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Fiji, Bovine Tuberculosis

Bovine Tuberculosis in Fiji: A “One-Health” Problem

Fiji is a small country of 18, 270 square kilometers and is located in Oceania. It is in the South Pacific Ocean, and consists of 333 islands and 500 islets, but with only 110 of islands being inhabited (“Fiji Bureau of Statistics”; “New Agriculturist”). As of 2017, Fiji’s total population was 884, 887 people. About half of Fiji’s population is urban (494, 252 people) and that leaves just under half of the people being rural (390, 635) (“New Agriculturist”).

Fiji has a very warm and tropical climate year-round with an average of 25 degrees Celsius, dropping to 18 degrees in the winter months, and rising above 30 degrees in the summer season. The rainy season stretches from November to April, with the larger islands receiving more rain than the smaller islands. The main islands are steep and volcanic. Most of the smaller islands are rainy and tropical, and are wettest in the south, east, and center. West Fiji is a savannah grassland and it is much drier. Fiji is fortunate to have varying climates as this allows the land to have many purposes. 65% of the land is forests, 10% is permanent pastures, 4% is permanent crops, 10% is arable land, and this leaves 11% of the land for other uses. Sugarcane and tourism are Fiji’s industries, but some other major ones are copra, silver, and small cottage industries. Clothing, gold, timber, fish, fruit, and sugar are major industries, and the main exports. The main agricultural products are not usually exported, and they are: sugarcane, cassava, coconuts, rice, sweet potatoes, bananas, ginger, horses, goats, fish, cattle, and pigs (“New Agriculturist”).

The government in Fiji is a parliamentary representative democratic republic. At an election, every adult can vote for parliament, and the party with the majority of the 50 seats in the house forms government with their leader as Prime Minister. The Prime Minister is then Head of Parliament. The party with the second most seats becomes the official opposition. The President is the Head of State and is appointed by the Prime Minister (Foster). The Ministry of Agriculture is responsible for animal health and agriculture in Fiji.

As for education in Fiji, the countries overall literacy rate is about 93% of adults (over age 15). Primary education in Fiji is free and mandatory and so is secondary school for students ages 12-16 (up to grade 13). Many villages in rural areas have a central school to share, but high schools are only located in towns and cities. University education in Fiji is available in cities, it is not free. Health care in Fiji is free if citizens use government operations, but any private services must be paid for. Health care in Fiji struggles to provide services throughout the whole country, as the geography is complex and hard to get everywhere (Fiji, Ministry of Health and Medical Services).

In Fiji, a typical farm family consists of 2-4 children, 2 parents, and occasionally grandparents. On the large islands, houses are made of wood and concrete breeze blocks, but the smaller islands have houses made of local materials. Western-style houses are not common in rural areas. Many houses will have electricity and clean, running water, but some remote areas rely on kerosene and benzene lanterns. Solar power has also been used increasing over the past few years. Most Fijian farmers are subsistence farmers; they eat what they grow and harvest/butcher it themselves. This means that they eat uninspected food which can carry disease. Rural families often eat rice, sweet potatoes, taro, coconuts, cassava, bread, fruit, fish, and any other product they raise (milk, beef, chicken, etc.) Most of their food is cooked in a Western style as has been adapted in Fiji, but many use small cookstoves and fires. (Olver; Langevin)

Almost all rural Fijians are farmers. Cattle farming in Fiji is much different than it is in Canada or the United States. Most of the Fijian farmers have small farms that are no larger than 10 or 20 head. The larger operations would have up to 100 head. Many farms have both crops and animals, and often raise more than one type of livestock as well. Fiji is a developing country with poorer families and self-sustained operations. Many cattle are dual purpose, so they are milked and used for meat. Different species of livestock are housed and fed together as well. Fiji also has next to no vaccinations for cattle because they do not have the resources or infrastructure to make it happen. Subsistence farming can increase the risk of zoonotic disease transmission because of the close contact of owners with their livestock and the contact between animal species. Zoonotic diseases are diseases that are caused by viruses, bacteria, parasites, or fungi. These germs can be passed between animals and people through direct or indirect contact, and can be vector-borne, food-borne, or water-borne. Zoonotic diseases can seriously affect anyone, but people older than 65 or younger than 5, pregnant women, and people with weakened immune systems are at risk with these diseases (“Zoonotic Diseases”; Hahn; Shope). Fiji has trouble with Zoonotic diseases, including Leptospirosis and Brucellosis, but this paper is going to focus on Bovine Tuberculosis.

Bovine Tuberculosis (bTB) is a chronic disease caused by bacteria that mainly affects the lymph nodes, lungs, spleen, and liver. bTB can live in an animal for years without displaying any symptoms but when they do, the animals are weak, have a small appetite, lose weight, and have a fever. As it gets worse a hacking cough will become present. Symptoms are shown inconsistently, so animals may seem sick and then appear to recover before showing symptoms again. bTB is most often spread through respiratory secretions, feces, and unpasteurized milk, but is also communicable through urine, vaginal secretions, and semen. Most animals are infected as a nursing calf from their dam’s milk, but they can catch it when they are older through nose-to-nose contact or shared water sources (Government of Canada).

