Assessment of Food Safety Risks Associated with Preslaughter Activities during the Traditional Slaughter of Goats in Gauteng, South Africa

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ABSTRACT

The South African Department of Agriculture, Forestry and Fisheries estimated in 2012 that there were 2.033 million goats in the country. Of these animals, less than 0.5% are slaughtered at registered abattoirs. Although informal and traditional slaughter of goats for home consumption is permitted under the South African Meat Safety Act 40 of 2000, the responsibility for ensuring that products are safe is left to the traditional or ritual slaughter practitioners. The objective of the present study was to assess whether preslaughter activities associated with traditional or ritual slaughter promote or reduce food-associated risks and to recommend mitigation strategies for potential food safety hazards. Structured interviews were conducted with 105 selected respondents (in and around Tshwane, South Africa) who had been involved in traditional goat slaughter. Approximately 70% of goats slaughtered were obtained from sources that could be traced to ascertain the origin of the goats. None of the respondents were aware of the need for a health declaration for slaughter stock. Some slaughter practitioners (21%) perform pre-purchase inspection of stock to ascertain their health status. However, this percentage is very small, and the approach is based on indigenous knowledge systems. The majority of respondents (67.6%) travelled 1 to 11 km to obtain a goat for traditional slaughter. Although approximately 70% of slaughter goats were transported by vehicles, the vehicles used did not meet the legal standard. More than two-thirds of goats were tied to a tree while waiting to be slaughtered, and the rest were held in a kraal. The holding period ranged from 1 to 72 h, but more than 70% of the animals were slaughtered within 36 h. This study revealed that traditional and ritual slaughter involves some preslaughter activities with potential to mitigate the risk of slaughtering animals that are not fit for human consumption. Such activities include pre-purchase inspection, obtaining goats from known and traceable sources, and ensuring that animals have sufficient rest before slaughter. However, given the rudimentary nature of these activities, they may not offer adequate protection to consumers of such meat. The lack of understanding of the importance of obtaining a health declaration certificate and minimizing stress in animals waiting to be slaughtered should be addressed to minimize the potential for propagation of foodborne diseases. The Meat Safety Act 40 of 2000 should be enforced where it applies and should be reviewed to provide guidelines that would help mitigate human health risks associated with traditional slaughter of goats.

The South African Department of Agriculture, Forestry and Fisheries in 2012 estimated that there were 2.033 million goats in the country (8). In 2005, the National Agricultural Marketing Council (26) estimated that less than 0.5% of goats are slaughtered at registered abattoirs. The rest were slaughtered informally, including using traditional or ritual slaughter methods. According to the Meat Safety Act 40 of 2000 (7) and the Constitution of the Republic of South Africa, slaughtering animals for home consumption or religious reasons outside designated areas (abattoirs) is permitted (Meat Safety Act 40, section 7(2)(b)) provided that the meat is not sold to the general public. Regulation 127 of the Meat Safety Act pertaining to ritual or traditional slaughter for home consumption states that animals slaughtered must be healthy and that a maximum of four goats or sheep may be slaughtered within a period of 14 days.

During informal ritual or traditional slaughter, food safety–associated hazards may not be controlled (25), resulting in possible exposure of both consumers of the meat and slaughter practitioners to hazards such as anthrax and brucellosis. However, under formal slaughter conditions, food safety and quality assurance are mandated. In view of the possible health risks associated with informal slaughter conditions, a farm-to-fork approach for identification and management of hazards should be considered as a model for traditional slaughter of goats. This approach would include preslaughter activities, which are important for the management of organisms known to cause foodborne diseases (9, 17, 31), e.g., ante-mortem inspection for identifying animals that are not suitable for slaughter.
Animals presented for slaughter may be asymptomatic; therefore, the history of the animals at the farm is important. A health declaration certificate and traceability are essential aspects of food safety protocols because they provide information for evaluation of food safety practices at the farm, including the possibility of exposure to hazardous substances (1, 21, 22, 36). Regulations 79 and 80 of the Meat Safety Act (7) require that a declaration of health be provided before the animal can be slaughtered at a registered abattoir. This step is important for mitigating the food safety risks associated with the slaughter of animals because it allows the inspector to stop the slaughter of unfit animals. During inspection, abnormal conditions can be detected, and unhealthy animals will be prevented from entering the food chain (38). However, informal or home slaughter does not include such inspections. The only requirement is that the animals presented for slaughter be healthy.

