

(RESEARCH ARTICLE)



## Traditional, breeding objectives and selection criteria of Arsi-bale goats reared at different Agro ecologies of bale zone, Ethiopia

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### Abstract

**Background and objectives:** This study was carried out to access the indigenous knowledge pertaining to the selection criteria and breeding objectives of Arsi-Bale goats reared under different agro ecologies of Bale zone, Oromia Region, Ethiopia. Thus, the study indicated that long-haired goats are reared only at highlands with a few being reared at the midlands. Most of the goats in the midlands were short coated. In the high lands the does were selected based on their coat type (long hair and glossy) coat color (black). While at the midlands the does were selected based on their reproduction rate, kidding interval for does and reproduction rate followed by body conformation were preferred trait of buck for the mid land. While in the low land they preferred does and buck for their body conformation, hair coat type (White). Bucks were reared at Highland for cash income, skin (saddle) and wealth. At mid-lands they were kept for meat, cash and manure while in the case of Low land Bucks are for cash and meat. The selection criteria of buck and does in High land included their adaptability to high altitude conditions besides black coat color and high body weight and does in Highland include long hair, large body and coat color (black). respectively. However, in Mid-Land does and bucks were selected based on higher body weight and with large body size followed by good mothering ability.

**Materials and methods:** The study was conducted in three Woredas of Bale zone Oromiya (Highland, Mid-Land, Low land) National Regional State. Bale zone has a latitude and longitude of 7°7'N 40°0'E with an elevation of 2,492 meters (8,176 ft) above sea level.

**Sampling methodology:** The weredas in the zone was selected based on purposive sampling method. The weredas i.e highlands (Dinsho), midlands (Agarfa) and lowlands (Ginnir) were selected based on the agro ecologies, goat population within the agro ecology. 135 respondents were identified purposively based on their experience in rearing goats, besides their willingness to participate in the project.

**Statistical analysis:** The data was analyzed using Statistical Package for Social Sciences SPSS (V24) of Windows. The data was divided into both quantitative and qualitative parameters. The quantitative traits were analyzed using descriptive statistics the means (inferential eta ANOVA) were compared across the three agro ecologies using Duncan's multiple Range test, while the qualitative traits were assessed using non parametric tests ( viz. chi square test).

**Results:** The preferred traits of does reared at different agro ecology of Bale Zone in the highlands indicate selection based on coat color of the goats were preferred the most over the other traits. The findings indicate that bucks are primordially reared for cash income. At midlands and lowlands the bucks are also reared for wealth and manure.

**Conclusion:** It can be concluded that goat selection criteria and breeding objective at different agro ecology are different. Most goat selection criteria was coat color and the main objective was for cash income, wealth and manure.

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**Keywords:** Arsi-Balegoat; Selection criteria; Agro ecologies; High land; Mid-Land; Low land

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## 1. Introduction

Small ruminants (sheep and goats) have a unique niche among the farmers especially among the developing countries. They are preferred by the smallholder farmers for the fact that they require little investments; have shorter production cycles, faster growth rates (when compared to the bovines) and greater adaptability to the prevailing environment [1] [2] Goats are reared under diverse agro-ecological zones from very arid to very humid regions and over a wide range of production systems where they serve multiple functions for the communities that rear them [3]. Goats are browsers and are selective feeders and thus it enables them to thrive on sparse bushes and shrubs covering long distances and utilizing feed resources otherwise unutilized by ovine and bovines alike [4]. They also have broad feeding habits and short reproductive cycle which provides them with comparative advantage over other species [5].

Goats are important in diversifying agriculture and livestock production, creating employment opportunities, improving family income, building capital, contributing to human nutrition and reducing risk associated with the vagaries of nature, in addition to their quantifiable outputs of several products [6].

The Arsi breed of goat is distributed throughout the Arsi, West-Arsi, Bale and parts of East-Shoa, South-Shoa and West Hararghe administrative zones, in altitude that range from 300 m lowland up to 4000 m above sea level, highland [7] and [8]. Traditional breeding practices aim towards sustainable genetic improvement program that too under smallholder situations, it heavily relies on indigenous knowledge which is structured differently from scientific knowledge[8]. Deviation from the indigenous knowledge leads to the setting up of unrealistic breeding goals and the consequence of which can put in danger the conservation efforts for indigenous animal genetic resources [9]. Pastoralists/smallholder farmers have very valuable knowledge about animal management and desirable traits [10]. However, they have less knowledge about the traits missing abilities of the genes and how to use information for the improvement of indigenous livestock and goats being no exception [11]. Currently, community based genetic improvement strategies are being advocated for pastoral goat production and it's expected to pay clear dividends over the years[8].

