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Abortion in ewes in Nineveh governorate, Iraq: A systematic review and meta-analysis

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Abstract

The current study was designed to examine the evidence and knowledge gaps in studies investigating abortion in ewes in Nineveh, Iraq, and quantify the overall incidence of abortion and the prevalence of potential infectious etiology of abortion. PubMed, CABI, and Google Scholar databases were used as search engines to track pertinent peer-reviewed studies. Additional relevant articles were identified by reviewing the reference lists of identified full-text articles and contacting colleagues who worked on pertinent topics. Identified studies were divided into two main groups, including studies that reported the abortion rate in ewes and studies that reported the potential infectious etiology of abortion. A meta-analysis was performed for each group. A total of 17 studies were qualified for review, including six studies that reported the abortion rate. The 17 studies examined the prevalence of potential etiology of abortion. The overall incidence of abortion was 7.32%, and the pooled prevalence of potential infectious etiology of abortion indicated that 51.43%, 31.92%, and 6.83% were for *Toxoplasma gondii*, *Brucella* spp., and other pathogens, respectively. In conclusion, it is essential to identify epicenters of abortion in Nineveh, the association between the incidence of abortion and parity, the effect of pregnancy season on the incidence of abortion, and confirm the prevalence of *T. gondii* in aborted ewes is high.

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Introduction

Abortion is simply defined as the termination of pregnancy at any stage of gestation due to infectious and less likely non-infectious causes (1). Infectious pathogens can include *Brucella* spp., *Chlamydophila abortus* (known as enzootic abortion of ewes), *Salmonella* spp., *Campylobacter* spp., *Listeria monocytogenes*, *Leptospira* spp., *Coxiella brunetii* (Q-fever), Border disease virus, *Toxoplasma gondii*, *Neospora caninum*, and *Anaplasma phagocytophilum* (2,3). Incidence of abortion in ewes can reach 5% in outbreak situations, although it is usually less than 2% in healthy sheep flocks (1). Regardless of the causative agent, abortion is considered a burden to the farmers and can have public health concerns. Abortion in ewes constitutes a burden to sheep producers. In Nineveh, the total number of sheep was estimated at 1,247,225 head (4), increasing trends to be approximately 3,928,870 head in 2020, according to Nineveh Agriculture Office. Locally, sheep are raised for the production of meat, milk, and wool. The homemade cheese and the upper layer of boiled milk, traditionally known as "Kishfa" or "Gushwa," are famous during lactation. Economic losses due to abortion can include loss of the newborn lambs, potential mortality of the aborted ewes, decreased probability of fertilization, and cost of treatment (5). The cost of abortion due to *Chlamydophila abortus* in the UK was estimated at 15 million pounds (about 20 million US dollars) per year (2). Abortion in ewes can be considered a public health issue. A study in Jordan reported that brucellosis in humans increased during the season of

lambing (6), indicating potential exposure of humans to *Brucella* spp. that cause abortion in ewes, which can contaminate the environment and infect humans (7). Most infectious agents that cause abortion in ewes are zoonotic. For example, humans can take *T. gondii* oocysts with food or water contaminated with hair of infected domestic dogs and cats (8) or by eating undercooked or raw meat containing viable tissue cyst (9). On the other hand, humans can be infected with *Brucella* spp. Due to the consumption of unpasteurized milk or homemade cheese from raw milk (7). In Nineveh, infectious diseases that can cause abortion in ewes have been investigated. For instance, in a study that included 12,626 ewes, *T. gondii* antibodies were diagnosed in 79% of aborted ewes (10). In another study, *Brucella* spp. Antibodies were identified in 27% of aborted ewes (11). The prevalence of brucellosis in sheep was estimated at 14.46% (12). In addition, *Campylobacter jejuni and Campylobacter fetus* (13), *Neospora caninum* (14), and Chlamydophila (15) were also reported in aborted ewes.

However, a systematic review and meta-analysis that can evaluate the current evidence and numerically summarize this evidence have not been performed. Therefore, the current study was designed to: (i) identify and assess the evidence, and knowledge gaps in peer-reviewed studies that investigated abortion in ewes in Nineveh, Iraq using a systematic review approach, and (ii) quantify the incidence of abortion and the prevalence of potential infectious etiology of abortion in ewes using a meta-analysis approach.

Materials and methods

A systematic review and meta-analysis for studies that have examined abortion in ewes in the Nineveh governorate were conducted according to PRISMA 2020 statement (16). In this study, abortion was defined as the termination of the pregnancy at any stage of gestation or delivering a weak newborn lamb that died shortly after the birth (i.e., stillbirth) regardless of the causative reason (1).

