African Multidisciplinary Journal of Development (AMJD)

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REPRODUCTIVE PERFORMANCE, BIRTH WEIGHTS, AND SEX RATIO DYNAMICS OF CAPTIVE GRASSCUTTER (Thryonomys Swinderianus)

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Abstract

The grasscutter (Thryonomys swinderianus) is a micro-livestock species with increasing economic importance in sub-Saharan Africa due to its high-quality meat and domestication potential. This study examined reproductive performance, sex ratio, and birth weight patterns of a captive grasscutter colony over a seven-year period (2016–2022) to provide insights for sustainable production. Data on litter size, sex ratio, and pup birth weights were analyzed using descriptive statistics, paired-samples t-test, and Welch's t-test. Results showed that male pups were significantly heavier than females (145.86 ± 17.24 g vs. 127.29 ± 13.29 g; $p < 0.001$), indicating sexual dimorphism in early growth. Seasonal variation influenced sex ratio, with the rainy season favoring more female births (M:F ratio = 0.93) and the dry season showing a slight male bias (M:F ratio = 1.05). However, the overall sex ratio (0.96) was near parity, supporting colony stability. Monthly litter distribution confirmed that grasscutters reproduced throughout the year, except in January and July, with no significant seasonal effect on litter size ($p > 0.05$). These findings suggest that grasscutters possess favorable reproductive adaptability under captivity, making them suitable for commercial production. The observed sexual dimorphism and balanced sex ratios highlight the importance of sex-specific growth monitoring and seasonally informed management strategies for optimizing productivity.

Keywords: Grasscutter, Birth, Sex ratio, Seasonality, Micro-livestock

Introduction

The grasscutter (*Thryonomys swinderianus*), also known as the greater cane rat, is increasingly being domesticated across West Africa as an important form of microlivestock. Belonging to the order *Rodentia* and family *Thryonomyidae*, the species is genetically more closely related to the porcupine than to the rat (Korankye et al., 2021). It is a monogastric herbivore widely distributed in the Guinea-Gulf savannah zones, particularly in areas dominated by tall grasses such as elephant grass (*Pennisetum purpureum*) and guinea grass (*Panicum maximum*), which constitute its primary food sources (Ankrah, 2005).

The domestication of grasscutters has gained attention due to their potential contribution to food security, income diversification, and sustainable livestock production in the subregion. Grasscutter meat is highly valued for its nutritional quality and cultural acceptance, making it a lucrative alternative to conventional livestock (Annor et al., 2006). Despite these prospects, several constraints limit the growth of the industry. These include the scarcity of improved breeding stock, inadequate technical expertise, poor management practices, insufficient housing systems, and limited access to start-up capital (Annor et al., 2006; Poku et al., 2013). Moreover, the productivity of

captive colonies is often hampered by low reproductive efficiency and high pup mortality, which undermine the profitability and sustainability of grasscutter farming.

Reproduction and growth performance in grasscutters are strongly influenced by nutrition, management, and environmental conditions. Optimal nutrition has been shown to enhance growth rate, reduce mortality, and improve reproductive success (Poku et al., 2013). Given the importance of grasscutter domestication for food security, income generation, and rural livelihoods in West Africa, a deeper understanding of the species' reproductive biology is critical for improving management practices and productivity. Accordingly, this study aimed to evaluate the reproductive performance, birth weights, and seasonal sex ratio dynamics of captive grasscutters (*Thryonomys swinderianus*) over a seven-year period (2016–2022), with the goal of identifying key factors influencing productivity and colony sustainability.

Materials and Methods

Study location and animals

This study was conducted between 2016 and 2022 at the Forestry Research Institute of Nigeria (FRIN), Ibadan, Nigeria. A total of 24 sexually mature does and 8 bucks of the grasscutter (*Thryonomys swinderianus*) were used. Animals were selected from the Institute's breeding colony based on sexual maturity, docility, reproductive performance, and good maternal ability. The grasscutters were 6–7 months old with average body weights of 1.20–2.48 kg. Sexual maturity was confirmed by the presence of a darkened perineum in males and vaginal membrane closure/rupture in females (Henry, 2011; Poku et al., 2013). None of the animals had been used for breeding before the commencement of the experiment.