Studies have also shown that the way in which animals are transported and held prior to slaughter may increase the food safety risks. Factors to be considered include the length of time animals are exposed to stressful conditions and the conditions under which they were held during transport (1, 31).

In 2009, 10 foodborne disease outbreaks were detected in South Africa in the following areas: Mpumalanga Province, KwaZulu-Natal Province, Limpopo Province, Gauteng Province, Tshwane and City of Johannesburg districts, Western Cape Province, and the Free State Province (28). From these outbreaks the most frequently isolated agents were Bacillus cereus toxin, Staphylococcus aureus and S. aureus toxin, Clostridium perfringens enterotoxin A, Shigella sonnei, Shigella flexneri, Shigella boydii, Shigella spp., adenovirus, rotavirus, Salmonella, Escherichia coli, Aeromonas hydrophila, Schistosoma mansoni, Giardia lamblia, and Isospora belli.

Outbreaks of foodborne disease in South Africa are common but rarely reported. Even when reported, in most cases they are not properly investigated (37). Between 2006 and 2007, the average incidences of diarrhea among children younger than the age of 5 years were 21.9 and 25.4%, respectively. The most commonly isolated agents were Shigella spp. (61%) and Salmonella serovars (36%), all of which are food associated pathogens. The Mpumalanga Center for Disease Control Directorate reported that in 2009, 1,180 foodborne illness cases were reported in the Mpumalanga Province. This was a dramatic increase of 72% compared with 2008 (15, 29).

Outbreaks of foodborne diseases have been associated with the consumption of food during traditional ceremonies in South Africa. On 19 June 2010, 195 of 400 people attending a funeral in Tshihhiwi village (Vhembe District, Limpopo Province) developed gastrointestinal symptoms after consuming food served at the funeral. This outbreak was associated with B. cereus. A similar outbreak occurred in North West Province following consumption of meat of a slaughtered horse in which 22 cases were reported with onset of illness within 24 h of eating the horsemeat; Salmonella was isolated in this incidence (15, 30). Internationally, a similar outbreak occurred in Sulyyel, Saudi Arabia, at a wedding ceremony where 88 of 238 people developed diarrhea after consuming the meal; the associated agent was Salmonella group C (2).

Despite the dangers associated with eating meat from animals that are slaughtered using traditional or ritual methods, no studies have been conducted to investigate the traditional slaughter process in South Africa. The responsibility of ensuring the safety of the meat produced during traditional or ritual slaughter is left to the traditional slaughter practitioners. The present study was conducted to assess pre-slaughter activities during traditional or ritual goat slaughter and determine how these pre-slaughter activities impact the production of safe meat. This information was used to identify points or critical areas where risk mitigation strategies can be implemented during pre-slaughter handling of goats to enhance the production of safe meat during traditional or ritual slaughter of goats.

MATERIALS AND METHODS

Area. The study was conducted among the taxi ranks and informal markets in Tshwane Metropolitan Municipality, the second largest municipality in Gauteng Province and among the six largest metropolitan municipalities in South Africa (5). The city of Tshwane was considered suitable for this study because it offered access to a cross section of people from different parts of the country. Tshwane consists of both urban and periurban areas but is largely urban and therefore a destination for a large number of people moving to the city in search of jobs. At the several taxi ranks and informal markets, large numbers of people can be accessed at one place. Most taxi ranks in Tshwane are near a mall or shopping center, which allowed access to shoppers from various parts of Gauteng Province. Informal markets included in this study consisted of 18 sites along roads leading to Soshanguwe, Mabopane, Brits, and Hammanskraal in North West Province. These 18 sites were selected because they sell live goats used for traditional slaughter. At these places, we could access people who had come to buy or enquire about goats.

Population. The target population in this study included people from areas within and outside Tshwane city (other provinces of the Republic of South Africa), i.e., people who are not permanent residents of the city of Tshwane and those who come to the city for a job, for shopping, or on route to other destinations in the country. As a result, the authors had access to a large number of both male and female individuals from both rural and urban areas and various parts of the country who had been involved in traditional slaughter of goats.

Data collection. Structured interviews were conducted with 105 respondents. The objectives of the study and reasons why the respondents were chosen to be part of the study were explained to each respondent. The respondents understood that they were free to withdraw during the interview at any stage of the study. Each respondent who agreed to participate in the study confirmed this by signing a consent form before the interview could proceed. The inclusion criteria for the respondents consisted of the following: the respondent agreed to be interviewed and had at one time been involved in the ritual slaughter process as a participant or as a traditional slaughter practitioner. Three hundred people were approached for an interview; 105 were accepted under these criteria.