Eligibility criteria

Studies written in Arabic or English, published in peer-reviewed journals, presented original data collected from ewes located in Nineveh governorate, Iraq, were considered for inclusion. Master theses and Ph.D. dissertations were also considered for inclusion in this study since they included rigorous methodology and evaluation similar to that for published studies (17). moreover, most of the results were published as an article in peer-reviewed journals. All studies conducted before the date of this review were considered for inclusion. Narrative reviews or meta-analyses were excluded.

Information sources and search strategy

PubMed, CABI, and Google Scholar were used as search engines to track pertinent peer-reviewed research reports. Google Scholar can track as much as possible pertinent reports conducted and published locally compared to other search engines as faculty members at the University of Mosul upload their research to their Google Scholar accounts as a regulation in the university. The search was conducted on July 24, 2020. The words (abortion, ewes, Nineveh, Iraq) were entered as keywords in the search box as a phrase where a comma and one space followed each word without any automatic filtering.

Selection Process

The two authors independently screened the records that appeared in the search, and the consensus was used to resolve any disagreement in studies selection. Duplicated and journal index records were removed, and the screening process was conducted at levels of titles, abstracts, and full-text articles. Reference lists of identified full-text articles were screened for additional relevant articles. Finally, colleagues who worked on pertinent topics were contacted for potential additional reports.

Data collection

The two authors collected the following data: study objectives, the total number of ewes, number of aborted ewes, tests used for diagnosis of potential infectious etiology of abortion, samples used for the diagnosis, results of tests used for the diagnosis, and the potential causative agents.

Data items

In this systematic review, the PICOS approach (population, intervention (or exposure), comparators, outcome, and study design) was used to identify characteristics of qualified studies (18). For studies that reported abortion rate, PICOS included (i) P: ewes in Nineveh governorate, Iraq; (ii) I: abortion, (iii) C: non-aborted ewes, (iv) O: abortion rate, and (v) S: observational studies. On the other hand, PICOS for studies reported potential etiology of abortion included: (i) P: pregnant ewes in Nineveh governorate, Iraq; (ii) I: an infectious etiology detected using serological or molecular methods, or isolated from animal specimens, (iii) C: ewes tested negative for that particular infectious etiology, (iv) O: the result of tests used for the diagnosis, isolates, or antibody titers, and (v) S: observational studies that examined potential infectious etiology in aborted ewes.

Assessing risk of bias in identified studies

The risk of bias in identified studies was assessed according to the checklist described by Hoy *et al*. (19) with some modifications. Each study was given up to 6 points score based on external and internal validity criteria. External validity criteria included 3 points; one point for each of the following: representation of Nineveh governorate, sample size calculation, the random selection of

study ewes. On the other hand, internal validity criteria included 3 points: one point for a precise definition of the case and 2 points for precise calculation resulting from clearly identifying the numerators and denominators. Identified studies were divided into two main groups based on the study objective: (i) studies that reported abortion rate in ewes, and (ii) studies that reported potential infectious etiology of abortion in ewes. In this study, the case definition for studies reported abortion rate constituted the definition of an abortion event, whereas studies reported potential infectious etiology of abortion constituted methods used to interpret laboratory test results.

Meta-analysis

In this study, research obtained from a systematic review reported abortion rates in the meta-analysis to calculate an overall incidence of abortion in ewes. The overall incidence of abortion represented the proportion of aborted ewes to pregnant ewes. A fixed-effect model assumed that all included studies were identical and computed the same effect size as all studies estimated abortion rate or incidence of abortion in ewes in Nineveh, Iraq (20). On the other hand, the overall prevalence of potential infectious etiology of abortion represented the proportion of ewes tested seropositive for a particular pathogen to aborted ewes. Only studies that used serum from aborted ewes were included in this analysis. A random-effects model was used based on the assumption that the effect size variation across studies is actual as the studies were estimated different pathogens using different methods of diagnosis (20).

In both analyses, Cochran's Q test was used to assess the evidence of heterogeneity, and *the* I^2 statistic was used to describe the percentage of the variability due to heterogeneity rather than chance (21). Egger regression was used to evaluate the bias (22). In all analyses, a *P*-value of ≤ 0.05 was considered significant. Finally, meta-analyses were performed using Review Manager (RevMan) [computer program], version 5.4.1 (The Nordic Cochrane Centre, The Cochrane Collaboration, Copenhagen, Denmark), and Egger regressions were performed using STATA, version 13.0 (StataCorp., College Station, TX, USA).

Results

Systematic review

PubMed and CABI revealed zero reports, whereas Google Scholar identified 240 records. A total of 224 reports were assessed for eligibility after removing 11 duplicate records and five records for the journal index. Screening reports assessed for eligibility identified eight studies qualified for review (Figure 1). Additional nine relevant reports were identified from reviewing the reference lists of identified full-text articles and contacting colleagues who worked on pertinent topics (Figure 1). The selection process identified a total of 17 studies qualified for review, including six studies that reported the abortion rate (Table 1). All 17 studies examined the potential infectious etiology of abortion in aborted ewes (Table 2), including studies that used serum samples (or milk) from aborted ewes to detect antibodies against different infectious agents. Other studies used vaginal swabs and fetuses for culturing purposes.

