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Original article

Impact of Brucellosis on Reproductive Performance of Small Ruminants in Al-Qaryat, Libya

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Abstract
Brucellosis is among the zoonotic diseases that have been affecting small ruminants and have had an impact on them, especially during their reproductive period. Therefore, the aim of this study was mainly to establish the prevalence of brucellosis in the Al-Qaryat region and its impact on small ruminant reproduction. 120 small ruminants were used for this study, 50 being goats and 70 being sheep from different farms. The blood samples of these animals were drawn for the purpose of carrying out a test that would determine whether they had acquired brucellosis or not. From the research, 28 had brucellosis, representing 23.3%, while 92 had not, representing 76.7% of the entire sample. In addition, it was demonstrated that animals with brucellosis had more reproductive problems compared to animals without the disease. For example, it was demonstrated that 39.3% of animals with brucellosis had abortions compared to only 9.8% of animals without the disease. In addition, it was also found that the fertility rates were low, lambing/kidding intervals were long, and stillbirths were high among the infected animals. This is supported by the statistical analysis, which showed a significant relationship between the infection of tiny ruminants by brucellosis and reproductive problems. This result unequivocally shows that brucellosis impacts the reproduction of tiny ruminants. It is therefore important to apply advanced methods of biosecurity, vaccination, and surveillance in the prevention of brucellosis in Libya.
Keywords: Brucellosis, Small Ruminants, Reproductive Performance, Sheep and Goats, Livestock Health.

Introduction

One of the most common zoonotic bacterial diseases, brucellosis has a wide host range, including domestic and wild animals. Small ruminants such as sheep and goats, which are the domesticated animals of humans living in developing countries such as Libya, are at risk for brucellosis caused by several different bacteria, including Brucella melitensis. Not only does brucellosis, which presents as many different reproductive diseases like abortion, placenta retention, and decreased fertility, pose an economic threat to humans as a zoonotic disease, but it also has many different animal health consequences for these domesticated animals [1]. However, the small ruminants are important in the agricultural industry in Libya, especially in the rural areas, where they greatly contribute to the improvement and earnings of the rural community. Sheep and goats are often raised in large, semi-intensive systems and often lack access to veterinary care, biosecurity, and surveillance, which may be a breeding ground for infectious diseases such as brucellosis, which may impair the productivity, sustainability, and breeding potential of the animals. Reproductive efficiency, including conception rates, litter size, kidding or lambing interval, and mortality rates of kids, is considered critical for the economic development of small ruminant production systems [2].

In brucellosis, reproductive organs and functions are often affected. For female animals, reproductive problems can arise in the form of abortion, stillbirths, or weak progeny, while male animals can suffer from orchitis and epididymitis, which can affect semen quality and fertility. Changes in reproductive efficiency can result in long nonproductive periods, increased veterinary costs, and decreased rates of growth. With many farms in Libya operating on minimal profit margins, even a small decrease in productivity due to infectious diseases like brucellosis can result in significant economic losses [3].

Despite the recognition of the importance of brucellosis as a major animal health problem, little literature is available on the effect of brucellosis on the reproductive performance of Libyan small ruminants. Brucellosis has not received the attention it deserves, and small ruminant brucellosis surveillance and control have always been given little priority in the animal disease control policies of the country. Past studies have indicated a significant association of brucellosis with reproductive failures, but little is known of the level of this association, considering Libyan farming conditions, which may be affected by various factors such as climatic stressors, breed, etc., which have not been adequately explored [4].

This problem is worsened by the fact that there is no collection of data, diagnostic methods are not uniform, and there are no coordinated methods of intervention. For example, most farmers are likely using symptoms as a basis for disease identification, which may not be sensitive enough, especially for subclinical and early stages of disease. This has led to the silent spread of brucellosis within the flock, silently impacting reproduction and spreading the disease to other animals and even humans who are in contact with the diseased animals and consume unpasteurized milk products. The need for an understanding of the impact of brucellosis on reproduction can be appreciated for the following reasons: reproduction has an impact on the productivity of the flock, hence impacting farm profitability, and reproduction has an impact on animal

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welfare since disorders may cause discomfort and pain for the animal due to abortion and neonatal health issues. Thirdly, understanding the consequences of the disease helps to provide evidence of the need to invest in disease control activities such as vaccination and testing drives, as well as improvements in biosecurity measures in farms [5].

