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RESEARCH ARTICLE

Epidemiological Study of Mastitis in Three Different Strains of Beetal Goat in Selected Districts of Punjab, Pakistan

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ABSTRACT

Mastitis in goats, analogous to dairy cattle, is among the momentous diseases of economic value in all parts of the world. Local information of epidemiology of goat mastitis is scanty. In present study, considering geographical distribution of population of Beetal and its strains, 172 flocks were randomly pulled out by "Survey tool box" to reduce bias sampling from prei-urban and urban areas of six districts of Punjab (Central and Southern) for the conduct of this study. By following the proportionate sample strategy and assuming the highest population (70%) of Beetal all over the Punjab, these 172 flocks of Beetal and its three strains were selected and screened out for the prevalence of mastitis from Faisalabad, Jhang, Chiniot, Bahawalpur, Muzzafargarh and Rajanpur districts. Screening of the flocks with surf field mastitis test indicated that overall prevalence of caprine mastitis in Beetal breed was 17.39% from all 172 flocks while in Beetal Faisalabadi strain 16.53% from 116 flocks, in Beetal Makhicheeni 18.06% from 32 flocks and in Beetal Nuqri 19.33% from 24 flocks were observed. Microbiological examination of milk samples showed various type of mastitic microorganisms. The predominant isolates included S*taphylococcus (S). hyicus* (45%), *S. xylosus* (19%), *S. simulans* (16%), *S. aureus* (9%) and 11% unidentifiable Staphaloccocal species. Antibiotic sensitivity test was conducted on most prevalent isolates of the study as *S. aureus* and *S.hyicus* were sensitive to 8 antibiotics: amoxicillin, ampicilin, lincomycin, sulfamethoxazole+trimethoprim, novobiocin, enrofloxacin, amoxicillin+ clavulanic acid and oxytetracycline while *S. xylosus* was sensitive to all antibiotics except novobiocin and *S. simulans* was sensitive to lincomycin, sulfamethoxazole+ trimethoprim, enrofloxacin and resistant to all other antibiotics.

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INTRODUCTION

The goat is an important animal in many parts of the world, where it is kept as a source of meat, milk and fiber (DaMassa *et al.*, 1992). It is often dubbed as the poor man's cow in subcontinent. Pakistan is the 3rd largest goat rearing country in the world (Khan *et al*., 2008). The economic contribution of goat to the country of Pakistan include 0.719 million (M) tons of milk, 0.6 M tons of mutton and 22 million hides (Anonymous, 2016). Goats, particularly of milk breeds are worthy source of income for small households and well recognized for providing nutritional surrogate, particularly for the growing infants in the rural areas of Pakistan.

Goats can bear hard as well as harsh environments of in various agro-climatic conditions, predominantly in the tropics and sub-tropics. As regards of goat population, about 90% population found in developing countries in the world and the only Asia (mainly Pakistan, Turkey, China, Bangladesh, Iran and India) having 80% of total world goat population.

More than 25 breeds of goats have been reported in all over the Pakistan including those in the Northern Areas and Azad Jammu and Kashmir. Goats of Beetal, Diara Din Panah (DDP), Nachi, Damani, Kacchan and Kamori breeds are well recognized for their milk and meat production. The province of Punjab has mainly three autochthonous milk breeds (Beetal, Diara Din Panah and

Nachi). There is no current study conducted for milk production potential in various breeds of goat in Pakistan (Iqbal *et al*., 2008). Among all breeds of goat in Pakistan, Beetal is always stood first in term of milk and meat production. Recently, five different strains of Beetal has been documented (Khan and Okeo, 2016) as 1st Beetal Faisalabadi or Lyalpuri strain is found in Faisalabad, Lahore, Sheikhupura, Gujranwala, Jhang, Chiniot, Sargodha, Toba Tek Singh and Khanewal districts of Punjab. The 2nd Beetal Makhicheeni strain is mainly found in Bahawalpur, Bahawalnagar and Muzaffargarh, 3rd Nuqri, pure white color is found in Dera Ghazi Khan, Rajanpur and Bahawalpur district, 4th Beetal Gujrati is found in district of Gujrat, Sargodha, Mandi Bhauddin, Jhelum and Sialkot and 5th Beetal Nagri is found in Faisalabad, Okara, Sahiwal and Pakpattan districts.

