Food Science and Quality Management
ISSN 2224-6088 (Paper) ISSN 2225-0557 (Online)
Vol.122, 2023

Selection Progress on Growth and Milk Production Performance of Indigenous Abergelle Goat Breed under on Station Condition in Wag-Himra, Ethiopia

Yeshiwas Walle* Mulatu Gobeze Bekahagn Wondiem Wubneh Aklog Alemu Demile Tigabu Limeneh
Sekota Dry Land Agricultural Research Center (SDARC) P.O.Box 62, Sekota, Ethiopia
Correspondence: author walleyeshiwas@gmail.com Tell: +25192

Abstract
The study was conducted at Aybera main animal breeding and feeding experimental site in Wag-Himra administrative zone in Amhara regional state, in Ethiopia. The site was established to conserve the indigenous Abergelle goat breed and improve the performance growth and milk production traits through selective breeding. A total of 516 kids for body weight, and 304 does for milk yield performance were used for this study. Animals were managed semi-intensively where they were arranged into pasture lands during day time with concentrate supplementation . Selection was based on bucks which was done once in a year using indexed estimated breeding value of yearling weight and their respective dam milk yield performances. Top-ranked bucks selected from the flock were used as replacements at the nucleus while the surplus bucks disseminated to nearby villages. The general linear model procedure of SAS software (version 9.0) was employed to evaluate the body weight and milk yield of the breed during the last five years (2016-2020). The overall birth-, three month-, six month-, nine month- and yearling weights were 1.98, 6.5, 8.6, 11.4, and 13.8 kg, respectively. The overall lactation milk yield, average daily milk yield and lactation length were 17.64 kg, 0.30 kg and 8.45 weeks, respectively. Within the last five consecutive selection years birth weight has increased from 1.64±0.04 to 2.3±0.02 kg, weaning weight from 5.6±0.25 to 7.5±0.15kg, and yearling weight from 13±0.43 to 15.2±0.27kg. All the fixed effects of birth type, parity, season and year of birth had significantly affected the birth weight. The pre-weaning and post-weaning body weights of kids were affected by the selection year. Wet season birth was important for increasing milk production and lactation length.Nucleus flocks in station the growth traits and milk traits can be improved by selection and selection at the station at once a year . The Selection of breeding bucks should be at age of six month.The station should be stop the inlet of does from the market.
Keywords: Abegelle goat ,dissemination, Nucleus, partial open,selection
DOI: 10.7176/FSQM/122-03
Publication date: July 31st 2023

1. Introduction

The goat population of Ethiopia was estimated to be52.4million(CSA, 2021). Goats in Ethiopia make an important contribution to the poor household in particular and the national economy in general.Goats in Ethiopia are found and distributed in different agro-ecological zones where a large proportion (58%) is found in the lowlands of the country, in large flocks by pastoralists while, 42% of the total are found in the highlands where there is a strong complementary relationship between small ruminant keeping and cropping (Deribe & Taye, 2013).Goat production in Ethiopia was low, total annual meat production from small ruminant was 154,000 tons per year (M.Rekik et al., 2016) and annual milk production in Ethiopia 93,000 metric tons more than Kenya that 91,000 metric tons and less than Sudan 154,400 metric tons (A.K.Banerjee et al.,2000).Meat production per animal was 9kg which was less than from Kenya and Sudan,11,15kg respectively.Most research of Abergelle goat breed was conducted on farm and the growth and milk yield performance evaluated by different scholars. The on station study of was single traits and very old like twining rateand mortality rate were 1.3and26.7 (Africa, 1996) respectively.The evaluated traits on farm,in five round of selection once a year overall weight mean weight with the base line information birth weight from 1.7kg to 2kg,weaning weight from 7kg to 7.2kg ,six month weight from 9.34 to 10.09kg,nine month weight from 12.76 to 13kg,,and yearling weight from 15.4kg to the 15.9kg respectively. But in five round of selection that's selection once a year and birth weight improved from 1.7kg to 2.4kg. at 5th round of selection other growth traits three- month weight ,six-monthweight,nine- month weight and yearling weight were 8.02kg,11.26kg,13.94kg,16.80kg respectively according to the report of (Bewketu Amare et al., 2020). Othe author also evaluated the this breed on farm and found the result for growth traits that was birth weight ,weaning weight ,nine month weight and yearling weight 2.27,7.38,9.39,and 11.2kg respectively (Minister Berhane et al, 2018). Those autors used three to five year performance data on farm recritued enuminators.Aberegelle goat breeds in area were kept for multifunctional roles but mainly to generate cash (Abegaz et al., 2013). But small household farmers in study area use their animals(goats) for milk and meat consumption. The breed has small birth weight, weaning and post weaning weight. But in milk production the breed has best performance when compared to like woytu guji with the same family.

