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RESEARCH ARTICLE

Seasonal Activity of Tick Infestation in Goats and Buffalo of Punjab Province (District Sargodha), Pakistan

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Summary

The purpose of the present study was to determine the prevalence of tick infestation in buffalo and goats of Punjab Province (District Sargodha), Pakistan. There were a total of twelve hundred buffalo and goats examined from October 2012 to September 2013 to determine the prevalence of ticks infestation. The results showed that the prevalence of tick infestation in buffalo was 84.33% (1012/1200). The ticks were collected and identified. In buffalo, the higher prevalence rate was *Hyalomma aegyptium* (37.91%) followed by *Rhipicephalus (Boophilus) microplus* (22.59%), *Rhipicephalus (Boophilus) annulatus* (17.15%), *Hyalomma marginatum* (9.45%), H*yalomma anatolicum* (9.03%) and *Rhipicephalus sanquineus* (3.84%) respectively. The breed wise prevalence was in Chenab breed (84.59%), Ravi breed (79.10%) and Hybrid breed (91.66%) respectively. The sex wise prevalence was in male (87.71%) and in female (83.53%). The prevalence based on age showed that the rate of infestation in buffalo having age group (1-4 year) was 85.48%, (4-8 year) was 86.02% and (>8 year) was 66.66%, respectively. The prevalence based on grazing pattern showed that rate of infestation in intensive grazing 85.28%, extensive grazing 86.41% and both (intensive and extensive) was 81.94%.While in case of goats the tick infestation was 86.50% (1038/1200). In goats, the higher prevalence was *Hyalomma anatolicum* (31.56%), *Rhipicephalus* spp. (25.95%), *Haemophysalis* spp. (21.07%), *Ixodes* spp. (15.46%), and *Ambylomma* spp. (5.93%) respectively. The breed wise prevalence was in Desi breed (91.12%), Taidi breed (90.97%), Lail Poori breed (91.78%) and Hybrid breed (66.66%) respectively. The sex wise prevalence was in male (79.16%) and in female (88.81%). The prevalence based on age showed that the rate of infestation in goats having age group (1-4 year) was 86.17%, (4-8 year) was 91.66%, respectively. The prevalence based on grazing pattern showed that rate of infestation in intensive grazing 86.71%, extensive grazing 85.97% and both (intensive grazing and extensive grazing) was 87.12%.The present study showed that these epidemiological factors have a significant effect on the prevalence of tick infestation in buffalo and goats of Sargodha district, Pakistan. The results of this survey showed that the ticks are active throughout the year except January but highly active from June to August. It would be very helpful in devising the future strategies towards the eradication and control of ticks in other endemic areas of Pakistan.

Keywords: *Ticks, Intensive grazing, Extensive grazing, Prevalence, Epidemiological factors, Pakistan*

Pakistan'ın Sargodha Bölgesi Pencab Eyaletinde Keçi ve Yaban Sığırlarında Kene Enfestasyonunun Mevsimsel Aktivitesi

