



Multidrug-resistant pathogens in sheep and goat value chains in Ethiopia—implications for public health

Barbara Szonyi, Aklilu Feleke, Fitsum Dulo, Seble Hailemariam, Reinhard Fries, Maximilian Baumann and Delia Grace

The Safe Food, Fair Food project in brief

Since 2008, the International Livestock Research Institute and partners have carried out research on food safety in informal markets in sub-Saharan Africa. Our vision is to improve the livelihoods of the poor by reducing health risks associated with animal-source food and improving nutrition and market access for smallholders.

Conventional food safety approaches focus on banning any product with germs or other hazards in it; this is bad news for small-scale farmers. New risk-based approaches seek to find out if there really is a danger to human health and, if so, how significant it is and what can be done about it. Risk analysis is the gold standard for food safety management in developed countries and can be a useful tool for decision-makers in sub-Saharan Africa where resources for addressing all potential hazards are scarce.

The Safe Food, Fair Food project is carried out with the financial support of the Federal Ministry for Economic Cooperation and Development, Germany (GTZ, Project no: 11.7860.7-001.00) and the CGIAR Research Program on Agriculture for Nutrition and Health, led by the International Food Policy Research Institute.

Gastroenteritis due to food-borne disease is one of the most common illnesses in Ethiopia, and it is a leading cause of death among people of all ages in the country. The lack of surveillance of food-borne pathogens, poor hygienic conditions and slaughter practices in abattoirs, and the widespread cultural practice of raw meat consumption are all important factors contributing to the high risk of exposure of Ethiopians to food-borne pathogens.

Why is multidrug resistance a problem and how does it arise?

- In developing countries like Ethiopia, resistance to commonly accessible antibiotics is a major concern, because there is a limited choice of drugs available for treatment of bacterial infections.
- Antimicrobial resistance arises due to excessive use or misuse of antibiotics in human and veterinary medicine. In particular, prophylactic (preventive) and sub-therapeutic (low-dose) administrations create ideal conditions for the selection of resistant strains.

- Livestock are often incriminated as originators of antimicrobial resistance. This is especially the case in industrialized nations, where antibiotics are commonly used in low doses to improve livestock productivity.
- In Ethiopia, antibiotics in livestock are not routinely used for prophylaxis or as growth promoters. However, antibiotics are commonly misused and antimicrobial resistance is an increasing problem throughout the country.

Study objectives

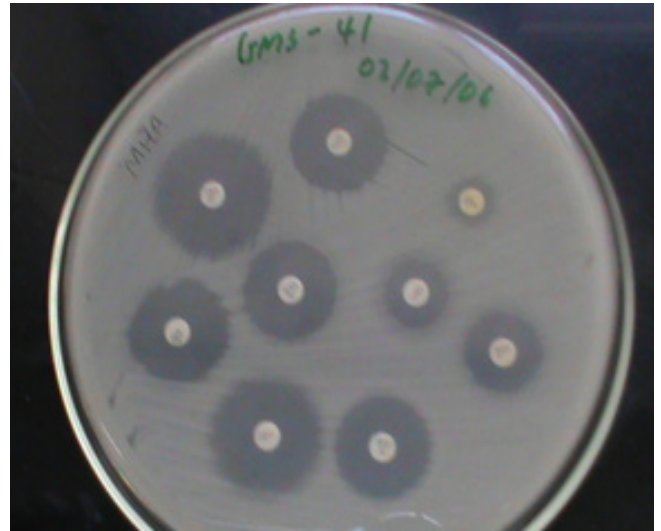
- To assess the carriage status of selected food-borne pathogens in sheep and goats in the study areas.
- To determine the antimicrobial susceptibility pattern of the isolates.
- To assess the hygienic conditions and the level of carcass contamination during the slaughter process.