In a resource-constrained country like Libya, agricultural activities are one of the main sources of rural employment, and thus, this kind of evidence becomes crucial. The phenomenon gap is a result of the absence of localized studies linking brucellosis infection status to quantified measures of reproductive performance in Libyan production systems. Though there is considerable evidence globally linking brucellosis to reproductive failures, using this evidence to draw parallels to Libyan production systems, where environmental, cultural, and management factors are likely to be different from the global average, would be a misrepresentation of the actual effects of the disease. There is a need to bridge this gap using primary evidence that realistically reflects the operation of Libyan production systems [6].

The novelty of the current study is based on the focus on an understudied population in a particular ecological and socio-economic context. Although brucellosis has been recognized as endemic in certain parts of North Africa, there is limited information on the effects of the disease on reproduction in Libyan small ruminants based on rigorous epidemiological and reproductive performance criteria. Moreover, the current study is based on an integrated approach that includes serological examination and assessment of reproductive performance. This is a move beyond descriptive studies on the prevalence of the disease, providing useful information for the management of the disease and policy formulation [7].

It is therefore very clear that the purpose of this study is to establish the impact of brucellosis on the reproduction of small ruminants in Libyan farms. The objective of this particular study is to establish the prevalence of brucellosis in the selected sheep and goats. The effect of brucellosis infection on the reproduction of small ruminants is also an objective of the study. The major aim of the study is to enhance knowledge about the effects of brucellosis infection on the fertility of small ruminants. This will help in the management of the disease, which will result in increased productivity.

The genus of the species Brucella is the causative agent of the highly infectious bacterial disease. One of the most dangerous zoonotic diseases is brucellosis, which primarily affects domestic and wild animals, but humans are also at risk. The Brucella consists of numerous species and biovars exhibiting strong host specificity. Brucella abortus (B.abortus), Brucella ovis (B.ovis), and Brucella suis (B.suis) are the most relevant species causing zoonotic diseases and significant economic losses in endemic underdeveloped regions. Brucella melitensis is the major cause of the disease in sheep and goats. The major symptoms of the disease are reproductive problems such as late abortions, stillbirths, infertility, retained placenta, and weak offspring. Direct contact with the infected animals, fetuses, placenta, vaginal discharges, milk, and environment are also modes of transmission of brucellosis. Apart from the economic impact of the disease, which can be observed through the reduction of productivity and breeding failures, the disease also has the potential to impact consumer health, especially that of those who consume unpasteurized milk, as well as those who handle the disease without proper protection, as cited by [8].

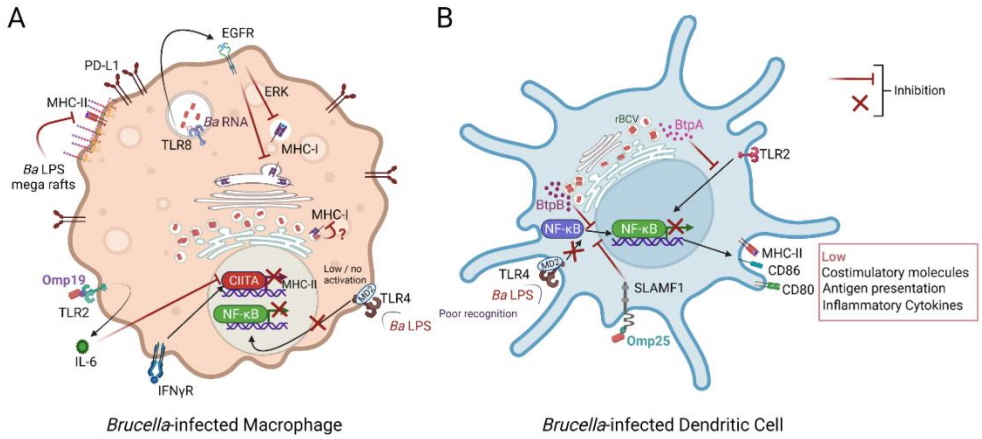

Figure 1. Mechanisms of Brucella's antigen presentation impairment [9].

This pathogen has developed various strategies that lead to inefficient antigen presentation by both macrophages and dendritic cells, resulting in an inefficient induction of an acquired immune response. (A) Recognition of Brucella lipoproteins by TLR2 results in the production of IL-6, which results in inefficient transcription of IFN-γ-induced MHC II due to the inhibition of CIITA. Also, Brucella abortus LPS, also known as Ba LPS, is expressed on the cell surface, forming a macrodomain with the MHC II complex, resulting in inefficient presentation of peptides to CD4+ T cells. This inefficiency is also seen in CD8+ cytotoxic T cells, in which MHCI molecules are retained in the Golgi apparatus by the TLR8/EGFR pathway after identifying Brucella abortus RNA (Ba RNA). (B) Omp25-SLAMF1 reduces the nuclear translocation of NF-κB, resulting in a decrease in the production of pro-inflammatory cytokines and costimulatory molecules on the surface