Özet

Bu çalışmanın amacı Pakistan'ın Sargodha Bölgesi Punjab Eyaletinde keçi ve yaban sığırlarında kene enfestasyonunun prevalansını belirlemektir. Kene prevalansını tespit etmek amacıyla toplam Her birinden 1200'er yaban sığırı ve keçi Ekim 2012 ile Eylül 2013 yılları arasında incelendi. Yaban sığırlarında kene enfestasyonu %84.33 (1012/1200). Keneler toplandı ve tanımlandı. Yaban sığırlarında en yüksek prevalans *Hyalomma aegyptium* (%37.91) iken bunu sırasıyla *Rhipicephalus (Boophilus) microplus* (%22.59), *Rhipicephalus (Boophilus) annulatus* (%17,15), *Hyalomma marginatum* (%9.45), *Hyalomma anatolicum* (%9.03) ve *Rhipicephalus sanquineus* (%3.84) takip etti. Türlere göre prevalans Chenab (%84.59), Ravi (%79.10) ve Hibrit (%91.66) olarak tespit edildi. Cinsiyete göre prevalans erkeklerde %87.71, dişilerde %83.53 olarak saptandı. Yaş gruplarına göre yaban sığırlarında enfestasyon oranları 1-4 yaş arası %85.48, 4-8 yaş arası %86.02 ve 8 yaş üzeri olanlarda %66.66 olarak bulundu. Otlama şekillerine göre prevalans yoğun otlatılanlarda %85.28, seyrek otlatılanlarda %86.41 ve her iki şekilde birden olanlarda %81.94 olarak tespit edildi. Keçilerde kene enfestasyonu %86.50 (1038/1200) olarak belirlendi. Kene prevalansları türlere göre sırasıyla %31.56 *Hyalomma anatolicum*, %25.95 *Rhipicephalus* spp., %21.07, *Haemophysalis* spp., %15.46 *Ixodes* spp. ve %5.93 *Ambylomma* spp. olarak tespit edildi. Keçi türlerine göre %91.12 Desi, %90.97 Taidi, %91.78 Lail Poori ve %66,66 Hibrit olarak belirlendi. Cinsiyete göre prevalans erkeklerde %79.16 dişilerde %88.81 olarak saptandı. Yaş gruplarına göre keçilerde enfestasyon oranları 1-4 yaş arası %86.17, 4-8 yaş arası %91.66 olarak bulundu. Otlama şekillerine göre prevalans yoğun otlatılan keçilerde %86.71, seyrek otlatılanlarda %85.97 ve her iki şekilde birden olanlarda %87.12 olarak tespit edildi. Bu çalışma Pakistan'ın Sargodha bölgesinde epidemiyolojik faktörlerin yaban sığırı ve keçilerde kene enfestasyonunun prevalansına önemli etkileri olduğunu göstermiştir. Bu taramanın sonuçları kenelerin Ocak ayı hariç tüm yıl boyunca özellikle de Hazirandan Ağustas ayına kadar oldukça aktif olduklarını ortaya koymuştur. Pakistan'ın diğer endemik bölgelerinde kenelerin eradikasyon ve kontrolüne yönelik planlamalar yapılmasının yaralı olacığa görüşündeyiz.

Anahtar sözcükler: *Kene, Yoğun otlatma, Seyrek otlatma, Prevalans, Epidemiyolojik faktörler, Pakistan*

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INTRODUCTION

Ticks are very important and most common ecto-parasites of mammals, birds and reptiles worldwide [1,2]. They are dioecious having separate sex [3]. Based on the number of hosts required to complete their as one-host, two-host and three-host ticks [4].

Ticks also have adverse effect on livestock in several ways and parasitize a wide range of vertebrate hosts and transmit a wide variety of pathogenic agents than any other group of arthropods [5]. They transmit protozoa, bacterial, rickettsial and viral diseases [6]. They down grade hide and skins quality and reduce milk and wool production, reduce productivity and increase susceptibility to the other diseases [7]. Due to economic and veterinary importance of ticks, their control and the transmission of tick borne diseases remain a challenge for the cattle industry in tropical and subtropical areas of the world and it is a priority for many countries in tropical and subtropical regions [8].

Tick infestation has adverse effects throughout the world particularly in the livestock. The 80% of cattle population is suffering with tick infestation in the world. Tick-borne diseases (TBDs) around the world have been associated with US$ 13.9 to US$ 18.7 billion annually loss in productivity [7,9-11]. More than US$1.0 billion and US$1.0 million annually losses by a single tick *Boophilus microplus* are reported in South America and Australia respectively [12]. Acricidal activities against diseases in order to control prevailing conditions enhance the production cost for the owner [13].

