

Antibiotic Mastitis Treatment for Lactating Cows

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Part 1: Product Information

Mastitis in Cattle

Mastitis is a bacterial infection in the mammary gland of the udder that causes redness, hardness, swelling, major discomfort and, when not treated correctly, can lead to the death of the animal. Mastitis is the response from bacterial pathogens that enter the teats and cause inflammation within the glands (AHDB, 2015). These pathogens are either contagious or environmental. Contagious pathogens are found within the skin of the udder or teat and are typically passed from cow to cow during milking when equipment and teats are not disinfected properly. Environmental pathogens are found in the bedding and/or housing areas and can pass from cow to cow during milking or when they are eating, sleeping etc. (AHBD, 2015).

There are a number of pathogens that cause Mastitis but the three main ones are *Streptococcus uberis*, *Staphylococcus aureus*, and *Escherichia coli* (*E coli*) (AHBD, 2015). *Streptococcus uberis* causes environmental mastitis as it is found in the bedding and is very acute, however it can be treated with antibiotics. The main cause of contagious mastitis is *Staphylococcus aureus* as it is great at attaching itself to the teat and udder. It is difficult to treat with antibiotics as it gets trapped in areas that antibiotics are not able to reach. *E coli* is an environmental pathogen that is generally found on all farms as it lives in feces. *E coli* is the main cause of environmental mastitis and left untreated, treated incorrectly or not treated early enough, can cause the animal enormous pain and even lead to its death. This type of mastitis does not typically show symptoms, therefore is hard to diagnose (AHBD, 2015).

Mastitis symptoms can show up in the udder as swelling, redness, pain, and the affected area may be hot to the touch. Other symptoms will appear in the milk product as a yellowish colour, with the infusion of flakes or pus (see figure 1) (AHBD, 2015). If not treated or depending on the severity of the case, mastitis can cause the cows temperature to rise, have sunken eyes, loss of appetite, dehydration, lower milk yield and loss of mobility (AHBD, 2015).

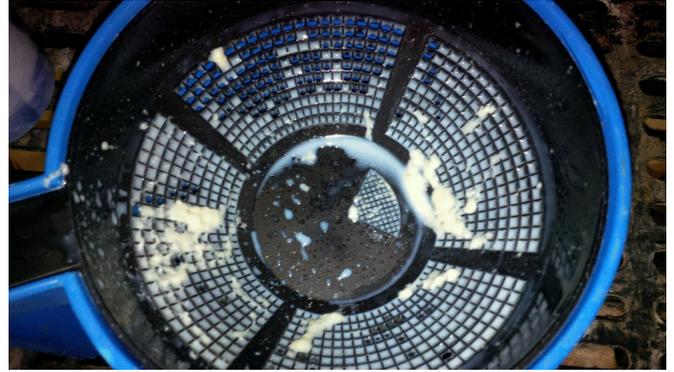


Figure 1: Flakes and pus in milk from a cow infected with Mastitis (Source: JStewart)

Product

The product I chose is an antibiotic called Special Formula 17900 Forte. Special Formula is available in tubes containing 10 mL of product. The key medical ingredients are Penicillin, Dihydrostreptomycin, Novobiocin, Polymyxin B Sulfate, Hydrocortisone Acetate, and Hydrocortisone Sodium Succinate (North American Compendiums, 2015). This product can be purchased by the box, which contains 20 tubes and 20 alcohol disinfectant wipes, for approximately \$350 Canadian (personal conversation Darrel



Figure 2: Special Formula 17900-Forte comes in a small box containing 20 tubes. (Source: J. Stewart)

Fried) from a local veterinary office (see figure 2). Typically the product is sold to a dairy farmer who is a client of the clinic. It does not have to be administered directly by a vet.

