Prevalence of Overall and Teatwise Mastitis and Effect of Herd Size in Dairy Buffaloes

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ABSTRACT

The cross sectional study was carried out to investigate the prevalence of clinical and subclinical mastitis in dairy buffaloes. The present study was conducted in two districts Lahore and Bhimber Azad Kashmir Pakistan. Total sample size for this survey was consisted of 1,036 lactating buffaloes. The screening of lactating buffaloes was performed with the California Mastitis Test. The overall prevalence of mastitis was recorded at 49%. Among mastitis cases the prevalence of clinical mastitis was 10.2% (106/1036 animals) as a whole. However, the prevalence of clinical mastitis in district Lahore was 11.8% (71/598 animals) whereas it was 8% (35/438 animals) in district Bhimber. The overall prevalence of subclinical mastitis was 38.8% (402/1036). The district wise prevalence of subclinical mastitis was 43.6% (261/598 animals) and 32.2% (141/438 animals) in the districts of Lahore and Bhimber, respectively. The quarter level prevalence was recorded 16.20% (673/4144 quarters from 1036 animals). The district wise prevalence of mastitis at quarter level was recorded 18.17% (449/2392 quarters) in a district Lahore while, it was 12.87% (224/1752 quarters) in district Bhimber. The overall prevalence of mastitis on the basis of herds size was 41/102 (40.2%), 186/400 (46.5%) and 281/534 (52.6%) in small, medium and large herds, respectively. Mastitis has greater economic losses in the dairy industry and it can be minimized by improving management and milking practices. It is concluded from the present study that mastitis increases when herd size increase. It order to control the mastitis, it is mandatory to screen the mastitis cases at quarter and herd size level.

INTRODUCTION

Milk produced from dairy animals provides an important dietary source for the majority of rural as well as urban and peri-urban population. However, milk production often does not fulfil the country's requirements due to various factors. Among them, mastitis is a major factor and it, abridged milk production all over the world (Fekadu, 1995). In Pakistan field surveys of major livestock diseases have indicated that mastitis is one of the most vital diseases (Hussain *et al.*, 2005). Mastitis is widely a dairy industry problem and causes economic losses in the form of discarded milk, reduction in the quality of milk and the cost of treatment (Radostits *et al.*, 2007). It has been observed that mastitis is responsible for nearly 38% of the total losses at the farm level (Albenzio *et al.*, 2002).

Bovine mastitis can be caused by physical or chemical agents, but the majority of cases is infectious and usually caused by bacteria. The disease has been reported by several authors on the prevalence and mastitis in different parts of the world (Biffa *et al.*, 2005; Hussain *et al.*, 2013; Chishty *et al.*, 2007). Moreover, there are no proper control measures in order to contain the disease because of its multifactorial nature. Milk contaminated from affected dairy animals with bacteria may render it inappropriate for human consumption.

Mastitis is closely related to the production system and environment in which the dairy animals are kept (Mekibib *et al.*, 2010). That's why monitoring udder health performance is impossible without reliable and affordable diagnostic methods (Zadoks and Schukken, 2006). Furthermore, it can be divided into two group clinical and subclinical mastitis. Clinical mastitis has visible changes in the udder and milk while subclinical mastitis doesn't have (Mustafa, 2003).

Mastitis prevalence was found to be significantly

influenced by numerous risk factors identified by various researchers like age, breed, stage of lactation, parity, breed, milk yield, anatomical abnormality of the udder, and some management aspects including floor type, disinfection of hands and teats dipping and nutrition (Almaw *et al.*, 2007; Karimuribo *et al.*, 2006; Madut *et al.*, 2009). There are some reports on the magnitude of the disease, but information relating to its risk factors is insufficient (Kahir *et al.*, 2008). Such information is important to envisage when designing appropriate strategies that would help to reduce its prevalence and effects.

