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HUMAN BRUCELLOSIS STATUS IN Al-JIFTLIKAREA

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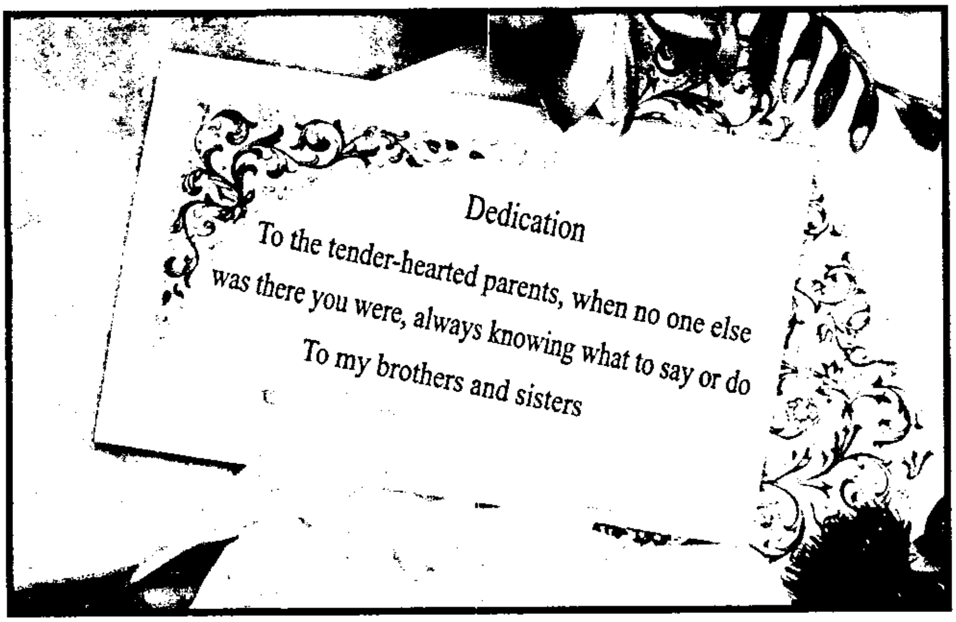
Dedication
To the tender-hearted parents, when no one else
was there you were, always knowing what to say or do
To my brothers and sisters

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I am grateful to Allah, who granted me the power and courage to finish this work. I can find no words to express my sincere appreciation and gratitude to my supervisors, Dr. Yahya Faydi, and Dr. Suleiman Khalil for their supervision, guidance, and helpful suggestions throughout the research and for being patient and kind enough in reviewing this thesis. Without their generous aid the completion of this work would not have been possible.

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The warmest feeling is extended to my parents, brothers, and sisters for their encouragement and financial support during all phases of the research.

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List of Abbreviations

PHC: Primary Health Care

CBRNE: Chemical, Biological, Radiological, Nuclear and Explosives

EMR: Eastern Mediterranean Region

SAT: Slide Agglutination Test

STA: Serological Tube Agglutination

HDIP: Health, Development, Information, and Policy Institutes.

RBT: Rose Bengal Test

CDC: Center for Disease Control

Herdsheep: A group of ten or more sheep or goats

WHO: World Health Organization

UPMRC: Union of Palestinian Medical Relief Committees

OPT: Occupied Palestinian Territories

IOE: International Office of Epizootics

SPSS: Statistical Packages of Social Sciences

ABSTRACT

Human Brucellosis Status in Al-Jiftlik area

An epidemiological study of the prevalence of human brucellosis in Al-Jiftlik area was carried out in the period between September and December, 2001.

A total number of 370 patients attending Al-Jiftlik clinic and having the symptoms of brucellosis were included in the study, 201 (54.3%) males, and 169 (45.7%) females. Out of these 44 (11.9%) patients were infected with brucellosis.

Seroprevalence of human brucellosis was not influenced by sex, (males 23 "11.4%", and females 21 "12.4%"). The prevalence rate of brucellosis was higher in older people 17 of 45 (37.8%), than in younger people 2 of 109 (1.8%).

Prevalence rate of brucellosis among people was not associated with the economic status, but it was higher among people having lower education level, and families with larger family size.

The overall seroprevalence was higher among farmers 24 of 115 (20.9%) and milk handlers 35 of 118 (18.6%) than in other occupations tested like labors 1 of 64 (1.6%), and students 2 of 67 (3%).

The results of this study emphasized the importance of contact infections, namely with infected animals and their products, as a cause of human brucellosis.

CHAPTER ONE

INTRODUCTION

INTRODUCTION

1.1 *Introductory Remarks*

Zoonoses constitutes an enormous heterogeneous group of diseases caused by pathogens that are primarily parasites of different animal species that may, under inappropriate circumstances, spread from the infected animal to man and so cause human disease. The pattern of spread of the pathogen is through infected animals and occasionally to man as an end host.

Brucellosis is considered the most widespread zoonosis in the world. The importance of this highly contagious disease is due to both: 1) Its economic impact on the animal industry causing an adverse effect on total animal protein supplies, and 2) Severe hazard it represents to human health, through either direct contact with infected animals or more frequently the consumption of contaminated milk or dairy products (Seifi *et al*, 1994).

A seasonal variation in the incidence of human brucellosis is usually noted in endemic countries, being high during the spring and summer months and low during autumn and winter. This variation is mostly related to animal parturition and milk production (Madkour, 1989).

Brucellosis persists in regions where infection in animals especially livestock has not been brought under control and where, consequently, transmission of the infection to humans frequently occur. The disease in humans is actually a reflection of the widespread of disease in animals.

Animal and human health are inextricably linked. People depend on animals for nutrition, socio-economic development and companionship. Yet animals can transmit many different diseases to humans. Diseases transmitted from animals to humans are termed zoonosis and some of them are potentially devastating (WHO, 1997).

Brucellosis is a zoonosis of both public health and economic significance in most developing countries, the animal disease has been brought under control in many countries, which has led to subsequent decrease in the number of human cases. The occurance of the disease in animals is largely dependent on the animal reservoir. Where brucellosis exists in sheep and goats, it causes the greatest incidence of infection in animals (WHO, 1997).

1.2 Historical Note

In 1861, Marston, a British army physician in Malta published the first accurate description of brucellosis as "Mediterranean gastric remittent fever". During the nineteenth century, brucellosis was known as Malta fever, Mediterranean fever, Gibraltar fever, gastric fever, remittent fever, and undulant fever. The disease caused considerable morbidity and mortality among British army personnel in Malta (Evans and Brachman, 1991).

Brucella was named in the honor of David Bruce, who was the first to observe it by the microscope as a microorganism he termed *Micrococcus melitensis*, and to isolate the species of *Brucella melitensis* from the postmortem spleen of a soldier with Malta fever in 1886, when he was an army doctor serving for the British Army in Malta. The disease gets its names from both its course “undulant fever” and location “Malta fever” (Evans and Brachman, 1991).

In 1897, Wright and Smith applied the newly discovered bacterial agglutination test to the diagnosis of Malta fever. They used small quantities of emulsion of the cocci and diluted serum from the patient in a sedimentation tube left at room temperature for 24 hours. They used a control from healthy serum with the emulsion of living organisms, the control tube remained turbid while that containing antibodies from patients showed agglutination at the bottom of the tube. Bernhard Bang, a Danish veterinarian and physician from Copenhagen, identified in 1897 an intracellular microorganism “*Brucella abortus*” as the cause of abortion in cattle, the disease was named after him as Bang’s disease (Strickand, 1991).

Zammit, a Maltese bacteriologist in the beginning of the century, identified goats as the reservoir of brucellosis in Malta, when restrictions were put on goats milk and milk product consumption, a significant fall in the number of cases was observed. The name brucellosis was proposed by Alice Evans, an American microbiologist who in 1918 renamed the genus *Brucella* to honor Bruce (Evans and Brachman, 1991).

1.3 Disease in Humans

Definition

Brucellosis is an infectious disease caused by bacteria of the genus *Brucella*. These bacteria are primarily passed among animals, and they cause disease in many different vertebrates.

Various *Brucella* species affect sheep, goats, cattle, deer, elk, pigs, dogs, and several other animals. Humans become infected by coming in contact with animals or animal products that are contaminated with these bacteria. The disease can become chronic and recur, particularly if untreated. However, if proper precautions are taken it can be prevented (Turkington and Carol, 2001).

