

An investigation of the quality of meat sold in Lesotho

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ABSTRACT

Since the closure of the Lesotho abattoir in 2003, only imported meat can be legally sold. However, it was estimated in 2007 that 80 % of the meat sold at butcheries comes from informal slaughter. The aim of this study was to investigate the situation. The number and location of informal butcheries in Lesotho ($n = 143$) were recorded and mapped using Geographical Information Systems. Observations (photographs) of informal slaughter indicated a lack of hygiene, unskilled slaughtermen and illegal disposal of offal with possible environmental pollution. In addition, a cross-sectional study was undertaken to determine the microbiological quality of meat from randomly selected carcasses ($n = 237$) of cattle, sheep and pigs from a sample of 44 butcheries, 4 of which were associated with registered supermarkets. As a control, samples for microbiological assay were taken from imported meat originating from carcasses ($n = 20$) slaughtered at a registered abattoir in South Africa. Of the 44 butcheries investigated only the 4 commercial butcheries associated with supermarkets sold imported meat only; 3 butcheries sold meat inspected at government slaughter slabs ($n = 3$), while the rest ($n = 37$) sold both imported and informally slaughtered meat. In terms of Lesotho legislation, informally slaughtered meat is only for home consumption. The bacteriological counts from all samples showed a total bacterial plate count exceeding 30 organisms per ml in contrast with the controls which all showed a count less than 5 colonies per ml. This was found for both imported and informally slaughtered meat sold in Lesotho. In addition, meat samples from butcheries showed the presence of the potential pathogens *Salmonella* ($n = 2$), *Staphylococcus aureus* ($n = 12$) and *Escherichia coli* ($n = 15$). During the study, anthrax was confirmed in 9 human patients, 5 of whom died, after consumption of informally slaughtered livestock. Although no cases of animal abuse were detected, it was considered that informal slaughter can prejudice livestock welfare. It was concluded that the current situation is not acceptable in terms of meat safety. Thus, the Veterinary Public Health Directorate of the National Veterinary Services has prioritised the monitoring of butchers, registration of slaughter slabs and a general extension campaign to improve hygiene and animal welfare standards for slaughter in Lesotho. This paper highlights the major risks associated with meat consumption without Veterinary Public Health intervention in accordance with international standards.

Keywords: food poisoning, informal slaughter, Lesotho, microbiological hazards in meat, zoonoses.

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INTRODUCTION

According to the Directorate Veterinary Services Report of 2004, the National Abattoir, which was the only abattoir in Lesotho, was built outside Maseru, the capital city, in 1985, but was closed in 2003. In 2004 and 2005 human cases ($n = 3$) of anthrax were reported due to consumption of informally slaughtered livestock (Director General Veterinary Services Report 2004/2005)^{7,8}.

Although there are still legal slaughter

slabs available, it was estimated in 2007 by the Veterinary Public Health Directorate of the State Veterinary Services, that in excess of 80 % of the meat consumed, originated from the informal or illegal slaughter of animals (Veterinary Public Health Directorate, pers. comm., 2007). It was decided to investigate the situation in order to plan a strategy to improve meat safety in Lesotho and decrease the risk of zoonoses, such as anthrax, in consumers.

Inspected meat is imported from South Africa for commercial sale, as only 3 slaughter slabs exist where meat can be inspected in Lesotho. Animals are also imported from South Africa for slaughter because the local production is insufficient to meet the needs for informal slaughter

for ceremonial purposes and home consumption in rural areas. The inspected meat (kg) and the number of livestock for local slaughter (uninspected meat) imported annually from South Africa between 2003 and 2007 are shown in Tables 1 and 2.

The 10-fold increase in meat imported between 2004 and 2005 was due to an outbreak of anthrax, which resulted in the banning of informal slaughter, as well as an increase in the number of visitors owing to SADC meetings hosted in the country. It may represent the proportion of meat normally derived from informal slaughter (for sale or home consumption) in Lesotho.

The prime objective of a formal meat hygiene and safety programme is to assure the wholesomeness and quality of meat sold to consumers. The purpose of a meat inspection system is to identify grossly apparent abnormalities during the *ante mortem* and *post mortem* examination. Complex microbial contamination, which could later precipitate major public health hazards and economic loss in terms of food poisoning and spoilage of meat, may not be recognised¹.