MATERIALS AND METHODS

Study area

The present study was conducted in two districts Lahore and Bhimber of Pakistan. These two selected district having a different geographical location. Lahore is a plain and urban city while Bhimber is rural, semi-hilly and mountainous. Lahore is a capital of Punjab province and it lies between longitudes 74° 20' 37 east and latitude 31° 32' 59 north and altitude is 209 meters above the sea level. The Lahore features hot, semi-arid climate with an average of temperature 110°F in summer and 35°F in winter and average annual rainfall is from 470.1 to 738 millimeters. While, Bhimber is district of Azad Kashmir and lies 74° 4' 0 east and latitude 32° 58' 60 north and average altitude is 314 meters from sea level. The weather of Bhimber is an arid climate with average temperature 102°F in summer and 22°F in winter. It has a very diverse climate; ranging from sub-humid subtropical, to moist temperate, dry cold temperate, very cold temperate. The mean annual rainfall varies from 800 to 1100 millimeters. Buffalo populations in Lahore and Bhimber were 403128 and 147539 heads, respectively (Anonymous, 2006).

Study population and design

The present cross sectional study was carried out to investigate the prevalence of mastitis in dairy buffaloes. All the dairy farms were selected randomly by simple random sampling. The each farm was considered as a cluster and a total of 50 dairy herds were included in this study. The total sample size for this study consisted from 1,036 lactating buffaloes. The farms were categorized as small scale 5-10, medium scale 11-30 and large scale having more than 30 dairy animals.

Diagnosis of mastitis

The clinical cases of mastitis were diagnosed on the basis of physical examination of udders, teats and milk while subclinical mastitis was screened by California Mastitis Test (Dingwell *et al.*, 2003).

Statistical analysis

All the collected data through questionnaire was entered into an Excel sheet of Microsoft Office Excel 2003 and transferred for analysis to R software and SPSS version 16.0. Firstly, all the data were labelled into sub heading and analyzed by using descriptive statistics for the frequency and cross tabulation tables. The 95% Confidence interval (CI) was worked out by using WinEpi Software.

RESULTS

Prevalence of clinical and subclinical mastitis

A total of 1036 buffaloes were examined for mastitis. Of the population studied, the animals examined in district Lahore were 598 buffaloes belonging to 25 herds, while the remaining 438 were from 25 herds maintained in Bhimber district. The overall prevalence of mastitis was recorded 49% (508/1036 animals). The prevalence of mastitis recorded in Lahore was 55.5% (332/598 animals) while in district Bhimber it was 40.2% (176/438 animals) (Table I).

Table I.- Prevalence of clinical and subclinical mastitis in lactating buffaloes.

Districts	Mastitis	Frequency	Prevalence(%)	95% CI
Lahore (n=598)	Clinical	71	11.8	9.5-14.6
	Subclinical	261	43.6	39.7-47.6
	Total	332	55.5	51.5-59.4
Bhimber (n=438)	Clinical	35	8.0	5.7-10.8
	Subclinical	141	32.2	27.9-36.7
	Total	176	40.2	35.5-44.8
Overall (n=1036)	Clinical	106	10.2	8.4-12.1
	Subclinical	402	38.8	35.8-41.8
	Total	508	49.0	46-52

Among mastitis cases the prevalence of clinical mastitis was 10.2% (106/1036 animals) as a whole. However, the prevalence of clinical mastitis in district Lahore was 11.8% (71/598 animals) whereas it was 8% (35/438 animals) in district Bhimber. The overall prevalence of subclinical mastitis was 38.8% (402/1036). The district wise prevalence was subclinical mastitis was 43.6% (261/598 animals) and 32.2% (141/438 animals) in the districts of Lahore and Bhimber, respectively.

Among the total of 508 cases of mastitis 20.86% (106/508) were of clinical mastitis while the remaining 79.1% (402/508) was subclinical mastitis. The clinical and subclinical mastitis on district wise among the mastitis cases was 21.38% (71/332) and 78.61% (261/332) in

Lahore while in Bhimber it was 19.88% (35/176) and 80.11% (141/176), respectively.

Teat wise prevalence

The teat wise prevalence was recorded 16.20% (673/4144 quarters from 1036 animals). The district wise prevalence of mastitis at quarter level was recorded 18.17% (449/2392 quarters) in district Lahore while it was 12.87% (224/1752 quarters) in district Bhimber. The one, two, three and four teats prevalence were recorded 78.5% (399/508), 12% (60/508), 8% (42/508) and 1.5% (7/508), respectively. In district Lahore, this was recorded as 76%, 13%, 10% and 1%, while in district Bhimber it was 83%, 10%, 6% and 1%, respectively.