Pakistan owns a large number of animals. These animals are playing important role to meet the ever increasing demand of animal protein and milk for mankind. Ticks are cosmopolitan in distribution, but occur principally in tropical and subtropical regions [1]. Pakistan being a tropical country provides optimal climatic conditions for growth and multiplication of ticks. Tick fauna of Pakistan is rich in number of genera and species [14]. The impact of ticks and tick borne diseases on the individual and national economics warrants application of appropriate tick control strategies on priority basis [15]. Most of the investigations on prevalence of tick species in Pakistan are more than a decade old [16-19], whereas periodical monitoring of tick infestation is an essential component for formulating effective control recommendations.

Due to high prevalence of this disease around the world and Pakistan keeping in mind the importance of livestock, above described facts and figures the present study was designed With following Objectives.

The objectives of the present study were to determine the;

- Seasonal fluctuation in population of ticks with respect to epidemiological factors like breed, herd size and sex etc.

- Correlation of tick population with intensive and extensive grazing pattern.

MATERIAL and METHODS

Location

Punjab is the Pakistan's second largest province at 205.344 km^2 (79.284 sq^2 miles) after Balochistan and is located at the northwestern edge of the geologic Indian plate in South Asia. The geographical location of the Sargodha is 32° 5′ 1″ North, 72° 40′ 16″ in Punjab Province, Pakistan.

Topography

The Punjab province is bordered by Kashmir (Azad Kashmir, Pakistan and Jammu and Kashmir, India) to the north-east, the Indian states of Punjab and Rajasthan to the east, the Pakistani province of Sindh to the south, the province of Baluchistan to the southwest, the province of Khyber Pakhtunkhwa to the west, and the Islamabad Capital Territory to the north. Undivided Punjab is hometo six rivers, of which five flows through Pakistani Punjab. From west to east, these are: the Indus, Jhelum, Beas, Chenab, Ravi and Sutlej. Nearly 60% of Pakistan's population lives in the Punjab. It is the nation's only province that touches every other province; it also surrounds the federal enclave of the national capital city at Islamabad. This geographical position and a large multi-ethnic population strongly influence Punjab's outlook on National affairs and induces in Punjab a keen awareness of the problems of the Pakistan's other important provinces and territories. The landscape is amongst the most heavily irrigated on earth and canals can be found throughout the province. Weather extremes are notable from the hot and barren south to the cool hills of the north. The foothills of the Himalayas are found in the extreme north as well.

Study Area

The present study was conducted in the district Sargodha, Punjab, Pakistan. The data was collected from five tehsils of Sargodha, Sahiwal, Silanwali, Kotmomin and Shahpur. The area is located 550 to 650 feet above the sea level. The area has a climate of extreme heat and cold. The maximum temperature reaches 50°C (122°F) in the summer while the minimum temperature recorded is low as freezing point in the winter [20].

Data Collection

The study was conducted from October 2012 to September 2013. Data was collected on monthly basis

from Sargodha and Silanwali, Shahpur and Sahiwal and Kotmomin.

Tick specimens were collected using forceps without damaging their mouthparts and preserved in 70% ethyl alcohol. Complete record was maintained for each tick specimen for their origin regarding species of the host. Permanent mounts of the tick specimens were prepared. Morphological characterization of ticks was carried out using a stereoscopic microscope according to the instructions given by [1].

Statistical analysis

The Statistical analysis (Chi-square) was done by using the statistical package SPSS version 20.0 for Windows 2007.

RESULTS

Buffalo

The present study was conducted in five tehsils of Sargodha district to determine the prevalence of tick infestation in the buffalo from October 2012 to September 2013. The results of present study revealed that the rate of infestation in buffalo was 84.33% (1012/1200). The ticks were observed mostly on the udder parts on the body dorsal side and ventral side of the infested buffalo. The ticks started to appear by the start of February and highly active from end of May to August *(Fig.1)*. The species collected from infested buffalo were identified as *Hyalomma aegyptium* 37.91% followed by *Rhipicephalus (Boophilus) microplus* 22.59%, *Rhipicephalus (Boophilus) annulatus* 17.15%, *Hyalomma marginatum* 9.45%, *Hyalomma anatolicum* 9.03% and *Rhipicephalus sanquineus* (3.84%).

