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Epidemiological Study of *Brucella abortus* Infection in Wasit Province

Zinah Shakir Shallal

Department of Pathological Analysis, College of Science, University of Wasit, Iraq

Corresponding authors: zalsoza@uowasit.edu.iq

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Abstract

Brucellosis, caused by *Brucella abortus*, remains a significant public health challenge in many regions, including Wasit Province, Iraq. This study analyzed the infection's seasonal trends and age-specific prevalence to understand its epidemiology better. Data from 2022 and 2023 indicated peak IgG positivity in January, May, and June, which were in line with the seasonality of agriculture. Interestingly, IgM positivity appeared sporadically, indicating limited acute infection or a lag in diagnosis. Age group 18-41 years had higher IgG rates, which pointed to occupational risk for subjects dealing with livestock. Findings here indicate the need for targeted interventions like improved veterinary services, public awareness campaigns, and vaccination programs on the persistent risk of zoonotic transmission. Such measures would focus on lessening the burden of brucellosis and protecting human and animal health in the region.

Introduction

Brucellosis is a zoonosis affecting both humans and various domesticated and wild animals. It is mainly caused by three species: *Brucella* abortus, involving cattle, other bovidae, and cervidae; *Brucella* suis, affecting swine; and *Brucella* melitensis, affecting sheep and goats. The infection is usually chronic in animals, resulting in abortion and infertility. In cattle, equines, and camels, brucellosis is generally associated with weaknesses during the later stages of pregnancy, abortion, and infertility. This disease infects herd animals and has been associated with several contaminated materials, venereal infections, and congenital or perinatal infections **[1]**.

Human brucellosis presents with spheroid incubation, with disease manifestations ranging from feverish activity to head and neck defects, fatigue, and severe sweating that may induce quinine and depression. This disease manifests in all human communities worldwide, excluding areas in which bovine brucellosis has been controlled and contained. Infection sources vary from region to region but are variously occupational or food born **[2]**. Preventive efforts involve staff education in ridding the job or profession of the often-latent incidences of corresponding diseases and inculcated safety in the slaughterhouse. However, gilt prevention aims to eradicate infection in infected animals **[3]**.

Brucellosis is endemic in several regions of the Middle East. Specifically, Iraq is one region where livestock farming forms the backbone of its economy; however, the province's location, farming methods, and almost complete economic dependence on cattle farming are strong factors in the disease's outbreaks.

Global and Regional Burden

Globally, brucellosis is a major public health concern worldwide, particularly in resource-limited settings. Historically, an evidence-based estimate of the global annual incidence of human cases has been elusive. Using international public health data, researchers estimated the annual global incidence to be 2.1 million, significantly higher than previously assumed **[4]**.

During the study period in Iraqi provinces in 2015, 1,824.5 patients were diagnosed clinically and serologically to have brucellosis infection. The infection is more prevalent in rural females in the summer months and among Iraqi Kurdistan people. In Baghdad regions, the serologic test was positive in most cases (71.3%), while only 38.3% were positive for *Brucella* culture **[5].**

In Wasit Province, brucellosis remains a persistent threat to public health and the economy. Brucellosis is endemic in Iraq, and annual surveys using advanced diagnostic assays are needed. A study investigating the prevalence of human brucellosis in rural areas in Wasit Province reported a seropositivity rate of 30.07%, with molecular findings confirming the presence of *Brucella abortus* and *Brucella melitensis* **[6]**. Traditional practices, such as the handling of infected livestock and consumption of unpasteurized dairy products, exacerbate the risk of zoonotic transmission, particularly in resource-limited and politically troubled countries like Iraq **[7]**.

Transmission and Risk Factors

Cattle often acquire *B. abortus* by contact with organisms in vaginal discharges and birth products, such as the placenta, fetus, and fetal fluids, from infected animals. Ingestion and transmission through mucous membranes are significant routes, while organisms can enter the body via broken skin. Shedding of *B. abortus* occurs in milk, urine, and semen, with intermittent shedding in milk. Calves may acquire *B. abortus* when nursing or via vertical transmission from infected dams. Persistently infected young animals often remain undetectable by diagnostic tests until they give birth or abort **[8]**.

