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SEASONAL VARIATION EFFECT ON GROWTH, BODY WEIGHTS, REPRODUCTIVE CHARACTERISTICSOF THE GRASSCUTTER (*THRYONOMYS SWINDERIANUS*)

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ABSTRACT

This study was conducted to investigate the influence of season on growth and reproductive performance of the grasscutter (*Thryonomys swinderianus*). The female grasscutters were randomly grouped into three (3) in a cage. Each group received one male for mating. The treatments for all the experimental animals were the three seasons of birth. The study was carried out for a period of seventeen months using 36 dams, 12 bucks and their 115 offspring fed. Basal diet of elephant grass was supplemented with 10 % crude protein concentrates.Completely Randomized Design was used and data collected was analysed using Generalised Linear Model (GLM) Type II procedure of SAS (2008). Results showed that season of birth had significant (P<0.05) effect on weaning weight, preweaning growth rate and litter weight at birth. Kids born in the dry season recorded highest (P<0.05) weaning weight, preweaning survival rate and litter weight at birth while those born in the major rains had significantly (P<0.05) lower weights. Pregnancy rate was highest (P<0.05) in dams mated in the minor rainy season. The highest (P<0.05) weight loss was at lactation was recorded in the dams that delivered in the dry season. This study concludes that season of birth is an important factor in breeding domesticated grasscutter.

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INTRODUCTION

The grasscutter belongs to the mammalian order *Rodentia* and the family *Thryonomyidae.* The grasscutter is genetically more closely related to the porcupine than the rat (Baptist and Mensah, 1986; Yeboah and Adamu, 1995). Grasscutter meat constitute an important food for the people of the West African sub-region and its production has increased considerably in recent years in order to meet the ever-increasing demand (NRC, 2009). The meat is preferred to the meat of any kind of domestic animal and commercially available game (Mensah and Okeyo, 2005). It is increasingly popular for the fact that it is very nutritious, lean and low in fat and cholesterol (Adjanohoun, 1989). Grasscutters are highly productive and this makes it an unthreatened species despite its heavy hunting. Grasscutters reproduce all year-round and this makes its meat available to West African consumers all the time (NRC, 1991).

The body length of the grasscutter (*Thryonomys swinderianus*) is usually 350-610mm and its tail reaches 65-260mm in length. The grasscutter is heavy and has an average neonatal and weaning weights of 120.5 ± 22.1g and 450.9 ± 42.9g, respectively (Addo *et al.,* 2007) with adult weight of 3kg in females and 4.5kg for the males (Fitzinger, 1995). The average weight of wild grasscutter is 4-5 kg for the female and the male reaches up to 10kg and average weight at 12 months as between 2.5-4.5kg in males and 2-3kg in females and dressing percentage of 64 (Jori *et al*., 1995). The major hindrances to the domestication of the grasscutter are the lack of improved breeding stock and nutrition (Annor and Djang-Fordjour, 2006), season of production, lack of technical know-how, lack of proper management practices for efficient production, housing design and poor reproductive performance (Adu, 1999).The grass cutter has a gestation length of 152-154 days (Addo *et al.,* 2007) and average litter size of 3.8-5.7 and produces 1.6 to 1.9 litter per female per year (Mensah, 2000). The effects of season on growth, reproductive and

survival performance have been studied by several researchers (Fayeye and Ayorinde, 2010). Birth weight, weaning weight, litter size and litter weight, dam weight and survivability were all influenced by season of birth. The aim of the study was to investigate the influence of season of birth on growth rate, body weights, reproductive characteristics and survival of the grasscutter (*Thryonomys swinderianus*).

MATERIALS AND METHODS

Study Location: The experiment was conducted at the grasscutter section of the Department of Animal Science Education, University of Education, Winneba, Mampong campus. Mampong- Asante is the capital town of the Mampong Municipality of the Ashanti Region. Mampong is located 60 km North-East of Kumasi on the Kumasi-Ejura road. The Municipality lies between latitude 07 04^{0}" degrees North and longitude 01 24" degrees west with altitude 457.1 m above sea level in the Transitional Zone between the Guinea Savanna Zone of the north and Tropical Rain Forest of the south of Ghana. The climatic condition is wet semi-equatorial type, with a bi-modal rainfall of 1224mm per annum and temperature range of 22.3ºC-30.6^{0}C. Rainfall occurs in April to July (Major Raining Season), August to November (Minor Rainy Season) and December to March (Dry Season).