Bale zone of Oromia region is characterized by diverse agro-ecological settings where goats play increasingly significant roles among the communities rearing them [9]. The existing goat breeds in Bale zone are of indigenous Arsi-Bale(AB) type reared under traditional management practices and across diverse agro ecologies. These goats play an important role in the livelihood of resource challenged communities by providing them with meat, milk and socio-cultural and playing economic roles [12].

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## 2. Material and methods

The weredas in the zone was selected based on purposive sampling method. The weredas i.e highlands (Dinsho), midlands (Agarfa) and lowlands (Ginnir) were selected based on the agro ecologies, goat population within the agro ecology and also be accessible to all weather motorable road. 135 respondents were identified purposively based on their experience in rearing goats, besides their willingness to participate in the project. Based on the numbers of goat rearers in the kebeles 15% (45 respondents) of the rearers were randomly selected from each agro ecology and 15 respondents were selected from each peasant association PA were selected from the three agro ecology. The study encompassed focus group discussions (FGD) one such study was held at each agro ecology, the participants of which were those who had at least ten (10) goats and have been selecting does and bucks.

The key informant (KI) interview was held with the traditional breeders who have been rearing the flocks for more than 5 years and from all the three agro ecologies taken together, this helped in identification of the crosscutting issues related to selection of the bucks and does and across the three agro ecologies.

The respondents were interviewed based on a questionnaire survey. The questionnaire had been of a semi structured type that was pretested and translated in the local language (Afaan Oromo). A check list was developed for the focus group discussion and key informant study. The questionnaire also encompassed studies related to the goat husbandry practices (castration and culling) across the three agro ecologies the traits used for selecting the bucks, does and also the kids. The traits used for the section of both the sexes separately were those of qualitative and quantitative nature.

## 2.1 Statistical analysis

The data was analyzed using Statistical Package for Social Sciences SPSS (V24) of Windows. The data was divided into both quantitative and qualitative parameters. The quantitative traits were analyzed using descriptive statistics the means (inferential eta ANOVA) were compared across the three agro ecologies using Duncan's multiple Range test, while the qualitative traits were assessed using non parametric tests ( viz. chi square test). The values were considered significant at  $P < 0.05$ . The ranking of the does and bucks will be carried out (for selection criteria, breeding objective and etc.) Using the following formula:

$I = \text{index} : \text{Index} = \text{sum of}(3 \text{ for rank } 1 + 2 \text{ for rank } 2 + 1 \text{ for rank } 3) \text{ given for an individual reason (attribute) divided by the sum of } (3 \text{ for rank } 1 + 2 \text{ for rank } 2 + 1 \text{ for rank } 3) \text{ for overall reason.}$

## 3. Results and discussion

### 3.1 Breeding objectives of the bucks and does

The preferred traits of does reared at different agro ecology of Bale Zone in the highlands indicate selection based on coat color of the goats were preferred the most over the other traits. Physiologically the goats raised in the highlands have long glossy hair which is used for skin production and also for padding of saddle of the horses, these skins fetch very high price which range from (850-1200) Ethiopian birr/ skin. These findings were similar with the report of [13]. While in midlands the does were selected based their reproduction rate, the traits which were preferred were short kidding interval and milk production, subsequently they are economically important traits and has high impact on overall productivity of the flock [14]. The findings are in close accordance with those of [15], who report that reproductive performances, good mothering ability, twinning and short parturition intervals were preferred trait during the flock-rankings for does by the farmers in Dire Dawa. The preferred trait/s for breeding does in the lowlands were body conformation, hair coat type (short hair and white), milk yield. White coat color help reflect the solar radiation to protect them from tropical sun [3]. Milk produced from goat in the lowlands ensure food security of the rearers. Goats are also a source of meat by the rearers in these areas. The findings are in close accordance with those of [16] who report that farmers in Arsi-Bale lowland area keep goats primarily for milk production for home consumption. Goats also function as means of financial security and source of cash from sale of live animals and probably milk. Contrarily to the result white coat-colored animals are not preferred by farmers in Abergelle area since such animals can be easily visible by predators from distant places [8].

