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Comparative performance of Malya goats at different agro-ecological zones of Tanzania

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Abstract

Aim: This study provides preliminary insights into the performance of Malya goats under semi-intensive management across three agro-ecological zones. The zones cover the Central, Northern, and Lake.

Methods: Performance records of 234 kids born from 2020 to 2022 under on-station management were used. Zonal differences in birth weights, sexes, pre-weaning average daily weight gains (ADGs), weaning weights and mortalities were compared. Data were analysed using R-Studio. Mean birth weights in the Central, Lake, and Northern zones were 3.15, 2.50, and 2.92 kg, respectively, while mean weaning weights were 11.44, 13.94, and 10.62 kg.

Results: Mean ADG was 74.26, 101.25, and 68.59 g/day for the Central, Lake, and Northern zones, respectively. Goats in the Northern zone had higher birth weight than those in the Lake zone ($p=0.002$), whereas goats in the Lake zone had higher weaning weight and ADG than those in the Central and Northern zones ($p=0.000$). No differences were observed between the Central and Northern zones for birth weight ($p=0.144$), weaning weight ($p=0.312$), or ADG ($p=0.541$). Sex had no effect on birth weight ($p=0.689$), weaning weight ($p=0.448$), or ADG ($p=0.287$), although the interaction between zone and sex significantly affected birth weight. Goats in the Central and Northern zones had higher survival odds than those in the Lake zone (OR=4.0 and 2.6, respectively). Birth rates differed significantly across years but not between zones.

Conclusion: The results highlight the importance of proper management to reduce agro-ecological effects on goat performance. The study provides knowledge on factors affecting variation in goat performance traits and management.

Keywords: *Agro-ecology, Malya goat, Pre weaning growth, Survival odd*

INTRODUCTION

Tanzania has a goat population of 27.6 million which 98% being the local indigenous goats. Tanzania depends largely on smallholder farming systems which are characterized by low-input, extensive management practices (Mussa *et al.*, 2026). These indigenous goats are distributed in almost all agro-ecological zones in the country, demonstrating high adaptation to diverse climatic conditions. They are renowned for their ability to thrive in harsh environments due to natural selection, which has endowed them with high resistance to heat, drought and endemic diseases. However, these goats have low productivity of meat and milk. Their growth rates are slow and they have a long maturity with small mature body size. Factors such as low genetic potential, low plane of nutrition, poor managerial practices and unorganized marketing system have been contributing to the low productivity of these goats. Furthermore, smallholder goat farmers encounter a wide range of systemic challenges that limit their ability to participate in formal markets, despite their important socio-economic role. These challenges arise from intertwined socio-economic, cultural, and infrastructural factors that constrain both their market engagement and overall productivity (Mussa *et al.*, 2026).

Breeding initiatives to increase goat meat and milk production in Tanzania was initiated in 1930s focusing on upgrading the local indigenous goats by crossbreeding them with exotic breeds (Kifaro *et al.*, 2008). The main purpose of crossbreeding these goats was to enhance their overall productivity, profitability and adaptability by combining their hardiness and environmental resilience traits with the superior, high-performance traits of exotic or improved breeds. This strategic approach was designed to leverage hybrid vigor (heterosis) and produce crossbred progeny that exhibit superior characteristics such as faster growth rates, higher fertility, better survival rates and increased yields of meat and milk.

During 1950s, the breeding program on Small East African (SEA) breed and its crosses with Boer and Kamori breeds led to the creation of a composite dual-purpose breed, popularly known as the 'Malya (or Blended) goat', which was then stabilized in the late 1960s at Malya Livestock Research Centre in Lake Victoria zone (Hyera *et al.*, 2024). The Malya goat has combined high-performance traits such as large body size, high twinning, fast growth and good carcass quality of Boer goat; milk production potential from the Kamorai breed; and tolerance characteristics provided by the indigenous SEA goat, allowing it to thrive in local semi-arid tropical climates. It has been recognized for its superior performance in weight gain and milk production compared to indigenous, non-improved goats, making it a valuable resource for crossbreeding and improving local goat populations in rural areas (Hyera *et al.*, 2018).

