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Quality of canned meats of East African wild ungulates

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One of the great problems in the feeding of the population of East Africa is lack of sufficient quantities of high quality protein in the diet. All too many children in Central and East Africa suffer from protein difficiency which, if they survive, means considerable retardaton of their psysical and mental development (4,10). The reason for this state of affairs is partly attributed to nutritionally adverse dietary habbits and partly to short supply of food with biological valuable protein. This problem seems to aggrevate with the increasing population in this part of the world.

A straight foreward solution to the problem would be increased production of animal protein. The solution is however met with difficulty as about a third of the area of East Africa has so low and scattered presipitation that it is unfit for agriculture. The vegetation is so sparse that overgrazing and destruction of the grassland very easily comes about as a result of extensive cattle management. The productivity of the cattle, essentially for beef production, is very low in the area as it takes more than 3 years to reach a live weight of 150—450 kg. Improvement of the poductivity of the local cattle through importation of European breeds has been unsuccessful as these do not adapt themselves well in the semi-arid environment (11). In large parts of the Savanna cattle production is downright impossible because of the tsetse fly which propagate the serious cattle disease Nagana.

The suggestion has been made to use the original fauna of the Savanna for food production. Research has shown that the wild ungulates utilize the vegetation more efficient than cattle and do not suffer from a number of the maladies and parasites which affect domestic stock. Their water requirements are much lowever than that of cattle so they are able to feed in considerable distances from water holes.

Studies have been made of the carcass composition of a number of wild ungulates (5, 7, 8, 12, 13, 19, 20). The yield of dressed carcass in % of live weight vary from 54 for the Topi antilope to 60 for the Eland antilope. In comparison the dressing percentage for the African Zebu cattle vary

between 40 and 60 in relation to age and comformation. For the antilopes no variation in conformation usually occur and the dressing percentage is relatively independant of age. For the Uganda kob the greatest difference in dressing percentage between immature and adult animals is only 1.4 (8). Of most importance is the low fat content of the dressed antilope carcasses which amounts to 0.5—4.0 % compared to about 29 % in Boran steers which is one of the best African zebu breeds. The lean content is about 82 % of the dressed carcass weight for the antilopes compared to 55 % for the steers, and a considerable quantity of the meat is located in the valuable hind guarter. The hind quarter thus amounts to 52—61 % of the dressed weight compared to about 53 % for the Boran steers.

The antilope meat may be distributed fresh to the local population or as dried meat (Biltng) which is successfully produced South Africa (9), but not very easily prepared in the East African climate (15). The distribution of meat from the wild ungulates on a greater scale is however hampered for veterinary reasons as the animals are potential reservoirs for a number of serious cattle diseases as f. ex.rinderpest and foot-and-mouth disease. These maladies may be spread with the distribution of the meat. The meat may however be distributed in cans cooked to sterility. Antilope meat and meat from other game animals may as canned meats serve the population of East Africa directly as a valuable protein source and indirectly as an export item for Europe and North America whereby foreign corrency may be obtained.

In the development of canning procedures it is of interest to know the water-holding capacity of the meat. In the following some observations are presented on the water-holding capacity of fresh meat from Wildebeest antilope in relation to ante-mortem treatment, and on the quality of meat of Wildebeest and other wild ungulates after canning.

EXPERIMENTAL

Water-holding capacity

Six 1—3 years old Wildebeest antilopes (Connochaetes taurinus) were shot with a rifle mounted with telescope sight on the plains around the Kirawira field station in Serengeti, Tanzania between 10.a.m. and 12.a.m. February 21. 1967. As the shots were fired on fairly long range some of the animals were not killed in the first shot and 5 to 15 minutes chase was necessary between 1. and 2. shot. The throat was cut according to Moslem tradition as fast as possible and the bled carcasses were brought to the experimental abattoir of the field station. Rigor had precipitated in the carcasses approx. 1 hour after killing and 1 hour later samples of musculus longissimus dorsi were cut for examination. The water-holding capacity was determined by the Grau and Hamm method (2). The pH of the meat was evaluated with

an indicator paper strip (Merck pH 5.4—7.0). For comparison the water-holding capacity of the same muscle of bull calves from the Danish progeny testing stations were evaluated 7 days after slaughter by the same procedure.