Humans acquire *B. abortus* through contaminated mucous membranes, ingestion, or inhalation of aerosols. Typical routes include exposure to unpasteurized dairy products or infected tissues such as aborted fetal material. *Brucella* spp. can persist in various environmental conditions, such as low temperatures, high humidity, and organic material, which prolong survival in water, manure, or hay for several months **[9]**.

In Wasit Province, the persistence of brucellosis is exacerbated by poor veterinary services, limited vaccination programs, and a lack of public awareness about the disease. The traditional mixing of livestock species in shared grazing areas promotes interspecies transmission. Inadequate preventive measures compound this, increasing the risk of zoonotic transmission to humans **[10]**.

Socioeconomic and Public Health Impact

Brucellosis is a severe zoonotic disease that can cause reproductive disorders in animals, with significant economic and public health implications **[11]**. Indeed, abortion, stillbirth, and infertility have caused heavy losses in farm animals, which mainly include sheep, goats, and cattle. Such losses directly affect farmers' livelihoods by lowering productivity and increasing the culling rate of these animals **[12]**.

Brucellosis is characterized in humans by various clinical forms ranging from nonspecific fever and headache to muscle and joint pain while leading to long-term complications involving the cardiovascular and neurological systems **[13]**. These patients are often sick for 10 or more days, followed by further symptoms lasting from 20 days to several years, with a final prognosis including a long-term sequela regarding multifactorial health consequences, disability, lost working days, and increased health expenditures **[14]**.

Aca. Intl. J. Med. Sci. 2025;3(1) 01-10.: https://doi.org/10.59675/M311

Small ruminants are vital for food security and income in urban, peri urban, and rural areas throughout Iraq; however, endemic diseases like brucellosis continue to challenge animal productivity and public health **[15]**. Heterogeneity in flock size, animal density, and inter-flock contact have made the persistence and transmission of the disease still possible **[16, 17]**.
The primary aim of this study was to estimate the prevalence of B. abortus infection in Wasit Province and evaluate the risk factors contributing to its spreading. The results will serve as robust databanks for consideration when planning interventions such as vaccination programs, public educational campaigns, and improvements in veterinary services.

Methods

Study Area and Duration

This cross-sectional epidemiological investigation was carried out in Wasit Province, Iraq, mainly between 2022 and 2023.

Study Design

A cross-sectional study was designed to measure the frequency with which infection with *Brucella abortus* occurred. A total of 6,000 samples would be collected over 2 years, or 250 samples on average each month. The samples were screened using the Rose Bengal test for IgG and IgM type antibodies followed by Enzyme-Linked Immunosorbent Assay.

Sampling and Population

The population sampled adult respondents of 18-41 years old consisted of 18-25 years, 26-33 years, and 34-41 years with both males and females to maximize the representativeness of the profiler of both sexes. Diagnosed with infection with *Brucella* abortus-related infectious symptoms

Diagnostic Tests

The Rose Bengal Test (RBT) has successfully demarcated a prompt and reliable screening technique for detecting *Brucella abortus* antibodies in serum samples. The test is multiple because of its simplicity, making it suitable for extensive epidemiological studies due to the fast turnover of results.
ELISA has been employed to confirm and quantify IgG and IgM antibodies. The test helped distinguish acute infections indicated by IgM antibodies against chronic or past infections indicated by IgG. Combination testing reduces the chances of mistaking the infection status and increases the reliability of serological findings.

Data Collection

Data collection entailed a systematic monthly evaluation of the prevalence rates for *Brucella abortus* infection for 2022 and 2023, with the view of catching seasonal variances with potential influencing effects on infection intensity. Several demographic factors, such as age and sex, were selected and analyzed to find patterns and tendencies in the study population.
Rates of positivity for IgG and IgM antibodies were noted for each month, with the approximate percentage determined according to antibody type indicative of an acute infection (IgM) and chronic or past infections (IgG). Monthly analysis thus permitted the monitoring of fluctuations in prevalence over time.
In addition, records were categorized according to varied age groups between 18 and 41, such as 18 to 25, 26 to 33, and 34 to 41, with males and females included in every group. Thus, this stratification would afford the distribution of the infection to be analyzed with respect to the specific demographic strata regarding age and gender susceptibility to *Brucella abortus* infection.