In people, bTB is also a respiratory disease that affects lymph nodes and lungs. Some symptoms include a fever, night sweats, and weight loss (“Mycobacterium Bovis in Humans”; Davis), but we commonly associate TB with coughing up blood. If this disease goes untreated, death can occur. There are two types of Tuberculosis. Human TB and bovine TB are different diseases but with similar symptoms. Knowing which TB a person has is important for treatment. One of the drugs used to treat TB in humans is not effective for bovine TB. Humans most often contract bTB from animals because they are consuming unpasteurized dairy products or come into direct contact with contaminated milk, blood, or saliva with an open wound. bTB can also be contracted through contaminated water sources (Langevin).

Bovine TB is a large problem in Fiji. It hurts human and animal health and creates a financial burden for farmers. It needs a solution. Luckily for Fiji, they can learn from other countries that have already tackled the bTB problem such as Canada, who has had a “mandatory national eradication program since 1923.”- CFIA. This eradication program includes mandatory testing at packing plants, wildlife screening, and testing of herds and contact herds if an infected animal is found. Because of this program, Canada’s cattle herd is considered TB free. Early on in the program, entire herds were destroyed because of a single positive test. The test itself was not very accurate, so many healthy animals/herds were destroyed. Canada’s current program is much better, but they have made mistakes in the past. They continue to destroy healthy animals as the Caudal Fold Test (CFT) still results in a high number of false positives. Fiji is fortunate in this way, as they have newer technology available and can learn from other countries’ mistakes to eradicate TB more cost effectively. My solution for Fiji has 4 steps:

1. Improve the bTB screening in Fiji.
2. Educate farmers on bTB and the importance of pasteurizing their own dairy products.
3. Set-up a compensation program for farmers with infected animals.
4. Re-stock Fiji’s livestock population.

Increasing the voluntary screening in Fiji will help because an unknown problem cannot be solved. Fiji does currently have a screening program (BTEC), but it does not include the smaller herds (Borja). This is a big miss, because smaller operations are high risk for Zoonotic diseases. At BTEC, they currently run the Caudal Fold Test (CFT) where an injection of tuberculin is put under the tail. 72 hours later, the animal is checked to see if they have any swelling. If they do, this indicates a positive test on the animal, so they are then sent to slaughter. Once the animal is dead, a necropsy is conducted to check if they are actually infected. The CFT is found to result in 2-6% false positives and 15-20% false negatives. This test also requires two days of chute work which is when the animals must be contained and run through a chute to conduct the test. This is not ideal as most Fijian farmers do not have chutes. It is a lot of cost and work for a moderately accurate test. However there is a new test for Bovine Tuberculosis.

Actiphage is a new test developed by PBD Biotech that is used to identify mycobacterial diseases like Bovine Tuberculosis and Johne’s disease. This test can be done with a single blood or milk sample, and can be finished within 8 hours. With Actiphage, you can test an animal whenever you want and more than once. This is a highly sensitive test as it can detect less than 10 live mycobacteria in 2 mL of blood, and the test can tell the difference between dead and live mycobacteria. This means that it will be a negative test if only dead mycobacteria are found. PBD Biotech is currently looking to do trials on their Actiphage test in highly infected areas in hopes of obtaining their World Organisation of Animal Health (OIE) validation (“Actiphage a Rapid Test”; “How to Trial Actiphage”). Since it is in a trial stage, testing is cheaper so it would be a more cost-effective approach for Fiji. I think that Fiji should consider this test to improve their bTB problem. With this test, they will only have to handle the cattle once, and they can get results faster. This would reduce any spreading time for infected animals, and the test is more accurate than the CFT (Hammond). Actiphage is a more expensive test than the CFT, it could be up to twice the cost, but more accurate testing should result in fewer healthy animals being destroyed. This means lower compensation for the government to pay out which would offset the higher testing costs.

Another unique feature of the Actiphage test is its ability to identify the difference between dead and live bacteria. This makes it a test that can be used alongside a vaccination program. bTB vaccinations are not currently used because the CFT cannot tell the difference between immunized and infected animals. The only existing vaccination for Bovine Tuberculosis is Bacillus Calmette-Guerin. It could be used on cattle in Fiji (Hope). A vaccination could be another part of the eradication in Fiji.