The symptoms of the disease include intermittent fever, sweating, chills, headaches, joint pains, and mental depression. The synonyms for human brucellosis are undulant fever, Malta fever, Mediterranean fever, and Bang's disease (Center for disease control, 2001).

The incubation period is usually one to three weeks, but sometimes several months (WHO, 1997).

Etiology

Six species of *Brucella* exist which are associated with several principal hosts. Currently, of the six main species of *Brucella*, four have moderate-to-significant human pathogenicity. *Brucella abortus* (from cattle, moderate pathogenicity), *B.melitensis* (from sheep, highest pathogenicity), *B.canis* (from dogs, moderate pathogenicity), *B.suis* (from pigs, high pathogenicity), *B.neotomae* (desert rat). Recently, *Brucella* infecting sea mammals have been described (Maloney, 2001). *Brucella* bacteria are small, non- motile, non–capsulated, gram negative coccobacilli which do not form spores. *Brucella* species grow best at 37 °C under increased CO_2 tension and are separated from each other by biochemical and serological techniques (Schuring, 2001).

Brucella melitensis is the most virulent species of all *brucellae*, it is very sensitive to direct sunlight. However, the organism can survive in necrotic fetal and placental material for up to six months and in soil protected from sunlight for up to three months (Alton, 2001).

Sources of infection

1) Close contact with infected animals or with their products

   Uterine contacts, vaginal discharges, aborted fetuses.
   Udder, colostrum, milk and other dairy products.
   Sperms.
   Urine.
   Blood, flesh or organs (liver, spleen, kidneys).

2) Contaminated environment, including equipment, premise, pastures , waterways, manure of foodstuffs (Seifi *et al*, 1994).

Transmission

Brucellosis is transmitted through contaminated and untreated milk and milk products and by direct contact with infected animals (cattle, sheep, goats, pigs, camels, wild ruminants and, very recently, seals), animal carcasses and abortion materials (Al-Sekait *et al*, 1992).

Infection by ingestion takes place mainly through the mucous membrane of the upper section of the intestinal tract. The disease can also be transmitted through the raw organs of the infected animals which are consumed uncooked, or partially cooked, such as raw liver, raw kidneys, and other raw meat (WHO, 1997). A study by (Evans and Brachman, 1991) in USA through 309 patients infected with brucellosis revealed that 55% of cases were among meat-packers, 4.2% were among governmental inspectors for slaughter houses, 17.5% were livestock breeders, and 4% were among veterinarians (Evans anad Brachman, 1991).

Inhalation of *Brucella* organisms is not a common route of infection, and it occurs as an occupational hazard, but it can be important for those working in laboratories where the organisms are cultured (Fleming *et al* , 1995).

A number of cases of laboratory acquired infections have been reported. Laboratory–associated infections represent 2% of reported cases of brucellosis, demonstrating the high risk of acquired brucella infections in clinical microbiology laboratories where the highly infective bacteria are handled (Pier *et al*, 2000).

Brucellosis are able to infect humans through multiple routes, including skin, mucosal contact, and percutaneous inoculation. Skin abrasions or accidental skin penetration during butchering or meat processing is a well recognized route for entry of *Brucella* organisms. Also humans are infected through having the bacteria enter the body through penetration of the mucous membrane of the eye conjunctiva (Yagoupsky *et al*, 2000).

In man, cross infection does not normally occur, although there have been rare cases in which circumstantial evidence has indicated sexual transmission. *Brucella* organisms have also been isolated from the colostrum and breast milk of nursing mothers. Additional example of human–to– human transmission is by tissue transplantation but it is insignificant (Mantur, 1996).

Transmission of *Brucella* infection by blood transfusion and bone-marrow transplantation have been described, but this transmission is very unusual (Doganay *et al*, 2001).

Neonatal brucellosis have been reported, suggesting the possibility of transplacental transmission during pregnancy or at the time of delivery (Seifi *et al*, 2001).

Worldwide, millions of individuals are at risk, especially in developing countries where the infection in animals has not been brought under control, heat treatment procedures of milk (e.g. pasteurization) are not routinely applied, and food habits such as consumption of raw milk and poor hygienic conditions favour human infection. In such conditions transmission of the infection to humans may frequently occur. Although the disease in animals has been brought under control in several industrialized countries, it occurs sporadically in individuals who acquire the infection abroad or by ingestion of unsafe animal products (WHO, 1997).

Symptoms and Signs

The manifestation of brucellosis is similar in neonates, children, and adults. The onset can be acute in approximately half of the cases and insidious in the remainder.

Symptoms are extremely variable. In the acute form (< 8 weeks from illness onset), symptomatic, nonspecific and "flu–like", including fever (39-40 °C "102.2-104 °F"), sweats, malaise, anorexia, severe headache, lethargy, myalgia, failure to thrive, loss of appetite, joint pain, low back pain, and general weakness. In the undulant form (< 1 year from illness onset), symptoms include undulant fever, arthritis, and orchiepididymitis in males. As the disease progress, temperature increases in the night and subsides gradually in the morning when profuse sweating usually occurs (Seifi *et al*, 1994).

In the chronic form (> 1 year from onset), symptoms may include chronic fatigue syndrome–like, depressive episodes, weight loss, splenomegaly, hepatomegaly, lymphadenopathy, and arthritis (Banai, 2001).

In contrast to the multiple somatic complains, physical abnormalities may be few. Mild lymphadenopathy occurs in 10-20%, and splenomegaly in 20-30% of cases. Nausea, vomiting, weight loss, diarrhea, or constipation followed with abdominal discomfort occurs in 30-60% of patients. Central nervous system involvement occurs in less than 5% of patients and usually presents as acute or chronic meningitis. Fetal death and abortion may occur in pregnant women (Keren, 2001).

Arthralgia and arthritis have been reported in one-third of patients in locations such as the knees, shoulders, ankles, lips and wrists (Landau, 1999).

Diagnosis

Brucellosis should be suspected in patients with typical manifestation and a history of exposure. Due to the non-specific nature of the symptoms, people with brucellosis infection may be misdiagnosed.

The diagnosis of brucellosis depends on the combination of the presence of clinical features and confirmatory positive blood or tissue culture and / or the detection of raised *Brucella* agglutinations in the serum of patients (Madkour, 1989).

Brucellosis is usually diagnosed by detecting one or more *Brucella* species in blood or urine samples. The bacteria may be positively identified using biochemical methods or using a technique whereby, if present in the sample, the brucellosis bacteria are made to fluoresce (Alton, 2001).

Brucellosis may also be diagnosed by culturing and isolating the bacteria from one of the above samples. Blood samples will also indicate elevated antibody levels or increased amounts of protein produced directly in response to infection with brucellosis bacteria (Seifi *et al*, 1994).

Agglutination is a strong indication for the presence of *Brucella* and the screening for *brucella* antibodies was performed with the Rose Bengal Test (RBT), and slide agglutination test. Positive sera were then tested by the suitable confirmatory test as serological tube agglutination "STA" (Seifi *et al*, 1994).

Clinically neutropenia and lymphocytosis occur in the more severely affected patients.

Risk Factors

Individuals recognized to be at increased risk include farmers, abattoir workers, veterinarians, and laboratory technicians "generally through aerosolization" (Keren, 2001).

On the other hand, the contact with infected tissues, blood, vaginal discharges, aborted fetuses, ingestion of raw milk or cheese from infected animals are considered high risk to be infected with *Brucella* (CDC, 2001).

Another risk factors for brucellosis include the eating of raw organs such as liver and kidneys, the movement of infected animals from one area to another, and the faeces of the infected animals which are laid in the roads near houses.

The accidental splashing of attenuated live *Brucella* vaccines into the eyes has been reported as a cause of brucellosis in veterinarians and veterinary workers (Madkour, 1989).

Considerable variation in the global prevalence of the intensity of human brucellosis have been attributed to differences in geographic and climatic factors, and human activities.

Khalid Seifi *et al*, (1994) conducted a project study about brucellosis control in the West Bank. They concluded that the dairy products represented the most significant source of infection (80%). Animal contact (as in the cases of farmers, veterinarians, abattoir workers, and laboratory technicians) represented (10%) of the sources of infection, and unknown sources represented (10%).