Aca. Intl. J. Med. Sci. 2025;3(1) 01-10.: https://doi.org/10.59675/M311

Statistical Analysis

Statistical analysis was accomplished using IBM SPSS Statistics software, version 27. The Chi-square test was undertaken to check the significance of differences in infection prevalence across months, age groups, and gender; this gave the means of identifying significant statistics in the distribution of *Brucella abortus* infection. $P \leq 0.05$ were statistically significant, whereas $p \leq 0.01$ were highly significant.

Ethical Considerations

The ethical guidelines for epidemiological research were followed in this study. Informed consent was obtained from all participants. Data privacy and confidentiality for any of the participants were upheld.

Results

Monthly Distribution of *Brucella abortus* Infections in 2022 and 2023

The investigation estimated the monthly infections of *Brucella abortus* in Wasit Province for 2022 and 2023 using serological tests IgG and IgM. The monthly sample size totaled 250.

2022 Results: IgG-positive cases ranged between 38% (July) and 68% (January and May). No IgM-positive cases were recorded in most months, except for August (1.2%), October (0.8%), and December (1.6%). A statistically significant difference was observed in IgG positivity across months ($p \leq 0.01$). IgM positivity was non-significant ($p = 0.702$) (Table 1).

2023 Results: IgG-positive cases varied from 37% (September) to 58% (February). IgM positivity ranged between 0% and 1.6%, with significant detection in August and January. IgG positivity across months showed a significant difference ($p \leq 0.01$), while IgM remained non-significant ($p = 0.519$) (Table 2).

Table 1: Monthly Distribution of *Brucella abortus* Infections (IgG and IgM Positivity) in 2022

Month (2022)	IgG (%)	IgM (%)
January	68.0	0.0
February	55.0	0.0
March	61.0	0.0
April	54.0	0.0
May	68.0	0.0
June	51.6	0.0
July	38.0	0.0
August	56.0	1.2
September	40.0	0.0
October	51.0	0.8
November	65.0	0.0
December	61.0	1.6

Table 2: Monthly Distribution of *Brucella abortus* Infections (IgG and IgM Positivity) in 2023

Month (2023)	IgG (%)	IgM (%)
January	46.0	1.6
February	58.0	1.2
March	48.0	0.8
April	40.0	0.4
May	52.0	0.0
June	54.0	0.0
July	44.0	0.4
August	56.0	1.6
September	37.0	0.0