Following their development, Malya goats were distributed to various research centres across different agro-ecological zones to evaluate their performance under diverse environmental conditions, including on-station, on-farm, and in semi-arid areas. However, since the introduction of Malya goats at different agroecological zones, the information regarding their performance at

these zones has historically been limited. Therefore, the purpose of this preliminary study was to compare the variation in performance traits of Malya goat kids managed under on-station management system at three different agro-ecological zones of Tanzania mainland.

MATERIALS AND METHODS

Description of the study area

In the central zone of Tanzania, Malya goats were managed at TALIRI Mpwapwa farm situated in the 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 farm is located at an altitude of about 1,100 meters above sea level with an average annual rainfall of 660 mm, which varies greatly in distribution and amount from year to year. The zone is semi-arid with average temperature of 15.5 °C, the coolest month being August and the warmest month is November (30.2 °C).

In the northern zone, these goats were kept at TALIRI West Kilimanjaro farm, which is situated at 3°S latitude and 37°E longitude, at an altitude of approximately 1270 meters above sea level. The farm falls in the area, which is characterized by erratic rainfall ranging between 450 - 700 mm. The long rainy season extends from Late-March to May; whereas short rainy season occurs from November to December. Cooler dry season begins throughout June to October and is characterized by prolonged coldest and dry weather with recurrent cloudiness, slight fog, tiny snowfall and strong winds blowing at speed up to 25 km/hr. The hot season lasts on average from January to Mid-March. The area experiences temperatures ranging between 11.7 °C - 27.8 °C.

In Lake Victoria zone, these goats were reared at TALIRI Mabuki farm, which is located between latitudes 2° 58' 84" South and longitudes 33° 58' 12" East, at an altitude of about 1174 meters above sea level. Temperatures range between 25°C and 35°C and rainfall ranges from 600 to 800 mm per annum. The rainfall pattern is bimodal, with short rains starting in November and ending in February, and long rains starting in mid-March and ending in May. Also the area is characterized by grasslands dominated by diverse natural grass species and sparse tree bushes of Acacia and Combretum spp. The soils are mainly mbuga soils/black cotton soils with some clay soils. It lies within the dry savanna areas in northwestern Tanzania.

Animal management

In all three agro-ecological zones goats were kept under similar semi-intensive management by allowing them to graze during the day and keeping them indoors at night so as to balance production with available resources. Herding was strategically based on organizing animals into distinct groups by age, sex and breeding status to manage herd dynamics, resources, and reproduction effectively. This structured approach was essential for optimizing grazing efficiency, protecting vulnerable animals, and controlling breeding. The flocks were grazed in the farm grazing land for 6 hours per day from 9:00 am to 15:00 pm. This schedule generally allowed the animals to consume the majority of their daily forage requirements while avoiding the early

morning dew, which could carry parasites and, depending on the season, allowed for resting during the hottest part of the afternoon. Grazing were in paddocks of 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 highly valued, nutrient-rich browse species such as *Acacia tortilis*, *Dichrostachys cinerea* and *Grewia* spp. All goats were derwormed using antihelmintics on a set schedule of once after every three months. External parasites were controlled by spraying using acaricides once per week. All animals were kept in roofed houses with raised floors at night. Natural controlled (seasonal) mating was used.

Newborn kids were kept with their mothers for 3 - 5 days and after this period they were isolated from the dam, and suckling was restricted to twice daily to manage milk intake and the transition away from full-time nursing to a diet of solid food until weaning at 4 months. All goats were ear tagged for identification and were herded separately according to a breeding plan.

Data collection and statistical analysis

Performance data from 2020 to 2022 of a total of 234 Malya goat kids were involved. Performance attributes recorded were birth weight, weaning weight and mortalities of kids s. Live weight of all kids was taken using the weighing scale. Factorial design was employed in the study, this design was chosen simply because more than one factors affected the growth of kids. Also the design is cost effective as information on various factors can be obtained in the same number of experimental units (animals), space and time without compromising on accurate.

Data were analyzed using the R-Studio. The difference between zones were examined using a two-way analysis of variance (ANOVA) to assess the main and interaction effects of the independent variable.

The influences of birth year (2020–2022) and agro ecological zone (Central, Lake, and Northern) on birth rates were analysed using a Poisson regression model. The year 2020 and the Central zone were treated as reference categories. Model parameters were estimated using maximum likelihood, and statistical significance was assessed at the 5% level (p -values <0.05).