1.4 Prevention

Continued investigation of *Brucella* pathogenesis is necessary because brucellosis remains a major zoonosis worldwide and cause economic hardship as a result of the loss of livestock (sheep, goat, and cattle). *Brucella* represents a continued threat as a weapon in biological warfare until better treatment regimens and preventive measures are developed.

Prevention of brucellosis in humans still depends on the eradication or control of the disease in animal hosts. The incidence of this disease has fallen in the countries that have attempted to eradicate the infection in animals (Pier *et al*, 2000), for example in the United States the widespread pasteurization of milk and nearly complete eradication of the infection from cattle has reduced the number of human cases from 6,500 in 1940 to about 70 in 1994 (Ficht, 2001).

Wide spread vaccination is the most effective method for control of brucellosis among goat and sheep in many countries (Al-Khalaf *et al*, 1992).

Brucellosis can be prevented by avoiding consumption of raw milk and raw milk products. Proper heating treatment of milk and milk products is important for effective prevention of brucellosis in humans (WHO, 1997).

Brucellosis in cattle was completely eradicated in many developed countries as in Australia, Canada, Cyprus, Denmark, U.K, Japan, and Norway, while sheep and goat brucellosis due to *B. melitensis* was eradicated only in Cyprus since the rate of infection was very low, initiating an eradication campaigne based on the slaughter of infected animals rather than on vaccination. The social and economic costs of animal control programs for brucellosis may be beyond the financial and human resources of some developing countries. Therefore, prevention and control through food hygiene, environmental protection, personal hygiene, and education will remain important complementary considerations in brucellosis prevention (Nicoletti, 1992).

The bacteria are localized in the lymph nodes surrounding reproductive organs and the udder, this is the reason the bacteria are excreted in the milk, which is produced in large quantities in the cow. The requirement to remove the udder and internal organs from slaughtered cows would necessarily lead to the exposure of the abattoir personnel to huge amounts of the organisms. To reduce the risk it is recommended that the cows can be dried off prior to sending them to slaughter (Banai, 2001).

Prevention of infection and therefore disease, can be achieved by animal vaccination. As a general rule, induction of an effective, long lasting protecting immune response to facultative intracellular parasites requires the use of live attenuated vaccines (Schuring, 2001).

Travellers to regions where the disease is endemic need to take precautions against infection , like avoiding contact to contaminated dairy products (Maloney, 2001).

The department of health brucellosis in Washington State, in the year 2001, showed that the prevention of human brucellosis can be achieved through:

1. Immunizing all livestock: young goats and sheep with live attenuated strains of *B.melitensis* and calves with live attenuated strains of *B.abortus*. There are no vaccines for humans.
2. Eliminating the disease in domestic animals.
3. Washing hands after handling any animal carcass or raw meat product.
4. Protecting open wounds or abrasions of people working with animal carcasses with bandages, and using of protective clothing, gloves, and goggles.
5. Avoiding picking up wildlife of any kind.
6. Regularly disinfecting trucks taking cattle, sheep, and other animals to abattoirs.

Rox,J. (Director of the OIE reference center for brucellosis–WHO), raised the issue of brucellosis, defining the principle techniques required in order to combat the disease in the region as follows:

1. Developing protective measures aimed at humans .
2. Reducing the sources of infection .
3. Limiting the means of contamination .
4. Developing resistance to infection .

Treatment

Because the bacteria live inside human cells "intracellularly" like certain other microorganisms as *Mycobacterium tuberculosis*), it is hard to keep the antibiotic there long enough for care, so it requires the association of more than one antimicrobial for several weeks.

The treatment recommended by World Health Organization for acute brucellosis in adults is rifampicin 600 to 900 mg and doxycyclin 200 mg daily for a minimum of six weeks (Alton, 2001).

Some still claim that the long-established combination of intramuscular streptomycin with an oral tetracyclin gives fewer relapses. There is some evidence of physiologic antagonism between rifampicin and tetracyclin but recent studies suggest that the two regimens have very similar results given adequate time.

Moreover, patients need bed rest, glucose and electrolyte solutions. Fever may persists 2-7 days after the start of therapy, 10% of cases relapse within three months of therapy (Alton, 2001).

Brucella is resistant to many drugs such as penicillins and cephalosporins and susceptible to many disinfectants, such as 1% sodium hypochlorite, 70% ethanol, iodine / alcohol solutions, glutaraldehyde, formaldehyde.

Prognosis

Early diagnosis and prompt treatment is essential to prevent chronic infection. Acute uncomplicated brucellosis recover in 2-3 weeks. Untreating the disease may result in a state of ill health for several years, and the disease is too serious to be dealt with lightly . But it is rarely fetal, and relapses may also occur. (Turkington and Carol, 2001).

1.5 Prevalence

Although brucellosis can be found worldwide, it is more common in countries that do not have good standardized and effective public health and domestic animals health programs. Mediterranean region and Middle East areas are considered as high risk areas (Banai, 2000).

The disease has a limited geographic distribution, but remains a major problem in the Mediterranean Region, Western Asia, and parts of Africa and Latin America (Amato Gauci, 1995).

The main species causing brucellosis in the Eastern Mediterranean Region (EMR) are B. melitensis and B. abortus and the main reservoir of infection in most countries are sheep and goats, and to a lesser extent cattle and camels (Abdon, 1995). This affects the low seroprevalence of the disease among cattle farmers compared to sheep farmers (Dajani, 1991).

Six countries (Egypt, Iran, Jordan, Oman, Saudi Arabia, and Syria) reported a combined annual total of more than 90,000 cases of human brucellosis in 1990 (Abdon, 1995).

Brucellosis is most prevalent in rural areas, and is an occupational disease among meat-packers, veterinarians, and farmers. In Urban areas ingestion of raw milk and its products is the most common mode of transmission of the disease.

The true incidence of human brucellosis is unknown. Reported incidence in endemic disease areas varies widely, from > 0.01 to < 200 per 100,000 population. While some areas, such as Peru and Kuwait have a very high incidence, the low incidence reported in other known brucellosis-endemic areas may reflect low levels of surveillance and reporting (Lopez-Merino, 1989).

In Saudi Arabia (52/100,000) population were confirmed in 1987, and (74/100,000) population in 1989 (WHO, 1992).

B. melitensis, the most pathogenic species in humans, constitutes a public health priority. Although a notifiable disease, official figures do not reflect the number of human infections that occur each year which may be as high as 10 to 25 times the reported figures. Cases very often remain unrecognized because of inaccurate diagnosis, and are thus treated as other disease or as "fever of unknown origin". Up to 77 cases per 100,000 population have been reported from certain communities of South European Countries. In Mediterranean and Middle East countries the annual incidence of brucellosis in people varies from 1 to 78 cases per 100,000 population and in some confined endemic areas lacking animal control measures greater number of cases have been reported (WHO, 1997).

In Palestine, 837 cases of human brucellosis were reported in the year 1998 and the incidence rate was 32.4 cases per 100,000 population, and 747 cases have been reported in the year 1999, the incidence rate was 26.9 cases per 100,000 population, but in the year 2000, the number of cases declined to 303, and the incidence rate was 10.5 cases per 100,000 population (Palestinian Ministry Of Health, annual reports - 1998, 1999, 2000).

A regional survey was carried out in 1989 in the northern region of Saudi Arabia. A sample of 3152 persons was subjected to clinical and laboratory evaluation. The study revealed that the prevalence of brucellosis increased by age and was higher in rural areas, and one of the most important factors of having brucellosis was milking of livestock (Al-Sekait, 1992).

In Western Europe and the United States of America (USA), the incidence of brucellosis is low, for example in the United States of America < 0.5 cases per 100,000 population were reported. Most cases were reported from California, Florida, Texas, and Virginia-December 1995 (Abram, 2000).

In a study by Torre *et al* (1997), in the southern part of Italy, a sample of 1294 persons was subjected to the study, they revealed that the prevalence of brucellosis was (3.1%), and there was no significant association with sex (Torre *et al*, 1997).