The buffalo of three breeds (Chenab breed, Ravi breed, Hybrid breed) were examined on monthly basis. The prevalence in Chenab breed was 84.59% (851/1006), Ravi breed 79.10% (106/134) and Hybrid breed 91.66% (55/60) respectively *(Fig. 2)*.

The tehsil wise prevalence was determined in the present study. It was in tehsil Kotmomin 86.20% (300/348), Shahpur 81.66% (147/180), Sargodha 79.41% (162/204), Silanwali 86.84% (198/228) and Sahiwal 85.41% (205/240) were respectively *(Fig. 3)*. The statistical analysis has showed no significant differences (P<0.13) in the prevalence of tick infestation in different tehsils of district Sargodha Punjab Province, Pakistan.

The results showed that female 83.53% and male 87.71% buffalo were infested *(Fig. 4)*. The prevalence in buffalo having age group (1-4 year)was 85.48% (636/744), in age group (4-8 year) was 86.02% (320/372) and the age group (>8 years) was 66.66% (56/84) were infested *(Fig. 5)*. The results showed that younger buffalo were more infested as compared to older buffalo.

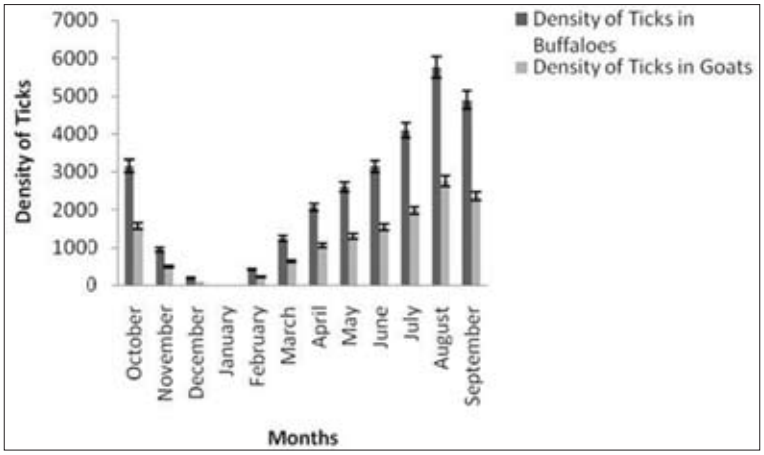


Fig 1. Showing the fluctuation of tick density on the goats and buffalo examined during study. Tick density was highest in August followed by September and was least in January

Şekil 1. Çalışma boyunca incelenen yaban sığırı ve keçilerde kene yoğunluğunun aylara göre dağılımı. Kene yoğunluğu en yüksek Ağustos ayında gözlendi, bunu Eylül ayı izledi. En düşük Ocak ayında tespit edildi

