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Research Article

Assessment of Reproductive Performance and Breeding Objective of Blackhead Somali Sheep in Korahey Zone, Somali Region, Ethiopia

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Abstract

The study was conducted in Ethiopia's Somali Region's Korahey Zone. This study set out to evaluate black-headed Somali sheep's reproductive performance, breeding habits, and preferred traits. 180 households in all will be identified, with 90 per district and 30 every peasant association (Kebele). At first lambing, the average age was 16.9±0.18 months. According to the survey results, the overall goals for raising sheep in each region were graded according to cultural function (0.05), income (0.52), meat (0.29), and saving (0.14). With index values of 0.34 and 0.33 in the districts of Kabrid Dehar and Sheygosh, respectively, natural pasture was ranked as the top feed source for sheep during the wet season. During the rainy season, rainwater was the primary water source for sheep in all districts, followed by river water. In contrast, during the dry season, harvested water was the main source, with pond water as the secondary option. The findings revealed that the major challenges faced by blackhead Somali sheep across all districts were the prolonged dry season, feed shortage, water scarcity, diseases, and predators, with overall index values of 0.31, 0.27, 0.18, 0.16, and 0.07, respectively. Black-headed Somali sheep were frequently reported to have poor reproductive performance. Poor management, illness, and inadequate nutrition could be the cause of this. Farmers use breeding and selection to enhance sheep's commercially significant features. Therefore, when creating a community-based program to improve the production of blackhead Somali sheep in the study region, it is important to take into account the features that blackhead Somali sheep owners demand in terms of selection, breeding, and production by sheep farmers.

Keywords

Breeding Objective, Management Practice, Reproductive Performance

1. Introduction

The most numerous and diverse native sheep populations and breeds in Africa can be found in Ethiopia. Nine genetically distinct breeds and six breed groupings comprise Ethiopia's approximately 14 traditionally recognized sheep populations [31]. Twenty-five percent of the nation's approximately 26 million sheep are located in the lowlands, with the remaining 75 percent found in the highlands, where mixed crop-livestock production systems predominate [14, 12]. Sheep are extensively dispersed throughout Ethiopia's varied agro climatic conditions. About 99.78% of Ethiopia's total

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sheep population are indigenous breeds, which are the foundation of the country's sheep output [13]. Due to their greater flexibility under low input extended production systems in their production environment, where feed and water scarcity are the two main restraints, Black Head Somali sheep are the most promising of the indigenous sheep breeds [17]. Although Ethiopia is well known for having a sizable population of sheep with a great deal of variety in particular traits, there is insufficient breed-level characterization data available for the country [41].

Sheep are the living banks for their owners and source of immediate cash and insurance against crop failure [38]. They are relatively drought tolerant, small in size, easily manageable, and saleable resources. However, their performance is poor, so there is a need to improve their productivity through selection and breeding [40].

In order to make best use from sheep keeping operation, it is important and a prerequisite to have a comprehensive understanding of the whole situation through assessing the production environment (climate, feed availability, and disease prevalence); the production system (production practice, preferences, socio-economic circumstances and level of input use); and productive and adaptive characteristics of the sheep breeds [30].

Despite the large number of sheep population and their contributions to the livelihood of the farmers and the national economy sheep productivity in Ethiopia is low due to different factors including, Weak attention from scientists, administrators and legislators [6, 25], low genetic potential and policy issues [20] shortage, seasonal unavailability and low nutritive (poor nutrition) value of feed and/or [7, 9, 35]; prevalence of different diseases and parasites [32] labor shortage, lack adequate veterinary service, water shortage, capital shortage, market problem and capital shortage [7].

Sheep production is vital to the livelihood of the pastoralist households in the region as it generates income, provides fertilizer, and provides meat for domestic consumption. The Agricultural Office's Korahey Zone report states that there are a significant number of black-headed Somali sheep in the Kabri Dehar and Sheygosh districts. Nevertheless, no contemporary research has been done on the breeding objective, trait preferences, or reproductive performance of sheep production in particular districts. Thus, the study's objective was to determine the black-headed Somali sheep's breeding objective, reproductive performance, preferred traits, and management practice in the Korahey zone of the Somali region of Ethiopia.

