

Evaluation of Growth Performance of Different Genotypes of Goats Managed on Station in the Central Part of Tanzania

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Abstract

A study was conducted to evaluate growth performance of three goat genotypes while comparing the effects of sex, birth type, genotype, season and year of birth. A total of 919 kids born from 2012 to 2017 were involved in the study. Data on birth weight, weaning weight, weight at six months and yearling weight were collected. Pre-weaning and post-weaning weights were used to calculate the average daily gain of goats. Analysis of data was done using the General Linear Model (GLM) procedures of Statistical Analytical System (SAS). The overall least square mean (LSM) of birth weight, weaning weight, weight at six months and yearling weight were 2.46, 9.39, 11.13 and 14.58kg, respectively. Birth type and sex had significant effect ($P < 0.05$) on birth weight, weaning weight, weight at six months and yearling weight. Single kids were significantly heavier at birth, weaning, six months, yearling, preweaning and postweaning periods. Blended goats were heavier than Gogo white and Buha at birth, weaning, six month and yearling weight. Gogo white goats were significantly ($P < 0.05$) heavier than Buha in all traits. The body weight gained from birth to weaning and weaning to six month were 62.36 and 27.86g per day, respectively. Male kids out performed their counterparts females on weight in all stages of growth and average daily gain. Single kids were heavier than those twin kids and had high growth rate. Kids born during the dry season were heavier than those born in the wet season. Year of birth had significant effect on weight at birth, weaning, six months, yearling, preweaning, and postweaning period. From the present results, growth performance of Blended goats outperformed Gogowhite and Ujiji goats. Variations in growth performance of Blended goats against Gogowhite and Ujiji goats implies genetic improvements that may be required for Small East African (SEA) goat strains if higher meat yields and faster market weights are desired.

Keywords: weight, preweaning, postweaning, average daily gain

Introduction

Livestock in Tanzania is an important sector that provides animal protein and income to farmers through selling animal products and by product. According to the Ministry of Livestock and Fisheries (URT, 2024), Tanzania is a home to various livestock species including 37.9 million cattle, 27.6 million goats, 9.4 million sheep and 103.1 million chicken whereby in 2022 the livestock sector grew at 5% and contributed 6.7% to the national GDP.

Goats are life-sustaining to most agro-pastoral and pastoral communities especially

for rendering food security due to their high reproductive capacity and low initial investment. Apart from income sources and animal protein, goats assist as security for the period of scarcity to farmers including women and youths. In most African countries including Tanzania, indigenous goats have special values such as dowry payment and offering sacrifices that cannot be done by other livestock.

The Gogo white goat is an indigenous goat found in the Central part of Tanzania mainly Dodoma region; kept by the Gogo tribe for meat production. Experience from goat keepers in the Central zone shows that they have quality meat

compared to other indigenous goats. The Ujiji goat is an indigenous goat strain found in Ujiji town in the western zone, near Lake Tanganyika. Their main characteristics are twinning ability and being raised for meat production. Both Gogo white and Ujiji goat strains belong to the Small East African (SEA) Goat breed (Nguluma et al., 2022).

Blended goat is a breed developed and stabilized in the late 1960s at Malya Livestock Research Centre in the Lake Victoria zone in Tanzania. It is composed of 30% Boer of South Africa which was meant for meat, 55% Kamorai of Pakistan for providing milk and 15% Tanzania indigenous goat's blood for adapting to harsh environments and farmers conditions. Referable to the importance of goats in rural communities, two goat breed subtypes, Ujiji and Gogowhite, were introduced to Tanzania Livestock Research Institute (TALIRI), Mpwapwa farm. This was done for the purpose of characterization and conservation. The objective of the study was to evaluate the growth performance of Buha and Gogowhite goats in comparison with the Blended goat which is the composite breed managed on the station.

Material and methods

Description of the study area

The experiment was conducted at TALIRI Mpwapwa farm situated at Mpwapwa district which lies between Latitudes 6°00" and 7°30" South of the Equator and between Longitude 35°45" and 37°00" East of Greenwich. The Institute lies at an altitude of about 1,100m above sea level with an average annual rainfall of 660mm and varies greatly in distribution and amount from year to year. The area is semi-arid with an average minimum temperature is 15.50C, the coolest month being August and warmest month being November (30.20C).

Animal management

All the Blended, Ujiji and Gogo white goats were grazed during the day and kept indoors at night. Grazing was done by considering age, sex and breeding groups. All goats were grazed in the paddocks found at the institute for a duration of six hours per day. Grazing was done in areas with improved pastures with major mixtures of

grass (*Chloris gayana*, *Cenchrus ciliaris*, and *Cynodon* spp) improved legumes and shrubs such as *Leucaena* spp as well as local trees and shrubs that included leaflets and pods of *Acacia tortilis*, *Dichrostachys cinerea* and *Grewia* spp. All goats were dewormed using antihelmintics which was given once after three months. External parasites were controlled by spraying using acaricides once per week. All animals were kept in roofed houses and raised floors during the night. Natural controlled mating was used for two seasons including dry and wet.