The overall quarter wise prevalence of mastitis among LF, LR, RF and RR was recorded as 9.4% (97/1036), 28.0% (290/1036), 8.2% (85/1036) and 19.4% (201/1036), respectively. In district Lahore the quarter wise prevalence of mastitis in LF, LR, RF and RR was 11.0% (66/598), 30.8% (184/598), 10.5% (63/598) and 22.7% (136/598), while in district Bhimber it was 7.0% (106/438), 24.2% (106/438), 5.0% (22/438) and 14% (65/438), respectively (Table II).

Table II.- Teat wise prevalence of mastitis in lactating buffaloes.

Districts	Teat	Mastitic teat	Prevalence (%)	95% CI
Lahore (n=598)	Left front	66	11	8.7-13.7
	Left rear	184	30.8	27.2-34.6
	Right front	63	10.5	8.2-13.1
	Right rear	136	22.7	19.5-26.2
Bhimber (n=438)	Left front	31	7	4.9-9.8
	Left rear	106	24.2	20.4-28.4
	Right front	22	5	3.2-7.4
	Right rear	65	14	11.7-18.4
Overall (n=1036)	Left front	97	9.36	7.7-11.2
	Left rear	290	28	25.3-30.7
	Right front	85	8.2	6.6-10.1
	Right rear	201	19.4	17.1-21.9

Prevalence of mastitis on the basis of herd size

The herds were categorized into three groups, *i.e.* small, comprising of 5-10 animals, medium sized 11-30 animals and large having more than 30 animals. The overall prevalence of mastitis was 41/102 (40.2%), 186/400 (46.5%) and 281/534 (52.6%) in small, medium and large herds, respectively. In district Lahore the herd

wise mastitis prevalence was 45.7%, 52.5 % and 56.8%, while in district Bhimber it was 29.9%, 40.3% and 44%, respectively (Table III).

Table III.- Prevalence of mastitis on basis of herd size in lactating buffaloes.

Districts	Herd size	Total examined	Mastitic teat	Prevalence (%)	95% CI
Lahore	5-10	35	16	45.7	29.2-62.2
	11-30	204	107	52.5	45.6-59.2
	> 30	359	204	56.8	51.7-61.9
	Total	598	332	55.5	51.5-59.5
Bhimber	5-10	67	20	29.9	19.8-41.6
	11-30	196	79	40.3	33.6-47.2
	> 30	175	77	44.0	36.8-51.4
	Total	438	176	40.2	36.4-44.1
Overall	5-10	102	41	40.2	31-49.9
	11-30	400	186	46.5	41.6-51.4
	> 30	534	281	52.6	48.4-56.8
	Total	1036	508	49.0	46-52

DISCUSSION

In the present study the overall prevalence of mastitis was 49%. Among these clinical mastitis was 10.2%, while subclinical mastitis was 38.8%. Prevalence of mastitis in present study agreed with a prevalence of mastitis from previous studies conducted in Sudan, Nigeria and Iran by Nigo (2013), Junaidu *et al.* (2011), Hashemi *et al.* (2011), respectively. The findings in the present study in case of clinical mastitis (21%) among the total (508) mastitic buffaloes, were in accordance to Mustafa *et al.* (2014) and Ali (2009) who reported prevalence of clinical mastitis was 14% to 31.75%, while, the finding of some previous studies (Mustafa *et al.*, 2014; Bilal *et al.*, 2004) who reported the prevalence of clinical mastitis in buffaloes was more than 40%.