Housing and management

Animals were housed in floor-level hutches made of 6-inch hollow concrete blocks. Each hutch (0.70 m × 0.50 m × 2.00 m) contained two compartments connected by a passable opening, allowing movement and providing refuge. Given the polygynous mating system of grasscutters, each buck was paired with one to three does under close observation. Pregnant or injured animals were separated to reduce stress and prevent abortion. Environmental temperature during the study ranged between 25.7 and 32.4 °C.

Feeding regime

Animals were fed twice daily. In the morning (08:00–10:00), freshly harvested elephant grass (*Pennisetum purpureum*) was offered, while in the afternoon (14:00–15:00), concentrate feed was provided. Clean water was supplied ad libitum. Routine health management, including deworming and prophylactic treatments, was maintained throughout the study.

Data collection

Reproductive data were recorded continuously between 2016 and 2022. Parameters included number of litters, litter size at birth, pup sex composition, seasonal distribution of parturitions (rainy vs. dry season), and pup body weights. Births were confirmed by direct observation and logged in farm records.

Statistical analysis

Data were analyzed using SPSS software (Version 20.0). Descriptive statistics (means, standard deviations, frequency distributions, and charts) were used to summarize reproductive and growth performance. For inferential analysis, paired-samples t-tests were used to compare mean male and

ISSN: 2518-2951 https://doi.org/10.59568/AMJD-2025-14-1-09 African Multidisciplinary Journal of Development (AMJD)

female pup weights. Spearman's rank correlation assessed associations between litter size and pup body weights. Welch's t-test was applied to compare seasonal differences in litter size, and Cohen's *d* was calculated to estimate effect sizes. Statistical significance was determined at $p < 0.05$.

Results and Discussion

The reproductive performance of grasscutters (*Thryonomys swinderianus*) across the seven-year observation period (2016–2022) exhibited marked inter-annual variability (Table 1). Over the study period, a total of 735 pups were produced, corresponding to an overall average of 4.38 pups per doe annually. This mean reproductive output aligns with earlier reports by Lameed and Ogundijo (2006), who documented a litter size range of 3–5 per doe, and by Mensah (2000), who observed average litter sizes between 3.8 and 5.7.

The most productive year was 2017, with 185 pups and the highest reproductive rate of 7.71 pups per doe, followed by 2020 with 160 pups and 6.67 pups per doe. In contrast, reproductive outcomes were markedly depressed in 2019, 2021, and 2022, yielding only 2.29, 2.29, and 1.25 pups per doe, respectively. These values are within the reproductive limits described in earlier studies. For instance, Onadeko and Amubode (2002) reported litter sizes ranging between 2 and 7 pups, while Henry (2011) observed a maximum of 7 pups in exceptional cases, with most females producing between 1 and 3 pups. Similarly, Addo et al. (2007) documented a range of 2–6 pups per litter, and Hagan et al. (2012) reported a mean litter size of 3.96 ± 0.32 pups.

The observed fluctuations underscore the influence of temporal factors on reproductive efficiency, which may be linked to environmental variability, feed quality, and husbandry practices. Nutrition, in particular, plays a pivotal role, as highlighted by Poku et al. (2013), who reported that optimal dietary protein not only enhances growth rates but also reduces mortality and significantly improves litter size at both birth and weaning. The peak reproductive outputs recorded in 2017 and 2020 suggest that favorable breeding conditions, likely involving improved management and stable environmental conditions, can substantially enhance reproductive success. Conversely, the sharp declines in 2019, 2021, and 2022 may reflect periods of nutritional deficiencies, increased disease pressure, or climatic stress factors well-documented to constrain reproductive performance in small herbivores.