2. Materials and Methods

2.1. Description of the Study Areas

The study was carried out in Ethiopia's Somali Regional State's Korahey Zone. There are eleven zones in Ethiopia's Somali region, including the Korahey zone. The Gode border Korahe on the southwest, Fiq on the northwest, Degehabur on the north, Werder on the east, and the federal state of Galmudug in Somalia on the southeast. The Korahey zone is 1004.1 kilometers away from Ethiopia's capital, Addis Ababa. Temperatures in this zone, which is classified as tropical and semi-arid, range from 23 to 360 degrees Celsius. Based on the 2007 census by the CSA, this zone has a total population of 312,713, of which 177,919 are men and 134,794 are women.

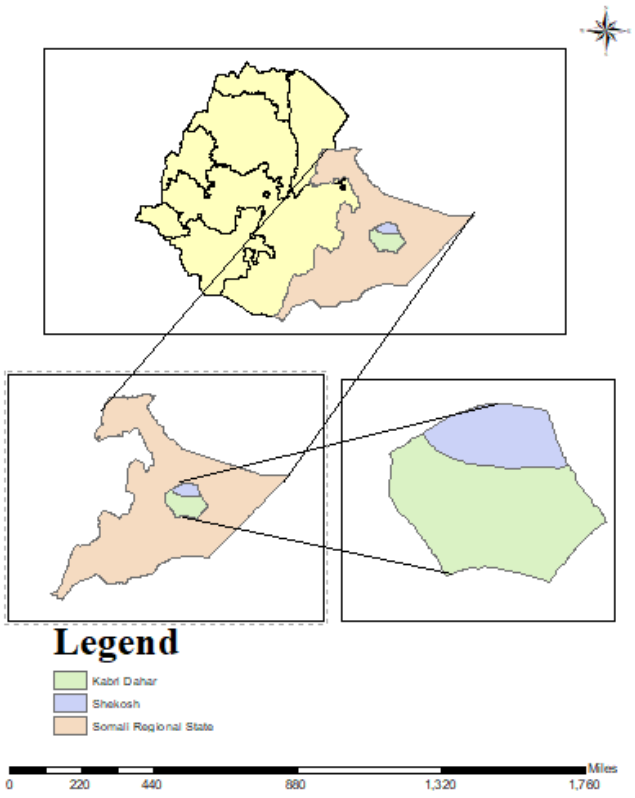

Figure 1. *Map of the Study Area.*

2.2. Sampling and Data Collection Techniques

Purposively, two districts Kabri Dehar and Sheygosh were chosen because of their potential for output. Three peasant organizations (Kebele) per district were chosen purposefully for the study after consulting with the district agricultural office regarding the size of the sheep population and its potential for productivity. Each peasant association's houses were chosen at random from a list of households depending on how long they had been farming and how many sheep they had raised.

A total of 180 households (90 per district and 30 each peasant association (Kebele)) were found from each of these chosen PAs that owned at least one sheep. A semi-structured questionnaire was utilized for every household survey. Extension workers, developmental agents (DAs), model farmers and village leaders, respected village elders, youth, and women participated in one focus group discussion with an

average of seven to nine members in each of the chosen peasant associations (Kebele).

Using trained enumerators and a semi-structured questionnaire with both closed-ended and open-ended questions, a formal survey was carried out. Before being administered, a semi-structured questionnaire was created, pre-tested, and revised, reframed, and rearranged to reflect respondents' opinions.

The study used data from both primary and secondary sources. A pre-tested structured questionnaire was used to gather primary data from randomly selected respondents, including their profile, land and animal holdings, sheep reproductive performance, breeding practices, and trait preferences for sheep production. The District Office of Agriculture, various publications, books, and other pertinent written materials were the sources of secondary data.