Surface contamination of carcasses during slaughter and processing can be reduced by ensuring good manufacturing practices such as hygiene and sanitation of the floor, equipment and carcasses, with suitable disinfectants and sanitisers¹⁰. To enable risks involved to be estimated and appropriate measures to be taken, analysis of the slaughtering process has to be complemented by collection of abattoir-specific microbiological monitoring data at critical control points, in accordance with hazard analysis critical control point (HACCP) principles¹⁴. Microbiological examination of carcasses allows reliable conclusions to be drawn with regard to long-term hygienic conditions in abattoirs²³.

The responsibility for achieving this objective lies primarily within the relevant public health authorities (in the Ministry of Agriculture and the Ministry of Health represented by veterinarians and health inspectors respectively)¹³. Only meat imported from registered abattoirs in South Africa currently meets all the above criteria in Lesotho.

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Table 1: **Importation of meat (kg) from South Africa** (data obtained from Veterinary Services Lesotho).

Year*	Mutton	Beef	Pork	Chicken
2003–2004	1 526 659	412 638	1 061 845	4 008 240
2004–2005	12 289 181	8 683 678	27 218 099	15 884 344
2005–2006	1 303 367	584 664	160 019	1 439 744
2006–2007	339 637	1 184 161	4 074	7 503 068

*The year runs from 31 March to 1 April the following year.

Table 2: **Animals imported through Maseru border gate from South Africa for slaughter** (data obtained from Veterinary Services, Lesotho).

Year	Cattle	Sheep	Goats	Pigs
2003/2004	24 787	58 193	38 538	–
2004/2005	22 651	66 502	40 311	–
2005/2006	23 242	43 352	33 705	25 025
2006/2007	22 095	33 853	36 415	19 412

*The year runs from 31 March to 1 April the following year.

Legislation currently in force in Lesotho is based on 'The Abattoir Regulations 1972' Legal Notice Number 27 of 1972. The Meat Safety Act (2006) has not yet been promulgated. The legislation is outdated and difficult to implement because it is not based on HACCP. While HACCP is a useful tool in the prevention of food safety hazards in an abattoir, it is not a stand-alone programme. Prerequisites such as good manufacturing processes, standard operating procedures for sanitation and a personal hygiene programme are also not well covered by the legislation. International criteria for traceability, transport of carcasses and animal welfare that were introduced after 1972, are also lacking.

For the purposes of this study, illegal informal slaughtering of animals was defined as slaughtering and processing of food animals and sale of carcasses, meat and meat products, without approval or compliance with meat safety legislation in Lesotho. It is legal to slaughter meat for home consumption in Lesotho; however, the sale of meat from animals slaughtered outside of a registered abattoir or slaughter slab is illegal. The aim of the study was to investigate the number and location of butcherries in Lesotho, find out whether they were selling informally slaughtered meat illegally and determine the microbiological quality of meat sold to consumers.

To prevent microbial contamination, which affects consumer health and causes serious public health problems, appropriate slaughterhouse design and internal control are necessary. The level and type of microbial contamination were monitored for maintaining and improving the hygienic status and quality of meat

produced by a slaughterhouse in accordance with international norms¹⁰.

The Aerobic Plate Count (APC) and Enterobacteriaceae Counts (EBC) are generally used as hygienic indicators in the food chain^{9,19,21,23}. The APC reflects general microbial contamination. The EBC is a marker for possible faecal contamination. Faeces are a major source of pathogens such as *Escherichia coli* O157:H7, *Salmonella* or *Campylobacter*²².

MATERIALS AND METHODS

A cross-sectional study was conducted on butcherries that sell meat from informally slaughtered animals in Lesotho, as outlined below:

- Observational study and structured questionnaire A questionnaire was designed to acquire relevant information from butcherries. The personal structured interview^{6,16} was the method of choice because:
- The interviewer was able to follow a well-defined structure, preventing the respondent from subjective interpretation of the questions;
- It allowed more control over the interview process and people with no or low literacy levels were easily interviewed; and
- It allowed the interviewer to explain questions unclear to the respondent.

Experimental design and procedures

The questionnaire for the structured interview was designed to determine the source of meat eaten in Lesotho. This was done with the assistance of 3 enumerators working in the Department of Livestock Services in the section of veterinary public health; they are trained meat inspectors. Microsoft Excel[®] (Microsoft Corporation,

USA) was used to capture and store the data. Samples were collected from the butcherries and these were sent to a contracted Veterinary Laboratory in Bloemfontein to isolate and identify bacteria using sampling kits (Analytical and Diagnostics Products, Weltevreden Park, South Africa).

Sampling kits

Each kit consisted of a sterile glove, sterile template, sterile sponge, and sterile buffered peptone water (BPW).

