

*Farmers' knowledge, practices and preferences of nematode control in Bonga and Horro sheep, Ethiopia: prospect of breeding for nematode resistance*

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## **Summary**

Parasitic nematodes are one of the main health and production constraints of sheep worldwide. We used a questionnaire survey to assess farmers' knowledge about gastrointestinal nematodes (GIN) of sheep, current control practices and preferences for control methods between farmers involved and not involved in community-based breeding program (CBBP) in two different locations, Bonga and Horro, Ethiopia. A total of 240 households were interviewed. Farmers associated transmission of GIN with ingestion of grass. CBBP farmers (55 and 85.7%, respectively, in Bonga and Horro) use anthelmintics (AH) at least four times per year per animal compared to non-CBBP farmers (15 and 52.5%, respectively in Bonga and Horro). The farmers in CBBP had incorrect perception pertaining to sustainability of anthelmintics for control of GIN in sheep suggesting awareness creation should be done on the threats of anthelmintic resistance. Selective breeding (SB) was preferred as a sustainable option for control of GIN of sheep more significantly (mean score = 4.03 vs. 2.43,  $p < 0.001$ ) by CBBP than non-CBBP farmers in Horro. This suggests that there is possibility to introduce SB in CBBP. In conclusion, CBBP farmers practice AH treatment more frequently than the non-CBBP farmers. To reduce risk of development of anthelmintic resistance, taking into account the inclusion of nematode resistance trait into the CBBP is crucial.

*Keywords: gastrointestinal nematodes, sheep, farmers' knowledge, practice, genetic selection*

## **Introduction**

Gastrointestinal nematodes (GIN) remain one of the main health and production constraints of sheep globally (Roeber et al., 2013; Zvinorova et al., 2016). Their control methods include anthelmintics, ethnoveterinary remedies, grazing management, nutritional supplementation, genetic approaches, biological methods and vaccination. The utilization of these control options depends on their availability, effectiveness, cost, ease of implementation and sustainability (Stear et al., 2007; Stear, 2010; Zvinorova et al., 2016). Currently, anthelmintic treatment offers a simple, cheap, effective, and readily available method of nematode control (Stear, 2007). However, as concerns with anthelmintic resistance have increasingly become important worldwide, genetic selection of sheep for resistance to nematodes seems to be a sustainable

option (Stear, 2010). Given that Ethiopian local sheep breeds have evolved under nematode challenge, utilizing genetic variation for viable control of GIN should be considered. In Ethiopia, community-based breeding programs (CBBP) were established through participatory definition of breeding goals and the implementation has been in effect since 2009 for four local sheep breeds including Bonga and Horro (Mirkena et al., 2012). There is an opportunity to include nematode resistance trait(s) such as, fecal egg count (FEC) in the breeding goal of CBBP.

Prior to designing and implementation of sustainable GIN control options in CBBP communities with introduction of breeding for nematode resistance, there is a need to understand local knowledge regarding GIN of sheep and the extent of anthelmintic use by sheep farming communities. Thus, the aim of this study was to assess farmers' knowledge about GIN of sheep, current control practices and differences in preference for control methods between farmers involved and not involved in CBBP in two different locations, Bonga and Horro, Ethiopia.

## **Materials and Methods**

The study was conducted in two locations of Ethiopia (Horro and Bonga) from October 2016 to December 2016. Horro is located in Oromia Regional State at about 315 km from the capital, Addis Ababa. Bonga is located in Southern Nations Nationalities and People's Regional State at about 450 km from Addis Ababa (Mirkena et al., 2012). A questionnaire survey was used for data collection. A total of 240 households were interviewed from two types of communities (CBBP, n=60 and non-CBBP, n=60) in each study sites. Preference data were collected based on four methods for control of GIN of sheep; ethnoveterinary remedies (EV), anthelmintic (AH), selective breeding (SB) and nutritional supplementation (NS). These were rated for four attributes, each on a 5-point scale as follows: effectiveness (1=not effective to 5=very effective); cost (1=very expensive to 5=very cheap); availability (1=hardly available to 5=easily available); sustainability (1=not sustainable to 5=very sustainable). Chi-square ( $\chi^2$ ) and Mann-Whitney U tests were done using SPSS (IBM SPSS Statistics 20), to compare farmers' practices and preferences for control methods of GIN of sheep based on their attributes.

## **Results and Discussion**

### **Farmers' Knowledge of GIN (perceived transmission and effects)**

About 89 and 55% of CBBP and non-CBBP respondents, respectively in Horro, and 95 and 82.5% of CBBP and non-CBBP respondents, respectively in Bonga, reported that GIN worms infect sheep during grazing. Majority of the respondents in both areas perceived that stomach and intestinal worms are harmful to sheep. The reported harmful effects of GIN on sheep were slow growth in lambs, diarrhea, loss of weight, and often death.