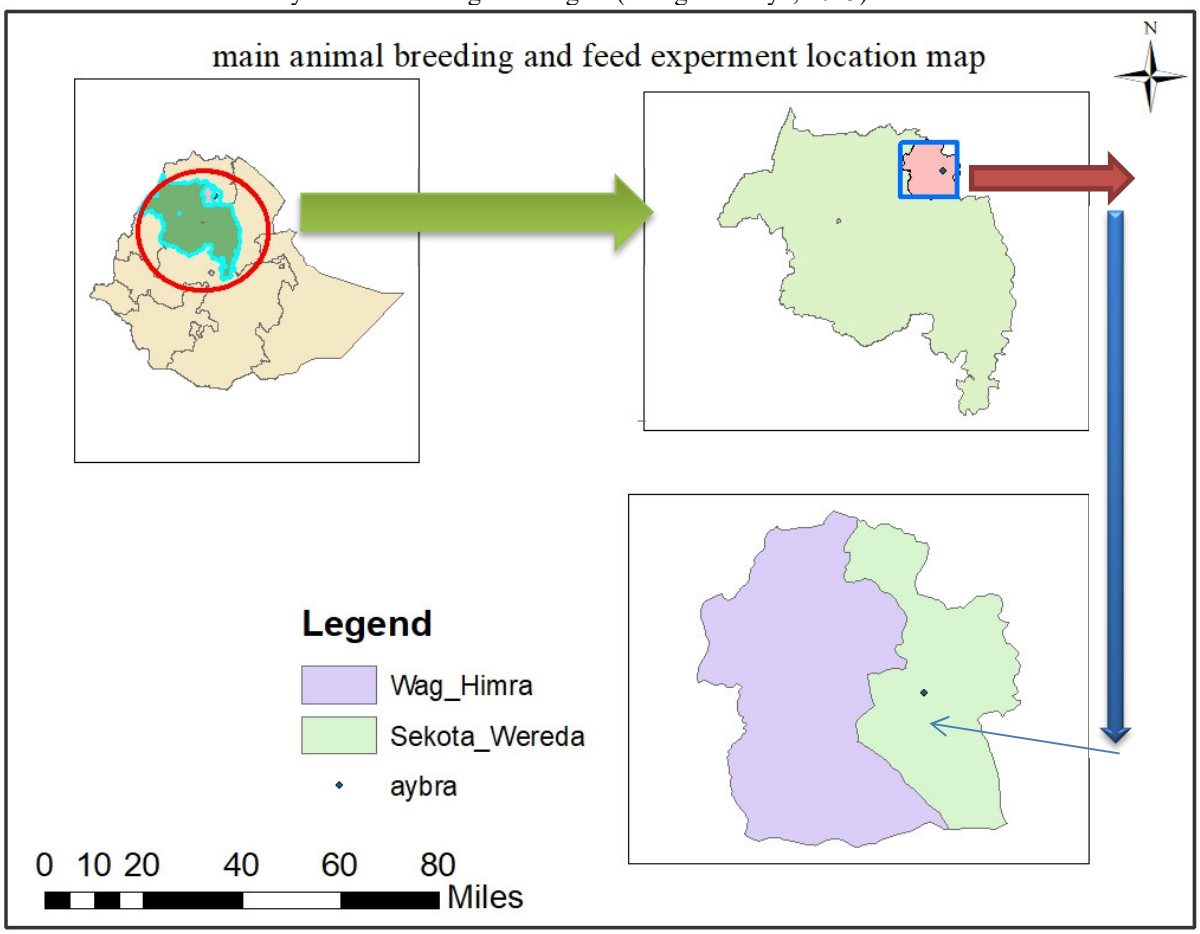
Aberegelle goat breed was one of the rift valleys families, located in the low land of Wag-Himra that's in Abereglle, Ziqula and Sekota Zuria district and around east Bellessa in Gondor.The breed is also characterized by its long kidding intervals, and high resistance to drought and harsh environment(solomon, 2014).Farmers in the low land of Wag-Himra use the breed for the purpose of meat and milk production. The breed population size in 2021 in Wag-Himra was 550,000(CSA, 2021).Most of Abergelle goat research findings were implemented on farm rather than on station, as result the study was required to implement on station with the following objectives.