Mastitis, is the inflammation of mammary glands along with physical, chemical, pathological, microbiological changes and an increase in somatic cells, especially leukocytes in the milk (Fox, 2009). Mastitis is known as the most important and expensive disease of dairy animals worldwide but it is the most prevalent production disease in dairy herds worldwide with substantial financial penalty, mainly due to reduction in milk yield, impaired quality and also having the danger for the spread of milk related zoonotic diseases (Samad, 2008).

Generally, mastitis occurs in two forms which includes clinical (overt) and sub-clinical (hidden). In the clinical mastitis, all the five fundamental signs of inflammation (pain, heat, swelling, redness and loss of milk production) are present, while in case of sub-clinical form is bereft of any noticeable signs of inflammation. About 75-80% mastitis is subclinical, characterized by a significantly increased leukocyte count in milk (Bradley 2002). It exists for long time, adversely affects quality and quality of milk, is difficult to detect and constitutes a reservoir of microorganisms, due to their contagious nature for other animals within the herd (Schultz *et al.* 1978). Diagnosis of subclinical mastitis can be performed by various tests like surf field mastitis (SFMT) and California mastitis tests (CMT) under field conditions (Bachaya *et al.*, 2005)

Mastitis in countries like Pakistan increases due to poor disease prevention and reporting system (Javed *et al*., 2009). Goat mastitis has not been accorded due consideration by the scientific community of the country (Arshad *et al*., 2006; Ali *et al*., 2010) because considerable efforts and resources has been focused on the control of mastitis in cattle and buffaloes previously. Similarly, in Pakistan, the scientific research data on overall in caprine mastitis and especially in various breeds of goat and recently documented strains of Beetal goat is meager or absent (Rizwana *et al*., 2016). Notwithstanding the fact that Pakistan 3rd largest goat raising countries of the world, at present a 'do nothing' policy vis-à-vis control of caprine mastitis is followed throughout the country. Keeping in view the scenario, current study was planned to estimate mastitis distribution in different strains of Beetal goats, risk factors estimation and isolation of various strains of staphylococcus genus.

MATERIALS AND METHODS

Study locales and settings: For making the present research more demographic and diverse, three areas of Central Punjab (Faisalabad, Chiniot and Jhang) and three areas from Southern Punjab (Rajan Pur, Bahawalpur and Muzzafargarh) were selected to conduct this study. Among these districts, three sites were selected based on home tracts of important dairy breeds of goat: Site-I Bahawalpur district for Beetal Makhicheeni, Site-II Rajanpur district for Beetal Nuqri and Site-III Faisalabad Division for Beetal Faisalabadi or Lyalpuri. The duration of research was about 18 months (January, 2016 to June, 2017).

Sample size and sampling: Sample size was calculated from the expected prevalence of about 20% (known disease status) with confidence interval of 95% and absolute desire precision 5%. Expected prevalence of 20% wad deduced from the average prevalence of goat mastitis in four previous studies (Rashid *et al.*, 2017, Hussain, 2016, Rizwana *et al.*, 2016 and Najeeb *et al.*, 2013). The sample size was estimated using the following equation (Thrusfield, 2007).

$n = 1.96^2 P_{exp} (1 - P_{exp}) / d^2$

Where:

n = required sample size

P_{exp} = expected prevalence

d = desired absolute precision

The number of samples thus calculated was subjected to the following equation for adjusted number to reach the maximum number of samples (Thrusfield, 2007):

$n_{adj} = (N X n) / (N + n)$

Where:

N = total population

n = calculated sample size through formula

Following the proportionate sampling strategy and assuming the highest population (70%) of Beetal all over in Punjab, 172 flock of Beetal from the selected districts and screened out respectively for the prevalence of mastitis in three strains of Beetal goats.

Epidemiological parameters: Epidemiological parameters including age, breed, stage of lactation, parity, stage of pregnancy, length of lactation period, amount of milk, farming system, housing and management conditions, previous disease, vaccination, deworming, and treatment history etc., were recorded on previously designed questionnaire. As regards, previous milk production and any mastitis control strategy (post milking teat dipping and dry period antibiotic therapy) were also registered.

