Veterinary public health in the Nepal Himalaya

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Chasing water buffalo through Himalayan villages may not be the image that springs to mind when thinking about veterinary medicine, unless, that is, you are fortunate enough to have worked in Nepal. We are 2 veterinary students of the Ontario Veterinary College who were invited to spend the summer of 1999 with Dr. Durga Dutt Joshi, director of the National Zoonosis and Food Hygiene Research Center (NZFHRC) in Kathmandu, to help with some of his ongoing public health projects, such as examining slaughtering conditions, milk production systems, and testing for zoonotic diseases in rural villages. The project was the result of over a year of planning and fundraising. The information collected will be used by Dr. Joshi, local community leaders, and government officials to implement realistic and effective measures aimed at breaking the cycle of zoonotic disease transmission and degradation of the environment, while considering the social, cultural, and economic boundaries.

The Himalayan Kingdom of Nepal may be one of the most beautiful countries in the world, but it is also one of the poorest. The majority of the population survive through subsistence agriculture, but an increasing movement of people from rural areas into the capital city, Kathmandu, has resulted in a significant threat to public health. Human disease is common, hygiene standards are very low, and there is a severe shortage of clean drinking water. The lack of city planning and infrastructure only exacerbates these factors, contributing to the immense public health threat.

Water buffalo slaughter system

We worked with the NZFHRC to examine the water buffalo slaughtering conditions in Kathmandu. This is especially important, as there are currently no enforced meat inspection laws in Nepal. There are many sources of meat contamination, including ruminal fluid spills, lack of personal hygiene, and use of unclean tools, as well as human and animal traffic through the sites. Typhoid, diarrhea, and parasitism are 3 common diseases in Nepal, all with a basis of transmission in the slaughtering process. A recent study by Dr. Joshi indicates that the prevalence of echinococcosis is 30%–40% among female buffaloes and 17% among males. When hydatid cysts are observed in the liver, they are drained and the liver is sold to consumers.

Public health initiatives over the last 2 years have resulted in significant improvements to the slaughtering system and a buffalo contractor is now responsible for the management of the animals. Previously, animals were left wandering along the riverside for weeks, waiting for slaughter, which created a significant opportunity for transmission of zoonotic diseases.

The contractor provides a holding area where the buffalo can be unloaded, fed, housed, and then sold to the butcher. The contractor gives managerial assistance only; all buying and selling is done independently. There are about 100 suppliers and the average daily intake is 30 to 40 animals. Half of the buffaloes come from India, the other half comes from Nepal. This system necessitates proper animal identification, making it easier to implement a trace-back system for future disease surveillance.

The buffalo arrive at the holding area by trucks, in which they are tied lying down to prevent injury. Approximately 30 small animals or 20 large animals can be transported on one truck. The trip to Kathmandu takes an average of 15 hours and the buffalo are watered, but not fed, at various points throughout the journey. The mortality rate in transit is about 2.5%, and these animals are sold to the people who live en route for their consumption. Upon arrival, the supplier and number of buffalo are noted. Six men work for the contractor and are responsible for the daily care of the buffalo. Each morning, butchers buy a few days' supply of animals and take them to the slaughtering places, near the river. The butcher pays the contractor, who, in turn, pays the supplier on delivery of the next load. This system has been a tremendous success, and plans are in place to build another site in the village of Pokhara in western Nepal.

Buffalo slaughter places

Animals are slaughtered early each morning at one of about 200 sites along the rivers in Kathmandu. Most Nepalese do not have refrigeration, so meat is purchased freshly killed and prepared that day. Some ethnic groups prefer to have the skin left on the animal, so the intact skin is carefully burnt until sufficiently prepared.

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Project supplies were donated by: IDEXX, Intervet, Iowa State University Press, United States Department of Agriculture, Canadian Food Inspection Agency, Trudell Medical, and Ketchum Manufacturing Inc.

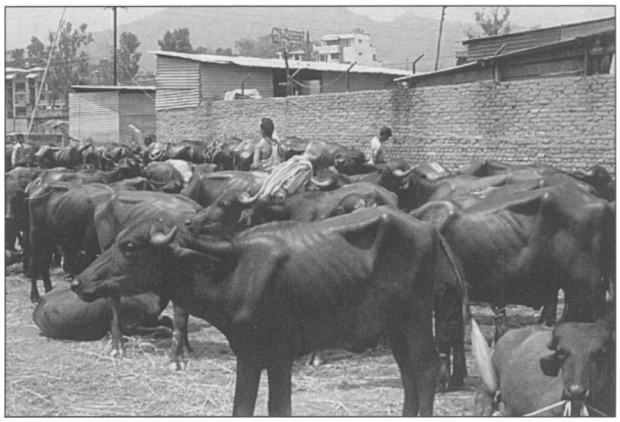

Figure 1. Buffalo at the contractor facility.

