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Research Article

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Effects of Environment on Production of Holstein Fresian Kept in Baluchistan, Pakistan

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Abstract The present study was planned to explore the productive performance including birth weight (BWT), lactation length or days in milk (DIM) and milk yield (MY) on imported Holstein Friesian kept under the local conditions at different locations in Baluchistan. Overall average values for BWT ranged from 15 to 68 kg with an average of 30.12 ± 0.15, DIM were 180 to 728 with an average of 313.56 ± 3.83 and MY ranged from 1471 to 7033 lit with an average of 3731.26 ± 40.52. The effect of year, season, age and location were studied and the results revealed that the year ($P<0.01$) and season of birth ($P<0.05$) and location of the farm ($P<0.01$) had significant effect on BWT, while age of the dam had non-significant effect on this trait. In case of DIM and MY, season of calving and location of farm had non-significant effect while the effect of year of calving ($P<0.01$) and age of the dam ($P<0.01$) had significant effect on MY but no significant effect on DIM. Overall performance of these imported and farm born Holsteins was much better as compared to the local breeds.

Keyword: Holsteins, lactation, Birth weight

Introduction

Milk production is one of the most processes in converting plant material into nearly a perfect food for humans. Milk constitutes an integral part of our daily diet and is an almost complete food providing essential ingredients necessary for the nourishment and healthy development of nation. That's why all over the world milk is given the highest importance for the health of the future generations. From a total of about 19 million tons of milk produced in Pakistan, about 24% is received from 17.9 million cattle. The per capita availability of milk is Pakistan has been reported as 121.48 kg per annum (Economic Survey, 1995-96) which is far less than that of several advanced countries. To abridge this gap, buying spree and import figures of dairy products like powdered milk (10. 185 million tons, Economic Survey, 1993-94) are escalating day by day taxing heavily our national exchequer. Reducing these figures through augmenting the domestic milk supply has become a great challenge for researchers and planners. Decline in the import of milk is also necessitated by the higher imposition of regulatory duties, money devaluation and demand for more fresh milk production for growing mouths. Less demand and interest of producing bull calves coupled with the pressure of mechanization demands enhanced production of milk from the fewer animals available which can be achieved through proper care and management and by exploitation of alternative feed resources. In turn, rapid increase in human population and limited feed resources also entails the better utilization of cattle. There is no question about the resistance, hardship and disease tolerance etc. but the milk genes in our indigenous cattle have limited potentials. The low productivity of our animals is established mainly because of non-descript animals which according to some estimates total to 73% of the entire cattle population [1] in recent

past, to meet the increasing demand of milk, the Government of Pakistan encouraged the import of exotic breeds of dairy in the country with the objective of either rearing as pure bred, or to be used for up-grading the indigenous non-descript cattle.

The well known black-and-white cow i.e.; Holstein, being a popular dairy breed of the temperature regions renowned for its economic traits such as fast growth rate, adequate fertility and high milk production, was imported to augment the milk production and to obtain suitable farm born semen for rapid genetic up gradation leading to the development of high yielding and better adopted cattle to meet the public need. Improving productive and reproductive efficiency to make the dairying entrepreneurship sector an attractive and profitable for the public, were the added benefits. However, there are several physiological and environmental factors which can affect the production of these animals in tropical and subtropical environment but they still perform significantly much superior than local Zebu cattle [2]. These pure exotic dairy cattle were imported and maintained in the country to increase milk production, but these cattle have to be managed and maintained in a well established scientific way to fully exploit their genetic potentials.

The present project, therefore, was planned to investigate the productive performance of Holsteins imported from Denmark and kept at different locations in Baluchistan province. It was also the aim to study the magnitude of various environmental aspects on the productive traits of these animals.

Methodology

Experimental Animals and Data Collection

Data for the present study was collected from seven different Government Dairy Farms in Kalat (1), Khuzdar (2), Loralai (3), Mastung (4), Pishin (5), Quetta (6) and Zhob (7). The number of animals comprised more than 210 with 750 lactations record covering almost 17 year from the period of their importation 1977 to 1994. Their performance parameter were taken up to lactations, at some places the records up to 6 lactations were also available.

The mathematical model for determining the environmental factors on birth weight was as follows:

$Y_{ijklm} = \mu + Y_i + S_j + A_k + L_l + \mu_{ijklm}$

where:

i = 1,2,…… p (number of years = 13)

j = 1,2,…….. q (number of seasons = 4)

k = 1,2,…… r (number of age groups of dams = 7)

I = 1,2,……. s (number of locations = 7)

Y_{ijklm}= birth weight of m^{th} calf at I^{th} location of k^{th} dam age group born in j^{th} season of the i^{th} year and μ= overall population mean.