The interviews lasted 10 to 15 min per respondent and were conducted in the respondent’s home language by four Animal Health Technician trainee students from the University of Southern
Africa under the supervision of both authors (who are qualified veterinarians). Each interviewer was trained and tested before implementation of the study to ensure that they would be able to use good interview practices. The questionnaires were pretested at the Faculty of Veterinary Science on a group of 10 people from Mabopane to ensure that interviewees are able to follow the study protocol. Feedback from the pretest was then incorporated into the questionnaires.

**Questionnaire design.** The questionnaire was designed using Excel (Microsoft, Redmond, WA) and Epi-info 7 (Centers for Disease Control and Prevention, Atlanta, GA). The following categories were included in the questionnaire: demographic characteristics of respondents, sources of goats, preslaughter examination, transportation, and preslaughter holding area. The section on preslaughter activities consisted of 15 questions (both open ended and closed).

**Data entry and analysis.** Data were captured with Epi-info 7, which was also used to perform descriptive statistical analysis and generate frequency tables. Open-ended questions were analyzed using word-based technique as described by Ryan and Bernard (35).

### RESULTS

#### Demographic profile.
Of the 105 respondents who were interviewed, 54.3% were males and 45.7% were females. The majority of respondents were from three provinces: 61.9% were from Gauteng Province, 15.24% were from the neighboring Limpopo Province, and 10.48% were from the neighboring Mpumalanga Province. A small number of respondents came from the neighboring Free State province (1.9%) and from neighboring countries, e.g., 3.8% from Zimbabwe and 0.95% from Mozambique.

#### Sources of goats for traditional slaughter.
According to the respondents, goats used in traditional slaughter came from the following five main sources: speculators (22.55%), neighbors (20.59%), subsistence farmers (14.71%), auctions (11.76%), and their own herds (30%) (Table 1).

None of the 105 respondents asked for a declaration of health certificate with the goat (Table 2). All respondents said that the characteristics of the animal as required by the ancestors are more important when judging the animal for fitness to slaughter.

The majority of respondents (80%) did not require some form of prepurchase examination to be performed on the goat. Of the 21 respondents (20%) who indicated that they required or performed a prepurchase inspection of goats before purchasing, only 12 (57%) indicated that they had experience in carrying out such examinations (Table 2). Thus, 90% of traditional slaughter practitioners lacked training. Those who said that they had experience in performing antemortem examinations had gained this experience through informal training offered by older relatives who were respected in the community and had experience performing ritual slaughter (Table 2).

Based on the statements of the 21 respondents who indicated that they had observed and/or performed ante-mortem inspections, the criteria for antemortem inspections included examination of the following systems: skeletal, integumentary, urogenital, gastrointestinal, and special

### TABLE 1. Questions related to traditional slaughter of goats regarding the source of goats, type and duration of transport, and type, place, and duration of restraint.

<table>
<thead>
<tr>
<th>Question 1</th>
<th>Question 2</th>
<th>Question 3</th>
<th>Question 4</th>
<th>Question 5</th>
<th>Question 6</th>
</tr>
</thead>
<tbody>
<tr>
<td>Where do you buy a goat(s) to slaughter for traditional purposes?</td>
<td>For how far (kilometers) do you travel between the place you bought the goat(s) and the place you slaughter it?</td>
<td>What method do you use to transport the goat to a place of slaughter?</td>
<td>What method do you use to retrain the goat during transport to a place of slaughter?</td>
<td>Where do you keep the goat before slaughter?</td>
<td>For how many hours is the goat kept before slaughter?</td>
</tr>
<tr>
<td>Own goats</td>
<td>Speculator</td>
<td>Neighbor</td>
<td>Farmer</td>
<td>Auction</td>
<td>Car</td>
</tr>
<tr>
<td>Speculator</td>
<td>Neighbor</td>
<td>Farmer</td>
<td>Auction</td>
<td>Car</td>
<td>Foot</td>
</tr>
<tr>
<td>Neighbor</td>
<td>Farmer</td>
<td>Auction</td>
<td>Car</td>
<td>Foot</td>
<td>Trailer</td>
</tr>
<tr>
<td>Farmer</td>
<td>Auction</td>
<td>Car</td>
<td>Foot</td>
<td>Trailer</td>
<td>Bus</td>
</tr>
<tr>
<td>Auction</td>
<td>Car</td>
<td>Foot</td>
<td>Trailer</td>
<td>Bus</td>
<td>Truck</td>
</tr>
</tbody>
</table>

