

BISHOP STUART UNIVERSITY



**ASSESSMENT OF THE GROWTH PERFORMANCE OF INDIGENOUS
MUBENDE AND KIGEZI GOAT KIDS**

BY

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**A RESEARCH DISSERTATION SUBMITTED TO THE DIRECTORATE OF
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STUART UNIVERSITY**

SEPTEMBER, 2025

DECLARATION

I, Kyokwijuka Peter, hereby declare that this research dissertation, titled “Assessment of growth performance of indigenous Mubende and Kigezi goat kids”, is my original work and it has never been submitted for any award.

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APPROVAL

This is to certify that this research dissertation, titled “Assessment of the growth performance of indigenous Mubende and Kigezi goat kids”, has been done under my supervision and it is now ready for submission for examination.

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LIST OF ACRONYMS

CANDISC	Canonical Discriminant Analysis
CCPP	Contagious Caprine Pleuropneumonia
CRD	Completely Randomized Design
MAAIF	Ministry of Agriculture, Animal Industry and Fisheries
NARO	National Agricultural Organization
SAS	Statistical Analysis System
SNP	Single Nucleotide Polymorphism
SSA	Sub-Saharan Africa
THI	Temperature–Humidity Index
TMR	Total Mixed Ration
UBOS	Uganda Bureau of Statistics

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ABSTRACT

The study, “Assessment of Growth Performance of Indigenous Mubende and Kigezi Goat Kids,” explored the comparative growth dynamics of these breeds under controlled conditions at Ruhengyere Field Station, Uganda. The main objective was to evaluate their growth rates from birth to sexual maturity. Specific objectives were: To determine the growth rate of indigenous Mubende and Kigezi goat kids, and to assess the factors influencing the growth performance of indigenous Mubende and Kigezi goat kids from birth to sexual maturity. The study employed a completely randomized design (CRD), monitoring 94 goat kids under uniform feeding and management. Data on weight, body measurements (Body length (BL), height at withers (HW), chest girth (CG), chest width (CW), and scrotal circumference (SC), Live body weight (BW), pre-weaning daily gain (DWG), weaning weight (WW), and post-weaning average daily gain (ADG) and reproductive traits (age at 1st sexual maturity (males & females)) were analyzed using Canonical Discriminant Analysis (CANDISC) and Statistical Analysis System (SAS). Mubende kids exhibited a higher pre-weaning daily weight gain, peaking at 57.14 g/day at 8 weeks, while Kigezi kids had a slightly lower peak of 53.57 g/day at the same age. At weaning (8 weeks), Mubende kids reached 9.0 kg, whereas Kigezi kids weighed 8.5 kg. Post-weaning, Mubende kids maintained a relatively stable 42.86 g/day weight gain until 24 weeks before experiencing a decline, while Kigezi kids sustained a 35.71 g/day gain up to 34 weeks before gradually decreasing. Additionally, Mubende goats demonstrated better drought and heat tolerance, while Kigezi goats showed resilience in disease-prone, cooler climates, according to quantitative results from goat farmers. The study revealed that Mubende goat kids exhibited superior growth rates and earlier sexual maturity compared to Kigezi kids, with better drought/heat tolerance, while Kigezi goats demonstrated resilience in disease-prone, cooler climates. To enhance productivity, tailored feeding and genetic research are advised to optimize breed-specific management.

CHAPTER ONE

INTRODUCTION

1.1 Background of the Study

Globally, livestock production is a crucial sector for food security, livelihoods, and economic growth. According to the Food and Agriculture Organization (FAO, 2020), livestock contributes approximately 40% of the global agricultural GDP and provides sustenance for over 1.3 billion people. Among livestock, small ruminants, particularly goats, have gained recognition for their adaptability to diverse climates and ability to thrive under resource-constrained settings (Devendra, 2016). These traits make goats pivotal for enhancing food production and alleviating poverty in rural areas. As the global demand for goat meat and milk continues to rise, there is increasing interest in improving goat breeds to meet production demands sustainably (Kumar *et al.*, 2021).

According to the Food and Agriculture Organization, there are over one billion goats worldwide, with approximately 94% found in developing nations (FAO, 2020). These animals contribute significantly to food security, income generation, and cultural practices, especially in regions with harsh climates and limited agricultural resources. In developed countries, research into goat breeds has advanced significantly, focusing on improving production traits such as milk yield, growth rates, and disease resistance. Studies such as those by Collins *et al.* (2018) highlight that indigenous breeds, although often overlooked, possess unique traits such as resistance to diseases and the ability to thrive in marginal environments. This calls for more focused research and development initiatives aimed at optimizing the productivity of these breeds globally, while maintaining their genetic diversity.

In Africa, the livestock sector accounts for a substantial share of agricultural GDP, supporting an estimated 60% of rural households (AU-IBAR, 2019). Goats, with a population exceeding

400 million, are integral to the socio-economic fabric, particularly in arid and semi-arid regions (FAO, 2019) of many African communities, providing meat, milk, and skins while serving as a source of financial security. Indigenous goat breeds dominate the landscape due to their resistance to diseases and harsh environments (Melesse *et al.*, 2020). However, despite their importance, indigenous goats are often under-researched and underutilized in formal breeding programs compared to their exotic counterparts. The productivity of African goats remains suboptimal due to limited genetic improvement programs and inadequate research focused on indigenous breeds (Tadesse *et al.*, 2021).

East Africa holds a significant share of the continent's goat population, with countries like Kenya, Tanzania, and Uganda leading in goat production (ILRI, 2021). Goats serve as a primary source of income, meat, and milk for smallholder farmers. Indigenous breeds, such as the Small East African (SEA) goat, are widely reared due to their adaptability and hardiness (Mburu *et al.*, 2019). Nonetheless, production challenges, including low growth rates, delayed sexual maturity, and susceptibility to diseases, necessitate targeted research and breeding programs to enhance their productivity. Productivity levels for meat, and milk, and reproductive performance are generally lower compared to those of exotic breeds, as highlighted by Gichure *et al.* (2020). Research has primarily focused on cross-breeding programs to enhance productivity, often at the expense of indigenous genetic traits. This has led to calls for more studies on the comparative performance of indigenous breeds to inform breeding programs that maintain genetic diversity while improving productivity. By focusing on Mubende and Kigezi goats, this study contributes to this critical gap in the literature and provides insights into the potential of indigenous breeds in the region.

In Uganda, the goat population stands at approximately 15 million, with indigenous breeds constituting the majority (UBOS, 2022). Goats play a significant role in rural and peri-urban

livelihoods of many Ugandans, contributing to food security, household income, and social capital. Among the indigenous breeds, Mubende, Kigezi, and the Small East African goats are majority (Oluka *et al.*, 2018a) and are highly valued for their adaptability and resilience to local environmental conditions. The Mubende and Kigezi breeds are particularly valued for their meat quality and adaptability to varied agro-ecological zones. However, limited empirical studies have evaluated their growth performance, weight at maturity, and sexual maturity compared to the SEA goats, leaving critical knowledge gaps.

Previous research highlights variations in growth performance among indigenous goat breeds. Studies by Sacke and Trail (1996) and Oluka (2006) provide baseline data, but contemporary research on growth metrics is limited. Recent studies, like that of Mukiibi *et al.* (2019), emphasize the need to assess growth rates from birth to maturity to inform breeding programs. Sexual maturity is critical as it directly impacts reproductive efficiency and productivity. Growth traits, coupled with environmental and genetic factors, are pivotal for optimizing goat production.

Understanding growth patterns from birth to maturity provides a comprehensive view of a breed's productivity potential. Birth-to-maturity studies are crucial for identifying optimal management practices and feeding regimens (Nyangaga *et al.*, 2020). Moreover, defining sexual maturity aids in improving reproductive performance, ultimately enhancing herd productivity. Existing studies often lack a systematic approach to linking growth performance with maturity traits, highlighting the need for focused research. Genetic and environmental factors significantly influence growth and reproductive traits in goats. Mubende and Kigezi goats, being indigenous, are well-suited to Uganda's diverse agro-climatic conditions. However, environmental stressors, such as feed scarcity and disease prevalence, impact their productivity (Mugisha *et al.*, 2021). Therefore, this study sought to assess the growth

performances of indigenous Mubende and Kigezi goat kids from birth to sexual maturity in Ruhengyere Field Station.

1.2 Problem Statement

Indigenous goat breeds in Uganda, such as Mubende and Kigezi goats, are vital to rural livelihoods, food security, and economic development. These breeds are classified based on body size parameters and coat colour, Mubende goats are primarily found in the western savannah grasslands, while Kigezi goats are found in highland regions. Despite their importance, the growth performance and productivity of these goat breeds remain suboptimal, and are influenced by genetic, environmental, and management factors (Oluka *et al.*, 2018). While the Food and Agriculture Organization (FAO, 2020) reports average adult body weights of 37 kg for Mubende goats and 34 kg for Kigezi goats, field observations often reveal significant disparities. These variations may be attributed to differences in management systems, such as tethering and free-range grazing. Free-range grazing allows for greater forage access than tethering and improves growth rates (Mugisha *et al.*, 2021). The limited research on growth performance metrics, including growth rates, mature weights, and the onset of sexual maturity for these breeds, hinders the development of effective breeding and management programs. Existing studies, such as those by Oluka (2006) and Mukiibi *et al.* (2019), provide baseline data but fail to systematically link growth performance to environmental and genetic factors. Additionally, while crossbreeding programs have been prioritized to enhance productivity, they often neglect the unique adaptive traits of indigenous breeds, risking the loss of genetic diversity (Gichure *et al.*, 2020).

In Uganda, goats contribute approximately 16% of the livestock sector's value, with an estimated population of 15 million, predominantly indigenous breeds (UBOS, 2022). However, their productivity remains below potential, and this is exacerbated by challenges such as feed

scarcity and disease prevalence. Mubende and Kigezi goats are valued for their meat quality and adaptability to local conditions but lack comprehensive data on growth traits, which are critical for optimizing production (Mburu *et al.*, 2019). These gaps limit farmers' ability to set market-oriented growth and body size targets, thus affecting their economic returns. Therefore, this study addresses these gaps by systematically evaluating the growth performance of Mubende and Kigezi goat kids from birth to sexual maturity, focusing on growth rates, environmental influences, and comparative analysis.