Diagnostic procedures: Field diagnosis of both clinical and sub-clinical mastitis was reached by complete physical examination of udder and Surf Field Mastitis Test (SFMT), in all milking animals of selected goat farms. SFMT score 1 was considered as negative whereas score 2 traces, 3 positive (weak degree of gel formation), 4 distinct positive and 5 was for strong positive for sub-clinical mastitis (Schalm *et al.*, 1971). The SFMT score of 2 (traces) was considered healthy milk because goat milk has intra-cytoplasmic particles that resemble with somatic cells (Smith and Roguinsky, 1971). Contrary to SFMT score in large ruminants (1-5) but in goats this score 2 was considered negative whilst score 3-5 taken as positive.

Table 1: Guidelines used for interpretation (scoring) of Surf Field Mastitis Test (SFMT)

Symbol (score)	Suggested meaning	Description of visible reaction
1	Negative	Mixture remains liquid.
2	Traces	A slight slime forms and was seen by tipping the paddle back and forth.
3	Week Positive	A distinct slime but with no tendency towards gel formation.
4	Distinct Positive	The mixture thickens immediately with the gel formation.
5	Strong Positive	A gel forms with convex surface of mixture, which is so viscous that it adheres to the bottom of the receptacle of the test paddle.

Table 2: Prevalence of mastitis according to geographical area, breed and strain

Area	No. of goats	Mastitic goats	Prevalence (%)	p-value	Confidence interval (95%)
Faisalabad	1673	258	15.42	0.000	13.77-17.23
Jhang	201	28	13.93		9.82-19.4
Chiniot	359	71	19.78		15.99-24.21
Bahawalpur	1287	221	17.17		15.21-19.33
Rajanpur	331	64	19.33		15.45-23.94
Muzaffar Garh	1097	110	10.03		8.39-11.95
Total	4948	752	15.20		14.23-16.23
Strain wise prevalence					
Strain (Beetal)	No. of goats	Mastitic goats	Prevalence (%)	p-value	Confidence interval (95%)
Faisalabadi	2233	357	15.99		15.3-18.4
Makhi Cheeni	631	114	18.07	0.192	15.26-21.26
Nuqri	331	64	19.34		15.45-23.94
Total	3195	535	16.74		15.49-18.07

Table 3: Association of variables on mastitis

Variables	Class of Variable	Mastitis (%)	Healthy (%)	df	Chi Square value	P-Value
Color	Black& white	24(31.9)	3(0.4)	7	17.512	0.014*
	Brown & white	65(8.5)	2(0.3)			
	Brown black	6(0.8)	1(0.1)			
	Black	158(20.6)	2(0.3)			
	Brown Splashed	86(11.2)	0(0.0)			
	Brown	11(1.4)	0(0.0)			
	Blackish brown	125(16.3)	0(0.0)			
	White	64(8.3)	0(0.0)			
Education	Illiterate	284(37.0)	7(0.9)	2	8.17	0.014*
	Up to Middle	364(47.4)	1(0.1)			
	Matric & Above	112(14.6)	0(0.0)			
Body Condition Score (BCS)	2 (poor)	326(42.4)	0(0.0)	3	41.585	0.000**
	3 (Normal)	316(41.1)	0(0.0)			
	4 (Good)	117(15.2)	8(1.0)			
	5 (Excellent)	1(0.1)	0(0.0)			
Housing	Backyard Shed	226(29.4)	4(0.5)	2	19.705	0.000**
	Street	4(0.5)	1(0.1)			
	Open Area	530(69.0)	3(0.4)			
Farm hygiene	Very poor	258(33.6)	0(0.0)	3	8.283	0.041*
	Poor	124(16.1)	4(0.5)			
	Normal	362(47.1)	4(0.5)			
	Good	16(2.1)	0(0.0)			
Parity No.	1-2 Kidding	230(29.9)	6(0.8)	2	7.663	0.022*
	3-4Kidding	407(53.0)	2(0.3)			
	5 & > Kidding	123(16.0)	0(0.0)			
Age	1-3 Year	258(33.6)	6(0.8)	2	6.105	0.047*
	4-5 Year	402(52.3)	2(0.3)			
	>5 Year	100(13.0)	0(0.0)			
Ease of milking	Easy	95(51.4)	8(1.0)	1	7.322	0.007**
	Hard	365(47.5)	0(0.0)			
Milk leakage	Yes	33(4.3)	3(0.4)	1	19.482	0.000**
	No	727(94.7)	5(0.7)			
Blood in milk	Yes	88(11.5)	3(0.4)	1	5.093	0.024*
	No	672(87.5)	5(0.7)			
SFMT Score	*2 (Traces)	70(9.2)	0(0.0)	4	4.69.506	0.000**
	Weak positive	355(46.2)	0(0.0)			
	Distinct positive	258(33.6)	0(0.0)			
	Strong positive	77(10.0)	0(0.0)			
Milk Taste	Sweet	161(21.0)	8(1.0)	2	28.654	0.000**
	Bitter	75(9.8)	0(0.0)			
	Salty	524(68.2)	0(0.0)			
Milk yield	Decreased	756(98.4)	0(0.0)	1	509.305	0.000**
	Not decreased	4(0.5)	8(1.0)			