Kids born were allowed to stay with their mothers for 3-5 days, then were separated and suckled twice a day until weaning which is sixteen weeks. All goats were ear tagged for identification and were grazed separately according to breeding program.

Experimental design and measurements

Data of six successive years from 2012 to 2017 of 376 Blended, 173 Ujiji and 360 Gogowhite goat genotypes were allocated to five treatment groups in a completely randomized design. The data comprised a total of nine hundred and nine (919) kids of both sexes (424 males and 485 females) that were used in the study for performance evaluation. Growth performance traits including Birth Weight (BWT), Weaning Weight (WWT), Six Month Weight (SMWT) and Yearling Weight (YWT) were recorded. Live weight of all kids was measured using the weighing scale

Statistical analysis

Data were analyzed using the General Linear Model Procedures of Statistical Analysis System (SAS., 1999). Analysis of Variance (ANOVA) was applied to evaluate influences of sex, birth type, season of birth, breed and year of birth on the studied traits. The Least-Squares Means (LSM) and Standard Errors (SE) for growth traits in each treatment were analyzed. Least square mean separation was done using Duncan Multiple t- test.

The following model equation was used for statistical analysis:

$$Y_{ijklm} = \mu + B_i + S K_j + B T_j + S B k + Y B m + e_{ijklm}$$

Where:

Y_{ijklm} = The weights and ADG of the n^{th} kid

μ =	Overall mean	value reported by Hyera <i>et al.</i> (2018), Lyatuu <i>et al.</i> (1992) at Kongwa Pasture Research centre in Central part of Tanzania and Das <i>et al.</i> (1996) at Malya Livestock Research centre in Lake zone, this might be due to difference in agroecological zones and management.
Bl =	Effect of the l th breed of the kids	
SKi =	Effect of the i th sex of kid	
BTj =	Effect of the j th kid birth type	
SBk =	Effect of the k th season of birth	
YBm =	Effect of the m th year of birth	
eijklmn =	Residual error	

Result and discussions

The overall least squares mean (LSM) of the birth and weaning weights of the three goat breeds were 2.46 and 9.39kg respectively (Table 1). Blended kids were 3.07kg and 10.73 at birth and weaning weight respectively. The birth weight for Blended goats in the present study is lower than 3.11kg reported by Hyera *et al.* (2018) for Blended goats in Northern part of Tanzania. However, the weaning weight observed in this study was higher than the

Gogo white kids weighing 1.82kg and 8.47kg at birth and weaning respectively, were observed to be heavier than 1.42kg and 7.34kg for Ujiji kids. Birth weights for Gogowhite and Ujiji in the present study are lower than those Pare and Sonjo goats as reported by Hyera *et al.* (2018) in Northern part of Tanzania, this might be due to genetic makeup, climatic factors, seasonal variation and management (Nguluma *et al.*, 2016).

Birth type, sex, breed, the season of birth and year of birth had statistically significant ($P<0.05$) effect on birth and weaning weight.

Table 1: LSM and standard error of birth weight and weaning weight of three genotypes of goats at TALIRI Mwapwa

Classes	No	Birth weight (kg)	No	Weaning weight (kg)
Over all	909	2.46	612	9.39
Genotype				
Blended	376	3.07±0.04a	219	10.73±0.51a
Gogo	360	1.82±0.05b	278	8.47±0.56b
Ujiji	173	1.42±0.05c	115	7.34±0.68c
Birth type				
Single	423	2.37±0.02a	310	10.63±0.32a
Twin	465	2.13±0.02b	302	8.09±0.32b
Sex				
Female	485	2.39 ±0.04a	319	8.87 ±0.52a
Male	424	2.54±0.04b	293	9.94 ±0.54b
Season of birth				
Dry	208	2.63 ±0.05a	106	10.83 ±0.66a
Wet	701	2.41 ±0.04b	506	9.08 ±0.49b
Year of birth				
2012	212	2.12±0.06a	165	8.53±0.69a
2013	64	2.18±0.07a	52	8.38±0.79b
2014	181	2.19 ±0.05b	115	10.46±0.67b
2015	153	1.95 ±0.05ba	102	10.36±0.65b
2016	167	1.97±0.56ba	124	7.47±0.63ba
2017	132	2.23±0.05bc	54	7.88±0.67ba

Means without common superscripts within the column differ significantly at $p<0.05$

Kids born as singles were significantly heavier at birth and weaning than those born as twins. Results for single and twins birth weights in the present study are a bit lower than those (2.53kg and 2.55kg respectively) reported by Hyera *et al.* (2018) in Northern Tanzania. The results are comparable with findings by Zeleke *et al.* (2017), Alula *et al.* (2013). However, the weaning weight in present study for single and twins are higher than those reported by Hyera *et al.* (2018), this might be due to different agroecological zones.

