

Preventing Brucellosis in the Bedouin Society in Israel

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Abstract

Background: Brucellosis is endemic in the Bedouin population of southern Israel, where Poor hygiene and traditional practices including home dairy preparations, animal breeding methods contribute to disease spread. The raising of livestock has great importance in Bedouin culture. Commonly, herds of sheep, goats and camels are maintained in close proximity to living accommodations, resulting in a higher exposure to the disease.

The Objectives of this study is to prevent Brucellosis in the Bedouin Society, by locating the source of infection and providing health education and promotion activates to families and Society.

Methods: In Israel, Brucellosis is mandatorily notifiable since 1951. New cases are reported to the District Health Office (DHO) of the Ministry of Health and subsequently incidence rates or summarized. Epidemiological investigations that attempt to locate the source of infection preform control measures as a prevention program with health promotion and termination of infected herds if required with concurrent fair compensation of farmers.

Results and Actions: The incidence of the disease is on the rise within this population. In 2003 the incidence was 18 per 100,000, yet in 2013 the incidence rate increased almost sevenfold. To control the problem, the Southern DHO established a prevention program. Veterinary services and Bedouin community leaders partnered with public health officials in order to improve herd's vaccination rates, and to locate and eliminate infected stock. Despite these steps, the incidence continues to rise, reaching 154/100,000 in 2014.

Conclusions: In order to eradicate brucellosis among the Negev Bedouins, health promotion steps are necessary, but not sufficient and a comprehensive Health Education intervention must be integrated as part of overall policy, including the proper examination of livestock, termination of infected herds, compensation of farmers and advanced culturally and socially sensitive media interventions.

Keywords: Brucellosis; Bedouin; Health promotion

Strengths and Limitations of this Study

- Limited and preliminary information data collected by the Ministry of Agriculture Veterinary Services regarding the number of the *Brucella* infected small herds family owned in the Negev.
- One other limitation of this study is the implementation of the activities proposed in this paper they can be challenging, especially terminating the infected herds at the local level of small herds within homes and in "dispersal" communities.
- The main strength of this study is the fact that the data presented in this paper regarding Brucellosis in the Bedouin population are from information reported mandatorily. New cases are reported to the District Health Office of the Ministry of Health and subsequently summarized locally and nationally. Thus, we will have date regarding success or failure of Preventing Brucellosis in the Bedouin Society.

Introduction

Human brucellosis (Maltese fever) is a zoonotic bacterial infection caused by a spectrum of bacteria of *Brucella* spp. Common infection routes for humans include ingestion of infected unpasteurized products, direct inoculation through cuts and abrasions in the skin while caring for animals, especially during lambing and calving, and inhalation of infectious aerosols. Blood transfusion, tissue transplantation and sexual transmission are also potential routes of infection transmission. When dealing with this disease' it is also important to remember that the relative stability of the *Brucella* in aerosol form combined with a 'low infectious dose' makes it a suitable agent for bioterrorism [1,2].

In the Negev desert region of Southern Israel, the main source of infection is foodborne, principally through the consumption of contaminated dairy products such as unpasteurized milk and other dairy products from contaminated goats, sheep, and camels [3]. Poor hygiene, occupational traditional animal breeding methods, and human contact with infected animal tissues (after calving or during milking and handling of raw meat) contribute to the proliferation of this infection.

The disease is acute in about half of the cases, with an incubation period on the average of 2-3 weeks. In the remaining cases, the onset is insidious, with signs and symptoms developing over a period of weeks to months from the time of infection. The clinical manifestations are variable and nonspecific. They include fever ("undulant fever"), sweats, fatigue, malaise, anorexia, weight loss, headache, arthralgia and back pain [1]. Commonly, patients feel better in the morning, with symptoms worsening as the day progresses. Somnolence can be profound, and depression may also be pervasive. Complications may affect any organ system. The disease may persist in several forms such as relapse, chronic localized infection or delayed convalescence [1,4]. The duration of the human illness and its long convalescence means that Brucellosis also has considerable economic consequences for the patient as due to time lost from normal activities. Prompt diagnosis and treatment with antibiotics can greatly reduce the time a patient incapacity [1]. The standard of care in treating human brucellosis is the early administration of effective antibiotics for an adequate length of time, usually at least 6 weeks [1]. This should be within the context of general medical supervision and, for severely ill patients, may require prolonged hospitalization. In patients with complications, additional treatment, including in some cases surgical intervention, may be necessary [1,5].