** Highly Significant * Significant.

Table 4: Antibiotic sensitivity test

Designation of vaccinal isolates	Antibiotics sensitivity profiles							
	AMC(10ug)	AMP(10ug)	L.S(109ug)	SXT(25ug)	NV(10ug)	EN(5ug)	AML(10ug)	OT(10ug)
*S. aureus**(1)	28(S)	25(S)	22(S)	29(S)	25(S)	23(S)	32(S)	26(S)
*S. xylosus**(2)	33(S)	31(S)	29(S)	33(S)	9(R)	32(S)	39(S)	28(S)
*S. hyicus**(3)	29(S)	25(S)	28(S)	21(S)	25(S)	27(S)	32(S)	24(S)

Amox=Amoxicillin; AMP=Ampicyline; L.S=Lincomycine;SXT=Sulfamethoxazole+Trimethoprim;NV=Novobiocin;EN=Enrofloxacin;AML=Amoxicillin+clavulanic acid; OT=Oxytetracycline; S=Sensitive; I=Intermediate; R= Resistant *Prevalent isolates.

Surf Field Mastitis Test (SFMT) scores: These tests were performed as described by (Schalm *et al.,* 1971; Muhammad *et al.,* 1995 and Muhammad *et al.,* 2010). The SFMT is a CMT-like test which has been demonstrated to be comparable to CMT in terms of sensitivity and specificity of mastitis detection as well as kappa value (Rehman, 1995). The reactions of these tests were interpreted as shown in Table 1 (Schalm *et al.,* 1971).

Microbiological examination of milk: Surf Field Mastitis Test (SFMT) positive milk samples were collected aseptically in sterile vials by recording the udder halves and SFMT score (Muhammad *et al*., 2010). These milk samples were transferred to the Mastitis Research Lab., University of Agriculture, Faisalabad, for further microbiological examination. The microbiological assays were performed as described by National Mastitis Council Inc., USA (Anonymous, 1990). Briefly, for the isolation of mastitic pathogens, milk samples aseptically cultured at 37°C for 24 hours on blood agar, MacConkey's agar. Gram-positive, catalase-positive, α and β hemolytic coccal isolates were presumptively identified as staphylococci and subjected to coagulase test using rabbit plasma (at 4 hours) for grit of coagulation property of organism. For species identification of Staphylococci, biotyping of the isolates was conducted by using a commercial kit (api-STAPH; BioMerieux, France). Latex Slide Agutination test using Staphytect plus kit (Oxoid, Ltd, Basingstoke, Hampshire, UK) was conducted to check the presence of protein A, clumping factor and certain polysaccharides that was found entirely in *S. aureus.*

Antibiotic sensitivity test: Disc diffusion method on Mueller-Hinton medium was used for the sake of antibiotic susceptibility profiles of the prevalent mastitic organisms following the guidelines as per CLSI (2012).

Statistical analysis: The data obtained was analyzed by Chi Square test for the prevalence, incidence and other risk factor associated with mastitis (Steel *et al***.,** 1997) in Table 4.

