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Original Research Article

Farmers' Perception on Contribution of Community-Based Breeding Program to Sheep Flock Performance and Income of Producers in Hula and Dara Districts, Southern Ethiopia

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Abstract: Community-based breeding programs (CBBP) have been viewed as attractive breeding strategies, resulting in significant improvements in the performance of small ruminants and the income of producers in many parts of the world. As part of these interventions, a community-based breeding program was implemented on Abera sheep mostly reared in the region since 2013. An interview was conducted with 188 sheep producers (91 CBBP members) and 97 non-CBBP members) to know the contribution of CBBP in terms of sheep flock performance improvement and income of sheep producers in the Hula and Dara districts of Sidama region. Focused group discussions with 6–8 individuals in each breeder cooperative were separately made to complement the survey results. CBBP households owned significantly ($p<0.05$) larger sheep heads (7.28 versus 4.99) than non-CBBP members. CBBP households further had more market participation, sold significantly ($p<0.05$) higher average sheep (2.4 versus 1.3), and consequently earned significantly ($p<0.05$) higher annual income (ETB 3877) than non-participating (ETB 2007) households. The majority of CBBP households (85%) observed a better twining rate for their sheep flocks since they joined the breeding program. The average age of 8.63 months of a lambing interval, 7.9 months of ram maturity for breeding, and 10.42 months needed for a ram to achieve market age before implementation of the breeding program were significantly ($p<0.05$) reduced to 7.31 months, 6.2 months, and 7.69 months, respectively, after sheep producers started a selective breeding program. Low market integration (0.28), sheep mortality (0.21), feed shortage (0.20), low institutional support and coordination (0.17), and managerial problems of the committee (0.13) were major problems with the ranking index in parenthesis. Despite the significant contribution of the breeding program to sheep producers, the current study found weak and unsustainable institutional support for proper breeding program implementation. Therefore, the current study concluded that breeding programs contributed significantly to the sheep flock performance improvement and the income of producers. Adequate institutional support could significantly contribute to the sustainability of breeding programs.

Keywords: Abera Sheep, CBBP, CBBP Households, Income, Performance.

INTRODUCTION

Livestock contributes significantly to rural livelihoods in developing countries. Small ruminants are widely regarded as a valuable asset for smallholders in Ethiopia, where they play important economic and cultural roles and are reared in a variety of agro-ecological systems (Assefa, 2008). Sheep are important livestock for poor farmers because they require less capital and feed and have shorter generation intervals than larger ruminants. Due to their important adaptation qualities to unfavorable conditions and their ability to survive under low production systems, indigenous animal genetics are most valuable to the poor (Anderson, 2003). These indigenous breeds are widespread and vital to the survival and social well-being of a large human population in developing countries (Kosgey *et al*., 2004). Ethiopia is endowed with a large sheep population,

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estimated at 42.9 million (CSA, 2021), despite their productivity remaining low (Markos, 2006). Over the years, several approaches have been used to improve the performance of indigenous sheep resources in tropical areas. Due to a lack of infrastructure and technical capabilities, breeding programs involving the substitution of exotic breeds for indigenous breeds were unsuccessful (Kosgey *et al*., 2006). The most commonly used crossbreeding program, which was used to improve the performance of indigenous breeds by crossing temperate breeds, tended to undermine the adaptive traits of local breeds and similarly failed to be sustainable. Because of the lack of active participation of intended users, the centralized breeding program, which was typically controlled by governments, also failed to answer the long-term production questions of targeted producers. As a result, breeding programs that consider the entire production system and ensure the active participation of targeted producers at all stages of planning are encouraged (Kosgey *et al*., 2006). Community-based breeding programs (CBBP) were thus thought to be appropriate techniques for achieving genetic progress by improving animal performance and, ultimately, improving the livelihood of smallholder farmers. CBBPs are thought to be a system of genetic resource improvement and management in which livestock keepers are in charge of identifying, prioritizing, and implementing livestock conservation and sustainable use efforts (Tesfahun *et al*., 2008). The CBBP breeding program initiatives in Ethiopia were implemented between 2007 and 2011 and started in four locations across different regional states. The initiatives were financed by the Austrian Development Agency (ADA) with the collaboration of ICARDA, ILRI, the University of Natural Resources and Life Sciences (BOKU), and the national research institutes of Ethiopia. The four CBBPs implemented in Ethiopia between 2007 and 2011 were Bonga, Horro, Menz, and Afar. At the end of the project duration, the breeding programs implemented under three locations except Afar were successful and continued under CGIAR and started to expand to other locations in Ethiopia. Among other CBBPs implemented in Ethiopia, the Abera sheep community-based breeding program is one implemented for the indigenous sheep population reared in two districts—Dara and Hula districts of Sidama regional state since 3013. Abera sheep are characterized by long fat tails with straight tips, short and smooth hairs, and straight head profiles (Melesse *et al*., 2013). Through detailed analysis of the production system and breeding objectives, the mentioned breeding program was initiated and implemented with the overall aim of improving the performance of sheep and ultimately contributing to the income of sheep producers. There have been very limited research work has been conducted mainly aimed at evaluating this community-based breeding program. Therefore, the present study is aimed at an overall evaluation of Abera community based breeding program in terms of flock performance and farmers perception about the breeding program.