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of DCs. During infection, BtpA and BtpB effectors of Brucella are located in the cytoplasm, from which they interfere with the TLR2 and TLR4 signaling pathways, as well as DC maturation in dendritic cells. The unique architecture of the Ba LPS, particularly the core region, is poorly recognized by the TLR4-MD2 complex, resulting in the failure of DC maturation and T cell activation in both cell types. The phosphorylated active NF-κB dimers are represented in green [9]. Small ruminants, like sheep and goats, play a critical role in arid and semi-arid regions of the world. This is because these animals can adapt to harsh environmental conditions [10].

In regions like Al-Qaryat, livestock production systems are primarily based on extensive grazing across natural rangelands. The vegetation cover consists mainly of drought-resistant shrubs and scattered grasses that grow in wadis and seasonal grazing lands. These natural rangelands provide the main feed resources for sheep, goats, and camels [11]. However, the sustainability of livestock production in the region faces several environmental and economic challenges. Irregular rainfall patterns, desertification, overgrazing, and limited access to veterinary services have negatively affected rangeland productivity and animal health. As a result, improving rangeland management and developing sustainable livestock production strategies have become essential priorities for rural development in Libya [12].

Reproduction of ruminant animals includes the biological processes by which ruminant animals reproduce themselves so that the species is continued, and the number of the species is increased. The reproduction of ruminant animals includes several biological processes such as sexual maturation, estrous cycle, mating, fertilization, gestation, parturition, and postpartum recovery. The ruminant animals, such as cows, have an estrous cycle, in which the level of hormones in the body controls the breeding of the female, whereas the male animal is capable of releasing viable sperm during reproduction. Reproduction in ruminant animals is a successful biological process that can be evaluated using various parameters, such as the conception rate, fertility rate, kidding or lambing interval, litter size, and mortality rate. In small ruminant production, the number of newly born animals plays a major role in the profitability of the livestock sector, and thus, efficient reproduction is a critical biological function in livestock productivity [13].

Methods

Study design and sampling

This research was conducted using a cross-sectional research design to examine the effect of brucellosis on the reproductive performance of small ruminants in Al-Qaryat, Libya. The Al–Qaryat region is located in western Libya within the administrative boundaries of the Jabal al- Gharbi district. The area lies approximately between latitudes 30°23′–30°25′ N and longitudes 13°25′–13°35′ E, with an elevation of nearly 497 meters above sea level. The region includes several small rural settlements, which are characterized by low population density and scattered habitation patterns. Small ruminants, particularly sheep and goats, constitute the dominant livestock species in Libya due to their adaptability to harsh climatic conditions and their ability to utilize sparse vegetation. National agricultural statistics estimate that Libya possesses approximately 6-7 million sheep and goats, in addition to smaller populations of cattle, camels, and poultry.

The research was carried out among sheep and goats that were raised under traditional and semi-intensive farming practices in different livestock production areas in Al-Qaryat, Libya. The total number of animals that were used in this research was 120 small ruminants, comprising both sheep and goats that were of reproductive age. This research was carried out by randomly sampling these animals from different farms in the region, thus being representative of the entire small ruminant population in Libya. The sampling was primarily based on adult breeding females and males, as the data on the performance of the reproduction of the animals was more relevant for these categories. The sampling was also based on the collection of blood samples from each of the sampled animals to check for the presence of brucellosis infection in the animals using a lab test. The sampling was conducted with the consent of the owners of the farms and was based on the welfare of the animals.

Data collection

Data collection was achieved through lab tests and data recording from the field. The data collection methods involved aseptic collection of blood samples from the jugular vein of each animal using sterile syringes. The collected samples were then transported to the lab for diagnostic tests. The diagnostic tests for the data collection were achieved using serological methods for the diagnosis of Brucella infection, such as the Rose Bengal Test (RBT), which is widely used as a screening test for brucellosis in small ruminants. Besides the lab results, data on the performance of the animals was also collected from the farms and the farmers. The data collected on the performance of the animals included abortion history, fertility rate, lambing or kidding interval, number of offspring per birth, and stillbirths or weak newborns. The data gave a clear picture of the performance of the animals and the possible performance disorders due to brucellosis infection.