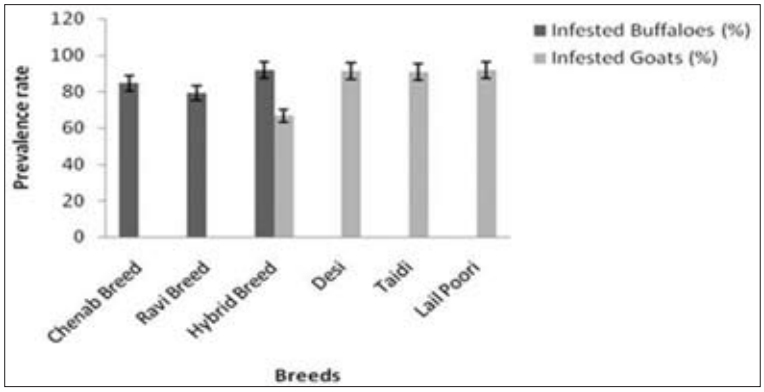


Fig 2. Showing breed wise prevalence of tick infestation in goats and buffalo

Şekil 2. Yaban sığırı ve keçi türlerine göre kene enfestasyonunun prevalansı

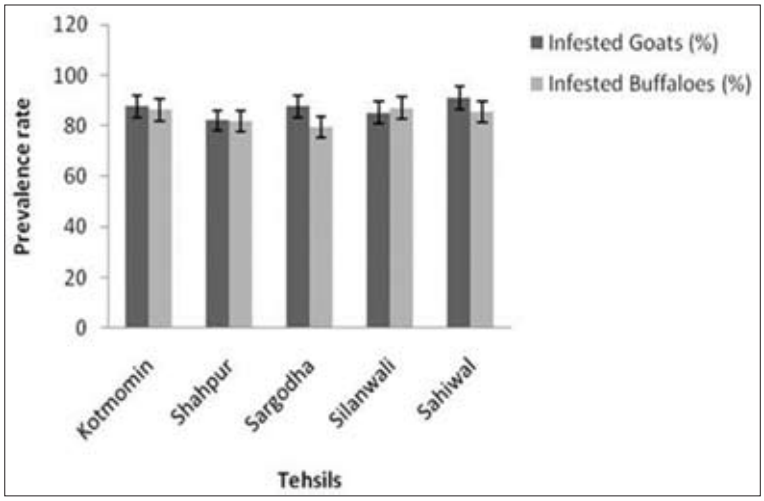
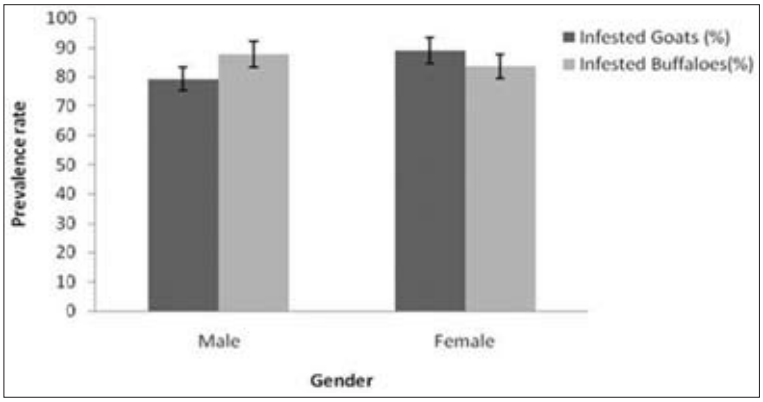