The [11] formula was used to calculate the number of sample households in the research region.

$$No = \frac{Z^2 * (p)\,(q)}{e^2}$$

Where;

No = required sample size

Z^2 = is the abscissa of the normal curve

e^2 = is the margin of error (±0.05%, margin of error for confidence level of 95%)

p = 0.136 is the degree of variability in the attributes being measured refers to the distribution of attributes in the population

q = 1-p

N_o= 1.962× (0.136) (0.864) ÷ (0.05)2

=3.8416 × (0.136) (0.864) ÷0.0025

=180.56≅180

2.3. Statistical Data Analysis

All data collected during the study period was reviewed for mistakes, corrected, and coded. For example, the goal of sheep production was categorized as 1 = money source, 2 = meat, 3 = saving, and 4 = cultural function recorded in Microsoft Excel 2007 for further analysis. Preliminary data analysis, such as homogeneity tests, normality tests, and screening of data outliers, were performed after the data was entered into Microsoft Excel. These were verified by lowering the weights of the outliers, altering their values, and employing robust estimation techniques. SPSS version 20 was then used for analysis. Additionally, descriptive statistics like percentages, means, and standard errors were used to present the outcomes of the analysis. Data on breeding objectives, phenotypic preferences, management techniques, and productivity restrictions for sheep were ranked using Microsoft Excel. An index, which is derived by dividing the sum of (3 x ranked first + 2 x ranked second +1 x ranked third) given for a single reason by the sum of (3 x ranked first + 2 x ranked second +1 x ranked third) for all reasons, is used to express the ranking [24].

3. Result and Discussion

3.1. Reproductive Performance

An effective cattle production program requires good reproductive performance. Table 1 shows the reproductive performance of sheep in a few chosen districts. With an overall mean value of 16.9±0.18 months, the mean age at first lambing in the districts of Kabri Dehar and Sheygosh was 16.6±0.25 and 17.3±0.26 months, respectively. The present findings were similar to those of [44], who reported first lambing ages of 15.90, 15.85, and 15.63 months in the districts of Seka, Mana, and Dedo in southwest Ethiopia, and [27], who reported an average age at first lambing of 18.10 months in the eastern Amhara region. The genetic composition and environmental factors that control the overall output of sheep during their life span also affected the age at first lambing.

Lambing intervals in the studied area were 8.9±0.13 months in Kabri Dehar and 8.95±0.13 months in Sheygosh district, according to the study report. Compared to previous publications in [18, 8], the lambing interval in this study was higher. Sheep litter sizes were 1.26±0.04 for Kabri Dehar and 1.24±0.04 for Sheygosh. For tropical breeds, the current findings fell between 1.08 to 1.75, as reported by [21]. For the Menz and Afar sheep breeds (almost one lamb per lambing), Bonga sheep (1.13), and Washera sheep (1.11), the current litter size was greater than those reported by [32, 33].

Table 1. *Reproductive performance of black head Somali sheep in the study districts.*

Traits	District		Overall Mean±SE
	Kabri dehar Mean±SE	Sheygosh Mean±SE	
Reproductive performance of sheep			
Age at first lambing (month)	16.6±0.25	17.3±0.26	16.9±0.18
Lambing interval (month)	8.9±0.13	8.95±0.13	8.9±0.09
Parity (no)	2.57±0.08	2.38±0.07	2.48±0.05
Litter size	1.26±0.04	1.24±0.04	1.25±0.03
Age at first mating ewe (month)	10.84±0.25	11.4±0.26	11.12±0.18
Age at first mating of ram (month)	9.13±0.14	9.24±0.15	9.18±0.10

In the districts of Kabri Dehar and Sheygosh, the ewe's first mating age was 10.84±0.25 and 11.4±0.26, while the ram's first mating age was 9.13±0.14 and 9.24±0.15 months, respectively. Because reproductive features are sensitive to environmental factors, careful herd reproductive management has an impact on them. Age, weather, season, and nutrition are some of the crucial elements that small ruminant farmers need to properly take into account. Breeds from sub-Saharan Africa have reproductive levels of 17.5–16.4 months at first parturition [28, 16] with lambing intervals of 230–437 days [39].

3.2. Breeding Objectives

Table 2 showed the ranking of the research area's sheep production goals. Income (0.52), meat (0.29), saving (0.14), and cultural function (0.05) were the overall goals for sheep husbandry in each district. With an aggregate index value of 0.52, the primary motivation for raising sheep across all districts was to generate income. According to the households, the farmer receives monetary revenue from the sale of live animals, which they can use to pay taxes, buy food and clothing, buy fertilizer, buy a child's book or pen, and buy other household things. With an overall index value of 0.42, the current finding was comparable to the [3] research, which stated that the primary motivation for raising sheep in every district was to generate cash income. With an overall index score of 0.29, the second primary justification for maintaining sheep in every district was for personal consumption of meat. Meat was ranked as the second purpose in this study, which was consistent with previous findings [8, 26, 2].