Data analysis

The collected data was then compiled and analyzed using statistical analysis methods. The data was analyzed using descriptive statistics to illustrate the prevalence of brucellosis infection among the sampled

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animals. The data was also analyzed to illustrate the various indicators of reproductive performance, such as abortion rate and fertility level. The data collected from the experiment were grouped into brucellosis-positive and brucellosis-negative categories. The data were then analyzed to assess the differences between the brucellosis-positive and brucellosis-negative groups in terms of reproductive performance. Statistical tests such as chi-square tests and correlation tests were applied to assess the relationship between brucellosis infection and its effect on the reproductive performance of the animals. The data was also analyzed to create tables and charts to illustrate the patterns from the data collected [14]. The purpose of the analysis was to determine whether brucellosis infection affects the reproductive performance of the animals in the Al-Qaryat region.

Results

Table 1 below illustrates the distribution of the sampled small ruminants included in the study. From the total sample size of 120 animals, 70 animals were found to be sheep, which accounted for 58.3% of the total sample. On the other hand, 50 animals were found to be goats, which accounted for 41.7% of the total sample. This illustrates that the study had a larger proportion of the sample population as sheep compared to goats. This may be due to the fact that the Al-Qaryat region had a larger number of sheep due to their ability to thrive in the environment and their economic importance in the country. However, goats were also included in the study, and this provided the study with the ability to conclude the existence and effects of brucellosis in the country. This is due to the fact that goats and sheep are the most important species in the small ruminant population in the country.

Table 1. Distribution of Sampled Small Ruminants by Species

Species	Number of Animals	Percentage (%)
Sheep	70	58.3
Goats	50	41.7
Total	120	100

Table 2 shows the results of the study based on the prevalence of brucellosis among the animals. Out of the 120 animals tested, 28 animals, which represents 23.3%, tested positive for brucellosis, while 92 animals, which represents 76.7%, tested negative. The results of this study show that nearly a quarter of the animals tested had the disease, which indicates that brucellosis is still present in animals. The results of this study also show that the animals are still at risk of contracting the disease, especially in production systems where animals are kept in proximity. Therefore, the results of this study emphasize the need to control the spread of brucellosis among animals by implementing control measures such as vaccination and better management of animals.

Table 2. Prevalence of Brucellosis Among Sampled Small Ruminants

Brucellosis Status	Number of Animals	Percentage (%)
Positive	28	23.3
Negative	92	76.7
Total	120	100

Table 3 presents a comparison of the abortion rates in brucellosis-positive animals and those found to be brucellosis-negative. From the 28 brucellosis-positive animals, 11 (39.3%) abortion cases were recorded, while from the 92 brucellosis-negative animals, 9 (9.8%) abortion cases were recorded. This shows a notable difference in the abortion rates of brucellosis-positive animals compared to brucellosis-negative animals. This shows a strong association of brucellosis infection with abortion. The abortion of lambs is one of the most characteristic signs of brucellosis infection in small ruminants. The high abortion rate in brucellosis-positive animals shows the effect of brucellosis infection on the reproductive efficiency of the animals. The abortion rate shows the economic effect of brucellosis infection on the animals. The abortion of lambs shows the effect of brucellosis infection on the production of lambs.

Table 3. Abortion Incidence in Brucellosis-Positive and Negative Animals

Brucellosis Status	Number of Animals	Animals with Abortion	Abortion Rate (%)
Positive	28	11	39.3
Negative	92	9	9.8
Total	120	20	16.7

Table 4 shows a comparison of several indicators of reproductive performance among brucellosis-positive and brucellosis-negative animals. The results revealed that the fertility rate of brucellosis-positive animals

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(61.5%) was significantly lower than the rate of brucellosis-negative animals (86.9%). This shows that brucellosis infection affects the ability of animals to conceive. The results also revealed that the average interval of lambing/kidding for brucellosis-positive animals (9.5 months) was significantly longer than the average interval for brucellosis-negative animals (7.8 months). This shows the effects of brucellosis infection on the reproductive cycles of the affected animals. The results revealed that the average number of offspring per birth for brucellosis-positive animals (1.2) was significantly lower than the average for brucellosis-negative animals (1.6). The results also revealed that the average percentage of stillbirths for brucellosis-positive animals (17.8%) was significantly higher than the average for brucellosis-negative animals (5.4%). The results have shown that brucellosis infection affects several indicators of animal reproduction.