Hadjichristodoulou *et al* (1999), conducted an epidemiological study of human brucellosis in some Greek villages, they found that the estimated prevalence in the study area was relatively high (18.64 cases per 100,000 population), the prevalence rate was higher in males (20.5%) than in females (16.5%), the percentage (25.9%) of the population with a high risk occupation, the percentage (47.5%) of the population in the study area who kept goat or sheep in their yard for providing them with milk and cheese.

1.6 Objectives

The present work is aimed at :

1. Obtaining adequate data on the prevalence of brucellosis in al-Jiftlik area.
2. Studying the effect of economic conditions and some other factors in the prevalence of brucellosis in the area under study.
3. Reducing brucellosis morbidity among humans in al-Jiftlik area.
4. Providing baseline data on *Brucella* infection to assist decision makers with planning for the prevention of environmental health diseases especially brucella infection in the area.
5. Raising public awareness about brucellosis.
6. Focusing on the health education for farmers and encourage them to cooperate in future projects.

CHAPTER TWO
MATERIALS
AND
METHODS

MATERIALS AND METHODS

2.1 Study Population

People in al-Jiftlik area who are at risk of contact with, mainly sheep, goats, and cattle, were investigated for brucellosis in the present study.

Random blood samples were collected from 370 people who attended the clinic of the Union of Palestinian Medical Relief Committees (UPMRC) in Al-Jiftlik area, and suspected clinically to be infected with brucellosis in the period between September and December, 2001.

2.2 Blood samples collection

1. About 5 ml blood was withdrawn from each patient using a sterile syringe and run into a sterile container.
2. Blood samples were kept warm untill clotting took place. Sera were collected in test tubes after centrifugation at 500g for 10 minutes.
3. All collected sera were tested by the screening slide agglutination test "SAT".
4. A titer > 1:80 was considered positive. Titer 1:40 was considered negative, the seropositive samples were confirmed by the tube agglutination method. (Immuno Sticks Incorporation, derived from cultured brucella bacteria, 2001).

2.3 Data Collection

Information was collected by personal interviews. The questionaires recorded the following information: occupation, sex, age, education, economic status, contact with animals specifying the species of animals, consumption of milk and milk products, history of previous brucellosis infection, and family history.

2.4 Slide Agglutination Test

Procedure

1. A clear, transparent slides were prepared.
2. Using a suitable pipette, the following amounts of test sera were added to the slide from left to right: 0.08 ml, 0.04 ml, 0.02 ml, 0.005 ml.
3. The previous step was repeated with positive and negative control sera.
4. To each amount of sera, one drop of *Brucella* antigen was added after mixing *Brucella* vial well.
5. Using a wooden sticks, the test serum and antigen composites were mixed well.
6. The slides were rocked gently back and forth for 2-3 minutes.
7. Positive samples were observed by the presence of agglutination in the slides.

Equipment

Bench centrifuge, test tubes, pipettes, stirring sticks, and agglutination slides.

2.5 Tube Agglutination Method

1. A total of 10 test tubes were prepared and labelled to show the dilution of each tube.
2. To the first test tube 0.9 ml sterile saline was added, while 0.5 ml sterile saline was added to each of the remaining test tubes.
3. To tube No.1, 0.1 ml of patient's serum was added to have a dilution of 1:10.
4. After mixing well, 0.5 ml was withdrawn from the first test tube and added to the second test tube to have a dilution of 1:20.
5. Using a new pipette, 0.5 ml was removed from the second test tube and added to the third test tube to have a dilution of 1:40.
6. Step No.5 was repeated for the remaining test tubes.
7. For each test tube, 0.05 ml *Brucelas* antigens was added after mixing *Brucella* vial well. The dilutions in the test tubes were 1:20, 1:40, 1:80, 1:160, and so on.
8. Test tubes were incubated in water bath at 37 C for 24 hours.
9. Positive, negative, and antigen controls were run with the test.
10. Positive samples were detected by the percentage of agglutination in the test tubes. Positive titer > 1:80 were considered positive.

2.6 Data processing and statistical analysis

All the collected data in this study were entered into the computer. Data were checked, frequency distributions and cross tabulations of variables were produced. The Chi-square test was used to determine approximate probabilities to indicate significant probabilities lower than 0.05 were considered significant.

2.7 Characteristics of the study area

Al-Jiftlik village is located in the northern part of the Jordan Valley, 35 km east of Nablus city (Fig.1), with a population of 3739. Most of the people work in agriculture and livestock breeding (Palestinian Central Bureau of Statistics, 2001).

Al-Jiftlik area is located between Jordan River and the eastern slopes of the central mountains of the West Bank with an elevation of 349-m below sea level to 100-m above sea level. The area is characterized by a very hot dry summer and mild rainy winter. The maximum average temperatures during January (coldest month) and August (hottest month) are 19 °C and 39 °C, respectively. The mean annual rainfall for the period 1968-1996 was 166 mm.

The village suffers from lack of adequate infrastructure services namely sewage system, veterinarian department, electric and water supply. The main source of water supply is stream water that is used for domestic and agricultural purposes (Barghothi and Diabis, 1993).

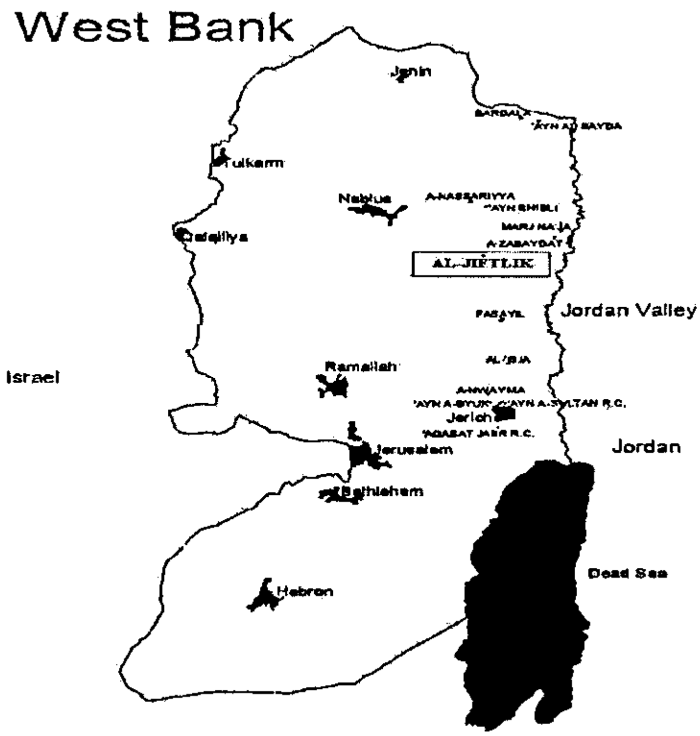

Fig.1 : West Bank map including the study area (Al - Jiftlik Village) .
(Ministry of the Palestinian Local Government)

CHAPTER THREE

RESULTS

RESULTS

Data on the prevalence and distribution of human brucellosis in al-Jiftlik area is presented in the following subsections.

From 370 patients tested for brucellosis, 44 (11.9%) were found to be infected (Table 1).

Effect of sex

From 201 tested males 23 (11.4%) were found to be positive for brucellosis, while 21 (12.4%) out of 169 tested females were found to be positive (Table 2, Fig.2).

Effect of age

As shown in (Table 3) and (Fig.3), from 109 patients in the age group 10-20 years old, 2 (1.6%) were positive for brucellosis. While from 124 patients in the age group 20-30 years old, 14 (11.3%) were found to be positive. In case of patients in the age group 30-40 years old, 11 (12%) from 92 patients were found to be positive. However, from 45 tested patients in the age group > 40 years old, 17 (37.8%) were found to be positive.

Effect of education

(Table 4) and (Fig.4) showed that from 59 illiterate patients, 18 (30.5%) were brucellosis positive. While from 279 patients less than Tawjihi level, 24 (8.6%) were positive. Patients with diploma level (10) and B.A level (3) were all negative for brucellosis.