All 105 respondents answered these six questions. Question 1: Where do you buy a goat(s) to slaughter for traditional purposes? Question 2: For how far (kilometers) do you travel between the place you bought the goat(s) and the place you slaughter it? Question 3: What method do you use to transport the goat to a place of slaughter? Question 4: What method do you use to restrain the goat during transport to a place of slaughter? Question 5: Where do you keep the goat before slaughter? Question 6: For how many hours is the goat kept before slaughter?
TABLE 2. Questions related to declaration of health and ante-mortem inspection during traditional slaughter of goats

<table>
<thead>
<tr>
<th>Question</th>
<th>No. of respondents</th>
<th>Yes</th>
<th>No</th>
<th>Characteristics favored by tradition</th>
<th>Training offered by older, experienced relatives</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Do you ask for a health declaration document?</td>
<td>105</td>
<td>0</td>
<td>100</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. Do you examine for signs of illness?</td>
<td>105</td>
<td>20</td>
<td>80</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. What do you consider important when buying a goat?</td>
<td>105</td>
<td>20</td>
<td>80</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. Did you get a formal training in goat health examination?</td>
<td>21</td>
<td>0</td>
<td>100</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5. Did you get any other training in goat examination?</td>
<td>21</td>
<td>57</td>
<td>43</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6. What kind of training did you receive?</td>
<td>12</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

DISCUSSION

Approximately 70% of the animals used by the respondents for traditional slaughter came from sources that were easily traceable, including their own herds, neighbors, and farmers. Thus, if necessary the origin of animals used in traditional slaughter could be traced in about 70% of cases. This traceability is good from a food safety point of view because food chains with non-traceable components are considered more vulnerable (32). In situations such as traditional slaughter, the slaughter process may be ineffective for removing certain hazards and may increase the risk of foodborne diseases (16, 22). Therefore, the origin of the animals and if possible the disease status of the place of origin should be known. Knowledge of the conditions under which goats are managed or reared is crucial for minimizing the likelihood of introducing hazards into the food chain (19).

When traceability of the animals slaughtered for human consumption is possible, the application of good agricultural practices to mitigate hazards associated with foodborne diseases can be assessed (14). Some authors have found that mitigation at the farm level (animal source) results in reduction of consumer exposure to Shiga toxin–producing E. coli (21). As in the European Union, a farm-to-fork approach to managing hazards in goats slaughtered during traditional slaughter should be mandatory among both advocates and opponents of ritual slaughter (4).

Although the above measures can help mitigate hazards during traditional slaughter, improvements are needed to ensure that the 30% of goats that are currently not traceable are obtained from sources that can be traced. Individuals who sell goats at auctions or along roads as speculators may not be easily traced after conducting a transaction. Therefore, animals that cannot be traced to the source in the event of a food safety problem after consumption should be excluded from entering the food chain. Relevant South African legislation must be updated to prescribe mitigation strategies for food safety risks that might be introduced at the goat source.

None of the respondents interviewed asked for a health declaration when purchasing a goat, which is a major food safety concern and indicates that traditional slaughter practitioners do not understand or appreciate the importance of a health declaration certificate for mitigating health risks associated with this type of meat. The Meat Safety Act (7) currently does not require provision of a health declaration certificate for animals destined for traditional slaughter; therefore, this Act should be updated to enforce use of a health declaration certificate by traditional slaughter practitioners. Regulations 79 and 80 of the Meat Safety Act require a declaration of health certificate to be provided by the owner of animals slaughtered in registered abattoirs. This certification is considered an important risk mitigation tool for abattoir slaughter and should be extended to traditional slaughter of goats in South Africa. This level of protection is particularly important given that 30% of the organs. Issues with the skeletal system include broken hooves, foot rot, foot problems of unknown cause, lameness, inability to stand, and abnormal ribs. Issues with the integumentary system include any skin diseases. Special organs problems are indicated by the color of the eyes. Problems with the urogenital system are indicated by abnormal changes in the color of urine. Gastrointestinal problems are indicated by evidence of diarrhea. The respondents also indicated that a general foul odor, sores, craziness (abnormal behavior), wounds on the body, and a sick appearance also are considered to be important when deciding whether the goat should be slaughtered.