Table 4. Comparison of Reproductive Performance Indicators

Reproductive Indicator	Brucellosis Positive	Brucellosis Negative
Fertility Rate (%)	61.5	86.9
Average Lambing/Kidding Interval (months)	9.5	7.8
Average Offspring per Birth	1.2	1.6
Stillbirth Cases (%)	17.8	5.4

Table 5 below shows the outcome of the statistical analysis used to assess the relationship between brucellosis infection and various disorders in reproduction. From the chi-square values and their respective p-values, it is clear that there are significant relationships between brucellosis infection and abortion, stillbirth, reduced fertility, and increased birth intervals. This is due to the fact that the p-values are all below the standard 0.05 significance level. Of all the disorders, abortion had the most significant relationship with brucellosis infection, as shown by the highest chi-square value. This confirms the critical role brucellosis plays in the reproduction disorders of small ruminants. The statistical significance of the relationships between brucellosis and the disorders confirms the importance of brucellosis control in the improvement and sustainability of reproduction in Libyan livestock.

Table 5. Statistical Association Between Brucellosis and Reproductive Disorders

Reproductive Disorder	x^2 Value	p-value	Interpretation
Abortion	14.62	0.001	Significant
Stillbirth	6.87	0.009	Significant
Reduced Fertility	8.41	0.004	Significant
Prolonged Birth Interval	5.23	0.022	Significant

Discussion

This study sought to evaluate the prevalence of brucellosis and its effects on the reproductive performance of small ruminants in the Al-Qaryat region. The results of the study have shown that brucellosis is a major health problem affecting sheep and goats, thus having major implications for the reproductive performance of these animals. The results of the study have shown that a large proportion of the animals under study were infected with brucellosis. The results have also shown that the reproductive performance of the infected animals was adversely affected by the infection, leading to abortion, stillbirths, reduced fertility rates, and long birth intervals. This shows the need for an understanding of the epidemiology of brucellosis in order to control the disease.

The distribution of the sampled animals revealed that sheep were in the majority among the sampled population, comprising 58.3% of the sampled animals, while goats comprised 41.7%. This is due to the fact that, in Libya, small ruminant farming is dominated by sheep, which can be raised in larger numbers due to their adaptability to arid and semi-arid climates, as well as their economic importance for meat and wool production. However, goats have also been kept by farmers in Libya due to their adaptability to harsh environmental conditions, which has contributed to their economic importance for milk and meat production. The reason for including both sheep and goats in this study was that brucellosis is prevalent among both species, although goats have been considered the primary host for brucellosis caused by Brucella melitensis. The inclusion of both species in this study provided an overall view of brucellosis prevalence among small ruminant farms [15].

The results from the lab tests revealed that 23.3% of the animals sampled were brucellosis-positive. The prevalence rate of 23.3% indicates that brucellosis is still prevalent in the small ruminants in the region of interest. The prevalence rate is also consistent with the prevalence rate reported in other regions with livestock production practices that allow for close contact between animals and a lack of implementation of disease control measures. The prevalence of brucellosis in the region of interest is a concern since the disease can be transmitted from an infected animal to a healthy one, thereby facilitating the spread of the

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disease within a flock or from farm to farm. Brucellosis is also a zoonotic disease, meaning that the disease can be transmitted from an infected animal to a healthy human being either by direct contact with the infected animal or by ingesting unpasteurized milk from an infected animal. The prevalence rate of brucellosis reported in the region of interest has implications for the health of both animals and humans [16].

One of the most important discoveries of the study is the high incidence of abortion in brucellosis-positive animals. As indicated by the results, there is a high incidence of abortion in infected animals, at 39.3%, compared to only 9.8% in animals that were negative for the disease. This is a strong indication of the relationship between brucellosis infection and abortion in small ruminants. Abortion is one of the most characteristic symptoms of brucellosis, especially in pregnant females infected with B. melitensis. This is because the bacteria have a strong affinity for the reproductive system, especially the placenta, where they reproduce very rapidly. As indicated in Figure 1, after the bacteria enter the body of the host via the mucosal surfaces of the oral or nasal cavity, they are carried by macrophages to the regional lymph nodes. From there, the bacteria are able to spread throughout the body via the bloodstream, including the reproductive system [17].