Aca. Intl. J. Med. Sci. 2025;3(1) 01-10.: https://doi.org/10.59675/M311

October	55.0	0.8
November	44.0	0.0
December	50.0	0.4

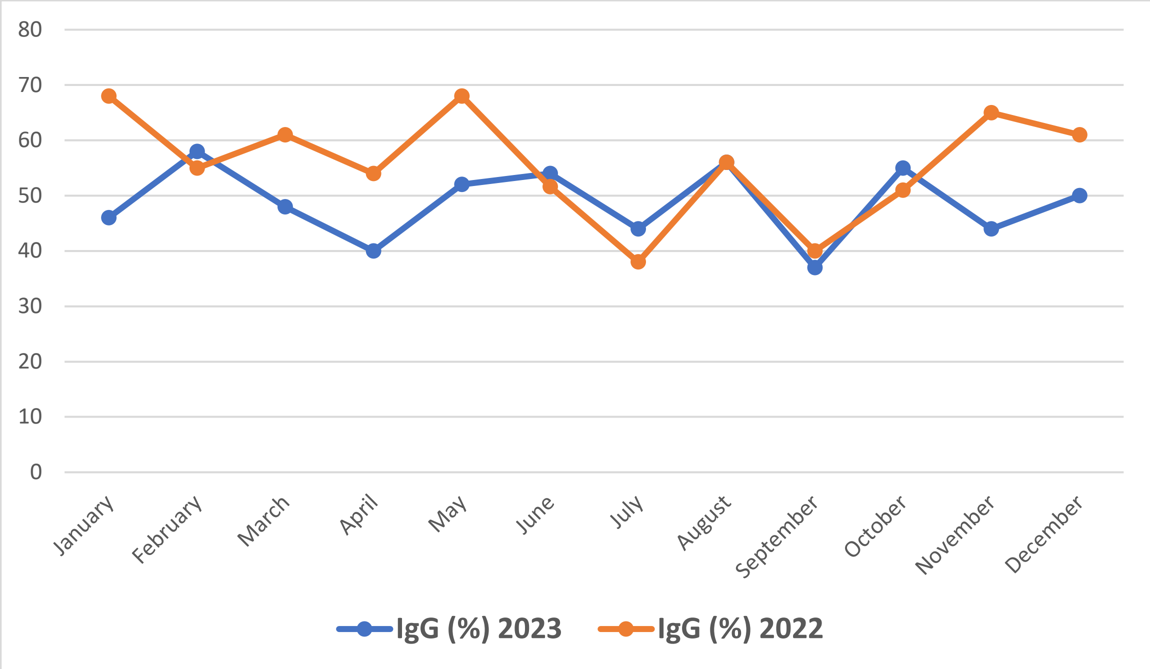

Figure 1: Monthly Distribution of *Brucella abortus* Infections (IgG Positivity) in 2022 and 2023

Age Group Analysis of *Brucella abortus* Infections

The study analyzed the distribution of *Brucella abortus* infections across three age groups (18–25, 26–33, and 34–41 years) for 2022 and 2023. The results are categorized by month and summarized in Tables 3 and 4.

2022 Results

In 2022, IgG positivity rates were highest in May across all age groups, with 25.2% in the 18–25 group, 22.4% in the 26–33 group, and 20.0% in the 34–41 group. IgM positivity was recorded only in August (0.8%), October (0.8%), and December (12%) in the 18–25 age group and sporadically in other age groups. Significant differences were observed in IgG positivity across all age groups ($p \leq 0.01$). IgM positivity, however, was non-significant ($p > 0.05$).

2023 Results

In 2023, the highest IgG positivity rates were recorded in June for the 18–25 group (21%) and the 26–33 group (23%), while the 34–41 group peaked in February (16%). IgM positivity was higher in January (1.2%) and August (1.6%) in the 26–33 group, with sporadic detections in other age groups. As in 2022, IgG positivity showed statistically significant differences across age groups ($p \leq 0.01$), while IgM positivity remained non-significant ($p > 0.05$).

Aca. Intl. J. Med. Sci. 2025;3(1) 01-10.: https://doi.org/10.59675/M311

Table 3: Effect of month and age groups in percentage of IgG and IgM / Infectional of *Brucella abortus* in 2022.

Month	(18-25) year		(26-33) year		(34-41) year	
	IgG No (%)	IgM No (%)	IgG No (%)	IgM No (%)	IgG No (%)	IgM No (%)
January	54 (21.6%)	0(0.0%)	71 (28.4%)	0(0.0%)	45 (18.0%)	0(0.0%)
February	45 (18.0%)	0(0.0%)	61 (24.4%)	0(0.0%)	32(12.8%)	0(0.0%)
March	51 (20.4%)	0(0.0%)	55 (22.0%)	0(0.0%)	47(18.8%)	0(0.0%)
April	46 (18.4%)	0(0.0%)	52 (20.8%)	0(0.0%)	37 (14.8%)	0(0.0%)
May	63 (25.2%)	0(0.0%)	56 (22.4%)	0(0.0%)	50 (20.0%)	0(0.0%)
June	46 (18.4%)	0(0.0%)	40 (16.0%)	0(0.0%)	43 (17.2%)	0(0.0%)
July	40 (16.0%)	0(0.0%)	34 (13.6%)	0(0.0%)	22 (8.8%)	0(0.0%)
August	47 (18.8%)	2(0.8%)	51 (20.4%)	1 (0.4%)	41 (16.4%)	0(0.0%)
September	32 (12.8%)	(0.0%)	45 (18.0%)	0(0.0%)	23 (9.2%)	0(0.0%)
October	49 (19.6%)	2(0.8%)	44 (17.6%)	0(0.0%)	35 (9.2%)	0(0.0%)
November	57 (22.8%)	0 (0.0%)	63 (25.2%)	0(0.0%)	42 (16.8%)	0(0.0%)
December	64 (25.6%)	3(12.0%)	52 (20.8%)	1(0.4%)	37 (14.8%)	0(0.0%)
P-value	0.0001	0.803	0.0001	0.877	0.0001	1.00