Experimental Animals and Mating: Thirty-six (36) adult female grasscutters (8-20 months old) raised at the grasscutter section of the Department of Animal Science of the University of Education, Winneba, Mampong were used in the experiment. The females weighed 1.5-3.5kg. Twelve (12) male grasscutters (bucks) aged between 10 and 20 months were selected from the same colony as the females. The males weighed between 2.3 and 3.7kg. Mating of the animals was done in concrete cages in a ratio of one male to three females. The date and time of mating were recorded. Males and females were left together for six (6) weeks. The females were examined for successful pregnancy by palpation at 6 weeks after separation. Non pregnant females were re-mated. All the kids born to the does in the experiment were selected and their growth, body weights, survival and reproductive characteristics were studied. One hundred and fifteen (115) kids were involved.

Housing of the Experimental Animals: The experimental grasscutters were housed in three-tier wooden and concrete cages. Each wooden cage measured 90×40×60 cm. The wooden cages were one-chambered. The concrete cages were two chambered with a passage at the centre. Each chamber measured 80×50×70 cm.

Experimental Design, Treatment and Feeding: The Completely Randomized Design (CRD) was used. The female grasscutters were randomly grouped into three (3) in a cage. Each group received one male for mating. The bucks and the does were kept and fed together for six weeks after which the males were separated from the females. The treatments for all the experimental animals were the three seasons of birth. Treatment 1: Major Raining Season (April-July), Treatment 2: Minor Raining Season (August-November) and Treatment 3: Dry season (December-March). The grasscutter colony at the University farm was fed a basal diet of elephant grass and supplementary concentrates that contained 10% crude protein (Table 1). The grasscutters were provided with fresh and clean drinking water *ad libitum*in twice daily.

Vitamin and Mineral Premix Composition: *Vit. A (8.000UI), Vit. D (1.500UI), Vit. E (2.5000UI), Vit. K_3 (1.000mg), Vit. B_2 (2.000mg), Vit. B_{12} (5mg), Nicotinimic acid (3mg), Calcium Panthotenate (2mg), Antioxidant (10mg), Folic acid (500mg), Chlorine Cloruro (50mg), Manganese (50mg), Zinc (40mg), Copper (4.50mg), Cobalt (100mg), Iodine (1mg) and Selenium (100mg).*

Health Management of Experimental Animals: All the grasscutters used in the study (bucks, does and kids) were tagged with metal ear tags on the left ear. The animals were observed every day for possible occurrences of diseases and sicknesses. Sick animals were isolated from the group and were treated. Wounds of injured animals were treated with Oxytetravet Aerosol suspension manufactured by Glaxo Pharmaceutical, United Kingdom. Disinfectant (Dettol) and fly repellant (Raid Insecticide Spray) made by Johnson Family Company were used to prevent pathogens and infestations. Foot bath and restriction of visitors were used to ensure biosecurity and to avoid animals being traumatized. Post mortem was conducted on dead animals and findings of possible causes of death were recorded.

Parameters Measured

Birth and weaning weight: Kids were weighed within 24 hours after birth and again at weaning with an electronic balance. Birth and weaning weights were recorded (g).

Litter size at birth and weaning: Live kids born to the dams were counted and recorded immediately after parturition. The kids were identified with the use of metal tags. Kids surviving up to preweaning were also counted.

Litter weight at birth and weaning: Total weights (g) of the kids in a litter at birth and at weaning were computed from individual weights at birth and at weaning, respectively.

Preweaning growth rate: Preweaning growth rate of the kids was calculated as:

$$Preweaning\ growth\ rate\ \left(\frac{g}{day}\right) = \frac{Weaning\ weight - Birth\ weight}{Number\ of\ days\ from\ birth\ to\ weaning}$$

Dam weight change from parturition to weaning: Weights of does were taken and recorded at parturition and at weaning of the kids with the use of digital electronic balance.

Preweaning Survival rates: For each litter the number of dead kids was recorded from birth to weaning. Preweaning mortality resulting from different ailments and incidences were recorded. Kids mortality at birth and post-natal were recorded as soon as they occur. The mortality rate was calculated as:

$$Preweaning\ mortality\ (\%) = \frac{Number\ of\ dead\ kids}{Number\ of\ kids\ born} \times 100$$

The overall preweaning survival rate at weaning was also calculated as:

$$Preweaning\ Survival\ rate\ (\%) = \frac{Number\ of\ kids\ alive\ at\ weaning}{Number\ of\ kids\ born} \times 100$$

Data Analysis: The data collected were subjected to Least Square Analysis using Generalized Linear Model (GLM) Type II procedure of SAS. Differences between means of significant effects were separated by using the probability of difference (PDIFF) procedure of SAS (SAS, 2008).