MATERIALS AND METHODS

Description of Study Area

The study was conducted in two districts; Dara and Hula districts of Sidama regional state. The Dara district is found in the eastern parts of southern Ethiopia, 85 km away from Hawassa, the capital city Sidama Regional States. The longitudinal and latitudinal positions of districts ranged between 38º38’–38º51’E and 6º36᾽–6º54᾽N, respectively, with an altitudinal range of 1200–2900 masl. The mean minimum and maximum temperatures of the district are reported to be 19 ºc and 28 ºc, respectively. Hula district is bordered by the Oromia region on the south, Dara district on the west, Aleta Wondo district on the northwest, Bursa district on the north and Bona Zuria on the east. Hula district's longitudinal and latitudinal coordinates are 38º46'–38º78' E and 6º40'–6o75' N, with a mean altitude of 2809 masl. The mean minimum and maximum temperatures of the district range between 6.2 ºc and 19.1ºc, respectively, with a mean annual rainfall of 1425 mm (NMA, 2012).

The mixed crop-livestock production system is an important source of income for communities in both districts studied. Sheep have traditionally been reared and have become an important sub-sector in the mixed crop-livestock production system. Corn, wheat, barley, and other cash crops are grown in the districts. Enset (false banana) is a common and widely consumed food crop in all districts. In most parts of the district, farmers also grow locally available varieties of cabbage and potatoes.

Abera sheep are long-tailed sheep that are mostly raised in the Sidama regional state's highlands. Sheep farming is a significant and vital economic activity that contributes significantly to the livelihood and food security of smallholder farmers. Sheep are mainly reared for meat production.

Breeding Program Description and Animal Management

A total of six breeder cooperatives have been established since 2013 in two districts (Dara and Hula) found in Sidama regional state. Out of six breeder cooperatives, two (Abera Gelede and Abera Atela) were established in 2013, whereas the rest four (Abera Doko, Abera Doda, Abera Bongodo and Bochesa Gobe) were established in 2014. The Abera CBBP now (2020) has 600 participants, with the biggest number (128) coming from Abera Atela and the lowest number (80) coming from Abera Doko breeder cooperatives. The overall goal of the breeding program, like that of other CBBPs, was to increase the performance of indigenous sheep based on household breeding objectives, hence increasing their income from sheep production.

Selection of male animals took place in the sixth month. Usually, ram selection is done twice a year. Selection is conducted based on EBV values of candidate

animals with the farmer's subjective approval for important morphometric attributes like coat colors, tails, and twining ability of rams considering their dam history. Researchers can help by identifying candidate rams considering their performance record and defined selection criteria.

During the wet season, natural pasture is the primary source of feed for sheep and other grazing livestock. Sheep are allowed to feed on crop residues during the dry season. Furthermore, some farmers have begun to grow improved animal feed forages such as Desho grass. At night, flocks were normally housed indoors in bamboo houses with whatever roofing materials were available locally.

Data Collection

Participants and non-participants in the breeding program provided primary data. A total of 188 households (91 CBBP households and 97 non-CBBP households) were involved in the interviews. The number of CBBP households selected from Abera Atela, Abera Gelede, Abera Doda, Abera Doko, Abera Bongodo and Bochesa Gobe was 19, 17, 16, 12, 14 and 13, respectively. Those CBBP households were selected using a proportional sampling strategy, whereas a simple random sampling strategy was used to select non-CBBP households. Some data, like the number and sex of CBBP households, were also used for analysis. Semi-structured questionnaires were employed to collect survey data at each household's farm gate. Focused group discussions comprising 6-8 individuals per breeder cooperative were conducted with selected individuals to complement the survey data.