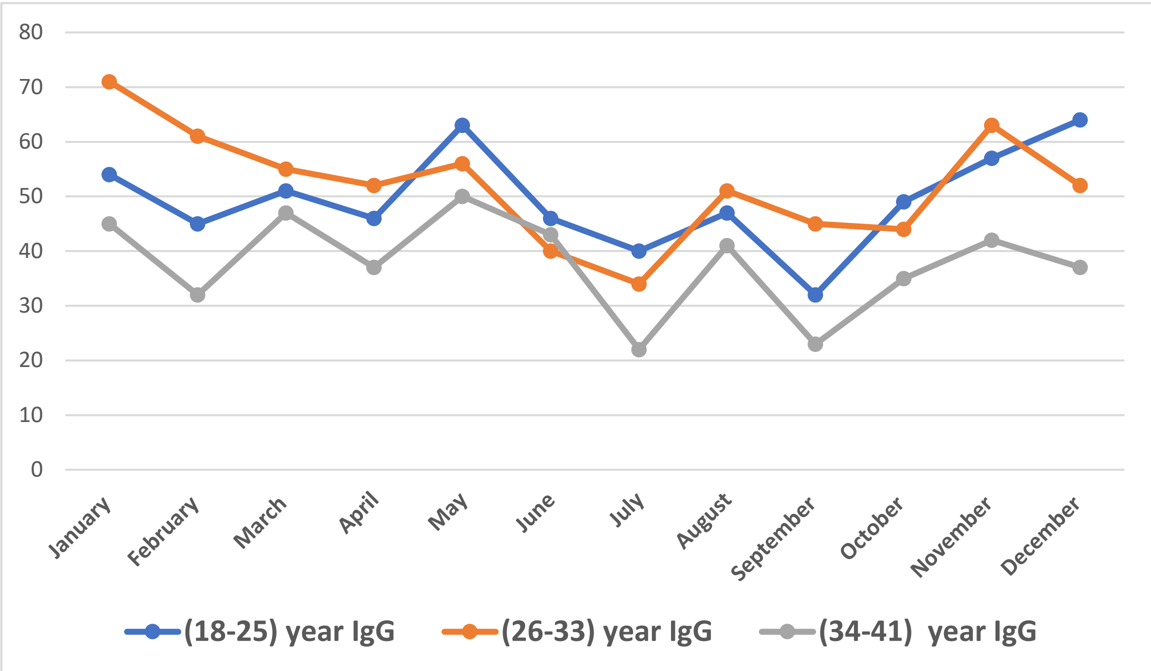

Figure 2: Effect of month and age groups in percentage of IgG and IgM / Infectional of *Brucella abortus* in 2022.

Aca. Intl. J. Med. Sci. 2025;3(1) 01-10.: https://doi.org/10.59675/M311

Table 4: Effect of month and age groups in percentage of IgG and IgM / Infectional of *Brucella abortus* in 2023.

