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AN EVALUATION OF THE CARCASS QUALITY OF MALE TENREC (Tenrec ecaudatus), A NON-CONVENTIONAL SOURCE OF MEAT PROTEIN IN MAURITIUS

by

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ABSTRACT

The tenrec (*Tenrec ecaudatus*; Order : *Insectivora*; Class : *Tenrecinae*) is consumed by a small section of the population, and constitutes a non-conventional source of animal protein. Male tenrecs were hunted in early October and in late November, and a comparison in carcass composition was made between the two periods.

The carcasses of males hunted early in the hunting season showed a higher fat content (P<0.05), compared to males hunted in late November. Adipose fat was dissected in similar depots (subcutaneous, suprarenal and mesenteric fat) at both periods, but the total weight of adipose fat was significantly higher in males hunted in early October, compared to late November (36.16g vs 7.89g; P<0.01). There were no fat depots around the heart at both periods. The total weight of edible meat yield was significantly greater in male tenrecs hunted in early October (P<0.05).

Keywords : Tenrec (*Tenrec ecaudatus*), male, carcass quality, non-conventional meat protein.

INTRODUCTION

World supplies of animal dietary protein are limited and costly. In developing countries, the consumption of non-conventional meat sources constitutes an appreciable source of protein intake (Blaxter, 1975; Cockrill, 1975). In contrast, in developed countries, meat from non-conventional birds and mammals is more a luxury item of diet (Blaxter, 1975). In Mauritius, there have been attempts made to farm non-conventional animals such as crocodiles and deer (Tatayah, 1996). The farming / domestication of non-conventional animal species leads to an increase in the consumption of such meat and a reduction in the associated taboos. There have been no attempts made so far locally to farm the tenrec (*Tenrec ecaudatus*), whereas in the neighbouring Réunion Island this practice is well established, with the development of mini-livestock enterprises (Hardouin, 1986).

The tenrec is a member of the order *Insectivora* (Eisenberg & Gould, 1970; Hutterer, 1984). It is the largest *Tenrecinae*, weighing up to 1300g (Young, 1981; Racey & Nicoll, 1984), with a short lifespan of typically less than 3 years (Tatayah, 1996). The tenrec meat is consumed locally by a small section of the population (Tatayah, 1996). There is a popular belief that the carcass quality of the tenrec changes over time during the hunting season, from late October to mid-June. The virtues of the tenrec meat are based essentially on local perception, which have not been substantiated by any systematic studies. During the hunting season, the tenrec may constitute the primary meat source for some families (Tatayah, 1996).

There are a number of factors which will favour the consumption of tenrec meat in the future. These factors include market availability, data on carcass quality, weakening of associated taboos (Pyke, 1978), development of tourism and the associated development of *Créole* cuisine locally.

The present study reports data on the carcass quality of male tenrec, hunted early and late in the hunting season. The original data obtained from the tenrec are compared with other farmed conventional livestock.

MATERIALS AND METHODS

Animals

Six male tenrecs were collected over a 11-day period in early October for the first sampling period, and a further six males collected over a 17-day period in late December, for the second sampling period. The animals were hunted over a restricted ecological niche (sugarcane fields and vegetable gardens), to reduce variability. The animals were hunted at night from 20.30-22.30 hours, with the help of experienced hunters and trained dogs. The animals were then kept in cages where they were starved (10-12h) prior to processing procedures. The animals were slaughtered by stunning. The dead animals were then brought to the laboratory within 30 min, weighed and stored in the chiller (4ºC), prior to processing.

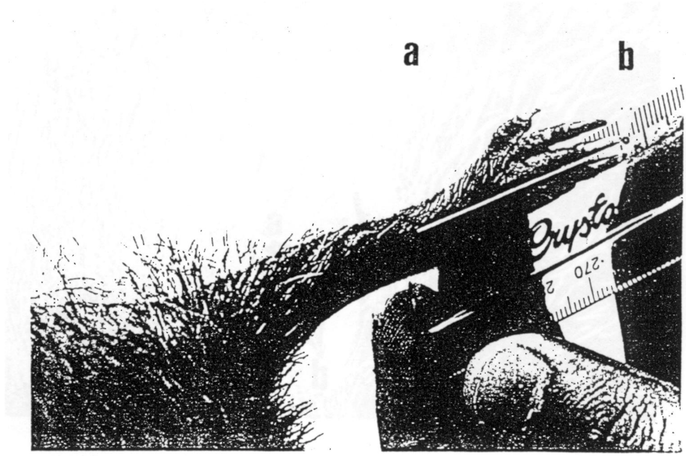

Fig. 1. Footpad length (a→b) of tenrec (*Tenrec ecaudatus*)

Fig. 2. Ear diameter (a→b) of tenrec (*Tenrec ecaudatus*)

Processing

Skin. The fur was closely clipped. Dissectible subcutaneous fat was removed, and skin thickness was measured with a micrometer.