Effect of family size

In case of families having < 4 persons, 4 (12.5%) out of 32 tested patients were positive. While in case of family size 4-6 persons, 16 (10.7%) out of 150 tested patients were positive. For family size 7-9 persons, 11 (8.6%) out of 128 tested patients were positive. However, in case of family size > 10 persons, out of 60 tested patients, 13 (21.7%) were positive (Table 5, Fig. 5)

Effect of economic status

(Table 6) and (Fig. 6) show that out of 33 tested patients from low economic status people, 8 (24.2%) were positive for brucellosis. In case of intermediate economic status people, 11 (5.1%) were positive out of 217 tested patients. While in case of good economic status people, 22 (20.4%) were positive out of 108 tested patients . However, in case of high economic status people, 3 (25%) were positive out of 12 tested patients.

Effect of profession

In case of farmers, 24 (20.9%) out of 115 tested patients were positive for brucellosis. While in case of students, 2 (3%) out of 67 tested patients were positive. For housekeepers 16 (15.5%) were positive out of 103 tested patients. In case of labors, 1 (1.6%) out of 64 tested patients was positive. However, in case of employees, 1 (12.5%) out of 8 tested patients was positive (Table 7, Fig. 7).

Effect of the kind of livestock

As shown in (Table 9), from 45 patients raising sheep, 12 (26.7%) were positive for brucellosis. While from 81 patients raising goat, 12 (14.8%) were positive. However, 3 (20%) out of 15 tested patients raising cattle were found to be positive.

Effect of milk handling

(Table 1 0) showed that 3 5 (18.6%) o ut o f 188 patients who handle milk were positive for brucellosis. While out of 6 patients who do not handle milk, 1 (16.7%) was positive.

Effect of the place of keeping livestock

In case o f p atients who k eep their livestock inside the courtyard of their houses, 29 (25.9%) out of 112 patients were positive. While in case of patients who keep their livestock outside their houses, 9 (10.6%) out of 85 tested patients were positive (Table 11).

Effect of livestock vaccination

Results of (Table 12) showed that the prevalence of disease contraction among patients who vaccinate their livestock was 18.5% (34 out of 184) patients. While in case of patients who do not vaccinate their livestock, 4 (36.4%) out of 11 patients were brucellosis positive.

Effect of veterinary services

From 155 tested patients who use veterinary services, 23 (14.8%) were found to be positive for brucellosis. While from 40 patients who do not use these services, 15 (37.5%) were positive (Table 13).

Effect of milk boiling

In case of patients who had used to boil milk, 32 (9.1%) out of 350 patients were brucellosis positive. While in case of patients who do not boil milk, 12 (63%) out of 19 tested patients were found to be positive (Table 14).

Effect of cheese and other dairy products boiling

As shown in (Table 15), from 46 patients who had used to boil cheese and other dairy products, 13 (28.3%) were positive for brucellosis. While from 323 patients who do not boil cheese and other dairy products , 31 (9.6%) were positive.

Effect of the previous infection

(Table 16) show that 24 (33.8%) out of 71 tested patients suffered formerly from the disease. While 20 (6.8%) out of 293 tested patients who do not suffer earlier from the disease were found to be positive for brucellosis.

Effect of family history of infection

In case of patients who had family history of infection, 22 (23.9%) out of 92 patients were found to be positive for brucellosis. While in case of patients who had not family history of infection, 22 (8.4%) out of 262 tested patients were brucellosis positive (Table 17).

Effect of dairy products heating

As shown in (Table 18), from 210 patients who heat dairy products till boiling, 29 (13.8%) were positive for brucellosis. While from 6 patients who heat dairy products 5 minutes before boiling, 2 (33.8%) were found to be positive. However, from 150 tested patients who heat dairy products 5 minutes after boiling, 13 (8.7%) tested patients were found to be positive.

Effect of using wool or skin of animals inside the house

(Table 19) showed that from 345 patients using wool or skin of animals in their houses, 43 (12.5%) were positive for brucellosis. While from 25 patients who do not use wool or skin, 1 (4%) patient was positive.

Effect of using manure of animals for agriculture or tabun

As shown in (Table 20), from 213 tested patients using manure for agriculture or tabun, 38 (17.8%) were brucellosis positive. While from 157 patients who do not use manure, 6 (3.8%) were positive.

Effect of eating uncooked meat

In case of patients who had used to eat uncooked meat, 8 (23.5%) out of 34 tested patients were found to be positive for brucellosis. While in case of patients who do not eat uncooked meat, 36 (10.7%) out of 336 tested patients were brucellosis positive (Table 21).

Table (1): Seroprevalence of brucellosis among all examined patients

Total No. examined	No. (%) Positive
370	44 (11.9)

Table (2): Distribution of cases by sex

Sex	Total No. examined	No. (%) Positive
Males	201	23 (11.4)
Females	169	21 (12.4)
Total	370	44 (11.9)

Table (3): Distribution of cases by age

Age	Total No. examined	No. (%) Positive
10-20	109	2 (1.8)
20-30	124	14 (11.3)
30-40	92	11 (12)
>40	45	17 (37.8)
Total	370	44 (11.9)

Table (4): Distribution of cases by education

Education	Total No. examined	No. (%) Positive
Illiterate	59	18 (30.5)
Less than Tawjihi	279	24 (8.6)
Tawjihi	19	2 (10.5)
Diploma	10	-
B.A or more	3	-
Total	370	44 (11.9)

Table (5): Distribution of cases by family size

Family Size	Total No. examined	No. (%) Positive
< 4	32	4 (12.5)
4-6	150	16 (10.7)
7-9	128	11 (8.6)
> 10	60	13 (21.7)
Total	370	44 (11.9)

Table (6): Distribution of cases by economic status

Economic	Total No. examined	No. (%) Positive
Low	33	8 (24.2)
Intermed	217	11 (5.1)
Good	108	22 (20.4)
High	12	3 (25)
Total	370	44 (11.9)

Table (7): Distribution of cases by profession

Profession	Total No. examined	No. (%) Positive
Farmers	115	24 (20.9)
Students	67	2 (3)
House keepers	103	16 (15.5)
Labors	64	1 (1.6)
Employees	8	1 (12.5)
Without	13	-
Total	370	44 (11.9)

Table (8): Seroprevalence of human brucellosis among livestock farmers

Livestock breeding	Total No. examined	No. (%) Positive
Yes	195	37 (19)
No	174	7 (4)

Table (9): Seroprevalence of human brucellosis according to the kind of livestock

Kind of livestock	Total No. examined	No. (%) Positive
Goat	81	12 (14.8)
Sheep	45	12 (26.7)
Cattle	15	3 (20)
Sheep and Goat	47	9 (19.1)

Table (10): Seroprevalence of human brucellosis among milk handlers

Milk handling	Total No. examined	No. (%) Positive
Yes	188	35 (18.6)
No	6	1 (16.7)

Table (11): Seroprevalence of human brucellosis according to the place of keeping animals

Place of keeping	Total No. examined	No. (%) Positive
Inside the house	112	29 (25.9)
Outside the house	85	9 (10.6)

Table (12): Seroprevalence of human brucellosis according to livestock vaccination

Livestock vaccination	Total No. examined	No. (%) Positive
Yes	184	34 (18.5)
No	11	4 (36.4)

Table (13): Seroprevalence of human brucellosis according to veterinary services

Veterinary Dept. visit	Total No. examined	No. (%) Positive
Yes	155	23 (14.8)
No	40	15 (37.5)

Table (14) : Seroprevalence of human brucellosis according to milk boiling

Consumption of unboiled milk	Total No. examined	No. (%) Positive
Yes	19	12 (63.2)
No	350	32 (9.1)

Table (15): Seroprevalence of human brucellosis according to cheese and other dairy products boiling

Consumption of unboiled dairy products	Total No. examined	No. (%) Positive
Yes	46	13 (28.3)
No	323	31 (9.6)

Table (16): Seroprevalence of human brucellosis according to the previous infection

Previous Infection	Total No. examined	No. (%) Positive
Yes	71	24 (33.8)
No	293	20 (6.8)

Table (17): Seroprevalence of human brucellosis according to the family history of infection

Family history (Previous infection)	Total No. examined	No. (%) Positive
Yes	92	22 (23.9)
No	262	22 (8.4)

Table (18): Seroprevalence of human brucellosis according to the period of dairy products heating

Period of heating	Total No. examined	No. (%) Positive
Till boiling	210	29 (13.8)
5 minutes before boiling	6	2 (33.3)
5 minutes after boiling	150	13 (8.7)