2. Objectives

1. To improve the performance of most preferred traits of Abergelle goat breed at station
2. To establish and maintain nucleus flocks of Abergelle goat which serve as pure and improved breeding population
3. To conserve indigenous Abergelle goat breed's genetic resources

3. Material and methods

3.1. Description of the study area**: -** The study was conducted in Sekota Zuria district at Aybra, which is located 12^{0} 41´ 11.92´´N and 39^{0}.00´58´´E in Wag- himra administration zone in Amhara region. The study area 17 Km far from Skota town, 447 km and 737 km from the Amhara regional town, Bahir Dar, and Addis Ababa capital city of Ethiopia, respectively. The district has rugged topography characterized by mountains, steep escarpments and deeply incised valleys. The farming practice of area was mixed crop-livestock production. The annual rainfall of the area was 650 mm with very short and an erratic distribution. The maximum and minimum temperature of the area is 26.6ºC and 31.6ºC, respectively, and Altitude of 1933 m.a.s.l. The main rainy season in the area starts from late June and to mid-July and ends during late August (Mengistie Taye, 2013) .



map of the study area 1 **.**

3.1. Animal management and recording

All animals for station selection were bought from Abergelle and Ziqula districts when starting the maintenance of the flock in 2016. One enumerator, one hygiene worker and eight (8) goat keepers were recruited, the data collector trained for the data collection and follow up and his roles was to coordinate the breeding program and collect pedigree and performance data of flock. The herding system was strict to control inbreeding and the season

of mating. During selection and mating season the station was partially opened, elite breeding bucks leave to community-based breeding program villages and came back to the station. Unselected bucks and bucks that completed their mating service were culled through sales. Mating has been done 1:15 male to female ratio in different herd either of mixing two or three of mating groups, for purpose of reducing the number of goat keepers. After completing their mating season the breeding bucks and doe herd separately.

4. Data analysis

Descriptive statistics were used to perform simple population characteristics and breeding value estimation. Productive performance data were analyzed using the GLM procedures of SAS software version 9.0. Birth type, kid sex, season of birth, parity, and year of birth were fitted as fixed factors for body weight variables whereas only season of kidding, parity of Dam and year of kidding were fitted as fixed factors for milk production traits.

For growth parameter;

$Y_{ijklm} = \mu + Bt_i + S_j + Sb_k + P_l + Y_m + ei_{jklm}$

Where: Y_{ijklm} = the observed growth performance of goat by weight mainly at birth weight, weaning weight to yearling weight

μ = overall mean

Bt_i = is the effect of i^{th} birth type (Single, twin, and triplet)

S_j = is the effect of j^{th} sex (male and female)

Sb_k = is the effect of kth birth season (wet, and dry)

P_l = is the effect of lth parity (1, 2, 3, …, 6)

Y_m= is the effect of the m^{th} year (2016, 2017, …, 2020)

e_{ijklm} = is random residual errorFor milk parameters;

Yijk = μ + Sbi + Pj+Yk + eijkl

Where: Yijkl the observed milk yield

μ = overall mean

Sbi = is the effect of i^{th} birth season (wet and dry)

Pj= is the effect of j^{th} parity (1-6)

Yk= is the effect of kth year (2016-2020)

