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Epidemiological studies on brucellosis in dairy farms in Nile delta, Egypt

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ABSTRACT

The current study was applied from January to December 2019 to determine and identify the prevalence rate of bovine brucellosis and its correlated risk factors in dairy herds in Nile delta, Egypt. The study populations comprised of 300 dairy farms which including 4000 dairy cattle. Estimated results showed that, the prevalence of brucellosis in dairy cattle was 6.05 % that depended on the result of CFT. The univariate statistical analysis revealed that positive cases of brucellosis was clearly higher in cattle housed under the intensive management system, and animals in the extensive management system had lower prevalence (P <0.001). Moreover, there was a statistically correlation between brucellosis and the age of animals (P < 0.01) but correlation was weak with the number of labor (P > 0.05). Significant increasing of positive cases was parallel with the increasing of the size of herd (P < 0.05). Sero-positivity to brucellosis was significantly correlated with history of abortions or stillbirths. The results estimated that brucellosis is endemic and widely distributed disease in Nile delta, Egypt.

1. INTRODUCTION

Brucellosis is a large distributed disease resulted from infection with *Brucella* microorganisms. Brucellosis has a great impacted effect on animal production and the health of human, especially in countries with large dairy production (Radostits *et al*., 1994; OIE 2004). Brucellosis is a very contagious and communicable disease overall the world. Its infection rate increased in last few years due to poor control programs and limited financial resources, as in developing countries. It causes many problems as abortion in last trimester and still birth or weak calf besides decreasing of production due to health problem (Khan and Zahoor, 2018). Brucellosis leads to great economic losses among infected animals. The disease has a negative impact on exports and breeding process beside its zoonotic impact. It can disrupt the whole breeding and production programs (Maadi *et al*., 2011;Mai *et al*., 2012). There are many risk factors related to brucellosis as the age of animals, herd size with high animal's density, management system and location of the farm beside weather conditions at the farm area (Norman *et al*., 2016). Contact between animals was the most important risk factor which associated with the spread of the disease in the endemic areas (P=0.01, OR=2.43).Other risk factor as the age of animals, size of herd and history of abortion also have very important role in transmission of brucellosis and its endemic statues (Temba *et al*., 2019).

2. MATERIAL AND METHODS

2.1. Animals:

This study conducted on 300 dairy cattle farms which located in Nile delta, Egypt. The period of the study was from January to December 2019. 4000 serum samples were collected from adult dairy cows with age over 2 years. The examined dairy farms were located in six governorates of Nile Delta including; Gharbia, Sharqia, Monufia, Beheira, Dakahlia and Kafr-El Sheikh governorate.

2.2. Design of Study:

Epidemiological survey was carried out on cattle which present in dairy farms using serological tests (Rose Bengal Plate Test and Complement Fixation Test).Clinical history and data collected from farm holders, veterinarians and farm workers by designed questionnaire including data about management system, herd size, age of animals, history of abortion and location of the farm.

2.3. Blood Samples:

About 10 mL of blood was collected by using vacutainer tubes from selected cows through the jugular vein. Samples tubes kept to clot overnight at room temperature. The sera were collected and transported in iceboxes to Brucella department, animal health research institute, Cairo (AHRI),and stored in deep freezer (-20°C) until testing.

2.4. Serological examination:

The RBPT and CFT were performed as mentioned by Alton et al. (1988). The antigens which used for tests were from Veterinary Sera and Vaccine Research Institute Abbassia, Cairo, Egypt.

2.5. Analysis of Data:

Data was stored in ExcelSheet program and analyzed by SPSS program version 20.

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- *The prevalence rate* was calculated by equation

$$\text{Individual prevalence} = \frac{\text{number of positive cases}}{\text{total number of animals}}.$$

- *Prevalence at herd level* was calculated by equation

$$\text{Herd prevalence} = \frac{\text{positive herd}}{\text{total herd number}}.$$

- *The prevalence within-herd* was calculated by equation

$$\text{Within herd prevalence} = \frac{\text{number of positive in the herd}}{\text{number of animals within the herd}}.$$

* Odds ratio used to estimation the correlation between the risk factors and the positivity to brucellosis.

