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Knowledge, Attitudes, Practices (KAP) of Brucellosis in Occupationally Exposed Groups in Armenia

H.M. Danelyan, P.G. Tumanyan, A.A. Hovhannisyan
Reference Laboratory for Especially Dangerous Pathogens, RVSPCLS SNCO, RA
Kh.V. Sargsyan
Scientific Centre for Risk Assessment and Analysis in Food Safety Area
hrantdanelyanedp@gmail.com, tumanyanp@gmail.com, hov-ashi@yandex.ru, khachikvsargsyan@mail.ru

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ABSTRACT

Brucellosis, a bacterial disease caused by the genus Brucella, is a zoonotic and occupational disease. A high risk of infection with Brucella is associated with the workplace. Infection may occur by inhalation, conjunctival or skin contamination, accidental injury with a syringe, or exposure in a slaughterhouse or food processing facility. This study delves into Brucellosis, a zoonotic bacterial disease caused by Brucella, focusing on occupational exposure among slaughterhouse workers and food processors in Armenia. The research assesses the knowledge, attitudes, and practices of 306 participants, including 18 slaughterhouse workers and 288 food processors (76 meat and 212 milk employees). Despite universal awareness (100 %) of Brucellosis risk, the study uncovers potential shortcomings in workplace practices, notably in the use of personal protective equipment (PPE), as 43.9 % of respondents wash their working clothes at home. The findings underscore the need for ongoing education and remediation efforts to enhance safety measures and also emphasize the imperative of addressing these issues within at-risk groups in Armenia.

Introduction

Brucellosis is the most common bacterial zoonotic disease worldwide, with global distribution and thousands of new cases among people (Rubach, et al., 2013). Brucellosis is transmitted to humans from infected animals (usually livestock and dogs), either through direct inoculation or consumption of contaminated food and milk (Galinska and Zagorski, 2013). Brucella is an intracellular, small Gram-negative aerobic bacterium, that is readily killed by boiling or pasteurization. Thus food-borne exposure is normally limited to persons consuming unpasteurized milk and dairy products (Corbel and Banai, 2005). However, brucellosis

is also considered primarily an occupational hazard affecting those working with infected animals or their tissues farmers, livestock breeders, veterinarians, abattoir workers, and other high-risk groups (Ning, et al., 2013). These occupational risks include exposure and contact with an entry of the bacteria through cuts and abrasions in the skin. Brucellosis is also a hazard affecting laboratory workers handling specimens containing Brucella species, as the pathogen is readily aerosolized and has a low infective dose (Yagupsky and Baron, 2005).

The incidence of brucellosis in humans is declining in many countries due to systematic efforts to control the disease in animals, particularly in developed nations (Detailed Countries Disease Incidence, 2014), however, brucellosis is widespread among agricultural animals in Armenia; which represents a significant threat to public health.

The emergence and spread of this disease are driven by many factors, including expanded livestock breeding and urbanization, increased animal migration, and inadequate sanitary and hygiene arrangements in livestock breeding and food processing (Chen, et al., 2014). According to data from the Ministry of Health (MOH) of the Republic of Armenia, the number of first-time human brucellosis cases has increased annually since 2004 (personal communications). The disease occurs as small outbreaks (worldwide it is commonly known to be caused by the consumption of raw milk) and isolated cases throughout the country and is most prevalent in the provinces (Dhanashekar, et al., 2012).

Brucellosis-related information is specific for high-risk groups. In terms of economic importance, the eradication of brucellosis in animals is vital. In addition to economic damage, brucellosis causes infertility, production losses, and mandatory slaughter of infected animals, and it also increases health care costs, treatment costs, and strains on the entire healthcare system (Dragon, 2004).

The presence of Brucella is routinely detected in large and small ruminants in almost all Armenian provinces. The current epidemiology of human brucellosis in Armenia is attributed to an increase in the number of patients with brucellosis with an unidentified source of infection. There is a high proportion of young people of working age who are among those affected by brucellosis. There is also an increase in infected individuals who are not in the classically known 'high-risk' occupational groups. Despite the high level of primary registration of patients with brucellosis, it can be assumed that the true situation with morbidity is much more strained because it has been shown that rural residents do not readily seek medical aid from medical and preventive facilities. Testing asymptomatic individuals in high-risk areas is the only reliable way to obtain accurate human brucellosis statistics in endemic countries like Armenia. Human brucellosis tests are not very sensitive and do not detect chronic cases of the disease (De Santis, et al., 2011).

Considering the current situation in Armenia, there is a distinct need for a well-defined program for brucellosis control and prevention among large and small ruminants in Armenia. Some measures, particularly laboratory testing and sanitary slaughtering, are already being implemented. Successful prevention and control programs for brucellosis are carried out by the close cooperation between veterinary, medical, and sanitary services.