RESULTS

Effect of season on birth weight and weaning weight: Season of birth did not affect birth weight (P>0.05) (Fig. 1). However, the effect of season of birth on weaning weight was significant (P<0.05). Kids born in the dry season recorded highest (P<0.05) weaning weight and those born in the major rains had significantly (P<0.05) lower weights (Fig. 1).

Effect of season of birth on preweaning growth rate, litter size at birth and litter size weaning: Preweaning growth rate was significantly influenced by season of birth and was higher in the animals born in the dry season. Kids born in the dry season had higher (P<0.05) preweaning survival rate than those born in major and minor seasons (Table 2). Season of birth had no significant effect on litter size at birth (P>0.05) and, however, significant effect was recorded in litter size at weaning (P<0.05) (Table 2).

Table 1. Chemical Composition of Diets

Variables	% Dry Matter	% Crude Protein	% Crude Fibre	% Ether Extract	% Ash
Formulated Diet	86.39	9.90	5.95	2.99	6.29
Elephant Grass *(Pennisetum purpureum)*					
Major Rains	34.30	9.25	31.00	1.17	9.80
Minor Rains	89.77	7.90	32.79	1.00	6.25
Dry	92.5	5.1	58.62	1.50	5.21

Table 2. Effect of season of birth on preweaning growth rate

Traits/Season of birth	April-July (Major rains)	August-November (Minor rains)	December-March (Dry season)
Preweaning growth rate (g/day)	5.29^{a}	7.57^{a}	10.83^{b}
Preweaning survival rate (%)	88.49 ± 4.89^{ac}	69.21 ± 2.88^{b}	97.78 ± 2.85^{c}
Litter size at birth	3.99 ± 0.65	4.27 ± 0.37	4.26 ± 0.34
Litter size at weaning	1.75 ± 0.12^{c}	2.83 ± 0.37^{b}	3.05 ± 0.36^{a}

Means bearing different superscripts in the same row are significantly different (P<0.05).

Table 2. Effects of season of birth on number of days from mating to conception, pregnancy rate and dam weights at parturition and weaning of kids

Traits/Season of birth	April-July (Major rains)	August-November (Minor rains)	December-March (Dry season)
Days from mating to conception	37.69 ± 3.20^{a}	9.16 ± 1.89^{bc}	9.91 ± 1.86^{c}
Pregnancy rate (%)	88.98 ± 4.82^{ab}	100.00 ± 2.84^{b}	82.36 ± 2.8^{a}
Dam weight at parturition (g)	3501 ± 95.95^{a}	2930.46 ± 56.59^{b}	$3762\pm08\pm55.87^{c}$
Dam weight at weaning of kids (g)	2761.39 ± 176.51^{ab}	2616.89 ± 104.16^{a}	3103.36 ± 98.18^{b}
Dam weight lost (g)	796.06 ± 169.83^{ab}	408.41 ± 100.22^{b}	822.50 ± 94.46^{a}

Litter weight at birth and weaning: Litter weight at birth and weaning was higher (P<0.05) in kids born in the dry season (Fig. 2). There was no significant difference between litter weight at birth in the major and litter weight at birth in the minor season (P>0.05). Litter weight at weaning increased from the rainy season to the dry season (Fig. 2).

Effects of season of birth on number of days from mating to conception, pregnancy rate and dam weights at parturition and weaning of kids: Dams that were mated in the minor rainy season had shortest (P<0.05) days of exposure of the female to the male before pregnancy as compared to those mated in the other seasons. The longest was recorded in major rainy season (Table 2). Pregnancy rate was highest (P<0.05) in dams mated in the minor rainy season (Table 2). Dams that conceived in the minor season and delivered in the dry season recorded higher (P<0.05) dam weight at birth and those that conceived in the dry season and gave birth in the major rainy season had lower dam weight at birth (Table 2). This resulted is similar to dam weights at weaning of kids (Table 2). Higher (P<0.05) weight loss was recorded during lactation of the dams which delivered in the dry season (Table 2), but was not significantly different from those that gave birth in the major season (P>0.05). Dams which delivered in the minor season recorded lesser weight loss during lactation (Table 2).