Al= is the effect of L^{th} age of dam (1-6)

eijkl = is random residual error

5. Result and discussion

The overall least square mean birth weight of kids was 1.98 kg (Table .2). This result was similar to value reported for the same breed by (Deribe and Taye, 2013) in farmer management practice 1.91kg, and also the result was highly similar to the report of the same breed by *(*Amare,*et al,* 2020) in CBBP villages in Aberegelle districts of Saziba village was 2.0 kg. The birth weight had positive association with weaning weight. The overall weaning weight and post weaning weight 6.5kg, 8.6kg, 11.4 kg and 13.8kg respectively. The fixed effects of parity, birth type, sex and season of birth had a significant effect on birth weight. The heaver the birth weight the late parities result from the physiological imprint in the uterus during the first pregnancy will facilitate relatively greater foetus growth in subsequent pregnancies (Gardner,*et al*, 2007). Birth type show significant effects on birth weight, kids were born single higher birth weight than those kids were born as twins (Table.2). This difference may be due to the feeding and good mother ability of the does for their kids.Males, single-born kids and those born during the wet season had significantly higher birth weight than females, twin born kids and dry season born ones.male in nature had high performance and feeding nourished in uterus of does than females. During the wet season, follicular growth could be supported by available forage. Weight increments in different ages Birth weight (Bwt), three-month weight (Tmwt), six-month weight (Smwt), nine month weight (Nmwt) and yearling weight (Ywt) in the respective years were the positively affected. This was the effect of selection, control of inbreeding and the feeding management of the flock with some limitations. The management of the flocks, feeding system at station opposes the natural feeding behavior of the animals. Goats at station were supplemented concentrated feed throughout the year and enforced to sustain browsing on degraded areas. The result of the study in same breed was highly different from the reports of (Amare et al., 2020) ,7.2,10.1,13.0 and 15.9kg for, weaning ,six-month ,nine-month and yearling weight and similar to the reports of (Deribe & Taye, 2013) which was, 6.84, 9.13 ,14.25 Kg weaning weight, six month ,yearling weight and respectively. Sex had no show the significant effect on weaning and six month weight. This is due to the shocking on weaning age which mean by stop suckling of milk. The weaning, six month and the yearling weight were not significantly affected by parity of the doe but doe's with earlier and higher parity had a potential of giving higher birth weight kids. In first parity does compared with older doe's that have reached physiological maturity. It was in agreement with some other studies and the results of (Deribe & Taye, 2013). Birth weight (Bwt) improvement had a positive association with weaning weight (Wwt) but birth weight had no significant effects on post weaning weight as a result birth weight improvement was not

more important in any other growth traits except weaning weight. As shows below in table.3 Pearson correlations birth weight had no positive relation with post-partum weight, six month weight, nine month weight and yearling weight, but the weaning weight, with six month weight, weaning weight nine month weight and weaning weight with yearling weight positive correlation and also six month weight with nine month weight and nine month weight with yearling weight had positive association. This result similar to the report of(Jembere et al., 2020) .Pearson correlation "r" between birth weight (BWT) & six month weight (6MW), BWT & nine month weight (9MW), three month weight (3MW) & 6MW & 3MW & 9MW).But this study had little contradiction(Jembere et al., 2020).As shown in table 4 Kidding interval, litter size and age at first kidding of the flock was 395, days1.09 and 462 days, this result was almost the same with the results of(Abegaz et al., 2014) 372 days , 1.04 and 465 days. Twining rate was only12.7 % in the intervened population of goats. As showing in figure 1,the reason of leaving from the population was death culling and disseminate for community service (breeding bucks). Death was more in nine month and yearling age as shown in figure 2. This due to the reason disease outbreak at nine and yearling age. The traits preference on the station was based on Abegaze dissertation.Table 1. List of preferred traits by farmers (own flock ranking method for females group animal ranking for males), adopted from (Abegaz et al., 2014).

