallard and Muscovy ducks. The findings support the report that amino acid composition of meat depends on the type of species and influenced by genetic make-up (Brudnicki *et al*., 2012).

The fatty acid composition did not differ significantly between Philippine White Mallard and Pekin ducks (Tables 2, 3, and 4). The similarity in the fatty acid profile of both breeds is as expected since the ducks were fed similar diets. Greenwood *et al*. (2005) and Brickett *et al*. (2007) emphasized the importance of diet in the growth performance of animals and in the nutrient content of the resulting meat. El-Deek *et al*. (1997) reported relatively differences on fatty acid profiles of skin and lean which they attributed to breed type and diet.

The predominant fatty acids are palmitic (C16), stearic (C18) and oleic (C18:1) in the duck skin (Table 2). Moreover, 60% of the fatty acids are saturated. In comparison, the lean meat contains more palmitic, stearic, oleic and linoleic (18:2) acids than the skin. Farchat and Chavez (2000) also reported that duck meat is high in polyunsaturated fatty acids particularly linoleic acid (C18:2). Unlike the skin, almost equal proportions of total

Table 1. Amino acid composition of Meat of Philippine White Mallard and Pekin Ducks.

Amino Acid Composition	Breed		*P*-value
	Philippine White Mallard	Pekin	
Essential amino acids			
Threonine	0.45±0.09	0.62±0.09	0.08
Valine	1.75±0.37	1.53±0.35	0.49
Methionine	0.14±0.12	0.28±0.12	0.21
Isoleucine	1.64±0.20	2.12±0.23	0.05*
Leucine	2.29±0.19	3.23±0.32	0.01*
Tyrosine	0.36±0.19	0.61±0.12	0.12
Phenylalanine	3.66±1.41	2.96±0.36	0.45
Histidine	0.99±0.43	1.06±0.17	0.79
Lysine	0.49±0.26	0.72±0.04	0.22
Total Essential Amino acid	11.77	13.13	0.52
Non-essential amino acids			
Aspartate	1.40±0.24	1.81±0.26	0.12
Glutamate	4.22±0.82	5.48±0.81	0.13
Tryptophan	0.92±0.29	0.67±0.29	0.36
Serine	0.62±0.13	0.85±0.11	0.09
Proline	0.85±0.34	1.36±0.17	0.08
Glycine	4.93±0.49	5.94±0.52	0.07
Alanine	1.01±0.20	1.06±0.16	0.75
Arginine	2.64±1.04	3.68±0.22	0.16
Total Non-essential Amino acid	16.59	20.85	0.04*

*Significantly different at $P<0.05$, $P<0.01$

saturated and unsaturated fatty acids are contained in the lean (Table 3). The reported major fatty acids in the lean in the current experiment are comparable with the results of Bernacki and Adamski (2001), Woloszyn *et al*. (2006), and Witak (2008) on breast muscles of selected strains of commercial Pekin duck. The main saturated fatty acids obtained from the present research are also similar to the findings of Ulbricht and Southgate (1991) in poultry breast, thigh, and leg muscles. One of the saturated fatty acids is stearic acid which is not implicated in raising blood cholesterol level. Kelly *et al*. (2001) showed that stearic acid in the diet had beneficial effects on thrombogenic and atherogenic risk factors in males.

Leskanich and Noble (1997) and Woloszyn *et al*. (2006) observed lesser amounts of saturated fatty acid and more of unsaturated fatty acids in breast muscles of commercial Pekin strains. In addition, duck meat was reported to have 5.57% more unsaturated fatty acids than chicken, pork, and beef. This could cause rapid lipid oxidation that probably leads to the development of the fish taint odor and flavor in duck meat. The flavor of the

Table 2. Fatty acid profile from skin of Philippine White Mallard and Pekin ducks.

Fatty Acid	Breed		*P*-value
	Philippine White Mallard	Pekin	
Saturated			
C_{6}	1.13±1.00	1.32±1.15	0.84
C_{7}	0.05±0.05	0.045±.045	0.82
C_{8}	0.13±0.05	0.18±0.03	0.12
C_{9}	0.09±0.08	0.10±0.09	0.92
C_{10}	0.40±0.06	0.39±0.04	0.91
C_{12}	12.67±1.91	12.73±0.86	0.96
C_{13}	Nd	Nd	
C_{14}	7.08±0.82	6.32±1.19	0.41
C_{15}	0.09±0.02	3.22±5.42	0.38
C_{16}	28.23±3.52	26.27±6.41	0.66
C_{17}	0.30±0.02	0.94±1.04	0.35
C_{18}	9.59±2.27	13.09±7.04	0.46
C_{19}	0.01±0.011	0.0047±0.0081	0.51
C_{20}	0.19±0.06	0.16±0.006	0.39
C_{21}	0.15±0.012	0.16±0.021	0.69
C_{22}	0.03±0.006	0.58±0.97	0.38
C_{23}	Nd	Nd	
Total	60.14	65.51	
Unsaturated			
$C_{18:1}$	33.97 ± 4.17	31.43±8.55	0.67
$C_{18:2}$	5.06±4.99	2.99±2.03	0.54
$C_{18:3}$	0.001±.002	.002±.003	0.79
$C_{20:5}$	Nd	Nd	
$C_{20:4}$	0.06±0.12	0.05±0.09	0.9
Total	39.09	34.47	

Nd- Not detected

meat is positively correlated with lipid content (Chartrin *et al*., 2006). Therefore, a higher fat content in duck meat may cause the stronger flavor.

