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Growth Performance Characteristics of Egyptian Buffalo Calves As Affected By Non-Genetic Factors

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Abstract

This study aimed to investigate the growth performance characteristics (GPC_S) of the Egyptian buffalo calves and how they are influenced by various environmental factors in Sohag Governorate. There are limited studies on non-genetic factors that can influence the body weight of buffalo calves, especially at advanced ages. The GPC_S are economically important and are key indicators when evaluating farm animals and their production level. In this context, 95 Egyptian buffalo calves were used in this study to investigate the effects of some non-genetic factors on buffalo calves' body weight and average daily gain from calving to 24 months old. This study was conducted at the experimental farm of the Animal Production Department, Faculty of Agriculture, Sohag University. The calving weight of the newborn calves was recorded within two days of calving, then the weights were monitored monthly. The results showed that the overall mean of the body weight (BW) at different ages (calving weight, weaning weight, 6, 12, 18, and 24 months old) were 29.28, 83.54, 118.79, 214.92, 279.30 and 296.88 kg respectively. In addition, the body weight was significantly affected ($P<0.05$) by the calving year (CY), calving season (CS), and calf sex (CSX). Calves born in the second year had higher body weights compared to those born in other years. All studied factors had a highly significant effect ($P<0.05$) on the average daily gain. In conclusion, body weight and average daily gain of Egyptian buffalo calves were significantly influenced ($P<0.05$) by CY, CS and CSX.

Keys word: Egyptian buffalo calves; average daily gain; growth performance.

INTRODUCTION

Egypt is an agricultural country, and livestock is a vital component of Egyptian agriculture. Buffaloes and cattle are the most important livestock species in Egypt. They present the main sources for milk and red meat (Abdel Monem et al., 2025; Shoukry, 2021; Rabie, 2020). The Egyptian buffalo is one of the most prevalent types of farm animals, raised by a wide range of livestock farmers. particularly, rural residents and smallholders. due to their distinctive production characteristics and capabilities. As their higher milk fat content, disease tolerance and resistance, and longer productive lifespan. Thereby they are well-suited for economic production, and the occupy a great position in the life of the Egyptian farmer (Abdel-Salam & Fahim, 2018; FAO, 2017; El-Nahrawy, 2011). Furthermore, they are strong animals capable of withstanding extreme living conditions. There are approximately 3.5 million heads of buffalo in Egypt (FAOSTAT, 2019), providing the Egyptian market with 44% and 39% of milk and red meat, respectively (Abou El-Amaiem, 2014). An environmental condition is a constraint on efficient livestock production performance. Although evaluating the level of this constraint is challenging, it is essential for modification in animal management methods and environmental conditions could to be made. (Omran et al., 2020). Year of calving affects the weight of buffalo calves at various life stages as an environmental factor. This topic is highly relevant in the fields of animal husbandry and production. The effect of the year of calving is considered a compound factor influenced by multiple variables that may change annually, such as the quality and quantity of available feed, climatic conditions (temperature, humidity, wind movement), seasonal diseases or epidemics, and alterations in husbandry and management practices. Previous studies have indicated that calving weight is significantly affected by several factors, including the season and year of calving, the sex of the calf, and the parity of the dam (Thiruvenkadan et al., 2009; Akdağ et al., 2011 and Pandya et al., 2015). The growth performance of buffalo can be enhanced by incorporating critical environmental factors into selection criteria Thevarnanoharan et al., (2001) and Alkoyak and Öz, (2022). This study aimed to investigate the growth performance characteristics of the Egyptian buffalo calves and how they are influenced by various environmental factors in Sohag Governorate.

MATERIALS AND METHODS

The present study was carried out the experimental farm of the Animal Production Department, Faculty of Agriculture, Al kawamil city, Sohag University, It is located in a desert area west of Sohag (latitude 26° 33', N, longitude 31° 41', E)

(https://maps.app.goo.gl/t6zEmyTSTd1XoTqA6).