The results of the present study about the prevalence of subclinical mastitis (38.8%) are in accordance with previous studies conducted in Ethopia and Sudan by Ayano *et al.* (2013) and Nigo (2013). Ayano *et al.* (2013) and Nigo (2013) reported prevalence of subclinical mastitis was 31% to 47% in cattle and buffaloes in Ethiopia and Sudan, respectively. The prevalence of subclinical mastitis was reported by Mustafa *et al.* (2014) as 59.64%, which was higher than present study. However, the prevalence of subclinical mastitis in this study is relatively higher than Sarkar *et al.* (2013) and Rahman *et al.* (2009) who reported

prevalence of subclinical mastitis as 9% to 20%. Basically, mastitis is a complex disease involving interactions of several factors, mainly of management, environment, and other factors relating to animal and causative organisms. Its prevalence is expected to vary from place to place. In this study, the prevalence of mastitis varies from previous studies. It might be due to different geographical locations, herd size, quarter level and management practices that applied in farms in different localities. In the present study, the prevalence of mastitis was different in both localities 55.5% and 40.2% in Lahore and Bhimber, respectively. Our finding is supported by previous studies conducted by Nigo (2013) and Biffa *et al.* (2005) who reported that the prevalence of mastitis was different in different localities. This difference in prevalence of mastitis in area wise may be due to different management practices and environmental contamination.

In our study, quarter level prevalence was recorded (16.20%) while district wise it was 18.17% and 12.87%, Lahore and Bhimber, respectively. The quarter wise prevalence of mastitis among LF, RF, LR, and RR was recorded as 14.4%, 12.6%, 43% and 30%, respectively. The mastitis was higher in hind quarters as comparable to forequarters. The association of quarters with a prevalence of mastitis was highly significant (p<0.001). The results of the present study were in line with previous studies of Nigo (2013), Gebrekrustos *et al.* (2012), Sori *et al.* (2005) and Chishty *et al.* (2007) who reported that in hindquarters prevalence of mastitis was higher than that of front quarters. Single quarter involvement was seen in maximum number of animals and this is congruent with the finding of Ali (2009) and Hussain *et al.* (2013) who reported that single quarter involvement was high and very rare involvement of the all quarters. The results of the present study are in accordance with previous studies by Egan and Meaney (1987), who reported that the higher prevalence in left rear quarter (34.0%) followed by the right front (28.0%), right rear (21.8%) and left front (15.3%). Further, among hind quarters, left hind quarters were found to be more susceptible to infection. In the present study the quarter wise prevalence of mastitis which showed that highest prevalence was in single and two quarters, which were in accordance to Iqbal and Siddique (1992), who reported that mastitis involvement was more in a single quarter (52.75%), Similarly, Singh and Shankar (2002) have recorded higher incidence of mastitis in single quarter (17.4%), as compared to two (2.6%), three (0.3%), and four quarters (2.7%). The present study was in line to Mustafa *et al.* (2014), Hussain *et al.* (2013) and Bilal *et al.* (2004) who reported it was higher in rear quarters than in fore-quarters in buffaloes. The prevalence of mastitis in left rear quarters

was higher than in other quarters. The possible explanation about the left rear quarters may be due to practices adopted by farmers. In Pakistan, the farmers, mostly milked the buffaloes from the left side. When milker milked the right rear quarter his hand touches the left quarter continuously. If the milker's hand is contaminated it can transmit the infectious to the left rear quarter. In our view, buffalo's hind quarters are large size and have high milk production as compared to front quarters. The hind quarters are more exposed to dirt when they lie down on the floor as well as they are more contaminated with fecal materials. It may be due to reasons that unhygienic conditions of the legs and presence of contaminated dung can help in the occurrence of mastitis. Also, they are in direct touch with the hind limbs at milking time. The difference in quarter wise prevalence of mastitis is probably due to the fact that predisposing factors like teat size, injury, defective sphincters, and so forth could vary from quarter to quarter.

In the present study, prevalence of mastitis was increased as the herd size increased. These findings are in accordance to Nigo (2013), Kivaria *et al.* (2007) and Islam *et al.* (2010) who reported that the prevalence of mastitis was high in large size herds as compared to small size herds. In the present study, the herd size was significantly (p< 0.02, having OR 1.65 at 95% CI of 1.07-2.54) associated with prevalence of mastitis which is in accordance to Kivaria *et al.* (2007), Nigo (2013) and Islam *et al.* (2010) who reported significant (p< 0.05) association of large herds size with a prevalence of mastitis.