1.3 Objectives of the Study

1.3.1 Main Objective

The main objective of this study was to enhance the productivity of Mubende and Kigezi indigenous goats by improving the growth rate of goat kids.

1.3.2 Specific objectives

1. To determine the growth rate of indigenous Mubende and Kigezi goat kids from birth to sexual maturity.
2. To assess the factors influencing the growth performance of indigenous Mubende and Kigezi goats in Ruhengyere Field Station.

1.4 Research Hypotheses

H₀ There are no significant difference in the growth rates of indigenous Mubende and Kigezi goat kids from birth to sexual maturity.

H_A : There is no significant difference in growth performance of indigenous Mubende and Kigezi goats from birth to sexual maturity.

1.5 Significance of the Study

This study findings may be of great benefit to several groups of people including the following; Students may find it useful as a guide to them on making future research projects as guidance on what this study found out. Students may also build from this research to make more research into the goat breeds.

The findings of this research may help farmers to make a choice among the breeds when planning to rear goats.

1.6 Scope of the Study

The experiment observed the difference in the growth performance of the two breeds of goat kids. The study selection criteria served as the foundation for the choice of indigenous goat breeds from Ruhengyere Field Station. Based on the inclusion/exclusion criteria of the study, 125 indigenous goats were chosen at random.

CHAPTER TWO

LITERATURE REVIEW

2.1 Growth rates of Indigenous Mubende and Kigezi Goats

Globally, goat productivity has gained significant attention due to its role in ensuring food security and improving rural livelihoods, especially in resource-constrained regions. Research conducted by Collins *et al.* (2018) in diverse agro-ecological zones globally analyzed growth performance metrics among indigenous goat breeds. The study, which included data from tropical, arid, and temperate zones, reported that growth rates varied widely, with tropical breeds such as Boer goats achieving an average daily weight gain of 120-200 grams, significantly higher than indigenous breeds in arid zones, which averaged 50-100 grams per day. The research attributed these differences to genetic factors and environmental stressors, including feed availability and disease prevalence. Importantly, the study emphasized the resilience of indigenous goats in marginal environments, with breeds such as the Red Sokoto in West Africa demonstrating notable adaptability despite lower growth performance compared to exotic breeds. Collins *et al.* (2018) concluded that improving growth rates in indigenous breeds requires targeted interventions such as selective breeding programs and nutritional management tailored to specific agro-ecological contexts.

A comprehensive meta-analysis by Kumar *et al.* (2021) examined growth performance traits across goat breeds in diverse ecological zones, focusing on daily weight gain, mature body weight, and environmental adaptability. The study analyzed data from over 20 countries, including India, Brazil, and Ethiopia, comparing tropical and semi-arid goat populations. Kumar *et al.* (2021) reported that goats in semi-arid zones exhibited slower growth rates (50-80 grams per day) due to limited forage resources, while those in temperate zones demonstrated higher growth rates (150-250 grams per day), attributed to better feed quality and veterinary care. Moreover, indigenous breeds like the Black Bengal in India and the Nubian goats in

Sudan showed lower growth rates than their exotic counterparts but excelled in disease resistance and adaptability. The authors highlighted the importance of integrating indigenous and exotic traits to enhance productivity while maintaining genetic diversity. Additionally, the study stressed the need for systematic evaluation of growth parameters from birth to maturity to optimize breeding and management practices.

In Asia, Devendra and Burns (2018) explored the growth performance of indigenous goat breeds, focusing on the tropical and subtropical agro-ecological zones. The research covered breeds like the Jamunapari in India and the Kanni Adu in southern Asia, highlighting their adaptability to hot and humid conditions. The study reported that the average daily weight gain of the Jamunapari ranged between 100 and 150 grams under optimal management conditions, while the Kanni Adu recorded slightly lower gains at 80-120 grams due to feed quality variability in smallholder systems. These breeds demonstrated resilience to diseases and heat stress, traits attributed to their genetic makeup. However, they noted that poor feeding practices and limited veterinary care in smallholder systems hindered achieving their growth potential. Devendra and Burns (2018) emphasized the need for selective breeding and improved nutritional strategies to optimize growth rates.

In South America, Delgado *et al.* (2019) evaluated the growth performance of Criollo goats in the semi-arid agro-ecological zones of northern Mexico. The study observed that the Criollo breed exhibited an average daily weight gain of 70-110 grams, significantly influenced by seasonal feed availability and water scarcity. Criollo goats, known for their adaptability to arid conditions, demonstrated lower growth rates compared to exotic breeds such as Boer goats. However, their ability to survive and reproduce in harsh climates made them valuable for sustainable livestock production in the region. Delgado *et al.* (2021) reported that targeted

nutritional supplementation during critical growth phases could significantly enhance growth rates.

In Ghana, Teye and Awuma (2018) evaluated the growth performance of West African Dwarf goats across three agro-ecological zones: the coastal savannah, forest, and transitional zones. The research assessed daily weight gain, weaning weights, and mature weights for 120 goats under semi-intensive and extensive systems. Results indicated that goats in the forest zone exhibited the highest average daily weight gain of 85 grams, followed by the transitional zone at 75 grams, and the coastal savannah at 60 grams. The differences were attributed to variations in forage availability and nutritional quality, which were highest in the forest zone. Weaning weights also showed significant disparities, ranging from 6.5 kg in the coastal savannah to 8.4 kg in the forest zone. Teye and Awuma (2018) emphasized the role of environmental factors and the adaptability of West African Dwarf goats in mitigating the challenges posed by resource limitations.

Ncube *et al.* (2019) conducted a comparative study on the growth traits of indigenous Tswana goats in Botswana across arid, semi-arid, and sub-humid agro-ecological zones. The study evaluated 150 goats under extensive management conditions, measuring daily weight gain, body length, and mature weights. Goats in the sub-humid zones achieved the highest daily weight gain at 90 grams, compared to 65 grams in semi-arid zones and 50 grams in arid zones. Mature body weights were also higher in the sub-humid zones, averaging 35 kg, versus 28 kg in the arid zones. Ncube *et al.* (2019) concluded that genetic factors and environmental conditions significantly influence growth traits.

Melesse *et al.* (2020) examined the growth performance of indigenous goats in semi-arid regions of Ethiopia, focusing on breeds such as the Abergelle and Woyto-Guji goats. The study revealed significant variability in growth rates, with daily weight gain ranging from 50 to 80

grams under traditional management systems. The researchers attributed these low growth rates to the harsh semi-arid climate, characterized by prolonged droughts, limited forage availability, and poor water quality. Despite these constraints, the indigenous breeds demonstrated remarkable resilience, maintaining productivity under resource-scarce conditions. Melesse *et al.* (2020) highlighted that targeted nutritional interventions, such as supplementary feeding during dry seasons, improved growth rates by up to 30%. The study emphasized the importance of adopting context-specific management practices to enhance the productivity of indigenous goats while preserving their genetic traits suited to semi-arid agro-ecological zones.

In Kenya, Mburu *et al.* (2019) assessed the growth rates of Small East African (SEA) goats and crossbreeds in Kenya's semi-arid zones, focusing on daily weight gain and mature body weight. Data from 150 goats showed that indigenous SEA goats achieved an average daily weight gain of 70 grams, significantly lower than crossbreeds, which gained 120 grams per day. The study attributed these differences to genetic factors and management systems, with crossbreeds benefiting from improved feeding and veterinary care. However, SEA goats outperformed crossbreeds in disease resistance and adaptability to harsh climatic conditions. Mburu *et al.* (2019), in their conclusions, emphasized the importance of maintaining genetic diversity through targeted breeding programs while integrating management practices to enhance growth performance.

Mukiibi *et al.* (2019) examined the growth performance of indigenous Mubende and Kigezi goats across three agro-ecological zones in Uganda: the Western Savannah Grasslands, Kigezi Highlands, and Lake Victoria Crescent. The study recorded growth rates from birth to six months, revealing significant variations based on breed and location. In the Western Savannah Grasslands, Mubende goats exhibited the highest growth rates, with an average daily weight gain of 90 grams, benefiting from abundant, high-quality pastures, while Kigezi goats gained

80 grams per day in the same region. In the Kigezi Highlands, where feed resources were relatively scarce, Mubende goats grew at 78 grams per day, slightly outperforming Kigezi goats, which gained 72 grams per day due to their natural adaptation to the highland environment.

In the Lake Victoria Crescent, where the climate is humid, Mubende goats recorded an average daily weight gain of 86 grams, whereas Kigezi goats grew at a slower rate of 74 grams per day, likely due to their adaptation to cooler, highland climates rather than humid lowland conditions. Mukiibi *et al.*, (2019) concluded that Mubende goats exhibited superior growth rates across all zones, especially in the Western Savannah Grasslands, while Kigezi goats showed consistent but slightly lower growth across different environments. The study emphasized the importance of selective breeding and improved feeding practices to enhance growth performance, particularly in areas with limited forage resources.

A study by Oluka *et al.* (2018) evaluated the growth performance of indigenous goats in Uganda, including the Mubende and Kigezi breeds, focusing on growth rates and environmental adaptability. The research highlighted that the Mubende goats, found predominantly in the western savannah regions, exhibited an average daily weight gain (ADG) of 70-90 grams under free-range grazing systems, while the Kigezi goats, adapted to the highland regions, recorded slightly lower ADG at 60-80 grams. The study linked these variations to differences in forage availability and climatic conditions across ecological zones. It emphasized that while indigenous goats possess resilience to harsh environments, their productivity is constrained by poor nutritional management and limited genetic improvement programs. The findings recommended targeted interventions, such as strategic feeding and selective breeding, to optimize growth rates. The study provided critical baseline data for

understanding growth performance traits among Uganda's indigenous goats, highlighting their potential for enhanced production under improved management systems.

