Journal of Animal and Veterinary Advances 10 (17): 2240-2243, 2011
ISSN: 1680-5593

The Effects of Some Environmental Factors Affecting on the Weaning Weight of Sistani Beef Calves

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Abstract: This experiment analyses the growth of calves of the conservation nucleus for Sistani cattle. Data in this study were obtained from the Sistani cattle Research Station of Sistan and Baluchistan province in Iran. Weaning weights data was available on 372 Sistani beef calves (198 male and 174 female), born between 2003 and 2007. The effects of sire, age of dam, year/season of birth, sex of calf and birth weight was used as a covariate on the 205 days weaning weight which was computed by analysis of variance (GLM). Overall mean of the 205 days weaning weight of all calves was 127.25 kg. According to the age of the dam, the weaning weight increased up to 7 years (with the exception of 6 years) and after the maximum (137.6 kg) decreased. The minimum values were found in the group of 8 years old (97.7 kg) cows. With respect to birth year, the highest weaning weight (141.1 kg) was observed in 2007 and the lowest (101.66 kg) in 2003. The year effect varied but the trend observed is that of an increase in weaning weight with time. For birth season, Spring, Summer, Autumn and Winter, the 205 days weaning weight was 112.2, 115.3, 123.2 and 131 kg, respectively. Male calves reached 121.6 kg and female calves 119.2 kg mean value of the adjusted weaning weight.

Key words: Environmental effects, 205 days weaning weight, Sistani beef calf, birth weight, seasons, Iran

INTRODUCTION

In most tropical areas, cattle are raised under dual purpose systems of management. In such systems, cows are expected to produce both milk and a calf at weaning. To the producer, a dead calf is extremely detrimental because economical losses not only include an unsold calf but also the milk that the cow ceases to produce in the absence of her calf. Although, almost 75% of world cattle population resides in tropical zones, animal production in these areas is often hampered by low genetic progress, lack of record keeping and reduced availability of scientific literature. Thus, information on linear body measurements of cattle in the tropics is lacking. In addition, factors affecting calf growth and survival such as neonatal weakness have not been adequately examined (Landaeta-Hernandez *et al*., 2004).

Growth traits such as birth weight and weaning weight are of primary economical importance in cow-calf production system. They are known to be influenced by the direct genetic effect of the calf and the maternal genetic effect (Koch *et al*., 1973; Garrick, 1990; Meyer, 1992). The primary goal of animal breeders is to maximize the rate of genetic improvement.

Weaned calves are the major product of beef cows, their weight has a great influence on returns from sales and hereby on the economy and profitability of beef cattle production. Moreover, the weaning weight of calf at a given age is an important performance and breeding criterion for beef cattle (Szabo *et al*., 2006). This study supplies information that helps in the correct selection of animals with better breeding values. Weaning, usually realized around 7 months age (around 205 days) indicates the end of directed influence of the cow on the calf. It is very important to measure weaning weight because approximately 50% of final weight is reached at weaning (Everling *et al*., 2001; Cucco *et al*., 2009). The growth of the calf is perhaps the most important factor for meat productivity in production systems (Correa *et al*., 2006). Weight and weight gains during the pre-weaning period reflect the general ability of cows to raise their calves but also reflect the capability of development of the animal (Martins *et al*., 2000; Cucco *et al*., 2009). The objective of this study is to determine the importance of the main environmental factors influencing growth traits (e.g., weaning weight) in the Sistani beef calves.

MATERIALS AND METHODS

Records of birth and weaning weight were available on 372 (198 male and 174 female) Sistani calves born between 2003 and 2007 at Sistani cattle Research Station of Zahack which it is located in South-East part of Iran. The calves were kept on the same farm during the same

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years so climatic, feeding and management conditions were similar. The herd was managed under a dual purpose management system. In this system, natural mating was used at a ratio of 1 bull per 20-30 cows and calving occurred all year round. Calves were weighed within 24 h after birth cows and calves were together only during milking hours (a.m.-p.m.). Calves stayed with their dams until weaning (approximate 5 months of age). Manual milking was performed twice/day, leaving one quarter for the calf.

Colostrum intake was assured by supervised suckling within the 1st 12 h after calving. Identification (ear tag), weight and health status were recorded within 24 h of calving. All calves dehorned and treated against internal parasites and vaccinated for food and mouth disease at 3-4 months of age. Dry lick mineral blocks and drinking water were available *ad-lib*. in the large pens.

The calves were weighed on the day of birth and at weaning, close to an age of 205 days. Weaning weight data, adjusted to 205 days of age were used for the evaluation of weaning results. Calculation was as follows:

$$A = \frac{B - C}{D \times 205 + C}$$

Where:

A = 205 days weight (kg)
C = Birth-weight (kg)
B = Weaning weight (kg)
D = Weaning age (days)

The effects, age of dam, year and season of birth and sex of calf were evaluated from the 205 days weaning weight. Birth seasons were partitioned into four seasons as follows: Spring (March to May), Summer (June to September), fall (October to December) and winter (January to February). Analysis of variance of the calf database was used. Age of dam at calving was classified in to 9 classes (2-9 years old and >9 years old). Adjustments by the model to the different factors were taken on the basis of the deviation from the mean. Interaction terms were included in the model. The model could be described by the following equation:

$$y_{ijklm} = \mu + S_i + A_j + L_k + T_l + b(w_{ijklm} - \bar{w}) + e_{ijklm}$$

Where:

y_{ijklm} = Adjusted 205 days weight of the calves
T_l = Effect of the calving year
μ = Mean
L_k = Effect of the calving season
S_i = Effect of the sex of calves
e_{ijklm} = Residual