Once processed, the meat is loaded into baskets or rickshaws and delivered to open-air market stalls. Bones and hooves are made into buttons and bone meal; the hides are used for leather.

There are significant environmental concerns involving these slaughter sites. Animal feces, intestinal contents, and offal are dumped directly into the river and accumulate downstream along the banks, especially during the dry season. This is of major public health concern, as the river is also used for drinking water, bathing, and washing clothes and dishes. A water sanitation site is being built by the Municipality of Kathmandu to help to improve the quality of the drinking water, but this will not stop the source of pollution.

Plans for the future include the expansion of the buffalo contractor's facility into a slaughterhouse that would allow for the inspection, refrigeration, and packaging of different cuts of meat. This would provide variety for the consumers, decrease the dependence on Indian meat, and allow for testing animals for zoonotic diseases before they enter the food chain.

Milk production and collection in rural Nepal

We also worked with the NZFHRC to examine the milk production system in the villages of Panchkal and Hokse in eastern Nepal and assess the possible implications that the system has the transmission of zoonotic disease. By working with rural farmers and local animal health workers, we were able to observe and document the animal management and milk collection systems.

It is primarily the job of the women to care for the animals and to milk them in the morning and evening. The farmers then carry the milk to a collection center each morning. There are 63 collection centres with volumes varying from 40 to 2500 L/day, depending on location and season. Upon arrival at the collection center, the fat content of the milk is tested to determine payment to the farmer. Samples are mouth-pipetted, the reagent is added, and the samples centrifuged. The milk is normally about 5% to 6% fat, and the farmers are paid about 3 rupees ($0.08 CN) per 1% fat/L.

The milk is pooled into 30-L cans at the collection center and transported to the Panchkal Milk Chilling Centre. The farmers are hired by the collection centres to work as porters, who bring approximately 15 000 L of milk to the chilling center. Of the 63 collection centers that serve the chilling center, the average distance travelled is 12 km, with the longest distance being 30 km and the shortest 50 m. The porters carry 30-kg milk cans in the traditional style, a strap around their head while balancing the can on their back. Over longer distances, tractors, trucks, or buses are used for transportation.

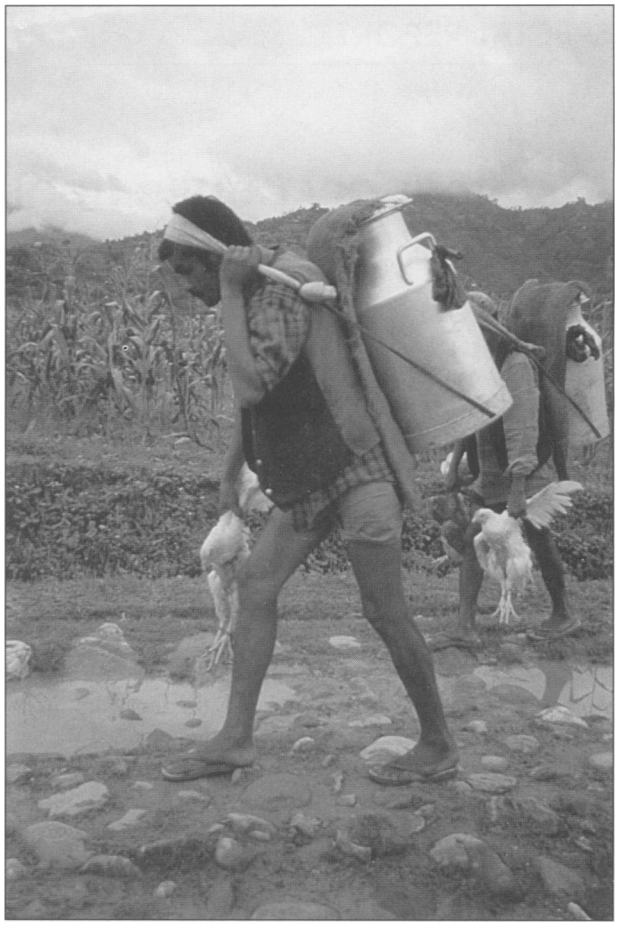

Figure 2. Traditional transportation of milk to the chilling centre.