Table 2. *Ranking of breeding objective of sheep in the study districts.*

Traits	Kabri dehar				Sheygosh				Overall
	R_1	R_2	R_3	I	R_1	R_2	R_3	I	I
Breeding objective of sheep									
Income source (sale)	55	47	44	0.56	44	39	50	0.48	0.52
Meat	27	17	30	0.26	30	25	26	0.31	0.29
Cultural function	2	7	5	0.05	2	7	5	0.05	0.05
Saving	6	19	11	0.13	14	19	9	0.16	0.14

R1= first rank, R2=second rank, R3= third rank, I= index.

3.3. Ranking of Respondents Traits Preferences

Table 3. *Ranking of respondents on sheep traits preferences.*

Traits	Kabri dehar				Sheygosh				Overall
	R_1	R_2	R_3	I	R_1	R_2	R_3	I	I
Sheep traits preferences									
Disease resistance	17	14	24	0.19	16	15	12	0.16	0.17
Trekking long distance	6	8	0	0.06	7	8	4	0.07	0.07
Twining ability	26	34	29	0.32	29	33	37	0.35	0.34
Body weight	34	26	27	0.33	34	25	25	0.32	0.33
Color	7	8	10	0.08	4	9	12	0.07	0.08

R1= first rank, R2=second rank, R3= third rank, I= index.

Table 3 lists the selection criteria for breeding sheep. With index values of 0.33 and 0.32, respectively, body weight and twining ability were ranked top and second in the Kabri Dehar areas while choosing a breeding sheep. Twining ability and body weight, which had corresponding index values of 0.35 and 0.32, were the selection criteria in the Sheygosh district. The present findings are consistent with those of [3], who found that the primary desired characteristics for selecting sheep were twining capacity and rapid development, with respective index values of 0.34 and 0.32. According to [4], the Wollo highland sheep reported that fast development, body size, and weaning rate were the primary prioritized qualities in order of priority, which was consistent with the current results obtained in the Kabri Dehar District sheep producers.

3.4. Management System

3.4.1. Housing

The housing system of sheep in the study area was presented in Table 4 below. The majority of households in the districts of Kabri Dehar (57.8%) and Sheygosh (51.1%) kept their sheep in separate houses, which is one of the main methods of sheep husbandry that protects them from extreme temperatures, rain, wind, predators, and theft. The current findings were in contrast to those of [36], who found that in Alaba, Southern Ethiopia, 0.7% of respondents kept their sheep in a separate house, while 98.6% of respondents kept their sheep flock in the main house with family members. [38] In the Menz and Afar districts indicated that 53.3% (the majority) of sheep owners are housed in the main house with a family, whereas [36] in Alaba of SNNPR likewise recorded approximately 98.6%. However, in the Horro Guduru and East Wollega zones of West Ethiopia, [22] found that the majority of farmers (83.33%) shelter their sheep in separate houses, while a smaller percentage (16.67%) do so in family homes. The present findings are different from those of [42], who found that in the districts of Ada Barga and Ejere in the West Shoa Zone of Ethiopia, 39.4% of farmers confine their sheep and goats in family homes, while 29.4% do so in separate homes.

Table 4. *Types of sheep houses and housing materials in selected districts.*

Types of house and material	Kabri dehar N (%)	Sheygosh N (%)	Total N (%)
Housing type of sheep			
In family house	24(26.7)	29(32.2)	53(29.4)
Separate house	52(57.8)	46(51.1)	98(54.4)
Veranda	14(15.6)	15(16.7)	29(16.1)
Housing materials in roofs of sheep houses			
iron sheet	13(14.4)	18(20)	31(17.2)
Wood	77(85.6)	72(80)	149(82.8)
Materials used for construction of walls of sheep houses			
Iron sheet	4(4.4)	7(7.8)	11(6.1)
Grass	52(57.8)	54(60)	106(58.9)
Wood	29(32.2)	21(23.3)	50(27.8)
Stone	5(5.6)	8(8.9)	13(7.2)
Materials used for flooring			
Wood	29(32.2)	22(24.4)	51(28.3)
Stone	48(53.3)	53(58.9)	101(56.1)
Earth/soil	13(14.4)	15(16.7)	28(15.6)

N= Number of respondents.