RESULTS

Mean with standard deviation for birth weight, weaning weight, and pre- weaning average daily gain of Malya goat kids across different agro-ecological zones are presented in Table 1. The two-way ANOVA showed that there was a significant difference in birth weight ($p=0.000$, $F=22.73$), weaning weight ($p=0.000$, $F=26.22$), and ADG ($p=0.000$, $F=38.87$) between zones. Pairwise comparisons showed that goats in the Central zone had significantly higher birth weights than goats in the Lake zone ($p=0.000$), and goats from the Northern zone had significantly higher birth weights than those from the Lake zone ($p=0.002$). Moreover, goats in the Lake zone had significantly higher weaning weight and ADG than goats in the Central and Northern zones

($p=0.000$). In addition, there was no difference in birth weight ($p=0.144$), weaning weight ($p=0.312$), and ADG ($p=0.541$) between goats of the Central and Northern zones.

Table 1: Birth weight and pre-weaning growth of Malya goat kids reared on-station at three agro-ecological zones of Tanzania

Zone	Variable	n	Mean	SD	Min	Max
Central	Birth weight (kg)	97	3.15	0.86	1.50	5.60
	Weaning weight (kg)	89	11.44	3.02	6.00	17.73
	Pre-weaning ADG (g)	89	74.26	25.11	27.68	120.
Lake	Birth weight (kg)	85	2.50	0.45	2.00	4.00
	Weaning weight (kg)	63	13.94	1.32	11.00	16.50
	Pre-weaning ADG (g)	63	101.25	11.53	75.89	120.53
Northern	Birth weight (kg)	52	2.92	0.59	1.77	4.20
	Weaning weight (kg)	35	10.62	2.67	6.30	14.86
	Pre-weaning ADG (g)	35	68.59	23.38	28.39	106.78

N = number of observations, SD = standard deviation

Means with standard deviation for birth weight, weaning weight, and pre-weaning ADG of male and female goat kids are illustrated in Table 2. These results also showed that sex had no effect on the birth weight ($p=0.689$), weaning weight ($p=0.448$), and ADG ($p=0.287$). But the interaction of zone x sex had a pronounced influence on birth weight. Moreover, the interaction of zone x sex was not significant on weaning weight and ADG.

Table 2: Birth and pre-weaning weight of male and female Malya goat kids reared on-station at three agro-ecological zones of Tanzania

Sex	Variable	n	Mean	SD	Min	Max
Male	Birth weight (kg)	127	2.85	0.71	1.50	5.60
	Weaning weight (kg)	98	11.91	2.85	6.10	16.50
	Pre-weaning ADG (g)	98	80.37	25.88	28.39	120.53
Female	Birth weight (kg)	107	2.88	0.77	1.50	5.30
	Weaning weight (kg)	89	12.36	2.78	6.00	17.73
	Pre-weaning ADG (g)	89	84.41	24.20	27.68	120.62

n = number of observations, SD = standard deviation

Further, based on the findings in the logistic regression analysis, the location of the goat (zone) was the only factor that had a significant effect on the odds of survival of the goats from birth to 24 weeks (Table 3). Goats from the Central zone had significantly higher odds of survival than those from the Northern and Lake zones (OR=4.0). On the other hand, although, goats from the Northern zone had higher odds of survival (OR=2.6) compared to goats from the Lake zone, the difference was not statistically significant. As well, there was no significant difference in odds of survival between goats of the Central and Northern zones. In addition, the effects of birth type, sex, birth weight and weaning weight on the odds of survival of the goats were not significant.

Table 3: Logistic regression analysis of factors influencing survival of kid and weaner goats from central, lake and northern zone of Tanzania

Variable	Level	OR [95% CI]	p-value
Birth type	Single	Ref.	0.328
	Twin	1.42 [0.70 – 2.87]	
Sex	Male	Ref.	0.235
	Female	1.50 [0.77 – 2.95]	
Zone	Lake	Ref.	0.004
	Central	4.02 [1.55 – 10.41]	
	Northern	2.62 [0.87 – 7.87]	
Birth weight		0.86 [0.51 – 1.47]	0.592
Weaning weight		1.12 [0.96 – 1.30]	0.135

OR = Odds Ratio, CI = confidence interval

Based on the Poisson regression results, the analysis indicated that birth counts varied significantly across years, but did not show significant differences between zones (Table 4). Comparison between years showed that births in 2021 were significantly higher, showing a 60% increase compared to 2020 ($\beta = 0.470, p=0.009$). Further, births in 2022 were approximately 18% lower than in 2020 ($\beta = -0.198, p=0.346$), although this decrease was not statistically significant. On the other hand, compared to the Central zone, the Lake zone had a non-significant 13% higher number of births ($\beta = 0.118, p=0.521$), while the Northern zone had a non-significant 7% lower birth count ($\beta = -0.074, p=0.700$).