Visible fat. The visible (dissectible) fat constituted the adipose fat depots, and was composed of the subcutaneous fat (under the dorsal and ventral surfaces of the skin), mesenteric fat and suprarenal fat.

Internal organs. The weight of lungs, liver, heart, alimentary tract, spleen, testes and kidneys were recorded (Mettler AE 200; ±0.001g).

Cut portions. The carcass was dissected and the weight of the following cuts was recorded : hind (pelvic limbs) and fore limbs (pectoral limbs); jowl (portion occupied by the cervical vertebrae), the flanks (right and left sides of the dressed carcass, including the ribs, sternum and intercostal muscles), and skull meat (found over the cranial and facial bones of the skull).

Total edible portions

The total edible portions were determined, and include the following (based on popular local beliefs and reported by Tatayah, 1996) : skull meat, flanks and jowl, hind and fore limbs, singed skin, subcutaneous fat, liver and heart.

Chemical analysis of edible portions

Sample preparation. All the edible portions were ground in a mixer (Kenwood A 900), and stored in the freezer, prior to chemical analysis.

Moisture determination. 5g samples were oven-dried (60-70ºC; Memmert Fan Convection Oven; AOAC, 1975), until constant loss in weight.

Crude protein (CP). CP (%Nx6.25) was determined by semi-micro Kjeldahl procedures.

Crude fat (CF). CF was determined by the Soxhlet extraction procedures (AOAC, 1975).

Heat of combustion. Heat of combustion was determined using an adiabatic bomb calorimeter (Parr Instrument). The oven-dried samples were made into pellets (1±0.05g dry matter), on a briquette press (12.5mm diameter), prior to ignition at an O_2 pressure of 25atm.

Organic matter (OM). OM was determined after heating at 500ºC, for 18h in a muffle furnace (Thermolyne, Dubuque iv; AOAC, 1975).

Iron. Iron content was determined in the ashed sample by atomic absorption spectrophotometric methods (Unicam 929 AAS).

Statistical Analysis

Statistical t-tests were performed to investigate the differences between male tenrecs hunted during early October, and late December.

RESULTS

Morphometric measurements

Table 1 shows the morphometric measurements of male tenrecs hunted in early October and in late December. There were no significant differences in the carcass weight of the animals, although the male tenrecs showed a heavier weight in October, compared to December. There were no significant differences in the skin thickness and CRL between the animals sampled in October and in December.

The males hunted in October showed a significantly larger heart girth ($P<0.01$), and diameter of internal ear ($P<0.05$), and larger upper canine teeth ($P<0.05$), compared to animals hunted in December.

Table 1. Morphometric measurements of male tenrec (*Tenrec ecaudatus)* hunted early October and late December

	Early October	**Late December**	**SED**	
Carcass weight (g)	838	651	105.0	ns
Crown-rump length (mm)	280	281	11.4	ns
Heart girth (mm)	271	234	14.7	**
Internal ear diameter (mm)	16.3	14.0	1.15	*
Foot pad length (mm) :				
Fore digits	38.8	37.8	2.26	ns
Hind digits	48.0	46.3	1.32	ns
Skin thickness (mm)	3.8	2.6	2.36	ns
Canine teeth (mm)[y]:				
Upper canine length	9.7	9.8	0.60	ns
Lower canine length	4.8	5.0	0.41	ns
Upper canine width	9.3	8.0	0.36	*
Lower canine teeth	4.1	3.8	0.49	ns

** : P<0.01; * : P<0.05; ns : non significant
[y]Right jaw

Internal organs

When expressed as a % of carcass weight, there were no significant differences in the weight of the heart, lungs, liver, testes and spleen between the two groups of animals. However, the weight of kidneys and alimentary tract (expressed as a % of carcass weight), was significantly higher (P<0.05) in males hunted in December (Table 2).