Treatment

The treatment is very easy to administer. For safety of the farmer, typically the cows are tied in a squeeze or between two gates to keep them still. The cow needs to be completely milked out prior to treatment. For the initial treatment farmers in Canada will treat the entire udder instead of just the infected quarter, this is to make sure any bacteria transferred is also destroyed.



Figure 3: The tip of the tube is inserted into the opening of the teat. (Source: J. Stewart)

To administer the treatment, each teat needs to be washed and dried completely then disinfected using the alcohol wipes (North American Compendiums, 2015). Once this has been done the tip of the tube is inserted into the teat canal, plunger is pushed and all contents of the tube enters the udder (see figure 3). This should be repeated for every quarter. Once the udder has been treated the udder should be gently massaged to push the antibiotic up and into the mammary glands. The teats should then be sprayed with a disinfectant dip such as iodine. This treatment can be repeated every 24 hours until the cow is clear. Normally only one quarter will show signs of being infected, if this is the case after the initial dose, only the infected quarter needs to be treated.

There are certain health factors to people if meat or milk is consumed after this treatment. The milk given from a treated cow cannot be consumed for at least 72 hours after the last treatment. The meat from a treated cow cannot be used as food products for up to 24 hours after the last treatment (North American Compendiums, 2015).

Zoetis (Pfizer)

Pfizer is a very large pharmaceutical company that does research, manufactures and produces many different medical products (Zoetis, 2015). Zoetis was born from Pfizer and became the leading animal



Zoetis.com, 2015

health company in 2013. They produce vaccines, parasiticides, anti-infectives, medicated feed additives and other pharmaceuticals for over seven different species including cattle (dairy and beef), horses, poultry, pigs, sheep and house pets (cats and dogs) (Zoetis, 2015). Zoetis is a global company that has locations in 120 cities all around the world including their headquarters in Kalamazoo Michigan and a satellite location in Kirkland Quebec (Zoetis, 2015). Zoetis has over 60 years of animal health experience, employs over 10 000 people and has an annual revenue of \$4.8 billion globally.

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Benefits to Canada

Selling Special Formula 17900 to Nepal would increase Canadian jobs, which in turn would help to make some Canadian's lives better. It will take many people in order for this product to be manufactured, packaged and shipped to Nepal. Zoetis would require more employees for manufacturing, packaging and labelling. The shipping company would require drivers to transport the product from the manufacturer to the depot. The last step would be pilots

to fly the product to Nepal as well as personnel at the airport. While not each company who touches this product from manufacture in Canada to delivery in Nepal will require additional manpower for this scenario alone, increasing the production of this product along with the other requirements for shipping goods around the world, will support steady employment for the employees of these companies.

Even though the dairy industry is not very large in Nepal, there is a desperate need for animal health products. By exporting this product and allowing farmers to see the benefits of it, Zoetis could end up exporting other medication and vaccination products. This could be an opening for a large partnership between Zoetis and Pharmaceutical companies in Nepal.



<http://www.postaltechnologyinternational.com/news.php?NewsID=46656>

Another benefit to Canada will be the increase in revenue. If a partnership forms between the two countries, the result would be a larger revenue for Zoetis. With Nepal being a small, poor country it would not be a great increase, however every little bit counts!

Part II: Nepal

Introduction to Nepal

Nepal is a small country of approximately 147 000 square kilometers, located between China and India (see figure 4) (CIA, 2015). Nepal has 3 major regions: Terai areas in the south, hilly regions in the middle and mountains in the north



Figure 4: Nepal is a small country surrounded by China and India.
(Source:

<http://vedicodyssey.com/spiritualadventures/2010/06/01/map-of-nepal-and-neighboring-countries/>).

(CIA, 2015). The climate in Nepal ranges from subtropical in the lowlands to cool in the mountains (Bradford, 2015). Approximately 30% of the land is used for agriculture. The agricultural land is 15% arable, 12.5% permanent pasture and the remaining 1.2% is permanent crops (CIA, 2015). The currency used in Nepal is called rupees. One Canadian dollar is equal to 50.05 rupees.