REFERENCES

Albenzio, M., Taibi, L., Muscio, A. and Sevi, A., 2002. Prevalence and etiology of subclinical mastitis in intensively managed flocks and related changes in the yield and quality of ewe milk. *Small Rumin. Res*., **43**: 219-226. https://doi.org/10.1016/S0921-4488(02)00022-6

Ali, L., 2009. *Epidemiology of mastitis in dairy buffalo and cow in Tehsil Samundri of district Faisalabad*. University of Agriculture, Faisalabad.

Almaw, G., Zerihun, A. and Asfaw, Y., 2007. Bovine mastitis and its association with selected risk factors

in smallholder dairy farms in and around Bahir Dar, Ethiopia. *Trop. Anim. Hlth. Prod.*, **40**: 427-432. https://doi.org/10.1007/s11250-007-9115-0

Anonymous, 2006. *All Pakistan livestock senses*. Pakistan Bureau of Statistics, Govt. of Pakistan, pp. 18-20.

Ayano, A., Hiriko, F., Simyalew, A. and Yohannes, A., 2013. Prevalence of subclinical mastitis in lactating cows in selected commercial dairy farms of Holeta district. *J. Vet. Med. Anim. Hlth.*, **5**: 67-72.

Biffa, D., Debela, E. and Beyene, F., 2005. Prevalence and risk factors of mastitis in lactating dairy cows in Southern Ethiopia. *Int. J. appl. Res. Vet. Med.*, **3**: 189-198.

Bilal, M., Iqbal, M., Muhammad, G., Avais, M. and Sajid, M., 2004. Factors affecting the prevalence of clinical mastitis in buffaloes around the Faisalabad district (Pakistan). *Int. J. Agri. Biol.*, **6**: 1-5.

Chishty, M., Arshad, M., Avais, M. and Ijaz, M., 2007. Cross sectional epidemiological studies on mastitis in cattle and buffaloes of tehsil Gojra Pakistan. *Buff. Bull.*, **26**: 50-55.

Dingwell, R.T., Leslie, K.E., Schukken, Y.H., Sargeant, J.M. and Timms, L.L., 2003. Evaluation of the California mastitis test to detect an intramammary infection with a major pathogen in early lactation dairy cows. *Canadian Vet. J.*, **44**: 413-415.

Egan, J. and Meaney, W., 1987. *Corynebacterium pyogenes* mastitis in spring-calving dairy-cows and heifers. *Irish Vet. J.*, **41**: 286-290.

Fekadu, K., 1995. *Survey on the prevalence of bovine mastitis and the predominant causative agents in Chaffa valley*. Proceedings of the 9th Conference of Ethiopian Veterinary Association: Addis Ababa, Ethiopia, pp. 101–111.

Gebrekrustos, M., Aferaa, B. and Tassew, H., 2012. Prevalence of mastitis and its relationship with risk factors in smallholder dairy farms in and around Mekelle. *Red Vet.*, **13**: 1-25

Hashemi, M., Kafi, M. and Safdarian, M., 2011. The prevalence of clinical and subclinical mastitis in dairy cows in the central region of Fars province, south of Iran. *Iran J. Vet. Res.*, **12**: 236-241.

Hussain, M., Malik, M.A., Fatima, Z. and Yousaf, M., 2005. Participatory surveillance of livestock diseases in Islamabad capital territory. *Int. J. Agric. Biol.*, **7**: 567-570.

Hussain, R., Khan, A., Javed, M.T. and Rizvi, F., 2013. Possible risk factors associated with mastitis in indigenous cattle in Punjab, Pakistan. *Pakistan Vet. J.*, **32**: 605-608.

Iqbal, J. and Siddique, M., 1992. *Some epidemiological aspects of mastitis in cows and biocharacterization of isolated Staphylococci*. M. Sc. thesis, University of Agriculture, Faisalabad, Pakistan.

Islam, M., Rahman, A., Rony, S. and Islam, M., 2010. Prevalence and risk factors of mastitis in lactating dairy cows at Baghabari milk shed area of Sirajganj. *Bangladesh J. Vet. Med.*, **8**: 157-162.