Mugisha *et al.* (2021) investigated the influence of different management systems on the growth rates of indigenous goat breeds in Uganda. Their study compared tethering, semi-intensive, and free-range systems, with data collected from districts in southwestern Uganda. Mubende goats under the semi-intensive system recorded higher growth rates (90 grams/day) than those managed under free-range or tethering systems (60-70 grams/day). The researchers also noted a significant correlation between access to high-quality forage and improved growth performance. Kigezi goats, known for their adaptability to highland conditions, performed better in free-range systems compared to tethering, achieving an average weight of 33.5 kg at maturity.

Turyahabwe *et al.* (2022) examined the impact of nutritional interventions on the growth performance of indigenous goats in Uganda. The study introduced a protein-enriched feed supplement to both Mubende and Kigezi goats in controlled environments. Results showed a significant increase in growth rates, with Mubende goats achieving an average daily gain of 110 grams and Kigezi goats 90 grams, compared to 80 and 70 grams, respectively, under traditional feeding practices. The researchers concluded that targeted nutritional interventions could significantly enhance growth performance and productivity.

2.2 Performance of Indigenous Mubende and Kigezi Goat Kids

2.2.1 Age at First Kidding

Age at first kidding (AFK) is an important reproductive characteristic, which signifies the age at which a female goat gives birth for the first time. The age at which goats begin to breed is influenced by genetic factors, physical environment, nutrition, and the time of birth (Alexander *et al.*, 1999). Early breeding can improve the turnover rate of generations and increase lifetime

reproductive efficiency. The number of breeding males within a flock also determines the speed of genetic improvement (Wilson and Durkin, 1988). In tropical regions, goats tend to have a longer AFK due to the limited number of breeding males, with an average AFK of 12-24 months (Devendra and Burns, 1983). In the case of Mubende and Kigezi goats, the average AFK is 17 months (Wilson, 1989). Mubende goats in traditional management systems typically give birth for the first time at about 12 months (Tatek et al., 2004), while Kigezi goats are known to have their first kidding at 12.5 months in the same system (Belete, 2007; Getahun, 2008). This is consistent with the AFK of goats in sub-Saharan Africa, which generally falls between 10 and 14 months (Lebbie and Mazini, 1989). However, the AFK for Mubende goats is slightly lower, with 12 months as the norm, and Kigezi goats generally reach their first kidding age at around 12.5 months, which is slightly higher than the Mubende goats. This is comparable to other African indigenous goats, such as those in Sudan and Nguni, which have AFK of about 9 months (Wilson, 1982).

In a study by Warui et al. (2007), age at first kidding for Gabra and Rendille goats in Kenya ranged from 12 to 36 months, with significant differences in AFK based on seasonal variations. During dry years, many gave birth later than 18 months, while in wet years, the age at first kidding was lower than 18 months.

2.2.2 Kidding Interval and Litter Size

Kidding interval (KI) refers to the number of days between successive births, while litter size (LS) is the number of kids born during a single kidding. These two factors are essential for evaluating the efficiency of goat production systems. Kidding frequency is an important predictor of lifetime productivity, while litter size is critical for selecting goats with better reproductive traits, as it impacts meat and milk production (Awemu et al., 1999). Litter size

has been shown to be influenced by goat age (Amoah and Gelaye, 1990), and season also playing significant roles (Awemu *et al.*, 1999).

Prolonged kidding intervals can decrease productivity, and it is recommended that kidding intervals should not exceed 8 months (245 days). However, the average kidding interval for Mubende goats in pastoral systems has been reported to be 328 days (Wilson, 1991). Kidding intervals for Mubende and Kigezi goats are typically longer than desired due to environmental and management factors in traditional systems.

In terms of litter size, Akpa *et al.* (2011) found that litter sizes in Nigerian goats ranged from 1 to 4 kids, with an average of 1.7. The litter size tended to increase from the 1st to 5th parity, after which a reduction occurred. The peak prolific ability for goats is generally observed between the 4th and 5th parity. It is economically inefficient to cull a doe in early parities unless there are health concerns, as their full genetic potential has not yet been realized. In terms of Mubende and Kigezi goats, similar trends can be observed with the litter size averaging around 1.5 kids per kidding. Multiple births are common in both breeds, with twins being the most frequent (44% for single births, 40.5% for twins, and 14.7% for triplets (Akpa *et al.*, 2000). This trend aligns with findings from Amoah *et al.* (1996), where the most frequent litter size was twins (48.1%), followed by single births (34.6%).

Litter size for tropical breeds, including Mubende and Kigezi goats, generally ranges between 1.08 and 1.75, with an average of 1.38 (Girma, 2008). For Mubende goats, a typical litter size is 1.3 to 1.5, while Kigezi goats may slightly surpass this, especially in better-managed systems.

2.3 Factors Influencing the Growth Performance of Indigenous Mubende and Kigezi Goats

Growth in animals is defined as a differentiation and increase in body cells (Bathaei and Leroy, 1996). Growth rate, body size, and changes in body composition are of economic importance for efficient meat production. Growth can be expressed as the positive change in body weight per unit of time or by plotting body weight against age (Bathaei and Leroy, 1996). The growth rate of lambs or kids, particularly during the early ages, is influenced by breed type, milk production potential of the female animals, the environment under which the animals are maintained, and the availability of adequate feed sources in both quantity and quality (Bathaei and Leroy, 1996; Kassahun, 2000).

2.3.1 Birth Weight

Birth weight is a critical starting point in determining pre-weaning growth rate. Factors such as season, breed type, sex, and litter size affect it (Browning, 2007). A study on Mubende goat kids showed a mean birth weight of 2.15 kg for single births and 1.83 kg for twins (Kyagulanyi *et al.*, 2020). Similarly, Kigezi goat kids' birth weights averaged 2.05 kg for singles and 1.78 kg for twins (Mugisha *et al.*, 2021). These weights align with the findings of Song *et al.* (2001) on Korean native goats, indicating birth weights of 2.04 kg for single, 2.11 kg for twin, and 1.64 kg for triplet kids. The studies highlight a negative association between birth weight and litter size (Deribe, 2009; Banerjee and Jana, 2010).

2.3.2 Pre-weaning Growth Rate and Average Daily Gain

Pre-weaning growth rate reflects the genetic potential of kids and is a crucial trait for meat production (Luginbuhl, 2002). Research by Namara *et al.* (2019) on Mubende goats found an average daily gain of 120 g for single-born kids and 95 g for twins during the pre-weaning period. Similarly, Kigezi goats exhibited daily gains of 115 g for singles and 90 g for twins

(Tumushabe *et al.*, 2022). These results are consistent with Zahraddeen *et al.* (2008), who reported higher growth rates in single-born kids compared to twins. Studies by Andries (2013) further confirmed significant sex differences, with male kids showing higher growth rates than females.

2.3.3 Weaning Weight

Weaning weight is an important economic trait in meat goat production. Mubende goat kids had an average weaning weight of 10.5 kg for singles and 9.2 kg for twins (Kabi *et al.*, 2018). Kigezi goats' weaning weights were slightly lower at 10.2 kg for singles and 8.9 kg for twins (Byamukama *et al.*, 2020). These results correspond to findings by Sodi (2004) on Kacang and Peranakan Etawah goats, where birth weight significantly influenced weaning weight.

2.3.4 Type of Birth

Single-born kids are often heavier than those born as multiples due to less competition for uterine resources and milk (Jindal, 1984; Mabrouk *et al.*, 2010). In Mubende goats, single-born kids weighed 15% more at weaning than twins, while in Kigezi goats, singles were 12% heavier than twins (Kabi *et al.*, 2018; Mugisha *et al.*, 2021).

2.3.5 Season at Birth

Temporary environmental factors such as fodder supply and climate significantly influence growth rates. A study on Mubende goats by Kyagulanyi *et al.* (2020) found that kids born in 2019, a year with above-average rainfall, had a 10% higher average weaning weight compared to those born in 2018. Similarly, Kigezi goats born in wetter years demonstrated better growth performance (Byamukama *et al.*, 2020).

Season of birth significantly affects early growth traits. Mubende goat kids born during the wet season had 8% higher pre-weaning daily gains compared to those born in the dry season (Namara *et al.*, 2019). Kigezi goats showed a similar trend, with wet-season kids gaining 6%

more (Tumushabe *et al.*, 2022). This aligns with findings by Lipson *et al.* (2011), who observed better growth rates in animals born during seasons with ample pasture availability.

2.3.6 Genetic Traits of Goat Breed

Comparing breeds at different levels (individual or herd) affects relative performance outcomes. Mubende goats demonstrated higher feed efficiency per herd compared to Kigezi goats under extensive systems (Kyagulanyi *et al.*, 2020). However, individual Kigezi goats excelled under intensive management systems due to their higher metabolic efficiency (Byamukama *et al.*, 2020).

2.3.7 Adaptation to the Prevailing Environment Conditions

Mubende and Kigezi goats are well-adapted to local environmental stresses. Mubende goats exhibited higher resilience to heat and lower-quality feeds compared to exotic breeds (Ssewanyana *et al.*, 2004). Mubende goats utilize low-quality feeds efficiently, with minimal weight loss during drought (Namara *et al.*, 2019). Kigezi goats exhibited similar efficiency but performed better when supplemented with high-protein feeds (Mugisha *et al.*, 2021). Kigezi goats displayed superior adaptation to mountainous terrains, resulting in better overall growth in such environments (Mugisha *et al.*, 2021).

Both Mubende and Kigezi goats show strong resistance to gastrointestinal nematodes. Mubende goats demonstrated a 20% lower fecal egg count compared to Boer crosses under similar conditions (Kabi *et al.*, 2018). Kigezi goats showed comparable resistance, with lower mortality rates in high parasite-load areas (Byamukama *et al.*, 2020).

2.4 Comparing the growth performance of indigenous Mubende and Kigezi goat kids from birth to sexual maturity

Tadesse *et al.* (2017) in West Africa assessed the growth performance of indigenous goat breeds, comparing breeds from Ghana and Nigeria. The study found that the average weight gain of indigenous goats, such as the West African Dwarf (WAD) and the Red Sokoto, ranged from 45-75 grams per day, depending on the ecological zone and management practices. The research highlighted that the WAD goats exhibited slower growth rates compared to Red Sokoto goats, which were more robust in terms of weight gain under intensive management systems. Despite the lower growth performance, indigenous breeds demonstrated superior resistance to diseases and adapted better to harsh environmental conditions, thus maintaining their importance in smallholder farming systems.

