

## Full Length Research Paper

# Further studies on Bovine Ixodide Ticks in and around Bedelle, Southwest Ethiopia

Hunde Aboma, Assefa Kebede and Mukarim Abdurahaman\*

College of Agriculture and Veterinary Medicine (JUCAVM), Jimma University, P. O. Box 307, Ethiopia.

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Considering the economic impact of various ticks species on livestock, the present study was conducted for epidemiological characterization of common ticks infesting Ethiopian cattle between November 2013 and March 2014 period at various locations of Bedelle region. A total of 384 cattle were examined on random basis throughout the five months, out of which 231 cattle were found to be infested with ticks (60.12%). On the basis of morphological studies, a total of 2108 ticks belonging to three genera (that is, *Amblyomma*, *Boophilus* and *Rhipicephalus*) were collected during the study period. The species of ticks encountered in this study comprise of *Amblyomma coherence* (32.97%), *Amblyomma gemma* (4.6%), *Amblyomma lepidum* (3.7%), *Amblyomma variegatum* (3.98%), *Rhipicephalus (Boophilus) decoloratus* (31.87%) and *Rhipicephalus evertsi evertsi* (22.87%). Furthermore, the present study showed a significant difference in the prevalence of tick infestation among the different age groups with higher prevalence in cattle with age >6 years (79.07%), whereas no statistically significant association was observed among breed, sex groups and different localities of the studied region ( $P > 0.05$ ). Additionally, the results indicated that the favorable predilection sites of *Amblyomma* species were axilla, scrotum, udder, and belly/groin, while adult *R. evertsi-evertsi* had a strong predilection for tail as well as ano-vulva areas. Further studies on factors affecting tick burden and tick control strategies are recommended.

**Key words:** Bedelle, cattle, prevalence, tick species.

## INTRODUCTION

Ethiopia is well known for its cattle population. Moreover, the general epizootiological factors make it a favorable hub for various parasitic diseases which are a global problem and considered as a major obstacle in the health and product performance of livestock. Additionally, cattle play a significant role in the socio-economic life of the people of Ethiopia. In addition to the products of meat

and milk, cattle provide draught power for cultivation of the agricultural lands of many peasants. Skins and hides are also important components of the livestock sector in generating foreign export earnings.

In Ethiopia, ectoparasites in ruminant cause serious economic losses to small holder farmers, the tanning industry and country as a while through mortality of

\*Corresponding author. E-mail: mukevet@yahoo.com.

animals, decreased production, downgrading and rejection of skin and hide (Tiki and Addis, 2011). From the ectoparasites, ticks are ranked as the most economically important of livestock in tropics including sub-Saharan Africa (Jongejan and Ulienberg, 2004). Ticks are small, wingless ectoparasitic arachnid arthropods that are cosmopolitan and prevalent in warmer climates (Olwoch et al., 2009).

Ectoparasites, mainly ticks, play an important role in all species of domestic animals and pose a wide range of health problems that confront the productivity of animal, birds and reptiles worldwide (Rajput et al., 2006).

Moreover, ticks either cause direct losses through tick worry, blood loss, damage to hides and udders, toxin production and body weight loss (Stachurski et al., 1993; Kaufman et al., 2006; Marufu, 2008) or indirectly through transmission of bacterial, viral and protozoan infections, predisposing for secondary disease condition such as screw-worm myiasis and dermatophytosis (Mtshali et al., 2004; Soulsby, 2006; Kaufman et al., 2006; Marufu, 2008) reduction in milk yield and stunted growth (FAO, 2004). More significantly, ticks transmit diseases from infected cattle to healthy ones. Ticks transmit a greater variety of pathogenic micro-organisms than any other arthropod vector group, and are among the most important vectors of diseases affecting animals (Jongejan and Ulienberg, 2004). A single female engorged tick imposes a daily loss of 0.5 to 2 ml of blood, 8.9 ml of milk and 1 g of body weight (Minjauw and McLeod, 2003; Soulsby, 2006).

Annual worldwide losses due to tick infestation and diseases transmitted by ticks have been estimated to be 18 billion US\$ (de Castro, 1997). Furthermore, the costs associated with maintaining chemical control of ticks in tropical and subtropical regions of the world have been estimated at US\$25.00 per head of cattle per year (Pegram, 2001).