Methodology

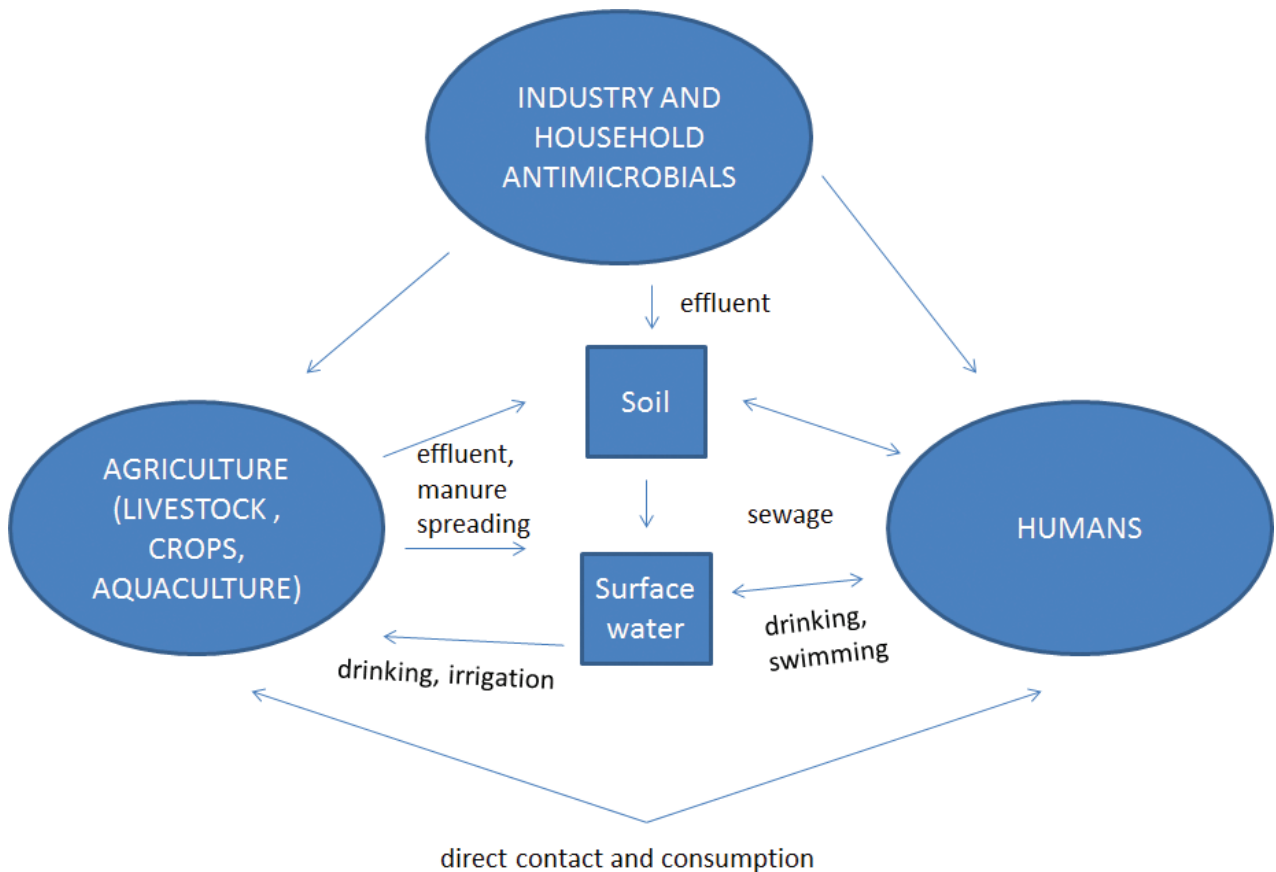
Two abattoir-based, cross-sectional studies were conducted in two different agro-ecological regions of Ethiopia in 2014. The first study abattoir was located in the central highlands where sheep are raised in a smallholder mixed crop/

livestock production system. The second study abattoir was located in the remote Somali region, representing the lowlands, where goat production dominates in an extensive, pastoralist system. Faecal samples and carcass swab samples were collected from sheep and goats presented for slaughter to the respective study abattoirs. Environmental samples were also taken. Standard microbiological techniques and biochemical tests were used to isolate the targeted pathogens and to determine the antibiotic susceptibility profiles of the isolates.

Antimicrobial susceptibility testing using the disk diffusion method



The epidemiology of antimicrobial resistance¹.



Pathogens targeted in this study

- We selected to study *Escherichia coli* (*E. coli*) O157 and thermophilic *Campylobacter* species, which are among the most common food-borne bacteria worldwide.
- These pathogens are carried in the intestinal tract of healthy livestock, including sheep and goats. They can be excreted in the faeces of carrier animals.
- During the slaughter process, these bacteria can get transferred to the sterile meat surfaces. Therefore, proper technique and good hygiene during the slaughter process are critical to avoid meat contamination with these pathogens.