Preferred trait for the breeding buck in all the study that rearers in the highlands prefer buck based on their appearances (good looking), adaptation to cold area followed by ability to fend off predators. Due to the presences of monkey's, foxes, and wild dog's which inhabit the Dinsho Park (which is adjacent to the study areas) bucks which can fend off the predators are the ones which are preferred [17].

In the midlands the farmers prefer buck which have high fertility followed by body conformation. farmers in the midlands prefer bucks withly fertile and have above average body conformation are preferred for breeding [8]. This may be ascribed to the fact that the price of the bucks are determined by their body condition followed by coat color, sex and other attributes. While the traits which are preferred by farmers from the lowlands indicate that coat color and hair coat type (white and short smooth), followed by their ability to withstand feed and water shortage. Farmers in the low lands do not prefer black or red goats as it is correlated with their adaptability to warmer areas. Goat with white coat color are believed to be tolerant towards frequent drought which is in close accordance with those of [9] from Medawalbu, Sewena and Rayitu districts.

### 3.2 Purpose of keeping buck and does

Bucks are primordially reared for cash income which is in close accordance with the observations of [18]. Studies by [19]; [20] and [21]; have indicated that livestock in general and goats in particular are reared as a source of insurance against the crop failures and to meet immediate cash related needs. The one peculiarity is that in the highlands the skin of the long haired goats are used as a part of the saddlery of the equines and also as home decor these observations too are in close accordance with the reports of ([22]; [23] and [24]; [16] from highlands of Ethiopia.

**Table 1** Trait preference of breeding does in the studied areas

Parameters	Highland		Midlands		Lowland	
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	1 <sup>st</sup>	2 <sup>nd</sup>	3 <sup>rd</sup>	4 <sup>th</sup>	I	1 <sup>st</sup>	2 <sup>nd</sup>	3 <sup>rd</sup>	4 <sup>th</sup>	I	1 <sup>st</sup>	2 <sup>nd</sup>	3 <sup>rd</sup>	4 <sup>th</sup>	I
Adaptability	3	1	11	8	0.1	1	4		9	0.06	5	2		1	0.06
Disease resistance	2	8	1		0.08		7	5	7	0.08	3	5	1	2	0.07
Ability to produce milk	1	4	3	11	0.07	8	2	4	6	0.12	11	8	5	2	0.18
Reproduction rate	2	8			0.07	15	3	7	14	0.22	7	3	4	1	0.1
Ability to withstand feed and water shortages			7	4	0.04		5		2	0.04	2	8	10		0.12
Hair coat type	1	4	2	7	0.2	4	1	3		0.06		8	11	22	0.15
Ability to fight predator	7	5	3	2	0.11	4	7		5	0.09		2		8	0.03
Coat color	9	5	6	9	0.16		2	3		0.03					0
Body conformation		5	3	4	0.06		11		2	0.08	15	8	1	7	0.21
Mothering ability	1	2	3		0.04	2		5		0.04	2	1	8	2	0.06
kidding interval	3		4		0.04	2	3	16		0.11					0
Twinning rate		3	2		0.03	9		2		0.09					0

Index = sum of(4for rank 1 + 3 for rank 2 +2 for rank 2 +1for4) ) given for an individual reason (attribute) divided by the sum of (4 for rank 1 + 3 for rank 2 +2 for rank 2 1for4)for overall reason. Were n=45 in all the agro ecology, over all N=135