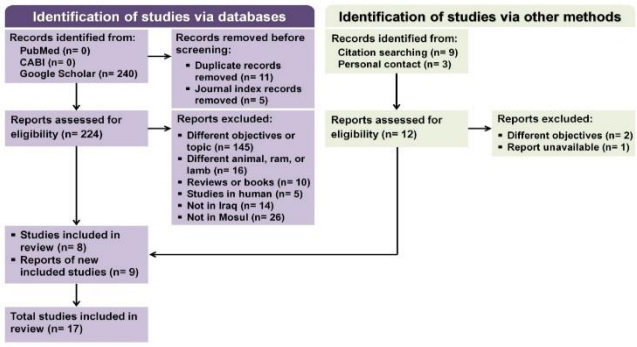

Figure 1: Flow diagram of article selection process applied in the systematic review for the epidemiology of abortion in ewes in Nineveh, Iraq. Keywords (abortion, sheep, ewes, Mosul, Iraq) were used on July 24, 2020.

Table 1: Characteristics of the studies reported abortion rate in ewes in Nineveh governorate, Iraq

Study	Animals in the flock	Pregnant ewes	Aborted ewes	Abortion rate	Score
Hussain *et al*., 1994 (23)	1,918	Not reported	337 [a]	17.6	2
Altaee, 2002 (10)	Not reported	12,626	1,444	11.4	4
Al-Hankawi, 2006 [b] (11)	5723	3745	91	2.4	5
Mohammed, 2006 [c] (24)	3000 (2880 ewes)	Not reported	345	11.9	2
Al-Farwachi *et al*., 2010 (25)	172	172	27 [d]	15.7	1
Al-Sanjary *et al*., 2014 [e] (26)	Not reported	630	50	7.9	--

[a] This number was not reported in that study, but it is calculated in the current analysis. [b] MSc thesis, part of it published as an article in a conference (27). [c] MSc thesis, part of it published as an abstract in a conference (28). [d] Included 20 abortions and seven stillbirths. [e] This study was not scored because numbers were not reported in the published study, but the authors provided them from raw data.

Table 2: Characteristics of the studies examined potential etiology of abortion in aborted ewes in Nineveh governorate, Iraq

Study	Aborted	Sample	Positive ewes	Tests used	Potential etiology	Score
Hussain *et al*., 1994 (23)	184	Serum	24 (13%)	RBT	*Brucella* spp.	2
Al-Jawaly, 2000 (13)	60	Fetus	5(16.6)	Culture	*C. jejuni*	2
		V. Swab	2(6.6)	Culture	*C. fetus*	
Al-Sim'ani, 2000 (29)	139	Serum	41 (29.5%)	Latex		
			65 (46.8%)	IHAT	*T. gondii*	2
	35	Serum	5 (14.3%)	IgM ELISA		
Altaee, 2002 (10)	220	Serum	173 (79%)	Latex	*T. gondii*	2
Aghwan, 2005 (30)	50	Fetus	20 (40%)	Histopath	*T. gondii*	2
Hassan *et al*., 2005 (31)	166	Serum	76 (45.78%)	IHAT	*T. gondii*	
	400	Serum	74 (18.5%)	RBT	*Brucella* spp.	1
	74	V. swab [a]	54 (73%) [b]	Culture	*Brucella* spp.	
Al-Hankawi, 2006 (11)	91	Serum	25 (27.5%)	RBT	*Brucella* spp.	3
			25 (27.5%)	MRBT	*Brucella* spp.	
			20 (22%)	SAT	*Brucella* spp.	
			23 (25.3%)	2-ME	*Brucella* spp.	
			29 (31.7%)	i-ELISA	*Brucella* spp.	
	44	Fetus	7 (15.9%)	Culture	*B. melitensis*, *B. abortus*	
	7	V. swab	0			
	5	Milk	0			
Mohammed, 2006 (24)	425	Serum	155 (36.5%)	RBT	*Brucella* spp.	
	30	Serum	(36.5%)	PCR	Brucella	
			26 (86.7%)	PCR	*Br. melitensis*	3
	12	Fetus	7 (58.3%)	Culture	*B. melitensis*, *B. abortus*	
	12	V. swab	0	Culture	-	
Mansour and Al-Shahery, 2006 (32)	14	V. swab	5 (35.7%)	Culture	*B. melitensis*	2
		Milk	0			
Al-Farwachi *et al*., 2010 (25)	12	Fetus	4 (33.3%)	Culture	*Brucella* spp.	2
			4 (33.3%)	Smear	*Brucella* spp.	
			5 (42%)	m-ELISA	*Brucella* spp.	
Al-Farwachi *et al*., 2012 (14)	96	Serum	7 (7.3%)	i-ELISA	*Neospora caninum*	2
Al-Abdaly *et al*., 2013 (33)	25	Fetus	12 (48%)	Culture	*Brucella* spp.	1
	5	F. mem.	1 (20%)			
	45	V. swab	8 (17.8%)			
	50	Blood	0			
Aghaa and Rhaymah, 2013 (34)	62	Serum	2 (3.2%) [d]	c-ELISA	Rift Valley Fever virus	2
Isihak *et al*., 2013 (35)	50	Serum	13 (26%)	RBT	*Brucella* spp.	2
Al-Dabagh *et al*., 2014 (36)	100	Serum	*	ELISA	*T. gondii*	
				ELISA	*Brucella* spp.	
				ELISA	*Chlamydia* spp.	
				ELISA	Unidentified	
Al-Sanjary *et al*., 2014 (26)	50	Serum	35 (70%)	RBT	*Brucella* spp.	2
		Milk	34 (68%)	PCR	*B. melitensis*	
Rhaymah *et al*., 2018 (15)	150	Serum	15 (10%)	i-ELISA	*Chlamydophila abortus*	2

