

Assessment of Ixodid tick infestation with its impact on composition and milk production in livestock of Ballari province, Karnataka

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Abstract

A Survey was conducted for a period of 12 months from 2021 – 2022 to identify the major ectoparasitic infestation on cattle and buffaloes and to assess the impact of infestation on the production and composition of milk. Only milking animals were selected for the study. The infestation rate was divided in to three types with $n=0-15$ low infestation, $n=20-45$ moderate infestation and $n \geq 50$ high infestation. Milk was collected in sterilised bottles from both infected and uninfected animals separately.

Parameters such as Total solids, proteins, Fats, Ash, lactose, acidity and pH were analysed through automatic milk analyser kit. Milk yield of healthy cows and buffaloes was approximately 10 ± 0.68 and 7 ± 0.24 and the results of the present study revealed that the cattle breeds Holstein Friesian cross, Jersey cross when infected showed 0.5 litres decrease in milk production when compared to that of the uninfected ones. Whereas Sahiwal species showed a total of 1.0 litres decrease in milk production than that of the uninfected animals. Similarly the buffalo species such as Nagpuri, Murrah and Surti showed a total decrease of 0.5 litres of milk production when compared to the non-infested animals. Total solid concentration in healthy cows was recorded as 17.65% when compared to the infected cows the total solid composition was 23.03%. Similarly in uninfected buffaloes composition of Total solids was 16.08%, where as in infected buffaloes the concentration of Total solids 22.64%.

From the above results, it can be concluded that tick infestation is responsible for the decline in milk composition and production in the cattle and buffaloes of Ballari region.

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Karnataka is the 7th most urbanised state in India. More than half of the population of the state lives in the eight districts of Bangalore, Belgaum, Mysore, Tumkur, Gulbarga, Ballari, Bijapur and Dakshina Kannada. Karnataka is the 9th largest state in cattle and buffalo population in the country, accounting for 4.3 per cent of the total population as per the latest Livestock Census, 2012. It has six indigenous cattle breeds and cows yield up to 1,500 kg of milk per lactation²⁷. Animal Husbandry plays a vital role in determining the agricultural economy of the State. The main occupation of more than 75% of the rural population in this State is agriculture and its allied activities. Agricultural activities are predominantly dependent on drought power provided by Animal Husbandry Sector. Ectoparasitic infestation is one of the major veterinary problems affecting livestock industries in many parts of the world¹². Among these, ticks have been recognized as important ectoparasites of livestock. They have been incriminated as voracious bloodsuckers; causing heavy blood losses resulting in lowered productivity⁴ and mortality²³. Ticks are primarily parasites of wild animals and only about 10% of species feed on domestic animals, primarily sheep and cattle^{13,17}. Ticks are ectoparasites of all terrestrial vertebrates. Up to now there are 896 described species of ticks in three families¹⁰. They are widely distributed around the world but the prevalence is higher in countries with warm, humid climates. Ticks and the diseases they transmit are widely distributed throughout the world, particularly in tropical and subtropical regions. It has been estimated that 80 percent of the world's cattle population is exposed to tick infestation⁵. One of the biggest obstacles to

cattle rearing around the world is losses due to endo and ectoparasites. Ticks and tick borne diseases (TTBDs) are of global importance because of their economic and health implications in livestock, human and companion animals¹³. There are two well established families of tick, the Ixodidae (hard tick), and Argasidae (soft tick), both are important vectors of disease-causing agents to human and animals throughout the world³⁴. Tick is obligatory bloodsucking arachnid arthropods; infesting mammals, birds, reptiles and amphibian. They act as vectors of diseases, causing anemia, dermatitis, paralysis, otoacariasis as well as loss of production²⁹. These parasites generate direct effect in cattle on terms of milk production and weight reduction²⁵. Due to heavy infestation of ticks, cattle take more feed for fulfilment of requirement of parasite, then it effects the retarded growth of young ones, while adults may remain internally weak, stunted, thin and production of milk in dairy cows became greatly reduced⁹. The present study was undertaken to measure the impact of tick species *Boophilus microplus* infestation on the yield of milk production in cattle and buffaloes. The study would be helpful to create a safe zone for domesticated animals to enhance the milk productivity in near future.