According to the World Health Organization, Brucellosis is widespread throughout the world, with recommended standards for surveillance, prevention and control as performed with other major zoonotic diseases involving livestock [1].

The Negev desert region covers 21,000 sq km of Southern Israel and comprises about 60% of the country's landmass. 20% of the Southern District population are Bedouins (223,000 people) [6]. Approximately 60% of the Bedouins live in permanent urbanized towns, while the rest still live outside of established settlements in traditional villages and rural settings, commonly referred to in Israel as "dispersal" ("pezura" in Hebrew). The living conditions include traditional tents or temporary buildings not connected to central infrastructures such as electricity, water, paved roads. The Bedouin population is transitioning to an urban lifestyle, moving from the semi-nomadic lifestyle to permanent settlements. Most Negev Bedouins live in large families with many children, are of a low social economic status and lower levels of education compared to the general population [7]. In the Bedouin population there is high prevalence of health-related problems including infectious diseases including Brucellosis [7,8].

Animal husbandry is a traditional occupation among the Bedouin; it is a significant part of their lifestyle and has great economic and social importance for them. The livestock-raising tradition is maintained despite the transition of Bedouin life into permanent villages and cities. Sheep and goats are kept in close proximity to the family residence and sometimes in backyards and within tents, increasing the extent of daily contact between humans and livestock, and subsequently, the risk of brucellosis transmission. This phenomenon is enhanced manifold in "dispersal" communities. Furthermore, family-owned herds are often unlicensed and unvaccinated. Also, a door-to-door barter exchange exists for the unpasteurized homemade dairy foods derived from the produce of these infected animals [5].

Since the mid-1980s, *Brucella abortis* has been eliminated as the agent of brucellosis in Israel [5]. Now in Israel, it found only *Brucella melitensis*. *Brucella* can cause abortion in pregnant sheep and goats and impair fertility in male animals. With the exception of abortion, infected animals do not show pathognomonic signs of brucellosis.

However, sheep and goats may remain *Brucella* carriers and may continue to excrete the bacteria for long periods of time [9]. The highest concentration of the *Brucella* is found in expelled birth tissues: non-viable fetuses, placenta and uterus; this is the main cause for the infection of healthy animals in the herd. The disease cannot be eradicated in sheep and goats after infection. Prevention of spread of animal disease is possible only by slaughter of infected sheep and goats or, partially, using *Brucella* type Rev1 vaccine given by drops into the sheep and goats eyes [10]. The Israeli Ministry of Agriculture Veterinary Service Department aims at implementing a plan for the mapping and immunization of all livestock in the Bedouin sector. The herd vaccination program was designed to control and actively locate new infected herds. This program also includes a health hygiene education program for the safe and hygienic handling of herds. Once infected herds are identified an immediate slaughter of test-positive animals is necessary. This process is expensive and requires owners' cooperation including, by Israeli law, compensation for the destroyed livestock. As both owner cooperation and funding from the government is limited, herds are at best only vaccinated and rarely destroyed, resulting in a stable enzootic state amongst these herds and risk to humans [8].

Objectives

The Objectives of this study is to prevent Brucellosis in the Bedouin Society, by locating the source of infection and providing health education and promotion activates to families and society and termination of infected herds if required with concurrent fair compensation of farmers

Methods

This is an "Observational non experimental study", as it reviews the state of the Brucellosis infectious diseases among the Bedouin Arabs. It address factors known to influence the re-emergence of Brucellosis in the Negev society in recent years (2012-2014),

Data source

In Israel, Brucellosis is mandatorily notifiable since 1951. New cases are reported to the District Health Office (DHO) of the Ministry of Health and subsequently summarized nationally. Upon notification of each case of brucellosis, a DHO physician conducts an epidemiological investigation in order to locate the source of infection, control the spread of disease, identify larger patterns of infection (within families, neighborhoods, or tribes), communicate results to the Veterinary Services, and provide health education to the affected families. However, lack of information (lack of telephone, identifying information) enables the completion of epidemiological investigations in only part of the reported cases. As is common with passive surveillance systems, the extent of under-diagnosis and under-reporting is unknown [5].