Study area

Lesotho is a land-locked monarchy, completely surrounded by the Republic of South Africa. It has a population of 2.1 million citizens who are mainly Sotho speaking, although English is the official language and Xhosa and Zulu are also spoken¹⁵. Formerly known as Basutoland, it is a member of the Commonwealth of Nations (Ministry of Communications, 2008¹⁸). Administratively it is divided into 10 districts (Fig. 1) each headed by a District Administrator located in a capital known as Camptown. There are 120 local community councils (local government) and health inspectors are responsible for food safety in each municipality⁵.

Sampling frame

A sampling frame is a list of all the units within the study area from which samples are taken. Butcherries were the sampling unit²⁰. They were classified into 2 groups. 'Commercial' butcherries were those associated with supermarkets or large shops, mainly in urban areas. 'Informal' butcherries were those located in or close to informal markets. Most of the informal butcherries are also licensed by the Minister of Trade (Trading Enterprise Act of 1999), so are not illegal. From the list of 143 butcherries a total of 44 were randomly selected for sampling. Four of these were classified as formal butcherries as they were associated with registered supermarkets.

Microbiological sampling and analysis. A maximum of 5 carcasses, (cattle, sheep, or pigs) per butchery were sampled. Random selection was not possible as in all butcherries the number of carcasses was 5 or less than 5. Meat samples were taken from carcass anatomical sites specific for each species, using the swabbing method described in the FAO/WHO¹¹ and FSIS/USDA Meat and Poultry Regulations of 1996¹² and the Scottish Meat HACCP Regulations, Number 234 of 2002^{2,4,23}. The results of the microbiological samples from different anatomical sites for each carcass were averaged.

Samples were aseptically collected and

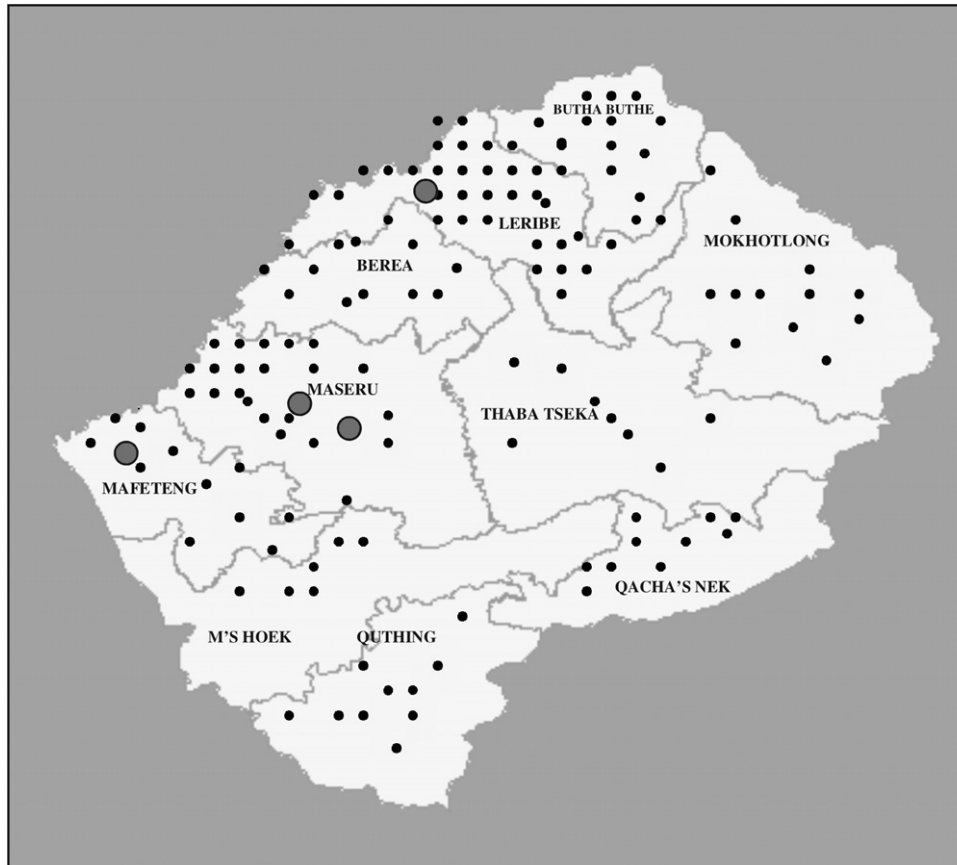


Fig. 1: Map of Lesotho showing butcheries in each district (GIS map). ● Commercial butcheries (in supermarkets); ● ordinary butcheries.

swabs were placed in sterile stomacher bags. The bags were labelled and placed in a cool box to maintain a temperature of ± 4 °C and transported to the laboratory in Bloemfontein. The total number of samples collected from the 44 butchers in Lesotho was 237 (Table 3). In addition, 20 samples were collected from South Africa, from a retailer who sells abattoir-slaughtered, inspected meat, and were used as controls. Of the latter, 3 were discarded owing to poor handling during transport.

