INCIDENCE OF REPEAT BREEDING IN VARYING BREEDS OF BUFFALOES AND CATTLE IN DIFFERENT CLIMATIC CONDITIONS IN KHYBER PAKHTUNKHWA (PAKISTAN)

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ABSTRACT

Change in climatic factors poses formidable challenge to the livestock sector development in Pakistan. Repeat breeding (RB), defined as adult buffalo and cow's failure to conceive from more than 3 times regularly spaced AI or natural services in the absence of any detectable reproductive abnormalities, is a costly problem for the dairy sector. An active surveillance was conducted aimed to address the impact of climate change on incidence of RB in different cattle and buffalo breeds in Khyber Pakhtunkhwa (KPK), Pakistan. Through multistage cluster sampling 3 different climatic and geographic clusters were selected. Total of 1167 animals were included in the study. Out of total 586 were cows and 581 were buffaloes. The sampled population was stratified on parity basis into primiparous and multiparous cow's and buffalo sub-groups. The overall incidence of RB was calculated 27.33%.

RB incidence was significantly ($P<0.05$) higher in buffaloes (33.04%) than in cattle (21.67%).

Whereas RB in multiparous (29.28%) were significantly ($P<0.05$) higher than primiparous (23.71%) cattle and buffaloes. Significant variations in incidence of RB with season were observed. The results also elicit the significant impact of monthly mean temperature, humidity, average annual rainfall, altitude and breed on the incidence of RB. The culling percentage was significantly ($P<0.05$) higher in repeat breeder buffaloes (77%) than in cattle (23%). In conclusion the result shows that exotic and cross bred cattle breeds were more efficient reproductively than buffaloes and non descriptive breeds of cattle in varying environmental conditions. It was also concluded that RB is a multi-factorial problem that involves a number of intrinsic and extrinsic factors fixed to the animal.

Keywords: repeat breeding, geographic, primiparous, multiparous, incidence

INTRODUCTION

Repeat breeding (RB) has been considered from many decades one of the most important reproductive disorder in cattle and buffaloes. Incidences of RB in lactating large dairy

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animals varied among regions, management and environments. Internationally, declined have been reported in calving rates to 1st service from 60% to 40% over the past twenty five years (Bulman *et al*., 1978). Environment all over the world is the major factor in these days affecting reproductive and productive efficacy respectively. Breeding efficiency in buffaloes is affected greatly by season. Previous studies have shown a certain tendency of having better performance in cool months, July to February (70 to 80% conception rate) in buffaloes. It is also known that buffaloes are activated sexually by decrease in day length and temperature (Agrawal *et al*., 2003). As they have poor thermal regulation system. That's why it is important to protect them in summer from extreme heat allowing them wallowing and also in winter from extreme cold, that may give chance to many other diseases to attack the animal (Ramesh *et al*., 2002).

A lower number of services per conception are needed during the July to February. RB syndrome is a major cause of economic losses and deprived reproductive performance in the dairy sector (Bartlett *et a*l., 1986; Bage *et al*., 2002). It contributes to lower the dairy profit by insemination costs and wasting semen, increasing culling, increasing interval to conception and replacement costs and also reduces fertility (Gustafsson *et al*., 2002). The incidence of RB ranges from 10.1 to 24% mostly in exotic cattle breeds (Bartlett *et al*., 1986; Bage *et al*., 2002; Gustafsson *et al*., 2002). Though, specific causes of RB are not clear but it has found to be a multi-factorial problem involving a number of intrinsic as well as extrinsic one (Gracia *et al*., 2007). Ever since numerous factors affect incidence of RB in dairy animals, therefore it is intricate to make generalizations about major causes (Silvia, 1994).

Acclimation is a phenotypic reaction by the animals developed within the environment to an individual source of stress (Fregley, 1996). To cope with the thermal challenges that leads to reduced feed intake and many physiological functions alterations i.e. productive and reproductive efficiency (Beede and Collier, 1986; Wolfenson *et al*., 2000) reported that more that 50% of bovine population is being located in the tropical region and estimated economic losses in about 60% of the dairy farms due to heat stress around the world. It compromises oocyte growth in dairy animals by altering progesterone level, follicle-stimulating hormone, secretion of luteinizing hormone (LH) and dynamics throughout the estrus cycle (Ronchi *et al*., 2001).

