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Evaluation of Non-Genetic Factors Affecting Birth Weight in Sistani Cattle

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Abstract: The study under taken investigates the effects of some non-genetic factors (Sex of calf, year and season of birth, parity and calving difficulty) affecting on birth weight in Sistani cattle. Data were collected on 932 (466 males and 466 females) Sistani calves from the progenies born in the Sistani Cattle Research station of Sistani and Baluchistan province in Iran during the period from 1989-2007. Analysis of variance indicated that the effects of sex of calf, year and season of birth, parity and calving difficulty with gestation length as a covariate on birth weight were significant ($p<0.01$). The least square mean for birth weight of Sistani calves was found to be 24.143±0.509 kg. The effect of calf sex on birth weight was highly significant ($p<0.01$). Male calves were 1.935 kg heavier at birth than females. Birth weights of male calves were 7-8% heavier than female calves. The winter born calves had the highest (25.168 kg) birth weight. Calves born in early parities were lighter in weight than those born to late-parity dams. Difference between the means for maximum and minimum years is 6.023 kg. Sistani cattle difficult calving occurred in 1.2%. First parity cows exhibited more frequent calving difficulty whereas among other parities there were no statistically significant differences.

Key words: Birth weight, sistani cattle, non-genetic factors, gestation length, calving, Iran

INTRODUCTION

The Sistani cattle have become popular for meat production and are well known for their ability to produce and reproduce under harsh environmental conditions, their natural immunity against endemic diseases.

One of the important breed characteristics in cattle breeding is calf birth weight. Same time, birth weight is characterized as growth critter, initially (Akbulut *et al*., 2001). Since, birth weight is considered as an initial reference point with regard to subsequent development of individual as well as other characteristics, this trait is of critical importance to cattle industry. In addition, birth weight is also one of the main criteria for determination of calving difficulty. If birth weight can be estimated, changes dystocia can be decreased even if it is impossible to prevent dystocia completely (Unalan, 2009; Shahzad *et al*., 2010).

Differences in size between calves at birth are sometimes used as an indication of differences between them in vigor, potential growth rate and mature size. If variations in the size of calves at birth weight are to be considered in selection or mating plans, knowledge of the relative importance of the various sources of this variability can be used for standardizing the non-genetic influences.

It is demonstrated that calves having too small live weight at birth may lack vigor and tolerance to external conditions. Besides these extremes, heifers having high birth weight grow fast and produce more beef. High correlations between birth weight and first calving age have also been reported (Kaygisiz, 1998). In general, factors affecting birth weight may be grouped into genetic and environmental (Holland and Odde, 1992). Breed, calf sex and genetic abnormalities are considered as genetic factors and dam age, calving weight of dam, mothering ability, nutritional conditions of dam, litter size, gestation length, calving year, season, geographical region and altitude are considered as environmental factors (Holland and Odde, 1992). In short, the phenotype of an animal's birth weight is the result of the genetic potential and the influence of environment as well as maternal effects (Meyer, 1992; Mandal *et al*., 2008; Tilki *et al*., 2008). Maternal effects are important consideration when evaluating growth performance. A maternal effect is defined as any environmental influence that the dam contributes to the phenotype of her offspring (Kaygisiz *et al*., 2010).

Birth weight can be considered as a selection criterion in local beef cattle herds if properly weighted in a multi trait selection index taking into account its association with further live weights and presence of genetic variability within sexes (Assan *et al*., 2011).

Although, data on birth weight of exotic and crossbred cows are available in plenty but are very limited in case of indigenous cattle due to the absence of recording system. Indigenous cattle are reared predominantly in the rural farmers' house. A comprehensive study on the traits of indigenous cattle is essential for improving the breeding efficiency and

formulating breeding strategy. It is also an important tool of a breeder to evaluate the factors affecting birth weight of indigenous cattle. Sistani cattle is one of such indigenous cattle of Iran concentrated in Sistan region and have been declining their existence due to indiscriminate breeding with exotic, crossbreds and drought during last few decades. Research on this type of indigenous cattle is very limited so far. Now a days government and some non-government organizations are giving emphasis on this potential type of indigenous cattle for their sustainable utilization to adverse socio-economic and climatic condition of Iran.

The present study was undertaken to determine some of the non-genetic factors that could significantly affect birth weight in Sistani cattle.

MATERIALS AND METHODS

Data on birth weight of 932 calves (466 males and 466 females) of Sistani cattle collected between (1989-2007) in the National Beef Research station of Sistani cattle located in Sistan distract, Iran. During the breeding season, the herd was observed closely by herdsman, once a day for about 60 min. All cows exhibiting estrus signs and bred by a bull were identified and recorded.