3. RESULTS

3.1. Individual Animal Seroprevalence:

Out of 4000examined sera 244(6.1%) were positive by RBPT, from which242(6.05%) gave positive result by CFT with a titer >1:20.The distribution of positive farms over the governorates of Nile Delta were as following; Gharbia governorate 12.8% (9/70 herds), Sharkia 5.2%(2/38),Monufia11.11% (5/45), Beheira 8% (2/25), Dakahlia7.14% (3/42) and Kafr-El Sheikh governorate 12.5% (10/80) as showed in Figure (1).

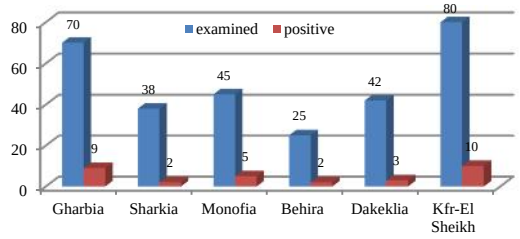

Figure 1 Seroprevalence of brucellosis in dairy farms in Nile Delta.

The result of univariate logistic regression revealed statistically significant effect of herd size (P < 0.001), age of examined cows (P < 0.001) and seasonal climate (P< 0.001)on the individual animal sero-prevalence. The intensive cattle production system,(6.77%) had a significantly higher prevalence when compared with cattle in the extensive system (0.9%).Odds ratio indicated that infection in herds with large size up 200 animals were 3 times more than animals in the small herd less than 200 animals. Animals with age above5 years (n = 1460) had significantly higher prevalence (8.18%) than animals with age2-5years (n = 2540) (1.63%), (P<0.001). The OR showed that older animals were more likely to be infected with brucellosis about 5 times than younger animals. The risk of seropositivity was 20 (19.8%)and 19 (17.43%)in the large and medium size herds, respectively as showed in Table (1).Fisher's Exact Test revealed that history of stillbirths (P < 0.05) abortions (P <0.001) especially in the individual animal were greatly associated with sero-positivity of brucellosis, therefore most abortion cases recorded at the cold months from October to April (P < 0.001).There was great correlation between the number of parturition and the positivity for brucellosis as seropositive rate increase with the number of parturition (no parturition 8/242 (3.3%), single parturition 80/242 (33.05%), multiple parturition 154/242 (63.64%) as showed in Table (1).

3.2. Herd-Level Seroprevalence:

Out of 300 farms, 50(16.67%) farms were positive by CFT. The prevalence of within-herd level varied between none to 13% based on CFT. Moreover, farms under intensive management system (15.07%) had significantly higher prevalence than in the extensive system (P <0.01).The values of OR showed that farms with intensive system had opportunity to infection about 3 times more than as farms with extensive system. However, herd-level sero-positivity to brucellosis was not associated with herd size (P > 0.05) as showed in Table (2).

4. DISUCSSION

The results of the present study reveal that farms with intensive management system had more opportunity to take brucellosis than that in extensive housing system. These results come in agreement with that reported by Patel *et al*.,(2014) who reported that animals in herds with intensive management system had more prevalence of brucellosis than others in extensive system. and the prevalence of brucellosis was higher in herds reared under intensive production systems. 7.78% and 63.64% prevalence were found at individual level and herd-level in the intensive system, respectively but 1.23% and 3.13% were reported in the extensive system. Both individual and herd prevalence were higher in intensive management system than other systems (Mekonnen *et al*., 2010).

Table 1 Risk factors of brucellosis sero- positive of individual animals.