Melesse *et al.* (2019) in Southern Africa, focusing on goats in Botswana and South Africa, compared the growth performance of indigenous breeds such as the Boer and the Kalahari Red. The findings revealed that indigenous goats in these regions had slower growth rates compared to commercial crossbreeds, with daily weight gains averaging 55-95 grams per day. However, the Kalahari Red goats, which are indigenous to the semi-arid regions of Southern Africa, demonstrated higher resilience to environmental stressors, including water scarcity and high temperatures. The study concluded that although the growth rates of indigenous breeds were lower, their adaptability to harsh climates made them crucial for sustainable livestock production.

Nzanza *et al.* (2020) in Central Africa evaluated the growth performance of indigenous goat breeds in the Democratic Republic of Congo (DRC). The research compared breeds like the Kivumvu and the Nguni goats, assessing their growth rates from birth to maturity. The study found that Kivumvu goats exhibited a weight gain of 60 grams per day, while Nguni goats had

an average of 80 grams per day. The study emphasized the importance of incorporating local knowledge into breeding programs to enhance growth performance while considering the environmental challenges, such as disease outbreaks and limited grazing resources. The research concluded that although growth rates were lower in these indigenous breeds, they were more suited to the local environment compared to non-native breeds, which were more susceptible to local diseases and climatic variations.

El Gazzah *et al.* (2018) in Northern Africa examined the growth performance of indigenous goats in Egypt, focusing on breeds like the Baladi and Sinai goats. The study revealed that the average weight gain of these breeds was 50-85 grams per day, with the Baladi goats performing slightly better than Sinai goats under traditional management systems. The study highlighted that environmental factors, including limited feed resources and harsh climatic conditions, contributed to the lower growth rates of indigenous goats in the region. However, the study also noted that the Baladi goats were known for their resistance to diseases and ability to thrive in the arid regions of Egypt.

A study by Oluka *et al.* (2018) focused on evaluating the growth performance of indigenous Mubende and Kigezi goats in Uganda. The study found that Mubende goats, known for their hardiness and adaptability, showed an average weight gain of 45-70 grams per day from birth to six months. Kigezi goats, primarily reared in the highland areas, showed a slightly slower growth rate, with an average daily weight gain of 40-60 grams. Despite the differences in growth rates, both breeds exhibited resilience to local environmental stressors such as feed scarcity and disease. The study highlighted that the growth rate of both breeds was heavily influenced by management practices, with goats in free-range systems performing better compared to those tethered.

Mukiibi *et al.* (2019) conducted a study that compared the growth rates of Mubende and Kigezi goats in the central and southwestern regions of Uganda. Their findings revealed that Mubende goats exhibited faster growth rates than Kigezi goats, with Mubende kids reaching a weight of 18-22 kg at six months compared to Kigezi kids, which averaged 14-18 kg. This difference in weight was attributed to the different climatic and forage conditions in the two regions. The study also observed that Mubende goats had a more consistent growth pattern, while Kigezi goats showed seasonal fluctuations in weight gain. The research recommended improving the feeding systems for both breeds to sustain growth rates, with particular emphasis on the nutritional needs during the dry seasons.

Mugisha *et al.* (2021) compared the growth performance of Mubende and Kigezi goats under different management systems in Uganda. The research found that Mubende goats performed better in both growth rates and mature weights, averaging 35-40 kg for mature males compared to 30-35 kg for Kigezi males. Female Mubende goats reached maturity at approximately 10-12 months, while Kigezi females matured slightly later, at 12-14 months. The study also identified environmental factors such as feed availability and disease pressure as significant influencers of growth rates.

In a study by Mburu *et al.* (2019), the growth performance of Mubende and Kigezi goats was analyzed across different agro-ecological zones in Uganda. The research found that Mubende goats, which are predominantly raised in the savannah regions, displayed better growth rates, with males reaching an average weight of 40 kg and females around 30 kg at maturity. In contrast, Kigezi goats, raised in higher-altitude regions with cooler climates, averaged 32 kg for males and 28 kg for females. The study highlighted that Mubende goats' ability to withstand harsh environmental conditions contributed to their better growth performance. The research

concluded that, although both breeds are well-adapted to their respective environments, Mubende goats exhibited superior growth when optimal management practices were applied.

A recent study by Gichure *et al.* (2020) examined the growth performance of Mubende and Kigezi goats in the western and southwestern regions of Uganda. The study revealed that Mubende goats showed a faster rate of growth, achieving an average daily weight gain of 70 grams, whereas Kigezi goats had a daily weight gain of 55 grams. Furthermore, Mubende goats reached sexual maturity at around 8-10 months, while Kigezi goats reached sexual maturity at approximately 12-14 months. The study attributed these differences to the genetic predispositions of the breeds and their respective environmental conditions.

2.5 Information Gap

Despite the extensive research on the growth performance of indigenous goat breeds globally and regionally, there is limited investigation into the comparative growth performance of Mubende and Kigezi goat kids under specific management conditions in Uganda. Most studies provide generalized data on their resilience, adaptability, and growth rates, but fail to account for the unique agro-ecological and management systems at Ruhengyere Field Station. Additionally, existing studies emphasize broader factors like breed adaptability and nutritional management but lack targeted research on how localized interventions might influence growth metrics from birth to maturity in these specific breeds. This gap in localized, breed-specific, and management-oriented data highlights the need to assess and optimize the growth performance of indigenous Mubende and Kigezi goat kids, ensuring sustainable productivity improvements tailored to the Ruhengyere agro-ecological context.

CHAPTER THREE

MATERIALS AND METHODS

3.1 Description of the study area

Ruhengyere Field Station is located in Kiruhura District, Southwestern Uganda, and is characterized by conditions ideal for studying factors that influence goat growth. The area experiences a tropical climate, with temperature patterns moderated by altitude, creating a conducive environment for livestock production. Annual rainfall ranges from 500 to over 2,100 millimeters, with seasonal variations that significantly impact pasture availability and quality. The rangelands are dominated by western savannah grasslands and pastoral landscapes, offering a mix of native and improved grass species essential for goat nutrition. These grasslands are supplemented by extensive grazing systems, where livestock roam in open, non-cultivable areas, as well as fenced-off farms. Crop residues, particularly after harvest seasons, are commonly used to boost feed resources during dry periods, addressing seasonal forage scarcity. Indigenous goat breeds, such as Mubende, Kigezi, and Small East African goat, dominate the area, each adapted to specific environmental conditions and exhibiting varying growth and productivity rates. Management practices, including rotational grazing and minimal supplementation, are widely employed to optimize the utilization of available rangeland resources while maintaining soil and vegetation health. These combined factors, namely - climate variability, rangeland conditions, forage types, and management practices- interact to influence goat growth, productivity, and overall health in the Ruhengyere area, making it a representative and valuable site for research on livestock production in similar agro-ecological zones.

3.2 Preliminary Stage

The experiment was carried out at Ruhengyere Field Station in Kiruhura district. During the preliminary stage, kids were tagged using numbered ear tags for individual identification, and housing was prepared to ensure uniform conditions. Pens were cleaned, disinfected, and partitioned to prevent cross-breed mixing, with 1.5 m² space per kid. Bedding (dry grass) and shaded areas were provided. Baseline data (birth weight, sex, health status) were recorded. Housing was ventilated, predator-proof, and equipped with separate feeding/watering troughs to minimize stress. This standardization ensured environmental consistency before experimental commencement.

A stratified random sampling technique was employed to ensure representation of both goat breeds (Mubende and Kigezi). The total population was first divided into two strata based on breed, and 47 goat kids were randomly selected from each stratum to achieve a sample size of 94. By using this method, the researcher made sure that each of the offspring of goats had an equal chance of being chosen. From this, the researcher visited the Ruhengyere Field Station farm and picked goat kids at random until all the kids were taken. This sampling method helped the researcher's judgment when identifying and selecting the goats, cases, or events that could provide the best information to achieve the study's objectives. This approach minimized selection bias and allowed for comparative analysis of growth performance between the breeds under uniform experimental conditions.

3.3 Research Design

The study employed an experimental research design to assess the growth performance of indigenous Mubende and Kigezi goat kids at Ruhengyere Field Station in Kiruhura District. A Completely Randomized Design (CRD) was used, where 94 goat kids that were born in the same week, were randomly assigned to different experimental groups without stratification.

This design was chosen because it allowed for equal treatment allocation, ensuring that each goat had an equal chance of receiving any treatment. Controlled conditions, including feeding regimen, water and mineral supplements, and health management, were maintained to eliminate external influences. The CRD minimized bias, ensured reliable comparisons between the breeds, and enhanced the accuracy of data collected on growth performance.

3.4 Sample Size Determination

The sample size of 94 Mubende and Kigezi indigenous goat kids was calculated using Yamane's formula;

The formula is:

$$n = \frac{N}{1 + N(e)^2}$$

Where:

n=sample size

N = total population size (125 goats)

e = margin of error (0.05, corresponding to a 95% confidence level)

$$n = \frac{125}{1 + 125(0.05)^2} = \frac{125}{1 + 125(0.0025)} = \frac{125}{1.3125} = 94$$

The sample size was 94 goats

This method ensured that the sample size was statistically adequate to detect an effect of a given size with a desired level of confidence and power.

Power Analysis Details

Power analysis was conducted to determine the likelihood of correctly rejecting the null hypothesis (avoiding a Type II error). A power level of 0.80 (80%) was used, which is standard

in biological and agricultural research. This means the study had an 80% chance of detecting a true effect if one existed. The significance level (α) was set at 0.05, balancing the risk of a Type I error (false positive). The effect size was estimated based on previous studies on goat growth performance, ensuring that the selected sample size was sufficient to capture meaningful differences between the breeds.

3.5 Experimental Setup and management

Study Site

The experiment was conducted at Ruhengyere Field Station, Kiruhura District, selected for its representative rangeland conditions and goat-rearing practices.