Month	(18-25) year		(26-33) year		(34-41) year	
	IgG No (%)	IgM No (%)	IgG No (%)	IgM No (%)	IgG No (%)	IgM No (%)
January	42 (17%)	1(0.4%)	47 (19%)	3(1.2%)	26 (10%)	0(0.0%)
February	50 (20%)	0(0.0%)	53 (21%)	3(1.2%)	41 (16%)	0(0.0%)
March	42 (17%)	1(0.4%)	46 (18%)	1(0.4%)	33(1%)	0(0.0%)
April	32 (13%)	0(0.0%)	40 (16%)	1(0.4%)	27 (11%)	0(0.0%)
May	45 (13%)	0(0.0%)	53 (21%)	0(0.0%)	31 (12%)	0(0.0%)
June	53 (21%)	0(0.0%)	57 (23%)	0(0.0%)	25 (10%)	0(0.0%)
July	45 (18%)	0(0.0%)	44 (18%)	1(0.4%)	21 (8%)	0(0.0%)
August	52 (21%)	1(0.4%)	55 (22%)	2 (0.8%)	33 (13%)	1(0.4%)
September	36 (14%)	0(0.0%)	37 (15%)	0(0.0%)	20 (8%)	0(0.0%)
October	51 (20%)	0 (0.0%)	53 (21%)	2(0.8%)	34 (14%)	0(0.0%)
November	40 (16%)	0 (0.0%)	45 (13%)	0(0.0%)	26 (10%)	0(0.0%)
December	37 (15%)	3(12.0%)	65 (26%)	0(0.0%)	22 (9%)	1(0.4%)
P-value	0.0001	0.869	0.0001	0.649	0.0001	0.502

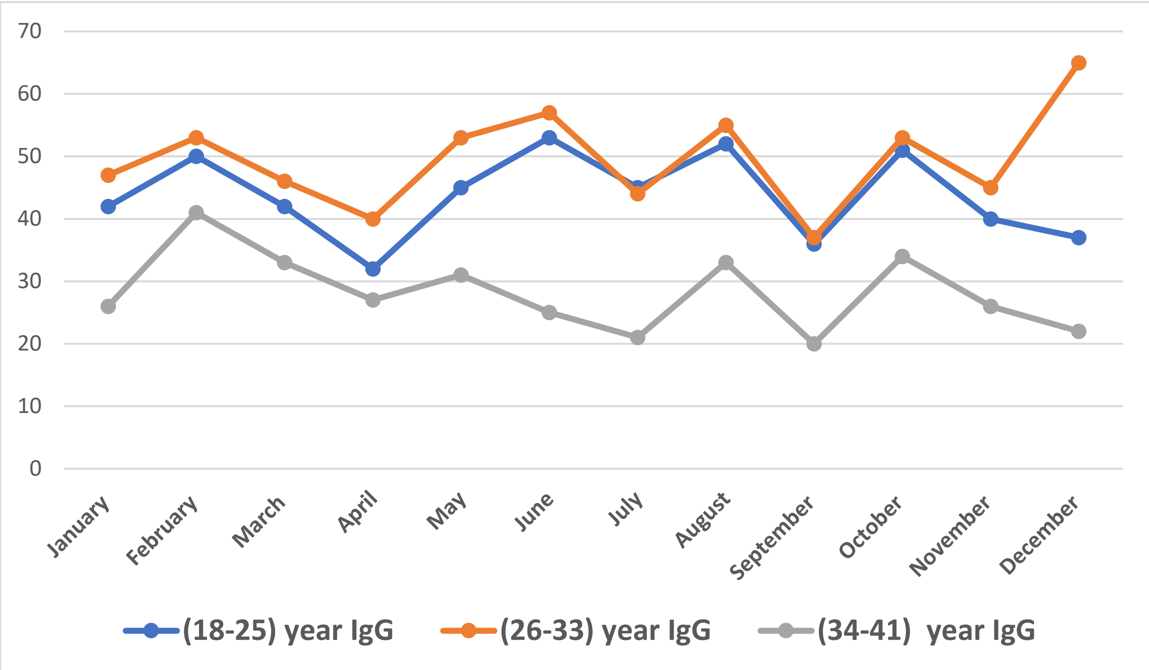

Figure 3: Effect of month and age groups in percentage of IgG and IgM / Infectional of *Brucella abortus* in 2023.

Chi-square analysis revealed statistically significant differences in IgG positivity across months for both years ($p \leq 0.01$). However, IgM positivity did not show significant variation. These results emphasize the seasonality and age-specific dynamics of *Brucella abortus* infections in Wasit Province. Further studies are recommended to understand the factors influencing IgM detection and to evaluate intervention strategies.