**Table 2** Trait preference of breeding bucks in the study areas

Parameters	Highland					Midlands					Lowlands				
	1 <sup>st</sup>	2 <sup>nd</sup>	3 <sup>rd</sup>	4 <sup>th</sup>	I	1 <sup>st</sup>	2 <sup>nd</sup>	3 <sup>rd</sup>	4 <sup>th</sup>	I	1 <sup>st</sup>	2 <sup>nd</sup>	3 <sup>rd</sup>	4 <sup>th</sup>	I
Adaptability	11	3	5	8	0.16			7	16	0.07		7	5	9	0.09
Disease resistance	9	5		13	0.14	12	4			0.13		9		6	0.07
Reproduction rate		11	2	5	0.09		4	3		0.04		13	5	7	0.12
Hair coat type	11	3	3		0.13	1	6	9	3	0.1	7	6	7	19	0.18
Ability to withstand feed and water shortages.							5	9		0.07	13				0.12
Ability to fight predators	3	5	16	8	0.15				9	0.02		10	5	4	0.1
Coat color		9	3	7	0.09			2	2	0.01	15		13		0.19
Age		3		3	0.03										
Body conformation	4		1		0.04	9	13		9	0.19	5		9		0.08
Fast growth						7	11			0.14			1		
Temperament	7	6	15	1	0.17	10		15	6	0.17	5				0.04

(I)Index = sum of(4for rank 1 + 3 for rank 2 +2 for rank 2 +1for4) ) given for an individual reason (attribute) divided by the sum of (4 for rank 1 + 3 for rank 2 +2 for rank 2 1for4)for overall reason. Were n=45 in all the agro ecology, over all N=135

At midlands and lowlands the bucks are also reared for wealth and manure which too are in close accordance with the findings of [25] and [26],the droppings are important source of manure especially for backyard gardens which in turn help in recycling of nutrients and also food security of the rearers [9].

The results also show that at all the locations the does are raised for wealth generation which too is in accordance with the findings of [11]. The observations too find a reason for rearing small ruminants by the small and marginal farmers [27] and [28].The findings also indicate that goat milk is popular among the respondents at all the studied locations especially those reared at low land. Contrarily the report of [29] in Metema none of them are reared goat for milk. Goat milk has therapeutic value and is palatable for even young and elderly people who are unable to digest cow milk [2].

Therefore, if there is initiation of community based breeding program in the area care has to be taken to include the same as a selection criterion[2].



**Figure 1** Breeding objective of Arsi Bale Goat in different agro ecology. I =0.25

**Table 3** Purpose of keeping buck in the study areas

Parameters	Highland					Midlands					Lowland				
	1 <sup>st</sup>	2 <sup>nd</sup>	3 <sup>rd</sup>	4 <sup>th</sup>	I	1 <sup>st</sup>	2 <sup>nd</sup>	3 <sup>rd</sup>	4 <sup>th</sup>	I	1 <sup>st</sup>	2 <sup>nd</sup>	3 <sup>rd</sup>	4 <sup>th</sup>	I
Meat	3	10	4	13	0.14	24	12	6	6	0.33	7	13	8	8	0.20
Cash	22	18	4	15	0.37	18	10	13	10	0.31	25	10	15	10	0.38
Skin	15	6	14	7	0.25		4	4	3	0.05	2	5	3	2	0.07
Manure		5	3	2	0.05		10		24	0.12	3	8	1	17	0.12
Wealth	5	2	10	4	0.11	3	5	13	1	0.12	5	2	10	4	0.11
Insurance		4	10	4	0.08		2	9	5	0.06	3	7	8	4	0.12

Index = sum of(4for rank 1 + 3 for rank 2 +2 for rank 2 +1for4) ) given for an individual reason (attribute) divided by the sum of (4 for rank 1 + 3 for rank 2 +2 for rank 2 1for4)for overall reason. n=45/ agro ecology,

**Table 4** Purpose of keeping does in the study areas

Parameters	Highland					Midlands					Lowland				
	1 <sup>st</sup>	2 <sup>nd</sup>	3 <sup>rd</sup>	4 <sup>th</sup>	I	1 <sup>st</sup>	2 <sup>nd</sup>	3 <sup>rd</sup>	4 <sup>th</sup>	I	1 <sup>st</sup>	2 <sup>nd</sup>	3 <sup>rd</sup>	4 <sup>th</sup>	I
Meat		2	5	5	0.05			10	3	0.05	7	10	8	7	0.18
Milk		18	8	7	0.17		18	5	10	0.16	22	9	6	5	0.29
Cash	21	9	7	5	0.29	15	9	10	6	0.25	16	5	4	6	0.21
Skin	16	5	4	6	0.21		3	4	6	0.05		4	4	3	0.05
Manure	1	3	4	3	0.05	10	7	8	10	0.19		10	12	11	0.14
Wealth	5	5	12	11	0.16	10	5	4	9	0.16		5	5	8	0.07
Insurance	2	3	5	8	0.08	10	3	4	1	0.13		2	6	5	0.05