According to Walker et al. (2003) ticks which are considered to be most important to health of domestic animal in Africa comprise about seven genera. Among these genera the main tick genera found in Ethiopia includes *Ambylomma*, sub genus *Rhipicephalus* (*Boophilus*), *Haemaphysalis*, *Hyalomma* and *Rhipicephalus*. The genus *Ambylomma* and *Rhipicephalus* are predominating in many parts of country, *Hyalomma* and sub genus *Rhipicephalus* (*Boophilus*) also have significant role (Solomon et al., 2001).

Due to economic and veterinary importance of ticks, their control and transmission of tick born diseases remain challenge for the cattle industry of the world and it is a priority for many countries in tropical and subtropical regions (Lodos et al., 2000).

However, it is essential to have up-to-date information on the importance of ticks in various ecological zones as this provides an option to develop cost effective ecologically sound tick control strategy. Therefore, the

present study was undertaken to know the prevalence of ticks in relation to the different age groups, sex, breeds, and localities of the animals, sites of their attachment and identification of ticks up to species level.

## MATERIALS AND METHODS

### Study area

The study was conducted in Southwestern Ethiopia, Ilu Ababora zone, Bedelle district of Oromia regional state, which is 480 km from Addis capital city of the country. Bedelle is located at elevation of 2060 m above sea level and 8-9°N latitude and 36-37°E longitude. The area receives annual range of rainfall from 1800 to 2050 mm and mean annual temperature varies from 20 to 25°C from an October to January and decline to level of 15 to 25°C during the rest of the months (CSA, 2010). The district has resident of 36,945 people, 107,446 heads of cattle (21,061 cows, 15,633 oxen, 10,810 bulls, and 10,562 calves), 23,607 heads of sheep, 24,192 heads of goats, 8,134 equine and 48,400 heads of poultry. The total area of Bedelle Woreda is 74,600.01 km<sup>2</sup>, from this 29,449.25 km<sup>2</sup> is used for cultivation, 1,960 km<sup>2</sup> for forest, 1,440 km<sup>2</sup> for grassland and 41,750.76 km<sup>2</sup> is used for others (BWAB, 2006).

### Study design and study population

A cross sectional study was conducted from November 2013 to March 2014 on cattle brought to Bedelle Veterinary Clinic. Weather condition was Bega which typically occurs between October and January, and is characterised by generally dry weather and followed by short rainy season, known as the Belg, which runs from February to May. Both local and cross breeds of cattle with all age groups in both male and female animals coming to Bedelle Veterinary clinic were examined for presence of adult tick.

### Sampling technique

For the collection of data a random sampling technique (Thrusfield, 2007) was applied to gathered the data on tick prevalence from ten districts of the Bedelle. All the information about the date, host, age, and locality were entered on the label of each container.

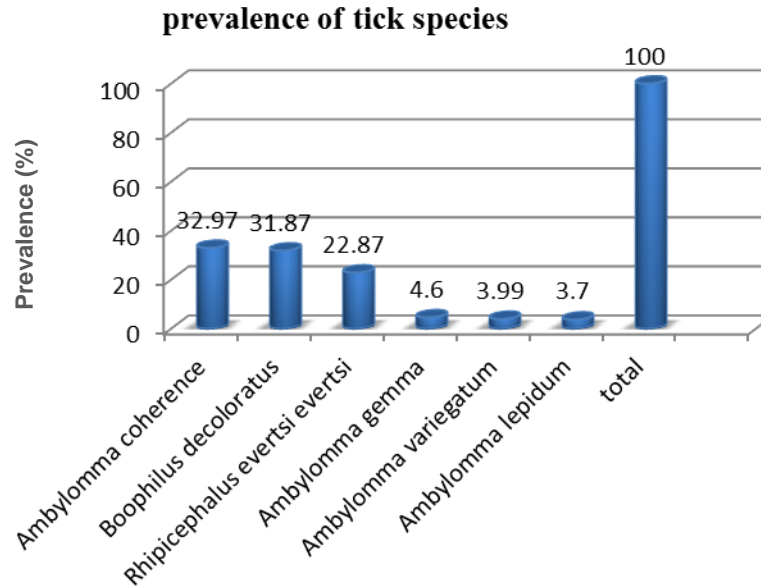
The sample size was decided based on the formula described by Thrusfield (2005) with 95% confidence interval at 5% desired absolute precision and assuming the expected prevalence of 50%.

$$N = 1.96^2 (P_{exp}) (1 - P_{exp}) / D^2$$

where N=sample size required, P<sub>exp</sub>=expected prevalence (50%), and D=desired level of precision (5%); therefore, the sample size was 384 cattle.