Data Analysis

The primary data collected by the survey was analyzed using descriptive statistics. The analysis used measures of central tendency and frequency distributions in particular. Statistical significance tests were employed to determine whether there was significant variation between breeding cooperative members and non-members for sheep flock size (and structure), age, family size, land size, number of sheep flocks sold, annual income, and other similar data. Narrative analyses were used to analyze data like perceived challenges in community-based breeding programs (data collected through focused group discussion).

RESULT AND DISCUSION

General Characteristics of Study Households

The general characteristics (gender, age, educational status, family size, and land size) of CBBP households and non-CBBP households are given in Table 1. The majority of households, both from CBBP households and non-CBBP households were male-dominated, with female participation of 20.9% and 18.7%, respectively. Concerning educational status, about 87.2% of CBBP members and 71.1% of non-CBBP members were literate. The proportion of CBBP households that attained primary school, secondary, and university/college level was observed at 53.2%, 20.2%, and 13.8%, respectively, while the corresponding value for non-CBBP was 52.8%, 8.3%, and 10.2%. CBBP households had a significantly higher educational status, which would help CBBP households adopt livestock-related techniques like CBBP, where recording performance data was critical for further evaluation efforts.

Age and Family Size:

The overall mean age of households was 40.46 years. The mean age recorded across breeder cooperatives was significantly ($p<0.05$) different across breeder cooperatives, whereas the observed difference was not different between CBBP members and non-members. Households in the Abera Gelede Breeder cooperative were significantly ($p<0.05$) older than the average age observed in other resting breeder cooperatives. The overall mean (7.3) of family size observed in the present study was significantly ($p<0.05$) different between CBBP households and non-CBBP households as well as across breeder cooperatives. The CBBP households had significantly ($p<0.05$) wider family sizes than non-CBBP households. The observed mean family size of households in the Abera Gelede breeder cooperative was significantly ($p<0.05$) higher than that of households in the Bochesa Gobe and Abera Doda breeder cooperatives.

Land Holding:

The overall mean of total land holding and land allocated for grazing by CBBP households was 1.84±0.1 ha and 0.83±0.5 ha, respectively, while the corresponding value for non-CBBP households was 1.54±0.1 ha and 0.7 ±0.4 ha. The result showed that CBBP households owned significantly ($p<0.05$) wider total land holdings and land allocated for grazing land than non-CBBP households. The total land owned by CBBP households was significantly ($p<0.05$) different across breeder cooperatives.

***Sheep Flock Holding*:**

Table 2 presents the average flock size for CBBP and non-CBBP households. The overall mean sheep holding of studied households was 6.13 ±0.3 heads. The mean sheep holding of CBBP households (7.28±0.4) was significantly ($p<0.05$) larger than the mean flock size owned by non-CBBP households (4.99±0.3). The mean flock size owned by the CBBP households was also significantly ($p<0.05$) different across breeder cooperatives. The highest flock ownership was observed by households of the Abera Gelede breeder cooperative, followed by flock size owned by households of the Abera Doko breeder cooperative, whereas the lowest mean flock size ownership was observed in the remaining breeder cooperatives. The variation in flock size across breeder cooperatives would provide a good basis for the selection of animals for breeding purposes, where higher flock size

implies higher numbers of candidate animals for selection.

Table 1: Sex (%), age (mean), educational status (%) family size (mean) and land size (mean) of respondents

Variable	Gender (%)		Educational status (%)				Age (year)	Family size	Land size (ha)
	Male	Female	NFS	Primary	Secondary school	University/ college			
Overall	81.3	18.7	20.9	52.9	14.2	12	40.46	7.3	1.69
CBBP	79.1	20.9	12.8	53.2	20.2	13.8	40.5	7.8	1.84
Non-CBBP	83.43	16.57	28.9	52.6	8.3	10.2	40.4	6.7	1.54
P-value	0.8871[a]		0.0088[a] ; $X^2 = 0.0088$				0.932	0.026	0.037

[a]*p*-value is calculated using chi-square test; NFS – No formal school; ha: hectare

Table 2: Mean sheep holding of interviewed households across breeder cooperatives