The advantage of duck meat is the nature of its fat. The melting point of duck fat is only 14°C, compared with the melting points of beef, pork, and chicken which are 45°C, 38°C, and 37°C, respectively (Watanabe *et al*., 2008). The low melting point of fat makes the duck meat very delicious even when served cold (Watanabe *et al*., 2008). Moreover, the fat is easily excreted and will not cause problems of obesity.

Table 3. Fatty acid profile of lean muscles of Philippine White Mallard and Pekin ducks.

Fatty Acid	Breed		*P*-value
	Philippine White Mallard	Pekin	
Saturated			
C_{6}	Nd	Nd	
C_{7}	Nd	Nd	
C_{8}	0.04±0.06	0.09±0.15	0.61
C_{9}	Nd	Nd	
C_{10}	0.12±0.10	0.22±0.09	0.25
C_{12}	7.12±0.46	8.46±2.59	0.42
C_{13}	Nd	Nd	
C_{14}	5.13±0.89	4.87±1.09	0.76
C_{15}	0.06±0.06	0.06±0.06	0.96
C_{16}	23.50±5.50	20.20±2.46	0.39
C_{17}	0.11±0.12	0.24±0.21	0.85
C_{18}	12.71±3.34	9.07±1.03	0.15
C_{19}	0.02±.02	0.003±0.001	0.30
C_{20}	Nd	Nd	
C_{21}	0.14±0.02	0.15±0.06	0.72
C_{22}	0.56±0.51	0.58±0.93	0.97
C_{23}	0.70±0.73	1.19±1.01	0.53
C_{24}	0.71±1.22	0.76±1.32	0.96
Total	50.92	45.893	
Unsaturated			
$C_{18:1}$	32.13±1.17	30.07±1.79	0.17
$C_{18:2}$	16.84±9.84	20.85±10.04	0.65
$C_{18:3}$	0.02±0.02	0.03±0.02	0.78
$C_{20:5}$	0.02±0.03	0.01±0.02	0.83
$C_{20:4}$	Nd	Nd	
$C_{24:1}$	0.13±0.22	0.44±0.57	0.42
$C_{22:6}$	0.002±0.004	0.005±0.009	0.63
Total	49.14	51.41	

Nd-not detected

Table 4. Balance sheet of fatty acids of skin and muscles from Philippine White Mallard and Pekin ducks.

	Breed				*P*-value	
	Philippine White Mallard		Pekin			
%	Skin	Lean	Skin	Lean	Skin	Lean
SFA	60.8±8.6	50.9±9.0	65.5±9.9	45.8±12.3	0.57	0.80
UFA	39.1±8.6	49.2±8.9	34.5±10	51.4±12.3	0.57	0.81
MUFA	33.9± 4.2	16.2.±23	31.4±8.6	15.3±21	0.69	0.97
PUFA	1.7±3.0	4.2±8.4	1.02±1.7	5.2±10.4	0.74	0.89
SFA/UFA	1.54	1.04	1.90	0.89		
SFA/MUFA	1.77	1.58	2.08	1.50		
SFA/PUFA	11.75	3.02	21.55	2.20		

The current study also revealed higher polyunsaturated fatty acids (PUFA) particularly in Pekin ducks. Woloszyn *et al*. (2006) had stated that preference in human diets is given to the high level of the n-3 PUFA which is the most valuable acid among the unsaturated fatty acid or UFA group from the nutritional and physiological points of view. The dietary intake of polyunsaturated fatty acids is known to be effective in lowering blood lipids levels (Grundy and Denke, 1990). Henceforth, PUFA are considered to have functional properties of which duck meat is rich of.

Significant differences were observed in the cholesterol level of meat from Philippine White Mallard and Pekin ducks (Table 5). The skin and lean of Philippine White Mallard had higher amount of cholesterol compared to Pekin. The higher concentration of cholesterol found in Philippine White Mallard may be associated with the usage and utilization of cholesterol in the animal body. Philippine White Mallard, being an egg-type breed, may have a greater need for cholesterol as a preparation for the onset of egg production at around 18-22 weeks or 4-5 months of age. The ducks used in this study were harvested at 12 weeks of age which is a few weeks away from the onset of the laying period. Pekin ducks usually mature and start laying eggs between 6 to 7 months hence, the harvest age used in the current study is earlier than the ideal age for preparation for sexual maturity. This probably explains the lower cholesterol content of Pekin. For Philippine White Mallard, cholesterol is necessary for the production of hormones during sexual maturity as well as in egg production in which most of the cholesterol are directly found in the egg yolk. Unlike with Pekin, a meat-type duck, cholesterol is utilized in other body processes.

The levels of cholesterol obtained from this research are below the limits and are considered safe based on the Dietary Guidelines for American which recommends that less than 300 mg/day may be consumed (USDA/HHS, 2010). Thus, cholesterol from duck meat is safe for human consumption, that is, it can benefit important structural component of membranes, act as precursors for synthesis of steroid hormones, vitamin D, and bile acids.

The breed and type of diet were factors and provided some pronounced effects on amino acid and fatty acid compositions, and cholesterol content between the two breeds of

Table 5. Cholesterol content (mg/100 g) of meat from Philippine White Mallard and Pekin Ducks.

	Breed		*P*-value
	Philippine White Mallard	**Pekin**	
Skin	34.02±34.65	23.65±3.89	0.05
Lean	91.39±6.58	76.35±20.93	0.01

Significantly different at $P<0.05$, $P<0.01$

duck. Although Philippine White Mallard is not for meat production, it has a potential for meat processing because of its unsaturated fatty acids and can compete with other meat-type ducks due to its comparable nutritional value.

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