

## CAMEL AS A MEAT ANIMAL

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### Background

The camel (*Camelus dromedarius*, one-humped camel) is an important livestock in hot and arid environments, particularly in the arid lowlands of Eastern Africa. It is able to survive under extreme environmental conditions [1] and can be used for riding, transport and as a provider of meat and milk.

In Africa, especially Northern Kenya, there still exist health problems including malnutrition. Camels here could play a more important role as potential meat producers and assist in eradicating such problems. The meat, blood and edible offal are important sources of nutrition in this region.

As a rule, camels are slaughtered if diseased, injured, or suffering from old age and weakness. It is known that the methods of slaughtering by herdsmen and in slaughterhouses in these regions are not only inhumane and painful for the animals, but also very unhygienic. Furthermore, to date no official deboning and dressing procedures exist; processing of the meat is limited to drying.

### Objectives

The first step was to develop a humane and hygienic method for slaughter of camels taking into account local facilities and conditions. The next step was to develop a suitable dressing and cutting procedure of the camel carcass into retail cuts and standardization of processing material. Finally, it was important to create a range of products with good shelf life of high and low cost for sale to various market sectors with special interest to the local population with a limited budget. Different meat standards were used to manufacture several meat products such as dried products (Raw Ham, Jerkey Sticks, Summer Sausage, Pasterma), cooked products (Bologna, Camfurter, Cumberland Sausage, Beerwurst), local market products (Haggies, Blood Sausage, Faggots, Andouillette), ready-to-eat products in tins (Camel Irish Stew, Butter Bean Stew with Debreciner, Chili con Carne, Corned Camel) and others (Camburger, Pastrami, Pickled meat, Marinated Steaks).

### Methods

A slaughterhouse was built at the Ol Maisor Ranch, Laikipia District, Kenya. All equipment and fittings were second hand goods due to the low financial budget. The building was supplied with mains electricity and drinking water was supplied from a rainwater tank. The processing area was equipped as follows: cutter, grinder, autoclave, stuffer, vacuum-packaging machine, slicer, balance, can sealer, clip machine, deboning benches as well as equipment for measuring the pH and water activity. Furthermore, there are a smokehouse and a cold storage room.

A total of eight camels have been slaughtered for research purposes. All camels were a cross-breed between the one-humped camel races "Turkana" and "Somali". With the exception of one they were male and castrated. The ages ranged from seven to ten years and had live weights from 530 to 800 kg. The animals' live weight was determined about two hours before slaughter. The individual parts were weighed about two hours after slaughter.

The recipe of Deng Deng (Figure 4) represents the group of dried meat products and was prepared from 100% C II (Figure 3). Additives and spices were added per kilogram meat: 28 g nitrite curing salt, 10 g sucrose, 10 g onions (diced 10x10 mm), 2 g black pepper, 2 g garlic powder, 2 g coriander (whole), 1 g chili powder, 0.5 g cardamom, 0.5 g ascorbic acid and 0.5 g monosodium glutamate. The analyses for moisture, protein, fat, ash and sodium chloride were carried out according to the official analytical methods in Germany [2].

The recipe of Goulash (Figure 5) represents the group of ready-to eat products in tins and was prepared according to the following weight based formula: Meat from shanks (diced 30x30 mm) 31%, potatoes (diced 30x30 mm) 8%, carrots (sliced 3-5 mm) 8%, onions (sliced) 1% and sauce 52%.

### Results and discussion

The slaughter procedure of the one-humped camel was according to the slaughter procedure of cattle [3]. Figure 1 gives an overall review of the average dressing percentages of eight camels relative to live weight. The animals' general condition was very good, without any external injuries. Figure 2 shows the classification of the camel into retail cuts, processing material and remaining parts. In this method of cutting, instead of the meat being simply cut off the bones and sold, as usually happens with traditional carcass dressing in Africa, there is optimum utilization of the individual cuts. This has the advantage that appropriate cutting improves the culinary use of the fresh meat and allows it to be sold at a higher price, e.g. to hotels, restaurants and supermarkets. In addition to the method for cutting fresh meat, a standardization system for processing meat is presented (Figure 3), with which it is possible to produce a wide variety of camel meat products, using the recipes. An important aspect in the development of camel meat products in Kenya is their keeping quality. The search for meat products with a long shelf life and which do not require cooling led to the development of a range of products. For example, products preserved by means of drying, e.g. Deng Deng (Figure 4) or tinned ready-to-eat dishes like goulash (Figure 5), are ideal food to consume during expeditions since they can be stored without cooling.

### Conclusions

In conclusion, the camel has some unique anatomical and physiological characteristics, which enable the camel to produce meat and milk in environmental conditions difficult for other domestic livestock.