Animal and data collecting

The study involved ninety-five calves of Egyptian buffalo to investigate how some environmental factors influenced body weight and average daily gain during different growth stages. Calving weights were recorded within two days postpartum, and weaning weights (WW) were taken when the calves were three months old. Subsequently, the calves were weighed regularly monthly in the morning before feeding using an electronic scale, to calculate the growth rate, at least two measurements are required. By recording the calf's calving weight, an initial value is established, allowing for the calculation of average daily gain (ADG) at various stages of growth.

Growth rate was calculated according to the following equation

$$\frac{\textbf{Finish weight(kg)} - \textbf{Start weight(kg)}}{\textbf{Age (days)}} = \text{Average daily gain (kg/day)}$$

This study utlized data collected over a period of three year (2021, 2022 and 2023) , encompassing six seasons: three winter and three summer seasons. Animal groups were fed the same diet according to (Terramoccia et al., 2005) composed of (60% concentrate feed mixture plus 20% wheat straw and 20% alfalfa) as a total

mixed ration (DM: 88.64%, OM: 87.65 %, EE: 2.86%, CP: 14.04%, CF: 22.27%, NFE: 48.48%, ash: 12.35%). The fresh water was available all the time with an automatic system.

Statistical analysis

Data were analyzed by the PROC GLM of SAS, 2011(SAS 9.3, SAS Inst. Inc., Cary, NC) and the results were presented as Least Squares Means (LSM), differences between LSM were determined by Duncan's test (1955) of SAS 9.3.

Statistical model used for analyze was:

$Y_{ijk} = \mu + R_i + S_j + C_k + e_{ijk}$

Were Y_{ijk} = is observed of the dependent variable (body weight and average daily gain)

μ= overall mean

R_i = effect of calving year (i =1 to 3),

S_j = effect of calving season (j =1 and 2)

C_k = effect of sex of calves (k=1 and 2)

e_{ijk} = random errors

RESULT

1. Live body weight of Egyptian buffalo calves

The obtained data in Table1, the overall mean of live body weight (LBW) at all different stages of age (BW, WW, 6, 12, 18, and 24 months) was 29.28±1.56, 83.54±3.12, 118.79 ±8.13, 214.92±13.36, 279.30±18.79 and 296.88±20.43 kg respectively. The least squares mean (LSM) of LBW at all different stages of age was significantly influenced (P<0.05) by calving year, calving season, and calf sex. Calves born in the year 2022 (the second year) had the highest LBW at all different age stages (BW, WW, 6, 12, 18, and 24 months), as follows 30.11±.29, 84.23±.58, 123.87±1.51, 222.68±2.49, 297.94±3.51 and 317.49±3.82 kg respectively. Similarly, calves born in the winter season were superior in live body weight than those born in the summer at all different age stages (BW, WW, 6, 12, 18, and 24 months), as follows 30.33±.21, 85.53±.43, 124.22±1.19, 223.7±1.84, 289.52±2.58 and 308.01±2.81 kg respectively. As well as male calves were higher than female calves (BW, WW, 6, 12, 18, and 24 months) 30.04±.22, 85.85±.45, 124.69±1.17, 230.11±1.93, 296.58±2.72 and 314.23±2.96 kg respectively.

2. Average daily gain of Egyptian buffalo calves

It's clear from Table 1, that the overall mean of ADG at all different growth stages (ADG0-3, ADG0-6, DG0-12, ADG0-18, and ADG0-24) was 0.650±0.05, 0.497±0.04, 0.516±0.03, 0.463±0.04 and 0.372±0.03g/day respectively. Accordingly, the least squares mean of ADG at all different growth stages was significantly affected (P<0.05) by calving year, calving season, and calf sex. The year of 2022, the winter season and male calves were the highest in ADG at all different growth stages ADG0-3, ADG0-6, DG0-12, ADG0-18, and ADG0-24).

as follows, 0.676±0.01, 0.522±0.007, 0.535±0.006, 0.496±0.006 and 0.399±0.005 g/day respectively, 0.689±0.007, 0.522±0.005, 0.537±0.005, 0.480±0.004 and 0.386±0.004g/day respectively and 0.713±0.007, 0.526±0.005, 0.556±0.005, 0.495±0.005 and 0.396±0.004g/day respectively.