The mean birth weight for male (2.54kg) and female (2.39kg) for the present study are slightly lower than 2.72 and 2.56kg reported by Hyera *et al.* (2018). However, weaning weights are higher than 8.79 and 7.89kg reported by Hyera *et al.* (2018). Male kids were significantly ($P < 0.05$) heavier than female kids both at birth and weaning weight. This finding agrees with the report for various breeds of goats by Hyera *et al.* (2018), Nugroho *et al.* (2018). Blended goats were found to be heavier than other two indigenous goats breeds with 3.07 kg at birth. The higher weight in Blended goat might be due to the composite breed. This result is closely to findings by Hyera *et al.* (2018) who reported 3.11kg for Blended goat in Northern Tanzania. Gogo white kids were heavier than Ujiji kids at birth and weaning weight.

Kids born in dry season were heavier than those born in wet season. This result agrees with Zeleke *et al.* (2017), Debele *et al.* (2011) for Arsi-Bale goats. However, the results contradict with findings by Mustefu *et al.* (2019) where kids born in wet season had higher weight than those born in dry season. Kids born in 2015 and 2016 had lower birth weight compared to other years and those weaned in 2016 and 2017 had lower weights than other years. Variation among the years might be effect of climatic conditions, managerial practices and feed availability whereby there is always adequate feeds for livestock in the wet season than in the dry season. These results concurred with the results of Zeleke *et al.* (2017) on Central highland x Boer crossbred goats.

Mean weight of kids at six -months and at yearling for the three goat breeds are presented in Table 2. Blended goats at six-month and

yearling weighing 13.58kg and 13.97kg respectively, were observed to be heavier than Gogo white and Ujiji goats. On the other hand, Gogo white at six month and yearling weighing 11.47kg and 13.51kg respectively, were heavier than Ujiji goats. These difference in weight might be due to genetic makeup as reported by Nguluma *et al.* (2016) for Small East African Goat of Tanzania. The lower weight for Ujiji goats were also described by Nguluma *et al.*, 2022 in different agro ecological zone of Tanzania. The mean weight in this study are lower than (13.54 ± 0.2 and 19.53 ± 0.38 kg) and (11.2 ± 0.31 and 16.7 ± 0.48 kg) as reported by Belay *et al.* (2015) and Mustefu *et al.* (2019) on six month and yearling weights, respectively.

Birth type and sex had a significant effect ($P < 0.05$) on six-month weight and yearling weight. Single kids were heavier than twins kids at six months and yearling weight. These difference in higher weight for single kids when compared with twin kids were also reported by Das *et al.*, 1996; Deribe and Taye (2013; Deribe *et al.*, 2015 and Hyera *et al.* (2018).

Male kids had higher weights at both six months and yearling weight. The higher weight in males is attributed to male sex hormone secreted from gonads which has an anabolic effect. The difference in sex chromosomes in the position of genes related to growth, physiological characteristics and endocrine variations such as the type and measure of hormone secretion particularly sex hormone result to difference in animal growth (Mohammadi *et al.*, 2010). Moreover, the fast habit of males during suckling and feeding is another reason for higher weight in males (Sapkota *et al.*, 2012). Similar findings were reported by Nugroho *et al.* (2018) and Mustefu *et al.* (2019).

Breed and season of birth had significant effect on six month weights and also the year of birth revealed statistically significant ($P < 0.05$) effects for six-month and yearling weights, respectively.

The mean for pre weaning and post weaning growth rate of three goats were 62.36 and 27.86 gm per day respectively (Table 3). The present study had higher growth rate at pre weaning period for both males and females than (52.9 ± 2.33 and 47.5 ± 2.31 gm per day) respectively

Table 2: Least square means and standard error of six months and yearling weight of three genotypes of goat at TALIRI Mpwapwa