[a] In that study, vaginal swabs were taken from aborted ewes tested positive in RBT, i.e., 74 ewes. [b] This percentage was not reported in that study, but it is calculated in the current analysis. [c] Part of MSc thesis (37), [d] Included n=1 confirmed positive, and n=1 expected positive. [*] Percentages and numbers were potentially inaccurately reported in that study; therefore, it was challenging to address them. The authors reported 100 aborted ewes, but one ELISA plate would not permit a total of 100 samples. Most likely, they have tested 94 samples.

Meta-analysis

The overall incidence of abortion in Nineveh, Iraq was 7.32% (95% CI=7.32, 7.33; Figure 2) estimated by fixed-effect model from a total of 2,294 aborted ewes and 21,971 pregnant ewes obtained from 6 studies published between 1994 and 2014. The analysis indicated that the overall pooled prevalence of *T. gondii* was 51.43% (95% CI = 20.76, 82.10), *Brucella* spp. was 31.92% (95% CI = 20.35, 43.48), and other pathogens were 6.83% (95% CI = 2.46, 11.21) among aborted ewes (Figure 3). The random-effects model estimated the pooled prevalence from 629 ewes tested seropositive for different pathogens, and 1,883 aborted ewes constituted 12 studies published between 1994 and 2018. In both analyses, there was evidence of heterogeneity (Q statistics *P*-value < 0.05), and the percentage of total variation between studies due to the existence of heterogeneity was high (I^2=100%). Egger regression revealed evidence of a small study effect (*P*-value < 0.05).

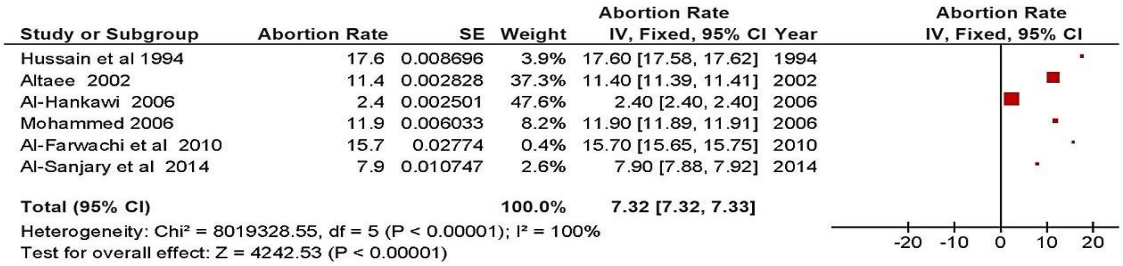

Figure 2: Forest plot for studies reported abortion rate in ewes in Nineveh governorate, Iraq. Each study was identified by the last name of the first author and the year of publication. The squares indicated the individual study's effect size as an abortion rate.

