AN INITIAL EVALUATION OF THE TAIL MEAT OF FARMED, FRESHWATER, JOHNSTON RIVER (CROCODYLUS JOHNSTONII) AND SALT-WATER (CROCODYLUS POROSUS) CROCODILES

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SUMMARY

Tail meat from farmed, juvenile, salt-water (SW) and sub-adult, freshwater (FW) crocodiles produced after "hot" - butchering and varied, but rapid, cooling, was found to be of an acceptable bacteriological and organoleptic standard. However, the limited data indicate that "hot" butchering and very rapid cooling may induce muscle shortening and suggest that these procedures should be investigated in larger numbers of animals slaughtered commercially.

INTRODUCTION

The sale of crocodile meat is a necessary adjunct to the sale of skins from crocodile farms, particularly in the case of freshwater (FW) crocodiles whose skins are less valuable. In this paper preliminary evaluations of the tail meat of two crocodile of each species are described.

Animals, capture, transport and slaughter

Tail meat was obtained from two, sub-adult, male, freshwater crocodiles (bodylengths 1.22 and 1.47 m) 4.4 and 5.4 years old and two, juvenile, one male and one female, salt-water (SW) crocodiles (bodylengths 1.55 and 1.65 m), 3.2 and 5 years old. On the crocodile farm they were subdued (jaws bound and placed in an hessian sack) after periods of intense struggle lasting less than 5 minutes, transported to the slaughter facility (20 minutes), and kept in shade until slaughter. Ambient temperature was 31°C and deep cloacal temperature 31.0 ± 0.21°C (S.D.). Animals were shot through the frontal part of the brain and their spinal cord severed; they were not exsanguinated. Immediately after slaughter the carcasses were transferred to an air-conditioned room, 24.9°C and skinned. About 30 min later each carcass was skinned, cut into portions (trunk, legs and tail) and, sequentially, put into a chest freezer to freeze. Rates of cooling, thus, differed with order of slaughter. Times for muscles to cool to 10°C were determined from logarithmic plots of recorded muscle temperatures.

Meat evaluation

The four tails, wrapped in polyethylene bags, were thawed for 49 hr at 5-6°C, and sampled for bacteriological evaluation. Four, 5 cm^2, core samples were taken, symmetrically, around the base of each tail and blended in 180 ml of 0.1% peptone water (PW). Samples were plated on Tryptone Yeast Extract Soya Glucose Agar (TYSG) with, or without, NaCl; 0.25 ml of a 30% solution of NaCl was spread over the agar surface before plating. Plates were incubated aerobically at 25°C for 4 days before Total Counts (TC) were made. The tails were weighed, the flesh (muscle and fat) separated from the bones and the bones weighed. The *Mm. ischiocaudalis* (IS) and *iliocaudalis* (IL) were dissected and weighed. The ultimate pH of both muscles was measured at 20°C and samples taken for sarcomere length measurement using a laser-diffraction method. Each muscle of each pair of IS muscles was weighed, one muscle was cooked at 60°C and the other at 80°C, tightly wrapped in polyethylene bags, in water baths, for an hour. The

TABLE 1: Total aerobic plate counts on TYSG, with or without 0.5% NaCl, (3 days at 25°C) of core samples taken from the base (proximal) of the tail

Tag No.	Species	Count (cm^{-2}) TYSG	Count (cm^{-2}) TYSG+0.5% NaCl
1	FW	4.59×10^4	3.5×10^4
3	FW	2.65×10^4	2.42×10^4
2	SW	3.8×10^4	1.92×10^5
4	SW	7.2×10^3	3.5×10^4

TABLE 2: Some objective measurements of tenderness of the cooked, 60°C or 80°C for 1 hr, striated muscle of the tail (IS)

Tag No.	Species	WBIY shear values(kg)		WB PF values(kg)		Compression values		Percent cooking loss	
		60°C	80°C	60°C	80°C	60°C	80°C	60°C	80°C
1	FW	2.1	3.3	2.5	3.6	1.0	1.3	23.5	38.1
3	FW	2.9	4.5	3.7	4.9	1.2	1.7	22.5	36.8
2	SW	2.7	4.5	3.2	4.8	1.4	1.8	21.5	37.9
4	SW	2.8	5.0	3.0	5.1	1.6	1.8	21.5	38.4