Fig 3. Showing the tick infestatıon of goats and buffalo in different tehsils

Şekil 3. Değişik bölgelere göre keçi ve yaban sığırlarındaki kene enfestasyonu

Fig 4. Showing sex wise prevalence in goats and buffalo

Şekil 4. Cinsiyete göre keçi ve yaban sığırlarındaki kene prevalansı



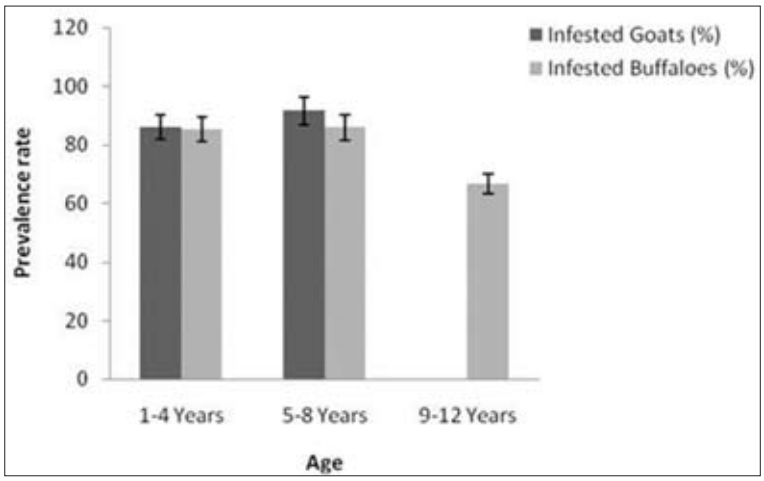


Fig 5. Showing age wise prevalence of tick infestatıon in goats and buffalo

Şekil 5. Keçi ve yaban sığırlarındaki yaşa göre kene enfestasyonu prevalansı

The statistical analysis showed that there is no significant difference between infested and non-infested buffalo in all age groups *(Table 1)*. The prevalence rate in animals reared under intensive grazing system was 85.28% (429/503), extensive grazing 86.41% (229/265) and both (intensive and extensive) grazing was 81.94% (354/432) respectively *(Fig. 6)*.

Goats

The results of present study revealed that the rate of infestation in goats was 86.50% (1038/1200). The ticks started to appear by the start of February and highly active from end of May to August *(Fig. 1)*. The species collected from infested goats were identified as *Hyalomma anatolicum* 31.56%, *Rhipicephalus* spp. 25.95%, *Haemophysalis* spp. 21.07%, *Ixodes* spp. 15.46%, and *Ambylomma* spp. 5.93%.

The goats of four breeds (Taidi breed, Desi breed, Lailpoori and hybrid breed) were examined in the present study on monthly basis. The statistical analysis shows

Table 1. *Showing the statistical analysis of different epidemiological factors on the prevalence of tick infestation in buffalo Sargodha district of Punjab Province, Pakistan*

Tablo 1. *Pakistan'ın Sargodha Bölgesi Pencab Eyaletinde yaban sığırlarında kene enfestasyonu prevalansı üzerine değişik epidemiyolojik faktörlerin istatistiksel analizi*

S. No	Factors	Groups	Prevalence in Buffalo		Statistical Analysis (Chi-square)
			Infested	Non Infested	
1	Age	1-4 Years	636 (85.48%)	108 (14.51%)	χ^2=21.39 d f=2 P=0.000
		5-8 Years	320 (86.02%)	52 (13.97%)	
		9-12 Years	56 (66.66%)	28 (33.33%)	
2	Breed	Chenab	851(84.59%)	155 (15.40%)	χ^2=5.266 df=2 P=0.072
		Ravi	106 (79.10%)	28 (20.89%)	
		Hybrid	55 (91.66%)	5 (8.33%)	
3	Gender	Male	200 (87.71%)	28 (12.28%)	χ^2=2.443 df=1 p=0.069
		Female	812 (83.53%)	160 (16.46%)	
4	Tehsils	Kotmomin	300 (86.20%)	48 (13.79%)	χ^2=6.933 df=4 P=0.139
		Shahpur	147 (81.66%)	33 (18.33%)	
		Sargodha	162 (79.41%)	42 (20.58%)	
		Silanwali	198 (86.84%)	30 (13.15%)	
		Sahiwal	205 (85.41%)	35 (14.58%)	
5	Grazing Patterns	Intensive Grazing	429 (85.28%)	74 (14.71%)	χ^2=3.082 df=2 P=0.214
		Extensive Grazing	229 (86.41%)	36 (13.58%)	
		Both (intensive and extensive grazing)	354 (81.94%)	78 (18.05%)	