After calving, calves were allowed to suckle their dams until weaning. The birth weight of the calves was taken within 24 h after parturition. Sex calf, dam identification and data of birth were also recorded.

About 6 months old male and female calves were separated. All of the calves were vaccinated against the common diseases in the area. Records obtained were analyzed based on the effects studied. The effects are sex of calf, year and season of birth, parity and calving difficulty. Calving difficulty has been classified into two classes: 1 = Easy calving (Unassisted or calving with minor help), 2 = Difficult calving (At least 2 persons or veterinarian help), gestation length was introduced as a covariate. Gestation length was calculated for all calves by subtracting breeding date from calving date. Only gestation length between 270 and 305 days were accepted as reliable. In this study the following model was used:

$$A_j + L_k + D_l + P_m + b(GL_{ijklmn} + \overline{GL}) + e_{ijklmn} + y_{ijklmn} = \mu + Se_i$$

Where:

y_{ijklmn} = The observation of the dependent variable birth weight
μ = The population mean
Se_i = The effect of sex; i = 1, 2
A_j = The effect of calving year; j = 1, 2..., 19
L_k = The effect of calving season; k = 1, 2, 3, 4
D_l = The effect of calving difficulty; l = 1, 2
P_m = The effect of parity; m = 1, 2, 3, ..., 10
GL = Gestation Length
b = Regression coefficient for gestation length
e_{ijklmn} = Random residual error

Simple means and standard errors for the trait studied were estimated using SPSS-16 computer package program. To find out the non-genetic effect, Analysis of Variance (ANOVA) and mean comparisons with Least Significance Difference (LSD) test were performed using SPSS program considering sex of calf, year and season of birth, parity and calving difficulty with gestation length as a covariate on birth as non-genetic or fixed effect.

RESULTS AND DISCUSSION

The least-squares means and standard errors of mean for birth weight as well as with their mean comparisons are shown in Table 1. All factors had significant main effects ($p<0.01$) on birth weight.

Table 1: Birth weight of RCC in nucleus herd as affected by different non-genetic factors

Variables	Mean±SE	Overall mean±SE	Level of significance
Sex of calves			
Male	25.110±0.520	24.143±0.509	**
Female	23.175±0.517		
Year of birth			
1989	27.708±0.865	24.143±0.509	**
1990	24.384±0.861	-	-
1991	23.807±0.769	-	-
1992	22.580±0.692	-	-
1993	21.685±0.611	-	-
1994	22.247±0.699	-	-
1995	24.686±0.606	-	-
1996	22.999±0.600	-	-
1997	22.324±0.636	-	-
1998	23.878±0.612	-	-
1999	22.914±0.632	-	-
2000	24.490±0.624	-	-
2001	24.705±0.649	-	-
2002	25.038±0.629	-	-
2003	24.009±0.663	-	-
2004	24.084±0.640	-	-
2005	26.394±0.621	-	-
2006	25.660±0.631	-	-
2007	25.120±1.333	-	-
Season of birth			
Spring	23.928±0.544	24.143±0.509	**
Summer	23.821±0.553	-	-
Autumn	23.655±0.536	-	-
Winter	25.168±0.535	-	-
Parity of calves			
1	21.593±0.488	24.143±0.509	**
2	23.219±0.485	-	-
3	23.716±0.537	-	-
4	23.885±0.548	-	-
5	23.960±0.583	-	-
6	24.259±0.636	-	-
7	24.767±0.768	-	-
8	25.188±0.874	-	-
9	25.821±1.230	-	-
10	25.019±1.228	-	-
Calving difficulty			
1	25.457±0.219	24.143±0.509	**
2	22.829±0.947	-	-

**Highly significant ($p<0.01$), *Significant ($p<0.05$), NS = Non Significant ($p>0.05$)

Average birth weight±Standard Deviation in Sistani calves were found to be 24.143±0.509 kg. In the present study, the first most important variable affecting the birth weight of calves was found to be sex of calf. So, sex was found to have a significant effect on birth weight ($p<0.01$). The result of this study is closely in agreement with the results of Bayram and Aksakal (2009), Habib *et al*. (2009), Raja *et al*. (2010) and Olawumi and Salako (2010).

The mean birth weight of Sistani calves found in this study was 25.11±0.520 kg for male and 23.175±0.517 kg for female. Male calves were found to have 1.935 kg higher birth weight than females, this difference was significant (Table 1). Birth weights of male calves were 7-8% heavier than female calves.