Study area :

The survey was undertaken in the villages from where maximum milk was supplied to KMF of Ballari taluk. These places were selected in particular since more the milk production greater will be the population of livestock (cattle, buffaloes, goats, sheep *etc.*). Ballari is one of the seven taluks of Ballari district lying at coordinates 15.1394°N Latitude

and 76.9214°E Longitude with 104 villages. Ballari district is an arid zone with scanty rainfall with the scrub and dry deciduous forests. Agriculture covers nearly 50 percent of the geographical area and provides occupation to maximum percentage of its population. The total area of Ballari is 1689 sq.km with a population density of 456 per sq.km. Among 104 villages a total of about 20 villages were selected for the present study where maximum milk production in litres per day was observed. A Survey was conducted for a period of 12 months from 2021 –2022 to identify the major ectoparasitic infestation on cattle and buffaloes and to assess the impact of infestation on the production and composition of milk. The study villages of Ballari taluk are depicted in Table and Fig 1.

Study animals :

Three breeds of cow and buffalo were selected for the present study viz...Sahiwal, Holstein Friesian cross, Jersey cross, Nagpuri, Murrah and Surti. Only milking animals were selected for the study. Direct and indirect losses incurred due infections, diseases, mortality, and reduced milk production in animals was also calculated on the basis of data collected during the study period.

Data collection :

About 1462 animals were surveyed and 953 animals were found to be infested with different ectoparasites. Ticks were collected from randomly selected animals both cows and buffaloes (adult & young) from 20 villages. The collection was made either in the morning hours or in the evening hours by using fine forceps to avoiding the crushing of mouth

parts. The infestation rate was divided in to three types with $n=0-15$ low infestation, $n=20-45$ moderate infestation and $n\geq 50$ high infestation. A total of 1381 ticks were collected (including nymphs) on 953 animals out of which 559 were collected on cow species and 394 ticks were collected from buffalo species. In case of high infestation more than 30 ticks were collected. The collected ticks were preserved in 70% alcohol during the sampling period and were identified using the taxonomic keys described by Krantz¹⁶; Geevarghese *et al.*,⁷; Richard Wall *et al.*,²⁸ and Stephen *et al.*,³². Randomly about twenty animals were selected to analyse the decline in milk production in the present study.

Milk collection and analysis :

Milk was collected in sterilised bottles from both infected and uninfected animals separately. During milking strict hygienic measures were employed and the samples were transferred to Department of Studies in Zoology, VSK University, Ballari for the estimation of parameters such as Total solids, proteins, Fats, Ash, lactose, acidity and PH through automatic milk analyser kit.

The present study was undertaken to assess the impact of tick infestation on the quality, quantity and composition of milk from the study area. A total of 953 animals belonging to different species such as Sahiwal, Holstein Friesian cross, Jersey cross, Nagpuri, Murrah and Surti were considered for the current study from 2021-2022.

Effect of tick infestation on milk production:

Milk yield of healthy cows and buffaloes

was approximately 10 ± 0.68 and 7 ± 0.24 and the results of the present study revealed that the cattle breeds Holstein Friesian cross, Jersey cross when infected showed 0.5 litres decrease in milk production when compared to that of the uninfected ones. Whereas Sahiwal species showed a total of 1.0 litres decrease in milk production than that of the uninfected animals. Similarly the buffalo species such as Nagpuri, Murrah and Surti showed a total decrease of 0.5 litres of milk production when compared to the non-infested animals. The results of the present study were in accordance with the results of Rafique *et al.*²⁶ who reported the predictable decrease of more than 50% of milk production in most of dairy farms of Brazil. Climate influences the rate of tick infection in animals. Data regarding the comparison of milk production (in litres) in both infected and uninfected animals was recorded (Table-2).

Effect of tick infestation on the composition of milk :

The parameters such as Total solids, Proteins, Fats, Ash, lactose, Acidity and PH were analysed in both infected and uninfected animals. Total solid concentration in healthy cows was recorded as 17.65%, proteins 3.31%, Fats 4.85%, Ash 0.73%, lactose 4.88%, Acidity 0.14% and PH 6.64% when compared to the infected cows the total solid composition was 23.03%, Proteins 2.97%, Fats 9.62%, Ash 0.84%, lactose 4.37%, Acidity 0.15% and PH 7.13%. Similarly in uninfected buffaloes composition of Total solids was 16.08%, Proteins 3.92%, Fats 7.78%, Ash 0.19%, lactose 4.32%, Acidity 0.19% and PH 6.54% where as in infected buffaloes the concentration of Total solids, Proteins, Fats, Ash, lactose,

Acidity and PH was 22.64%, 3.87%, 11.66%, 0.25%, 4.09%, 0.19% and 7.02% respectively which is depicted in table and fig 3.

Estimation of economic losses in terms of milk production :

The economic losses can be estimated using the mathematical equation given by B. W. Narladkar, 2018.

$$PEL = \frac{[(TP \times \frac{PPA}{100}) \times (\frac{AP \times PL}{100}) \times (CMR)]}{TP}$$

Where,

PEL: Projected economic losses from a particular vector/ vector borne disease in a geographical area per animal or from total livestock population.