Cooperatives	CBBP participants		Non CBBP participants	
	N	Mean±SE	N	Mean±SE
Overall mean	91	7.28±0.45	97	4.99±0.81
Abera Gelede	17	13.77^{a}±1.04	18	7.56^{a}±1.01
Abera Atela	19	5.37^{c}±0.98	20	4.78^{c}±1.01
Abera Doda	16	4.75^{c}±1.07	17	2.35^{c}±1.04
Abera Doko	12	9.27^{b}±1.29	13	5.31^{c}±1.19
Abera Bongodo	14	5.00^{c}±1.10	15	4.40^{c}±1.11
Bochesa Gobe	13	5.50^{c}±1.16	14	5.47^{b}±1.11
CV%		70.0		96.33
p-value		<0.0001		0.025

***Flock Structure**:*

The flock structure was recorded for CBBP households (Table 3). The mean ± standard error for breeding ram, breeding ewe, lamb ram and lam ewe was observed to be 1.28±0.1, 4.13±0.2, 1.15±0.1 and 1.16±0.9, respectively. The mean flock structure was significantly ($p<0.05$) different across breeder cooperatives for all categories. Observed mean of adult ram and ram lambs were highest in Abera Gelede and Abera Doko breeder cooperatives. The highest mean of breeding ewes was observed in Abera Gelede, whereas the lowest was observed for Abera Bongodo and Abera Doda breeder cooperatives.

Table 3: Mean flock structure (mean±SE) of CBBP participants across breeder cooperatives

Breeder cooperatives	Breeding ram	Breeding ewe	Young ram	Young ewe
Overall	1.28±0.11	4.13±0.24	1.15±0.10	1.16±0.96
CV%	96.52	74.70	82.98	91.28
Abera Gelede	2.16^{a}±0.26	8.47^{a}±0.52	1.47^{b}±0.20	1.63^{a}±0.20
Abera Atela	0.7^{c}±0.27	3.11^{bc}±0.53	0.89^{bc}±0.21	0.94^{ab}±0.21
Abera Doko	2.17^{a}±0.32	5.17^{b}±0.65	2.42^{a}±0.25	1.67^{a}±0.26
Abera Doda	1.5^{bc}±0.28	2.5^{c}±0.57	0.4^{c}±0.22	0.47^{b}±0.23
Abera Bongodo	0.36^{c}±0.30	2.27^{c}±0.61	1.14^{bc}±0.23	1.21^{ab}±0.24
Bochesa Gobe	0.75^{c}±0.33	3.25^{bc}±0.65	0.67^{bc}±0.25	1.0^{ab}±0.26
p-value	<0.000	<0.000	0.003	<0.000

Farmers' Participation in the Abera CBBP

Since the inception of the Abera CBBP breeding program in 2013, the number of participants has rapidly increased, reaching more than 600 in 2019. Only 39 sheep producers were organized in 2013 under two breeder cooperatives, Abera Gelede and Abera Atela. The attractive progress and achievements made by CBBP participants were the primary reasons for the rapid increase in breeding program participants. Other community-based breeding programs in Ethiopia, such as Bonga and Menz, have also seen increased participation (Zelalem *et al*., 2017). Only 9% of the participants in the current study were female. This is because women have a greater domestic workload than men, which limits their participation. Females were underrepresented in Abera community membership and/or leadership, which is consistent with previous studies (Zelalem *et al*., 2017). This needs extra effort to increase female participation to exploit higher participation to boost sheep productivity because females play a larger role in sheep husbandry practices. Low gender participation was also observed in Bonga CBBP, with a female proportion of 10%, which is comparable to the current study (Zelalem *et al*., 2017). Horro and

Menz's community-based breeding programs had higher gender participation rates of 20.98% and 20.51%, respectively (Zelalem *et al*., 2017). In terms of participant distribution in the present study across breeder cooperatives, Abera Atela (128) has the most participants (128), with only 4% being female. Abera Doko had the fewest participants (80), with a gender participation rate of 15%, indicating that female participation is relatively higher as compared with other breeder cooperatives (Figure 1).