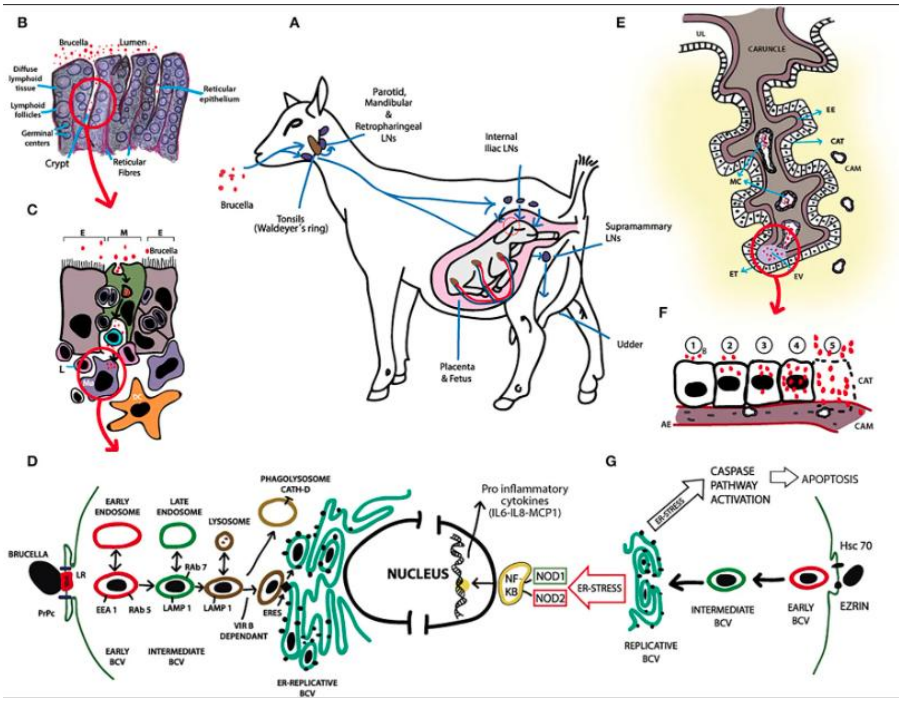

Figure 2. Pathogenesis of B. melitensis infection in small ruminants [17].

(A) Brucella melitensis infection in small ruminants occurs through the alimentary canal, with the pathogen entering through the oral mucosa and tonsils and reaching the lymph nodes of the head, and in pregnant females, the infection is located in the placenta, which causes abortion and stillbirth, and the pathogen is shed through vaginal discharge, abortion, placenta, and milk. (B) The pathogen invades the oral cavity and colonizes the tonsillar crypts, infecting the reticular epithelium. (C) M cells in the reticular epithelium are responsible for transporting the pathogens past the mucosal surface, where macrophages and dendritic cells engulf the pathogens, which activate the immune response and also facilitate the pathogen's spread. (D) The pathogen survives inside the macrophages by the formation of Brucella-containing vacuoles (BCV), which interact with the cellular organelles and form endoplasmic reticulum-derived compartments, which facilitate the replication of the pathogen and protect it from the immune system. (E) The bacteria will be transported to the placenta through the blood of the mother, where they will infect the trophoblast cells of the placentome and spread to the chorion-allantois membrane. (F) The bacteria will then adhere to the cell, be engulfed by the cell, multiply, and then induce apoptosis, releasing a large amount of bacteria. (G) The intracellular trafficking of the bacteria to the trophoblast cells is similar to the intracellular trafficking of the bacteria to the macrophage cell, leading to endoplasmic reticulum stress, inflammation, leading to apoptosis of the trophoblast cell, leading to placentitis and abortion of the small ruminant [17].

Once the animal is pregnant, the Brucella melitensis invades the placenta and chorioallantoic membranes, which leads to placentitis and interferes with the normal growth of the fetus. The Brucella species invade the trophoblast cells and multiply inside the membrane, which helps them to evade the immune system of the host. The pathogen survives by staying inside the membrane, which allows it to multiply and stay in the tissues of the host. The infection causes inflammation and stress, which eventually leads to the death of the trophoblast cells, resulting in the release of large quantities of the pathogen into the tissues. The infection

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causes damage to the placenta, fetus, and abortion. The aborted fetus, placenta, and fluids contain large quantities of the pathogen, which are released into the environment, causing infection in other animals. It is for this reason that abortion cases play a major role in the spread of brucellosis in animal herds [18].

Besides the abortion effect, brucellosis also had a negative effect on some other reproductive performance parameters of the animals that were studied. For instance, the fertility rate of the brucellosis-positive animals was lower than that of the non-infected animals. This indicates that brucellosis can also affect the ability of the animals to conceive. The lower fertility rate of the brucellosis-positive animals could be due to the infection, as the infection could have caused the animals to be unable to conceive. The brucellosis-positive animals also had a longer lambing or kidding interval than the healthy animals. The longer the birth interval, the lower the number of offspring that a female can produce during its lifespan. The study also showed that the average number of offspring per birth was lower in the brucellosis-positive animals than in the healthy animals. This indicates that brucellosis could have affected the development of the offspring, resulting in the birth of smaller offspring [19].