RESULTS

The number and locations of butcheries in Lesotho are shown in Fig. 1. As would

have been expected, the numbers of butcheries in an area were related to population density and most of them were clustered around urban areas, where there is a bigger market.

Structured interviews with randomly sampled butchers ($n = 44$) showed that 4 of them were associated with registered commercial supermarkets. The educational level varied and 19 had tertiary education, 11 had finished high school, 6 had finished primary school and 8 had not completed primary school.

Only 1 of the respondents, who owned a butchery in Maseru, had any formal training, as he had been employed in the National Abattoir prior to 2003.

However, all the others ($n = 43$) had received individual training in meat hygiene from staff of the National Directorate of Veterinary Public Health, which falls under the Director General Veterinary Services, during routine fortnightly inspections. The National Directorate instituted these inspections in 2006, when it was observed that the inspection by municipal inspectors was inadequate.

Respondents were asked if they knew what meat inspections were and why they were carried out. It was found that 26, which included all butchers ($n = 10$) from Maseru District, knew the value of meat inspection, while 18, mainly from rural areas high in the mountains, did not.

It was observed that the informal butcheries ($n = 40$) were selling both imported meat and meat from informally slaughtered livestock (see Fig. 2) The 4 butcheries associated with supermarkets only sold imported meat. It is probable that a large proportion of the livestock imported legally from South Africa for slaughter, is being illegally slaughtered by butchers instead of being used for ceremonial slaughter and home consumption.

Observations of informal slaughter indicated that personal hygiene, the hygiene of the environment during slaughter and the dressing of carcasses, were deficient. Contamination of the environment was also observed, as ingesta and

Table 3: Number of samples taken per species from butchers in each area.

District	Cattle	Sheep	Pigs	Total
Maseru ($n = 10$)	23	18	9	50
Butha buthe ($n = 5$)	9	12	2	23
Leribe ($n = 4$)	9	9	2	20
Berea ($n = 4$)	9	10	0	19
Mafeteng ($n = 3$)	8	6	1	15
Mohale's hoek ($n = 4$)	6	13	1	20
Quthing ($n = 3$)	4	11	0	15
Qacha's nek ($n = 4$)	5	14	1	20
Mokhotlong ($n = 4$)	4	15	1	20
Thaba tseka ($n = 3$)	6	9	0	15
South Africa ($n = 1$)	10	7	3	20
Total number ($n = 45$)	93	124	20	237



Fig. 2: Informal slaughter of sheep in contaminated surroundings.

Table 4: Ablution facilities available at butchereries.

District	Pit latrine	Water system toilet
Thaba tseka (n = 3)	3	0
Mokhotlong (n = 4)	4	0
Butha Buthe (n = 5)	2	3
Leribe (n = 4)	3	1
Berea (n = 4)	1	3
Maseru (n = 10)	1	9
Mafeteng (n = 3)	0	3
Mohale's hoek (n = 4)	1	3
Quthing (n = 3)	1	2
Qacha's nek (n = 4)	1	3

blood were left on the site of slaughter and scavenged by stray dogs (Fig. 3).

Three types of informal slaughter by butchers (n = 40) were found in Lesotho. The 1st was the casual hiring of untrained slaughtermen (n = 30) who slaughtered livestock 'in the bush'. The 2nd was the use of employees or family of the butcher (n = 7) to slaughter livestock close to the business, while the 3rd was the legal but informal slaughter at a government slaughter slab (n = 3) where meat inspection was carried out by the municipal health inspectors or the local state veterinarian. The 3 functional slaughter slabs remaining in Lesotho in 2008 are registered in terms of 'The Abattoir Regulation

Legal Notice Number 27 of 1972'. Except for the 4 commercial butchereries linked to supermarkets, slaughtermen did not wear protective clothing or wash their hands, as ablution facilities were inadequate and even where waterborne sewage was available, no hand basins were seen (Table 4).

In all cases except 1, the butchereries were connected to electricity supplied by the Lesotho Electricity Corporation and the carcasses were hung in chillers after slaughter. The 1 exception was a deep freeze powered by gas. It was, however, noted that the temperatures within the chillers were not consistently maintained at 7 °C, even in the supermarkets. This is

probably the reason for high bacterial counts in the meat (Table 5).