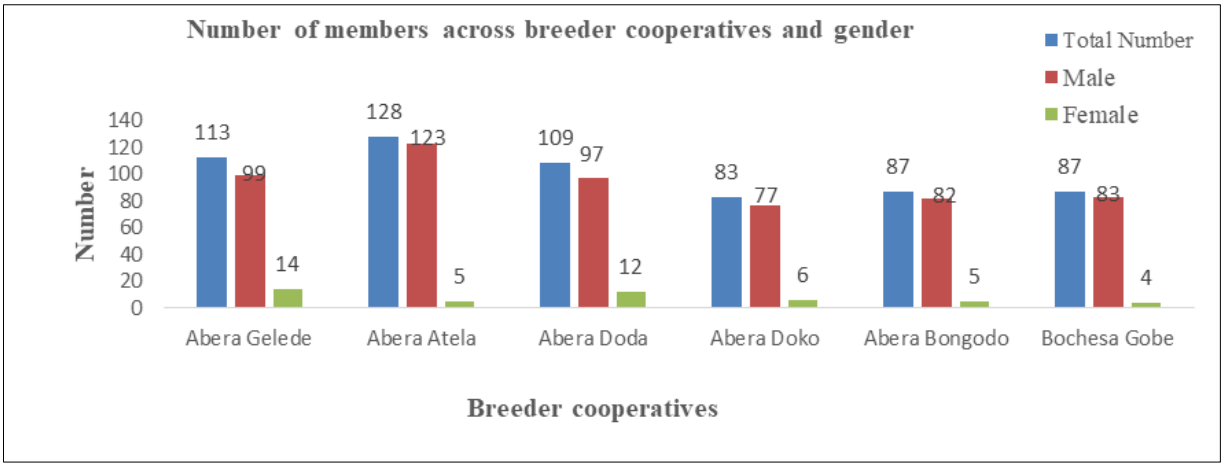

Figure 1: Number and gender of CBBP households in Abera community-based breeding program

The majority (67%) of interviewed households were involved in a breeding program but never served on a committee or as a cooperative head. About 30.8% of the interviewed households had an opportunity to serve at the committee level whereas only 2.2% had worked as cooperative heads. Females are underrepresented on the committee, with only two female members (1 Abera Atela and 1 Bochesa Gobe). None of the female members had ever worked as a cooperative head. This may have limited the decision-making power of females in breeding programs which is mainly associated with either domestic workload or females not seeking leadership positions as they are less educated compared with males.

Sheep Selling Reasons, Time, and Trends of Mutton Consumption

Table 4 gives the reasons for sheep sales, the timing of sales, and trends in mutton consumption as perceived by CBBP households. The current study looked at why CBBP households sell their sheep flock. The result showed nearly half (49%) sold primarily for immediate cash demands, which are to fulfill many social and economic obligations like buying school supplies for children, food and clothing for family members, and agricultural inputs such as fertilizer and seed. Many previous studies (Markos, 2006; Endeshaw, 2007; Tsedeke, 2007; Getahun, 2008) similarly mentioned that sheep producers sell their sheep to generate immediate cash income. About one-fourth of households that want to maximize profit sell their sheep flocks when their sheep reach a good marketable weight. A few CBBP households (14%) sell sheep to replace ewes when they become older or are looking for ewes with better twining ability. Increased demand for breeding rams from elsewhere was another reason why households sold their male animals.

CBBP households chose different occasions to sell their sheep flocks. The majority (80%) target different New Year and holiday festivals. In agreement with the present study, Getachew (2008) reported that about 80% of sheep producers sell their sheep targeting different holiday festivals. A few households—nearly 11% and 9%—sell their sheep at any time or when breeding rams are demanded from elsewhere.

Table 4: Sheep selling reasons, time and trends of mutton consumption by CBBP households (N=91)

Reason of selling	%	Selling time (when)	%	Mutton consumption trends	%
Immediate cash demands	49.5	Holydays/new year festival	80.2	Increased	25.3
Profit maximization	25.3	At any time	11	No change	64.8
Replacement (mainly ewe)	12.3	Ram demanded for breeding	8.8	Decreased	9.9
For breeding/elsewhere	10.9				

Perceived trends in mutton consumption over the past few years were explored through household interviews (Table 4). Mutton consumption is here associated with slaughtering sheep for consumption at home or outside (in hotels or restaurants). Only 25% of households observed increased trends for mutton consumption, whereas nearly 65% observed no change. No significant change in mutton consumption trends would be associated with the increased market price of sheep that forced sheep producers to be less willing to slaughter. In contrast to the results of the present study, about 53% of CBBP households observed increasing

mutton consumption trends in Bonga and Menz community-based breeding programs (Zelalem *et al*., 2017). In close agreement with result of current study, previous study indicated implementation of community-based breeding program increased income and mutton consumption by 20% (Haile *et al*., 2020). The findings of the focus groups and individual interviews revealed an increase in the consumption of meat from other animals, which would be associated with increased household income.