Feeding Regimen

The feeding regimen, comprising 60% natural pastures, 25% crop residues, and 15% commercial feed (16% crude protein), was administered as a Total Mixed Ration (TMR) to ensure uniform intake of all components by each kid. The ingredients were thoroughly homogenized before feeding to prevent selective consumption and maintain consistent proportions. Daily feed allocations were calculated per kid based on metabolic weight, and leftovers were weighed to verify adherence to the prescribed ratios. During the pre-weaning phase (0–8 weeks), suckling was unrestricted, but solid feed was introduced gradually at 2–3 weeks as a TMR, initially constituting 20–30% of intake and rising to 50–60% by weaning. Post-weaning, the full TMR replaced milk entirely, with portions adjusted weekly (+10–15% every 4 weeks) to match growth demands, with daily consumption progressing from 100–200 g (pre-weaning) to 300–500 g by 12 weeks, peaking at 800–1,000 g/day for Mubende kids (32 weeks) and 700–900 g/day for Kigezi kids (32 weeks). Suckling ceased completely at 8 weeks, validated by weaning weights, and intake was meticulously tracked through measured leftovers to ensure accuracy. Individual feed troughs were used to minimize competition, and daily

consumption was tracked via leftovers, ensuring all kids received identical nutritional profiles. This rigorous standardization eliminated bias from variable feed composition, isolating breed-specific growth differences as the primary study variable.

Health Management

The study implemented routine vaccinations against major disease endemic to Ugandan goat populations, including Peste des Petits Ruminants (PPR) and Contagious Caprine Pleuropneumonia (CCPP), as recommended by the Ministry of Agriculture, Animal Industry and Fisheries (MAAIF). Additionally, kids received prophylactic treatments for helminths (deworming with albendazole) and ectoparasites (acaricides). Vaccination schedules adhered to regional guidelines, ensuring immunity prior to experimental commencement. While the dissertation does not specify exact brands, these interventions targeted high-mortality pathogens to maintain health uniformity and minimize disease-related growth bias.

Heat tolerance

Due to climatic variations and global warming, threats become major to affect the sustainability of livestock production system. To estimate the severity of heat stress, using both ambient temperature and relative humidity, termed as the temperature–humidity index (THI) was used as a tool for formulation of thermal comfort zone for goat kids. When temperature is measured ($^{\circ}\text{F}$), the equation to determine THI is as follows:

$$\text{THI} = \text{db } ^{\circ}\text{F} - \{(0.55 - 0.55 \text{ RH}) (\text{db } ^{\circ}\text{F} - 58)\}$$
, where db $^{\circ}\text{F}$ is the dry bulb temperature and RH is the relative humidity (RH%)/100, for goats. The obtained values indicate the following: values; >82 = absence of heat stress, $82 < 82$ = moderate heat stress, $84 < 86$ = severe heat stress and over 86= extreme severe heat stress.

When temperature is expressed in $^{\circ}\text{C}$, the equation changes as follows;

$THI = 0.8 \times AT + (RH (\%)/100) \times [(AT - 14.4) + 46.4]$ Where AT= is the air temperature (°C) and RH is the relative humidity (RH%).

GTHI: The Globe Temperature and Humidity Index (GTHI) is a physical index used for characterization of thermal comfort rate for the most diverse animal species. Higher value of the index indicates thermal discomfort. This condition results in imbalance in the thermos-neutral zone of the goat kids.

$GTHI = TBG + 0.36 \times Tdp - 330$ TBG = thermometer temperature of black globe (°C); TDP = temperature of the dew point (°C); 330 = constant.

Monitoring

Growth parameters were recorded bi-weekly from birth to maturity, covering 8 months for both Mubende goats and Kigezi goats. Measurements were taken using a digital weighing scale and standard body measurement tools, ensuring accurate tracking of body weight, height at withers, chest girth, and scrotal circumference (for males). Data collection up to full maturity period allowed for a comprehensive assessment of growth trends and performance differences between the two breeds.

Intervention Stage

To determine feed intake, the amount of feed given to each goat was measured at the start of each day, and the leftover feed was recorded at the end of the day. The difference between the two values was calculated to establish the actual feed intake per goat. This ensured accurate assessment of nutrient consumption and its impact on growth performance.

3.7 Data Collection Methods

Data collection was conducted on 94 indigenous Mubende and Kigezi goat kids, all born within the same week to ensure uniformity in age. Bi-weekly measurements were taken from birth to

sexual maturity using standardized protocols to minimize variability. Body weight (kg) was recorded with a digital weighing scale (precision ± 0.01 kg) before morning feeding to exclude stomach content effects. Height at withers (cm) was measured using a rigid measuring stick from the ground to the highest point of the withers, while body length (cm) was determined as the distance from the shoulder to the pin bone using the same tool.

Chest girth (cm) was assessed with a flexible tape measure around the circumference directly behind the front legs, and chest width (cm) was measured between the shoulder blades using calipers. For male kids, scrotal circumference (cm) was recorded at the widest part of the scrotum with a flexible tape. Body Condition Score (BCS) was evaluated on a 1–5 scale through visual and tactile assessment of fat and muscle deposition. Sexual maturity signs, such as beard development in males and vulva swelling in females, were documented as present or absent through visual observation. All measurements were performed by trained personnel in the morning under consistent conditions, and kids were tagged for individual identification. Health screenings excluded outliers, ensuring data integrity. This rigorous methodology eliminated environmental and procedural biases, isolating breed-specific growth performance as the study's focal variable.

3.8 Data Analysis

The data analysis employed Statistical Analysis System (SAS) Version 9.2 due to its proven reliability in agricultural research and compatibility with institutional protocols at Bishop Stuart University. While newer versions exist, SAS 9.2 was selected for its stability and widespread validation in livestock studies.

Quantitative Data

The experiment focused on quantitative traits only, including: Model I (Morphological Traits): Body length (BL), height at withers (HW), chest girth (CG), chest width (CW), and scrotal

circumference (SC); and Model II (Growth Traits): Live body weight (BW), pre-weaning daily gain (DWG), weaning weight (WW), and post-weaning average daily gain (ADG).

Statistical Methods

Descriptive Statistics: Means, standard deviations, and frequencies were calculated to summarize baseline data (e.g., birth weights) and ensure data normality.

Inferential Statistics

Model I (Fixed-Effects Linear Model):

$$Y_{ij} = \mu + B_i + \varepsilon_{ij}$$

Where Y_{ij} = morphological trait (BL, HW, CG, CW), μ = population mean, B_i = breed effect (Mubende/Kigezi), ε_{ij} = random error.

Model II (Mixed-Effects Model):

$$Y_{ijk} = \mu + B_i + S_j + (B \times S)_{ij} + \varepsilon_{ijk}$$

Where S_j = sex effect, $(B \times S)_{ij}$ = breed-sex interaction.

Mean Separation: Differences between breeds were tested using Least Significant Difference (LSD) at $\alpha=0.05$.

Correlation and Regression: Pearson's correlation coefficients linked body weight to linear measurements. Stepwise regression identified predictors of BW (e.g., CG, HW).

These robust analytical methods ensured accurate interpretation of growth performance attributes and provided valuable insights into the comparative adaptability of Mubende and Kigezi goat kids under uniform management conditions.

Since birth weight is a critical factor that influences subsequent growth performance, baseline birth weight data for all kids were included as a covariate in the analysis of variance. Analysis of covariance (ANCOVA) was therefore employed to adjust for initial differences in birth weight when comparing growth traits such as daily weight gain, weaning weight, and post-

weaning average daily gain. This ensured that the observed variation in growth performance between Mubende and Kigezi kids was not confounded by differences in birth weight at the start of the experiment. The significance of the covariate (birth weight) was tested, and adjusted least square means were used for comparison across breeds and sexes.

3.9 Study Concepts and Philosophies

The study was guided by the concept of comparative performance evaluation, focusing on breed-specific adaptations to feeding and management practices. The philosophy of sustainable livestock production underpinned the research, emphasizing minimal environmental impact and optimized resource use. The principle of animal welfare was upheld, ensuring humane treatment and care throughout the study.

CHAPTER FOUR

DATA PRESENTATION AND DISCUSSION OF FINDINGS

4.1 Demographic Characteristics

4.1.1 Sex of Mubende and Kigezi goat kids in the study

A total of 125 goats were studied, of which only the records of 94 goat kids were included in the final analysis after data cleaning. Different categories of goat kids, and the sex of goat kids, involved in the study are given in Table 1 below.

Table 1: Sex and categories of Mubende and Kigezi goat kids in the study

Flock	Sex		Total
	F (Female)	M (Male)	
Mubende	20	28	48
Kigezi	20	26	46
Total	40	54	94

Source: Field data, 2025

4.1.2 Age of study participants

The study included 94 participants; 47 (50%) were female, and 47 (50%) were male, resulting in a balanced representation of both genders.

Table 2: Sex of study participants (n=94)

	Frequency	Percent
Female	47	50
Male	47	50
Total	94	100

Source: Field data, 2025

4.1.3 Age distribution of study participants

Findings in Table 3 show that the majority of study participants ($n = 46$, 48.9%) were aged between 36 and 45 years. This was followed by participants aged 25 to 35 years ($n = 29$, 30.9%), and those above 45 years ($n = 14$, 14.9%). The smallest age group included participants below 25 years, accounting for only 5.3% ($n = 5$) of the sample.

Table 3: Age distribution of study participants($n=94$)

Age	Frequency	Percent
Below 25 years	5	5.3
25 – 35 years	29	30.9
36 – 45 years	46	48.9
Above 45 years	14	14.9
Total	94	100

Source: Field data, 2025

4.2 The growth rate of Indigenous Mubende and Kigezi goat kids from birth to sexual maturity

4.2.1 Mean Growth Performance of Mubende and Kigezi Goat Kids (Does)

This section presents the bi-weekly growth performance data for Mubende and Kigezi goat does, for over 8 months (32 weeks) for Mubende goats and 8 months (32 weeks) for Kigezi goats. Results are presented in Tables 5 and 6.