According to the Intergovernmental Panel on Climate Change (IPCC) evaluation reports, about 0.6^{o}C increase has occurred in average global temperature since the industrialization and in future increase of 2 to 4.5^{o}C is almost expected by the end of 21th century (IPCC, 2007). Although climate changes at the global level, its positive impacts as well as negative, will be experienced at the local level.

The average annual temperature in South Asia by the end of 21th century could go up from 3.5 to 5.8^{o}C because this region occurs in the arid and semi-arid zone (IPCC, 2007). Therefore the South Asian region will be more affected by the consequential climate change effects. In Pakistan these impacts are already visible particularly since 1990 Pakistan meteorological department (PMD records). For having great topographic contrasts and as a result the climate of the Pakistan has large temporal and spatial variations. In Pakistan no such research has conducted before addressing the impact of changing climatic factors at different altitudes on incidence of RB in different breeds of

cattle and buffaloes. This research will also provide clue for future research to specify most significant risk factors responsible for incidence of RB.

MATERIALS AND METHODS

Study design and site selection

An active surveillance based study was conducted in account to pile the incidence and impact of climate change on Repeat breeding (RB) in different breeds of cattle and buffaloes in Khyber Pakhtunkhwa (KPK) Pakistan. The target population in the study area was about 808068 lactating, 184229 dry and 97664 not yet calved buffaloes and 6059041 lactating cows, 743852 dry and 419547 cows that were not yet calved (Livestock census, 2006). Administratively the northern province of Pakistan KPK is divided into three agricultural zones i.e. Semi-Arid, Sub-Humid and Humid region (Fig 1). Eight districts were selected randomly, at least two from each region and one from Federally Administered Tribal Areas (FATA) (Figure 1). Geographically KPK could be separated into two zones: the northern and the southern one. The northern zone is winters with heavy rainfall and moderate summers. While southern zone is arid with hot summers and cold winters with scanty rainfall. The climate of KPK varies immensely as compared to its size, encompassing the majority of many types of climates found in the country.

Repeat breeder's definition and exclusion criteria

A cow or buffalo was considered as a repeat breeder when it did not conceived after three inseminations or natural services (in case of buffaloes mostly), apart from having no detectable clinical reproductive disorders. The animals were excluded on the following conditions.

- Having any detectable reproductive disorder.
- If not available for three consecutive AI or natural services.
- If the owner is not willing.
- No farm animal was included in the study.

Sampling technique and Sample size calculation

Through multistage cluster sampling the study frames were selected. Then the end sample was drawn through simple random method for higher accuracy of results. The number of cow's and buffaloes to be sampled for estimate prevalence with a confidence interval of 95% was estimated using the formula by Thrusfield, (1995).

$$N = 1.962 \times P_{exp} (1 - P_{exp})/d2$$

Where n = required sample size,
P_{exp} = expected prevalence, and
d = desired absolute precision.

Since the prevalence estimates of RB in the area were not available, therefore a 50% random estimate was chosen. The minimum number of cattle and buffaloes needed to be included from the study site calculated was 384. More animals were selected to take care of excluded animals during study.

Data collection

Data regarding cattle and buffaloes from smallholder dairy owners of the rural areas of KPK were obtained on a predesigned questionnaire. Only house hold animals were observed purposely to see the climatic impact under the local management

practices in the study area. Various surveys were encountered from December 2012 to mid December 2013 to observe the status of RB in the included sampled animals at different seasons. Data about each cow and buffalo: breed, parity, season of heat and services, any reproductive disorder (pyometra, fetal membranes retention, endometritis, ovarian cysts and urovagina) was recorded.

Statistical analyses

Analysis was performed by using the statistical package (SPSS 16.0). Chi square test was used to calculate the association between the categorical variations studied in the study i.e. repeat breeding with season, climatic region, parity, animal species, breed of the animal, average mean temperature and culling status of the repeat breeders.

RESULTS

A total of 1216 animals were included in the present study, in which 49 animals were lost in follow up not falling in the inclusion criteria. Thus 586 cows and 581 buffalo's were included in the study. The study population was also stratified on parity basis to see the impact of climate change in relation to age of the animal. Total of 409 primiparous, 758 multiparous cows and buffaloes were selected (Table 1). Statistical analysis showed (27.33%) cumulative incidence of repeat breeding (RB); in cows (21.67%) and in buffalo (33.04%) significantly ($P<0.05$) higher than in cattle. The result elicits the insignificant impact ($P>0.05$) of climatic region on the incidence of RB (Table 1).