Breeding Program Contribution to Participants

CBBP members were asked closed-ended questions about the impact of a breeding program implementation on their livelihood. More than 90% of them believed the implementation of a breeding program had a positive contribution to their income and livelihood. As per the results of FGDs and individual interviews, the implementation of a breeding program has helped sheep producers in different ways. CBBP helped the sheep producers realize the value of working in breeder cooperatives where they pooled their sheep flocks together and created a larger gene pool from which they could choose the best breeding male. Further, sheep producers understood the value of better management of animals (obtained awareness and training), which ultimately caused their flock to fetch a higher market price than sheep owned by non-participant groups. In line with the results of the present study, CBBP members in Bonga and Menz areas mentioned that their sheep fetch a higher market price than sheep owned by non-participating groups (Michelle, 2020), who reported sheep producers in Bonga used to sell sheep for ETB 1200–1300 before Bonga CBBP was implemented and for ETB 3800–6700 after Bonga CBBP was implemented. The number of sheep sold and the annual income obtained from sheep sales are presented in Table 5. CBBP members had higher market participation in sheep marketing and sold significantly more sheep ($p<0.05$) than non-CBBP members. In line with the current study's findings, a previous study (Zelalem *et al*., 2017) found that CBBP members had higher market participation than those who did not participate in the breeding program. This higher market participation of CBBP members could be associated with a higher number of sheep holdings than non-participating groups.

The annual cash income obtained by sheep producers was also assessed, and the results showed that CBBP members had earned significantly ($p<0.05$) more annual income than that obtained by non-participating groups (Table 5), which was in agreement with a previous study (Zelalem *et al*., 2017) where CBBP members obtained ETB 614 higher than non-participating groups in the breeding program. Higher annual cash income obtained by CBBP members could be associated with more sheep holdings and higher market participation than those in the non-participating group.

Table 5: Average sheep sold and annual income obtained by CBBP households versus non-CBBP households

Parameters	Participation	Mean±SE	*p*-value
Sold in year	CBBP households	2.4 ± 0.2	0.002
	Non-CBBP households	1.3± 0.1	
Annual Income obtained (ETB)	CBBP households	3877±377	0.0001
	Non-CBBP households	2007±230	

Prolificacy

Interviews with CBBP households were conducted to determine how they felt about the increase in sheep prolificacy since the program's commencement (Table 6). Nearly 82% of them reported their sheep giving mostly (and always) single births before CBBP was implemented. However, after CBBP was implemented, about 85% of CBBP households obtained mostly or always twin births. About 2.2% of CBBP households observed triple births, which was hardly reported before CBBP was implemented. Improvement in management condition and correlation with other growth traits could be reasons for improvement in the ability of sheep to give multiple births. The previous study reported the positive response of reproductive traits toward selection schemes indicating presence of positive genetic change for the number of lamb born and weaned for Rambouillet sheep (Burfening *et al*., 1993).

Table 6: Perceived prolificacy (%) of sheep before and after CBBP implementation (n=91)

Prolificacy	Before CBBP implementation		After CBBP implementation	
	N	%	N	%
Always give single birth	39	42.86	8	8.79
Rarely give twin birth	6	6.59	2	2.2
Mostly give single birth	36	39.56	2	2.2
Mostly give twin birth	6	6.59	66	72.53
Always give twin birth	4	4.4	11	12.09
Triple birth	0	0	2	2.2
X^2	146.4211			
p-value	<0.001			

CBBP households were also interviewed to learn about improvements in lambing intervals, lamb maturity for breeding, and marketing age (sale) for sheep owned by CBBP households (Table 7). The mean lambing interval of 8.63±0.17 months observed before CBBP implementation was significantly ($p<0.05$) lowered to 7.31±0.15 months in 2020. This could be associated with an improved reproductive ability of sheep (better breeding cycle). The longer duration of ram maturity was dramatically ($p<0.05$) lowered from 7.9 months to 6.2 due to the efforts of the breeding program. After CBBP was implemented, the time it took for rams to reach marketing age was also dramatically shortened. This could be linked to a selective breeding program that improved the productive performance of the sheep flock. Focused group discussions also revealed that sheep's growth performance improved significantly due to CBBP's implementation, which was consistent with earlier research (Zelalem *et al*., 2017). A Previous study stated that community-based breeding programs have a remarkable contribution to improving the growth rate of Bonga and Menz sheep in Ethiopia (Rekik *et al*., 2022). Tera *et al*., (2020) reported that a community-based breeding program implemented on Bonga sheep resulted in considerable genetic gain for reproductive traits characterized by low heritability and repeatability.