Key findings and their implications for public health

We isolated multidrug-resistant strains in both central highland and remote lowland areas

- We isolated multidrug resistant *E. coli* O157 from goats from a remote pastoralist system. The meat produced in this system is partly consumed locally and it is also exported to the Middle East.
- We isolated multidrug-resistant *Campylobacter* spp. from sheep from the central highlands region. Sheep from this study area are mainly consumed by the residents of Addis Ababa, the capital city of Ethiopia. This city has a rapidly growing population, currently estimated to be approximately 3 million people.
- Both production systems supply meat to a large population within Ethiopia and/or beyond. Thus, there is a large and geographically widespread human population at risk of infection with these multidrug-resistant pathogens.

We detected multidrug resistance to drugs not used in livestock

- Livestock are often incriminated as originators of antimicrobial resistance. In this case, however, our results indicate that livestock are not the originators but rather the victims of antimicrobial resistance in this part of the world.
- Our study highlights that antimicrobial resistance can not only go from livestock to humans, but the transfer can also occur in the opposite direction. Such transfer may occur through the environment, or by direct contact between animals and humans.
- Even in extensive and remote livestock production systems where antibiotic use is limited, livestock can carry multidrug-resistant strains which may enter the human food chain.

The study highlights how poor hygiene and slaughter techniques can result in contaminated meat

- Carcass contamination rate was higher than carriage rate for both target pathogens. This indicates cross-contamination of carcasses during the slaughter process. In other words, intestinal content/faecal material from one carcass was transferred to other carcasses down the slaughter line.
- Poor hygiene was also demonstrated by the isolation of target pathogens from the environmental samples in both study abattoirs. Contaminated slaughter knives, hands, clothes, water and equipment can all transfer pathogens to sterile meat surfaces.
- Poor slaughter hygiene and practices are especially risky in Ethiopia because of the common practice of eating raw meat. This means that consumers solely rely on the skills and hygiene of the butcher to avoid consumption of contaminated meat.
- To address some of these issues, our team has been collaborating with the Ministry of Agriculture in providing training to abattoir workers on proper practices and hygiene during the slaughter process.

Multidrug-resistant strains were found in both highland sheep (left image) and lowland goat (right image) production systems



Reference

I. Linton AH. 1977. Antibiotic resistance: the present situation reviewed. *Veterinary Record* 100(17): 354–360.

Reinhard Fries and Maximilian Baumann work for Food and Agriculture Organization of the United Nations Reference Centre for Veterinary Public Health, Faculty of Veterinary Medicine, Freie Universität Berlin, Germany, Aklilu Feleke, Fitsum Dulo and Seble Hailemariam work for Addis Ababa University, Faculty of Veterinary Medicine and Barbara Szonyi and Delia Grace work for the International Livestock Research Institute (ILRI).

Photo credit:

Page 1: ILRI\Zerihun Sewunet

Page 2: Fitsum Dulo

Page 3: Tamsin Dewe

Contact

Barbara Szonyi
ILRI, Ethiopia
b.szonyi@cgiar.org
<http://safefoodfairfood.ilri.org/>



RESEARCH
PROGRAM ON
Agriculture for
Nutrition
and Health



RESEARCH
PROGRAM ON
Livestock and Fish

ILRI
INTERNATIONAL
LIVESTOCK RESEARCH
INSTITUTE

giz

Deutsche Gesellschaft
für Internationale
Zusammenarbeit (GIZ) GmbH



ilri.org

better lives through livestock

ILRI is a member of the CGIAR Consortium

Box 30709, Nairobi 00100, Kenya
Phone: +254 20 422 3000
Fax: +254 20 422 3001
Email: ILRI-Kenya@cgiar.org

Box 5689, Addis Ababa, Ethiopia
Phone: +251 11 617 2000
Fax: +251 11 617 2001
Email: ILRI-Ethiopia@cgiar.org



The research brief has a Creative Commons licence. You are free to re-use or distribute this work, provided credit is given to ILRI.

May 2015