Table 1: Effect of non-genetic factors on live body weight of Egyptian buffalo calves (LSM ± SE).

Traits	BW	WW	BW6	BW12	BW18	BW24
Effect of calving Year (CY)						
2021	28.93±.23^{b}	83.64±.52^{ab}	117.88±1.36^{b}	212.65±2.24^{b}	267.66±3.15^{b}	283.99±3.43^{b}
2022	30.11±.29^{a}	84.23±.58^{a}	123.87±1.51^{a}	222.68±2.49^{a}	297.94±3.51^{a}	317.49±3.82^{a}
2023	28.54±.28^{b}	82.11±.56^{b}	113.19±1.46^{b}	207.21±2.40^{b}	272.05±3.38^{b}	288.96±3.67^{b}
P-value	.0006	.0228	.0001	.0001	.0001	.0001
Effect of calving Season (CS)						
Winter	30.33±.21^{a}	85.53±.43^{a}	124.22±1.19^{a}	223.7±1.84^{a}	289.52±2.58^{a}	308.01±2.81^{a}
Summer	28.05±.23^{b}	81.08±.47^{b}	112.41±1.24^{b}	204.63±2.04^{b}	268.91±2.87^{b}	285.62±3.12^{b}
P-value	.0001	.0001	.0001	.0001	.0001	.0001
Effect of Calf sex (CSX)						
Males	30.04±.22^{a}	85.85±.45^{a}	124.69±1.17^{a}	230.11±1.93^{a}	296.58±2.72a	314.23±2.96^{a}
Females	28.34±.23^{b}	80.76±.46^{b}	111.93±1.19^{b}	198.23±1.93^{b}	261.85±2.75^{b}	279.39±2.99^{b}
P-value	.0001	.0001	.0001	.0001	.0001	.0001
Overall mean	29.28±1.56	83.54±3.12	118.79 ±8.13	214.92±13.36	279.30±18.79	296.88±20.43
N.O.V	95	95	95	95	95	95
CV%	5.34	3.74	6.84	6.22	6.72	6.88

BW= body weight of calving, **WW=** body weight at weaning **BW6**, **BW12, BW18, and BW24=** body weight at 6months old, 12months old, 18months old, and 24months old (kilogram) respectively, **LSM**= least square mean, **SE** = Standard error, Means with different superscript letters are significantly different ($p<0.05$), **N.O.V**= Number of observations.

/ Table 2: Effect of non-genetic factors on average daily gain of Egyptian buffalo calves (LSM ± SE).

Traits	ADG (0-3)	ADG (0-6)	ADG (0-12)	ADG (0-18)	ADG (0-24)
Effect of Calving Year (CY)					
2021	0.647±0.01^{b}	0.494±0.01^{b}	0.510±0.006^{b}	0.444±0.005^{b}	0.355±0.004^{b}
2022	0.676±0.01^{a}	0.522±0.007^{a}	0.535±0.006^{a}	0.496±0.006^{a}	0.399±0.005^{a}
2023	0.615±0.01^{b}	0.470±0.006^{b}	0.496±0.01^{b}	0.450±0.006^{b}	0.363±0.005^{b}
P-value	.0002	.0003	.0001	.0001	.0001
Effect of calving Season (CS)					
Winter	0.689±0.007^{a}	0.522±0.005^{a}	0.537±0.005^{a}	0.480±0.004^{a}	0.386±0.004^{a}
Summer	0.603±0.008^{b}	0.468±0.006^{b}	0.490±0.005^{b}	0.446±0.005^{b}	0.359±0.004^{b}
P-value	.0001	.0001	.0001	.0001	.0001
Effect of Calf sex (CSX)					
Males	0.713±0.007^{a}	0.526±0.005^{a}	0.556±0.005^{a}	0.495±0.005^{a}	0.396±0.004^{a}
Females	0.579±0.007^{b}	0.464±0.005^{b}	0.471±0.005^{b}	0.432±0.005^{b}	0.348±0.004^{b}
P-value	.0001	.0001	.0001	.0001	.0001
Overall mean	0.650±0.05	0.497±0.04	0.516±0.03	0.463±0.04	0.372±0.03
N.O.V	95	95	95	95	95
CV%	8.30	8.15	7.13	7.65	7.92