Table 1. Annual reproductive performance and mean body weights (±SD) of male and female grasscutters

Year	Male litters	Female litters	Total pups	Pups per doe per year	Male Mean Wt (g) ± SD	Female Mean Wt (g) ± SD
2016	60	60	120	5.00	132 ± 6.6	116 ± 5.8
2017	95	90	185	7.71	145 ± 7.3	122 ± 6.1
2018	45	85	130	5.42	122 ± 6.1	109 ± 5.5
2019	25	30	55	2.29	154 ± 7.7	132 ± 6.6
2020	95	65	160	6.67	138 ± 6.9	127 ± 6.4
2021	30	25	55	2.29	156 ± 8.7	136 ± 5.0
2022	10	20	30	1.25	174 ± 4.5	149 ± 7.0
Total / Mean	**360**	**375**	**735**	**4.38**	**145.86 ± 17.24**	**127.29 ± 13.29**

Body weight differences between male and female pups

The mean birth weights of grasscutter pups showed consistent sexual dimorphism throughout the study period, with male pups being significantly heavier than their female counterparts (Table 2). Across all years, male pups averaged 145.86 ± 17.24 g, compared to 127.29 ± 13.29 g in females. This

ISSN: 2518-2951 https://doi.org/10.59568/AMJD-2025-14-1-09 African Multidisciplinary Journal of Development (AMJD)

pattern aligns with earlier findings by Onadeko and Amubode (2002), Ikpeze and Ebenebe (2004), and Akinola et al. (2015), who similarly reported that male grasscutter pups are generally heavier at birth than females. Henry (2011) also documented mean birth weights ranging between 120 g and 150 g, consistent with the values observed in the present study. A paired samples t-test further confirmed the statistical significance of this sex-based difference in mean birth weight (mean difference: 18.57 g; 95% CI: 13.65–23.49; $p < 0.001$). The presence of sexual dimorphism at birth suggests important implications for production efficiency. Heavier male pups may have enhanced growth trajectories, improved feed conversion efficiency, and potentially higher market value compared to females, underscoring the need for sex-specific monitoring in grasscutter farming systems (Ikpeze and Ebenebe, 2004).

Table 2. Paired samples t-test comparing mean birth weights of male and female grasscutter pups

Pair	Mean Difference (g)	SD of Difference	SE Mean	95% CI of Difference	t	df	*p*-value
Male vs. Female Mean Weight	18.57	5.32	2.01	13.65 – 23.49	9.24	6	<0.001

Correlations between reproductive output and pup body weights

The relationship between reproductive output and pup body weights revealed important biological trade-offs (Table 3). Spearman's rank correlation analysis showed a significant negative association between the number of pups per doe and female pup birth weight ($r = –0.703$, $p < 0.05$). Although not statistically significant, a similar negative trend was observed between reproductive output and male pup weight ($r = –0.667$). These findings are consistent with previous reports by Onadeko and Amubode (2002), who observed that increases in litter size were generally accompanied by a reduction in mean birth weight of grasscutter pups. Similarly, Ikpeze and Ebenebe (2004) reported an inverse relationship between birth weight and litter size, reinforcing the notion that larger litters tend to produce lighter offspring. By contrast, male and female pup weights were found to be strongly and positively correlated ($r = 0.964$, $p < 0.01$), indicating a consistent sex-related growth pattern across litters. This suggests that, despite differences in overall reproductive output, male and female pups are likely subjected to similar maternal resource allocation strategies.

The observed negative association between litter size and pup weight supports the principle of resource allocation in mammalian reproduction, where maternal energy investment must be distributed among offspring. Larger litters often lead to reduced energy per pup, producing smaller neonates. Such trade-offs are particularly relevant in grasscutter farming systems, where both litter size and pup quality directly influence productivity. As noted by Poku et al. (2013), optimal nutritional support improves growth rates, survival, and reproductive efficiency, suggesting that farmers aiming to increase litter sizes must simultaneously improve nutritional and management practices to maintain pup viability. These results underscore the importance of balanced breeding strategies that consider not only the quantity but also the quality of offspring in achieving sustainable grasscutter production.