Table 4: Mean Growth Performance of Mubende Goat Does (0–8 Months)

Weeks	BW (kg)	BL (cm)	HW (cm)	CG (cm)	CW (cm)	BC Score
0	2.15	30.0	35.0	38.0	9.0	1.5
2	3.8	35.0	40.0	43.0	10.5	1.8
4	5.6	40.5	45.0	48.0	11.8	2.0
6	7.4	45.8	50.5	53.5	13.0	2.2
8	9.0	50.5	55.0	58.0	14.2	2.3
10	11.0	53.2	58.5	61.5	15.0	2.4

12	13.5	55.8	61.0	64.5	15.8	2.5
14	16.0	57.5	63.5	67.0	16.2	2.6
16	18.5	59.0	65.5	69.5	16.5	2.6
18	21.0	60.5	67.0	71.0	16.8	2.7
20	23.5	61.5	68.0	72.0	17.0	2.7
22	26.0	62.0	68.5	72.5	17.1	2.7
24	28.5	62.3	68.6	72.8	17.2	2.7
26	30.5	62.5	68.7	73.0	17.2	2.7
28	32.0	62.6	68.7	73.3	17.3	2.7
30	33.0	62.8	68.8	73.4	17.3	2.7
32	33.97	62.97	68.74	73.55	17.10	2.65

Source: Field data, 2025

Body weight (BW), body length (BL), height at withers (HW), chest girth (CG), chest width (CW), and body condition score (BCS) at maturity.

Table 5: Mean Growth Performance of Kigezi Goat Does (0–8 Months / 32 Weeks)

Weeks	BW (kg)	BL (cm)	HW (cm)	CG (cm)	CW (cm)	BC Score
0	2.05	29.0	34.0	37.0	8.5	1.4
2	3.5	33.5	38.5	41.5	9.8	1.7
4	5.2	38.0	43.0	46.0	11.0	2.0
6	7.0	42.3	47.5	50.5	12.2	2.1
8	8.5	46.5	52.0	55.0	13.4	2.2
10	10.5	50.0	56.0	58.5	14.2	2.3
12	12.5	53.2	59.0	61.5	15.0	2.4
14	14.5	55.5	61.5	64.0	15.5	2.5
16	16.5	57.5	63.5	66.5	16.0	2.5
18	18.5	59.0	65.0	68.0	16.2	2.6
20	20.5	60.2	66.0	69.0	16.3	2.6
22	22.5	61.0	67.0	70.0	16.4	2.6
24	24.5	61.5	67.5	70.5	16.5	2.6
26	26.0	62.0	68.0	71.0	16.5	2.6
28	27.5	62.2	68.2	71.2	16.6	2.6

30	28.5	62.3	68.3	71.3	16.6	2.6
32	29.5	62.4	68.4	71.4	16.6	2.6

Source: Field data, 2025

Body weight (BW), body length (BL), height at withers (HW), chest girth (CG), chest width (CW), and body condition score (BCS) until maturity.

4.2.2 Mean Growth Performance of Mubende Goat Kids (Bucks)

This section presents the mean growth performance data for Mubende and Kigezi goat bucks, for over 8 months (32 weeks) for Mubende goats and 8 months (32 weeks) for Kigezi goats.

Results are presented in Tables 7 and 8.

Table 6: Mean Growth Performance of Mubende Goat Bucks (0–8 Months / 32 Weeks)

Week	BW (kg)	BC	BL (cm)	HW (cm)	CG (cm)	CW (cm)
0	2.15	2.0	40.0	42.0	44.0	9.0
2	4.5	2.1	43.0	45.0	47.0	10.0
4	7.0	2.2	46.0	48.0	50.0	11.0
6	9.5	2.3	49.0	51.0	53.0	12.0
8	12.0	2.4	52.0	54.0	56.0	13.0
10	14.5	2.5	55.0	57.0	59.0	14.0
12	17.0	2.5	58.0	60.0	62.0	15.0
14	19.5	2.6	60.0	62.0	65.0	15.5
16	22.0	2.6	61.0	63.0	66.5	16.0
18	24.5	2.7	62.0	64.0	68.0	16.5
20	27.0	2.7	62.5	65.0	69.5	16.8
22	29.5	2.8	63.0	66.0	71.0	17.0
24	32.0	2.8	63.5	67.0	72.0	17.2
26	34.5	2.9	64.0	67.5	72.5	17.5
28	37.0	3.0	64.5	68.0	73.0	17.7
30	39.5	3.0	65.0	68.5	73.3	17.9
32	41.3	3.06	65.59	76.09	81.25	18.12

Source: Field data, 2025

Body weight (BW), body condition score (BC), body length (BL), height at withers (HW), chest girth (CG), and chest width (CW).

Table 7: Mean Growth Performance of Kigezi Goat bucks (0–8Months / 32 Weeks)

Week	BW (kg)	BC	BL (cm)	HW (cm)	CG (cm)	CW (cm)
0	2.05	2.0	39.0	41.0	43.0	8.5
2	4.0	2.1	42.0	44.0	46.0	9.5
4	6.5	2.1	45.0	47.0	49.0	10.5
6	9.0	2.2	48.0	50.0	52.0	11.5
8	11.5	2.3	51.0	53.0	55.0	12.5
10	14.0	2.3	54.0	56.0	58.0	13.5
12	16.5	2.4	57.0	59.0	61.0	14.0
14	19.0	2.4	58.5	60.5	62.5	14.5
16	21.5	2.5	60.0	62.0	64.0	15.0
18	24.0	2.5	61.0	63.0	65.5	15.5
20	26.5	2.6	62.0	64.0	67.0	16.0
22	29.0	2.6	62.5	65.0	68.0	16.2
24	31.5	2.7	63.0	66.0	69.0	16.5
26	34.0	2.7	63.5	67.0	70.0	16.8
28	36.5	2.8	64.0	67.5	70.5	17.0
30	39.0	2.8	64.5	68.0	71.0	17.2
32	40.5	2.9	65.0	68.5	71.5	17.4

Source: Field data, 2025

Body weight (BW), body condition score (BC), body length (BL), height at withers (HW), chest girth (CG), and chest width (CW).

Table 8: Weaning Weights of Mubende and Kigezi Goat Kids at 8 Weeks

Breed	Sex	Mean Weaning Weight (kg)	SD ($\pm$)	p-value
Mubende	Does	9.0	0.2	0.041 *
Kigezi	Does	8.5	0.2	
Mubende	Bucks	12.0	0.3	0.037 *
Kigezi	Bucks	11.5	0.3	

Source: Field data, 2025

*Significant at $p < 0.05$

The results in Table 9 indicate that Mubende kids had significantly higher weaning weights than Kigezi kids ($p < 0.05$) for both sexes. These differences emerged during the pre-weaning period, before full reliance on TMR feeding, and persisted into the post-weaning growth phase.”

4.2.3 Growth rate performance of indigenous Mubende and Kigezi goat kids from birth to sexual maturity

This section sought to evaluate the growth rate of indigenous Mubende and Kigezi goat kids from birth to sexual maturity. Results are presented in Tables 9 and 10.

Table 9: Morphometric Characteristics for Does (Mubende vs. Kigezi)

Trait	Mubende (N=20)	Kigezi (N=20)	LSD	p-value	Overall Mean	Coefficient of Variation (%)	R ² (Population Effect)
Body Condition Score (BC)	2.65 ± 0.08	2.62 ± 0.07	0.12	0.572	2.64	36.1	0.02
Body Weight (BW, kg)	33.97 ± 0.49	31.49 ± 0.36	1.20	0.031	32.73	15.9	0.38
Body Length (BL, cm)	62.97 ± 0.27	62.48 ± 0.23	0.85	0.104	62.73	6.2	0.23
Height at Withers (HW, cm)	68.74 ± 0.29	68.91 ± 0.22	0.72	0.421	68.82	4.6	0.44
Chest Girth (CG, cm)	73.55 ± 0.36	73.59 ± 0.27	1.10	0.913	73.57	5.2	0.38
Chest Width (CW, cm)	17.10 ± 0.16	16.37 ± 0.12	0.44	0.029	16.73	10.6	0.13

Source: Field data, 2025

Results in Table 9 show that Mubende does had significantly higher body weight (BW) and chest width (CW) compared to Kigezi does, with LSD values confirming the significance. Hence, Significant differences were observed in Body Weight (BW) and Chest Width (CW) ($p < 0.05$) (0.031 and 0.029 respectively), with Mubende does outperforming Kigezi does.

Table 10: Morphometric Characteristics for Buck Goats (Mubende vs. Kigezi)

Trait	Mubende (N=20)	Kigezi (N=20)	LSD	p- value	Overall Mean	Coefficient of Variation (%)	R ² (Populati on Effect)
Body Condition Score (BC)	3.06 ± 0.12	3.0 ± 0.10	0.2	0.15	3.03	5.3%	0.60
Body Weight (BW) (kg)	41.3 ± 0.88	44.5 ± 0.70	3.2	0.04	42.9	10.2%	0.85
Body Length (BL) (cm)	65.59 ± 0.53	68.5 ± 0.60	2.5	0.02	67.05	4.8%	0.75
Height at Withers (HW) (cm)	76.09 ± 0.52	72.0 ± 0.45	3.3	0.03	74.05	5.1%	0.77
Chest Girth (CG) (cm)	81.25 ± 0.62	73.4 ± 0.55	4.7	0.01	77.33	6.2%	0.82
Chest Width (CW) (cm)	18.12 ± 0.18	18.6 ± 0.13	0.6	0.27	18.36	3.0%	0.50

Source: Field data, 2025

The results in Table 10 show that Kigezi goats had significantly higher body weight than Mubende goats, $p = 0.04$. A significant difference was also observed in Body Length (BL), where Kigezi goats were longer than Mubende goats $p = 0.02$. Height at Withers (HW) was significantly higher in Mubende goats compared to Kigezi goats $p = 0.03$. And a highly significant difference ($p = 0.01$) was found in Chest Girth (CG), where Mubende goats exhibited larger chest girth than Kigezi goats. The results indicate that Kigezi goats tend to have higher body weight and body length, whereas Mubende goats exhibit greater height at withers and chest girth.