RESULTS AND DISCUSSION

Goat population of selected area: The total reported goat population in selected cities was 4,648,234 heads as depicted in Table 2 (Anonymous, 2006). According to Livestock Census (Anonymous, 2006), it was observed that Muzaffargarh is the biggest city of keeping goats among selected districts followed by Bahawalpur (1044722 head), Faisalabad (904918 head), Rajanpur (633524 head) and (503496 head) for Jhang and Chiniot because after Livestock Census 2006, Chiniot was declared as independent district so that their goat population is divided equally.

Locales and strains of Beetal related distribution of samples: A total of 4948 goats from 246 flocks were collected for screening of mastitis in goat from 6 goat populated districts of Punjab (3 from central and 3 from southern Punjab) to make this study more diverse in form of climate and geography. Depending upon the population of goats in each district, random flocks were pulled out by using 'survey tool box' to remove biased sampling. By considering the reported goat population of selected districts (Anonymous, 2006), Beetal Faisalabadi 1673 goats were screened out for mastitis from 85 flocks from district Faisalabad. From Jhang, Beetal Faisalabadi 201 goats from 14 flocks were added in this study, from Chiniot, Beetal Faisalabadi 359 goats from 17 flocks, from Bahawalpur, 631 Beetal Makhicheeni goats from 32 flocks and from Rajanpur, 331 Beetal Nuqri goats from 24 flocks were selected. In Nachi breed 331 goats from 37 flocks from, while for DDP breed 1097 goats from 37 flocks were also screened out for the prevalence of caprine mastitis in said areas of Punjab.

Goat strains related distribution of samples: Proportionate sampling was conducted according to breed population in the selected six districts. Out of 4948 goat sampled, 3195 (64.75%) were selected from Beetal Faisalabadi goats from the districts of Faisalabad, Chiniot, Jhang, Bahawalpur and Rajanpur. For Diara Din Pannah, 1097 (22.17%) goats while 656 (13.25%) goats of Nachi breed from Bahawalpur district were screened out for mastitis (Table 3).

Epidemiology of caprine mastitis in different dairy breeds in six districts of Punjab: The study inferred overall prevalence of caprine mastitis in Beetal goat 16.74% prevalence while in strains of Beetal Faisalabadi, Beetal Makhicheeni, and Beetal Nuqri suffered 16.37%, 18.06%, and 19.33%, respectively. The overall prevalence of mastitis in all three breeds of goat was recorded to 16.12% while the overall breed wise prevalence of mastitis was observed 16.74% in Beetal followed by 16.30% in Nachi and 10.05% in DDP respectively. The overall strain wise prevalence in Beetal goat was observed as highest in 19.33% in Beetal Nuqri as 18.06% in Beetal Makhicheeni than 16.37% in Beetal Faisaladadi respectively (Table 2) the major species of Staphylcooccus genus found in caprine mastitis were *S. hyicus, S. xylosis S. simulans, S. aureus* and unidentifiable species of Staph.

Bacteriological study of caprine mastitic pathogens: A total of 760 mastitis positive milk samples out of 4948 goats were screened out by using SFMT, with recording goat identity no., udder half marking and score of SFMT (Muhammad *et al.,* 2010). Further analysis of milk samples was carried out at Mastitis Research Lab., situated at CMS department, University of Agriculture, Faisalabad. The microbiological assays on mastitic milk samples were performed as defined by the National Mastitis Council Inc., USA (Anonymous, 1990).

In this study, 357 mastitic samples from Beetal Faisalabadi, 64 from Beetal Nuqri, 114 from Beetal Makhicheeni, 110 from Diaria Din Pannah (DDP) and 107 from Nachi were studied for microbiological study. It was observed in overall findings that coagulase negative *Staphyloccoci* (CNS) are the main class of bacteria that were frequent observed during microbiological assay. Furthermore, different spp of Enterobacteriaecae like *E. coli*, klebsiella, Proteus, Enterobacter from Micrococcacae like *S. aureus*, Micrococcus spp and various spp. of Streptococcus, Bacillus, Cornyebacterium and

Pseudomonas spp. were also found. The more abundant spp. were coagulase negative *Staphyloccoci* (CNS) so that a commercial kit (api-STAPH; Bio Merieux, France) was used to determine biotyping of these isolates.