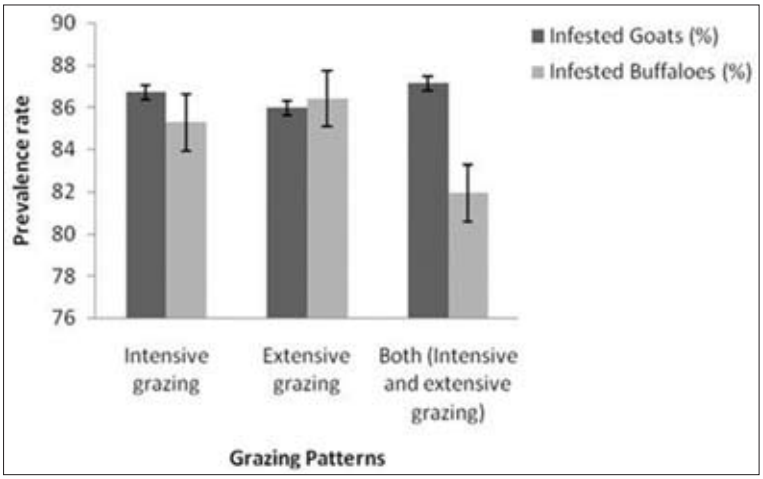


Fig 6. Showing grazing pattern based prevalence of tick infestatıoin in buffalo and goats

Şekil 6. Keçi ve yaban sığırlarındaki otlama şekillerine göre kene enfestasyonu prevalansı

that prevalence in Desi breed was 91.12% (688/755) Taidi breed 90.97% (131/144) Lail poori 91.78% (67/73) and Hybrid breed 152/228 (66.66%), respectively. Among all four breeds the highest infestation was observed in Lailpoori breed 91.78% *(Fig. 2)*.

The tehsil wise prevalence was determined from the Sargodha district. The prevalence in Sargodha district according to tehsil Kotmomin 87.50% (210/240), Shahpur 81.94% 177/216), Sargodha 87.50% (252/288), Silanwali 85.14% (235/276) and Sahiwal 91.11% (164/180) were respectively *(Fig. 3)*. The statistical analysis has showed the no significant differences (P<0.091) in the prevalence of tick infestation in different tehsils of district Sargodha Punjab Province, Pakistan.

The results showed that the infestation rate was 88.81% (810/912) female and 79.16% (228/288) in male goats *(Fig. 4)*. The prevalence in goats having age group (1-4 year) was 86.17% (972/1128) and in age group (4-8 year) was 91.66% (66/72) *(Fig. 5)*. The results showed that older goats were more infested as compared to younger goats. The statistical analysis showed that there is no significant difference between infested and non-infested animals in all age groups *(Table 2)*. The results showed that prevalence in the intensive grazing 86.71% (385/444), extensive grazing 85.97% (423/492) and both (intensive and extensive) grazing was 87.12% (230/264) respectively *(Fig. 6)*.

Table 2. *Showing the statistical analysis of different epidemiological factors on the prevalence of tick infestation in goats Sargodha district of Punjab Province, Pakistan*

Tablo 2. *Pakistan'ın Sargodha Bölgesi Pencab Eyaletinde keçilerde kene enfestasyonu prevalansı üzerine değişik epidemiyolojik faktörlerin istatistiksel analizi*

S. No	Factors	Groups	Prevalence in Goats		Statistical Analysis (Chi-square)
			Infested	Non Infested	
1	Age	1-4 Years	972 (86.17%)	156 (13.82%)	X^2=1.751 df=1 P=0.186
		5-8 Years	66 (91.66%)	6 (8.33%)	
2	Breed	Desi	688 (91.12%)	67 (8.87%)	X^2=94.847 df=3 P=0.000
		Lail Poori	67 (91.78%)	6 (8.21%)	
		Taidi	131 (90.97%)	13 (9.02%)	
		Hybrid	152 (66.66%)	76 (33.33%)	
3	Gender	Male	228 (79.16%)	60 (20.83%)	X^2=17.451 df=1 P=0.000
		Female	810 (88.81%)	102 (11.18%)	
4	Tehsils	Kotmomin	210 (87.50%)	30 (12.50%)	X^2=8.002 df=4 P=0.091
		Shahpur	177 (81.94%)	33 (18.05%)	
		Sargodha	252 (87.50%)	36 (12.50%)	
		Silanwali	235 (85.14%)	41 (14.85%)	
		Sahiwal	164 (91.11%)	16 (8.88%)	
5	Grazing Patterns	Intensive Grazing	385 (86.71%)	59 (13.28%)	X^2=0.220 df=2 P=0.896
		Extensive Grazing	423 (85.97%)	69 (14.02%)	
		Both (intensive and extensive grazing)	230 (87.12%)	34 (12.87%)	