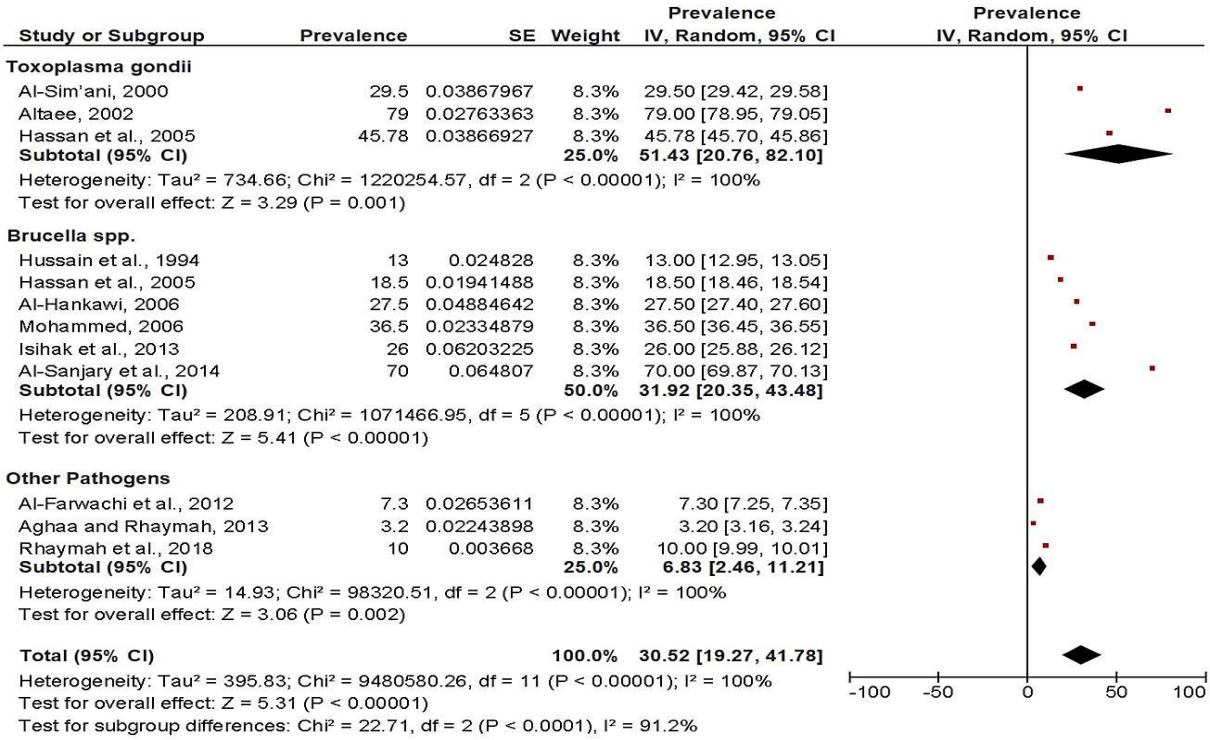

Figure 3: Forest plot for studies reported prevalence of potential infectious etiology of abortion in aborted ewes in Nineveh governorate, Iraq. Each study was identified by the last name of the first author and the year of publication. The squares indicated the individual study's effect size as a prevalence of the infectious pathogen. The above three diamonds showed the subtotal effect size estimate, whereas the last diamond showed the overall effect size estimate. The width of the diamond indicated the confidence interval of this estimate.

Discussion

The current study was the first investigation conducted to identify and evaluate the evidence and knowledge gaps in the studies that examined abortion in ewes in Nineveh, Iraq. The meta-analysis conducted here was the first analysis that quantified the overall incidence of abortion and prevalence of potential infectious etiology of abortion in ewes in the governorate. The analyses indicated that the overall incidence of abortion in ewes is 7.32%; *T. gondii* is the most infectious pathogen diagnosed in aborted ewes, followed by *Brucella* spp. and other pathogens.

Systematic review

Studies examined the potential infectious etiology of abortion

A total of 17 studies that examined the potential infectious etiology of abortion in aborted ewes in Nineveh was identified. The majority of these studies have investigated *Brucella* spp. (n=10) and *T. gondii* (n=5). In addition, *Campylobacter* spp., *Neospora caninum*, *Chlamydophila abortus*, and Rift valley fever virus were also investigated in different studies. Different samples have been used for this purpose, mostly serum from aborted ewes. Although identified studies showed the importance of particular pathogens as an etiology of abortion in ewes, different epidemiologic factors that can affect such infections were not extensively investigated. Nevertheless, classifying ewes based on parity (i.e., primiparous and multiparous) or the number of the gestation period (i.e., first gestation, second, or later gestations) could have been informative in studying abortion. On the other hand, the effect of geographical area on the infection examined by Altaee (10) and Al-Hankawi (11) was inconclusive because it can be confounded by other factors such as the flock management system. In addition, epicenters of studied pathogens in the governorate were not well identified. Further studies are needed to extensively explore epidemiologic factors that can influence the infection in ewes.

