THE CHARACTERISTIC OF THE BREAST AND LEG MUSCLES` COLOUR FROM MUSCOVY DUCKS

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Background

The Polish commercial ducks are mainly Muscovy ones. They have been sold either as whole carcasses or as breast and leg portions in fresh and in frozen state. Among the many quality factors of meat, the colour plays very important role from the commercial point of view. The colour has been often the cause for either acceptation or rejection of meat by consumers. The colour of meat depends on concentration and chemical state of pigments, and physical structure of meat (Millar et al. 1996, Renerre 1999). Three myoglobin forms: deoxymyoglobin (Mb), oxymyoglobin (MbO_2) and metmyoglobin (MMb) are assumed to be the main pigments that are responsible for the colour of well bled muscles. Wołoszyn (2002) in her monograph reported that the muscles from Mulard ducks (male Muscovy x female Pekin) especially breast are characterized by large differentiation of colour. It is not advantageous phenomen from the commercial point of view, because the high quality food products have to have the invariable sensory profiles. But, the cause of this differentiation of colour has not been fully explained yet. It was the reason for undertaking the investigation of this subject.

Objectives

The objective of the research was to characterize the colour of leg and breast muscles from Muscovy ducks. It was realized by: sensory assessment of colour intensity (CJ) – expressed in conventional units [CU], determination of total heam pigments concentration (TP) – expressed at mg/g tissue, relative concentration of Mb, MbO_2 and MMb – expressed in percentage of total heam pigments, and lightness (L), redness (a) and yellowness (b).

Methods

The experimental materials covered the 37 breast and 37 leg portions (20 male, 17 female) cut out from industrially killed 11 week-old male and 9 week-old female Muscovy ducks, 24 h after slaughter. The heam pigments were extracted using the procedure described by Pikul (1993). The Hewlett Packard's Diode Array UV/VIS spectrophotometer was used for measuring the pigment extract absorbance (wavelength range 350 – 820 nm). The concentration of TP and relative concentration of: Mb, MbO_2 and MMb were calculated with the equations given by Krzywicki (1982). The parameters: L, a and b were measured with CHROMAMETER Minolta CR 200b. The sensory assessment of the colour was conducted by the sensory panel (7 persons) according to ANALSENS NT programme, using the ten point scale of intensity. The pH was measured with digital pH-meter Meratronic-517. The T-Student's test was used for establishing differences between average values.

Results and discussion

The absorbance spectra for all the extracts from breast and leg of investigated muscles were like the spectra of reflected light from the surface layer of fresh beef (Krzywicki 1979) and of fresh goose muscles (Skrabka-Błotnicka et. al 2001). The absorbance spectra for all the investigated muscles were recognized as typical for fresh meat (fig. 1). Three maxima of absorption are shown at: 418, 520, 580 nm.
The colour of the male breast and leg muscles was defined as pink-red with intensity on the same level 6,2 [CU] – breast and 5,9 [CU] – leg, whereas the female breast and leg muscles were characterized by a heterogeneous colour and it was different within the same kind of muscles. And so, the female breast muscles were recognized as: two–coloured (pink, pink–red; 12 samples), three–coloured (pink, pink–red, red; 5 samples), whereas the leg muscles were defined as three–coloured (pink, pink–red, red; 10 samples), two–coloured (pink, pink–red; 2 samples) and one–coloured (pink–red; 5 samples). The observed occurrences is very unfavourable from the commercial point of view. The significant differences in pink-red and red colour intensity between the breast and leg muscles were noted. From this observation results, that the colour differentiation of ducks` muscles within the same kind of muscles and the same sex, occurs in case of female Muscovy ducks as well. Consequently, it is not a characteristic attribute for Mulard ducks.
The female breast muscles comprised more Mb and less MMb that leg ones, whereas TP content and MbO_2 were on the same level in both kinds of the investigated muscles. The above statements and lower values of pH are reflected in the higher values of L parameter in case of breast muscles. The male breast muscles covered the higher values of: TP concentration, relative concentration of Mb and MbO_2, and a, b parameters, but the lower values of: MMb and L parameter. The statistically significant differences were in the L, a and b parameters for both kinds of the male muscles, however these differences were not so large in order to influence the sensory assessment of colour intensity. The homogeneous colour and not large variation in colour intensity between the individual male ducks` muscles permit to class them as a high quality products.
Comparing the breast and leg muscles from the male and female ducks we stated that in case of breast muscles the sex influenced the investigated magnitudes except Mb, whereas in case of leg muscles the sex influenced: the TP and all the colour parameters. There is no correlation between the colour parameters and TP. It is clear, because the contributions of Mb, MbO_2 and MMb were different depending on the sex and kind of muscles. There are relationships between either L or a parameter and ratios of MbO_2 to Mb and MMb to Mb that are described by the second degree polynomials by TP constant (Wołoszyn 2002).

Conclusion

The female Muscovy ducks' muscles were characterized by heterogeneous colour that was differentiated within the same kind of muscles. It is the reason for these muscles can not be recognized as high quality products, without selection. On the other hand the male Muscovy ducks' muscles that were characterized by homogeneous colour defined as pink – red can be classed as high quality products for this reason.

Pertinent literature

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Acknowledgements

Tab. 1. The evaluation of the colour and heam pigments content in Muscovy ducks' muscles.

	FEMALE				MALE			
	Breast		Leg		Breast		Leg	
	x	v	x	v	x	v	x	v
TP [mg/g]	1,56^{aA}	0,423	1,43^{aA}	0,650	2,89^{aB}	0,219	2,24^{bB}	0,200
Mb [%]	37^{aA}	0,045	31^{bA}	0,060	36^{aA}	0,050	32^{bA}	0,037
MMb [%]	16^{aA}	0,447	25^{bA}	0,041	4,0^{aB}	0,85	23^{bA}	0,180
MbO_2 [%]	47^{aA}	0,123	44^{aA}	0,045	60^{aB}	0,082	45^{bA}	0,130
Lightness (L)	42,27^{aA}	0,032	41,27^{bA}	0,027	39,91^{aB}	0,058	42,86^{bB}	0,033
Redness (a)	20,99^{aA}	0,051	18,62^{bA}	0,017	19,48^{aB}	0,054	16,64^{bB}	0,046
Yellowness (b)	4,83^{aA}	0,28	4,16^{aA}	0,20	3,72^{aB}	0,19	2,65^{bB}	0,350
CJ [CU]	-	-	-	-	-	-	-	-
Pink colour	6,68	0,214	6,44	0,138	---	---	----	---
Pink-red colour	5,78	0,267	6,71	0,112	6,21	0,105	5,9	0,130
Red colour	6,37	0,172	7,53	0,183	---	---	---	--
pH	5,70	0,005	6,0	0,00	5,72	0,002	6,02	0,002

x – average value; v – coefficient of variation
a,b – values with different letters differ within a sex at P< 0,05
A,B - values with different letters differ within kind of muscles at P< 0,05

Fig.1. The absorbance spectrum for the extract from duck leg.