3.4.2. Health

Table 5 lists the health issues that the sheep in the study areas faced. Of the households that were interviewed, the most common issues were disease and parasites that caused serious problems, with an overall index value of 0.42. The second and third most common issues in the study area were lack of medication and distance to the government clinic, with overall index values of 0.35 and 0.24, respectively. The current study supported [29] findings that the most frequent factor influencing small ruminant output in the Jijiga and Shinile Zones of Somali Regional State, Ethiopia, was illness. In the central highlands, annual mortality rates for all stock classes average 23% for sheep and 25% for goats, with about half of all lambs had born dying from various reasons [1].

Table 5. Sheep health problem in selected districts.

Description	Kabri dehar				Sheygosh				Overall
	R_1	R_2	R_3	I	R_1	R_2	R_3	I	I
Distance to government clinic	34	29	33	0.36	30	27	33	0.33	0.35
High prevalence of disease	29	44	37	0.39	45	35	36	0.45	0.42
Shortage of drug	27	17	20	0.25	15	28	21	0.22	0.24

R1= first rank, R2=second rank, R3= third rank, I= index.

3.4.3. Feeding System

Table 6 shows the Index values of the main sources of sheep feed in each research district during the dry and wet seasons. In all study districts, the primary source of feed for small ruminants during rainy seasons was natural pasture. [5] In Dawuro Zone, Konta Special Woreda of SNNPR; [10] in Low Land areas of South Omo Zone; and [2] in the Amhara and Tigray National Regional States were all in agreement with the current findings.

According to the current study, natural pasture was the top feed source for sheep throughout the rainy season in Kabri Dehar and Sheygosh districts, with index values of 0.34 and 0.33, respectively. Concentrate feed, with index values of 0.35 and 0.31 in the districts of Kabri Dehar and Sheygosh, respectively, was the primary feed source for sheep throughout the dry season. In the current study, home leftover food, salt or local minerals, and maize grain both before and after grazing were the main feed sources employed to supplement the sheep. The present results were consistent with those of [18] in Ethiopia's highlands and [8] in the Goma area of the Jimma Zone in Western Ethiopia. In the study district, 62.5 and 30.2% of households, respectively, supplemented their sheep once and twice daily.

Table 6. Major sheep feed sources in selected districts in wet and dry seasons.

Feed resource	Kabri dehar				Sheygosh				Overall
	R_1	R_2	R_3	I	R_1	R_2	R_3	I	I
Wet season									
Natural pasture	36	26	21	0.34	34	33	26	0.33	0.34
Crop residue	20	17	27	0.22	25	17	27	0.25	0.24
Concentrates	7	12	20	0.12	5	12	15	0.1	0.11
Foliage	27	33	22	0.31	24	27	22	0.27	0.29
Hay	0	2	0	0.01	2	1	0	0.01	0.01
Dry season									

Feed resource	Kabri dehar				Sheygosh				Overall
	R_1	R_2	R_3	I	R_1	R_2	R_3	I	I
Wet season									
Natural pasture	6	12	16	0.11	27	17	24	0.25	0.18
Crop residue	27	34	27	0.32	15	35	27	0.26	0.29
Concentrates	37	25	29	0.35	34	25	15	0.31	0.33
Foliage	4	7	15	0.07	4	7	17	0.07	0.07
Hay	16	12	3	0.14	10	6	7	0.09	0.23

R1= first rank, R_2=second rank, R_3= third rank, I= index.

3.4.4. Water Source and Utilization

Table 7 displays the results of the water source and irrigation frequency. In every district, the primary supply of water for sheep during the wet season was rainwater, which was followed by river water. In all districts, however, pond water and water harvesting were the primary sources of watering throughout the dry season. The current study's findings are consistent with those of [2], who noted that water harvests were a significant source of rainwater for sheep during the wet season and water during the dry season. Black Head Somali sheep were watered once every three days, according to [45]. In contrast, [19] noted that irrigation frequency could last up to 10 days in severe lowlands.