TP: Total population exposed to vector/at risk in a geographical area.

PPA: Percent population affected/exposed/at risk of vector/vector-borne disease in a geographical area.

AP: Standard average production of milk/meat/wool from individual/from total livestock population animal in a geographical area.

PL: Percentage loss from vector/vector-borne disease an individual animal in terms of milk/meat/ wool.

CMR: Current market rate per unit of milk/meat/wool.

The economic losses for total livestock population in India can be calculated as.., Total livestock population of total milking cows + buffaloes in India is (**TP**): 80526070 (8.05 crore)²².

Percent population affected (**PPA**) is: 100%. Standard Average/total milk production of India

from total milking cows+buffaloes (**AP**): 132.43 million tons (13243 core liters) (Department of Animal Husbandry, Dairying and fisheries. Annual Report, 2013-14)

Percent loss from vector/vector-borne disease to animal in terms of milk (**PL**): 18.97% (Narladkar and Shivpuje)²¹.

Current market rate per unit of milk (**CMR**): ₹ 35-38.

As per the above formulations

$$PEL = \frac{[(1 \times 100) \times (7.02 \times 18.97) \times (38)]}{100 \times 100}$$

PEL per individual animal = ₹ 50.60 per crossbred cow per day²¹.

In the present study the younger animals (below 1 year) were more prone to infection as reported by Abdul *et al.*,¹ Rafique *et al.*,²⁶ and also yield and composition of milk was significantly affected in tick infected cows and buffaloes. Other factors such as age, sex, diet, lactation will also influence the number of ticks the animals carry. Different species of animals have varying capacity of resistance to tick infestation. The crossbreeds have low tick infestations and also high resistance to infections. Economic production losses caused by cattle tick seemed to be indicating that an average of one mature tick per day caused a growth rate reduction equivalent to at least 450gms per year²⁶. Production losses due to Theileria in bovines have also been reported in Kenya by Latif *et al.*,¹⁸; Muraguri *et al.*,¹⁹ and in Tanzania by Homewood *et al.*,¹¹; Kivaria and Kivaria *et al.*,¹⁵. The long term infection of ticks can also induce anaemia in the infected animals. Seifert³⁰, reported that the average blood uptake (0.3 ml) of enlarged adult female quantity is about twice its own

weight and it had lost ability to adequately replace blood protein such as haemoglobin and plasma albumin because of an immunological response²⁶. Tick infestation also resulted in a change in body composition for example, infested animals had relatively more fat and less muscle than their uninfected ones^{26,31}. According to Bedane *et al.*,³ most livestock owners and health professionals believe that ticks are the major cause of udder damage and teat blindness, which is a major influencing factor for the decline in cow milk production. Certainly, extreme load of ticks could be responsible for more than collapse of lactations, but can also lead to the death of host²⁶. The total milk production in India is about 132.43 million tons during year 2012-13 and the projected loss of milk production is @23.0% -30.46 million tones which directs to about @₹ 38 L/Kg = 115748 crore IN ₹ per annum²¹. Perich, *et al.*,²⁴ have estimated the loss of \$275.7 million annually due to the transmission of tick-borne diseases and cost of tick control. Furlong, *et al.*,⁶ has recorded the reduction of 23% in milk yield/day in crossbred Holstein Zebu cows. Teodoro, *et al.*,³³ has found out a total reduction of 529 kg (26%) of milk/lactation in Holstein cows. Ghosh, *et al.*,⁸ has estimated that roughly about 2000 crores per annum of economic losses in India due to ticks and tick borne diseases. Narladkar, and Shivpuje²¹ have reported the economic losses due to trypanosomosis in buffaloes and theileriosis in cross bread cattle in Karnataka which accounts to a total of 396.08 (loss per animal Rs:1273.5) and 231.26 crores (loss per animal Rs: 854.20).

From the above results, it can be concluded that tick infestation is responsible

Table-1. Total No of cattle's and buffaloes surveyed in different localities of Ballari taluk during February 2021- January 2022