Sex	Traits	
Female	Milk Yield	20.47
	Drought resistance	14.96
	Body size	14.17
	Kid growth	11.81
	Twining	10.24
	Kidding Interval	19.45
	Other cumulative traits	18.9
Male	Body size	21.03
	Color	23.86
	Body conformation	10.12
	Height 9.09	9.09
	Fast growth	7.95
	Other cumulative traits	27.95

The most preferred trait for doe's were milk yield, good mothering ability and strong feeding behavior (drought resistance) in the existing extreme eroded and undulating areas While farmers had given more priority for color, body conformation and body size traits to select their breeding bucks. The most preferred trait improve on the station was the growth performance and milk yield and color traits.Aberegelle goat breed had low annual predicted genetic gain compared to the western low land goat breed and center high goat breeds(Jembere et al., 2020).These variations were due to higher phenotypic variation of the traits, lower generation interval and better performance (such as high twinning rate) of Western Lowland goats. The Abergelle goat breed had no high variation on phonotypic traits, low generation intervals, low in twining rate.

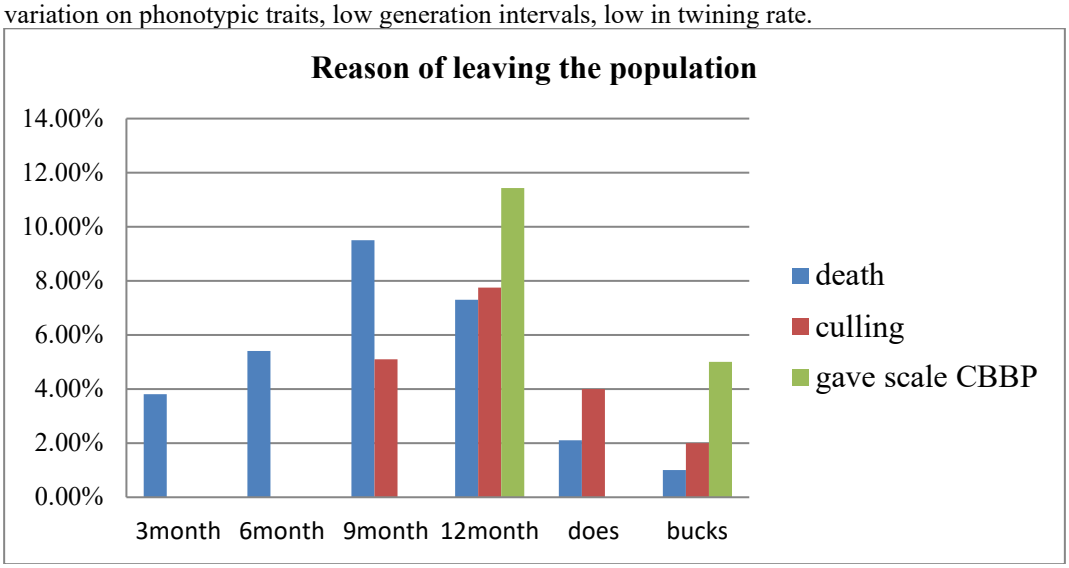


Figure .1

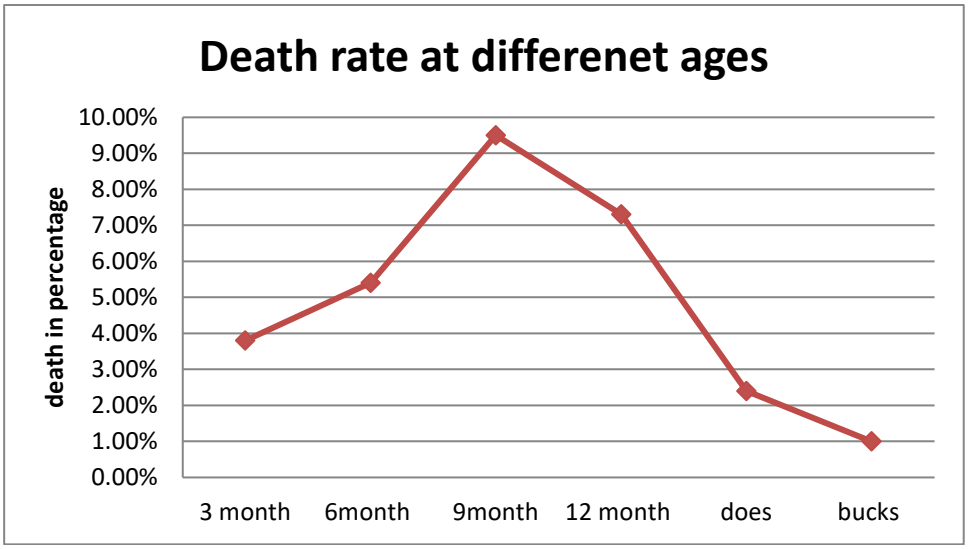


Figure.2

Table 2. Least square means (±SE) subsequence live weight at different age (kg) of Abergelle goat breeds on station

Variables		BWT	N	TMWT	N	SMWT	N	NMWT	N	YWT
	N	LSM±SE		LSM±SE		LSM±SE		LSM±SE		LSM±SE
Overall	**516**	**1.98**	**492**	**6.5**	**474**	**8.6**	**459**	**11.4**	**429**	**13.8**