Nepal has a population of approximately 31 million people (Bradford, 2015). The most common language in Nepal is Nepali and the most common religion is Hindu. There are many other religions, languages and cultures within the country. Eighty-one percent of the population live in rural areas and 75% of the population work in agriculture (CIA, 2015). Children only spend 12 years in school which accounts for the low literacy rate. Only 64% of the female population and 53% of the male population is literate (CIA, 2015). Children between the ages of 5 and 12 make up 34% of labour. These children are pulled out of school or made to work physical jobs and go to school as well (CIA, 2015).

The CIA World Fact book, as of March 2005, states that Nepal is the 48th poorest country in the World. The Nepalese on average make less than \$200 a year, half the population live below the poverty line and half the children are considered to be malnourished (Nepalvista.com, 2015).

Agriculture in Nepal

Agriculture makes up over 30% of the GDP in Nepal (CIA, 2015). The main crops grown consist of rice, corn, wheat, and root crops. Farmers raise cows for milk and buffalo for their meat. In the Hindu religion, a cow is considered a sacred animal and must not be consumed for food. Nepal has approximately 3 million livestock holders, a population of approximately 7

million cows and approximately 3 million buffalo (Singh and Pundir). The average small family farm has 3-4 bovines each. In 1998 the average milk yield was 380 kg per cow in Nepal (Singh and Pundir) compared to almost 9000 kg per cow in Canada (CDIC, 2015).



Figure 5: <http://www.spotlightnepal.com/News/Article/MASF-A-Working-Approach>

Over 500 000 households contribute to the production and sale of milk products within Nepal (CDCAN, 2015). The Nepalese government promotes the dairy industry through investment (CDIC, 2015). In 2014 the dairy industry made up approximately 9% of the national GDP (Manandhar, 2014). The majority of agriculture in Nepal are cooperatives ranging

from multipurpose to specifically dairy (Poudel, 2007). There are approximately 1700 dairy cooperatives alone (CDCAN, 2015). The average daily need for milk is approximately 8.2 million litres, where the average production is only 4.26 million litres (Manandhar, 2014). Only half of what is needed for the population in the entire country is produced. What is the cause of this? The low quality and quantity of milk produced is caused primarily by little to no animal health care. Poor blood lines also contributes to this and the poor bloodlines can also be attributed to poor animal health.

Mastitis in Nepal

Mastitis is a bacteria that affects all types of bovine breeds and can be found throughout the world. A study was done in Nepal where 250 cattle and 212 buffalo were examined for this bacteria. Thirty-five percent of the quarters in the cattle and 27% of the quarters in buffalo were infected (Subedi, Dhakal, 2002). A large number of farmers are not aware of mastitis, which

resulted in no treatment for the animals and/or no preventive measures taken (Khanal and Pandit, 2013). The study done by Khanal and Pandit concluded that (2013) “the farmers should be inspired for mastitis management, udder health management, shed management and nutrition management through training, workshops, tours, farmers’ schools for hygienic milk production in commercial scale” (pg. 54).

Mastitis can cause a huge decrease in income for farmers as well as cause an increase in expenses. If Mastitis is not treated it will result in the death of the animal, and therefore increases expenses as the animal will need to be replaced.

Transportation and Distribution

The product itself is very easy to transport as it comes in fairly small boxes and is light weight. It would be shipped from the manufacturer’s facility in Kirkland, Quebec by FedEx for approximately \$275 to Kathmandu, Nepal by international Economy. According to the Canadian Import and Export Policy, the product Special Formula 17900 would not require any special export permits as it is manufactured as well as sold in Canada (Government of Canada, 2010). This product needs to be stored in a temperature range from 15°C to 25°C and has a shelf life of approximately a year (North American Compendiums, 2015).

This product should be distributed by a Veterinary Medical Centre. There are a number of companies in Nepal that purchase, import and distribute veterinary medicine (see table 1).