### Specimen collection

Before collection of ticks, animals were restrained properly and their whole body was thoroughly inspected visually for the presence of tick. Tick specimens were collected following the procedure of Ica et al. (2007). Ticks were gently plucked up from the body of the host by hand manipulation or with the aid of blunt pointed forceps without damaging their mouth parts. The specimens were kept in separate plastic containers with ventilated cap according to the sites of attachment. These samples were transported to the



**Figure 1.** Prevalence of tick species in the study area.

laboratory of Bedelle Regional Veterinary Laboratory for identification.

#### Mounting and identification of ticks

Following the methods of Soulsby (2006), the tick specimens were mounted and identified using standard morphological tick identification keys (Walker et al., 2003) under stereomicroscope.

#### Data analysis and management

The data recorded was entered into Microsoft excel database system and statistical analysis was done by STATA statistical software (STATA corp, 2005). The prevalence rate was calculated by dividing the proportion of cattle infested with tick by the total number of animal examined and multiplied 100. The risk factors for infestation by tick are investigated using percent values and Pearson Chi-square ( $\chi^2$ ). A P-value less than 0.05 at 95% confidence intervals was considered for significance.

## RESULTS

### Prevalence of tick infestations

Out of the total 384 animals examined, 231 (60.12%) were found to be infested with at least a single and/or different species of ticks. From the total of 2108 ticks collected, two genera, one sub genus and six species were identified. Of which *Amblyomma* accounts for 954 (45.25%), sub genus *Rhipicephalus* (*Boophilus*) 672 (31.87%) and *Rhipicephalus* 482 (22.86%). *Amblyomma coherence* (32.97%), *Amblyomma gemma* (4.6%), *Amblyomma lepidum* (3.7%), *Amblyomma variegatum* (3.98%), *Rhipicephalus* (*Boophilus*) *decoloratus* (31.87%)

and *Rhipicephalus evertsi evertsi* (22.87%). *A. coherence* was the highest species collected and *A. lepidum* is the least species encountered (Figure 1).

### Abundance of ticks

Tick were collected from 10 parts of animal namely axilla, anovulval, back/flank, dewlap/neck, head, groin/belly, under tail, leg, udder and scrotum. Different species of ticks found to prefer different predilection sites where *Amblyomma* found most predominately in the axilla, groin/belly, and udder, scrotum whereas, sun genus *Rhipicephalus* (*Boophilus*) found abundantly around dewlap, back and head but also found on the rest of the body and *Rhipicephalus* found predominating around the smooth skin (under tail, anovulval) areas of examined animals (Table 1).

During the study, the collected ticks were identified as male and female. The proportion of male ticks was found higher than its counterpart except for *R. (Boophilus) decoloratus* (Table 2).

### Prevalence of tick infestations in relation to age groups, sex, breed, and localities

Among breed and between sex and breed group of animals examined, infestation was found to be statistically insignificant ( $P > 0.05$ ), whereas infestation was found significant between age groups ( $P < 0.05$ ). Infestation shows no significant association among different localities of animal origin in Bedele district ( $P > 0.05$ ) (Table 3).

**Table 1.** Distribution of tick species in different body parts of cattle.

Attachment site	<i>A. coherence</i>	<i>A. gemma</i>	<i>A. lepidum</i>	<i>A. variegatum</i>	<i>R. (B) decoloratus</i>	<i>R. evertsi evertsi</i>	Overall (%)
Scrotum	187	27	13	-	72	-	299 (14.18)
Udder	243	18	14	-	21	-	296 (14.04)
Dewlap/Neck	45	17	13	-	305	-	380 (18.03)
Belly/Groin	108	17	15	49	33	-	222 (10.53)
Axilla	81	18	12	25	36	-	172 (8.16)
Anovulva	31	-	11	-	36	21	99 (4.7)
Under tail	-	-	-	-	-	461	461 (21.87)
Head	-	-	-	-	62	-	62 (2.9)
Back/Flank	-	-	-	-	81	-	81 (3.8)
Leg	-	-	-	10	26	-	36 (1.7)
Total	695	97	78	84	672	482	2108 (100)