Year of collection	Month of collection	Total No of animals surveyed	Total No of animals infested (02 years)	Infested animals				Tick infestation Stages			
				Adult female (Above)	Younger (Above 01 year)	Young (Below 01 year)	Not infested	Adult male	Adult female	Nymph	Total
2021	February	120	87	37	29	21	33	29	43	-	72
	March	186	126	64	43	19	60	42	56	-	98
	April	98	57	28	21	08	41	26	72	19	117
	May	131	70	31	24	15	61	47	89	43	179
	June	158	98	63	19	16	60	52	63	-	115
	July	76	41	13	15	13	35	23	37	12	72
	August	81	34	14	11	09	47	48	56	37	141
	September	103	83	41	23	19	20	19	21	69	109
	October	77	59	23	25	11	18	39	50	30	119
	November	197	142	59	39	44	55	25	32	12	69
December	66	47	19	21	07	19	48	53	37	138	
2022	January	169	109	47	33	29	60	51	67	34	152
Total		1462	953	439	303	211	509	449	639	293	1381
Percentage		-	-	46.06	31.79	22.14	-	32.51	46.27	21.21	-

Table-2. Impact of tick infestation on milk production in cattle and buffaloes in the study area

Sl.No	Species of Cow's and buffaloes' surveyed	No of animals infested with ticks	Milk production in infested cows and buffaloes (Litres)	Milk production in uninfested cows and buffaloes (Litres)
Cow Species				
01	a Sahiwal	205	6.0	7
	b Crossbred Holstein Friesian	171	14.5	15
	c Crossbred Jersey	183	9.5	10
Buffalo species				
02	a Nagpuri	112	3.7	4.2
	b Murrah	159	14.5	15
	c Surti	123	4.5	5.0

Table-3. Effect of tick infestation on the composition of milk in cattle and buffaloes

Sl.no	Parameters	Uninfected animals		Infested animals	
		Cow (%)	Buffalo (%)	Cow (%)	Buffalo (%)
01	Total solids	17.65	16.08	23.03	22.64
02	Proteins	3.31	3.92	2.97	3.87
03	Fats	4.85	7.78	9.62	11.66
04	Ash	0.73	0.19	0.84	0.25
05	lactose	4.88	4.32	4.37	4.09
06	Acidity	0.14	0.19	0.15	0.19
07	PH	6.64	6.54	7.13	7.02

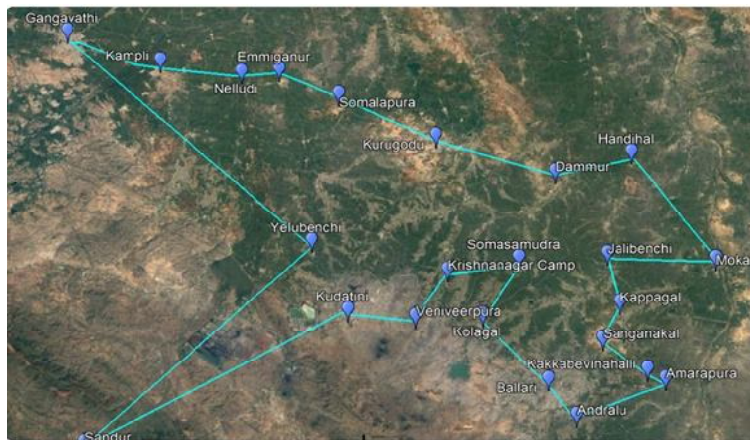


Fig. 1. Location of study area (Source: Google Earth)

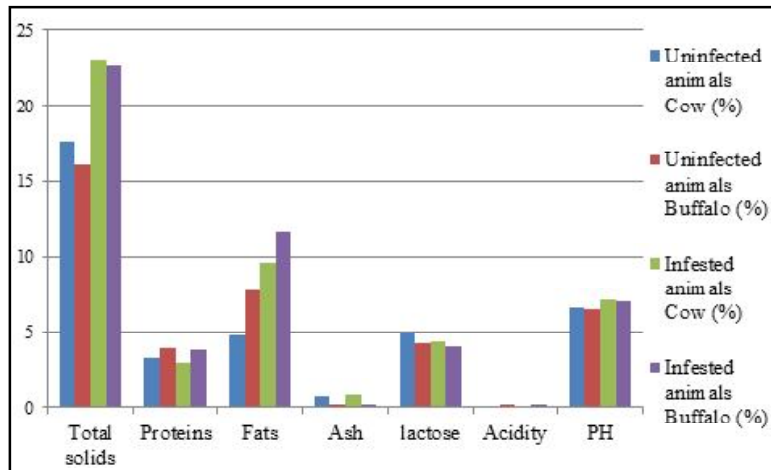


Fig. 2. Tick infestation impact on milk composition

for the decline in milk composition and production in the cattle and buffaloes of Ballari region. The adverse effects of tick infestation in animals may include loss of appetite, weight loss, muscle loss and anaemia. Hence ticks and tick infestation play a significant role in assessing the projected economic losses of the state in dairy industry. By adopting preventive and control measures the ticks and infestations from ticks can be kept at bay and in turn the milk and composition production remains unaffected.

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