In order to implement Actiphage testing a portable handling system, vet or vet tech, and working crew need to be provided. They would need to travel from island to island easily for testing. Luckily, the BTEC program is already ambulatory and often provides their own portable chute (Olver). A herd health incentive such as parasite control or vaccine could also be used to improve overall cattle health in Fiji, since they are already in a chute. Lastly, they would need to create a management strategy program to help farmers dispose of infected animals and cost effectively rebuild their herd.

bTB is such a large problem in Fiji that possibly over half of Fiji's livestock population is contaminated. This will require mass eradication. Fiji has a slower slaughter system that might not be able to keep up, but the animals need to be disposed of quickly. A compensation program should be put into place. Every farmer who euthanizes the infected animal themselves should be paid market price, because doing so reduces the spread of bTB. With any screening program in Fiji, once an animal receives a positive TB test, they would be euthanized by the owner. Euthanized animals would have to be disposed of, as they cannot be used for meat. Disposal sites would most likely be local, and could be as simple as a burial pit or burn site nearby. In general, most Fijians do not own stock trailers. As such, transportation is limited.

Once infected animals are eradicated, Fiji's cattle population will drop. Their numbers are already low due to a Brucellosis eradication a few years ago, so they need to repopulate. Semen and embryos could be imported from clean herds around the world. A bonus to importing genetics is that they can also improve beef carcass quality in Fiji. Many carcasses look to be poor quality (Brown), so breed improvement could be a side benefit for both Fijians and their tourist population.

A second part of the solution to improve animal and human health in Fiji is education. People should know what bTB is and how it spreads as well as its symptoms. They could learn not only the health benefits, but the long-term economic benefits of cleansing their herd to avoid spreading. An education program could also explain what bTB lesions they can look for in their home-slaughtered meat, and that if they notice these lesions they should contact the Department of Agriculture to find out if their meat is safe and if they have bTB in their other animals. People should understand that they can get help managing bTB and that they could get compensation for any infected animals. Although it is illegal in Fiji to butcher your own animals, many still do. Clearly rules are not going to fix the bTB problem, so efforts would be better put towards an ag extension or education program. Fiji already has an ag extension program: the Animal Health & Production Division of the Ministry of Agriculture. This program would be the logical choice to deliver education. However, a general mistrust of government might render this ineffective. If so, other non-government organizations may be better suited. Whichever organization was chosen would be responsible for delivering information to citizens.

Fresh pasteurized milk is not commercially available, so people are drinking Ultra High Temperature milk (Tetra packs) or fresh milk. Home pasteurization of raw milk should be encouraged in Fiji. Pasteurizing milk at home is actually very easy. First, make sure that all the containers are sterilized before adding any milk. Set up a double boiler with water in the bottom and milk on top. Heat milk slowly to 63 degrees Celsius for at least 30 minutes, or 72 degrees Celsius for minimum 15 seconds. Then, pour milk into sterilized containers in the fridge so they can cool down. The now pasteurized milk is good to keep in the fridge for 2 weeks (Environmental Public Health). Pasteurizing milk makes it much safer to drink as it kills Bovine Tuberculosis and other Zoonotic diseases. It would be an effective way to significantly decrease the spread from animals to people.

A solution needs a leader and funding. Currently, the New Zealand Ministry of Foreign Affairs and Trade funds the BTEC program, but I think that to extend this program, the Ministry of Agriculture should take care of expanding tests, disposing of sick animals, and an embryo/seed and compensation program. The Ministry of Health could cover the education, as that is more human than animal health related. For any further funds in this testing program, a per head checkoff of about \$5 per head could be put in place. A checkoff program is where a set amount of money is taken from every animal sold, and this money goes toward improving other aspects of the cattle industry such as bTB testing. Organizations such as ILRI and the FAO have mandates to... “support large-scale efforts to control neglected zoonoses such as cysticercosis and brucellosis.” and “generate evidence on the cost and impact of zoonoses and the benefits of their prevention.” -ILRI and to “lead(s) international efforts to defeat hunger and improve nutrition and food security.” -FAO. They are natural partners in this human/animals health improvement project. ILRI is an organization that focuses on human and animal health. They have dealt with other zoonoses in Kenya and East Africa, so they could help with testing animals and funding parts of the program. Organizations such as the WHO and FAO would be useful for education citizens and providing further funding. The Animal Health & Production Division of the Ministry of Agriculture in Fiji could be involved with testing and eradicating animals, and education. PBD Biotech would provide the TB test for the program. These organizations are either closely connected to Fiji or the solution, and if they’re not, they are large organizations that are there to improve human health.

Some barriers that may make this program difficult include money and general mistrust of government. Money is always a problem, but with a checkoff program and funding from NGO’s, it could be mitigated. There could be producer opposition to a checkoff program. Other countries have overcome this by having an “opt-out” rather than “opt-in” delivery. In that case, producers apply to get their money out rather than send their fees in. Mistrust of government is a larger problem, but having an NGO or local community group deliver the program may help. Including a trusted community member in the organization may also help.

Bovine Tuberculosis is clearly a human and animal health problem for rural farmers in Fiji, and the technology exists to solve the problem. With bTB eradicated in Fiji, small farmers would be able to reduce their own health risks, improve their herd health, and increase their income. By providing a solution, we can truly solve this “One-Health” Problem in Fiji.

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