The data presented in this paper regarding Brucellosis in the Bedouin population are from information reported to and collected by the Southern DHO of the Ministry of Health.

After locating the source of Brucellosis infection, health education and promotion activates are provided to infected families and the community frequently termination of infected herds if required with concurrent fair compensation of farmers.

Results

Over the last decade, there is a clear trend of increasing brucellosis incidence rates among the Bedouins of the Negev. In 2003 the rate of Brucellosis was 20 per 100,000, yet 10 years later, in 2014, the incidence rose to 154 per 100,000 as compared to near-zero rates in the Jewish population (Figure 1). These rates clearly comprise an epidemic/outbreak of Brucellosis.

According to this data, the incidence in 2013 increased significantly in comparison to the year 2012. This is probably related to a change in reporting methods, when the Southern DHO started to receive reports directly from the regional bacteriology laboratory at Soroka Medical Center [11]. However, the overall increase in incidence clearly preceded the change in reporting methods.

In 2012 the incidence rate of brucellosis in the Negev Bedouin was 74 cases in 100,000 compared to neighboring countries like Jordan and Syria where the incidence rate is 1.66 and 7.8 cases per 100,000 people respectively, (data obtained from the World Organization for Animal Health Data Base of Zoonotic Diseases [12]).

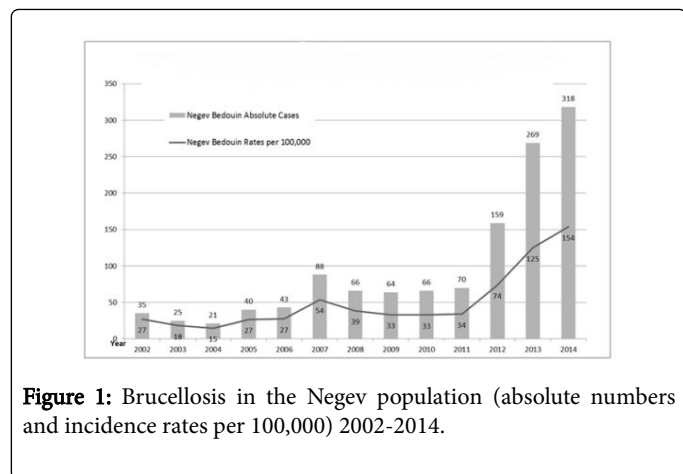


Figure 1: Brucellosis in the Negev population (absolute numbers and incidence rates per 100,000) 2002-2014.

The examination of the disease incidence demonstrates a clear seasonal trend, correlating with the spring lambing season (mainly March through May) Figure 2.

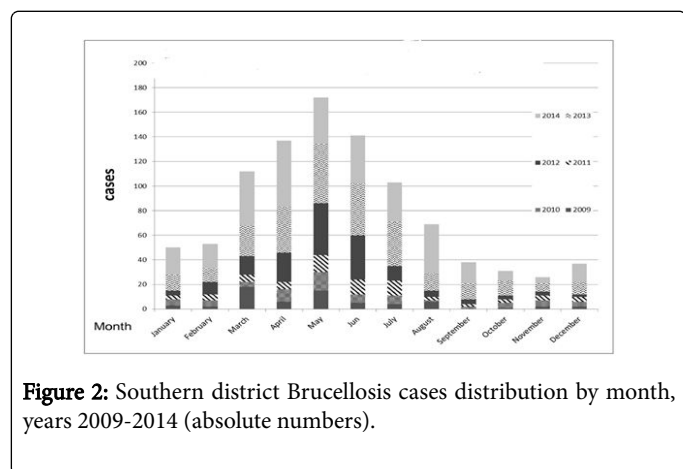


Figure 2: Southern district Brucellosis cases distribution by month, years 2009-2014 (absolute numbers).

