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Estimation of hard Ticks prevalence among sheep and goats in Sennar state, Sudan

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Abstract
With the objective of determining the prevalence and species diversity of hard ticks encountered in sheep and goats, this cross-sectional study was carried out in Sennar state as part of the ongoing investigations on Sudan viruses. In the present study, 1414 animals (sheep and goats) were surveyed, among which 270 animals were non-infested (92 sheep and 178 goats), the rest (1144 animal), were found infested by 4766 and 3012 different types of ticks in sheep and goats, respectively. Four genera and 6 and 5 species of hard ticks were identified in sheep and goats, respectively. The prevalence of the genera on sheep was: 96.12%, 2.18%, 0.86% and 0.84% for *Rhipicephalus* (*R.*), *Amblyomma* (*A.*), *Boophilus* (*B.*) and *Hyalomma* (*H.*), respectively. However, on goats was: 98.80%, 1.00%, 0.20% and 0.00% for *Rhipicephalus*, *Amblyomma*, *Boophilus* and *Hyalomma* respectively. The tick species and tick sex were identified during the study period. The prevalence of the tick species was: 41.94% *R. camicasi*, 41.94% *R. guilhoni*, 40.64%, *R. evertsi evertsi*, 13.53%, *A. lepidum*, 02.18%%; *R.* (*B.*) *decoloratus* 0.86%% and *Hy. Anatolicum*, 0.84%% of the total. However, in case of goats was: *R. guilhoni*, 39.31%; *R. camicasi*, 37.92%, *R. evertsi evertsi*, 21.58%, *A. lepidum*, 1.00% and *B. decoloratus*, 0.20% of the total collected ticks. Neither males nor females of *Hy. anatolicum* nor males of *B. decoloratus* were found in the examined goats. Further studies are recommended to estimate the impact of tick's infestation on tick-borne diseases in general and viruses in particular, and to design effective management and prevention strategies.

Keywords: ticks prevalence, sheep and goats, Sennar state, Sudan

Introduction
In Sudan and other developing countries, small ruminants (i.e., sheep and goats), are suited to a high percentage of smallholder producers economically and socially. That is because such animals have lower feed and are utilize a wide range of feedstuffs of little value, have shorter generation intervals and well adapted to the local conditions [1]. In Sudan, the free grazing is the most common form of feeding for livestock starting from June. Therefore, the animal health and production is mainly determined by the quantity and quality of the drinking water and pasture herbage. The disastrous impacts of the rainfall variability are threatens the health of local animals and rural families in terms of meat, milk production and vulnerability to disease. In 2004, the Ministry of Animal Wealth estimates the sheep and goat population at 48.0 and 42.0 million heads, respectively [2]. However, the low levels of management, disease and parasite challenges, inadequate feed and poor marketing are part of constraints facing the small ruminant's productivity [3]. Apparently, tick-borne viruses, such as Crimean-Congo hemorrhagic fever virus (CCHFV), are substantial public health threat. Infected tick, becomes a reservoirs, via bites, transmits such viruses to animals and humans and transovarially and trans-stadially transmits among ticks' generations [4]. Additionally, infected animals could become reservoir also. Moreover, humans could be infected through infected-tick bites, crushing infected ticks; contacts with infected people (e.g nosocomial) and through infected animals body fluids and handling infected animal carcasses. Moreover, as a result of a nosocomial spread of the disease (people in contact), the time interval between the contact and the onset of symptoms was reported to be merely 20 hours to 7 days and the treatments for infected people and animals are limited beside unavailability of vaccine [5]**.** Isolations of such viruses, e.g. CCHFV, from humans, other mammals and ticks demonstrated their presence in Europe, Asia and Africa. For instance, in Africa in six countries surrounding Sudan: Republic of Central African, Congo Zaire, Uganda, Kenya, Ethiopia and Egypt in addition to Senegal, Nigeria and Tanzania [6]. In Sudan, surveys have reported the presence of various arboviruses in human populations in Khartoum state [7]. Additionally, in Sudan, the CCHFV had been detected, as a result of eating infected uncooked sheep meat, in several sporadic cases and nosocomial outbreaks associated with high case-fatality in the Kordofan region [8]. Such virus specific antibodies have been detected in animals all of which had been imported to these countries from Sudan such as in sheep and goats in Jeddah, Saudi Arabia [9, 10]. It is however, essential to establish an investigating program to study such arthropod viruses. Furthermore, Alkhurma a severe tick-borne virus was reported in Saudi Arabia [11] and from infection of Italian travelers in Egypt after bitten by ticks while riding camels [12]. Moreover, they also noticed that twenty-seven tick species and subspecies have been reported to be CCHFV reservoirs/vectors. Such vectors and the