### **Farmers' practices of GIN control in sheep**

Table 1 presents the frequency of anthelmintic use per year per animal by CBBP and non-CBBP farmers for control of internal parasites in general and GIN of sheep in particular in Bonga and Horro areas. The frequency of all classes of anthelmintics that were used over the last one year by the farmers was considered.

Table 1. Frequency of anthelmintic use per year per animal by CBBP and non-CBBP farmers for control of GIN of sheep in Bonga and Horro areas.

Area	CBBP	% anthelmintic use frequency/year/sheep				Total (N=240)	$\chi^2$ (df)	p-value
		$\leq$ once	twice	thrice	$\geq 4$ times			
Bonga	yes	7.5	5.0	32.5	55.0	60	16.9 (3)	0.004
	no	5.0	25.0	55.0	15.0	60		
Horro	yes	0.0	0.0	14.3	85.7	60	9.9 (3)	0.019
	no	10.0	12.5	25.0	52.5	60		
Total							21.0 (3)	0.001

Breeding program intervention (CBBP) influenced the frequency of anthelmintic use in both areas (Horro;  $\chi^2=9.9$ ,  $df=3$ ,  $p<0.05$  and Bonga;  $\chi^2=16.9$ ,  $df=3$ ,  $p<0.05$ ). Majority (85%) of non-CBBP and minority (45%) of CBBP farmers in Bonga utilized anthelmintics at most three times per sheep over the last one year. Over the same period in Horro, 52.5% of non-CBBP and 85.7% of CBBP farmers utilized anthelmintics at least four times per year per animal. The extent of anthelmintic use in present finding is higher than the study of Datiko et al. (2013) who reported the maximum number of two treatments per year in and around Bishoftu, central Ethiopia. Besides, there is a clear indication that CBBP farmers practice utilization of anthelmintics for control of GIN and other worms of sheep more frequently than the non-CBBP farmers. This heavy reliance on anthelmintics may lead to development of anthelmintic resistance in the CBBP communities' sheep and suggests that introduction of more sustainable control options for GIN of sheep is important in these communities.

### Sheep farmers' preference for GIN control options

Preferences of CBBP and non-CBBP farmers for four control options and their attributes for control of GIN of sheep in Bonga and Horro areas is provided in Table 2. In Horro, CBBP farmers preferred SB as a sustainable GIN control option more than non-CBBP farmers (mean score = 4.03 vs. 2.43,  $p<0.001$ ). This indicates that SB has potential to be introduced into the CBBP community.

Table 2 Preferences of CBBP and non-CBBP farmers for attributes of GIN control options in Bonga and Horro areas.

GIN control options & attributes		Horro			Bonga		
		CBBP	non-CBBP		CBBP	non-CBBP	
		mean score	mean score	p-value <sup>u</sup>	mean score	mean score	p-value <sup>u</sup>
effectiveness	EV	1.37	1.76	**	4.12	3.88	*
	AH	4.69	4.41	**	4.83	4.93	ns
	SB	4.07	2.45	***	2.92	2.50	ns
	NS	3.54	2.53	***	3.03	2.60	ns

availability	EV	1.27	1.55	*	4.57	4.05	*
	AH	4.90	4.74	*	4.73	4.31	***
	SB	2.90	1.62	***	1.57	1.67	ns
	NS	2.08	2.02	ns	1.47	1.34	ns
(cheap) cost	EV	1.47	2.03	*	4.57	4.28	ns
	AH	3.59	3.66	ns	4.02	4.19	ns
	SB	3.12	2.26	***	1.20	1.64	*
	NS	2.56	2.19	ns	1.40	1.71	ns
sustainability	EV	1.14	1.55	**	3.75	3.66	ns
	AH	4.76	4.24	***	4.70	4.84	ns
	SB	4.03	2.43	***	3.50	3.57	ns
	NS	2.97	2.22	**	3.30	3.53	ns

<sup>u</sup>Mann-Whitney U Test: ns=not significant ( $p>0.05$ ), \*=significant at  $p<0.05$ ; highly significant ( $P<0.01$ ); very highly significant ( $P<0.001$ )

The CBBP farmers in Horro rated AH as a sustainable option more than the non-CBBP farmers (mean score = 4.76 vs. 4.24,  $p<0.001$ ). However, this perception held by CBBP farmers indicates that they lack awareness on anthelmintic resistance. Thus, awareness should be created to minimize the risks of AH resistance in the community.

In conclusion, there is increased use of anthelmintics in CBBP communities. To reduce the risks of developing anthelmintic resistance, taking into account the inclusion of nematode resistance traits into community based breeding programs is crucial.

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