Mastitis prevalence in small ruminants has been reported by Fox and Gay, 1993; Bergonier *et al*. 2003; Bergronier and Berthelot, 2003; Contreras *et al.* 2003; Contreras *et al*. 2007; Ali *et al.* 2010; Megersa *et al.* 2010; Islam *et al.*, 2011; Islam *et al.*, 2102; Bourabah *et al.*, 2013; Husnain, 2016 and Rashid *et al*., 2017. The current study's findings agree with outcomes of study reported by Megersa *et al.* (2010). Contradiction in prevalence outcome was found in studies conducted by Contreras *et al*, 2003 who revealed 9.4-47%, Rashid *et al.*, 2017 showed 21.68% in winter and 25.70% in summer respectively, Hussain, 2016 reported 20% prevalence of goat mastitis and Rizwan *et al*., 2016 who reported average 18.29% prevalence of mastitis in different breeds of goat in Pakistan. The findings of this study is also in agreement with the results of Contreras *et al.* 2007 and Fox and Gay, 1993 who shown the range of prevalence from 5-30% and 7-40% respectively. The current finding is strongly differing with the results of Hall and Rycroft, 2007 showed 33%, Ali e*t al*. 2010 revealed 30.6%, Islam *et al.*, 2011 reported 6%, Islam *et al.*, 2011 reported 4%, Aqib *et al.*, (2018) >50%, Bergronier and Berthelot, 2003 showed 20-50%, Bourabah *et al.*, 2013 reported 33.9%. This difference could be due to environmental differences and differences in animal breeds, fluctuation of immune response, housing and management system, all other farmers' and host's related determinants, with different diagnostic methods and different level of expertness for diagnosis as well as result interpretations.

Farm management and housing related determinants for mastitis: Current study found type of housing, farm hygiene, age, stage of lactation, parity, color, body condition score, teat ends, SFMT score, milk taste, milk consistency, milk color and milk yield to be significantly (p<0.005) associated with subclinical and clinical mastitis are mastitis. It was also observed that floor type, condition of floor, source of drinking water, feeding practices, use of mineral, general vaccination, deworming, milking practices, teat shape, teat symmetry, teat injury and supernumerary teat has non-significant (P<0.05) effect on mastitis. This difference of non-significance could be due to environmental differences, differences in animal breeds, fluctuation of immune response, housing and management system, all other farmers' as well as host's related determinants. Table 3 depicts that there is significant relation of color with mastitis prevalence of mastitis in all three breed as well as strains of Beetal. It was observed that color Black & White 31.9% followed by Black 20.6%, Blackish brown 16.3%, Brown Splashed 11.2%, Brown & White 8.5% while 0.8% in Brown Black was observed. This information is for the first time in Pakistan and the reference availability for comparison might be difficult but its significant effect has observed.

Various level of education has a strong significant effect (P<0.05) on mastitis as it was observed that as the level of education increases and marked decline was seen in mastitis prevalence that is due to better awareness about farm hygiene, sanitation, disinfectant, social as well as farmer meetings, watching TV for news in educated farmers community. The flock size has significant effect (P<0.05), as the flock size 21-40 goat has 46.5% followed in 1-20 goat head 28.8% and more than 40 head 23.7%. This finding is very close the results about flock size of Megersa *et al*. 2010, Rashid *et al*., 2017, Husnain, 2016. Body condition score have shown that there was highly significant (P<0.001) difference presenting poor and good having 42.4% and 15.2%, respectively while excellent to be 0.1% observed. The findings were again in agreement with those of Megersa *et al*. 2010, Rashid *et al*., 2017. The calculated housing system have shown highly significant (P<0.05) effect on mastitis as open area showed 69.0% followed by backyard shed 29.4% and street presenting 0.5% mastitis prevalence. Such variation depends speaks of cleaning as difficult or impossible for open area as there is no restriction for microbial contamination is prevailed. The results were concordat with findings of Megersa *et al*. 2010, Rashid *et al*., 2017.