Table 7: Performance of Abera ewe and ram before and after CBBP

Parameters		Mean±SE (Month)		*p*-value
	N	Before CBBP	After CBBP	
Lambing interval	91	8.63±0.17	7.31±0.15	0.001
Ram maturity for breeding	91	7.90±0.16	6.20±0.11	0.001
Ram for sell/marketing	91	10.42±0.40	7.69±0.31	0.001

All CBBP households believed that the improvement in body size of new lamb born was a result of a selective breeding program as body size was the top-ranked breeding trait of sheep in Abera CBBP. Selective breeding programs also caused significant improvement in the twining ability of sheep, as 64.8% of those interviewed believed. Most CBBP households (60%) did not observe improvement in the mothering ability of ewes, which was because mothering ability was hardly considered during ram selection and was not breeding objectives of sheep producers (Table 8). In agreement with this, Haile *et al*., (2020) reported that community based breeding program resulted in substantial genetic gain.

Table 8: CBBP household's perception on change in body size, twining and mothering ability of sheep flock after CBBP

Observed change	Body size of new born lamb		Twinning ability		Mothering ability	
	Frequency	%	Frequency	%	Frequency	%
Showed improvement	91	100	59	64.8	37	40.7
Showed no change	-	-	32	35.2	54	59.3
Decreased	-	-	-	-	-	-

Important Institutional Arrangements and Government Support

The current study evaluated the involvement of several institutions and governmental assistance for the proper establishment of Abera CBBP through focused group discussion and households' interviews. The Southern Agricultural Research Institute (SARI) and the Hawassa Agricultural Research Center were found to play a greater role in the Abera community-based breeding program's sustainability. SARI's help and services include training on breeding ram selection and use; input/materials supply (drugs, weight balance, ear tags, and ear tag applicators). SARI also employed enumerators on a permanent basis for each breeding cooperative. Enumerators' key responsibilities include following up with cooperative members; recording sheep flock data; and attaching an ear tag to a newborn lamb. The enumerators also ensure that selected breeding rams are used properly and unselected rams are culled properly too. The livestock and fishery Zonal to District Bureau played a part in creating market linkages and assisting in the auditing of cooperative financial resources. However, institutional support, coordination, and connectivity were poor and insufficient, as the focused group discussants mentioned.

Limited involvement of non-governmental organizations was reported in the current study. Despite this, the International Center for Agricultural Research in Dry Areas (ICARDA) has recently begun assisting sheep producers in community-based breeding projects.

The training was delivered primarily by governmental institutions (SARI and district extension workers) and to a lesser extent by non-governmental organizations (NGOs) to 85% of the CBBP households interviewed. Those involved in training suggested that training is a critical aspect that contributes significantly to the success of a selective breeding program, proper animal management, and utilization of selected breeding rams as well as culling of unselected ones. Some of interviewed households also received training on how to record performance data, income and expense in the breeding program.

Farmers' Attitudes toward Community-Based Breeding Program

The CBBP breeding program was accepted and supported by the interviewed households because they believed it would benefit their livelihood. They mentioned that implementation of breeding program had positively improved their livelihood. They further explained that implemented community-based breeding program resulted in performance improvement of sheep flock and consequent income increment from the sheep sale. In line with this, Haile *et al*., (2020) reported community-based breeding program resulted in substantial genetic gain and income of sheep producers. Getachew *et al*., (2016) stated that farmers are very keen and interested in implementation of certain breeding programs if they believed it would benefit them. CBBP households were also asked whether CBBP could sustain with external support. About 69% of member strongly supported need for external supports for smooth running of breeding program. The pointed out the need for well-coordinated involvement of various institution, financial support and technical follow up. In line with this, Mueller *et al*., (2015) stated the need for technical, financial, and organizational support so that community-based breeding programs remain sustainable. However, sheep producers had a very strong desire to continue in the breeding program favoring the support not to be withdrawn. They mentioned that at least technical follow-up is essential for active participation and working in the breeder cooperatives as a unit. Wurzinger *et al*., (2011) stated that the sustainability of the breeding program needs active farmers' participation and strong institutional and technical support.