According to the DHO cases investigations in 2014, the most common sources of infection include direct exposure to infected animals (reported in 55% of cases) and consumption of local milk and dairy products (reported in 38% of cases). The exposures begin during

early childhood and continue throughout life, resulting in inclusion of all ages within the case-mix matrix Figure 3.

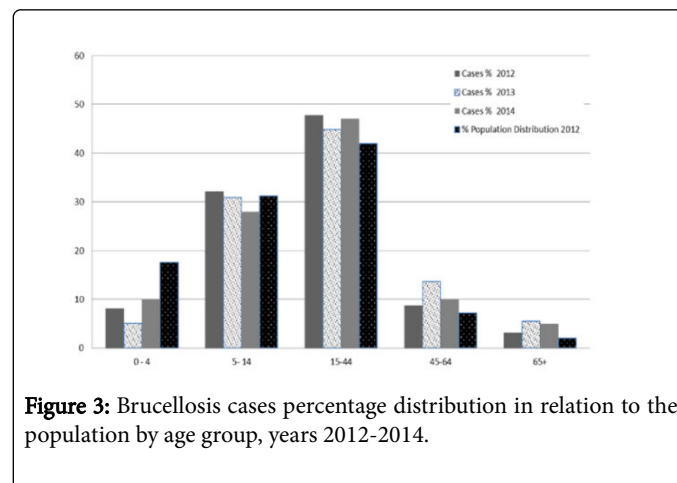


Figure 3: Brucellosis cases percentage distribution in relation to the population by age group, years 2012-2014.

Discussion

We describe a major outbreak of Brucellosis in the Bedouin community of Southern Israel-the Negev Region. The outbreak, caused by widespread and uncontrolled stock keeping and risky health practices, extends through the entire Bedouin population and presents further risks to the general population throughout the country.

According to preliminary data collected by the Ministry of Agriculture Veterinary Services (unpublished), a substantial part of the small family owned herds in the Negev are already infected by *Brucella*. The Israeli Ministry of Agriculture has published recommendations for the prevention of brucellosis in livestock, i.e. cleansing of animal herds with compensation of herders, quarantine, serological testing for *Brucella*, separation of infected animals, disposal of infectious materials, and burial of non-viable fetuses and carcasses. However, most of these measures have not been implemented at the time of this report. The implementation is expected to be challenging, especially at the local level of small herds within homes and in "dispersal" communities. It is clear that terminating the infected stock will be the main necessary step towards reducing the incidence of human Brucellosis [1,9].

The Southern DHO, while in charge of the regulation of commercial food products (including sheep and goat dairy products), has found it difficult to control the production and door-to-door barter of unpasteurized dairy foods, which is common practice in the Bedouin population. Findings of many case-investigations are limited, as they contain incomplete information partially attributable to an intentional reluctance to reveal the existence of illegal homemade dairy produce obtained through the local economy system. Furthermore, there is fear of slaughter of the entire herd after finding of positive cases. This fear, in some instances, leads to removal of the herd by different means, including selling to highest bidder anywhere in the country.

Brucellosis prevention at the community- health promotion activities

In order to better control current Brucellosis outbreaks and improve prevention of the disease, the Southern DHO initiated a health promotion and education program for the Bedouin population. This program stresses the importance of proper personal hygiene while

interacting with the animals and the preferred use of pasteurized dairy products. Oral presentations were supplemented with written information materials in Arabic and in accordance with health and cultural beliefs of the Bedouin population. These include tutorials on supervision of infected meat during slaughter, home pasteurization of dairy products, control of environmental conditions to minimize spread, changes in behavioral habits and increasing awareness of how exposure to livestock and animal food products cause disease. Health promotion and education programs are implemented in schools and community cultural centers and include joint activities with local partners and stakeholders.