In parallel to the results obtained in this study, previous studies Akbulut *et al*. (2001), Bakir *et al*. (2004) and Topal *et al*. (2010) reported that male calves had 1.3-3.6 kg higher birth weight than females.

Increased gestation length had a positive effect on birth weight in Sistani cattle. So, increased gestation length for 1 day had increased probability for birth weight for 183 g in Sistani cattle.

Difference in birth weight attributed to year of birth was statistically significant ($p<0.01$). The heaviest calves were born from 2000-2007. Trend of increasing birth weight was found during the progress of year that might have resulted due to selective breeding and climatic, feeding, sanitary and managing conditions of the dams during gestation. This result is also supported by Akbulut *et al*. (2001), Bakir *et al*. (2004), Raja *et al*. (2010) and Kocak *et al*. (2007).

One of the factors affecting birth weight was calving season. In this study the effect of the season on birth weight was significant ($p<0.01$) which is supported by the study of Kocak *et al*. (2007) and Assan *et al*. (2011). The highest birth weight (25.168 kg) obtained in winter and the average birth weight for other three seasons (Spring, summer, autumn) was comparable. Calves born in autumn were found to have a birth weight of 1.513 kg lower than those born in other seasons. Difference between the highest birth weight and the lowest birth weight (Autumn) was found significant ($p<0.01$). The highest birth weight as observed in this study, the effect of the season on birth weight was significant in other studies carried out by Bakir *et al*. (2004), Bayram and Aksakal (2009), Kocak *et al*. (2007), Akbulut *et al*. (2001) and Topal *et al*. (2010).

This may result from low temperature to winter calves during the last trimester. The influence of month of calving on birth weight may be the result of differential availability of pastures to pregnant dams due to variable weather conditions during different months and the direct effect of the latter on the comfort of the animal (Messine *et al*., 2007).

The effect of parity on birth weight was found to be highly significant ($p<0.01$) for Sistani cattle. Akbulut *et al*. (2001) and Tilki *et al*. (2008) also reported that the effect of parity on birth weight of calves was highly significant. There seems to be a trend of increasing birth weight in the subsequent parity (Table 1). The lowest birth weights 21.593 kg was recorded in 1st parturition and highest birth weight 25.821 kg was obtained in 9st. Calves born in early parities were lighter in weight than those born to late-parity dams. Mean birth weights appeared to be similar between 3rd and 10th parturitions (Table 1). One explanation of these results is that earlier-parity cows continue to grow until reaching adult size and may compete with the fetus for available nutrients during pregnancy. These results are in agreement with the findings of Kocak *et al*. (2007), Johanson and Berger (2003), Swali and Wathes (2006), Akbulut *et al*. (2001, 2002), Tilki *et al*. (2008) and Kaygisiz *et al*. (1995).

The effect of calving difficulty on birth weight was significant ($p<0.01$). Increased calving difficulty was observed in the first parity cows whereas no differences were observed among other parities. With increased gestation length probability for difficult calving increased. Sex showed no significant effect on calving difficulty.

The selection on lower birth weight could be the answer to calving ease. But on the other side they were aware that there is also a strong correlation between birth weight, growth rate and weaning weight. The result of this study is also consonance with the results from Kotnik *et al*. (2009), Naazie *et al*. (1991), Dargatz *et al*. (2004), Marquez *et al*. (2005) and Washburn *et al*. (2007).

CONCLUSION

Sex of calf, year and season of birth, parity and calving difficulty were found to be significant sources of variation in the birth weight of the Sistani cattle.

Increased gestation length had a positive effect on birth weight in Sistani cattle. Male calves were 1.935 kg heavier at birthday than their female counterparts and this difference was significant.

Trend of increasing birth weight was found during the progress of year that might have resulted due to selective breeding and climatic, feeding and sanitary, managing conditions of the dams during gestation.

The highest birth weight (25.168 kg) obtained in winter and the average birth weight for other three seasons (Spring, summer, autumn) was comparable. Calves born in autumn were found to have a birth weight

of 1.513 kg lower than those born in other seasons. There seems to be a trend of increasing birth weight in the subsequent parity. The lowest birth weights 21.593 kg was recorded in 1st parturition and highest birth weight 25.821 kg was obtained in 9st. Calves born in early parities were lighter in weight than those born to late-parity dams. Mean birth weights appeared to be similar between 3rd and 10th parturitions.

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