reservoirs could easily cross Sudan international borders. Notwithstanding all of the above points, the existence of tick-borne viruses such as CCHFV and Alkhurma virus in Sudan have not been totally excluded. Literature surevy revealed that few reports observed ticks on sheep and goats in Sudan, for instance, [13-20]. For instance, it was noticed that out of some 70 tick species recorded in the Sudan, 34 species of different genera were collected from sheep and goats [19]. However, tick-borne arboviruses surveillance to determine the circulation range of such viruses has not been reported. For better control of tick and tick-borne diseases in general, and viruses in particular, the present study attempts to know the prevalence, geographical distribution and seasonal distribution of ticks on sheep and goats in Sennar state, Sudan.

Materials and Methods

Study area

Sennar state is a plane area borders by Gezira state in the north, Gadarif state in the east, Blue Nile state in the west and Ethiopian international border in the south. Tick collection sites were around 5 cities: Sennar, Singa, Muzmum, Abu Na'ama and Dindir.

Study animals

Fifty animal (25 Watish sheep and 25 Nubian goats), were randomly selected from each of the aforementioned 5 locations every 2 month, year-round from November 2014 to October 2015 (6 collections). Cross-sectional study design was implemented to determine the distribution and abundance of males and females tick species during three seasons: Winter (November to February), summer (March to June) and autumn (July to October).

Tick collection and identification methods

Ticks were collected from all body of animals using forceps and were preserved with 70% alcohol in universal bottles separately. Date of collections and place of collections were recorded. The reported taxonomic key were used to identify ticks under Stereomicroscope [13, 14, 21].

Data analysis

The study data was analyzed using SPSS version 16. First, the data was coded appropriately into Microsoft excel spread sheet before been loaded into the SPSS. The prevalence of tick infestation was determined with descriptive statistics. The association between tick distribution and other factors such as location and season, was determined by the chi-square test. The 95% confidence intervals and $p < 0.05$ were set for significance in all cases.

Results and Discussion

During the present study, Table 1 shows that, 1414 animals (717 sheep and 697 goats) were surveyed, among which 270 animals were non-infested (92 sheep and 178 goats), the rest, 1144 animals (625 sheep and 519 goats) were found infested by different types of ticks. It is about 8 and 6 ticks per sheep and goat, respectively, a result that is similar to the highest mean of ticks per sheep recorded from 2002-2003 work in the same state of [20].

During the present study, a total of 4766 ticks were collected from 717 Watish sheep breed in the five locations: 145 sheep (20.22%) in Sennar; 146 sheep (20.40%) in Singa; 153 sheep (21.34%) in Mazmum; 149 sheep (20.90%) in Abuna'ma and 124 sheep (17.30%) in Dindir (Table 2A). However, a total of 3012 ticks were collected from 697 Nubian breed of goats from the five sites as follows: 142 goats (20.37%) in Sennar; 152 goats (21.81%) in Singa; 137 goats (19.65%) in Mazmum; 140 goats (20.09%) in Abuna'ma and 126 goats (18.08%) in Dindir (Table 2B). While the seasonal sheep infestation was: in winter (November to February) 240 sheep (33.47%); in summer (March to June) was 254 sheep (35.42%) and in Autumn (July to October) was 223 sheep (31.10%) (Table 2A). The seasonal goats' infestation was: in winter was 236 (33.88%); in summer was also 236 (33.88%) and in Autumn was 225 (32.28%) (Table 2B). Additionally, a total of 4766 ticks were collected from sheep and comprising four genera. The total of *Rhipicephalus* found was 4581 ticks (96.12%); *Amblyomma* were identified in 104 (2.18%); *Boophilus* were observed in 41 (0.86%) and *Hyalomma* were noticed in 40 (0.84%) (Table 3A). However, on goats the genera found were: *Rhipicephalus* 2976 ticks (98.80%); *Amblyomma* 30 ticks (1.00%); *Boophilus* 6 ticks (0.20%) and *no Hyalomma* genus was collected from goats, 0.0 ticks (0.00%) as from sheep, (Table 3B).