The majority of respondents (67.61%) travelled 1 to 11 km to obtain a goat for ritual slaughter. Very few (2.82%) indicated that they had travelled 31 to 51 km (Table 1).

Six methods of transport for goats destined for traditional and/or ritual slaughter were identified. The most common mode of transport was personal and/or public transport (46.81%) followed by trekking (29.79%) (Table 1).

Over half of the respondents (56.82%) indicated that they tie all four legs of the goat together as a restraint during transportation; 19.32% of respondents did not restrain the animals during transportation (Table 1). The majority (66.29%) of respondents kept the goat tied to a tree just before slaughter. Another common method of holding animals preslaughter was keeping them in kraals (29.21%). Only 3.37% of respondents indicated that the goat was slaughtered immediately upon arrival with no restraint needed.

The majority (26.67%) of respondents indicated that they slaughtered goats within 1 h of arrival, 24% indicated that they slaughtered goats within 12 h of arrival, and 22.67% said that they slaughtered goats within 24 h of arrival (Table 1).
respondents indicated that they obtained animals from providers who might not be easily traced and that antemortem inspection is not performed for 80% of the animals slaughtered. Relevant regulation should be developed and applied to traditional slaughter of goats to protect the consumer and traditional slaughter practitioners from possible hazards associated with slaughtering animals whose disease status is unknown.

The declaration of health is probably even more critical for traditional slaughter than for formal slaughter because access to veterinary services in South Africa is very limited in rural areas. Most veterinarians are located in the urban areas, where small animal practices, pharmaceutical companies, and production animal consultants (the three main employers of veterinarians in South Africa) are located. Access to veterinary services has declined in rural South Africa (33), and these services are usually rendered by the state veterinary officials who offer extension services to farmers. The government veterinary service is unable to reach remote areas of the country where disease control is needed (23). Lack of awareness of zoonotic animal diseases and their prevention is common in rural areas, and goat sellers and traditional or ritual slaughter practitioners are unable to make informed decisions about animal diseases when selling or purchasing goats for slaughter.

In South Africa, diseases such as brucellosis, bovine tuberculosis, anthrax, rabies, and Rift Valley fever in goats by law must be reported to the relevant authorities when encountered (6). However, no legal requirement exists for reporting food-associated diseases. As a result, few data are available on zoonotic diseases when they occur as food-associated diseases. Even where high-impact and controlled zoonotic diseases occur, reports are usually sporadic. Thus, limited surveillance data are available on these diseases in the various provinces of South Africa. Lack of information about zoonotic and high-impact diseases makes it difficult to control these diseases, which in turn could translate into an increased risk of exposure of traditional practitioners to such diseases. Lack of primary and secondary meat inspection during ritual slaughter also compounds the problem of not requiring a declaration of health certificate for goats destined for slaughter. Traditional slaughter of goats is exempted from primary and secondary meat inspection. Therefore, the only quality control measure available to traditional or ritual practitioners is the indigenous knowledge–based antemortem inspection performed on live animals. These inspections are not necessarily based on scientific principles and do not offer the consumer sufficient protection against zoonotic diseases known to occur in goat populations in South Africa, e.g., anthrax, brucellosis, orf, toxoplasmosis, and Rift Valley fever (20).

Failure to recognize carcass lesions that are indicative of disease is another issue that makes the lack of a declaration of the health significant among traditional slaughter practitioners. Many practitioners involved in ritual slaughter depend on indigenous knowledge passed on from generation to generation rather than science-based knowledge, which increases the likelihood that diseased or abnormal animals will not be identified as such.

Meat slaughtered during traditional ceremonies is eaten by all members of the community, including vulnerable groups such as children, elderly individuals, and those with compromised immune systems (e.g., human immunodeficiency virus–positive persons). Lack of knowledge of the health status of the animal used in these ceremonies puts such groups of people at risk of zoonotic diseases that can be contracted by coming into contact with infected goats and/or eating infected goat meat.

Although preslaughter examination is important for food safety reasons, during traditional slaughter the characteristics of the animal that are pleasing to the family ancestors are far more important, meaning that fulfilling the tenets of traditional practices is far more important than food safety. This prioritization increases the risk that consumers of such meat will contract foodborne and/or zoonotic diseases.