Meta-analysis

The meta-analysis conducted here indicated that the overall incidence of abortion in Nineveh was 7.32%. The estimated incidence is potentially overestimated because most of the available studies on targeted flocks are already affected by abortion. However, a well-designed investigation is required to confirm this proportion. The systematic review has indicated that the epidemiologic principles of sampling methodology for such studies were overlooked (i.e., random sampling principle). The analysis showed high heterogeneity, most likely a function of small studies that reported a high abortion rate. The effect of small studies was supported by the egger regression result (22). In addition, the analysis indicated that *T. gondii* seems to be a significant infectious pathogen that can cause abortion in pregnant ewes in the governorate, unlike what is usually shared between local veterinarians that *Brucella* spp. is the most pathogen that causes abortion in local ewes. The heterogeneity of the analysis is probably true because the included studies have investigated different infectious etiology (i.e., *T. gondii*, *Brucella* spp., and other causes). Egger regression revealed the effect of small studies investigating particular pathogens; consequently, they dominated these pathogens apparently as a cause of abortion in local ewes. An additional explanation of the high percentage of infectious pathogens identified in aborted ewes (particularly *T. gondii* and *Brucella* spp.) is the lack of active control programs against such pathogens. Finally, a flock management system could affect the spread of the infection.

Studies reported the abortion rate

The systematic review identified six studies performed between 1994 and 2014 that reported the abortion rate in ewes in Nineveh, Iraq. However, most of these studies have not been designated to study the abortion rate in the governorate. Indeed, they were aimed to diagnose particular pathogens that can cause abortion in pregnant animals. For instance, a comparison between different tests used for seroprevalence of brucellosis in sheep and goats was performed (11). In that study, the prevalence of brucellosis in the governorate was estimated, and the abortion rate in pregnant ewes and does was also reported. This study earned the highest score in the quality, as the external and internal validity were not contradicted, except that the sample size calculation was missed. In another study, abortion due to *T. gondii* in the governorate was examined (10). In that study, only flocks affected by abortion were targeted, decreasing the study's external validity. In addition, epidemiologic principles of sampling methodology for studies aimed to report the prevalence or incidence rate of abortion were overlooked, such as sample size calculation and random selection of study animals (23-39). In all identified studies, factors that can affect the incidence of abortion in ewes, such as parity, size of the flock, and geographical area, were not examined. Therefore, it is crucial to examine these factors in further studies.

Conclusions

The overall current evidence of abortion in ewes in Nineveh, Iraq, included that the incidence is expected to be around 7%, *T. gondii* and *Brucella* spp. are the most pathogens investigated as a potential infectious etiology of abortion in pregnant ewes in the governorate, and *T. gondii* is probably the most prevalent infectious pathogen that can cause abortion in pregnant ewes in the governorate, followed by *Brucella* spp. On the other hand, although identified

studies reported abortion rate in Nineveh governorate, Iraq, different knowledge gaps are existed, including: (i) epicenters of abortion is not well identified, (ii) the association between the incidence of abortion and parity is not studied, (iii) the effect of pregnancy season and other different factors on the incidence of abortion is not well recognized. Finally, as long as abortion is a potential economic burden to sheep producers, possible policy options can include widely applying active control programs against possible infectious pathogens that can cause abortion in ewes throughout the governorate. Such programs can include selecting appropriate diagnostic tests, vaccinating sheep against high prevalent pathogens, restricting the movement of animals from/to epicenter areas, and advising sheep owners to practice good flock management by isolating the aborted ewes from the flock following hygienic procedures in discarding the aborted fetuses.

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Conflict of interest

The authors declare that there is no conflict of interest in the research.