DISCUSSION

It was found that 37 of the 40 informal butchers (92.5 %) were illegally selling informally slaughtered meat. All of the 17 carcasses with average bacterial counts of less than 5 colonies per ml came from the control group purchased from a registered retailer in South Africa. The high total plate counts suggested that meat marketed in Lesotho was not fit for human consumption and indicated poor hygienic quality of meat. Contamination with coliforms could have occurred during slaughtering, cutting and dressing of the carcasses, soiled hands and by the butcher's own clothing because no protective clothing was used. The knives used for slaughtering and cutting and contaminated water could both have been important sources of the coliforms found in the meat sampled. High numbers of bacteria can be transferred from the fleece/skin of the animal to the carcass surface during hide/skin removal³.

Foodborne bacterial diseases cause considerable morbidity and mortality throughout the world. Preventive measures such as good manufacturing practices (GMP), supplemented by the hazard analysis critical control point (HACCP) system, have been introduced as a means of ensuring the production of safe food. However, their use does not necessarily provide quantitative information on the risks associated with the consumption of a particular food product. In all 10 districts of Lesotho, the total bacterial counts were higher in the meat sold at butchers than in the control samples. There is also a risk of transfer of zoonotic diseases during informal slaughter and this was substantiated in 2008, during the study period, when anthrax was confirmed in 9 patients in Lesotho, 5 of whom died, after consumption of informally slaughtered livestock.

The 2 samples found positive for *Salmonella* were of special public health significance for a country like Lesotho, where undercooked (grilled) meat is the favour-

Table 5: Average total bacterial counts for meat (per species) from butchereries in Lesotho.

Species	Total bacterial count (colonies per ml)				<i>E. coli</i>	<i>Salm.</i>	Fungi	<i>S. aureus</i>
	<5	<30	>30	TMTC				
Bovine (n = 93)	7	0	13	73	7	0	5	8
Ovine (n = 124)	7	0	6	111	5	2	4	3
Porcine (n = 20)	3	0	2	15	3	0	3	1
Total (n = 237)	17	0	21	189	15	2	12	12

E. coli: *Escherichia coli*. *Salm.*: *Salmonella*. *S. aureus*: *Staphylococcus aureus*.



Fig. 3: A, Informal slaughter in the bushes with dog in the background; B, dressing the carcass of an informally slaughtered cow on its skin; C, informally slaughtered carcass lies in the dirt with no separation of innards

ite meal in most areas. *S. aureus* is also a significant cause of food poisoning.

Livestock welfare can also be a problem during informal slaughter¹⁷.

CONCLUSIONS

In rural and urban communities many family members participate in the informal slaughter process, therefore increasing the number of people put at risk during informal slaughter. The wider public is also put at risk by consuming the illegally

slaughtered meat sold by butchers.

It was concluded that there are 5 main areas of concern with regard to the sale of meat in Lesotho:

- i) Illegally slaughtered carcasses are not being inspected by trained personnel to ensure that the meat offered for sale to the general public is free of diseases and parasites which could be transmitted to humans.
- ii) There is a lack of basic health and hygiene compliance by butchers.

- iii) A potentially negative impact on the environment was observed during informal slaughter, where no attempt was being made to dispose of effluents, by-products and inedible offal.
- iv) The presence of vermin and insects such as flies in places where informal slaughter occurs are also of public health concern and scavenging dogs could spread pathogens (especially any meat containing anthrax spores) over a distance.
- v) Results of testing show severe microbiological contamination throughout the food chain from slaughter to consumption. This was linked to unacceptable slaughter and dressing methods, poor handling, insufficient chilling and no maintenance of the cold chain. The presence of potential pathogens such as *Salmonella*, *Staphylococcus* and *E coli* type I in samples increases the risk of foodborne diseases in the consumer. It is suggested that an integrated food safety network be introduced in Lesotho.

The high total aerobic counts and high levels of coliforms, as well as the anthrax transmission, indicate a crucial need to improve quality management and meat safety systems in Lesotho. Re-opening of the abattoir and re-conditioning of the district slaughter slabs as well as proper licensing of butcheries is a priority. It appeared that financial problems led to the closure of the abattoir in 2003 and steps should be taken to investigate cost-effective models or international donors, to make meat inspection a profitable reality. It may be necessary for the state to partly subsidise a new abattoir in the interests of public health. In the short term, more rigorous implementation of current regulations and training of stakeholders should be undertaken by the state veterinary services.

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