Table 7. *Source and frequency of watering sheep in dry and wet seasons.*

Description	Kabri dehar		Sheygosh		Overall	
	Rainy season	Dry season	Rainy season	Dry season	Rainy season	Dry season
Source of water for sheep N (%)						
River	25(27.8)	15(16.7)	28(31.1)	15(16.7)	53(29.4)	30(16.7)
Pond	14(15.6)	22(24.4)	12(13.3)	25(24.4)	26(14.4)	47(26.1)
Rain water	34(37.8)	-	36(37.8)	-	70(38.8)	-
Water harvest	15(16.7)	46(51.1)	10(14.4)	43(47.7)	25(13.8)	89(49.4)
Pipe	2(2.2)	7(7.8)	2(3.3)	7(7.8)	6(3.3)	14(7.8)
Frequency of watering sheep N (%)						
Freely available	64(71.1)	39(43.3)	65(72.2)	35(38.9)	128(71.1)	72(40)
Once a day	18(20.0)	43(47.8)	18(20)	47(52.2)	36(20)	90(50)
Once in 2 days	8(8.9)	8(8.9)	7(7.8)	8(8.9)	16(8.9)	18(10)

N= Number of respondents.

3.4.5. Constraints in Sheep Production

Prior to developing effective intervention strategies to increase productivity, it is necessary to identify the main obstacles to a particular farm animal production system in a given area. Based on respondent interviews, the main obstacles to small ruminant production systems in the study areas were identified and are shown in Table 8. The findings indicated that the longest dry season was the top constraint for

sheep in every district, with index values of 0.32 and 0.30 in Kabri Dehar and Sheygosh, respectively. Shortage of feed, shortage of water, illness prevalence, and predators were additional research restrictions; their respective total index values were 0.27, 0.18, 0.16, and 0.07.

The main obstacles to sheep production in Ethiopia and livestock production in general, include a variety of variables, including the scarcity of feed, seasonal variations, and the prevalence of various diseases and parasites [32, 37]. In a similar view, [43] noted that feed scarcity was a serious issue for small-scale ruminant production in the Bure district of northwest Ethiopia.

According to [29, 18, 15, 23, 43] in Burie District, North Western Ethiopia, [34] in Shebedino District, Sidama Zone of Southern Ethiopia, the primary obstacle to livestock production across various agro ecologies in various parts of the country is a lack of adequate feed resources.

Table 8. *Major constraints for sheep production in selected districts.*

Constraints	Kabri dehar				Sheygosh				Overall
	R_1	R_2	R_3	I	R_1	R_2	R_3	I	I
Lack of feed	25	27	22	0.27	27	24	21	0.27	0.27
Lack of water	15	17	19	0.18	15	16	19	0.17	0.18
Diseases	14	11	15	0.15	12	19	16	0.16	0.16
Predators	5	9	7	0.07	5	9	8	0.07	0.07
Long dry season	31	26	27	0.32	31	22	26	0.30	0.31

R1= first rank, R2=second rank, R3= third rank, I= index.

4. Conclusion and Recommendation

It was discovered that sheep generally performed poorly in terms of reproduction. Poor management practices, sickness, inadequate shelter, inadequate nourishment, and a dearth of genetically modified breeds could all be to blame for this. Therefore, reducing technical limitations, increasing the adoption of better technologies, and providing extension in the right way are all necessary to increase sheep productivity in the study area. In the study area, the main goals of sheep breeding were for cultural, economic, meat, and saving purposes. When choosing ewes and rams for breeding, factors like body weight, twining ability, disease resistance, long-distance trekking, and color have become very important. These factors must be taken into account when making decisions about breeding and selection in order to improve the economic and genetic traits of sheep.

Abbreviations

CSA	Central Statistical Agency
DA's	Development Agents
PA	Peasant Association

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Author Contributions

Ayana Birhanu: Conceptualization, Data curation, Formal Analysis, Funding acquisition, Investigation, Methodology, Project administration, Resources, Software, Supervision, Validation, Visualization, Writing – original draft, Writing – review & editing

Wondimagegn Tadesse: Conceptualization, Data curation, Formal Analysis, Funding acquisition, Investigation, Methodology, Project administration, Resources, Software, Supervision, Validation, Visualization, Writing – original draft, Writing – review & editing

Conflicts of Interest

The authors declare no conflicts of interest.

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