Table 4: Poisson regression analysis on the variation in birth rates by year and zone

Variable	β (Estimate)	SE	IRR (e^{β})	95% CI for IRR	p-value
Birth Year					
2021 vs 2020	0.470	0.180	1.60	1.12 – 2.28	0.009
2022 vs 2020	-0.198	0.211	0.82	0.54 – 1.25	0.346
Zone					
Lake vs Central	0.118	0.184	1.13	0.79 – 1.62	0.521
Northern vs Central	-0.074	0.193	0.93	0.64 – 1.36	0.700
Intercept	2.796	0.179	16.38	—	<0.001

β = regression coefficient, SE= standard error, IRR=Incidence rate ratio, CI = confidence interval

DISCUSSION

The Lake zone generally reported lower birth weight, and higher weaning weight and ADG in Malaya goats compared to Central and Northern zones. Despite potential for lower birth weight the Lake zone's environment, combined with on-station management generally provided a favorable environment for growth compared to other zones. The observed differences in growth

performance can be largely attributed to variations in agro-ecological conditions and nutritional (grazing or feeding) management across the zones. The results suggest that selecting for higher birth weight and monitoring maternal, breed, and environmental factors is essential in tropical on-station settings.

The finding that the interaction of zone x sex was not significant on weaning weight and ADG implies that the impact of the agro-ecological zone (representing environmental stressors like nutrition or climate) on growth was consistent across both male and female animals. In other words, while the zone may affect how fast an animal grows, it did not do so differently for males versus females in this study. In some studies, while the zone x sex interaction is not significant, the main effects of zone (due to environmental stress) and sex (due to hormonal differences) can still be significant on their own (Das *et al.*, 1996; Hyera *et al.*, 2018; Hyera *et al.*, 2024; Magonka *et al.*, 2024).

The findings of the logistic regression analysis suggests that environmental or management factors associated with the specific geographical zone, such as climate, vegetation, disease prevalence, or husbandry practices were the primary drivers of survival rates, overriding individual characteristics such as birth type, sex, birth weight, and weaning weight. In the previous work by Hagan *et al.* (2014) birth type, parity of does and year of birth affected survivability; whereas, season of birth and sex had no effect. In many other studies, birth type, sex, birth weight, and weaning weight are often significant indicators of survival (Baiden, 2007; Chauhan *et al.*, 2019; Dessie and Tilahun, 2021). In general, these findings are often context-dependent, with factors like management practices, maternal health, nutrition, and season of birth often overriding the effects of individual kid traits.

The results regarding birth counts advocate that temporal factors (year/time period) were more predictive of the birth counts than spatial factors (zone or geographical location). This suggests that while the total number of births shifted over time, the geographical distribution of those births remained relatively consistent. The observed variation in birth counts across years is attributed to factors like seasonality in disease and climate variations.

CONCLUSION

Comparison indicated considerable variations in birth weight, growth and survivability of Malya goat kids across different agro-ecological zones. The Central and Northern zones were superior to Lake zone in birth weight; whereas, Lake zone was superior in weaning weight and ADG. As well, the Central zone had outperformed other zones in survivability of Malya goats. Temporal factors were more predictive of birth counts than spatial factors. The results emphasize the importance of optimal management practices to mitigate the negative impact of the agro-ecological conditions on goat performance. The ultimate goal is to enhance production by optimizing breeding, nutrition, health, and housing practices. The study construct on knowledge of factors influencing variation in performance traits and management of goats. A further study

should be conducted to examine the influence of seasons on the performance of Malya goats across different agro-ecological zones.

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CONFLICT OF INTEREST

The authors declare no conflict of interest.

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AUTHOR CONTRIBUTIONS

All authors contributed equally to this work.

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