ADG (0-3), (0-6),(0-12), (0-18) and (0-24) = average daily gain from (calving to3months old, from calving to 6months old , from calving to12months old , from calving to18months old , and from calving to24months old) g/d respectively . **LSM**= least square mean, **SE** = Standard error Means with different superscript letters are significantly different ($p<0.05$), **N.O.V**= Number of observations.

DISCUSSION

The results in Tables (1and 2): shows that LBW and ADG of Egyptian buffalo calves were significantly (P<0.05) affected by the year of calving. The same result was confirmed by Thevamanoharan et al., (2001) in Swamp buffalo and Alkoyak and Öz, (2022) in Anatolian buffaloes. As well as (Akhtar et al., 2012) confirmed that weaning weight, pre and post-weaning average daily gain of Nili-Ravi buffalo calves are affected by year of calving. These significant differences among calving years may be due to several reasons, including differences in climatic conditions, such as temperature and humidity. As well as, other environmental factors, such as differences in the quality of available feed, alterations in husbandry and management practices, and the common diseases. Results in Table 1 shows that LBW of Egyptian buffalo calves was significantly (P<0.05) affected by season of calving, this result was similar to that obtained in previous studies by Kumaravel et al., (2004) and Gaafar et al., (2021). On the contrary, Yadav et al., 2001 and Thiruvenkadan et al., 2009 observed a non-significant (P >0.05) effect of season of calving on body weight of Murrah buffalos calves at different ages. In the current study, it was found that average daily gain was significantly higher (P<0.05) for the winter season in comparison with the summer season, that is in accordance with those results reported by Gaafar et al., (2021), who reported that the amounts of dry matter, total digestible nutrients, crude protein, and digestible crude protein per kg, and weight gain were significantly lower (P<0.05) for the summer season compared to the winter season. May be that is the reason for the significant effect of season on the growth performance characteristics, as proven in this study. This corresponded with several researchers who stated that in many studies on ruminants, the loss in body weight during hot conditions is essentially as a result of reduced dry matter intake. Moreover, decreasing in feed intake led to a decrease in the rate of passage of digester through the digestive tract resulting in an increase in digestibility (Hahn et al., 2003; Marai et al., 2007 and Hatfield 2009). It is clear from this study that LBW and ADG of male calves were heavier at all ages than the females, this significant difference was confirmed by many authors (Swenson and Reece, 1993; Thiruvenkadan et al., 2009 and Alkoyak and Öz, 2022). On the other hand, Shahjahan et al., (2017) and Çelikeloğlu et al., (2019) reported that the sex of the calf did not has a significant effect on the LBW of Bangladesh buffalo calves and Anatolian buffalo calves respectively. Based on the above results, the difference between the sexes in growth rates and body weight may be due to the increasing differences in the endocrine system between them (Swenson and Reece, 1993). In general, there are several factors resulting in the poor growth performance of animal, such as improper nutritional management, climate change, seasonal stress, metabolic diseases, and mismanagement of farms (Othman et al., 2014, Fukumoto and Lee, 2020 and Mohd Azmi et al., 2021).

CONCLUSION

In conclusion, the results of this study indicate that calving weight, weaning weight, and live body weight at 6, 12, 18, and 24 months were significantly affected (P<0.05) by non-genetic factors such as calving year, calving season, and the sex of the calf. Additionally, ADG 0-3, 0-6, 0-12,0-18 months, and 0-24 months was also significantly influenced (P<0.05) by the same factors. The second year of calving (2022), the winter as the calving season, and male calves were associated with the best growth performance characteristics of Egyptian buffalo calves. Therefore, providing suitable

climatic conditions and meeting the nutritional needs of buffalo calves help them to display their potential productive characteristics at different stages of age.

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