The descriptions of preslaughter evaluations of animals provided by 20% of traditional slaughter practitioners indicate that the methods used are rudimentary and not science based. However, these informal preslaughter evaluations have one advantage over the antemortem inspections in formal slaughter settings in that they use a systems approach to evaluate the animals. The main concern is that very few practitioners of traditional slaughter consider prepurchase inspection of goats important, and very few of these traditional practitioners carry out prepurchase and antemortem inspections. The results obtained in the present study suggest that the current prepurchase inspection as practiced by traditional practitioners of ritual slaughter can be improved on and brought in line with guidelines of the Meat Safety Act 40 of 2000 so that pathogenic organisms such as E. coli O157, which may contaminate fresh meat, can be identified during antemortem inspection and the risks to consumers can be mitigated (1, 34). Veterinarians, meat inspectors, and examiners are responsible for antemortem inspection at registered abattoirs. Unlike traditional practitioners, these veterinarians are trained to determine the fitness of the animals for slaughter based on scientific criteria (27). In contrast, people who perform antemortem inspections during traditional or ritual slaughter use knowledge and experience passed on from one generation to the next rather than information gained through formal training.

Long-distance hauling without preconditioning of animals has been associated with increased stress and defection, which may increase the likelihood that foodborne pathogens will contaminate the carcass (3). In the present study, the majority (67.61%) of respondents traveled 1 to 11 km with their goats, and all respondents traveled less than 50 km/day (Table 2). This distance is within the required standard by the Food and Agriculture Organization of the United Nations (11) and the South African Department of Agriculture (27), both of which recommend that animals should not be hauled for more than 36 h. Mather et al. (24) found that the level of E. coli O157 contamination of the carcass increases with the distance the
animal travels before slaughter. In the present study, goats used in traditional slaughter were usually not hauled over long distances. This important food safety risk mitigation measure should be encouraged. Animals are usually transported by personal vehicles or public transportation, which therefore do not meet the regulatory requirements for vehicles used to transport animals (7, 10, 12, 27).

The most common method of restraint used by traditional slaughter practitioners in South Africa is tying of all four legs of the animal together, similar to methods used during Shechita (Jewish ritual slaughter) (13). However, this restraint method can increase the level of stress in the animal and the shedding of enteric bacteria during transport, thus increasing hide contamination and carcass contamination and the subsequent risk of foodborne diseases for the consumer (3, 18).

In holding areas (lairage), cross-contamination can occur between infected and clean animals (1). For traditional slaughter of goats, the two most common methods of holding animals before slaughter were tying to a tree (66.29% of respondents) and holding in a kraal (29.21% of respondents). These results were expected because traditional slaughter of goats takes place mainly in rural areas where special holding facilities for animals awaiting slaughter are not available. However, mixing of animals to be slaughtered with animals that are not to be slaughtered, as could happen in a kraal, may result in and/or cause cross-contamination.

At abattoirs, a minimum lairage time of 1 h is prescribed for goats (27). A shorter holding time forslaughtering may result in reduction in the levels of lactic acid important for control of bacterial growth in the meat. In traditional slaughter, very few respondents (3.37%) slaughtered animals immediately on arrival. The majority of respondents (97%) slaughtered their animals within 24 h of arrival, which allows enough time for the animal to rest and enhances the safety of meat.

In conclusion, traditional slaughter practitioners generally do to use structured pre-slaughter risk mitigation practices that help minimize the food safety risks associated with meat derived from this type of slaughter. Risk mitigation strategies identified in this study include pre-slaughter inspection similar to the ante-mortem inspection in formal slaughter situations, obtaining animals from sources that can be traced, holding animals for at least 1 h before slaughter (which extends the shelf life of the meat by reducing stress), and transporting animals over short distances. Practitioners need to be made aware that unsuitable holding areas can be a source of food safety hazards, and specific areas for holding animals awaiting slaughter should be designated. Because few traditional slaughter practitioners perform or request pre-purchase inspections, the importance of this step should be emphasized. Regulations for the transport of goats are difficult to enforce because socioeconomic factors determine the methods of transport used. However, training in food safety and animal welfare during transport would be helpful. Guidelines could be developed that take into consideration socioeconomic factors and their role in the implementation of these guidelines. The current South African Meat Safety Act allows for slaughter of animals for traditional purposes without involvement of personnel trained in food safety and animal disease, which poses a risk to the public. Legislation should be reviewed to address the issues raised in this study that impact the safety of meat derived from traditional slaughter, and a pre-slaughter food safety control system should be developed for traditional slaughter of goats in South Africa.

REFERENCES