Table 1: Characteristics of the data structure and summary statistics

Traits	Values
No. of animals	372.00
No. of dams	87.00
No. of sires	27.00
Mean of the weaning age (days)	138.55
Mean of the weaning weight (kg)	92.50
Mean of the 206 days weaning weight (kg)	127.25
Mean of the birth weight (kg)	25.93

A_j = Effect of the dam's age at the time of birth
$\bar{w}$ = Mean of birth weight
b = Regression of weaning weight from birth weight

Additionally in the model, the sire and the birth weight were considered as random effect and covariate, respectively while the other above-mentioned factors (age of the cow, birth year and season of the calf, sex of the calf) were considered as fixed effects. The structure and summary statistics for data sets are shown in Table 1. Data was processed using the GLM procedure in SPSS (Version 16) Statistical Program. Significant differences between mean values were evaluated by the LSD trial.

RESULTS AND DISCUSSION

Mean value of the 205 days weaning weight of 372 calves was 127.25 kg with a standard error of 1.517 kg. The 205 days weaning weight according to year is shown in Table 2. Age of dam at calving was classified in to 9 classes. The effect of the age of cows on the 205 days weaning weight was significant ($p \leq 0.001$). From the data, a tendency of increasing weaning weight is observed until the age of 7 years (137.6 kg) with the exception of 6 years (104.43 kg) but thereafter the tendency begins to decrease.

The minimum weaning weight was produced by the calves of 8 years old cows (97.69 kg). The effect of the age of cows on the 205 days weaning weight is similar to the findings of Szabo *et al.* (2006), Jakubec *et al.* (2000) and Lengyel *et al.* (2003).

Cows influence the preweaning growth of their calves both by the genes transmitted to the calf and by maternal environment provided to weaning. Presumably, changes in size, weight and physiological function which accompany aging might be expected to influence this environment and consequently have a direct effect on birth and weaning weight. Over the study period, the best result (on the average 141 kg) was obtained in 2007. It was about 39 kg higher than the weaning weight of the worst year, i.e., 2003 at 101.66 kg. The large differences between the years may have been caused by differing weather, pasture conditions and management. The year effect varied but the trend observed is that of an increase in weaning weight with time as was to be expected. Because

Table 2: Least squares means and standard errors for weaning weight of Sistani cattle

Age of dam (years)	No. of calves	Mean value (kg)	SE
2	27	133.24	6.21
3	75	126.67	4.57
4	90	128.97	4.46
5	54	136.77	4.97
6	39	104.44	5.45
7	27	137.61	6.12
8	21	97.69	6.79
9	15	99.01	7.71
≥10	24	119.23	5.79

of birth weight was a criterion of selection for the improvement of the performance of Sistani beef cattle in Sistani Cattle Research Station. Phenotypic correlation between birth weights and 205 days weight was +0.292. The differences between years are similar to those reported by Pell and Thayne (1978), Szabo *et al.* (2006) and Abreu *et al.* (2002) for the year effect.

Season of birth had no significant influence on weaning weight. The effect of birth season on weaning weight is shown in Table 3. This suggests that the variations in temperature, precipitation and other environmental factors among seasons had little effect on the calves or on their dams at weaning. Results in this trial were similar to those reported by Rumph *et al.* (2003) and De Oliveira *et al.* (1982). From the results, we can see that the calves born in winter reached the highest 205 days weight (130.91 kg) while the lowest was produced by the calves born in spring (112.2 kg).

On this basis, we could suggest the advantage of mating at certain time of year so that the birth-weaning interval includes the largest number of days with the highest availability of forage which in turn would determine plentiful feeding for the dams and thus more efficient nursing conditions. This result deviates from the report of Szabo *et al.* (2003, 2006) who found that the weaning performance of calves born in summer was the highest while the lowest was in winter. This result is similar to the findings of Kovacs. In their opinion, the weight of calves born in autumn was the highest. These contradictory findings for the effect of season are certainly due to difference in surroundings and management practice. According to the results, the weight advantage of males over females calves was 6.27.

The 205 days weaning weight for males was 130.18 kg compared with 123.91 kg for females. The advantage of male calves is established. The difference between the sexes is lower than that reported by Jakubec *et al.* (2000) but higher than that found by Lengyel *et al.* (2003) and Bazzi *et al.* (2008) in their studies. Observed difference between sexes in weaning weight could be partially explained by the action of sex hormones on the secondary sex characteristics (e.g., skeletal conformation and muscle size). In addition, owing to the longer gestational period, males are heavier at birth and carry this advantage throughout the nursing period with higher weaning weights (De Oliveira *et al.*, 1982).

Table 3: Least squares means and standard errors at weaning weight (adjusted 205 days) of Sistani cattle

Season of birth	No. of calves	Weaning weight* (kg)
Spring	90	112.2±4.4
Summer	45	115.3±5.3
Autumn	81	123.2±4.5
Winter	156	130.9±4.5

*Least square means±standard errors

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