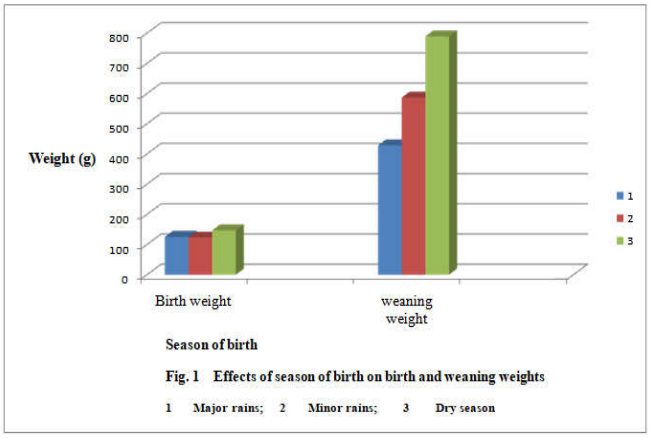
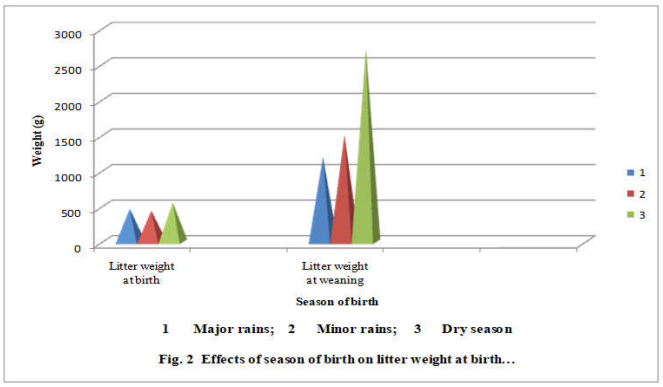


Fig. 1 Effects of season of birth on birth and weaning weights

1 Major rains; 2 Minor rains; 3 Dry season



1 Major rains; 2 Minor rains; 3 Dry season

Fig. 2 Effects of season of birth on litter weight at birth…

DISCUSSION

The influence of season of birth of kids was significant on weaning weight, growth rate, litter weight at birth and weaning, survival rate, and pregnancy rate, number of days of mating to conception, and weight loss of the dam (Sušić *et al.,* 2005). However, (Fayeye and Ayorinde, 2010) reported no significant effect of season of birth on litter size at birth and birth weight. The study showed that kids born in the dry season were found to be heavieras compared to the other seasons and, therefore, exhibited heavier weaning weight and growth rate (Ndlovu and Simela, 1996). This performance could be attributed to good nutritional levels of the mothers during the rainy seasons where grasses had good crude protein content (Bayble *et al.*, 2007) and poor performance in the other seasons which corresponded to time when pasture quality were lacking and dams received had little nutritional benefit. The findings may also suggest that the 10% crude protein supplement was not sufficient to guarantee adequate milk production during the dry season. Additionally, the differences in seasonal effect on birth weight and weaning weight may be partly due to differences in ambient temperature which influenced the feeding patterns of the dams during gestation. This confirmed the earlier report by Husain *et al*. (1995) in sheep and Fayeye and Ayorinde (2010) in rabbit and this suggests that kids born in different seasons may have different weaning weights and preweaning growth rate (Yilmaz *et al.,* 2006).

Survivability increased in the kids born in the dry season and weaned in the major rainy season and is an indication that kids borne during the dry season may have the benefit of immunity as a result of the nutritional status of dams during gestation, quality of milk and lower disease infestation as a result of the environment within the period of birth (Sušić *et al.,* 2005). Though, grasscutter exhibit induced ovulatory behaviour and breed all-year-long (Addo *et al.,* 2001), this study revealed that varied season have different effect on days of mating to conception, pregnancy rate and dam weight during gestation and post parturition.

CONCLUSION

This study concludes that season of birth was an important factor in breeding domesticated grasscutter. Grasscutters that were mated in the minor season and gave birth in the dry season showed significant improvement in growth, body characteristics, reproductive characteristics and survival rates.

RECOMMENDATIONS

On the basis of the findings the following recommendations were made:

- This study recommends that dams be mated in the second rainy season (August-November) and deliver in the third season (December-March)
- This study further recommends that grasscutter breeders and farmers should consider seasonal influence on grasscutter production in their breeding programmes.

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