Junaidu, A., Salihu, M., Tambuwal, F., Magaji, A. and Jaafaru, S., 2011. Prevalence of mastitis in lactating cows in some selected commercial dairy farms in Sokoto Metropolis. *Adv. appl. Sci. Res.*, **2**: 290-294.

Kahir, M.A., Islam, M. Rahman, A.K.M., Nahar, A., Rahman, M.S. and Son, H.J., 2008. Prevalence and risk factors of subclinical bovine mastitis in some dairy farms of Sylhet district of Bangladesh. *Korean J. Vet. Serv.* **31**: 497-504.

Karimuribo, E.D., Fitzpatrick, J.L., Bell, C.E., Swai, E.S., Kambarage, M.D., Ogden, N.H., Bryant, M.J. and French, P., 2006. Clinical and subclinical mastitis in smallholder dairy farms in Tanzania: risk, intervention and knowledge transfer. *Prevent. Vet. Med.*, **74**: 84-98. https://doi.org/10.1016/j.prevetmed.2006.01.009

Kivaria, F., Noordhuizen, J. and Msami, H., 2007. Risk factors associated with the incidence rate of clinical mastitis in smallholder dairy cows in the Dar es Salaam region of Tanzania. *Vet. J.*, **173**: 623-629. https://doi.org/10.1016/j.tvjl.2006.01.008

Madut, N.A., Gadir, A.E.A. and EL-Jalii, I.M., 2009. Host determinants of bovine mastitis in semi-intensive production system of Khartoum state, Sudan. *J. Cell Anim. Biol.*, **3**: 71-77.

Mekibib, B., Furgasa, M., Abunna, F., Megersa, B. and Regassa, A., 2010. Bovine mastitis: prevalence, risk factors and major pathogens in dairy farms of Holeta Town, central Ethiopia. *Vet. World*, **3**: 397-403. https://doi.org/10.5455/vetworld.2010.397-403

Mustafa, Y.S., Awan, F.N. and Zaman, T., 2014. Prevalence and antibacterial susceptibility in mastitis in buffalo and cow in district Lahore, Pakistan. *Buff. Bull.*, **32**: 312-319.

Mustafa, A., 2003. *Mastitis in dairy cows; Dairy cattle production 342-450A*. Department of Animal Science, Faculty of Agricultural and Environmental Sciences, Macdonald Campus, McGill University.

Nigo, K.L.S., 2013. Epidemiological and bacteriological investigation of bovine mastitis in Khartoum State-Sudan. *Sudan J. Sci. Tech.*, **14**: 1-15.

Radostits, O.M., Gay, C.C., Hinchcliff, K.W. and Constable, P.D., 2007. *Veterinary medicine. A*

textbook of the diseases of cattle, sheep, pigs, goats and horses, 10th ed. Saunders Elsevier, Spain, pp. 1045-1046.

Rahman, M., Bhuiyan, M., Kamal, M. and Shamsuddin, M., 2009. Prevalence and risk factors of mastitis in dairy cows. *Bangladesh Vet.,* **26**: 54-60.

Sarkar, S.C., Parvin, M.S, Rahman, A.A. and Islam, M.T., 2013. Prevalence and risk factors of subclinical mastitis in lactating dairy cows in north and south regions of Bangladesh. *Trop. Anim. Hlth. Prod.*, **45**: 1171-1176. https://doi.org/10.1007/ s11250-012-0342-7

Singh, R. and Shankar, H., 2002. Occurrence of mastitis in organized farms. *Indian J. comp. Microbiol., Immunol. Infect. Dis.,* **23**: 55–57.

Sori, H., Zerihun, A. and Abdicho, S., 2005. Dairy cattle mastitis in and around Sebeta, Ethiopia. *J. appl. Res. Vet. Med.*, **3**: 332-336.

Zadoks, R.N. and Schukken, Y.H., 2006. Use of molecular epidemiology in veterinary practice. *Vet. Clin. N. Am: Fd. Anim. Pract.*, **22**: 229-261. https:// doi.org/10.1016/j.cvfa.2005.11.005