Table 1: Veterinary Medicine Companies in Nepal (Business Ports B.V)

Best Vet Center Kalanki, Nepal	Gurans International P Ltd. Teku, Nepal	Haki International Kathmandu, Nepal	Medilink International Kathmandu, Nepal
Nepal Annapurna International Pvt Ltd. Kathmandu, Nepal	Niprada Vet Pharma Chitwan, Nepal	Pancharatna Vet Pharma Kathmandu, Nepal	The Kennel Kathmandu, Nepal

Benefits to Nepal

Two of the main benefits of shipping this product to Nepal would be better milk quality with increased quantity as well as higher income for the farmers. As we have previously stated, Nepal is a very poor, malnourished country. As a food product milk is high in carbohydrates, fat and protein as well as being a great source of vitamins and minerals. In Nepal approximately 51.5 kg of milk is available per capita per year, where the recommended average is 91.25 kg (Liu, 2013). There is a huge potential for increase in production to help meet the required demand.

The Dairy Counsel of California (2015) recommends that children between the ages of 4 and 8 should consume at least 2.5 cups of milk per day as it contains nutrients that are under consumed by most people. People from the age of 9 and up should consume at least 3 cups of milk. The Nepalese farmer already has 3-4 cows on their farm, so adding to the production of



Figure 6: Dairy products have high nutrition value.
 (<http://www.ktm2day.com/2011/07/12/ddc-sets-out-plan-for-expansion/>)

milk would be an easy way to help nourish their family. Having better quality of milk to consume will help to better the health of the Nepalese. Having a larger quantity of milk to consume is great, however; if it is of poor quality it defeats the purpose. Mastitis causes the milk to have higher bacteria and somatic

cell counts. The protein and fat content in milk is faster to deteriorate in mastitic milk than in healthy milk, therefore, it does not have as high of nutritional ingredients (PennStateExtension, 2015).

Increasing income for Nepalese farmers would have a huge benefit not only for the individual household themselves but also for the total GDP of Nepal. Over 6% of income for farmers in the mountain and rural hill areas is from dairy compared to 1% that comes from meat (see figure 7) (Maltsoglou and Taniguchi, 1996-97).

Region	Mean Income (NRs.)	Share of Home Production Income(%)	Share of Total Income (%)
Dairy			
Mountains	1,678	9.4	6.1
Rural Hills	2,070	11.9	6.3
Rural Terai	1,041	7.5	3.2
Other Urban	950	10.9	1.9
Katmandu	254	6.6	0.4
Total	1,365	9.7	4.2
Meat			
Mountains	221	1.6	1.0
Rural Hills	333	2.2	1.2
Rural Terai	142	1.7	0.6
Other Urban	102	1.7	0.2
Katmandu	17	0.8	0.0
Total	196	1.8	0.7

Figure 7: Comparison of Dairy vs. meat for Nepalese farm income. (Maltsoglou and Tangiguchi, 1996-97).

Recommendations

This is a great product for developed countries and I have seen firsthand how quickly it treats infected cows, however, I do not feel that this product would be suitable for developing countries. As stated above this product costs \$350 Canadian for a box of 20 tubes, that equals \$17.50 Canadian each. Convert that to Nepalese Rupees and it is equal to Rs 1403. Unfortunately that is more than 7 times what a farmer makes in a year.

I also do not feel that shipping this product from Canada to Nepal is a good idea because Zoetis has locations all over the world including China (Zoetis, 2015). It would most likely be cheaper for Nepal to ship it directly from a closer location.

Using this treatment takes the cows out of useful production for up to 12 milkings, there are other antibiotics that would be as effective and only take the cows out of production for 6 milkings. It would be more cost effective for the Nepalese farmer to use these. The largest cost in mastitis is the loss of usable milk.