Clinical manifestations of brucellosis in humans differ from those in animals. The incubation period for Brucella species is highly variable, but it usually ranges from five to sixty days. Symptoms can not generally be differentiated by species though the specific manifestations of the high (*B. melitensis, B. abortus* and *B. suis*) and low-frequency pathogens (*B. canis, B. pinnipedialis, B. ceti, and B. inopinata*) causing human brucellosis (Garcia and Isenberg, 2007).

The symptomology between *B. melitensis, B. abortus*, and *B. suis* is largely indistinguishable. Clinical presentations are usually divided into acute, sub-acute (or undulant), and chronic brucellosis (depending on the amount of time the patient has had symptoms) for *B. melitensis* infections. This is less useful for patients with *B. abortus* or *B. suis* infections, as the chronic or recurring forms are uncommon (Zhen, et al., 2013).

Brucellosis diagnosis is challenging because of disease presentation variability. The situation becomes more complicated in cases where, along with brucellosis, there are other pathological processes, that affect the manifestation of clinical signs (Garcia and Isenberg, 2007).

Understanding the level of knowledge, attitudes, and practices of respondents, carefully designed awareness, training, and capacity building programs can be designed to achieve better outcomes. The current study aimed to assess the extent of knowledge and understanding of brucellosis in occupationally high-risk groups across the entire country of Armenia to identify practices on the job site that might pose a risk for humans contracting brucellosis.

Materials and Methods

Questionnaire development

The survey included three-parts knowledge, attitude, and practice (KAP). All of the information was collected using the questionnaire, which was designed by a group of specialists and consists of the following sections: demographic data, knowledge, attitude, and practice. The questionnaire consisted of over 200 questions (parsed based on occupation), related to the causative agents of brucellosis, routes of transmission, source of infection, clinical features, diagnostics, and treatment questions related to attitude and practice regarding human brucellosis and the diagnosis and treatment of disease from a clinical point of view. The questionnaire employed a quantitative and qualitative approach and contained closed-ended and open-ended questions. This survey was coupled with a public outreach campaign with training materials based on the safe handling of animals suspected of carrying brucellosis and included proper practices for handling animal products suspected of disease.

Study area, design, and selection of participants

Between July and October 2021, a cross-sectional study using an interview-based survey was conducted among high-risk groups. Armenia is subdivided into eleven administrative divisions. Of these, ten are Marzes. This cross-sectional study was carried out in all Marzes across Armenia and Yerevan; Figure 1 shows the map of Armenia with each of the provinces identified (Aragatsotn, Ararat, Armavir, Gegharkunik, Kotayk, Lori, Shirak, Syunik, Tavush, Vayots Dzor, and Yerevan. The entire country was selected because there is a high degree of variation in both social and physical differences across Armenia.

The sample size calculation was based on the number of food processing sites, slaughterhouses, and laboratories in Armenia that may encounter Brucella species during their routine work. We estimate that we were able to obtain over 50 % coverage across the country, with at least one respondent from each Marz for each high-risk group. We note and acknowledge that while a random selection of individuals from each high-risk area might be desirable, it was necessary to work with the Ministry of Economy in the selection to ensure both cooperation with private corporations and ensure a broad range of responses. A total of 306 professional staff were targeted for interviews. The questionnaire comprised three parts. The first part included questions about demographic characteristics, knowledge about animal brucellosis clinical signs of brucellosis, and potential herd management practices that could pose a risk for brucellosis acquisition in animals. The second part of the questionnaire focused on attitudes of working groups and brucellosis, potential routes of transmission from animals to people, and information on practices posing a risk of brucellosis acquisition in humans. The third part of the questionnaire focused on work practices that they follow.

Fig. Map of Armenia with each of the Marzes (https://hpnonline.org).

The questionnaire was pretested to assess clarity and time requirements and modified in line with feedback from the pre-test. Questions were then translated into Armenian, a questionnaire was created and collected data were entered using Epi Info software (version 7.2).

Interview procedure

In each group, the worker received either an email or an onsite interview which provided the objectives and the participant information sheet in Armenian. Respondents were told that participation in the study was voluntary and that the identification of the respondent would not be disclosed. At the end of the interview, they received the correct answers and public outreach information regarding the disease brucellosis and how they may be at risk in their occupation.

Ethics statement

The respondents have explained the study aims and requested collaboration in the current study. Participants were asked for their consent. All the participants were informed about the aims of the study, methods, and the individual information will not be disclosed, and voluntary participation. The participant information questions were explained before starting individual interviews. Written consent with the participant's signature was not possible. Consent was recorded in the survey software. The current study, participant information sheet, and the consent form/ method were approved by the Ministry of Economy of Armenia.

Results and discussions

It is expected that the findings of this study will help devise future disease control programs and One Health interventions (Shumaila, et al, 2017).

A total of 306 respondents participated in this study. Demographic characteristics of the respondents: Food producer respondents were 50/50 male/female. Slaughterhouse workers were 100 % male. All respondents had at least 5 years of work experience in their field, with >45 % of food producers and >65 % of slaughterhouse workers having >21 years of experience. A total of 58.9 % of respondents were between 31-50 years old, with only 12 % under 30.