The data showed the species composition and sex, males and females (M and F), of ticks feeding on sheep (Table 3) and goats (Table 4A). On sheep, ticks were identified and counted as follows: *R. camicasi*, 1999 ticks (41.94% of the total) and 50.88% and 49.12% male and females ticks, respectively; *R. guilhoni*, 1937 ticks (40.64% of the total) and 48.68% and 51.32% male and females ticks, respectively; *R. evertsi evertsi*, 645 ticks (13.53% of the total) and 63.72% and 36.28% male and females ticks, respectively; *A. lepidum*, 104 ticks (02.18%% of the total) and 60.58% and 39.42% male and females ticks, respectively; *R.* (*B.*) *decoloratus*, 41 ticks (0.86%% of the total) and 0% and 100% male and females ticks, respectively and *Hy. anatolicum*, 40 ticks (0.84%% of the total) and 37.50% and 62.50% male and females ticks, respectively. However, in case of goats (Table 4B) ticks' species and sex (M and F) were scored as follows: a total of 3012 ticks were collected comprising the genera *Rhipicephalus*, *Boophilus*, *Amblyomma* and no *Hyalomma* genus was collected. The data showed the species composition of ticks feeding on goats as: *R. guilhoni*, 1184 ticks (39.31% of the total) and 42.15% and 57.85% male and females ticks, respectively; *R. camicasi*, 1142 ticks (37.92% of the total) and 50.96% and 49.04% male and females ticks, respectively; *R. evertsi evertsi*, 650 ticks (21.58% of the total) and 56.31% and 42.69% male and females ticks, respectively; *A. lepidum*, 30 ticks (1.00% of the total) and 50% and 50% male and females ticks, respectively and *B. decoloratus*, only 6 (0.20% of the total) and 0.00% and 100% male and females ticks, respectively and such results could be due to the small size of these males and could be overlooked. The most abundant tick species were found in Singa; 153 ticks (21.34%) in sheep and 152 ticks (21.81%) in goats (Table 1). The seasonal prevalence of reported tick species on sheep and goats is year-round and very close however, the highest was in summer 254 ticks (35.42%) on sheep and 236 ticks (33.88%) on goats in both winter and summer (Table 2). Additionally, regarding the

four genera, *Rhipicephalus* (*R.*) was the most abundant genus on both sheep (4581 ticks constituted 96.12%) and goat (2976 ticks represented 98.80%); *Amblyomma* (*A.*) scored the second 104 (2.18%) and 30 ticks (1.00%) on sheep and goats, respectively. *Boophilus* (*B.*) was the third 41 (0.86%) and 6 ticks (0.20%) however, *Hyalomma* (*H.*), which are incriminated as vector of CCHFV, were noticed in 40 (0.84%) in sheep and non on the examined goats (Table 3).

Regarding tick species, *R. camicasi*, was the most abundant tick species found on the examined sheep (1999 ticks) and constituted 41.94% of the total ticks collected and 50.88% and 49.12% males to females ticks, respectively. Before 13 years, this species was the least collected throughout the study period at all localities and in small numbers [20]. *R. guilhoni* scored the second place in the present study with (40.64% of the total). However, the order was contrary in case of goats; *R. guilhoni*, was the first (39.31% of the total) and *R. camicasi* was the second with 37.92% of the total (Table 4). *R. guilhoni* was also present at all studied localities before 13 years with the highest means total body 5.43 ± 0.50 [20]. Then, *R. evertsi evertsi*, was the third in order with 13.53% and 21.58% of the total on sheep and goats, respectively. Before 13 years, the species was present at all localities with the highest means total body 1.43 ± 0.33 [20]. The prevalence of *R. e. evertsi* (9.1%) was reported in River Nile state, Northern Sudan with the mean tick load of 11.2 per animal [22].The immature stages of *R. evertsi evertsi* was found feeding on sheep [17]. It was observed that *R. evertsi evertsi* is more or less common tick species on domestic animals in Kassala province, eastern Sudan [15, 18]. However, in Ethiopia, a contiguous country to this area, this species shows no apparent preference for season and rainfall [23].