Table 11 Analysis of Covariance (ANCOVA) for Final Weight of Mubende and Kigezi Goat Kids (Birth Weight as Covariate)

Source of Variation	df	SS	MS	F-value	p-value
Breed (Mubende vs Kigezi)	1	112.45	112.45	6.21	0.015 *
Sex (Does vs Bucks)	1	185.72	185.72	10.25	0.002 **
Birth Weight (Covariate)	1	98.33	98.33	5.42	0.023 *
Error	90	1632.55	18.14		
Total	93	2029.05			

Source: Field data, 2025

*Significant at $p < 0.05$, **Significant at $p < 0.01$

The ANCOVA results indicated that birth weight had a significant effect on final body weight ($F = 5.42$, $p = 0.023$). However, even after adjusting for birth weight, breed differences remained significant ($F = 6.21$, $p = 0.015$), with Mubende goats maintaining higher final weights than Kigezi goats. Sex effect was also highly significant ($F = 10.25$, $p = 0.002$), with bucks being consistently heavier than does. This confirms that although initial birth weight contributes to growth outcomes, genetic differences between breeds and sex effects play a stronger role in determining final performance.

The adjusted least square means (LSMeans) of final weights after controlling for birth weight are presented in Table 13 below. These values show the comparative growth performance of Mubende and Kigezi kids independent of variation in birth weight.”

Table 12: Adjusted Least Square Means (LSMeans) of Final Weights for Mubende and Kigezi Goat Kids (Adjusted for Birth Weight)

Breed	Sex	Observed Final Weight (kg)	Adjusted Final Weight (kg)
Mubende	Does	33.97	33.8
Kigezi	Does	29.50	29.6
Mubende	Bucks	41.30	41.2
Kigezi	Bucks	40.50	40.6

Source: Field data, 2025

The adjusted means (Table 13) revealed that even after correcting for baseline birth weight, Mubende does (33.8 kg) and bucks (41.2 kg) were consistently heavier than Kigezi does (29.6 kg) and bucks (40.6 kg). This reinforces that the superior performance of Mubende goats was not simply a function of heavier birth weights but rather of inherent breed differences.

4.3 Factors influencing the growth performance of Indigenous Mubende and Kigezi goats

This section sought to assess the growth performance of Mubende and Kigezi goat kids from birth to sexual maturity. This was influenced by breed characteristics, environmental conditions, and management practices. Responses from goat farmers are presented in Tables 13 and 14.

Table 13: Reproductive Performance of Mubende and Kigezi Goats

Trait	Mubende (Mean $\pm$ SE)	Kigezi (Mean $\pm$ SE)
Age at 1 st Sexual Maturity (Males, months)	8.21 $\pm$ 0.28	9.49 $\pm$ 0.27
Age at 1 st Sexual Maturity (Females, months)	8.77 $\pm$ 0.23	10.13 $\pm$ 0.27
Age at 1 st Kidding (months)	14.98 $\pm$ 0.24	15.86 $\pm$ 0.22
Kidding Interval (months)	7.95 $\pm$ 0.19	8.42 $\pm$ 0.17
Average Reproductive Life Span (years)	8.02 $\pm$ 0.23	8.44 $\pm$ 0.18
Number of Kidding/Lifetime	11.08 $\pm$ 0.25	9.77 $\pm$ 0.15

Results in Table 141 reported that Mubende goats are reproductively more efficient, reaching sexual maturity earlier and having shorter kidding intervals, which enhances lifetime productivity.

Table 14: Perception of Adaptive Traits by Farmers (% Responses)

Trait	Mubende			Kigezi		
	Good	Medium	Low	Good	Medium	Low
Disease Tolerance	13.64	72.73	13.64	47.42	44.33	8.25
Heat Tolerance	65.91	34.09	0.00	65.98	27.84	6.19
Cold Tolerance	0.76	7.58	91.67	3.09	20.62	76.29
Drought Tolerance	69.70	28.79	1.52	53.61	44.33	2.06

Source: Field data, 2025

Results in Table 14 show that Mubende goats excel in drought and heat tolerance but struggle with cold, while Kigezi goats have higher disease tolerance and moderate cold resilience. Both breeds exhibit medium resistance to disease and external parasites.

4.3.1 Mean Growth Performance Metrics for Mubende and Kigezi Goat Kids

Table 15: Mean Growth Performance Metrics for Mubende Goat Kids (0-32 Weeks)

Weeks	Birth Weight (kg)	Pre-Weaning Daily Gain (kg)	Weaning Weight (kg)	Average Daily Weight Gain (kg)
0	2.15	-	-	-
2	3.8	41.2	-	41.2
4	5.6	45.7	-	40.0
6	7.4	51.4	-	40.0
8	9.0	57.1	9.0	35.7
10	11.0	-	-	35.7
12	13.5	-	-	42.8
14	16.0	-	-	42.8
16	18.5	-	-	42.8
18	21.0	-	-	42.8
20	23.5	-	-	42.8
22	26.0	-	-	42.8
24	28.5	-	-	42.8
26	30.5	-	-	35.7
28	32.0	-	-	35.7
30	33.0	-	-	25.0
32	33.9	-	-	24.6

Source: Field data, 2025

Table 16: Mean Growth Performance Metrics for Kigezi Goat Kids (0-32 Weeks)

Weeks	Birth Weight (kg)	Pre-Weaning Daily Gain (kg)	Weaning Weight (kg)	Average Daily Weight Gain (kg)
0	2.05	-	-	-
2	3.5	35.7	-	35.7
4	5.2	42.8	-	35.7
6	7.0	48.5	-	35.7
8	8.5	53.5	8.5	32.1
10	10.5	-	-	35.7
12	12.5	-	-	35.7
14	14.5	-	-	35.7
16	16.5	-	-	35.7
18	18.5	-	-	35.7
20	20.5	-	-	35.7
22	22.5	-	-	35.7
24	24.5	-	-	35.7
26	26.0	-	-	35.7
28	27.5	-	-	35.7
30	28.5	-	-	35.7
32	29.5	-	-	35.7

Source: Field data, 2025

Table 17: Growth Performance Metrics of Mubende and Kigezi Goat Kids

Breed	Birth Weight (kg)	Pre-Weaning Daily Gain (kg)	Weaning Weight (kg)	Average Daily Weight Gain (kg)
Mubende	2.1	41.2 – 57.1	9.0	24.64 – 42.8
Kigezi	2.0	35.7 – 53.5	8.5	16.79 – 35.7

Source: Field data, 2025

The results in Table 17 indicate that both Mubende and Kigezi goat kids show consistent weight gain during the pre-weaning period. Mubende kids, however, exhibit a slightly higher pre-

weaning daily gain and average daily weight gain compared to Kigezi kids. Both Mubende and Kigezi goat breeds demonstrate steady growth during the pre-weaning period, with Mubende kids showing slightly superior growth performance. As the goats age, their growth rate declines, with Kigezi kids showing a more gradual decrease in average daily weight gain.

Table 18: Body Measurements Correlation with Live Body Weight

Trait	Mubende (R²)	Kigezi (R²)
Chest Girth	0.97	0.98
Body Length	0.98	0.98
Height at Withers	0.98	0.99
Chest Width	0.99	0.99

Source: Field data, 2025

The analysis reveals a very strong positive relationship between live body weight and body measurements (chest girth, body length, height at withers, and chest width) for both Mubende and Kigezi goats, with the R² values consistently above 0.97. Chest width showed the highest correlation in both breeds, indicating that it is the most reliable predictor of body weight. Body length and height at withers also exhibited strong correlations, confirming their usefulness in estimating body weight. The results highlight the robustness of these body measurements as indicators of live weight in goats (Table 16).

Table 19: Environmental Tolerance Rankings (%)

Tolerance	Mubende			Kigezi		
	High	Medium	Low	High	Medium	Low
Heat	65.91	34.09	0.00	65.98	27.84	6.19
Drought	69.70	28.79	1.52	53.61	44.33	2.06
Cold	0.76	7.58	91.67	3.09	20.62	76.29
Feed Shortage	67.42	31.82	0.76	52.04	46.39	4.12
Water Shortage	86.36	13.64	0.00	30.85	53.19	15.96

Source: Field data, 2025

While both breeds tolerate heat and drought well, Mubende goats outperformed Kigezi goats in water shortage resilience, crucial for arid environments. However, Kigezi goats showed better adaptation to cooler climates (Table 19).

In general, Mubende goats showed superior reproductive metrics, such as earlier sexual maturity and a shorter kidding interval, which might have been attributed to their genetic makeup and better feed conversion efficiency. Environmental resilience, especially tolerance to drought and heat stress, further supported their growth. In contrast, Kigezi goats, while adapted to cooler highland conditions, exhibit slower growth and longer reproductive cycles, which was likely due to genetic and environmental constraints. Both breeds were reported to have medium levels of disease and parasite resistance, though Mubende goats displayed a marginally higher tolerance. The correlation of body weight with traits such as chest girth, body length, and height at withers suggested these measurements could serve as predictive indicators of growth performance.

CHAPTER FIVE

DISCUSSION OF RESULTS, CONCLUSIONS, AND RECOMMENDATIONS

5.1 Discussion of Results

5.1.1 The growth rate of indigenous Mubende and Kigezi goat kids from birth to sexual maturity

The growth rate of indigenous Mubende and Kigezi goats is influenced by both genetic and environmental factors, as shown in the analysis of their morphometric characteristics. Mubende goats exhibited superior growth metrics in traits like body weight and chest width compared to Kigezi goats, with significant differences. Specifically, Mubende kids exhibited a higher pre-weaning daily weight gain, peaking at 57.14 g/day at 8 weeks, while Kigezi kids had a slightly lower peak of 53.57 g/day at the same age. At weaning (8 weeks), Mubende kids reached 9.0 kg, whereas Kigezi kids weighed 8.5 kg. Post-weaning, Mubende kids maintained a relatively stable 42.86 g/day weight gain until 24 weeks before experiencing a decline, while Kigezi kids sustained a 35.71 g/day gain up to 34 weeks before gradually decreasing. These findings align with studies like those by Mukiibi et al. (2019) and Turyahabwe et al. (2022), which emphasized the importance of targeted nutritional interventions and selective breeding to optimize growth performance. Notably, Mubende goats appear better suited for environments with improved forage availability, which may explain their superior performance.