Preventative Measures

There are many different, cost effective measures that can be taken to prevent a cow from becoming infected with Mastitis. I believe that teaching these to the Nepalese farmers would be a good place to start. Some of these include:

1) Keeping the bedding areas clean of feces and urine. Environmental pathogen live in these types of habitats.

2) When cleaning or adding new bedding, a disinfectant lime spray can be added as well. This helps to keep the pathogens out of the bedding. It is very affordable at \$10 Canadian per bag (personal conversation Brian Fried) (see figure 8).



Figure 8: Spray lime to apply before bedding (Source: J. Stewart)

3) Disinfecting milking equipment with soap and water (whether that be hands or actual milkers) before and after milking each cow.

Disinfecting the cow's teats before and after milking. This can be done by using a disinfectant such as iodine if available or simply using soap and water. Iodine is good for after milking as it coats the teat and prevents bacteria from entering (see figure 9). Iodine spray can be purchased for as little as \$10 a gallon and when bought in bulk can be even less (personal conversation Brian Fried).



Figure 9: Iodine solution used to disinfect the cows teats before and after milking. (<http://www.delaval.com/en/-/Product-Information1/Animal-comfort--care/Products/Udder-health/Teat-dips/Blockade/>)

4) Keeping contaminated milk away from others in the herd. Don't allow the animals to walk or lie where there has been contaminated milk. The animal will then become a carrier for the pathogen.

5) The last step that can be taken once a cow has mastitis is to dry up the infected quarter or stop milking it. Cows will dry up themselves after a period of time, especially once the

calves (in nature) stop feeding. Allowing the cow to dry up will prevent her from spreading to others in the herd.

Conclusion

I believe that teaching the Nepalese farmers the preventative measures and introducing the idea of disinfectant sprays for both the animal and their bedding would be a very beneficial and much more cost effective. The antibiotic itself is not an affordable option for Nepal. The cost for the product alone and then to ship it to Nepal is more than a Nepalese farmer could ever afford. If antibiotics are needed in Nepal it would be much more cost effective to ship from Zoetis' location in China before sending all the way from Canada as both production and shipping costs would be lower. Antibiotic mastitis treatment for lactating cows is a great idea, however not feasible due to cost and location for Nepal.

References

Agriculture and Horticulture Development Board. 2015. Pathogens: The Cause of Mastitis. AHBD Dairy. [Internet]. Kenilworth, Warwickshire, UK. [2015, Nov 27; 2015 Nov 25]; [about 2 screens]. Available from: <http://dairy.ahdb.org.uk/technical-information/animal-health-welfare/mastitis/pathogens-the-cause-of-mastitis/#.VIYpx3arTIU>

Bailey K, Heinrichs J and Jones C. 2005. Milk Components: Understanding the Causes and Importance of Milk Fat and Protein Variation in Your Dairy Herd. PennStateExtension. [Internet]. University Park, Pennsylvania. [2015 Nov 29]; [4 screens]. Available from: <http://extension.psu.edu/animals/dairy/nutrition/nutrition-and-feeding/diet-formulation-and-evaluation/milk-components-understanding-the-causes-and-importance-of-milk-fat-and-protein-variation-in-your-dairy-herd>

Bradford, Alina. 2015. Nepal: Facts about Geology and Culture. LiveScience. [Internet]. Purch.com. [2015, Nov 27]; [2 screens] Available from: <http://www.livescience.com/50734-nepal-facts.html>

Business Ports B.V. Veterinary Products1.com. Veterinary Medicine Suppliers in Nepal. Retrieved from: <http://www.veterinaryproducts1.com/veterinary-medicine-suppliers/nepal.html>

Canadian Dairy Information Centre. 2015. Average Production by Breed. Canada.ca [Internet]. Ottawa, ON. [2015, Nov 30; 2015 Nov 11]; [1 screen]. Available from: <http://aimis-simia-cdic-ccil.agr.gc.ca/rp/index-eng.cfm?action=pR&PDCTC=&E=1&R=213>