There was a 100 % awareness of animal and human brucellosis among the participants, and over 95 % of respondents correctly identified which animals can contract the disease. Only 19.6 % of food processors recognized the correct signs and symptoms of human brucellosis. Furthermore, 28.3 % believed it was either a respiratory disease or a skin disease. Interestingly, only 63.6 % of food processors, but 100 % of slaughterhouse workers, recognized that a human can become infected by handling/consuming raw milk or dairy products; however, 6.5 % and 2.7 % believed that the disease could be contracted by insects or raw fruits and vegetables, respectively. More than 91 % of respondents correctly identified the need for sanitary food passports, as well as the need for temperature-controlled transportation of food; 100 % also stated that they comply with country-specific safety regulations. 32.5 % of respondents believe they are very likely to contract brucellosis in their profession; however, over 91.3 % are required to use personal protective measures in their profession, which include laboratory coats (44.8 %), gloves (98.1 %), hard hats (65 %), masks/respirators (23.9 %), boots (41.3 %), or a special uniform (76.1 %).

Nevertheless, 47.8 % of respondents were required to wash their clothes at home, indicating that there is a significant risk of bringing contaminated clothing back into the home environment. This fact indicates a paradoxical situation where a considerable number of respondents believe that they are at risk of contracting brucellosis in their profession, despite the majority reporting compliance with personal protective measures and adherence to safety regulations. The finding that almost half of respondents are required to wash their work clothes at home raises concerns about potential contamination in domestic settings. This highlights the need for a more comprehensive approach to occupational safety, including proper laundering facilities and protocols.

Over 80 % of food processors were aware if they were processing Brucella-infected foods because of veterinary documents indicating results, with over 84 % slaughtered in a slaughterhouse. 80 % of respondents work in facilities with environmental monitoring programs. A total of 95.7 % of respondents have had a medical exam in the last 6 months as mandated by their place of work. In terms of opinions related to brucellosis in Armenia, over 96.5 % of respondents had a strong belief that milk and meat for processing should be under the control of government regulation and products be accompanied by veterinary records, 100 % of interviewees attached special importance to special safety regulations during meat and milk processing.

Since this is the first such study conducted in Armenia, we tried to study the published data to understand the relevance of the problem and our possible gaps and limitations. Thus, some studies confirm that risk factors for occupational groups were both animal exposure and raw milk ingestion. In contrast to the results of our study, there are published data showing that except for laboratory workers, few veterinarians, and dairy workers none had heard about brucellosis (Smita, et al, 2016). Several published data regarding the KAP surveys on brucellosis among different target groups in a lot of countries show that gaps and problems are present, and KAP surveys are a useful tool for the identification of those gaps. So, a KAP survey conducted among smallholder dairy farmers in Pakistan highlighted that the respondents with no formal education and those who had not heard of the disease displayed greater risky behavior. Poor understanding of the disease, the presence of multiple risky practices on the farm and at the household, and incorrect perception support the need for an educational awareness program to ensure the uptake of improved practices (Shumaila, et al, 2017). Another survey realized among dairy farmers in

Indonesia also justifies that the practice level of brucellosis surveillance and control is moderate, and it is necessary efforts to improve the situation (Kustiningsih, et al., 2023).

The study emphasizes the importance of continuous monitoring and evaluation of occupational health practices. The discrepancy between perceived risk and reported adherence to safety measures underscores the need for targeted interventions, such as improved education, training, and infrastructure support. Additionally, promoting collaboration between government regulatory bodies and industry stakeholders can enhance safety standards enforcement and contribute to a safer working environment.

Conclusions

The KAP (Knowledge, Attitudes, and Practices) survey and questionnaire conducted by the Food Safety Inspection Body and Ministry of Economy marked a significant milestone. This initiative successfully spanned the entire nation, reaching out to slaughterhouse workers and food processors, crucial populations at high risk of contracting brucellosis – an endemic disease in the country. The findings of the study underscored a critical need for enhancing knowledge and understanding of brucellosis among food processors and slaughterhouse workers. The survey implies a dual recommendation. First, recognizing the need for sustained efforts to bridge the identified knowledge gaps, stakeholders should consider developing additional training programs. Secondly, while acknowledging the strides made in workplace safety by commercial entities, focused attention on refining high-risk practices is essential. This includes implementing strategies to enhance the safety of activities like washing uniforms at home. In conclusion, the comprehensive insights gleaned from this survey provide a foundation for targeted interventions to enhance awareness, improve practices, and ultimately mitigate the impact of brucellosis within the identified high-risk demographic in Armenia. Providing this data to the responsible organizations of the Public Health sector and collaborating with them will be important and will improve the situation regarding brucellosis in the country.

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Declarations of interest

The authors declare no conflict of interest concerning the research, authorship, and/or publication of this article.

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