Table 3. Spearman's rank correlations between reproductive output and mean body weights of grasscutters

Variables	Pups per doe	Male mean weight	Female mean weight
Pups per doe	1.000		
Male mean weight	–0.67	1.00	

ISSN: 2518-2951 https://doi.org/10.59568/AMJD-2025-14-1-09 African Multidisciplinary Journal of Development (AMJD)

Female mean weight	–0.70*	0.96**	1.00

Note: *Correlation is significant at the 0.05 level (1-tailed).

**Correlation is significant at the 0.01 level (1-tailed).

The distribution of litters by sex and season is presented in Table 4. Over the seven-year period, a total of 275 females and 255 males were produced during the rainy season (March–November), resulting in a female-biased sex ratio of 0.93. In contrast, the dry season (December–February) yielded 105 males and 100 females, producing a slightly male-biased ratio of 1.05. When pooled across seasons, the colony produced 360 males and 375 females, corresponding to an overall sex ratio of 0.96, which reflects near parity between sexes. Such balance is beneficial for colony sustainability and aligns with the findings of Owusu et al. (2010), who emphasized that a sex ratio close to equilibrium supports stable population growth and maintains genetic diversity.

The predominance of females during the rainy season, as illustrated in Figure 1, suggests that environmental factors may influence sex determination or pup survival. Improved forage availability, nutrient density, and favorable climatic conditions during this period likely enhance maternal physiological status, leading to a higher probability of female pup production. Conversely, the slight male bias observed in the dry season may be linked to nutritional stress, thermal fluctuations, or other seasonal constraints that alter maternal endocrine responses during conception and gestation. Similar observations have been documented in rodents, where maternal nutrition, body condition, and reproductive history are key determinants of sex ratios (Owusu et al., 2010).

Nonetheless, not all studies have shown seasonal effects on reproductive traits. Fayeye and Ayorinde (2010) reported no significant influence of season of birth on litter size or birth weight in grasscutters. This aligns partly with the present study, as Figure 1 demonstrates that grasscutters reproduced throughout the year, with the exception of January and July. This agrees with earlier reports by Asibey (1974) and Onadeko and Amubode (2002), who observed year-round breeding in grasscutters, although Happold (1987) noted subtle seasonal variation in reproductive intensity. For commercial production, a slight female bias, as recorded during the rainy season, is advantageous because it increases the number of potential breeding does, thereby enhancing the reproductive potential of the colony. A skew towards females has been highlighted in livestock management as a driver of reproductive output, since female availability directly determines breeding herd capacity.

Statistical comparison of litter sizes between rainy and dry seasons (Table 5) showed no significant difference (Welch's $t = 0.35$, $df = 3.1$, $p = 0.735$). This finding supports the report of Korankye et al. (2021), who similarly found that season of birth had no significant effect on grasscutter birth weight ($p > 0.05$). The low effect size (Cohen's $d = 0.18$) further suggests that seasonal effects on litter output are minimal compared to other factors, such as nutrition and management practices. The monthly distribution of births (Figure 1) highlights October as the peak reproductive month, with 155 pups produced, followed by March and April. Conversely, May, December, and July recorded the lowest outputs. These patterns suggest that while grasscutters can breed throughout the year, peaks in littering may coincide with periods of high forage availability and quality, which in turn support maternal nutrition and reproductive success.

Table 4: Sex ratio of grasscutter (*Thryonomys swinderianus*) litters during rainy and dry seasons

Parameter	Male litters	Female litters	Sex ratio (M:F)
Rainy season	255	275	0.93
Dry season	105	100	1.05

ISSN: 2518-2951 https://doi.org/10.59568/AMJD-2025-14-1-09 African Multidisciplinary Journal of Development (AMJD)

Overall	360	375	0.96

Note: Sex ratio calculated as the proportion of male to female litters.

Table 5: Comparison of grasscutter litter productivity between rainy and dry seasons

Season	n	Mean (±SD)	t	Df	p-value	Cohen's d
Rainy season	7	75.71 ± 45.59				
Dry season	3	68.33 ± 20.82	0.35[1]	3.1[1]	0.735[1]	0.18

[1]Welch's t-test (equal variances not assumed).