Central Intelligence Agency. 2015. The World Factbook. CIA. [Internet]. Washington. DC. [2015, Nov 19; 2015 Nov 11]; [about 10 screens]. Available from: <https://www.cia.gov/library/publications/the-world-factbook/geos/np.html>

Dairy Council of California. 2015. Nutrients in Milk. Healthyeating.org. [Internet]. [2015, Nov 29]; [2 screens]. Available from: <http://www.healthyeating.org/Milk-Dairy/Nutrients-in-Milk-Cheese-Yogurt/Nutrients-in-Milk.aspx>

Dhakal IP and Subedi K. 2002 Clinical Mastitis in Different Breeds of Cattle and Buffaloes at Chitwan, Nepal. 23:65-69. Abstract retrieved from Journal of the Institute Agriculture and Animal Science: <http://www.nepjol.info/index.php/JIAAS/article/view/744>

Government of Canada. (June 1, 2010) Import and Export Policy for Health Products under the Food and Drugs Act and its Regulations. Retrieved from: http://www.hc-sc.gc.ca/dhp-mps/compli-conform/import-export/pol-0060_biu-uif-eng.php#a53

Khanal T and Pandit A. 2013. Assessment of sub-clinical mastitis and its associated risk factors in dairy livestock of Lamjung, Nepal. Nepal Journals Online. [Internet]. [2015, Nov 30; 2015 Nov 28]; [about 5 screens] Available from: <http://www.nepjol.info/index.php/IJIM/article/view/8322>

Liu C. 2013. The milky way to prosperity. Nepal Times. [Internet]. Kathmandu Nepal. [2015, Nov 30; 2015 Nov 29]; [2 screens]. Available from: <http://nepalitimes.com/article/business/Business-the-milky-way-to-prosperity,519>

Maltsoglou I and Taniguchi K. 1196-1997. Poverty, Livestock and Household Typologies in Nepal. FAO.org[Internet]. [2015, Nov 29]; [15 screens]. Available from: <http://www.fao.org/ag/againfo/programmes/en/pplpi/docarc/wp13.pdf>

Manandhar N. 2014. The Milky Way. Kathmandu Post. [Internet]. Kathmandu Nepal. [2015 Nov 28]. [about 3 screens]. Available from: <http://kathmandupost.ekantipur.com/news/2014-10-01/the-milky-way.html>

Nepalvista.com. 2015. Poverty. Nepalvista.com. [Internet]. [2015, Nov 29]: [3 screens] Available from: <http://www.nepalvista.com/features/about-real-nepal/poverty>

North American Compendiums. 2015. Special Formula 17900 – Forte Suspension. Drugs.com [Internet]. [2015, Nov 23; 2015 Nov 11]; [1 screen] Available from: <http://www.drugs.com/vet/special-formula-17900-forte-suspension-can.html>

Poudel D. 2007. Farmer Cooperatives for Food Self-sufficiency, Agricultural Commercialization, and the Socio-economic Development of Nepal. CFFN.ca. [Internet]. [2007, Oct. 7; 2015 Nov 28]. [about 5 screens] Available from: <http://cffn.ca/2007/10/farmer-cooperatives-for-food-self-sufficiency-agricultural-commercialization-and-the-socio-economic-development-of-nepal/>

Pundir R and Singh. Problems and prospects of smallholder dairy production and marketing in South Asia: An overview. Ilir.org. [Internet]. [2015, Nov 15]; [about 5 screens]. Available from: https://www.ilri.org/InfoServ/Webpub/fulldocs/South_South/ch11.htm#P267_28056

Zoetis Canada. (2013-2015). Zoetis at a Glance. Zoetis.com. [Internet]. [2015 Oct 21]; [1 screen]
Available from: <https://www.zoetis.ca/about-us-pages/about-us.aspx>