

Perspectives

Emerging Brucellosis Outbreaks Associated with Unpasteurized Milk in China

Dongri Piao¹; Zhongjie Li²; Xiaowen Yang¹; Guozhong Tian¹; Hongyan Zhao¹; Hai Jiang^{1,†}

Brucellosis is caused by several species of *Brucella* and is one of the most common zoonotic diseases globally. Common species causing human brucellosis include *B. melitensis*, *B. abortus*, and *B. suis* (1). Although deaths due to *Brucella* infections are rare, infections can cause intermittent fevers, malaise, and muscle, joint, and back pain. If not treated effectively with antibiotics, infections can become chronic and difficult to cure (2).

UNSTERILIZED MILK INTAKE RAISES CONCERNS OF EMERGING BRUCELLOSIS OUTBREAKS

As a zoonotic disease, transmission to humans occurs primarily through direct contact with the placenta or fetus from infected animals or by indirect contact from infected animal byproducts such as milk, meat, and cheese (3). The primary transmission route of brucellosis was through occupational exposure based on the China National Surveillance Program (4–5). In recent years, China CDC has reported hundreds of cases of human brucellosis resulting from exposure to *Brucella melitensis* after the consumption of raw milk. During 2005–2018, there were 242 public health emergency events according to the annual brucellosis surveillance report. Among those, professional exposure was 92.2% (223/242) and food-borne transmission was 5.8% (14/242). There were 56 public health emergency events of brucellosis in 2019. Among those, 33 were related to animal husbandry, 8 to exposure to raw milk, and 8 to processing and marketing of animal products. In 2020, Wang et al. reported a food-borne outbreak of brucellosis caused by drinking raw goat milk in Wuhua County, Guangdong Province. A total of 30 cases were found and 21 *Brucella* strains were identified as *B. melitensis* bv.3 from the patient blood samples (6). Based on a review of the literature, Qin et al. also reported a food-borne outbreak of brucellosis caused by drinking unpasteurized ewe's milk in Pinggui County, Guangxi

Zhuang Autonomous Region in 2016. A total of 122 cases were found and only one *Brucella* strain, *B. melitensis* bv.3, was identified from the index case's marrow sample. The MLVA-8 genotype of this strain was “42” and it belonged to the predominant genotype in China (7).

Some cases of the consumption of unpasteurized dairy products were also reported in endemic countries such as Asia, Middle East, Africa, Central and South America (8–9). Furthermore, in non-endemic countries, brucellosis has also been reported to occur after travel to and subsequent consumption of raw dairy products in endemic countries (10). Recently, the increase in the consumption of raw dairy products comes not only from cows, sheep, and goats, but also from camels, llamas, donkeys, horses, buffaloes, reindeer, and yaks, which poses an additional risk of brucellosis transmission (11). Interestingly, US CDC reported that human brucellosis outbreaks have been confirmed to be caused by exposure to the live-attenuated vaccine strain *Brucella abortus* RB51 following the consumption of raw milk (12–13). These messages demonstrated the need for intensified concern of raw milk acquired human brucellosis outbreak.

UNSTERILIZED MILK INCREASES THE RISK OF TRANSMISSION OF BRUCELLOSIS

According to the National Food Safety Standards for Sterilized Milk (GB 25190–2010) and Pasteurized Milk (GB 19645–2010), sterilization involves the heating of raw milk to a defined temperature for a specific period of time to inactivate live, disease-causing organisms such as *Staphylococcus aureus*, *Escherichia coli*, and *Salmonella enterica*. The process has been invaluable in the improvement of the safety of milk for human consumption. As the main product of the Chinese dairy market, cow milk had been closely monitored by the Chinese government for the past few

years. However, goat milk was often consumed by private individuals as a substitute milk product, and there had been little monitoring of goat milk (14). Particularly in rural areas, the emerging interest in natural foods and products has led to the increased preference for raw milk due to its acclaimed health benefits that are believed to be destroyed upon pasteurization. Local inhabitants lack awareness on the food-borne transmission of brucellosis when sheep's milk is contaminated with *Brucella*. The elderly, children, and persons with immune-compromised conditions are also high-risk populations because they are more likely to drink the raw milk. Therefore, legislation and supervision of raw milk and related products are in urgent needs. In order to master the status of *Brucella* contamination of raw milk and milk products and provide a basis for risk assessment, pilot sentinels were set up in 9 provincial-level administrative divisions (PLADs) (Shanxi, Inner Mongolia, Jilin, Heilongjiang, Henan, Guangdong, Sichuan, Shaanxi, and Gansu) by the China National Center for Food Safety Risk Assessment in 2020.

STRICT REGULATIONS ARE URGENTLY NEEDED

Field epidemiological investigations suggest that trade of unquarantined live animals from endemic areas may be the cause of the brucellosis outbreak in non-endemic areas. In the past decades, there were no outbreaks of brucellosis in southern China. As a result of advances in traffic and logistics, the risk associated with importing sick animals (mainly sheep) from high-risk areas to southern provinces has increased rapidly. In addition, insufficiently strict regulations of the sale of unpasteurized milk in some rural areas probably lead to brucellosis outbreaks. As family-based breeding is not generally supervised, the risk of infection associated with the sale or trade of sheep, meat, and dairy products privately from endemic areas is higher. Therefore, effective control of sheep and goat brucellosis will significantly reduce the risk of human brucellosis. We recommended the following preventative measures that should be taken by all stakeholders in China: 1) strengthening brucellosis information dissemination and dairy products marketing supervision, especially in non-endemic rural areas; and 2) improving veterinary and public health services surveillance, such as by preparing fast detection tests for the screening of suspected raw milk and milk

products, and setting standard operating procedures for food-borne transmission risk assessment.

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Corresponding author: Hai Jiang, jianghai@icdc.cn.

¹ State Key Laboratory for Infectious Disease Prevention and Control, Collaborative Innovation Center for Diagnosis and Treatment of Infectious Diseases, National Institute for Communicable Disease Control and Prevention, Chinese Center for Disease Control and Prevention, Beijing, China; ² Division of Infectious Disease, Key Laboratory of Surveillance and Early Warning on Infectious Disease, Chinese Center for Disease Control and Prevention, Beijing, China.

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