Table (19): Seroprevalence of human brucellosis among people using wools or skin of animals in their houses

Use wools or skin	Total No. examined	No. (%) Positive
Yes	345	43 (12.5)
No	25	1 (4)

Table (20): Seroprevalence of human brucellosis among people using manure for agriculture or tabun

Use manure	Total No. examined	No. (%) Positive
Yes	213	38 (17.8)
No	157	6 (3.8)

Table (21): Seroprevalence of human brucellosis among people eating uncooked meat

Eating uncooked meat	Total No. examined	No. (%) Positive
Yes	34	8 (23.5)
No	336	36 (10.7)

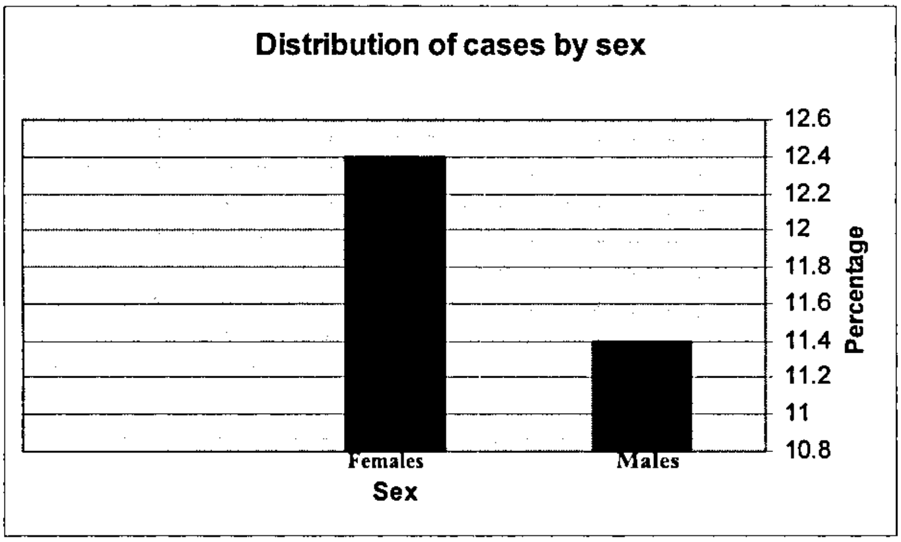

Fig. 2 : Distribution of cases by sex

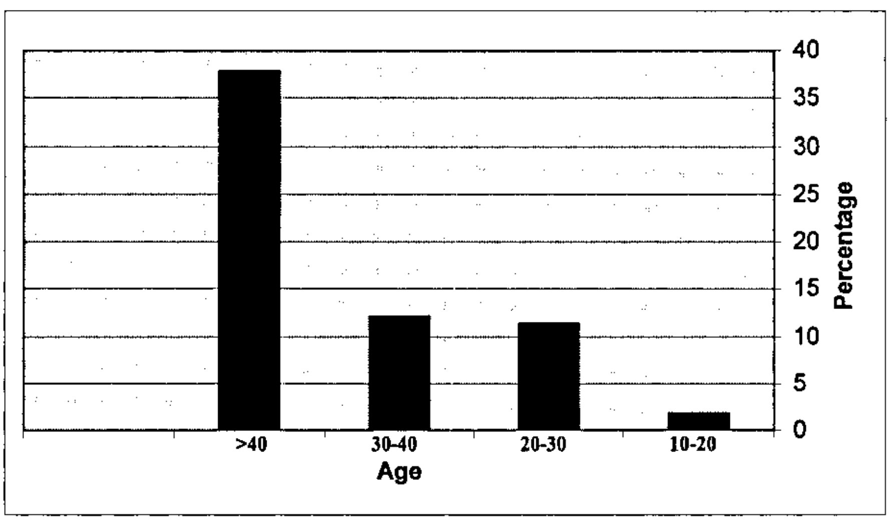

Fig. 3 : Distribution of cases by Age

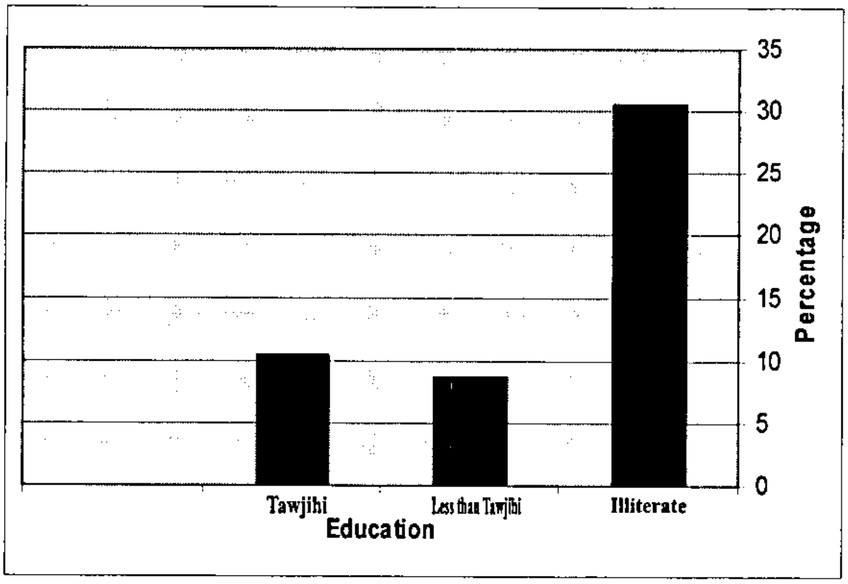

Fig. 4 : Distribution of cases by education

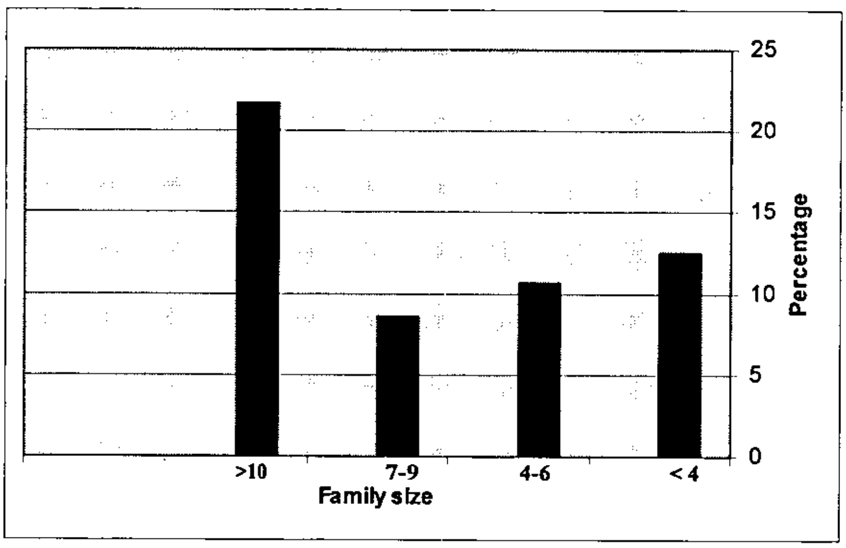

Fig. 5 : Distribution of cases by family size

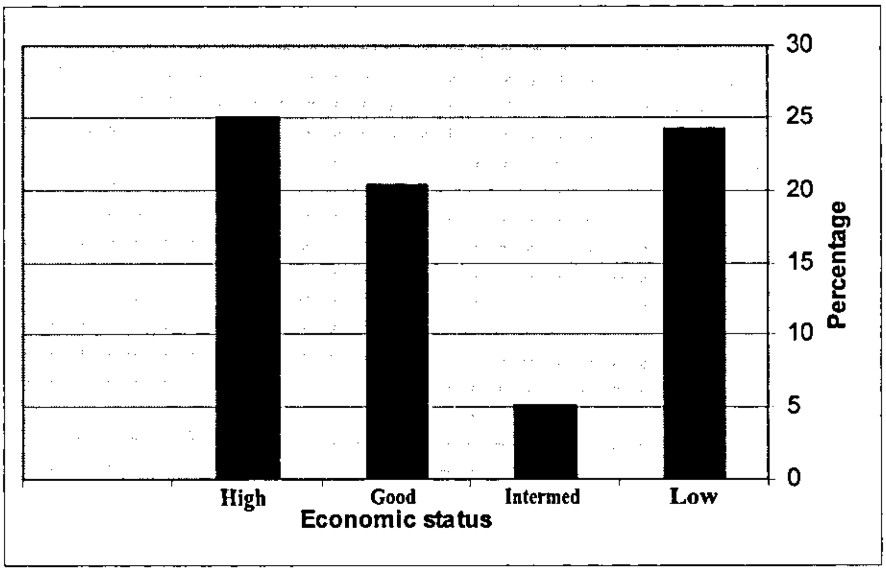

Fig. 6 : Distribution of cases by economic status

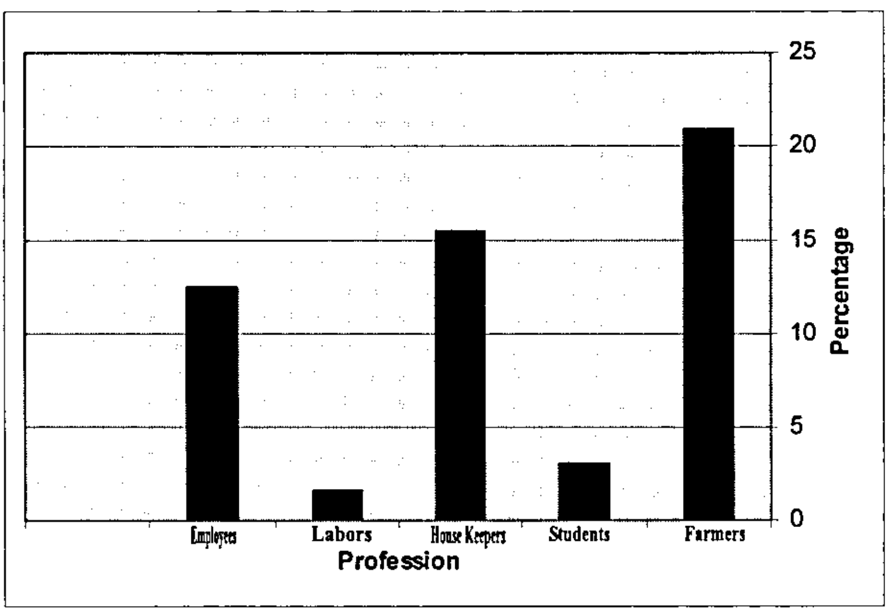

Fig. 7 : Distribution of cases by profession

CHAPTER FOUR

DISCUSSION

Discusion

Brucellosis still remains a major public health concern in many Mediterranean countries despite the efforts and resources spent in control programs. To achieve elimination of animal and human brucellosis the control measures should be implemented continuously without weakening the strength and the power of interventions.

In most of the countries brucellosis surveillance is an essential tool in order to achieve and maintain brucellosis elimination in both humans and animals. If the control measures are not implemented for a long period and the surveillance is weakened the disease will recur (Al-Sekait, 1992).

Cases of brucellosis were reported even in countries succeeded in eradicating animal brucellosis and declared by WHO to be brucellosis free countries (WHO, 1997).

It is well known that the animal vaccination control program is efficient, if it is implemented continuously in the whole country in order to reduce the prevalence among animals. The coverage of the program must be high in the whole country, otherwise the disease could re-emerge starting from a region with low coverage (Hadjichristodoulou *et al*, 1999).

This study showed that the seroprevalence of human brucellosis was 11.9% (44 of 370) among people in al-Jiftlik area (Table 1).

In the present study however, no significant (P= 0.0771) differences in the prevalence of human brucellosis were found among the different sexes. The prevalence among males was (23 of 201) (11.4%), and among females was (21 of 169) (12.4%) as shown in (Table 2) and (Figure 2). This result supports simillar findings in the study of (Torre *et al*, 1997), in their study they revealed that there is no significant association with sex. This is probably because males and females are equally exposed to infection in the area, and this infection is not affected by the sex. Both sexes are dealing with animals and infected products in the same way.

Statistics showed that seroprevalence of brucellosis increased with age showing a significant relationship (P= 0.00) which is in consistant with observations made in Saudi Arabia (Al-Sekait, 1992). The old age group (> 40 years) had the highest seroprevalence (37.8%) (17 of 45) as shown in (Table 3) and (Figure 3). This is may be related to longer exposure periods to the environment. The lower prevalence found in children compared with adults may be a result of less exposure of children to the livestocks due to their education.

Higher prevalence rate of human brucellosis among people in the area was found to be associated with families with lower educated level (30.5%) (18 of 59) which is significantly higher (P= 0.00007) than other classes (Table 4 and Figure 4). This can be explained by those less educated people have a lower awareness about brucellosis and about the protective measures that must be done to avoid the infection. These findings may reflect that educated people have no enough time to raise livestock. But if they were so, they would be better able to deal with them. In addition, they can adopt the preventive measures in order to prevent transmission of the disease and to minimize its spread.