TABLE 3: Some characteristics of the segmented muscle of the tail (IL)

Tag No.	Species	Ultimate pH	Sarcomere length(m)	Juiciness	Flavour	Texture	Overall accept.
1	FW	5.62	2.23	4.74	3.87	3.00	2.63
3	FW	5.81	2.00	4.74	3.54	3.16	3.06
Specific Mean				4.74[a]	3.71[a]	3.08[a]	2.85[a]
2	SW	5.54	3.24	5.78	3.66	4.22	3.96
4	SW	5.70	2.09	5.14	3.81	3.83	3.63
Specific Mean				5.46[a]	3.74[a]	4.04[b]	3.80[b]
Overall Mean				5.01	3.72	3.55	3.32

[a] Specific means with different superscripts differ significantly, $P<0.05$. (v.juicy, v.good, v.tender, v.good = 0 to v.dry, v.poor, etc. = 10)

samples were dried, reweighed after cooking to determine cooking losses, and used for objective measurements, after they had cooled overnight at 1°C. Strips, 1 cm^2 in cross-section, were cut for Warner-Bratzler shear measurements and slabs, 1 cm thick, for Instron Compression (IC) measurements.

The IL muscle was used for subjective assessments. Steakettes, 2 cm thick, were baked in a forced-draught oven, at 230°C for 20 min. Duplicate samples, hot, were presented to a 10-member taste panel. They scored their opinions of the juiciness, flavour, texture and overall (organoleptic) acceptability. The divided scales were identified at the extremes (eg. very juicy and very dry).

RESULTS AND DISCUSSION

The mean proportions of bone in the tails of the two species were 19.1 (FW) and 13.6% (SW). The total plate counts are shown in Table 1.

Total plate counts were acceptably low. Recovery of bacteria from tails of SW crocodiles was increased when NaCl was added but this addition did not significantly affect recovery from FW tails. Oblinger et al. (1981) sampled *Alligator mississipiensis* meat and skins, on Plate Count Agar, at 20 or 35°C and found lower counts than those on the IC muscle.

The ultimate pH values of the striated IS muscles were 5.55 and 5.62 (FW) and 5.47 and 5.49 (SW) and the, corresponding, sarcomere lengths 2.01 and 2.29 (FW) and 1.79 and 2.51 μm (SW). Other objective measurements are given in Table 2.

The two IS muscles (regardless of species) of the two carcasses which cooled faster had shorter sarcomere lengths and there appeared to be an inverse relationship between the sarcomere length of the IS and IL muscles. This may have resulted from cold-induced shortening in the IS muscles distorting the tail and stretching the IC muscles and indicates that in a commercial situation the time of butchering of the flayed carcass and the cooling rate could have a significant effect on eating quality. The ultimate pH values of the striated, IS, tail muscles were less than those of the segmented, IL, muscles (Tables 2 and 3). Cooking losses at either of the cooking temperatures were similar to those of beef and sheep muscles. The Warner-Bratzler initial yield (IY) and peak force (PF) values and IC measurements indicated that the IS muscles were "tender" to "acceptably tender".

The taste panel (Table 3) found no specific difference in the juiciness, or flavour, of IL muscles but considered that this muscle of FW animals was more tender and more acceptable than that of the SW crocodiles. Overall, the panel found this meat to be tender, relatively bland, and of average juiciness. These data indicate that crocodile meat of an acceptable bacteriological and organoleptic status can be produced from farmed FW (sub-adult) and SW (juvenile) crocodiles. They also indicate that time of butchering (relative to time of slaughter) and cooling rates of carcasses or butchered cuts may influence tenderness.

REFERENCES

Oblinger, J.L., Kennedy, J.E., Mcdonald, E.D. and West, R.L. (1981). *Journal of Food Protection* **44**:98-99.