Another notable phenomenon was the increased rate of stillbirths recorded in the infected animals. Stillbirth occurs when the fetus dies before birth, often due to infection, insufficient functioning of the placenta, and other complications related to brucellosis. Stillbirth, therefore, contributes to economic costs for the farmers, considering that it reduces the number of live offspring, which are useful for herd replacement and sale. In small ruminant farming, where economic profitability is often linked to reproduction, such economic costs can be substantial. Moreover, additional costs may be incurred by the farmers, considering the veterinary costs, disease control, and replacement of the lost animals [20]. This is confirmed by the results of the statistical analysis, which revealed the significance of the association between brucellosis infection and the occurrence of reproductive disorders. All the reproductive disorders analyzed, such as abortion, stillbirths, decreased fertility, and prolonged birth intervals, have a p-value less than 0.05. This implies that the results obtained were not due to any random effect. Among the reproductive disorders analyzed, abortion had the strongest association with brucellosis infection. This further supports the fact that brucellosis infection is a major reproductive problem in small ruminants. These results are similar to those obtained from other countries, which have also demonstrated the strong association between brucellosis infection and reproductive disorders in small ruminants such as sheep and goats [21].

The results of the study emphasize the need to adopt brucellosis control strategies in small ruminant production in Libya. This might involve the regular surveillance of the disease, laboratory testing of the animals, vaccination of the animals, and the implementation of biosecurity measures. The farmers should be made aware of the risks associated with brucellosis. They should be made aware of the importance of handling aborted fetuses and placental materials. The improvement of the services of veterinarians and the collaboration of farmers, veterinarians, and government authorities have a crucial role to play in the reduction of the disease [22].

Conclusion

The objective of this study was to assess the prevalence of brucellosis and its effect on the reproductive performance of small ruminants in Al-Qaryat region. The study findings indicated that brucellosis is still present among sheep and goats, with a prevalence rate of 23.3% among the tested animals. The study findings have clearly indicated that brucellosis infection has a significant impact on the reproductive performance of small ruminants. Animals that were positive to brucellosis infection had higher rates of abortion, stillbirth, reduced fertility, and longer kidding and lambing intervals compared to those that were not infected with the disease. These reproductive problems have significant effects on the productivity of the animal, which in turn affects the farmer's economy. Statistical analysis of the study findings indicated that there is a significant relationship between brucellosis infection and reproductive problems, such as abortion. The study has clearly indicated the significant role played by brucellosis infection as a major reproductive disease affecting the reproductive performance of small ruminants in Libya. Therefore, the disease has to be controlled and prevented to improve animal health and the sustainability of animal farming in Libya.

Based on the findings of this study, the following recommendations can be made to help in controlling the prevalence of brucellosis and its effects on the reproductive performance of small ruminants. First, disease surveillance and testing should be carried out in order to control the spread of brucellosis in small ruminant herds. Secondly, vaccination against brucellosis should be encouraged and adopted in the areas where small ruminant rearing is practiced in order to protect the animals against the disease. Thirdly, farmers should be made aware of the importance of biosecurity in controlling the prevalence of brucellosis in their animals, as aborted fetuses, placentas, and materials are the major cause of the disease in small ruminants. Hygienic practices and reduced interaction between infected and uninfected animals may also help in controlling the prevalence of brucellosis in small ruminants. Furthermore, veterinary services should be improved to control the prevalence of brucellosis in small ruminant herds. Additionally, this study recommends further research to be carried out in a larger population and different geographical locations in Libya in order to have a better understanding of the prevalence and effects of brucellosis in the country.