Examination of canned meats

Canned meat was prepared of Wildebeest, Thompson gazelle, Eland, Waterbuck, Warthog, Buffalo, Elephant and Zebra carcasses. The canning was performed by Dr. A. Glees of the Serengeti Research Project, who kindly provided the samples of cans for the examination. For canning the meat was cut in slices and packed in 1 lb. cans which were autoclaved to commercial sterility. The procedure was analogues to preparation of »pork in own juice». The cans were examined for viable bacteria by plate counting and for anaerob spore forming bacteria by the iron-sulphite-agar-method. The content of dry matter, fat, nitrogen, ash and NaCl content was determined according to official A.O.A.C. methods (1). From the N values the protein content was calculated by use of the factor 6.25.

Organoleptic evaluation of the meats

The samples were presented to a panel of 12 persons, males and females, with considerable routine in examination of meat and meat products. Scores were given for color and appearance, taste and texture by using a scale from +5 to −5 with 0 denoting a quality »neither good nor bad». Positive scores were given for increasing degrees of excellence, and negative scores were given for increasing degrees of shortcomings in the quality with −5 as complete inedible. The panel was also presented for two commercial brands of Danish »pork in own juice» for comparison.

RESULTS

In table 1 is shown the results from the observations on the fresh meat of Wildebeest. In all the samples the pH values were in the range of 5.8 to 6.2. The water-holding capacity was very variable from animal to animal. There is however a clear indication that the animals killed by the first shot gave the best water-holding capacities. When comparison is made to the water-holding capacities of the meat from the bull calves (table 2) we see that the Wildebeest samples come out favorably if processed the day of slaughter. If the meat is allowed to hang without adequate chilling it will rapidly become unfit for manufacture.

In table 3 is given the result of the chemical analysis of the meat. We note the high protein and low fat content of the samples. The results correspond well to the observations on the body composition of the animals. The

Table 1. *Water-holding capacity and appearance of Wildebeest musculus longissimus dorsi*

Animal No	*Ante-mortem treatment*	*Water-holding capacity* muscle area juice area*	*appearance of meat*
1	killed after 2. shot	0.387	pale, watery meat
2	— — 2. —	0.538	bright red
3	— — 2. —	0.384	pale watery meat
4	killed in 1. shot	1.357	dark red
5	— — 1. —	1.000	bright red
6	— — 1. shot	0.750	bright red

* higher numbers denote better water-holding capacity.

Table 2. *Water-holding capacity of m. longissimus dorsi of bull calves from Danish progeny testing stations*

Animal No	*Water-holding capacity muscle area juice area*
1	0.218
1	0.430
3	0.673
4	0.455
5	0.411
6	0.241

results also correspond closely to results from analysis of meat from Finnish reindeer meat (Niinivaara 1967, personal communication). The canned meat thus fulfil the requirements which can be made to a high protein food. The bacteriological examinations revealed nothing abnormal so it can be stated that the canning procedure was fully satisfactory from a hygienic point of view for these cans. No visible signs of larvae were found. This might be a problem as the muscles of antilopes sometimes are heavily infected with tapeform lawae(15). In table 4 is given the results of the organoleptic evaluation of the canned products. The panel considered the appearance of Zebra and Wildebeest meat as best and that of buffalo least appealing. With regard to taste the panel preferred buffalo and considered elephant least