Regarding the prevalence rate of tick species on sheep by location, as mentioned under tables, different superscripts indicate significant difference at $p \leq 0.05$. Therefore, sheep carried significantly (2.03±0.2) and (2.14±0.2) more *R. camicasi* males in Mazmum and Dindir than Sennar (3.01±0.23), less significant in Abuna'ama (3.85±0.38) and there is no significant difference in Singa (Table 4). However, for *R. camicasi* females, the significant difference at $p \leq 0.05$ was at Abunaa'ama (4.87±0.62). *R. guilhoni* males, more significant in Mazmum and Dindir than Abuna'ama, less significant in Sennar and not significant in Singa. The *R. guilhoni* females were highest loaded in Singa and Dindir, less significant in Sennar and not significant in Mazmum and Abuna'ama. By Season (Table 5), *R. camicasi* males and females were more significant in autumn and Summer than Winter. *R. guilhoni* males were more significant in winter than summer and autumn however, the females were more in winter and summer than autumn. Interestingly, *B. decoloratus* females and not the males were collected from sheep. However, the significant difference was in autumn (1.12±0.12), less in summer and not significant in winter (Table 5). The goats, however, carried significantly more *R. guilhoni* males in Singa (1.68±0.2), and Abuna'ama (1.59±0.17) than Sennar (2.67±0.28), less significant in Mazmum (3.56±0.47) and there is no significant difference in Dindir (Table 6). However, *R. guilhoni* females, the significant difference at $p \leq 0.05$ was at Singa (1.72±0.13) least significance at Sennar and Muzmum and non-significance at Abuna'ama and Dindir. There is no significant differences regarding the load of *R. camicasi* males on goats however, the goats carried more significant *R. camicasi* females in Mazmum, less significant in Singa and non significant in Sennar, Abuna'ama and Dindir (Table 6). Interestingly, the *B. decoloratus* males highest load was in Muzmum (1.45±0.16), less significant in Sennar and Singa and not significant in Abuna'ama and Dindir. However, its highest significant differences were in Singa, Muzmum, Abuna'ama and Dindir and less significant in Sennar (Table 6). With regard to the significant differences of ticks load on goats by season (Table 7), *R. guilhoni* males are more significant in winter than autumn and not significant in summer. However, *R. guilhoni* females load was more significant in winter and summer than autumn.

In the present study, *A. lepidum* was the fourth ranked tick species on sheep and goats with a prevalence of 02.18%% and 1.00% of the total ticks collected, respectively. This result was lower than the finding that reported this species as the first on sheep [20]. Additionally, The immature stages of *A. lepidum*, were found feeding on sheep [17]. In Kassala province, eastern Sudan, it was reported that *A. lepidum* that incriminated as a vector of heart water among sheep and goats was less frequently infested sheep and goats [15]. Additionally, it was found in very low proportions even though it is adapted to dry habitats and occur in arid and semi-arid areas [21]. *R. (B.) decoloratus* ranked fifth with 0.86%% of the total in sheep and 0.20% in goats however, no males were collected from neither the examined sheep nor the goats. Amazingly, the same phenomenon was reported before 13 years [20]. They stated that all the ticks collected (7 ticks) were females. Such result needs to be investigated in the foreseeable future. Finally, *Hy. anatolicum*, was the least abundant on sheep with 0.84%% of the total and absent in the examined goats. It was reported in low numbers [18]. It was concluded that *H. a. anatolicum*, incriminated vector of theileriosis, has a one generation a year based on its disappearance during the hot period between April and August [22]. The immature stages of *Hy. anatolicum* were found feeding on sheep and it has a mixed three-host and two-host pattern of life cycle [17]. As confirmed, *H. a.anatolicum* has a mixed two-host and three-host feeding pattern in goats and 70% of ticks detach as engorged nymphs [22]. Furthermore, Nevertheless, *Boophilus decoloratus* and *H. anatolicum* were commonly found on domestic animals in Kassala province, eastern Sudan [15, 18] beside the traditional movement of animals from Great Butana to this and adjacent areas because of the 2015 drought, still their number is extremely low. Finally, such results are coincided with the results reported by [25, 20]. Even though *A. lepidum* is adapted to dry habitats and occur in arid and semi-arid areas [21], the proportions of *A. lepidum, B. annulatus* and *Hy. anatolicum* were very low in the present study.

The present data is coincided with what was stated that there is no pattern of seasonality for any tick species in Sudan however, the fluctuation could be attributed to irregular intervals between collections [25], recent use of acaricides [20] and/or other factors (e.g. food preference). That is because such species were adapted to a wide variety of climatic zones. The 2015 rainy season in Sudan's traditional rainfed agricultural areas has been characterized by delayed start of

the rainy season, below-average rains and intermittent dry spells from June through September. The rainfall shortage experienced throughout the 2015 rainy season in Sudan has led to unusually low availability of good-quality forage in wet-season grazing areas across the country, and pasture and water are likely to be less available than usual from now through to June 2016 (the start of the next rainy season), both due to the seasonal decline and the below-average rainfall. The mid-season assessment for September 2015, released by the federal Ministry of Agriculture and Forestry and supported by [2], described the body conditions of livestock across Sudan as below-average to average due to the relatively poor pasture in many regions affected by the rainfall shortage. The lack of pasture has also prompted early migration of livestock to dry-season grazing areas such as the Sennar state in the South.