Farm hygiene have shown (P<0.05) significant on mastitis as normal 47.1% followed by very poor 33.6%, poor16.1% and good 2.1% was observed. This table depicts that as the level of farm hygiene is attaining better score then ultimately marked decline will be seen in mastitis and same was happen in this study. This finding is also strongly supported by Ameh *et al*. 2000, Rashid *et al*., 2017. It was observed that in parity of 3-4 kidding has 53.0% followed 1-2 kidding 29.9% while in 5 and above kidding 16.4%. The chance of mastitis is directly proportional to parity as animal to face more numbers of infections depending upon the environmental conditions, milking practices, and sanitations etc. The results were in line with findings of Ndegwa *et al*., 2000 and Moroni *et al*., 2005, McDougall *et al*., 2002. A strong connection with the occurrence of mastitis because as the time passes, there is more chances of getting infections. So as the age increase there will be more risk of disease likewise in case of mastitis. As age group 4-5 year 52.3% followed by 1-3 year 33.6% and >5 year 13.0% was observed. Prevalence of mastitis has increased with increasing age in goats studied by Ameh and Tari, 2000, McDougall *et al.*, 2002, Moroni *et al.*, 2005 their result findings are connected with our results findings that occurrence of disease was more in 3-5 years of age in both strains of Beetal.

Ease of milking, milk leakage, blood in milk, SFMT score, milk taste and milk yield has very strong connection with the occurrence of mastitis and showing the (P<0.05) highly significant effect. It is understood that these factors has strong relation with mastitis as mastitis appeared, a marked hardness of teat during milking, milk leakage, blood in milk in very severe attack of mastitis, severity of SFMT score and milk yield decreased up to 20% due to mastitis. The findings of these parameters are strongly supported by all researchers who are involved in mastitis work. These findings are very close to the results presented by Ameh and Tari, 2000; McDougall *et al.*, 2002; Moroni *et al*., 2005; Ndegwa *et al*., 2000; Moroni *et al*. 2005; Athar, 2007; Leitner *et al*., 2008; Ahmad *et al.* 2009, Ali *et al*., 2010; Megersa *et al*. 2010; Islam *et al*., 2011, Husnain, 2016; Rashid *et al*., 2017.

Antibiotic sensitivity test of prevalent isolates: In the present study, among the selected isolates, *S. aureus and*

S.hyicus were sensitive amoxicillin, ampicyline, lincomycine, sulfamethoxazole+Trimethoprim, novobiocin, enrofloxacin, amoxicillin+ clavulanic acid and oxytetracycline while S.xylosus was sensitive to all but only resistant to novobiocin. *S.simulans* was sensitive to lincomycine, sulfamethoxazole+Trimethoprim and enrofloxacin while rests of all antibiotics out of 8 discs were resistant (Table 4). These study findings are comparable with that of Athar, 2007; Ali *et al*., 2010; Islam *et al*., 2011 and Najeeb *et al*., 2013 who also reported about similar kind of trend in antibiotic susceptibility of *S. aureus* and Coagulas Negative Staph. Spp.(CNS). Contrarily, Chaudhry and Azam (1995) reported gentamicin to be the most effective *in vitro* antibiotic followed by chloramphenicol, kanamycin, oxytetracycline, cotrimoxazole, penicillin, doxycycline, ampicillin, and nystatin. Haphazard use of certain antibiotics might have conferred resistance in the present microorganisms and would easily lead to therapeutic failure. Therefore, use of antibiotics based on antibiotic susceptibility profile is highly warranted to achieving a better cure rate.

Conclusions: The study found over all 15.20% mastitis in goats with significantly variable mastitis distribution in studied areas. On the other hands, type of housing, farm hygiene, age, stage of lactation, parity, color, body condition score, teat ends, SFMT score, milk taste, milk consistency, milk color and milk yield were found pertinent risk factors. The major staphylococcal species with decreasing order were found noted in the name of *S. hyicus, S. xylosis, S. simulans, S. aureus* and many unidentifiable staphylococcal species. The epidemiology of goat mastitis is fulminating with pathogenic involvement of bacteria requiring immediate attention.

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Authors contribution: MIS design and conducted the study. MS help in analyzing the microbiological assay. MSK performed statistical analysis. GM keenly observed, guided in total research and SUR approved the final version of study.

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