References

1. Menzies PI. Control of important causes of infectious abortion in sheep and Goats. Vet Clin Food Anim. 2011;27:81-93. DOI: 10.1016/j.cvfa.2010.10.011
2. Mearns R. Abortion in sheep: Investigation and principal causes. In Practice. 2007; 29:40-46. DOI: 10.1136/inpract.29.1.40
3. Mearns R. Abortion in sheep: Other common and exotic causes. In Practice. 2007;29: 83-90. DOI: 10.1136/inpract.29.2.83
4. Agricultural Statistical Atlas. Roadmap for agricultural development (green economy). Central Statistical Organization, Ministry of Planning, Republic of Iraq. Part 1 (In Arabic Language); 2011. [available at]
5. Gojam A, Tulu D. Infectious causes of abortion and its associated risk factor in sheep and goat in Ethiopia. International J Vet Sci Tech. 2020;4:007-012. [available at]
6. Shaqra QMA. Epidemiological aspects of brucellosis in Jordan. Eur J Epidemiol. 2000;16:581-584. DOI: 10.1023/A:1007688925027
7. Maxwell JR, Bill DE. Developing a brucellosis public health information and awareness campaign in Iraq. Military Medicine. 2008;173:79–84. DOI: 10.7205/milmed.173.1.79
8. Constable PD, Hinchcliff KW, Done SH, Gruenberg W. Veterinary medicine: a textbook of the diseases of cattle, horses, sheep, pigs, and goats. 11th ed. St. Elsevier; Louis, MO. 2017. [available at]
9. Liu Q, Wang ZD, Huang SY, Zhu XQ. Diagnosis of toxoplasmosis and typing of *Toxoplasma gondii*. Parasit Vectors. 2015;8:292. DOI: 10.1186/s13071-015-0902-6
10. Altaee AF. Survey on presence of *Toxoplasma gondii* antibodies in aborted ewes in Nineveh Province, Iraq. Iraqi J Vet Sci. 2002;16:9-16. [available at]
11. Al-Hankawe OKH. Comparative study for diagnosis of brucellosis in sheep and goats in Ninevah province using ELISA and other serological tests. MSc. thesis, University of Mosul, Iraq. 2006.
12. Dahl MO. Brucellosis in food-producing animals in Mosul, Iraq: A systematic review and meta-analysis. PLoS ONE. 2020;15(7): e0235862. DOI: 10.1371/journal.pone.0235862
13. AL-Jawally EAK. Campylobacteriosis of aborted ewes in Mosul. Iraqi J Vet Sci. 2000;13:237-240. [available at]
14. AL-Farwachi M, AL-Badrani B, AL-Khafaji W. Serodiagnosis of ovine neosporosis in Mosul city, Iraq. Eurasian J Vet Sci, 2012;28:190-193. [available at]
15. Rhaymah M, AL-Hankawi O, Hussain Kh, AL-Farwachi M. Prevalence of Chlamydophila abortion amongst local small ruminants in Ninevah province Iraq. Int J Adv Res. 2018;6:1028-1032. DOI: 10.21474/IJAR01/6945
16. Page MJ, McKenzie JE, Bossuyt PM, Boutron I, Hoffmann TC, Mulrow CD, Shamseer L, Tetzlaff JM, Akl EA, Brennan SE, Chou R, Glanville J, Grimshaw JM, Hróbjartsson A, Lalu MM, Li T, Loder EW, Mayo-Wilson E, McDonald S, McGuinness LA, Stewart LA, Thomas J, Tricco AC, Welch VA, Whiting P, Moher D. The PRISMA 2020 statement: an updated guideline for reporting systematic reviews. BMJ (Clinical research ed.), 2021;372, n71. DOI:10.1136/bmj.n71
17. Cook DJ, Guyatt GH, Ryan G, Clifton J, Buckingham L, Willan A, Mcllroy W, Oxman AD. Should Unpublished Data Be Included in Meta-analyses? Current Convictions and Controversies. JAMA. 1993;269:2749–2753. DOI: 10.1001/jama.1993.03500210049030
18. Liberati A, Altman DG, Tetzlaff J, Mulrow C, Gotzsche PC, Ioannidis JPA, Clarke M, Devereaux PJ, Kleijnen J, Moher D. The PRISMA statement for reporting systematic reviews and meta-analyses of studies that evaluate healthcare interventions: Explanation and elaboration. BMJ. 2009;339:b2700. DOI: https://doi.org/10.1136/bmj.b2700
19. Hoy D, Brooks P, Woolf A, Blyth F, March L, Bain C, Baker P, Smith E, Buchbinder R. Assessing risk of bias in prevalence studies: modification of an existing tool and evidence of interrater agreement. J Clin Epidemiol. 2012;65(9), 934–939. DOI: 10.1016/j.jclinepi.2011.11.014
20. Borenstein M, Hedges LV, Higgins JP, Rothstein HR. A basic introduction to fixed-effect and random-effects models for meta-analysis. Res Synth Methods. 2010;1:97–111. DOI: 10.1002/jrsm.12
21. Higgins JPT, Thompson SG, Deeks JJ, Altman DG. Measuring inconsistency in meta-analyses. BMJ. 2003;327: 557-560. DOI: 10.1136/ bmj.327.7414 .557
22. Harbord RM, Hrris RJ, Sterne JAC. Updated tests for small-study effects in meta-analyses. The Stata Journal. 2009;9:197-210. DOI: 10.1177/1536867X0900900202
23. Hussain KA, Saleem AN, Fatoohi FAM. Prevalence of brucellosis in buffaloes, cattle, and sheep in Mosul region. Iraqi J Vet Sci. 1994;7:233-239.
24. Mohammed HA. Investigation of brucellosis in sheep using PCR and other serologic tests. MSc. thesis, University of Mosul, Iraq. 2006.
25. Al-Farwachi MI, Al-Badrani BA, Al-Nima ThM. Detection of Brucella antigen in aborted ovine fetal stomach contents using a modified ELISA test. Iraqi J Vet Sci. 2010;24:1-4. DOI: 10.33899/ijvs. 2010.5577
26. AL-Sanjary R, Mohammed HA, Dahl MO. Using polymerase chain reaction technique (PCR) for detection *Brucella melitensis* in aborted ewes' milk in Nineveh, Iraq. Assiut Vet Med J. 2014;60:155-159. [available at]
27. Al-Hankawe OKH, Rhaymah MSH. Comparison between ELISA and other serological tests for diagnosis of brucellosis in sheep in Ninevah Province. Iraqi J Vet Sci. 2012;26(Suppl 2):97–103.
28. Mohammed HA, Saleem AN. Investigation of brucellosis in sheep using PCR and other serologic tests. Iraqi J Vet Sci. 2012;26(Suppl 1): 2.