DISCUSSION

The results showed that the prevalence of tick infestation in buffalo and goats of Sargodha district was 84.75% and 86.50% respectively. Our results correlates as 85.6% cattle were infested [21]. The spp. wise prevalence was *Rhipicephalus microplus* (22.59%), *Rhipicephalus annulatus* (17.15%), *Hyalomma marginatum* (9.45%), *Hyalomma anatolicum* (9.03%) and *Rhipicephalus sanquineus* (3.84%) respectively. Similar observations of tick spp. were reported on different genera of ticks on Friesian cattle in district Kasur, Punjab, Pakistan [22].

The results showed that the peak of population of ticks from June to August which is due to the high temperature and humidity [22]; the minimum population observed in January is due to low temperature and less humidity and short day length in buffalo and goats, respectively. The *Fig. 6* describe grazing pattern in buffalo and goats. According to this in buffalo, prevalence rate of tick infestation is higher in intensive grazing than extensive and the buffalo which possess the both types of grazing have high prevalence. While in case of goats prevalence rate is higher in extensive than intensive grazing and the goats which posses the both types of grazing have low prevalence. Similar observations were reported in case of parasitic disease like WFI, where the prevalence of disease was higher in intensive-extensive management grazing [23].

In case of extensive grazing the animals have to walk for food in the fields here there is little chance of attachment of ticks on the animal body due to more light exposure. When organism walks the more light falls on the dorsal side of body which increases the temperature and specify the under sites for attachment of ticks [24] that affect the reproductive activity of ticks and hence the prevalence of tick infestation decreases.

Most of the ticks were found on the udder, under tail and a small number on the chest and neck areas of the buffalo, while in case of goats mostly ticks were found on the ears and udder parts of the body [25]. It might be that the parts of the animals where ticks are found posses the soft tissues. This is the advantage for ticks that they can easily attach with the soft tissues and make a contact with the blood capillaries of the animal. Here female ticks can easily feed on the blood and get ready for the reproduction by leaving the host body part for laying the eggs. The other advantage for the ticks by attaching with the soft tissue is that they get protection from the predators such as birds. If they are exposed on the animal's body predators can easily get to them, will consume them and in this way the population of the ticks could be decrease.

The climatic determinants like temperature of the study area are very important in the prevalence of ticks in domestic ruminants [26]. The poor husbandry practices of small holder dairy farmers may be a determinant making the animals more prone to tick infestation. Moreover, a

stress should be given to practice a routine preventive therapy against ticks rather than treating the animals at the cost of lowered milk production [27]. Our study result shows that the prevalence of ruminant tick infestation is much higher in the developing countries of Asia [16,19,28-31] and Africa [32-35], followed by Australia [36], Europe [37-40], and the Americas [41-42].

After correlating temperature with that of population of ticks in multi angels it is concluded that density of the ticks fluctuates throughout the study period on goats and buffalo in district Sargodha Punjab province Pakistan. Climatic determinants of the study area greatly affect the prevalence of tick infestation. The population fluctuation depends on number of factors e.g. temperature, humidity, rain fall, gender and breed etc. The poor husbandry practices of small holder dairy farmers may be a determinant making the animals more prone to tick infestation. Keeping in view the results of this study, the farmers of the study area should be educated about the significance of the disease through local extension programs. Moreover, a stress should be given to practice a routine preventive therapy against ticks rather than treating the animals at the cost of lowered meat and milk production.

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