CV%		20.2		23		19.2		16.8		15.3
Sex		*		**Ns**		**Ns**		***		**
Male	254	2.01±0.028[a]	245	6.6±0.10[a]	231	8.6±028[a]	223	11.8±0.43[a]	205	14.2±0.19[a]
Female	262	1.81 ±0.068[a]	247	6.4±0.10[a]	243	8.4±0.12[a]	236	11±0.151[b]	224	13.6±0.31[b]
Birth type		***		Ns		**		Ns		***
Single	450	2.04±0.88[a]	427	6.5±0.08[a]	410	8.5±0.09[a]	399	11.4±0.25[a]	374	14.3±0.23[a]
Twin	66	1.62±0.46[b]	65	6.53±0.18[a]	64	9.4±0.26[b]	60	11.5±0.30[a]	55	13.2±0.26[b]
Season		*		ns		*		ns		Ns
Wet	466	2.0±0.04[a]	445	6.5±0.08[a]	429	8.5±0.09[b]	421	11.4±0.24	394	13.9±0.14
Dry	50	1.8±0.06[b]	47	6.3±0.19[a]	45	9.2±0.27[a]	38	11.2±0.42	35	13.6±0.35
Year		***		**		***		**		**
2016	48	1.64±0.04[d]	40	5.6±0.25[c]	38	8.1±0.39[c]	36	12.3±0.35[a]	37	13±0.43[d]
2017	67	1.37±0.03[c]	58	6.4±0.19[b]	57	7.3±0.23[d]	53	10.6±0.31[c]	50	13.3±0.29[c]
2018	82	1.94±0.05[b]	80	6.6±0.16[b]	75	7.3±0.23[d]	74	12.1±1.24[a]	68	13.8±0.22[b]
2019	175	2.1±0.09[b]	175	6±0.105[b]	161	9.1±0.16[b]	150	11.2±0.20[b]	128	13.8±0.24[b]
2020	133	2.3±0.02[a]	123	7.5 ±0.15[a]	118	9.8±0.10[a]	110	12.5±0.23[a]	94	15.2±0.27[a]
Parity		**		ns		ns		**		*
1	118	1.88±0.14[c]	115	6.2±0.17	111	8.8±0.20	103	11.6±0.24[b]	96	14.4±0.30[a]
2	96	1.89±0.04[c]	91	6.39±0.15	86	8.5±0.18	86	12.5±1.08[a]	79	14.2±0.31[a]
3	75	1.94±0.05[b]	68	6.49±0.20	66	8.1±0.21	64	10.9±0.28[c]	69	13.4±0.34[b]
4	79	1.97±0.05[b]	77	6.50±0.18	76	8.6±0.18	73	10.8±0.26[c]	70	13.6±0.33[b]
5	78	2.0±0.05[a]	76	6.7±0.17	72	8.7±0.25	70	10.9±0.27[c]	67	13.4±0.32[b]
>6	54	2.1±0.05[a]	63	6.7±0.24	61	8.9±0.25	60	11.5±0.32[b]	47	13.6±0.39[b]