Table 3. *Composition of canned meat of African wildliving ungulates*

	Water %	*Protein* %	*Fat* %	*Mineral matter* %	*NaCl* %
Thompson gazelle	73,4	21.0	1.9	3.7	1.13
Wildebeest	72.3	22.8	2.0	2.9	1.53
Eland	75.2	20.4	1.9	2.5	1.51
Waterbuck	71.7	22.0	1.9	4.4	1.42
Warthog	68.9	23.0	4.0	4.1	1.62
Buffalo	72.8	23.5	1.8	1.9	1.55
Elephant	74.2	20.7	2.8	2.3	1.59
Zebra	73.0	21.16	2.8	3.0	1.57

Table 4. *Taste panel evaluation of canned meats of African wilding ungulates.*

	Color & appearance	*Taste*	*Texture*	*Remarks*
Thompson gazelle...	1.167	—0.167	0.750	very loose texture little dry
Wildebeest	1.250	0.250	0.750	loose texture
Eland	1.000	—0.417	0.667	somewhat, dry, loose texture, juice little yellowish
Waterbuck	1.000	0.083	0.667	rather tough texture, juice yellowish
Warthog	1.083	0.250	0.500	
Buffalo	0.333	1.000	0.500	too dark color, mealy texture, juice yellowish
Elephant	0.583	—0.917	0.667	too dark color, loose texture
Zebra	1.500	0.417	0.500	loose texture, yellow tallow.
Danish pork I	—0.833	0.083	1.500	
Danish pork II	2.000	2.167	1.917	

tasty. There was not very much difference in the texture of the products. Many of the samples were considered loose and dry. In overall quality zebra, buffalo and wildebeest must be considered best. For comparison two commercial brands of Danish commercial »pork in own juice» were evaluated together with the African products. The texture of the Danish products were found considerably better than the African. With regard to taste and appearance one of the Danish products was considerably superior to the African while the other was less appealing than the African and in taste was average with the African.

DISCUSSION AND CONCLUSION

The results showed that the water-holding capacity of the wildebeest meat on an average is satisfactory when processed on the day of slaughter. It is however quite variable and became pale and watery when the animals were not killed at the first shot. To ensure a high and uniform quality of the meat it is therefore doubtful that conventional rifle shooting of the animals is advantageous. Slaughter methods should be worked out so the animals are killed immediately without causing turmoil and stampede of the herd. If no cooling facilities are available the meat should be processed on the day of slaughter. Although the severe heat treatment in the autoclave evens out differences in the water-holding capacity of the raw meat it is of interest in further development of the canning technique. A high water-holding capacity would give a superior product if a less severe heat treatment is combined with other preserving treatments f. ex. ionizing radiation.

The canned meat with the high protein content would be very suited from a nutritional point for distribution in areas with acute protein deficiency in place of the fresh meat (6, 9, 17). There might however be some difficulties with the acceptance of the canned meat by the public as it is common experience that African consumers prefer rather tough meat (3, 16). The texture of the canned meats was somewhat loose and dry as it appears from the remarks in table 4. This is in accordance with observations on the fresh meat. The meat is usually found tender but somewhat dry which most likely is due to the low fat content.

While there is not much variation between the different kinds of meat with regard to texture there is considerable variation in appearance and taste. There is a tendency for the canned meat of some of the ungulates to be very dark and yellowish. The yellowish tinge is most likely due to strong pigmentation of the finely dispersed intramuscular fat. This applies especially to buffalo and elephant meat while others like zebra and wildebeest meat had a nice appearance in the eyes of the panel. In taste there was even more variation than in appearance with some of the samples, like the elephant meat, having negative scores. This may be inherent in the nature of the meat but may also stem from the treatment of the meat after slaughter. When the carcasses are contaminated on removal of the hide or from the intestines when not eviscerated shortly after slaughter the meat may acquire a »gamey» flavor which often is repulsive. However when the meat is properly treated it may have an entirely satisfactory flavor as f.ex. the buffalo meat in this study. When one of the Danish samples was found to have a better flavor than any of the African samples the reason may partly be due to spicing. In the development of African canned meats as an export item it may be

pertinent to study which spices should be added to supplement and enhance the flavor of African meats.

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