Clear association was detected between family size and number of infected persons. Statistically this association did not reach significant level (P = 0.071). Families having more than 10 persons had the highest seroprevalence (21.7%) (13 of 60) as shown in (Table 5) and (Figure 5). This is probably because the bigger the number of the family members is, the more difficult to look after the personal health for each member. The parents attention may be dispersed which may lead to negative effects upon the families health.

Al-Jiftlik village is considered the largest village in Jordan Valley and it is probably the most under privileged area in the West Bank both in terms of socioeconomic conditions and availability of basic services (Barghouthi and Diabis, 1993).

However, no clear association was detected between the economic status index and human brucellosis in the area as shown in (Table 6) and (Figure 6), (P= 0.00003). This is probably because there was no effect of social life of being at high risk. As proved by the discussion of the educational status of the population, it is the educational status and not the economical status that has critical importance in minimizing the spread of the disease.

The results in (Table 7) and (Figure 7) summarize the prevalence among the different occupations tested. Seroprevalence among farmers (20.9%) (24 of 115) was significantly higher (P= 0.00027) than other occupations. This is in agreement with (Evans and Brachman, 1991). In their study a sample of 309 persons was subjected, the study revealed that the prevalence of brucellosis among livestock farmers was 17.5% which was higher than other occupations.The strong association between occupation and the prevalence of human brucellosis can be explained by the fact that most village inhabitants work in agriculture and livestock breeding and are therefore exposed to brucellosis, and they are in close contact with their animals, dealing with livestock and their products more than other persons. A problem complicated by the very low hygienic conditions undertaken by the farmers and the difficulty to control the disease in livestock.

As proved by test results, more than half of the tested people raise livestock and so they are exposed in one way or another to contact the disease. Results emphasize brucellosis as an occupational disease among livestock breeders, indicating that contact with sheep, goats, and cattle is an important method of transmission.

High seroprevalence of brucellosis in al-Jiftlik area can be explained by the fact that this area is on the boarder between Jordan and the Occupied Palestinian Territories where uncontrolled movement of flocks may occur, which may ease the spread of the disease.

Seroprevalence of brucellosis among farmers who breed livestock was (19%) (37 of 197) as shown in (Table 8), this can be explained that farmers who breed livestock are exposed to different risk factors, and this result emphasized that brucellosis is an occupational disease.

Shepherds had the highest seroprevalence among all livestock breeders (26.7%) (12 of 45) (Table (9) which is significantly higher than other professions (P= 0.00027). These results are in agreement with final reports estimating the level of infection at about (12% in sheep and 2% in cattle) (Dajani, 1991). This can be explained by the widespread of *Brucella melitensis* infections in sheep compared to other animals in this area, in addition to the high virulence of the agent *B*.melitensis and the traditional mode of consumption of sheep and goat products. Most of the livestock in the occupied Arab teritories consist of sheep and goats (Seifi *et al*, 1994). The results have shown that most of the cases are due to *Brucella melitensis* which occur in this kind of livestock.

Seroprevalence among milk handlers was (18.6%) (35 of 188) (Table 10), this can be explained by the sheep and goat or cattle milk being an important source of infection either by ingestion or contact during cheese processing which is in agreement with (Al-Sekait, 1992), in his study in 1989, a sample of 3152 persons was subjected. The study revealed that brucellosis increased by age and was higher in rural areas, and one of the most important factors of having brucellosis was milking of livestock. This result can also be explained by the fact that preventive measures are not used while milking the livestock.