Table 2. Weight of internal organs from male tenrec (*Tenrec ecaudatus*) hunted early October and late December

	Early October	**Late December**	**SED**	
Heart (g)	3.38	2.38	0.63	*
(% carcass weight)	0.39	0.36	0.05	ns
Lungs (g)	6.35	5.38	1.17	ns
(% carcass weight)	0.75	0.87	0.15	ns
Alimentary tract (g)[y]	65.9	95.0	9.55	*
(% carcass weight)	7.98	15.03	1.42	*
Liver (g)	20.5	16.4	2.76	ns
(% carcass weight)	2.45	2.53	0.20	ns
Kidneys(g)	3.53	4.05	0.43	ns
(% carcass weight)	0.40	0.63	0.07	*
Spleen (g)	2.23	1.50	0.73	ns
(% carcass weight)	0.48	0.23	0.32	ns
Testes (g)	5.21	4.53	0.83	ns
(% carcass weight)	0.65	0.71	0.02	ns

** : P<0.01; * : P<0.05; ns : non significant [y] Animals were starved for 10-12h

Adipose fat depots

Table 3 shows the differences in adipose fat depots between male tenrecs hunted early October and late December. During both periods, adipose fat was located in similar depots, *ie* as subcutaneous, suprarenal and mesenteric fat. There were no fat depots around the heart. The total weight of adipose fat (expressed in g, and as % carcass weight), was significantly higher (P<0.01) early in the hunting season, *ie* in October.

Table 3. Adipose fat depots in male tenrec (*Tenrec ecaudatus*) hunted early October and late December

	Early October	**Late December**	**SED**	
Total weight of adipose fat (g)	36.16	7.89	11.01	**
(% carcass weight)	4.17	1.10	1.01	**
Subcutaneous fat (g)	24.21	4.65	8.42	*
(% carcass weight)	2.76	0.68	0.72	**
Suprarenal fat (g)	8.01	1.98	3.13	*
(% carcass weight)	0.93	0.26	0.33	*
Mesenteric fat (g)	3.93	1.25	0.98	*
(% carcass weight)	0.47	0.16	0.12	*

** : P<0.01; * : P<0.05

Total edible meat yields

The total weight of edible meat yield was significantly greater in male tenrecs hunted early October, when expressed on g basis (P<0.05), and as a % carcass weight basis (P<0.05). During both periods, it was observed that the skin and the skull meat contributed largely to the edible meat yield (Table 4).

Table 4. Total edible meat yields from male tenrec (*Tenrec ecaudatus*) hunted early October and late December

	Early October	Late December	SED	
Total edible yield (g)	563.6	404.2	85.7	*
(% carcass weight)	67.3	61.4	2.0	*
Skin (g)	171.6	98.5	30.5	*
(% carcass weight)	20.3	14.7	1.6	*
Skull meat (g)	75.6	50.6	15.2	*
(% carcass weight)	8.9	8.1	1.0	ns
Jowl (g)	17.3	13.8	3.0	ns
(% carcass weight)	2.1	2.1	0.21	ns
Fore limbs (g)	45.2	38.8	5.8	ns
(% carcass weight)	5.4	6.0	0.35	ns
Hind limbs (g)	51.8	40.5	5.5	*
(% carcass weight)	6.4	6.3	0.78	ns
Flanks (g)	156.5	134.9	18.5	ns
(% carcass weight)	18.8	20.8	0.93	*
Heart (g)	3.4	2.4	0.63	*
(% carcass weight)	0.39	0.36	0.05	ns
Liver (g)	20.5	16.4	0.43	ns
(% carcass weight)	2.5	2.5	0.07	*
Subcutaneous fat (g)	24.2	4.7	8.42	*
(% carcass weight)	2.8	0.68	0.72	**

** : P<0.01; * : P<0.05; ns : non significant

Chemical composition

Table 5 shows the chemical composition of tenrec meat. The fat and energy content of meat (from edible yields) were higher in the tenrecs slaughtered early in the hunting season, *ie* in October ($P<0.05$).

