A COMPARISON OF MEAT CHARACTERISTICS BETWEEN DUCK AND CHICKEN BREAST

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Introduction

Duck is a waterfowl unlike chicken and has a different physiology compared with other poultry. More recently, duck cuts such as breast and leg have become more available, which offer more options for diet conscious consumers. Normally the slaughter procedure for duck is the same as for chicken in spite of duck having more red muscle fibres compared to chicken (Smith *et al.*, 1993) and is considered a red meat. Therefore, there is a need for different slaughter, processing and preservation methods for better quality duck meat. The objective of this study was to investigate the pH decline pattern postmortem, composition of muscle fibre type, meat characteristics and fatty acid composition of duck and chicken breast.

Materials and Methods

Twenty-four broilers (Ross) and 24 ducklings (Cherry berry) of 45 days were stunned and killed by conventional neck cut. Breast meat (Pectoralis major) was removed from each carcass at the following times post-mortem: 15 min (3 birds from each species), 30 min (3 birds from each species), and 1 h (complete processing of the rest of the birds). The breast meat was then placed in a plastic bag and kept in a cold storage room at 4°C. The pH was measured by a pH-meter (MP230, Mettler, Switzerland). The surface colour (CIE L* and a*) of meat samples was measured using a Minolta Chromameter (Minolta CR 301, Tokyo, Japan). Shear force was measured by using the Instron Universal Testing Machine (Model 3343) from each cooked breast meat sample. For fatty acid analysis, lipids were extracted with chloroform and methanol and fatty acid methyl esters were analysed on a gas chromatography (Agilent, 6890, USA). For muscle fibre type, the serial frozen sections (8 µm thick) were stained by histochemical reactions for observing the distribution of myofibre types. Myosin adenosine triphosphatase (ATPase) activities (Padykula and Herman, 1955) were detected after acid (pH 4.3) and alkaline (pH 10.5) pre-incubation (Brooke and Kaiser, 1969), as was reduced nicotinamide adenine dinucleotide dehydrogenase (NADH-DH) activity (Okamoto *et al.*, 1976). On the 2 series of photographs (×250) of each tissue taken at the same location on the different specimens, the myofibres divided into types I, IIA and IIB according to the nomenclature of Brooke and Kaiser (1969).

Results and Discussion

Significant differences were found in muscle pH at 1 and 3h postmortem between two species. The pH of chicken meat was significantly lower than duck meat at 1 and 3 h postmortem, but the ultimate pH at 24h was not different. Protein content was significantly higher in chicken breast whereas fat content was higher in duck breast. Muscle fibres of duck breast contained 23.4% type I, 48.5 % type IIA and 28.1 type IIB, whereas chicken breast contained 100% type IIB muscle fibre only. Smith *et al.* (1993) also found 16% and 100 % white fibres in *Pectoralis* muscle of duck and chicken, respectively. These results suggested that the rapid pH decline and lower fat content of chicken breast would be due to its higher content of white muscle fibre compared to duck breast. Because of the red muscle fibres in duck breast, as expected, significant higher redness (a*) and lower lightness (L*) values were observed in duck breast. During cold storage for 7 days, the a* value of duck remained the same but the L* value was increased. Also duck breast showed significantly higher TBARS values and cooking loss (%) compared to chicken breast during storage period. Shear force decreased when storage period was increased in both chicken and duck breast meat, and it decreased rapidly in duck breast compared to chicken breast. Alvarado and Sams (2000) also found higher cooking loss and shear force value in duck breast compare to chicken breast at different postmortem time. The fatty acids (%) C14:0, C16:0, C16:1, C18:2 and C18:3 were significantly higher while C18:0 was significantly lower in duck breast compared to chicken. Significant changes in fatty acids composition were found in both chicken and duck breast meat at 1 and 7 days of cold storage, and the change was severe in duck breast compared to chicken breast. Results suggested that the higher TBARS values in duck breast might be due to higher content of unsaturated fatty acids and severe changes in fatty acid composition during cold storage. Data also suggested that duck should be slaughtered and processed in a different way from chicken for a desirable meat quality.