The method of slaughter, cutting of carcasses and standardization of camel meat had to be developed. These are comparable with other livestock. There haven't been any previous experiences about that topic. The developed product range is suitable to the special circumstances which exist in Eastern and Northern Africa. There are dried and tinned products which ensure a long shelf life. On the other hand, there is a variety of fresh and cheap sausages for the local market with high nutritional value which should be consumed as soon as possible. Camel meat is nutritionally as good as red or white meat from traditional major sources.

**References**

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**Data in the form of tables**

Carcass [%]	Forequarter 23.8	Hindquarter 21.3	Hump 4.6	Neck 3.8	Tail 0.1					
Edible slaughter by-products [%]	Collected Blood 3.2	Liver 1.4	Lungs 0.5	Heart 0.4	Kidneys 0.3	Spleen 0.1				
Non edible slaughter by-products [%]	Intestines with content 20.8	Hide 7.3	Feet 3.4	Head 2.4	Kidney fat 1.1	Trachea & Esophagus 0.4	Penis 0.4	Bladder 0.1	Offal and loss at slaughter 4.6	

Fig. 1: Plot of carcass weights in percentage terms

Retail cuts [%]	Top-side 4.0	Silver-side 2.6	Eye of round 0.8	Nuggle 3.8	Sir-loin 1.4	Silver-side heel 0.9	Hind shank 1.1	Loin 2.4	Tender-loin 1.3	Shoulder clod 2.9	Chuck tenderloin 1.0	Blade 1.1	Small shoulder cut 1.1	Shank for roasting 0.7	Fore shank 1.6
Processing material [%]	C I 10.1	C II 12.3	C III 8.8	Hump fat 8.7	Fat Trimmings 6.3										
Remaining parts [%]	Bones 18.0	Offal and tendon 6.6	Cutting loss 2.7												

Fig. 2: Data from the deboning of the carcasses of eight camels

C I	Lean camel meat with as little visible fat as possible (about 5%) and almost no visible connective tissue
C II	Lean camel meat with about 15% visible fat and little connective tissue
C III	Relatively fatty camel meat with about 50% visible fat and clearly visible connective tissue
Fat trimmings	Solid fat tissue arising during cutting
Hump fat	Pure fat from the camel hump

Fig. 3: Camel meat standards

Processing procedure:	<ul style="list-style-type: none"> <li>- Dice C II, 30 mm edge and onions, 10 mm edge and mix with additives and spices</li> <li>- Grind mixture through a 3 mm plate and mix again by hand</li> <li>- Transfer the mass to a bowl, weigh balls of 60 grams and form balls (4-8 cm diameter) by hand</li> <li>- Put one ball between two pieces of foil and press with a platter until a disc form with 3-5 mm is achieved</li> <li>- Leave to stand overnight and remove meat slice from foil</li> <li>- Rotate meat slice on wire mesh to prevent curling of edges during drying process</li> <li>- Drying should be carried out under the following conditions: 25-30°C, no direct light, low atmospheric humidity good ventilation</li> <li>- The drying process is completed when the weight has been reduced by 60% within 48 hours</li> <li>- Pack in bags and store in a dry place</li> </ul>
Shelf life:	<ul style="list-style-type: none"> <li>- In vacuum or controlled packed bags without refrigeration up to 3 months</li> <li>- Stored at room temperature in bags which are permeable to air and water up to 2 weeks (depending on season)</li> </ul>
Note:	The production of Deng Deng is influenced by seasonal variations in the relative atmospheric humidity. In case of very high relative humidity during rainy season it is not easy to produce dried meat products due to the formation of different molds during the drying process or storage.
Chemical analyses:	Moisture 29.5% Protein 44.0% Fat 16.8% Ash 7.8% Collagen 4.0% Sodium chloride 5.5%

Fig. 4: Deng Deng

Processing procedure:	<ul style="list-style-type: none"> <li>- Dice meat and potatoes, 30 mm edge</li> <li>- Slice onions and carrots</li> <li>- Fry meat with corn oil for 10 minutes (e.g. in an adequate vessel, pan, autoclave)</li> <li>- Add sliced onions and roast for 5 minutes</li> <li>- Fill meat and onions into tins and add vegetables; mix well and fill up with sauce</li> <li>- Heat the tins in the autoclave at 121°C (pressure-cooking) for 1.5 hours</li> <li>- Cool down in cold water for 1 hour</li> </ul>
Tins:	Tinplate or aluminum (e.g. 99 mm diameter/ 120 mm height)
Weight loss of meat:	During roasting about 40%
Shelf life:	3 years below 40°C

Fig. 5: Goulash with potatoes and carrots