It was found that the seroprevalence of brucellosis among people who keep their animals inside their houses was higher than those who keep them away (Table 11). This is probably because animals live in close proximity to people, leading therefore to numerous possibilities of cross-contamination, and it can be explained by the long exposure time of the people to the infected animals inside their houses.

The results indicated that the percentage of disease infection was bigger among the farmers who did not vaccinate their livestock and did not show them to specialized veterinarians (Tables 12 and 13). This can be explained by emphasizing and adopting the necessary health measures to control the disease among animals, especially through vaccinating of animals to control the disease amng them which is consequently will lead to eradicate the disease among human beings.

The majority of brucellosis incidents result from the practice of certain food habits, methods of processing dairy products, regional customs and environmental hygiene (Seifi *et al*, 1994).

As shown in (Tables 14 and 15) people who usually drink milk without boiling or eat unboiled cheese were exposed to this disease. This helps us to realize that boiling milk and cheese before consumption which is a very simple and uncostly step can reduce disease infection.

(Table 16) shows that 24 (33.8%) out of 71 tested patients suffered formerly from this disease. This may be due to the fact that many of them were still disease carriers, as they did not receive the necessary medical treatment as they were far away from places of medical treatment. Some of them reinfected after recovery from the disease as the factors responsible for exposure to the disease did not change. This in turn provide opportunities for repeated infection.

Milk and dairy products appear to constitute one of the main sources of infection. These products are consumed in large quantities, especially in villages, and they are often not submitted to heat treatment, and this could explain the results of (Table 18).

Results of (Tables 19, 20, and 21) showed that poor hygienic habits of people who had used the products of infected animals like wool, faeces, and uncooked meat were more infected than other people, this is probably because these factors are considered one of the most risk factors of brucellosis, and the infection could be transmitted to these patients from these products. These results support what had been mentioned in the report of (WHO, 1997).

CONCLUSION

1. Prevalence rate of brucellosis in aL-Jiftlik area was higher among older age people, lower educated people, and among families having larger size.
2. Prevalence rate of brucellosis in the area was not associated with sex and socioeconomic status.
3. The study reveals contact with infected animals and their products as a major source of infection.
4. Brucellosis in animals remains a major public health hazard due to its transmissibility to human.
5. The only effective way to control the disease in human is by the elimination of infected animals and vaccination of the healthy ones in order to render those in regular contact with animals a lower risk to produce brucellosis from animal products.

RECOMMENDATIONS

1. Experts dealing with the infected animals should be careful and use the various preventive measures including masks, gloves, and protective clothes especially when attending animals which give birth.

2. Animals should be vaccinated on a large scale to prevent the disease and to reduce its spread.

3. General preventive measures should be followed while dealing with dairy products, and to ensure that via the concerned channels for contineous supervision, and to raise their general awareness.

4. To warn laboratory technicians who deal with brucellosis-suspected samples from the scattering aerosoles because it causes infection.

5. There should be obligatory slaughter of *Brucella*-positive animals under veterinary supervision and compensation for the owners.

6. To continue medical follow up of the diagnosed cases and to ensure contineous therapy, and to follow the infected cases regularly in order to make sure of recovery.

7. Epidemiological studies in animals and humans by serological survey should be considered.

8. Farmers, high-risk groups and the general population should be given health education about the nature of the disease and how to minimize the risk of transmission through animal contact and milk products produced from unpasteurized milk.

9. WHO protocols for the treatment of human brucellosis should be followed.

10. Surveillance of brucellosis should be strengthen in the population at risk in order to affect brucellosis control programs.

11. Intersectoral cooperation with different ministries and nongovernmental organizations should be increased in order to fulfill the final aim which is the total elimination of the disease.

12. To extend the study of brucellosis at medicine faculties and intermediate colleges, and to pay attention for chronological cases of the disease and how to deal with them.

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APPENDIX

First Part: Study Variables

Name:...............................

Occupation:.......................

Test Result:.........................

General Information:

Put ( ) in the suitable place according to your position

- **Sex:**

  1) Male ( )
  2) Female ( )

- **Age:**

  1) 10-20 years ( )
  2) 20-30 years ( )
  3) 30-40 years ( )
  4) > 40 years ( )

- **Education:**

  1) Illiterate ( )
  2) Less than Tawjihi ( )
  3) Tawjihi ( )
  4) Diploma ( )
  5) B.A and more ( )

- **Family Numbers:**

1) < 4 ( )
2) 4-6 ( )
3) 7-9 ( )
4) > 10 ( )

- **Economic Situation:**

1) Low ( )
2) Intermediate ( )
3) Good ( )
4) Excellent ( )

Second Part: Study Questions

Please put a circle arround the suitable answer

Q1: Do you breed livestocks?

1. Y 2. N

If the answer is "NO" move to the question number 7

Q2: What kind of livestocks do you breed?

1. Goats 2. Sheep 3. Cattle 4. Others

Q3: Do you produce dairy products?

1. Y 2. N

Q4: Where do you keep your livestock?

1. In the house 2. Outside stable

Q5: Do you vaccinate your livestock against Brucellosis?

1. Y 2. N 3. Do not know

Q6: Do you visit the Veterinarian Department?

1. Y 2. N 3. Do not know

Q7: Do you usually drink unpasteurized milk?

1. Y 2. N

If Yes, specify:

I. Your own production 1. Y 2. N

II. From the Market 1. Y 2. N

III. Type of milk 1. Goats 2. Sheep 3. Cattle

Q8: Do you eat fresh white cheese or unpasteurized dairy products?

1. Y 2. N

If Yes, specify:

I. Your own production

II. From the Market

Q9: Have you contributed Brucellosis earlier?

1. Y 2. N 3. Do not know

Q10: Have you had any cases of Brucellosis in your house?

1. Y 2. N 3. Do not know

Q11: When you stop heating milk or dairy products?

1. Until boiling 2.5 minutes before boiling

3. 5 minutes after boiling 4. Do not know

Q12: Do you use wool or skin of animals in house?

1. Y 2. N

Q13: Do you use manure of animals for tabun or fertilisation?

1. Y 2. N

Q14: Do you eat any part of livestocks without cooking them?

1. Y 2. N

ملخص

دراسة واقع الحمى المالطية عند سكان منطقة الجفتلك

الطالب: منتصر محمد حمد صبح

هذه الدراسة هي عبارة عن دراسة وبائية لتبيان انتشار مرض الحمى المالطية في منطقة الجفتلك ، وقد طبقت هذه الدراسة في الفترة الواقعة بين شهري أيلول وكانون أول من العام 2001

احتوت الدراسة على 370 مريضا راجعوا عيادة الإغاثة الطبية في المنطقة وكانوا يعانون من أعراض مرض الحمى المالطية ، 201 (54.3%) ذكور ، 169 (45.7%) إناث. وقد وجدت الدراسة أن عدد المصابين بالحمى المالطية بين أفراد العينة المأخوذة هو (44) ونسبتهم (11.9%).

وجدت الدراسة أن الإصابة بالحمى المالطية لم تتأثر بالجنس (ذكور 23 "11.4%" وإناث 21 "12.4%"). إن انتشار المرض كان أكبر بين كبار السن 17 من 45 (37.8%) في مقابل 2 من 109 (1.8%) ضمن الطبقة العمرية الدنيا في الدراسة.

كما أن انتشار المرض لم يرتبط في هذه الدراسة بالوضع الاقتصادي ، إلا أنه كان أكبر ضمن أولئك ذوي المستوى التعليمي المتدني ، وضمن الأسر الأكثر عددا.

الإصابة بالمرض كانت أكبر ضمن المزارعين 24 من 115 (20.9%) وأيضا ضمن أولئك الذين يقومون بحلب المواشي 35 من 118 (18.6%) ، أما بالنسبة للعمال فكانت 1 من 64 (1.6%) والطلاب 2 من 67 (3%).

إن نتائج هذه الدراسة تثبت أهمية العدوى الناجمة عن الاختلاط بالحيوانات المصابة ومنتجاتها كسبب رئيسي للإصابة بمرض الحمى المالطية.