The Milk Chilling Centre was established by Dr. D.D. Joshi and is the site where milk is tested for bacterial contamination (using a flame test) and for fat and nonfat solid content. This information is recorded in a logbook and used to determine the pay to be given to the collection centre for the milk. Once the tests have been completed, the milk is poured through a cheesecloth strainer into a piping system that passes it through a second filter and into a large tank. The milk is stored at 4°C until refrigerated trucks come each day to transport the milk to Kathmandu for pasteurization. The milk is then sold in bags to consumers in Kathmandu.

Mastitis testing

Historically, mastitis was not a problem in Nepal, as the local cows produced only 1 to 2 L milk/d. However, to keep up with current milk demands, some cows have been crossbred to European breeds, which increases

their production to 10–15 L milk/d. The increased milk production, although beneficial, has also increased the prevalence of mastitis in the milking animals.

California Mastitis Test (CMT) reagent was used to test milking cows, water buffalo, and goats in rural villages. The milk from all goats tested was negative, but it was mastitic in 21.4% of cows and 38.5% of buffalo. Animal hygiene and milking practices are the most likely source of infection, as most people do not wash their hands or the animal's udder before collecting the milk, and the cleaner animals had less prevalence of mastitis. An education program was carried out with the assistance of the NZFHRC translator and the local paravets (animal health workers). By using the CMT test to show the farmers mastitic milk, we believe that we were able to convey the concept of bacteria and the importance of hygienic practices in the prevention of udder infection. This is especially important, as most of the milk is not pasteurized before consumption by the family. The local animal health workers were trained in CMT techniques, and reagent and paddles were left with them to allow for further testing and education in their areas.

Brucellosis testing

Brucellosis is a zoonotic disease of major importance to the livestock and people of Nepal. It can cause production losses and abortion in animals, and undulant fever in humans. Transmission usually occurs through broken skin that is contacted by infected animal tissues and fluids, or from the consumption of infected raw milk or undercooked meat.

Blood samples were collected from the cattle and water buffalo in the villages of Panchkal and Hokse. These samples were combined with serum samples collected previously by the NZFHRC for *Brucella* testing. Two thousand Brucella Card Agglutination Tests (BCAT) were taken to Nepal, and serum from cattle, buffalo, swine, and humans were tested. Although the card test is a nonstrain-specific screening test, and therefore not ideal for individual testing, the NZFHRC felt that it was the most feasible diagnostic option available, given the limited laboratory facilities. The results are presented in Table 1 and are consistent with a study done previously in the Terai region of Nepal. The human serum samples were taken from hospitals in Kathmandu, where people have access to pasteurized milk and less direct contact with livestock. The figure of 0.4%, therefore, may not be representative of the population in the rural villages. The number of positive samples taken from the animals in the rural villages suggests that the people in these areas are at greater risk. More work needs to be done in this area to assess the prevalence of brucellosis in this population.

Table 1. Results of the Brucella Card Test for cattle, buffalo, pigs, and humans

Species tested	Number tested	Number positive	Percentage positive
Cattle	53	2	3.8%
Buffalo	45	7	15.6%
Swine	40	11	27.5%
Human	681	3	0.4%

Clinical practice in Kathmandu

Veterinarians in Kathmandu work for government laboratories during the week and operate small animal clinics during evenings and weekends. The clients are predominantly Europeans and North Americans living in Nepal. We spent 1 mo performing a canine heartworm testing program with Dr. Pradhan at the Patan Veterinary Clinic. Dr. Pradhan wanted to establish the prevalence of heartworm infection, as the climate and large number of mosquitos in the Kathmandu area were conducive for heartworm infection. Testing in Kathmandu is continuing and infection rates are undetermined; however, our preliminary work showed no positive results in the first 25 tests.

Conclusion

This project was an amazing experience for us and was considered very successful by Dr. Joshi. He has asked that another team from the Ontario Veterinary College return during the summer of 2000 to continue public health work. The main aspect of Project Nepal 2000 will be in implementing a rabies vaccination program for stray dogs in Kathmandu and examining humane methods of depopulation.

There are limited resources in Nepal and currently few trained personnel to examine these issues. We believe that veterinary students and health professionals can make an significant contribution to the health of the animals, people, and environment in Nepal, and we are excited to see this project continue.

Acknowledgments

We thank Dr. D.D. Joshi, The Center for International Programs/University of Guelph, Hill's Pet Nutrition Inc., Guelph Rotary Club, Heer's Photography, Pond's Photography, Nutramax Laboratories, Voyageur Insurance, and OVC faculty Dr. Baird, Dr. King, Dr. Lamarre, Dr. Leslie, Dr. Prescott, and Dr. Waltner-Toews.