Note: Welch's t-test was used due to unequal group sizes. CI = confidence interval; SD = standard deviation.

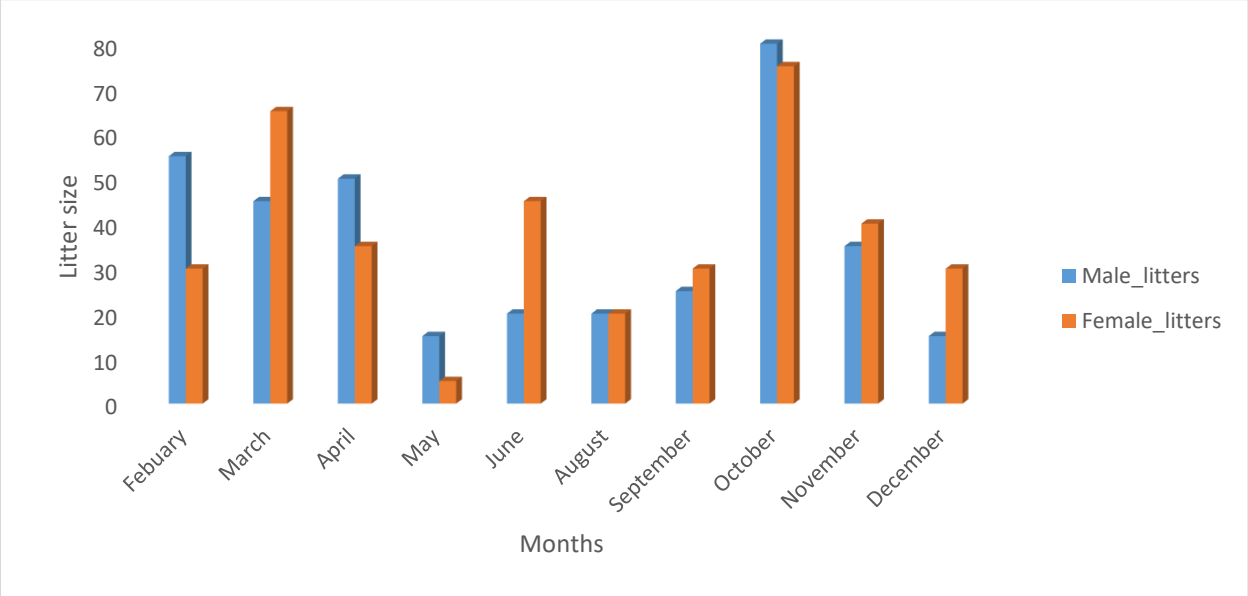

Figure 1: Monthly distribution of grasscutters

Conclusion

This study provides comprehensive insights into the reproductive performance and early growth patterns of captive grasscutters (*Thryonomys swinderianus*) over a seven-year period. The findings revealed that sex significantly influenced birth weight, with males being consistently heavier than females, a trend that aligns with earlier studies on sexual dimorphism in rodents. Seasonal variation also played a role, as the rainy season favored a slightly higher proportion of female births, while the dry season was associated with a male bias. Nonetheless, the overall sex ratio remained close to parity, which is advantageous for maintaining colony sustainability and genetic diversity. The observation that grasscutters littered throughout the year, except in January and July, underscores their reproductive adaptability under captive management. This year-round breeding potential, coupled with favorable sex ratios, highlights the suitability of grasscutters for domestication and commercial production. The study also emphasizes the importance of sex-specific growth monitoring and careful consideration of seasonal influences on reproductive outcomes, both of which have direct implications for productivity, market value, and long-term colony management. Overall, these findings contribute valuable knowledge to grasscutter husbandry, offering practical guidance for farmers, extension agents, and policymakers seeking to optimize captive breeding programs and enhance the role of grasscutters in sustainable livestock production systems.

ISSN: 2518-2951 https://doi.org/10.59568/AMJD-2025-14-1-09 African Multidisciplinary Journal of Development (AMJD)

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