Conclusions

Duck had higher red muscle fibres compared to chicken, resulting in different pH decline pattern at postmortem, proximate composition and meat characteristics. Higher TBARS values and cooking loss % were observed in duck breast compared to chicken breast during 7 days of cold storage. Data suggested that duck would be slaughtered and processed with different way from chicken for a desirable meat quality.

Table 1: The pH, proximate composition (%) and muscle fibre type (%) in chicken and duck breast meat.

Meats	pH at postmortem times					Proximate composition				Muscle fibre type		
	15 m	30 m	1 h	3 h	24 h	Moisture	Protein	Fat	Ash	I	IIA	IIB
Chicken	6.62^{A}	6.42^{B}	6.19^{CX}	6.06^{DX}	5.87^{E}	75.47	22.04^{X}	1.05^{Y}	1.07^{X}	0	0	100
Duck	6.55^{A}	6.42^{B}	6.32^{CY}	6.17^{DY}	5.94^{E}	76.41	20.06^{Y}	1.84^{X}	0.92^{Y}	23.4	48.5	28.1

$^{A-E}$Means with different superscripts within a raw in pH at different postmortem time differ significantly ($p<0.05$); $^{X-Y}$Means with different superscripts within same column differ significantly ($p<0.05$).

Table 2: The meat quality characteristics of chicken and duck breast meat during cold storage at 4°C.

Day	L*		a*		[1]TBARS		Cooking loss (%)		[2]Shear force	
	Chicken	Duck	Chicken	Duck	Chicken	Duck	Chicken	Duck	Chicken	Duck
1	57.1^{AX}	39.7^{BY}	1.7^{ABY}	18.2^{X}	0.14^{CY}	0.24^{CX}	29.2^{AY}	34.5^{X}	3.5^{A}	3.8^{A}
3	54.1^{BX}	41.8^{ABY}	2.5^{AY}	19.1^{X}	0.21^{BY}	0.32^{BX}	27.2^{ABY}	35.5^{X}	3.3^{A}	3.4^{B}
5	53.5^{BX}	41.7^{ABY}	2.0^{ABY}	18.8^{X}	0.22^{BY}	0.35^{BX}	24.8^{BCY}	35.6^{X}	3.4^{A}	3.4^{B}
7	57.0^{AX}	43.2^{AY}	1.3^{BY}	19.0^{X}	0.29^{AY}	0.40^{AX}	22.2^{CY}	35.6^{X}	2.7^{B}	3.1^{C}

$^{A-C}$Means with different superscripts within same column differ significantly ($p<0.05$); $^{X-Y}$Means with different superscripts within a row in the same parameters differ significantly ($p<0.05$); [1]mg malonaldehyde/ kg sample; [2]kg/cm^2.

Table 3: Fatty acid composition of chicken and duck breast meat.

Fatty acid	Chicken breast		Duck breast	
	1 day	7 days	1 day	7 days
C14:0	0.36^{BY}	0.78^{A}	0.91^{AX}	0.38^{B}
C16:0	17.22^{BY}	22.53^{A}	21.83^{X}	22.01
C 16:1	2.17^{Y}	3.27	4.16^{AX}	2.14^{B}
C 18:0	18.17^{AX}	10.54^{B}	10.46^{AY}	14.48^{B}
C 18:1	34.32	36.67	35.66	31.48
C 18:2	14.15^{BY}	16.74^{A}	19.34^{AX}	15.14^{B}
C 18:3	0.53^{Y}	0.60	0.84^{AX}	0.52^{B}
C 20:4	11.23	7.06	5.49^{B}	12.12^{A}
C22:5	0.89	0.94	0.68	0.83
C22:6	0.96	0.88	0.61	0.91
SFA	35.75	33.85	33.21^{B}	36.86^{A}
USFA	64.25	66.15	66.79^{A}	63.14^{B}
MUSFA	36.49	39.93	39.82^{A}	33.62^{B}
PUSFA	27.75	26.22	26.97	29.51
MUSFA/SFA	1.03	1.18	1.20^{A}	0.91^{B}
PUSFA/SFA	0.77	0.77	0.81	0.80

$^{A-B}$Means with different superscripts in a row within chicken breast or duck breast differ significantly ($p<0.05$); $^{X-Y}$Means with different superscripts in a row within 1 day chicken and duck breast differ significantly ($p<0.05$).

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