Y_i = effect of i^{th} year of birth

S_j= effect of j^{th} season of birth

A_k= effect of k^{th} dam's age group

L_i= effect of I^{th} location

μ_{ijklm}= random error associated with the birth weight of rn^{th} calf at I^{th} location of k^{th} dam's age group born in j^{th} season of the i^{th} year. It was further assumed that μ_{ijklm} was normally and independently distributed with mean zero and variance 2.

Mathematical models for lactation length and milk yield were similar to model of birth weight except that year and season of birth were replaced with year and season of calving and age of the dam with age of the cow itself. As the data of different parameters represented unequal disappropriate sub-class frequencies and were thus analyzed by using Mixed Model Least Squares and Maximum Likelihood [3] computer program.

Ambient Conditions

To study the effect of season on various parameters, the year was grouped in 4 seasons viz: Winter (Dec-Feb), Spring (Mar-May), Summer (Jun-Aug) and Autumn (Sep-Nov) by using the data on various environmental parameters like temperature (Temp), relative humidity (RH) and rainfall (RF), etc. recorded on the farm or in the

vicinity. The complete data were available from four locations only viz; Kalat, Khuzdar, Quetta and Zhob. The calculations initially envisaged for Temperature-Humidity Indices (THI) were not possible due to paucity of the data at all locations. However, the effect of location, year and season were studied extensively.

Results and Discussion

Overall performance values for birth weight (BWT), days in milk (DIM) and milk yield (MY) for Holsteins kept at different locations are presented in Table 1.

The table clearly shows that the performance of Holsteins in all of three traits is much better compared to local breeds of cattle. The effect of different environmental factors on BWT, DIM and MY were as under.

Table 1: Overall average values of various productive traits in Holstein Friesian

S. No.	Traits	No of observations	Range	Mean ± SE
01	Birth weight (BWT)	695	15-68 d	30.12 ± 0.15
02	Days in milk (DIM)	395	180-728d	313.56 ± 3.83
03	Milk yield (MY)	628	1471-7033 lit	3731.26 ± 40.52

Birth Weight

The obtained results revealed that there was a significant effect of farm location and the year of calving of ($P<0.01$) and season of birth ($P<0.05$) while the age of dam had non-significant effect on BWT (Table 2).

A wide variation was observed in the mean BWT during different years. The range being 26.88±1.55 kg in 1986 to 32.71±1.81 kg in 1978. Birth weights were higher (30.82±1.39 and 30.29±1.43 kg) among the calves born during winter and spring than those born in summer and autumn season (29.76±1.41 and 29.75±1.39 kg). Similar findings were reported by Ornelas et a;. (1981) which shows that spring born calves were heavier than autumn born calves of the imported cattle in the tropical areas. These results also favors the findings of Boonprong et al;. [4], as an average birth weight of Thai Brahman and Simental Brahman crossbred (Khabinburi) cattle were 28.5±0.32 and 32.16±0.55 respectively.

The variation in birth weight of calves observed during different years reflected the level of feeding and management as well as some environmental effects like rainfall, humidity and temperature, etc. on the cows during pregnancy. Heavier birth weight of calves born during winter and spring may be due to the availability of good quality fodder for cows during late pregnancy periods. The age of the dam did not exert any significant effect on birth weight of the newly born calf. It seems that the nutritional availability and health status of the cow is more important for better birth weight as compared to the age of dam. Shin et al;. [5] also reported that the age of the dam had no significant effect on the birth weight of the calves born.

The birth weight of calves was significantly ($P<0.1$) affected by the location of farm. The calves born at Quetta had the highest birth weight (32.25±1.52 kg), whereas the calves born at Khuzdar had the lowest birth weight (28.60±1.42 kg). This difference is mainly due to climatic conditions including altitude, rainfall/atmospheric pressure at different locations. The temperature situation in Quetta is quite low which is highly favorable for maintaining Holsteins that are well-adapted to the cold environments. The difference of location exerted in our study was significant which is also in agreement with the results of Shin et al;. [5] and Boonprong et al;. [6].

The effect of age of the dam or lactation number on the BWT of calves shows no specific trend (table 3). Lactation number in this study had no effect on the birth weight of calves. Mean BWT was in the range of 29.20 to 30.88 kg during different lactations. Some Indian workers [7] have reported the significant effect of age of the dam in imported cattle, but in this study no effect of lactation or age of the dam was observed.

Days in milk

The effect of year and season of birth, location of the farm and age of the dam on DIM were determined. The analysis of variance revealed that none of these factors influenced the lactation length or DIM (Table 2). There was no statistical difference in lactation length due to year of calving. Lactation length was minimum (267.86±31.82 days) in 1985 and was maximum (397.01 ±36.36 days) during 1991.