**Table 2.** Sex ratio of Major tick species in the study area.

Tick species	Male	Female	Sex ratio (M:F)	Total
<i>Ambylomma coherence</i>	419	276	1.58:1	695
<i>Ambylomma gemma</i>	76	21	3.62:1	97
<i>Ambylomma lepidum</i>	45	33	1.36:1	78
<i>Ambylomma variegatum</i>	54	30	1.8:1	84
<i>Rhipi(Boophilus) decoloratus</i>	173	499	0.34:1	672
<i>Rhipicephalus evertsi evertsi</i>	307	175	1.75:1	482
Total	1074	1034	1.06:1	2108

## DISCUSSION

From the total 384 examined for the presence of tick species, 231 infested with one or more tick species yielding an overall prevalence of 60.12% and this finding is in agreement with the findings of Wasihun and Doda (2013) with prevalence of 61% in Southern Nations, Nationalities, and Peoples' Region (SNNPR), Ethiopia. However, it is different from the findings of Nigatu and Teshome (2012) who reported an overall prevalence of 89.4% in Amhara regional state, this difference may be due agroecology of the study conducted. From the total of 2108 ticks collected two genera, one sub genus and six species were identified. The distribution and abundance of tick species infesting cattle in Ethiopia vary greatly from one area to another area (Yitbarek, 2004; Abera et al., 2010; Abunna et al., 2012; Fanos et al., 2012; Ayana et al., 2013). The distribution limits of ticks are determined by a complex interaction of factors such as climate, host density, host susceptibility and grazing habits (Minjauw and de Castro, 2000). The study was limited to adult ticks for the reason that they are more visible, relatively easier to collect and believed to be the most important ectoparasite stage in causing reduced productivity in cattle (Regassa, 2001).

Accordingly, from the total of 2108 ticks collected three genera and six species were identified, *A. coherence* was found to be the most abundant tick species (32.97%) in the present study. The present study agrees with the result of Fanos et al. (2012) in Mizan Teferi that *A. coherence* was the abundant tick species and Yitbarek (2004) in Jimma was found to be the most prevalent in the area with a prevalence of 50.5 and 83.1%, respectively. In the same study conducted on ruminants showed that species of ticks encountered comprise of *A. coherence* (44.1%) which is the highest of all species encountered which make agreement with the current study (Abera et al., 2010), but decreasing now. This report disagrees with result in Asella with prevalence of *A. coherence* 11.9% (Tesema and Gashaw, 2010). *A. coherence* is the most prevalent and abundant tick on cattle (Pergam et al., 1981). According to de Castro (1994), *A. coherence* is the most abundant tick species infesting cattle in Southwestern Ethiopia (Yitbarek, 2004; Fanos et al., 2012). It has been recorded in areas between 1,750 and 2,500 m above sea level receiving annual rainfall ranging between 750 and 1,500 mm (Sileshi et al., 2007). This tick prefers high altitudes and moist climate and is absent in the drier regions. The occurrence of this tick in western Ethiopia has also been

**Table 3.** Tick burden within group of sex, breed, age and localities.

Risk factors	Total number of examined animal	Number of infested animal	P-value	$\chi^2$
<b>Sex</b>				
Male	126	82(65.07%)	0.169	1.896
Female	258	149(18.99%)		
<b>Breed</b>				
Local	374	224(81.75%)	0.523	0.455
Cross	10	7(70%)		
<b>Localities</b>				
Kebele 01	82	46 (56.09%)	0.263	10.022
Kebele 02	82	42 (51.12%)		
Bitamute	29	17 (58.62%)		
Ilke kerero	36	26 (72.22%)		
Lalistu	29	21 (72.41%)		
Oddoo	50	33 (66%)		
Secho	19	13 (68.42%)		
Siddisa	38	20 (52.63%)		
Urgessa	19	13 (68.42%)		
<b>Age</b>				
<1	82	17 (20.73%)	0.000	72.039
1-3	87	54 (62.07%)		
3-6	172	172 (73.26%)		
>6	43	34 (79.07%)		

\*P>0.05 for sex, breed and localities, whereas P<0.05 for age group, Loca= zebu breed. Cross= Zebu with Holstein Friesian.

recorded by other workers (Ali and de Castro, 1993; Sileshi et al., 2001). This abundance variation is possibly due to the difference in ecological, climatic, animal breed, farming practice, etc., in study areas.