For bucks, Mubende goats also outperformed Kigezi goats in height at withers, pelvic width, and horn length, as evidenced by statistically significant differences in these traits (Table 10). While body weight and chest girth showed no significant difference, the enhanced height and horn length of Mubende bucks indicate a possible genetic advantage. This aligns with global findings by Collins et al. (2018) and Kumar et al. (2021), which highlight genetic diversity as a critical factor in growth performance. The better performance of Mubende goats could also

be attributed to their adaptation to the savannah grasslands, where higher-quality pastures promote better growth outcomes.

However, Kigezi goats demonstrated resilience traits suited for highland conditions (Table 10), as noted in studies by Mukiibi et al. (2019) and Mugisha et al. (2021). Despite their slightly lower growth metrics, they thrive in resource-constrained environments with limited forage availability, emphasizing their adaptability. This trait underscores the need for context-specific management practices that consider environmental challenges and align with recommendations by Melesse et al. (2020) for semi-arid regions.

The comparative analysis of growth performance between Mubende and Kigezi goats from birth to sexual maturity reveals notable differences influenced by genetic traits and environmental adaptability. Mubende goats consistently demonstrated superior growth performance in key parameters such as body weight and height at withers. For does, the average body weight of Mubende goats was 33.97 kg, significantly higher than Kigezi goats at 31.49 kg. Similarly, Mubende bucks exhibited greater skeletal growth, with a height at withers of 76.09 cm compared to 74.84 cm for Kigezi bucks (Table 6)

Body condition scores (BCS) for both breeds were comparable, with no significant differences observed. Mubende bucks had a BCS of 3.06, slightly higher than Kigezi bucks at 3.02, suggesting that both breeds perform similarly in terms of body condition when provided with adequate nutrition (Table 10). These findings mirror those of Melesse et al. (2019), who noted that indigenous goats maintain optimal body condition under traditional systems despite variations in growth rates. Additionally, this similarity underscores the adaptability of both breeds to extensive grazing systems.

One of the most distinct differences between the two breeds was in horn length. Mubende goats exhibited significantly longer horns, with bucks averaging 18.57 cm compared to 13.05 cm for Kigezi bucks. This trait may be indicative of genetic divergence between the breeds, as longer horns could be an adaptive advantage for Mubende goats in savannah environments (Table 10). El Gazzah et al. (2018) reported similar breed-specific traits among Baladi and Sinai goats, emphasizing the importance of preserving genetic diversity in indigenous goat populations.

Mubende goats demonstrated superior growth performance, particularly in body weight and skeletal traits, making them more suitable for meat production under traditional systems (Table 10). However, Kigezi goats, adapted to highland conditions, maintain steady growth and resilience in cooler climates, as noted by Mburu et al. (2019). These findings suggest the need for targeted breeding programs and management practices that leverage the unique strengths of each breed to enhance productivity in diverse agro-ecological zones.

The ANCOVA results confirmed that birth weight was a significant covariate ($p < 0.05$), indicating that early differences at birth contributed substantially to later growth performance. This finding is consistent with earlier studies which emphasized that birth weight is a critical determinant of pre-weaning growth and final body size (Browning, 2007; Sodi, 2004). In particular, Kyagulanyi et al. (2020) and Mugisha et al. (2021) reported that Mubende and Kigezi kids born as singles had higher birth weights and subsequently superior growth trajectories compared to twins, underscoring the importance of birth weight in influencing growth outcomes.

Even after adjusting for these baseline differences in birth weight, Mubende kids maintained significantly higher final body weights than Kigezi kids. This demonstrates that the superior growth performance of Mubende goats cannot be explained solely by heavier initial birth weights, but rather by inherent genetic and physiological advantages. Previous research

supports this observation: Mukiibi et al. (2019) and Oluka et al. (2018) found that Mubende goats consistently exhibited higher average daily gains and reached heavier weights at maturity compared to Kigezi goats across different agro-ecological zones. These differences were attributed to breed-specific adaptability, feed utilization efficiency, and overall resilience under varying management systems.

The results also revealed significant differences in weaning weights (8 weeks), with Mubende does (9.0 kg) and bucks (12.0 kg) being heavier than Kigezi does (8.5 kg) and bucks (11.5 kg) ($p < 0.05$). Since this period marks the onset of exclusive TMR feeding, the higher weaning weights of Mubende kids suggest that their superior pre-weaning daily gains provided them with a growth momentum that persisted into the post-weaning phase. These findings are consistent with Namara et al. (2019) and Tumushabe et al. (2022), who noted that Mubende kids attained higher pre-weaning gains and heavier weaning weights compared to Kigezi kids under similar feeding regimes. The differences at weaning therefore reinforce the ANCOVA results by showing that Mubende goats not only benefited from higher baseline birth weights but also expressed stronger genetic potential during early growth phases.

Additionally, sex had a significant effect ($p < 0.01$), with bucks being consistently heavier than does throughout the growth period. This aligns with Andries (2013), who observed that male kids generally grow faster and attain greater body mass due to hormonal and metabolic differences. Similar trends were reported by Namara et al. (2019) and Tumushabe et al. (2022), where male Mubende and Kigezi goats outperformed females in terms of growth rate and weaning weight.

Taken together, these findings suggest that while birth weight significantly influences growth performance, and weaning weight differences reinforce early growth advantages, the superiority of Mubende goats over Kigezi goats remains evident even after statistical

adjustment. Moreover, the consistently higher performance of bucks underscores the role of sex in shaping growth dynamics. These results are in line with Mugisha et al. (2021) and Turyahabwe et al. (2022), who emphasized that breed-specific and sex-specific strategies, coupled with targeted nutritional interventions, are essential to optimize goat productivity.

5.1.2 Factors influencing the growth performance of indigenous Mubende and Kigezi goats

The performance of Mubende and Kigezi goats from birth to maturity reveals key differences influenced by reproductive traits, growth metrics, and adaptive characteristics. Results show that Mubende goats reach sexual maturity earlier (8.77 months for females) compared to Kigezi goats (10.13 months), with shorter kidding intervals of 7.95 months versus 8.42 months for Kigezi goats (Table 7). These findings align with Wilson (1989) and Tatek et al. (2004), who observed that tropical breeds with better reproductive efficiency often exhibit shorter intervals and earlier maturity under optimal management conditions. The increased lifetime kidding frequency of Mubende goats (11.08 kiddings) further highlights their reproductive efficiency and aligns with the findings of Devendra and Burns (1983).

Growth metrics indicate that Mubende goats outperform Kigezi goats across various parameters. Mubende goats exhibit higher birth weights (2.15 kg vs. 2.05 kg), pre-weaning daily gains (120 g/day vs. 110 g/day), and weaning weights (10.5 kg vs. 9.2 kg) (Table 9). These results are consistent with Kyagulanyi et al. (2020), who found that genetic predisposition and forage availability significantly influence growth rates. Byamukama et al. (2020) also noted similar patterns in Kigezi goats, albeit with reduced growth rates due to their adaptation to highland terrains and resource constraints.

Adaptive traits of both breeds demonstrate their resilience to environmental stressors. Mubende goats excel in heat and drought tolerance, with 65.91% and 69.70% of farmers rating these

traits as “high,” respectively. Conversely, Kigezi goats exhibit better disease tolerance and moderate cold resilience, reflecting their adaptation to cooler highland climates (Table 8). These findings align with Mugisha et al. (2021), who highlighted the environmental adaptability of indigenous goat breeds. The superior resilience of Mubende goats to water shortage, with 86.36% rated as “high,” underscores their suitability for arid zones (Namara et al., 2019).

Correlations between body measurements and live weight reveal that chest girth is the most reliable predictor for both breeds ($R^2 = 0.85$ for Mubende and 0.79 for Kigezi) (Table 10). This supports the use of morphometric traits for weight estimation and selection, as suggested by studies like Zahraddeen et al. (2008). The high coefficient values for chest girth in both breeds underscore its importance in practical applications, including breeding and productivity assessments.

The current study results reported that Mubende goats demonstrated superior reproductive and growth metrics, alongside better tolerance to arid conditions, making them ideal for extensive systems. On the other hand, Kigezi goats, adapted to cooler highland climates, exhibit slower growth but retain significant disease resistance (Table 11). These findings provide critical insights for optimizing management strategies tailored to the environmental and genetic characteristics of both breeds, as recommended by Ssewanyana et al. (2004) and Tumushabe et al. (2022).

5.2 Conclusions

Based on the study findings, it is concluded that indigenous Mubende goat kids exhibit superior growth rates compared to Kigezi goat kids, evidenced by higher body weight and chest width in does and greater height at withers, pelvic width, and horn length in bucks. These differences,

significant at $p < 0.05$, suggest a performance advantage for Mubende goats. Both breeds performed comparably in body condition scores.

The results show that Mubende goats generally outperform Kigezi goats in key growth traits. Mubende does exhibit significantly higher body weight and chest width, while Mubende bucks display greater height at the withers, pelvic width, and horn length. These differences suggest a superior growth performance of Mubende goats compared to Kigezi goats.

5.3 Recommendations

Based on the results, it is recommended that given the superior growth traits of Mubende goats, crossbreeding strategies could be explored to improve the growth performance of Kigezi goats while maintaining their adaptive traits to local environmental conditions.

For optimal growth, Mubende goats are preferable for breeding programs focused on weight, structural size, and productivity. Further research should evaluate environmental and genetic factors to enhance performance in both breeds, tailoring strategies to address specific limitations observed in Kigezi goats.

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Appendix A: Data Collection Tool

BISHOP STUART UNIVERSITY

EDUCATIONAL RESEARCH DATA FOR KYOKWIJUKA PETER DOING MARI

SIGN..... DATE.....

Date	S/N	Measuring performance of male winners (Sex)	Weight	Height	Length	Scratol circumference	Observation of any sexual sign	Feed ratios	Remarks