Average lactation length observed in winter, spring, summer and autumn were 306.69±18.92, 335.57±20.48, 301.43±21.24 and 302.14±19.55 days, respectively with no statistical difference among seasons as well as location of the farm. These findings match the results reported by Mondal et al [8].

Increase in age of the dams or lactation number, slight decline in the DIM was observed but the difference was not significant within various age groups of the animals (Table 3). Mean DIM were in the range of 304.47±7.82 to 320.20±6.74 d during different lactations.

Present results are in line with those of (Queiroz et al;. [9]) who reported no effect of season on lactation length in Holsteins and crossbred cattle. Similar to our study are the results of Herrera [10] who mentioned that the age of the cow had non-significant effect on days in milk.

Table 2: The levels of significance of the means squares and the residual mean squares for BWT, DIM and MY in Holsteins

S. No.	SOV	BWT		DIM /LL		MY	
		DF	Sig	DF	Sig	DF	Sig
01	Birth year	17	**	17	NS	17	**
02	Birth season	3	*	3	NS	3	NS
03	Farm location	6	**	4	NS	6	NS
04	Age of the Dam	6	NS	5	NS	6	**
05	Residual mean	591	13.33	301	6859.45	521	984409

**Significant P<O.01). *significant = IP<O.05). NS= non-significant

Milk Yield

Significant (P<0.01) variation was found in MY in years of calving (Table 2). On yearly basis, milk yield per lactation was minimum in 1985 and maximum in 1992 as 2708.95±247.39 kg and 4263.72±269.76 kg respectively. The values for MY in various seasons were 3617.50±148.88, 3705.27±168.42, 3607.23±160.54 and 3615.07±151.78 kg for winter, spring, summer and autumn respectively. These results were in line with the Bashir et al [11] who reported that year and season had significant effect on milk yield in Jersey cattle.

There was a significant (P<0.01) variation in the MY among different age groups and lactation numbers of the dams while a non-significant effect of the season of calving and location of farm was observed (Table 3). Similar results have been reported by Kabuga and Agyemang [12] who studied this trait in Holsteins cattle kept in humid forests of Ghana.

Table 3: Least square means of BWT, DIM and MY during different lactations in Holsteins Fresein

S. No.	Lactation No	BWT		DIM /LL		MY	
		No of obs.	Mean±SE	No of obs.	Mean±SE	No of obs.	Mean±SE
01	212	17	30.88 ± 0.33	125	319.98 ± 6.83	203	3690.83 ± 77.40
02	182	3	30.86 ± 0.32	106	304.47 ± 7.82	174	3768.16 ± 84.65
03	163	6	29.93 ± 0.32	96	320.2± 6.74	150	3800.35 ± 89.48
04	108	6	29.69 ± 0.42	54	305.37 ± 11.21	88	3780.70 ± 113.41
05	28	591	30.36 ± 0.47	12	315.25±27.15	34	3740.33 ± 288.59
>05	15	591	29.20 ± 1.41	-	-	-	-

In this study, milk yield varied with the age of the animal. Maximum milk yield (3808.14±136.63 kg) was obtained at the age of 5-6 years while minimum (3465.64± 115.18 kg) at the age of 3-4 years. Maximum production at the age of 5-6 years is mainly due to that the animal is at its prime of production while at the age of 3-4 years the animal is at the growing stage and its body and secretary tissues are not fully developed. The effect of age on milk yield was non-significant statistically. It is mainly due to incomplete data as the animals of later lactations were only 7 to 9 years old. Similar results were obtained by Suk et a;. [13] who reported that age had non-significant effect on milk yield. Egyptian workers [14], concluded that season of calving (autumn and winter) was the major factor affecting total milk yield and suggested a negative relationship between production and reproductive efficiency of dairy cows.

Milk yield varied widely at different Government dairy farms at different locations of the province. The value was minimum (2540.82 ± 376.47 kg) for Kalat while it was maximum (4245.22 ± 238.05 kg) for Pishin. Milk yield at

Khuzdar and Quetta was about the same as at Pishin (4005.07 ± 169.36 kg and 4028.31 ±221.39 kg, respectively). The higher ranges of production at Pishin, Khuzdar and Quetta indicated better management and feeding available to the animals. The animals at these places are more open to visitors and get more attention and supervision as compared to other locations. The role played by the administrative guidance and directions is also quite evident.

Conclusions

It was concluded from obtained data that Holsteins kept in Baluchistan at all seven locations are doing well as far as their production performance is concerned due to the environment in these areas is cool, humid and temperate. By efficient and targeted managemental practices, increasing the levels of interest and commitment and better record keeping, much better results can be expected. Sudden changes of managemental staff also affect yields. Farm born animals should be given the same level of feeding, management and regular culling as envisaged for imported ones.

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