Index = sum of(4for rank 1 + 3 for rank 2 +2 for rank 2 +1for4) ) given for an individual reason (attribute) divided by the sum of (4 for rank 1 + 3 for rank 2 +2 for rank 2 1for4)for overall reason. n=45/ agro ecology

### 3.3 Breeding System in the Study Area

Bucks are owned by most of the respondents in the area, the findings are in close accordance with those of [30] who reported that farmers in Meta-Robi and Konso part of Ethiopia prefer to rear bucks alongside the does. Most of the respondents from highland and from midlands prefer to have bucks from their own flock, which can lead to inbreeding

in the flock which itself is not preferred. Therefore the respondents need to be appraised about the methods to avoid such problems.

**Table 5** Breeding system prevalent in the study area

Parameter		Highland	Midland	Lowland	Over all	$\chi^2_{cal}$
In house breeding bucks	Yes	32	31	32	95	0.071
	No	13	14	13	40	
Source of breeding buck	Born in the flock	30	19	5	54	64.1**
	from market	5	16	4	25	
	Gift	7	8	28	43	
	Rent	3	0	0	3	
	CBBP	0	2	8	10	
Special management for breeding buck	Yes	14	16	3	33	14.12**
	No	18	15	29	62	
purpose of keeping breeding buck in the flock	Mating	41	24	26	91	34.85**
	Social culture	2	15	19	36	
	For fattening	0	6	0	6	
	Mating and social-culture	2	0	0	2	
How do mate the does	Neighboring buck	2	0	3	5	3.42
	Communal grazing	11	14	10	35	

Values across the agroecology are significantly different at \*  $p < 0.05$ ; \*\*  $p < 0.01$  were  $N = 45$  / agroecology.

At low landas they prefer to sell the breeding bucks for cash ( Table24 ) most of the bucks are obtained as gifts, availability of which is quite unreliable and hence there may be absence of good bucks at the area, [16] therefore the respondents need to be appraised about Community Based Breeding Program so that bucks can be shared and therefore the does do not miss the estrus [9]. The results also indicate that the respondents were unaware of the management of the breeding bucks especially hygiene during breeding and also the feeding of the bucks to ensure optimum concentration of the semen. The findings are in close accordance with those of [30]. However, it is necessary to appraise the respondents about the buck management and thereby ensure a healthy flock [5]. The communal grazing process as followed by most of the respondents often would lead to inbreeding among the flock besides it is difficult to identify the sire among the flock and if at all it is identified is basically by guess [29].

The numbers of bucks differed across the locations and was lowest among the respondents at Low land which indicates that the chances of inbreeding is highest in the location and hence care has to be taken to avoid the same in the location [23]. The age at which the bucks are selected for breeding also differed across the locations which may be correlated with age at maturity which in turn by the nutrition and environmental factor obtained by them [9].

#### 4. Conclusion

Goat farming is an important component of the farming activity in the study areas and play multifunctional roles for their owners across the different agro ecologies. Improper breeding practices viz uncontrolled mating, mixing flock and negative selection of young bucks and high disease prevalence in both study areas and feed shortage in Arsi-Bale breed reared in different agro ecology area should be addressed. One of the basic tool for improving goat production and productivity is to improve the genetic makeup of the animal and its environment. In order to make this fruit full,

knowing the selection criteria depending on the agro ecology and breeding objective documentation of the existing goat and their production system has its own importance.

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## Compliance with ethical standards

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### *Disclosure of conflict of interest*

First, I declare that this research paper is my benefit work I truly declare that this thesis is not submitted to any other institution anywhere for the award of any academic degree, diploma or certificate.

### *Statement of ethical approval*

Requests for permission for extended quotation from or reproduction of this manuscript in whole or in part may be granted by the Head School of Animal Sciences and Range Sciences or the Dean of the School of Graduate Studies when in his or judgment the proposed use of the material is in the interest of scholarship.

### *Statement of informed consent*

Informed written consent was taken from all the participants including both study group and control group.

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