Classes	No	Six- month weight (kg)	No	Yearling weight (kg)
Over all	477	11. 13	335	14.58
Genotype				
Blended	154	13.58 ±0.67a	98	13.97±0.48a
Gogo	251	11.47±0.78b	185	13.51±0.59a
Ujiji	72	10.83 ±0.70c	52	13.15±0.45a
Birth type				
Single	246	12.38±0.31a	176	15.88 ±0.44a
Twin	228	10.37±0.32b	159	13.12 ±0.43b
Sex				
Female	259	11.43±0.77a	190	14.25 ±0.43a
Male	218	12.48±0.78b	145	15.00 ±0.44b
Season of birth				
Dry	79	12.94±0.87a	33	14.80 ±0.71a
Wet	398	10.87 ±0.75b	302	14.55±0.29a
Year of birth				
2012	118	12.05±0.88a	97	14.31±0.53a
2013	49	11.22±0.92a	38	16.51±0.57b
2014	92	12.96 ±0.88a	54	15.46±0.56a
2015	78	14.54 ±0.84ba	62	13.02±0.58bc
2016	113	10.74±0.83b	78	11.22±0.49ba
2017	27	10.23±0.98b	6	10.76±1.44ba

Means without common superscripts within the column differ significantly at $p < 0.05$

as reported by Hyera *et al.* 2018 in Northern Tanzania. However, growth rate from this present study are lower than 67.0 ± 2.26 and 31.5 ± 2.0 gm per day described by Mustaefu *et al.* (2019) and $(78.67 \pm 1.53$ and 37.27 ± 1.85 gm per day) reported by Belay *et al.* (2015) at preweaning and postweaning period respectively. Sex, birth type, breed, year of birth and season had effects on pre weaning growth rate but did not point post-weaning on post weaning growth rates. Male kids had higher average daily gain than their counterparts females at the pre weaning and post weaning periods. This might be attributed by growth superiority of male kids to higher growth rate and the presence of androgen which play a role in growth (Webb *et al.*, 2011). Estrogen hormone has a limited effect on the growth of long bones in females. That might be a reason for small bodies and lighter weights in females (Baneh & Hafezian, 2009). Single kids

had significantly resulted in higher growth pre weaning period though no effect was noted at post weaning period. The difference might be due to the intrauterine environment because of the availability of nutrients to the single kid and more space may facilitate growth. The uterine space and available nutrients shared by more than one kid might be responsible for low birth weight with increasing litter size (Zelege *et al.*, 2017).

Blended goats had higher growth rates followed by Ujiji and Gogowhite goats in ascending order. The higher growth rate for Blended goats was probably due to the composite nature of the breed which is 30% Boer, 55% Kamorai, and 15% Tanzania indigenous goat's blood. The composition was established for large body size, fast growth rate, and sound adaptation to the semi-arid tropical climate. Kids born during dry season had significant

Table 3: Least square mean and standard error of pre weaning and post weaning growth rate of three genotype of goat at TALIRI Mpwapwa

Classes	No	PWGR (g/day)	No	POWGR (g/day)
Overall	613	62.36	478	27.86
Genotype				
Blended	219	66.26 ± 2.73a	154	53.52 ± 9.89a
Gogo	279	53.96 ± 3.66b	252	43.56 ± 10.27ba
Ujiji	115	61.51 ± 2.98c	72	48.20 ± 11.41a
Birth type				
Single	300	72.40 ± 1.72a	247	32.07 ± 4.10a
Twin	302	55.46 ± 1.74b	228	29.35 ± 4.22a
Sex				
Male	293	66.36 ± 2.89a	218	30.52 ± 9.95a
Female	320	58.69 ± 2.78b	260	24.71 ± 10.12a
Season of birth				
Dry	106	72.83 ± .53a	79	38.18 ± 11.26a
Wet	507	60.18 ± .61b	399	25.84 ± 9.68b
Year of birth				
2012	165	60.22 ± 3.67a	118	38.72 ± 11.37a
2013	52	56.88 ± 4.23b	49	42.87 ± 11.97a
2014	115	68.94 ± 3.58b	92	49.59 ± 11.35a
2015	102	76.82 ± 3.47b	78	65.66 ± 10.85ba
2016	125	50.23 ± 3.38c	114	52.92 ± 10.79ba
2017	54	50.37 ± 3.57c	27	40.81 ± 12.65a

PWGR – pre-weaning growth rate, POWGR- post-weaning growth rate

Means without common superscripts within the column differ significantly at $p < 0.05$

difference higher growth rates both at the pre-weaning and postweaning periods than those born in the wet season.

Conclusion

Birth type, sex, genotype, season and year of birth had significant effects on birth weight, weaning weight and pre-weaning growth rates. Kids of Blended goats outperformed Gogowhite and Buha ones in terms of body weight at birth, weaning, six months and at yearling ages as well as on average daily gain before and after weaning respectively. Gogowhite kids ranked second in performance after Blended kids. Variations in growth performance of Blended goats against Gogo white and Ujiji goat strains implies that genetic improvement that may be required for these Small East African (SEA) goat strains particularly if higher meat yields

and faster market weights are desired.

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