This study has also revealed *R. (Boophilus) decoloratus* was the second most abundant tick species in the region (31.87%). As studied by other authors in Assosa, higher abundance of *R. (Boophilus) decoloratus* was reported with prevalence of 45% (Fantahun and Mohammed, 2012) which is in agreement with this result. Similar result was also reported in Haramaya (Kassa and Ayalew, 2012) with the result of 31.54% and in Southern Nations, Nationalities, and Peoples' Region (SNNPR), Ethiopia reported that the prevalence of *R. (Boophilus) decoloratus* was 30% which the highest from the tick species collected from the study area (Wasihun and Doda, 2013). The basic reason for this difference could be possibly accounted to the weather; environment and agro-ecology of the study area that might not be conducive to its reproduction and survival.

*R. evertsi evertsi* was the third abundant (22.8%) tick species in the present study and the result of the current research was in line with Tesema and Gashaw (2010) in

Assela, Husen (2009) in Bako and Wasihun and Doda (2013) in Humbo districts of SNNPR with prevalences of 22, 21.5 and 25%, respectively. This finding disagrees with result of study conducted in Mizan with prevalence of 3.6% (Fanos et al., 2012) and in Haramaya with prevalence of 5.5% (Bedasso et al., 2014). Pegram et al. (1981) described its wide distribution throughout the Ethiopian faunal region. This tick species is reported by different other authors result such as in Bahir Dar (Mesele, 1989) and in Holeta (Tiki and Addis, 2011), Morel (1980) confirmed that the native distribution of *Rhipicephalus evertsi evertsi* in Ethiopia seems to be connected with middle height dry savannas, bamboo and steppes in association with ruminant. This tick is the most abundant species with no marked seasonality (Yehulashet et al., 1995; Tesema and Gashaw, 2010). This tick species shows no apparent preference for particular altitude, rainfall zones or seasons (Morel, 1980).

*A. gemma* was the fourth tick species in this study with the prevalence of (4.60%). This result make agreement with report from Mizan (Fanos et al., 2012) with prevalence of 8.3% and disagreements with the results in

Borena Pastoral area by Ayana et al. (2013) with prevalence of 23.64% and in Somali region (Rahmeto et al., 2010) with 19.1%. Morel (1980) regards this species as not abundant in Ethiopia. Most of the previous studies conducted in the country revealed, as the distribution of *A. gemma* was clearly associated with dry types of vegetation or semi-arid rangelands and in lowland areas (Morel, 1980; Rahmeto et al., 2010; Ayana et al., 2013). Morel (1980) stated that *A. gemma* widely distributed in woodland, bush land, wooded and grassland in arid and semiarid area between altitude 500 to 1750 m above sea level and receiving 350 to 750 mm annual rain fall. The abundance of *A. gemma* as compared to other species may also perhaps be due to their host seeking and invasion properties, behavior and their adaptation for wide varied environment. Latif and Walker (2004) reported that tick populations in any particular environment, with a particular type of animals and management system; the average size fluctuation of tick populations depends partly upon the properties of ticks themselves; it might be host seeking.

*A. lepidum* is the least species of tick encountered during this study period (3.7%). This result agrees with the result reported in Northwest Ethiopia with prevalence of 1.95% (Moges et al., 2012) and in Borena Pastoral area (Ayana et al., 2013) with prevalence of 1.72%. In the present study, the prevalence of *A. lepidum* was very low in comparison to the reports of Sileshi et al (2001) who had reported this species of tick to be common in northeast of Ethiopia. This may be associated with the differences in agro ecological factors. Pegram et al. (1981) found *A. lepidum* throughout the 500 to 2000 m altitude zone and the 250 to 1000 mm rainfall zone and rare in wetter areas. However, the present study area agroecology was with altitude of 2060 m.a.s.l and receive 1800 to 2050 mm rain fall.