Where BWT=birth weight, TMWT=three month weight, SMWT=six month weight, NMWT=nine month weight, YWT= yearling weight, LSM= least square means and SE= standard error, *= p<0.005, ** =p<0.001,***=p<0.0001

Table.3 Pearson correlation among post-partum weight and weights at different age groups

	Ppwt	BWt	TMWt	SMWt	NMWt	Ywt
ppwt	1. 000					
BWt	-0.04128	1.000				
TMWt	-0.01033	0.19340	1. 000			
SMWt	0.05926	0.00019	0.34292 *	1. 000		
NMWt	0.04210	-0.00203	0.14088 *	0.33905	1. 000 **	*
YWt	-0.00856	0.01697	0.24278	0.50379	0.37845	1.000

Where: Bwt= birth weight, Tmwt =three month weight, Smwt= sex month weight, Nmwt = nine month weight, Ywt= yearling weight '*'=significantly associated at p<0.05, '**'= significantly associated at p<0.001, '***'= significantly associated at p<0.001

The reproductive performance table 4
Means ±SD of age at first kidding, kidding interval and the litter size

Traits	N	means (days)	SD
Age at first kidding	104	462	*52*
Kidding intervals	74	395	51
Litter size	450	1.09	0.2

Table 5. Least square means± SE of lactation milk yield (kg) and lactation length (weeks) influenced by different factors

Variables		LMY		ADMY		LL
	N	LSM±SE	N	LMS±SE	N	LSM±SE
Overall	304	17.64		0.298		8.453
CV%		23		21.2		20.2
season		***		**		***
wet	219	20.79±1.26^{a}	219	0.33±0.12^{a}	219	9±0.17^{a}
dry	108	10.43±1.79^{b}	108	0.216±0.154^{b}	84	6.9±0.33^{b}
Year		***		*		Ns
2016	25	13.24±1.63^{d}	25	0.217.4±0.12^{d}	25	8.7±0.34
2017	62	19.54±2.34^{c}	62	0.297±0.156^{c}	62	9.4±0.47
2018	43	20.79±2.98^{b}	43	0.316±0.13^{b}	43	9.4±0.68
2019	174	22.21±3.21^{ab}	174	0.356±0.123^{a}	174	8.9±0.21
2020	120	23.69±2.58^{a}	118	0.368±0.126^{a}	118	9.2±0.35
Parity		**		ns		Ns
1	36	17.93±3.3^{d}	36	0.305.4±0.128	51	8.4±0.31
2	45	19.067±3.80^{b}	45	0.313.2±0.137	56	8.7±0.44
3	51	18.26±2.89^{c}	51	0.307.4±0.124	47	8.5±0.38
4	47	17.93±2.12^{d}	47	0.305.6±0.117	68	8.4±0.44
5	68	18.60±2.88^{b}	68	0.309.8±0.127	36	8.6±0.47
6	56	19.18±2.64^{a}	56	0.315.4±0.100	45	8.7±0.49

Where LMY= Lactation milk yield ADMY= Average daily milk yield LL= lactation length LSM= least square means SE= standard error "*"p=<0.005,""p=<0.001,"***"p=0.0001**

Milk production performance

Milk is the most important product consumed by the community in the study area in sekota zuria district and in lowland of wag-himra. Milk data was used as a supportive trait for the selection of best performing breeding bucks that will be parents of the next generation. The lactation milk yield (LMY) average daily milk yield (ADMY) and lactation length (LL) was affected by the fixed factors season, year and parity.LMY, ADMY and LL was significantly affected by the season, doe produce more milk in wet than dry season this due to the availability of

forage ,and increase the length of lactation in wet season. Lactation milk yield, average daily milk yield and lactation length was significantly affected by the lactating years.in each consecutive year more of birth naturally synchronized wet season of the year and lactation started in accessibility of forage.

5. Conclusion and recommendation

- Body weight of kids and milk yield of doe was increase in four round of selection across years.
- Strong consideration of the fixed factors like birth type, season of birth and parity were become an important concern during estimation of breeding value (EBV).
- Six and nine month weight had better association with yearling weight (r=0.5and 0.378), respectively which calls for arranging the selection age from six up to nine months which can also allow the chance of maintaining elite kids. Total Milk production and lactation length increased in wet season, producer farmers synchronized birth at wet season.