Variables	N	Number (%) Positives	Univariate Analysis OR	*P* Value	95% CI	Multivariate Analysis OR	*P* Value	95% CI
Age (year)								
2-5	2540	62 (2.44)						
>5	1460	180 (12.32%)	5.3	0.002	1.8-15.5	4.2	0.009	2.3-49.3
Herd size(total herd number 300 farms) (50 infected farms								
1-100	90	11 (12.22%)						
101-200	109	19 (17.43%)	4.3	0.025	1.2-15.5	1.5	0.607	0.3-6.3
>200	101	20 (19.8%)	8.5	0.000	2.8-25.6	1.2	0.835	0.3-4.8
Climate								
Cold months (from October to April)	N. of positive 178	178/4000 (4.45%)	19.6	0.001	3,6-22.5		0.008	
Hot months (from June to September)	N. of positive 64	32/4000 (1.6%)	9.4	0.000	2.8-31.5			
Parity number								
No parturition	8	8/242 (3.3%)	5.5	0.095	0.7-41.1			
Single parturition	80	80/242 (33.05%)	6.1	0.094	0.7-49.9			
Multiple parturition	154	154/242 (63.64%)	5.3	0.104	0.7-40.3			

N = number OR = odds ratio

Table 2 Risk factors of sero-positive brucellosis among herd level.

Variables	N	Number positives of Herds (%)	Univariate Analysis		
			OR	*P* value	95% CI
Management system					
Extensive system	114	6/114 (5.26%)	15,2	0.005	2.3-127.3
Intensive system	126	19/126 (15.07%)			
Herd size factor					
1-100	70	30 (42.85%)			
101-200	60	50/60 (83.33%)	2.5	0.368	0.3-18.0
>200	110	41/110 (37.27%)	5	0.125	0.6-39.0

N = number OR = odds ratio.

In this study seropositive herds distributed over all governorates of Nile delta, some governorates had higher prevalence than others that may due to more animal populations and more density of cattle herds which increase the opportunity of infection inside those governorates, which agree with Elmidany *et al*., (2016), who noticed that Kafr El-Sheikh governorate and Gharbia governorate had the highest percent of positive cases of brucellosis, and this may be due to the two governorate have large numbers of dairy farms with big population and have large animals markets which act as a main source of animals replacement for other governorates in the area.

In intensive management system, the reported cases of brucellosis in older cows more than 7 years were higher than in small cows under 4 years. This might be due to cattle become more susceptible with increasing the production age (Walker 1999). These results also agree with the findings of many researchers (Asfaw *et al*., 1998; Bekele *et al*., 2000), who reported high prevalence of positive cases in older animals more than that in young animals as the older animals have more active reproductive system.

The significant higher positive result in the large herd size than in small herds is matching with several authors. Large herd size is one of the major risk factor that correlated with the prevalence of bovine brucellosis (Asfaw *et al*., 1998; Tolosa 2004). Large size herds with bad managing procedure or had history of abortion have more opportunity to be infected with brucellosis as a result of more contact with infected animals and heavy shedding of infected materials (McDermott and Arimi, 2002).

Regarding the effect of climatic conditions, positive sero-prevalence brucellosis was higher in cold months due to more rate of parturition, abortion or still birth with more shedding of *Brucella* microorganism in animals secretions and increase of bacterial load inside the farm which increase the chance of infection that agree with results recorded by Nematollahi et *al*., (2017), who reported that winter season (OR 1.30- 95% CI 1.13–1.72) are potential risk factor for brucellosis. The most cases of abortion recorded at the cold seasons that explain the reason of increase the cases of brucellosis infection at this period especially in herds with large size or under intensive production system (Niilo *et al*., 1986; Rivera *et al*., 2007).

History of abortions or stillbirths was significantly correlated with brucellosis sero-positivity. This could be due to that gynecological problems as still-births or abortions and retained placenta are typical problems correlated and were caused by brucellosis (Radostits *et al*., 1994; Sayour 2004). Similar results were also reported by other investigators as McDermottand Arimi, (2002), who noticed that the most brucellosis cases recorded at the winter season that due to more rate of parturition and more contact with animals secretion which act as the main source of infection. However, another researcher as AL-Khafaji (2003) recorded that seropositive prevalence of brucellosis is higher in hot season or nearly constant over all months.

5. CONCULOSIONS

It can be concluded that brucellosis is endemic in Gharbia governorate and there are many factors as animal age, management system, herd size and climate which affect the prevalence of the disease and should be consider in mind during application of control program.

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