29. Al-Sim'ani RG. Serological study for diagnosis of toxoplasmosis in sheep and human in Nineveh Governorate. MSc. thesis, University of Mosul, Iraq. 2000.
30. Aghwan SS. Immunological, experimental zoonotic studies of toxoplasmosis in Nineveh Governorate. Ph.D. dissertation, University of Mosul, Iraq. 2005.
31. Hassan MG, Sultan IA, Taher DM. Prevalence of toxoplasmosis and brucellosis in aborted ewes in Ninevah province. Raf Jour Sci. 2005;16:1-4. DOI: 10.33899/rjs.2005.43590
32. Mansour RS, Al-Shahery MN. Comparison between skin delayed-type hypersensitivity test using brucellin and Rose-Bengal test. Proceedings of the Fourth Scientific Conference, College of Veterinary Medicine, University of Mosul, Mosul, Iraq. 2006.
33. Al-Abdaly IBA, Arslan SH, Al-Hussary NA. The zoonotic impact of brucellosis in ruminants at Nineveh Province – Iraq. J Adv Biomed Pathobiol Res. 2013;3:18-23. [available at]
34. Aghaa OB, Rhaymah MSH. Seroprevalence study of Rift Valley fever antibody in sheep and goats in Nineveh governorate. Iraqi J Vet Sci. 2013;27:53-61. 10.33899/ijvs.2013.82778
35. Isihak FA, Albarodi SY, Al-Alim AM, Al-Attar MY, Al-Shahery MN, Mikhaeel NS. Screening for Brucellosis antibodies in ewes in Mosul. J Edu Sci. 2013;26(1):35-41. DOI: 10.33899/edusj.2013.89459
36. Al-Dabagh II, Jasim BM, Jarjees MT. Seroprevalence of antibodies to toxoplasmosis, brucellosis, and chlamydiosis in abortive sheep in Nineveh governorate, Iraq. Iraqi J Vet Sci. 2014;28:21-25. DOI: 10.33899/ijvs.2014.89467
37. Mansour RS. Epidemiologic and diagnostic study of brucellosis in Ninevah province. MSc. thesis, University of Mosul, Iraq. 2000.
38. Boyle MH. Guidelines for evaluating prevalence studies. Evidence-Based Mental Health. 1998;1:37-39. DOI: 10.1136/ebmh.1.2.37
39. Silva LC, Ordúñez P, Paz Rodríguez M, Robles S. A tool for assessing the usefulness of prevalence studies done for surveillance purposes: the example of hypertension. Rev Panam Salud Publica. 2001;10:152-60. DOI: 10.1590/s1020-49892001000900002

الإجهاض في النعاج في محافظة نينوى، العراق: مراجعة منهجية وتحليل شمولي

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الخلاصة

صُممت الدراسة الحالية لتحديد الأدلة الحالية والثغرات المعرفية في الدراسات المنجزة عن الإجهاض في النعاج في محافظة نينوى، وتحديد نسبة وقوع الإجهاض وانتشار المسببات المعدية المحتملة للإجهاض. أُستعمل لهذا الغرض محركات بحث علمية لتتبع الدراسات ذات الصلة بالموضوع. كما تم تحديد دراسات إضافية ذات صلة بالموضوع من خلال مراجعة قوائم مصادر الدراسات المحددة والاتصال بالزملاء الذين أجرَوْا بحوثاً في الموضوع نفسه. تم تقسيم الدراسات المحددة على مجموعتين رئيستين تضمّنت دراسات سجّلت نسبة الإجهاض في النعاج ودراسات كشفت عن المسببات المعدية المحتملة للإجهاض وأدرجت في تحليل شمولي لكل مجموعة. حَدّدت المراجعة المنهجية ١٧ دراسة تأهلت للمراجعة اشتملت على ست دراسات سجّلت نسبة الإجهاض في النعاج. سجّلت الدراسات السبع عشرة جميعها نسباً لانتشار مسببات معدية مختلفة محتملة للإجهاض. بيّنت نتائج التحليل الشمولي أن نسبة وقوع الإجهاض الإجمالية بلغت ٧,٣٢٪، وأن انتشار المسببات المعدية المحتملة للإجهاض كانت ٥١,٤٣٪ للمقوسات الكوندية و ٣١,٩٢٪ لجراثيم البروسيلا و ٦,٨٣٪ للمسببات الأخرى. أُستنتج من الدراسة الحالية أنه من الضروري تحديد بؤر الإجهاض في محافظة نينوى، ودراسة تأثير موسم الحمل على وقوع الإجهاض، وتأكيد ارتفاع نسبة انتشار الإصابة بالمقوسات الكوندية في النعاج المجهضة.