Reference

Abegaz, S., Sölkner, J., Gizaw, S., Dessie, T., Haile, A., Mirkena, T., Getachew, T., & Wurzinger, M. (2014). *Optimizing alternative schemes of community-based breeding programs for two Ethiopian goat breeds*. *18*, 47–55.

Abegaz, S., Sölkner, J., Gizaw, S., Dessie, T., Haile, A., & Wurzinger, M. (2013). Description of production systems and morphological characteristics of Abergelle and Western lowland goat breeds in Ethiopia: implication for community-based breeding programmes. *Animal Genetic Resources/Ressources Génétiques Animales/Recursos Genéticos Animales*, *53*, 69–78. https://doi.org/10.1017/s2078633613000088

Africa, F. (1996). Husbandry, Productivity and Producers Trait Preference of Goats in North Western Lowlands of Ethiopia. *Open Journal of Animal Sciences*, *10*(02), 313–335. https://doi.org/10.4236/ojas.2020.102019

Amare, B., Gobeze, M., & Wondim, B. (2020). *IMPLEMENTATION OF COMMUNITY BASED BREEDING PROGRAM TO IMPROVE GROWTH RATE AND MILK*. *September*. https://doi.org/10.51227/ojafr.2020.28

Banerjee, A., Getachew, A., & E, E. (2000). Selection and breeding strategies for increased productivity of goats in Ethiopia. *The Opprotunities and Challenges for Enhancing Goat Production in East Africa. Proceedings of a Conference Held at Debub University, Awassa, Ethiopia from November 10 to 12, 20002*, *January 2016*.

Bewuketu, A. (2020). *IMPLEMENTATION OF COMMUNITY BASED BREEDING PROGRAM TO IMPROVE GROWTH RATE AND MILK*. *January 2021*. https://doi.org/10.51227/ojafr.2020.28

CSA. (2021). *FEDERAL DEMOCRATIC REPUBLIC OF ETHIOPIA CENTRAL STATISTICAL AGENCY AGRICULTURAL SAMPLE SURVEY 2020 / 21 [2013 E . C .] VOLUME II REPORT ON*. *II*(March).

Deribe, B., & Taye, M. (2013). Growth performance and carcass characteristics of central highland goats in Sekota District, Ethiopia. *Agricultural Advances*, *2*(8), 250–258. https://doi.org/10.14196/aa.v2i8.902

Deribe, G., Abebe, G., & Tegegne, A. (2014). Non-genetic factors influencing reproductive traits and preweaning mortality of lambs and kids under smallholder management, Southern Ethiopia. *Journal of Animal and Plant Sciences*, *24*(2), 413–417.

Gardner, D. S., Buttery, P. J., & Symonds, M. E. (2007). *Factors affecting birth weight in sheep: Maternal environment*. *May 2014*. https://doi.org/10.1530/REP-06-0042

Jembere, T., Haile, A., Dessie, T., Kebede, K., Okeyo, A. M., & Rischkowsky, B. (2020). Productivity of Abergelle, Central Highland and Woyto-Guji goat breeds in Ethiopia. *Livestock Research for Rural Development*, *32*(8).

mengistie taye, B. deribe. (2013). *Mengestie Taye ,2013, Reproductive Performance of central highland goat under tradational managment in sekota district, Ethiopia*.

Minister, B. (2018). Performance evaluation of Abergelle goat under community based breeding program in selected districts , Northern Ethiopia. *Livestock Research for Rural Development*, *30*(4).

Rekik, A. M. ourad, Haile, A., Mekuriaw, Z., Abiebie, A., Rischkowsky, B., & Salem, I. Ben. (2016). Review of the reproductive performances of sheep breeds in Ethiopia. *Review Paper*, *6*(9), 117–126.

solomon, A. (2014). *Design of community based breeding programs for two indigenous goat breeds of Ethiopia Design of community based breeding programs for two indigenous goat breeds of Ethiopia Co-supervisors*.