Table 1: Prevalence of ticks infesting sheep and goats in five locations at Sennar State, Sudan, 2015.

	Sheep		Goats	
Location	**Frequency**	**Percent**	**Frequency**	**Percent**
Sennar	145	20.22	142	20.37
Singa	146	20.4	152	21.81
Mazmum	153	21.34	137	19.65
Abuna'ma	149	20.9	140	20.09
Dindir	124	17.3	126	18.08
Total	717	100	697	100

Tables 2: Seasonal prevalence of ticks infesting sheep and goats at Sennar State, Sudan, 2015

	Sheep		Goats	
Season	**Frequency**	**Percent**	**Frequency**	**Percent**
Winter	240	33.47	236	33.88
Summer	254	35.42	236	33.88
Autumn	223	31.1	225	32.28
Total	717	100	697	100

Table 3: Distribution frequency of ticks genera infesting sheep and goats at Sennar State, Sudan, 2015.

	Sheep		Goats	
Genera	**Total**	**Percent**	**Total**	**Percent**
Rhipicephalus	4581	96.12	2976	98.8
Amblyomma	104	2.18	30	1.00
Boophilus	41	0.86	6.0	0.2
Hyalomma	40	0.84	0.0	0.0
Total	4766	100	3012	100

Table 4: Means (±SE) of tick species infesting sheep in five locations at Sennar State, Sudan, (January to December 2015)

Locations	Revs M	Revs F	Rcam M	Rcam F	Rgu lM	Rgu lF	Alep M	Alep F	Hanat M	Hanat F	Bdeco F
Sennar	4.84±1.18	2.18±0.24	3.01±0.23 b	2.13±0.15 a	4.59±0.47 c	3.57±0.35 b	1±	4±	1.67±0.67	1.5±0.5	1±0
Singa	2.57±0.28	1.97±0.22	2.85±0.25 ab	2.76±0.21 a	2.32±0.25 ab	2.64±0.26 a	0	1.33±0.33	3±1	1	2.5±0.5
Mazmum	2.67±0.45	2.32±0.27	2.03±0.2 a	2.03±0.17 a	2.26±0.18 a	3.04±0.33 ab	1.67±0.17	1.9±0.31	1±0	1	1
Abuna'a ma	2.5±0.56	2.09±0.37	3.85±0.38 c	4.87±0.62 b	3.41±0.56 b	2.95±0.21 ab	2.12±0.72	1±0	1	0	1.25±0.25
Dindir	2.25±0.34	1.67±0.27	2.14±0.2 a	2.31±0.26 a	1.86±0.18 a	2.19±0.21 a	2.73±0.85	1.5±0.34	1	2.5±0.42	3.25±1.03
Total	3.29±0.43	2.07±0.12	2.88±0.13	2.93±0.18	2.95±0.18	2.93±0.13	2.17±0.38	1.64±0.19	1.67±0.37	2.08±0.34	2.16±0.48

Means (±SE) followed by the same letter in each column are not significantly different at 5% level based on Duncan test.
Male = M and Female= F
Amblyomma lepidum (Alep), *Hyalomma anatolicum* (Hanat), *Rhipicephalus camicasi* (Hcam), *Rhipicephalus guilhoni* (Hgul), *Rhipicephalus evertsi evertsi* (Hevs),, *Rhipicephalus* (*Boophilus*) *decolaratus* (Bdec)

Table 5: Means (±SE) of tick species infesting sheep in three seasons at Sennar State, Sudan, (January to December 2015)

Seasons	Revs M	Revs F	Rcam M	Rcam F	Rgul M	Rgul F	Alep M	Alep F	Hanat M	Hanat F	Bdeco F
Winter	3.95±0.78	2.2±0.16	3.64±0.34 b	4.45±0.59 b	3.42±0.42 a	2.46±0.18 a	2.65±0.62	1.69±0.24	1	2.71±0.42	2.37±0.3ab
Summer	2.7±0.25	1.91±0.19	2.72±0.18 a	2.62±0.13 a	2.12±0.17 b	2.32±0.16 a	1.63±0.26	1.63±0.38	1	1	4.33±2.85b
Autumn	1.17±0.17	1.67±0.37	2.47±0.18 a	1.95±0.14 a	3.38±0.14 b	3.63±0.24 b	1.25±0.25	1	2±0.52	1.25±0.25	1.12±0.12a
Total	3.29±0.43	2.07±0.12	2.88±0.13	2.93±0.18	2.95±0.18	2.93±0.13	2.17±0.38	1.64±0.19	1.67±0.37	2.08±0.34	2.16±0.48