Challenges and Constraints in Abera CBBP

Challenges and constraints in the study area were identified by individual interviews and focused group discussion and ranked by communities (Table 9). Low market integration concerning information and infrastructures was the primary problem (ranking index = 0.27) reported by the CBBP participants. They further mentioned sheep producers were forced to sell at a lower price in the local market, especially those ranked as inferior during breeding ram selection. FDG's result indicates better marketing options (other than the local district market) would increase farmers' participation in the breeding program and their income too. The result of the present study was in agreement with previous studies (Berhanu *et al*., 2006; Belete, 2009; Haile *et al*., 2019) reported that market development for livestock and livestock products is underdeveloped in terms of information and infrastructure. They further stated that this low market linkage and integration reduced small ruminant productivity, suggesting improving market linkage as an important driving factor that increases motivation and the active involvement of farmers in breeding programs. Gizaw *et al*., (2010) reported that the lack of a market is a significant production constraint for sheep and goats where the production system itself is not market-oriented.

Table 9: Ranking index of challenges and constraints perceived by CBBP participants

Variables	Index	Rank
Low market development and integration	0.28	1st
Low institutional arrangement and poor coordination	0.17	4th
Managerial problem (related to cooperative committee)	0.13	5th
Sheep mortality	0.213	2nd
Feed scarcity mainly during dry seasons	0.207	3rd

Lack of Diverse Institutional Integration:

Lack of diverse institutional support, poor integration among these institutions, and limited service delivery were mentioned as important challenges and constraints in the breeding programs. Regional research institutions (Hawassa Agricultural Research Center) played major roles in sustaining breeding programs with minimal support from extension services from the districts. FDG's results indicated a lack of integration and coordination in support delivery systems, which they believed to be very important. Breeder cooperative remoteness in terms of infrastructure development and accessibility was mentioned as another factor contributing to low institutional support. A previous study reported that the sustainability of community-based breeding programs requires well-organized institutional involvement, and technical and financial support (Muller et al., 2015).

Managerial Problem:

Sheep producers in the breeding program mentioned the smooth interrelationship among members and committee members is a pre-requisite for the proper functioning of the breeding program. Results showed that cooperative committees in some breeder cooperatives utilize common resources (cash) for their benefit which consequently harms the spirit of members working in a unit. Unfair resource distributions and unequal treatment of some members in the cooperative were other important challenges affecting the success of the breeding program. Farmers in some breeding villages also explained that committee members became dissatisfied with important managerial issues and even failed to reach an agreement. In this case, changing the committee member (s) was a solution.

Sheep Mortality:

Sheep mortality was the second major problem in the study area. Individual interviews and FGD results indicated increased sheep (and lamb) mortality during

dry seasons which is mainly associated with seasonal variation in feed availability and increased prevalence of diseases and parasites (early rainy seasons). Sheep producers mentioned that higher sheep mortality reduced sheep productivity and income from the sector. Previous studies (Markos, 2006; Belete, 2006; Gizaw *et al*., 2010) have also mentioned the increased prevalence of disease and parasites as a major production constraint in small ruminant productions. Higher sheep mortality could be partly associated with poor veterinary service delivery (Gizaw *et al*., 2010).

Feed Scarcity:

Feed shortages during dry seasons were the third-ranked production problem as ranked by the sheep producers. In agreement with this result, a previous report (Sisay, 2006) stated that a lack of adequate feed resources was one of the major constraints on livestock production in mixed crop-livestock production systems characterized by more cultivated land to feed the human population. FGDs and individual interviews indicated feed shortages during dry seasons, which reduced animal body conditions (low productivity) and led to sheep deaths in some cases. The previous report, in agreement with the present result, stated feed scarcity and poor quality as causes of increased lamb mortality and reduced animal productivity (Haile *et al*., 2019).

CONCLUSION AND RECOMMENDATION

Findings of the present study showed considerable benefit of community-based breeding programs to participants in many ways. Members of the breeding program had wider market participation, sold a higher number of sheep, and obtained higher annual income from sheep sale than non-members. Sheep of participating member had better growth rate, lower lambing interval and better prolificacy than sheep owned by non-participating households. There were more common understanding among sheep producers mentioning sustainability of community-based breeding program require well organized institutional, technical and financial support. Low market linkage, low institutional support, lamb mortality, feed shortages, and cooperative committee problems were perceived challenges in the breeding program. Inter-institutional coordination and involvement capacitating sheep producers in solving challenges, continuous assistance and support in selective breeding program further improve sheep flock performance and income of sheep producers**.**

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