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Conflict of interest. Nil

References

1. Moreno E, Blasco JM, Moriyón I. Facing the human and animal brucellosis conundrums: the forgotten lessons. Microorganisms. 2022;10(5):942. doi:10.3390/microorganisms10050942
2. Day R, Mohamed-Brahmi A, Aribi F, Jaouad M. Sustainable goat farming in southeastern Tunisia: challenges and opportunities for profitability. Sustainability. 2025;17(8):3669. doi:10.3390/su17083669
3. Zavattieri L, Macchi R, Canellada AM, Pibuel MA, Poodts D, Ferrero MC, Baldi PC. Brucella-induced impairment of decidualization and its impact on trophoblast function and inflammatory profile. Int J Mol Sci. 2025;26(17):8189. doi:10.3390/ijms26178189
4. Mengele IJ, Shirima GM, Bwatota SF, Motto SK, Bronsvoort BMdC, Komwihangilo DM, Lyatuu E, Cook EAJ, Hernandez-Castro LE. The status and risk factors of brucellosis in smallholder dairy cattle in selected regions of Tanzania. Vet Sci. 2023;10(2):155. doi:10.3390/vetsci10020155
5. Murugan T, Badusha NANM, Musa NS, Alahbabi EMM, Ahmed Alyammahi RA, Adege AB, Abdi A, Megersa ZM. Research advances in maize crop disease detection using machine learning and deep learning approaches. Computers. 2026;15(2):99. doi:10.3390/computers15020099
6. Ikram M. Assessing food security and environmental sustainability in North Africa: a composite indicator approach using data envelopment analysis. Sustainability. 2025;17(13):6017. doi:10.3390/su17136017
7. Pimenow S, Pimenowa O, Prus P, Niklas A. The impact of artificial intelligence on the sustainability of regional ecosystems: current challenges and future prospects. Sustainability. 2025;17(11):4795. doi:10.3390/su17114795
8. Moriyón I, Blasco JM, Letesson JJ, De Massis F, Moreno E. Brucellosis and One Health: inherited and future challenges. Microorganisms. 2023;11(8):2070. doi:10.3390/microorganisms11082070
9. Pellegrini JM, Gorvel JP, Mémet S. Immunosuppressive mechanisms in brucellosis in light of chronic bacterial diseases. Microorganisms. 2022;10(7):1260. doi:10.3390/microorganisms10071260
10. Sanjorjo RA, Tseten T, Kang MK, Kwon M, Kim SW. In pursuit of understanding the rumen microbiome. Fermentation. 2023;9(2):114. doi:10.3390/fermentation9020114
11. El-Zarroug MR, El-Maghrabi A, Al-Huni A. A survey of desertification in Al-Hira and its surrounding areas in Libya. J New Sci. 2019;74(5):4300–8.
12. Food and Agriculture Organization of the United Nations (FAO). Country programming framework for Libya (2016–2019). Rome: FAO; 2016.
13. Bazer FW, Minela T, Johnson GA. Novel aspects of the physiology of pregnancy in domestic ruminants. Animals. 2025;15(18):2672. doi:10.3390/ani15182672
14. Kydyshov K, Usenbaev N, Sharshenbekov A, Aitkuluev N, Abdyraev M, Chegirov S, Kazybaeva J, Brangsch H, Melzer F, Neubauer H, Pletz MW. Brucellosis in humans and animals in Kyrgyzstan. Microorganisms. 2022;10(7):1293. doi:10.3390/microorganisms10071293
15. Bouzalas I, Apostolidi ED, Scalas D, Davidopoulou E, Chassalevris T, Rosati S, Colitti B. A combined approach for the characterization of small ruminant lentivirus strains circulating in the islands and mainland of Greece. Animals. 2024;14(7):1119. doi:10.3390/ani14071119
16. Almuzaini AM. An epidemiological study of brucellosis in different animal species from the Al-Qassim region, Saudi Arabia. Vaccines. 2023;11(3):694. doi:10.3390/vaccines11030694
17. Rossetti CA, Maurizio E, Rossi UA. Comparative review of brucellosis in small domestic ruminants. Front Vet Sci. 2022;9:887671. doi:10.3389/fvets.2022.887671
18. Xiao Y, Li M, Guo X, Zeng H, Shuai X, Guo J, Huang Q, Chu Y, Zhou B, Wen J, Liu J, Jiao H. Inflammatory mechanism of Brucella infection in placental trophoblast cells. Int J Mol Sci. 2022;23(21):13417. doi:10.3390/ijms232113417
19. Martínez-Guerrero O, Hernández-Briano P, Muro-Reyes A, Maldonado YT, Perea-Lugo AL, Dávila-Ramos H, Gutiérrez-Piña FJ. Assessment and management of the impact of bovine brucellosis on dairy herd performance and profitability. Vet Sci. 2025;12(12):1119. doi:10.3390/vetsci12121119
20. Andrade MF, Simões J. Embryonic and fetal mortality in dairy cows: incidence, relevance, and diagnosis approach in field conditions. Dairy. 2024;5(3):526–41. doi:10.3390/dairy5030040
21. Wang C, Liu X, Ren Z, Du X, Li N, Song X, Wu W, Qu L, Zhu H, Hua J. The goat cytotoxic T lymphocyte-associated antigen-4 gene: mRNA expression and association analysis of insertion/deletion variants with the risk of brucellosis. Int J Mol Sci. 2024;25(20):10948. doi:10.3390/ijms252010948
22. Mehmedi, B., Iatrou, A. M., Yildiz, R., Lamont, K., da Costa, M. R., De Nardi, M., Allepuz, A., Niine, T., Niemi, J. K., & Saegerman, C. (2025). Economic Perspectives on Farm Biosecurity: Stakeholder Challenges and Livestock Species Considerations. Agriculture, 15(21), 2288. https://doi.org/10.3390/agriculture15212288

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