Aca. Intl. J. Med. Sci. 2025;3(1) 01-10.: https://doi.org/10.59675/M311

Discussion

This research offers a detailed study regarding *Brucella abortus* infections in Wasit Province, Iraq, indicating significant seasonal variations and age-related prevalence patterns. The discoveries manifest values of much epidemiological importance, directly impacting measures against public health and brucellosis control. Certain variations in IgG positivity rates were exhibited monthly, with peaks being in January and May in the year 2022 and in June in the year 2023. These peaks may correspond to specific agricultural practices or augmented periods of human-livestock interaction. IgM detection was occasional, with few cases observed during the entire study period, emphasizing chronic or previously contracted rather than acute cases of infection.

The IgG positivity for the above two years was consistently higher for individuals aged 26-33 and 34-41 years. This trend may be related to occupational exposure, as these age groups actively engage in agricultural or livestock activities. No such trend was observed for IgM positivity among age groups; this, therefore, calls for more actions to improve diagnostics to detect acute cases. The findings underscore the need for targeted interventions in specific age groups and during identified high transmission seasons.

Many studies have recorded seasonal variations in the incidence of brucellosis, often coinciding with livestock breeding seasons as they relate to increased human-animal interactions. For example, a study investigating human brucellosis in Iraq from 2007 to 2018 conducted by Mustafa et al. found that the disease did not show some temporal clustering as it reached incidence each year **[18]**. While it suggested that transmission was active throughout the year, human exposure usually took place during livestock breeding season, resulting in heightened infection during those seasons.

The concurrent meta-analysis of brucellosis in the Middle East indicated that the disease's management correlated mainly to livestock breeding seasons; a prime time is in the spring when human contact with some infected animals or their products is most expected **[19]**.

Our study's peaks occurring during January, May and June may correspond with certain agricultural practices or climatic conditions in Wasit Province that might favour increased contact between humans and livestock. These findings are consistent with the notion that seasonality related to animal husbandry could instead influence incidences of brucellosis.

Age-Specific Distribution

Our study results indicated higher IgG positivity rates for the age groups 26-33 and 34-41, corroborating findings reported from other regions. For instance, a study reported from Duhok in Iraq stated that the peak distribution of brucellosis seroprevalence occurred in the age group of 21 to 30, which comprised 22.7% of cases **[20]**. The subjects in this age group are usually actively involved in livestock rearing and farming activities, rendering them highly exposed to risks.

Moreover, a comprehensive review of brucellosis in Iraq suggested a higher prevalence in females (37.94%) than in males (20.85%), providing evidence of occupational exposure related to gender or some cultural behaviour that affects the infection rates **[21]**.

The low IgM positivity across all age groups in this study could indicate that these infections have been chronic or that most cases were mere past infections. Such tendencies may reflect the underreporting of acute cases or a delay in seeking medical assistance and, consequently, diagnosis at later stages.

Our findings' agreement with existing literature warrants targeted public health interventions directed at specified age groups and specific seasonal periods characterized by increased transmission. Educational programs on brucellosis transmission risk, personal protective

Aca. Intl. J. Med. Sci. 2025;3(1) 01-10.: https://doi.org/10.59675/M311

equipment use among those involved in livestock handling, and improved diagnostics for early detection are key aspects of control for the brucellosis epidemic in the Wasit Province.
The current study provides perspectives but demands further avenues to explore which specific factors may have contributed to seasonal peaks and age-based prevalence. Much work is still needed to focus on the incidence of brucellosis epidemics among affected people of different ages and sexes. Longitudinal studies can shed more light on understanding transmission routes of Brucellosis concerning occupational exposures, cultural practices, and environmental factors and aid in designing effective interventions.

Conclusion

The study revealed significant clues regarding *Brucella abortus* owners in Wasit Province. It marks important seasonal and age features through infection prevalence. Peak IgG positivity for a given month and a higher prevalence of infections in the age groups 26 and 41 are drawing attention to target population intervention strategies in the community for public health. Addressing the risk factor limitations of insufficient veterinary services, poor public awareness, and traditional farming practices is vital for disease control and protection against zoonosis transmission.

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