Means (±SE) followed by the same letter in each column are not significantly different at 5% level based on Duncan test.
Male = M and Female= F
Amblyomma lepidum (Alep), *Hyalomma anatolicum* (Hanat), *Rhipicephalus camicasi* (Hcam), *Rhipicephalus guilhoni* (Hgul), *Rhipicephalus evertsi evertsi* (Hevs),, *Rhipicephalus* (*Boophilus*) *decolaratus* (Bdec)

Table 6: Means (±SE) of tick species infesting goats in five locations at Sennar State, Sudan, (January to December 2015)

Locations	Rgul M	Rgul F	Rcam M	Rcam F	Revs M	Revs F	Alep M	Alep F	Bdec F
Sennar	2.67±0.28 b	3.45±0.39 c	2.62±0.21	2.15±0.21 ab	3.19±0.53 b	3.33±0.33b	0	0	0
Singa	1.68±0.2 a	1.72±0.13 a	2.28±0.19	2.49±0.19 b	3.21±0.45 b	1.96±0.3 a	2.75±1.03	2.75±1.03	1±0
Muzmum	3.56±0.47 c	3.5±0.48 c	2.2±0.31	1.79±0.2 a	1.45±0.16 a	1.54±0.21 a	1	1	2
Abuna'ama	1.59±0.17 a	2.11±0.22 ab	2.15±0.18	2.29±0.18 ab	2.76±0.29 ab	2.25±0.26 a	0	0	0
Dindir	2.27±0.21 ab	3.08±0.38 ab	2.17±0.19	1.95±0.21 ab	2.11±0.26 ab	1.93±0.23 a	1.5±0.5	1.5±0.5	1
Total	2.43±0.14	2.83±0.17	2.32±0.09	2.2±0.09	2.67±0.18	2.31±0.14	2.14±0.63	2.14±0.63	1.2±0.2

Means (±SE) followed by the same letter in each column are not significantly different at 5% level based on Duncan test.
Male = M and Female= F
Amblyomma lepidum (Alep), *Hyalomma anatolicum* (Hanat), *Rhipicephalus camicasi* (Hcam), *Rhipicephalus guilhoni* (Hgul), *Rhipicephalus evertsi evertsi* (Hevs),, *Rhipicephalus* (*Boophilus*) *decolaratus* (Bdec)

Table 7: Means (±SE) of tick species infesting goats in three seasons at Sennar State, Sudan, (January to December 2015)

Seasons	Rgul M	Rgul F	Rcam M	Rcam F	Revs M	Revs F	Alep M	Alep F	Bdec F
Winter	1.55±0.16 a	2.03±0.25 A	2.44±0.19	2.29±0.18	2.39±0.28	2.38±0.21	3±0.91	3±0.91	1±0
Summer	2.17±0.23 ab	1.98±0.16 A	2.21±0.15	2.08±0.12	2.98±0.33	2.4±0.24	1	1	00
Autumn	2.85±0.22 b	3.55±0.27	2.31±0.16	2.28±0.19	2.78±0.34	2±0.26	1±0	1±0	1.5±0.5
Total	2.43±0.14	2.83±0.17	2.32±0.09	2.2±0.09	2.67±0.18	2.31±0.14	2.14±0.63	2.14±0.63	1.2±0.2

Means (±SE) followed by the same letter in each column are not significantly different at 5% level based on Duncan test.
Male = M and Female= F
Amblyomma lepidum (Alep), *Hyalomma anatolicum* (Hanat), *Rhipicephalus camicasi* (Hcam), *Rhipicephalus guilhoni* (Hgul), *Rhipicephalus evertsi evertsi* (Hevs),, *Rhipicephalus* (*Boophilus*) *decolaratus* (Bdec

Conclusion

Apparently, such tick species are common and widely distributed on livestock in Sennar state, Sudan. The implications of such findings is considered as a step toward combating such vectors and diseases. Further broadened studies should be undertaken in order to precisely understand the species composition and distribution pattern of ticks on such animals in different part of Sudan. That is to estimate the impact of ticks infestation on tick-borne diseases in general and viruses in particular, and to design effective management and prevention strategies.

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