Ticks are known to be distributed in different parts of the host body. In this study, ticks were collected from different part of animal and rate of tick infestation differ from site to site. The predilection site mentioned in the result of this study was similar to with those reported by other authors (Okello-Onen *et al.*, 1999). *Amblyomma* species found on scrotum, udder, belly/groun, dewlap and anovulval areas, whereas *R. (Boophilus) decoloratus* species were found around neck/dewlap, udder, head, leg and scrotum. *R. evertsi evertsi* showed high preference to the anogenital region of the body, this is similar with report of Tiki and Addis (2011) and Bedasso et al. (2014). The predilection sites found in this study were also in line with those reported by Siyoum (2001) and Behailu (2004) in their study conducted in North Wollo zone and Asella, respectively. Factors such as host density, interaction between tick species, time and season (Kettle, 1995) and inaccessibility for grooming determine the attachment site of ticks (Chandler and Read, 1994). Information on predilection sites of ticks is helpful in spraying individual animals since it gives a clue

as to which part of the body requires more attention (Pegram et al., 1981).

The sex ratio of all tick species identified during this study periods were skewed towards male except (Table 3) for *R. (Boophilus) decoloratus*, this condition is due to the small size of males of *R. (Boophilus) decoloratus* make it difficult to see and get missed during collection. The high number of male tick of other species may be due to the fact that substantial proportion of females may be engorged in few days and fall on the ground in short period of time as compared to males. Therefore, this study was in agreement with the finding of Mekonnen et al. (2001) who also suggested that engorged females may be removed by self-grooming of the host, because of the large size (Solomon et al., 2001; Abebaw and Tamiru, 2010).

The prevalence of infestation was relatively similar ( $P=0.523$ ,  $\chi^2=0.512$ ) in two breeds (Local, Zebu, Cross, Zebu and Holstein Friesian) of cattle. It was 81.75% ( $n=224$ ) in local breeds and 70% ( $n=7$ ) in cross breed cattle. The relative higher prevalence of infestation in local breed cattle compared to the cross breed may be due to management practice. Most of the time cross breed and exotic animals got attention and treated more frequently than indigenous ones. This result is in agreement with the result of in and around Mekele (Yacob et al., 2008; Hilina et al., 2012), and Mulualem (2009), in and around Debre Zeit. My finding is in disagreement with that of Tamiru and Abebaw (2010) in and around Asella town, and Esihak (2011) in Adami Tulu. This variation may be due to the indigenous Ethiopian cattle breeds which were different from breed to breed.

There is statistically significant difference ( $p=0.000$ ) in infestation rate among different age groups of cattle. The old and adults are more susceptible than calves due to the fact that the calves are not often driven with adult age groups into grazing and watering points. This practice naturally reduces the chance of exposure of calves to ticks. This result agrees with that of Yismashewa (2005), in Decha woreda, Southern Ethiopia and Esihak (2011) in Adami Tulu. Similarly, Seyoum (2001) also found that the number of ticks attached to animals increases with their age. Since host seeking activity involves awaiting hosts in an environment, there is greater chance of attaching on larger animals than calves because of body surface area. Calves are less attractive to ticks than cows because they are protected by some form of innate, age related resistance (Okello-Onen et al., 1999).

The result of the present study revealed that the prevalence is getting decreased as compared to the previous, for example the studies conducted in Bedelle, the same with present study in 2010 and 2012 reported that the prevalence of *A. coherence* were 41.1 and 35.25% on ruminants and small ruminant, respectively (Abera et al., 2010; Abunna et al., 2012). This is probably due to an increase in the level of awareness of the

farmers on how to reduce the tick infestation of their cattle, improvement in the management of their animals and increase of veterinarians' number per district regular treatment with acaricides.

The attention given to the infestation had not been sufficient and lack of available information on tick species makes it difficult to determine their impact that there were little attempts made to control the infestation of tick. However, the attentions given to the infestation were not sufficient and the lack of available information on tick species and the demerits behind tick infestation aggravates the infestation of the livestock population in the area by ticks. Acaricide application is the main method of tick control in the region, these suggested that strategic deepening programs using acaricides should be applied to control tick population on animals. In general, the distribution limits of ticks are not fixed but are determined by a complex interaction of factors such as climate, host susceptibility and grazing habits.

Therefore, further studies on the distribution of tick species and their epidemiology are necessary for the continuous understanding of improved control strategies.

## CONFLICT OF INTERESTS

The authors have not declared any conflict of interests.

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