- Organized meetings and consultations with leaders in the Bedouin community in order to develop implement and evaluate an intervention health education and promotion program to prevent brucellosis;
- Collaborations were established between the Ministry of Agriculture, the Bedouin community leaders, and the District Department of Veterinary Services in order to raise herd vaccination rates, to encourage proper hygiene and handling of herds during milking and breeding (glove usage etc.) and to actively locate and destroy infected herds;
- Partnership with the Ministry of Education for the Bedouin community in order to establish a community-based education program to control brucellosis, and to develop a health education program in Bedouin schools. The teaching staff received information and health promotion materials about Brucellosis prevention to use at their schools. In some of the schools, the brucellosis health education is carried out by the DHO staff.
- A community health education program for Bedouin Women including proper milking hygiene and safe methods for food preparation was developed, and a workshop for the production of pasteurized milk cheese ("training by a professional chef").
- At the health systems level a brucellosis education and awareness program for medical staff working with the Bedouin community was implemented.
- Volunteers for civil service coaching brucellosis prevention at "maternal-child health centers".

For evaluation of this health promotion activity, the Southern DHO continues to monitor the population for brucellosis. A summary and comparison of disease incidence throughout the years before, during and after the health promotion activities will also evaluate changes in rates of disease.

Conclusions

Prevention of human brucellosis is most effectively achieved by eradication of infection through timely slaughter of infected animals and prevention of contamination in humans by proper animal handling hygiene and effective pasteurization of dairy products. However, cultural differences in the understanding of disease transmission and prevention require extensive educational efforts in order to identify and alter the incidence of disease, which is increasing despite (or possibly as a consequence of) large scale transition to non-nomadic living conditions.

The most important necessary step towards eradication of brucellosis among the Negev Bedouin population is termination of infected herds, with compensation of farmers and advanced, culturally and socially sensitive media interventions towards this goal. Additional steps include the need to construct and employ a long-term

comprehensive health education intervention program, emphasizing the importance of animal vaccinations and the proper examination and care of livestock.

Key Points

- The foremost necessary step towards eradication of brucellosis among the Negev Bedouin is: Termination of infected herds, with concurrent fair compensation of farmers.
- Additional steps for public health include the need to construct and employ a long-term comprehensive health education intervention program,
- Emphasizing the importance of animal vaccinations and the proper examination and care of livestock for public health.

Author's Contribution

This statement outlines how each author contributed to the research and the final document.

Dr Ziva Stahl, is the director of Health Promotion at the Southern District Health Office at the Ministry of Health. Her primary Functions that contributed to the research include promotion, planning, operation, and of evaluation the health promotion program to prevent brucellosis, and a main author of this paper.

Dr Larisa Dochan, is a public health physician in-charge of epidemiology unit at the Southern District health office of Israeli Ministry of Health. She conducted the epidemiological investigation in order to locate the source of infection, control the spread of disease, identify larger patterns of infection and communicated the results to the Veterinary Services), helped to preformed the analysis of brucellosis trends in The Negev desert identify the population health needs and evaluation of health trends. With the completion of epidemiological investigations, the data was collected, encoded and reported by her to the Epidemiology Department at the Ministry of Health for national the Brucellosis database.

Dr Farhan Alsana, is the physician in charge of the Bedouin population at the Southern District health office from Israeli Ministry of Health thus he contributed and conducted some of the epidemiological investigations in order to locate the source of infection, control the spread of disease, identify larger patterns of infection (within families, neighborhoods, or tribes in the Bedouin population) and provided health education to the affected families, he helped to preformed the analysis of brucellosis trends in The Negev desert identify the population health needs and evaluation of health trends.

Dr Eric J Haas is a public health physician at the Southern District health office from Israeli Ministry of Health. He contributed and conducted the some of the epidemiological investigations in order to locate the source of infection, control the spread of disease, and identify larger patterns of infection (within families, neighborhoods, or tribes of the Bedouin population). He helped to preformed the analysis of brucellosis trends in The Negev desert identify the population health needs and evaluation of health trends.

Dr Michael Gdalevich is the Medical Director of the Southern District health office from Israeli Ministry of Health responsible for the work at the district. He supervised the epidemiological investigations, communication of results, analysis of brucellosis trends in The Negev desert region, identification of population health needs; evaluation of

health trends, development and implementation of research of the health promotion programs including this program to prevent brucellosis.

All the team together contributed equally to write this final document.

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