Table 5. Chemical composition of meat[1] from male tenrec (*Tenrec ecaudatus*) hunted early October and late December

	Fresh weight (FW) (g/kg)				**Dry weight (DW)** (g/kg)			
	Oct	Dec	SED		Oct	Dec	SED	
Moisture	669.4	718.4	24.6	ns				
Protein	86.7	125.7	9.4	ns	74.5	220.7	8.11	ns
Fat	74.9	27.3	23.9	*	222.1	102.1	58.0	*
Ash	27.1	46.2	1.6	ns	95.2	168.0	5.7	*
Iron	0.10	0.12	0.012	ns	0.30	0.42	0.044	ns
Energy (MJ/kg)	1.406	1.147	0.06	*				

* : $P<0.05$; ns : non significant

[1]Edible yield from skull, flanks, hind and fore limbs, jowl, subcutaneous fat and skin

- Not determined

DISCUSSION

The present study has indicated that the components contributing to the edible meat yields are different in the tenrec compared to other conventional livestock species. From local reports (Tatayah, 1996), there is strong consumer appeal for dissectible fat, singed skin and skull muscles, in addition to carcass meat. Taking these components into account, the clean carcass yield (*ie* edible yield) is high in the tenrec compared to other conventional species - beef cattle : 64%; sheep : 48.3%; goat :

45.6%; red deer : 57.8%; poultry : 75.1%; pig : 75.8%; rabbit : 54.6%; male tenrec : 64.3% (Devendra & Burns, 1970; Cole & Lawrie, 1975; Kay *et al.* 1981; Lister *et al.* 1983; Drew, 1985; Devendra & McLeroy, 1987; Drew & Seman, 1987). The yield of meat from tenrecs is higher than in sheep and goats (on a % basis) due to the contribution of meat from parts that would not be conventionally eaten in these ruminants, namely skin, subcutaneous fat and skull meat.

Fat is important in the development of flavour in meat. The flavour of meat stems from flavour volatiles that are produced during cooking, from the interactions of fat, protein and minor constituents of muscles (Patterson, 1975; Lawrie, 1976). The presence of fat in meat will contribute to make meat more attractive, or in certain cases unacceptable (like in mutton, venison, pork). The tenrec meat, as opposed to other conventional sources, is appraised on its fat content. In Mauritius, the hunting periods for male tenrecs are October and March-April (which coincide with exit and entry in hibernation). These periods are associated with high body fat reserves.

The most important variable in a meat-producing animal is the fat content (Drew *et al*. 1978). The results of the present study indicate that the male tenrecs emerge from hibernation (October) with rich adipose tissues. These stores are then mobilized for the recrudescence of the reproductive organs and sexual activity (Oberle, 1981; Racey & Nicoll,1984; Nicoll, 1985) during the breeding season (November). By December, the adipose stores are largely mobilized, and the males are leaner. The seasonal Red Deer (*Cervus elaphus*) also shows seasonal cycles of reproductive activity. The fat accumulated in late summer (20-25% carcass fat) is heavily mobilized during the 6-week breeding season. Fat is then replenished very rapidly in spring (Simpson *et al*. 1978; Drew, 1985). The results of the present study confirm the popular belief that the tenrec is fat and tastier at the beginning of the hunting season, *ie* in October. The flavour arising from the fat content is the main consumer’s criterion for quality assessment of tenrec meat.

The chemical composition of meat influences its nutritive value, and likewise its consumer appeal (Ensminger *et al.* 1994). Data on the chemical composition of non-conventional meat sources could help in the weakening of associated taboos. The present study has shown that the composition of tenrec meat is not different compared to other livestock species (Table 5). However, the only important variation is the fat content of the meat.

In view of the increased awareness of potential health risks associated with excessive consumption of saturated animal fat, a study of the fatty acid composition and profile of main saturated and unsaturated fatty acids is desirable. Given that Mauritius is a heavy user of agro-chemicals (especially organophosphate herbicides), and that the diet of tenrecs consist of soil inhabiting organisms, the faT depots could constitute stores of chemical residues. In the interest of public health, it would be advisable to monitor toxic pesticide residue levels in tenrec meat.

CONCLUSIONS

The clean carcass yield (*ie* edible components) of the *Tenrec ecaudatus* is higher than the conventional ruminant livestock species (beef, goat and sheep). There is little variation in the chemical composition of the tenrec meat, compared to other livestock species, except for a high fat content. The quality of tenrec meat is assessed on its fat content. The male tenrec is fat early during the hunting period (early October), and leaner later (late December).

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