Parity of the animal was evaluated for the incidence of RB in different climatic conditions. It was found significantly ($P<0.05$) higher in the multiparous cattle and buffaloes; 23.71% in primiparous and 29.28% in multiparous. Average rainfall, altitude and monthly average mean temperature showed a significant impact on the incidence of RB especially in the cows breed. Different breeds were included in the study both from the cattle and buffalo population prevailing in the study area. Most of the breeds are used to bring from the Punjab province of Pakistan into this area for milk purpose. The results illustrated higher cumulative incidence rate of (35.87%) in the non descriptive breed of cattle. While the most efficiently reproductive and highly conceptive breed were exotic breeds of cattle (Table 1). The local breed of cattle (Achai) was also found to be highly conceptive as compared to the non descriptive ones. Same was the case with buffalo population; in which the local Aza kheli breed was found with the lesser incidence rate of RB than Nili ravi and non descriptive buffalo breeds.

Seasonal variation was observed; significantly higher ($P<0.05$) RB incidence rate of (34%) in the late summer (July to September). While a higher conception rate of almost 83% from the month of January to April (Table 1). The most important factor that was found in the present study was the culling practice of the farmers after an animal gone to be a RB. Total of 200 (62.69) animals were culled out of 319 RB; 154 (77%) buffaloes and 46 (23%) cows. Amongst the culled animals 146 (73%) were multiparous RB while 54 (27%) were primiparous ones. A significant ($P<0.05$) difference of culling for species and parity was observed in the present study (Figure 2). Seasonal variation with culling was also observed.

DISCUSSION

The present study was conducted to understand the impact of extent of change in the climatic factors i.e. monthly mean temperature, seasonal rainfall, humidity variation at different altitudes and geographical conditions. In this study, all the cows and buffaloes considered as RB had normal estrous cycles and returning to sexual cycle within 18 to 24 days, but did not got conceived, accordingly to the findings of (Allen *et al*., 1996).The reproductive performance of various breeds of cattle and buffalo's was also evaluated in different environmental conditions. The overall cumulative incidence recorded in the present study was 27.33%. This was much higher than the previous cumulative incidence recorded by Rabbani *et al*. (2010) in Faisalabad district (Pakistan). The difference may be due the time span or environmental conditions as well different management practices in the two study areas. Also the later study was conducted in one of the hotter regions of the country where buffalo are considered to be more adoptive to the hot environmental conditions as compared to the climate of KPK. The cumulative incidence in the buffalo (33.04%) population was significantly ($P<0.05$) higher than cow's (21.67%). This difference can be attributed to the difference in nature of two different species in terms of reproductive physiology. As previously discussed by Vale *et al*., (1988) and Danell (1987) that higher RB incidence in buffalo population might be due to low level of steroidal hormones and high progesterone level. The silent heat in buffalo is also the most reasonable cause of higher RB incidence. The incidence of RB in cows was in agreement with the reported incidence by Yusuf *et al*. (2010). The results of our study were also similar to that of (Perez *et al*., 2007; Kendall *et al*., 2009).

Table 1 depicts cumulative incidence of RB in different climatic regions showing in significant ($P>0.05$) variation. This is because of the overall incidence calculated for both the species studied. There was significant variation observed in the incidence of RB in between the species and also amongst the different breeds based on parity. It was confirmed; RB incidence in primiparous (23.71%) lesser than multiparous (29.28%). This substantial variation could be due to the stress of high production and change in environmental conditions on the aged animals as compared to young ones (primiparous). These estimates were in coincidence with that of (Rabbani *et al*., 2010) reporting (28.35%) of RB incidence in 2nd lactating cows. Though Yusuf *et al*. (2010) reported higher conception rate in 1st parity cows and higher RB incidence totally opposite to the results of the present study. In this study we concluded higher conception rate in primiparous cows and buffaloes that multiparous ones (Robert *et al*., 2011) reported (26.61%) incidence of RB in primiparous cows almost in acceptance with the results of our study. To our knowledge, in Pakistan no accessible data exists on about the incidence of RB in different cattle and buffalo breeds. Breed variation was recorded in the present study in both the species that varied 15 to 35% in cattle and 26 to 34% in buffaloes; that falls in the range reported by Robert *et al*., (2011) of 0.00% to 42.42% on basis of breed variations.

Seasonal variation was significantly recorded among all the breeds of both the species (Table 1). Such environmental stresses on reproduction have also been explained earlier by Dobson *et al*. (2000) and Gwazdauskas *et al*. (1981) that heat stress shortens the duration and intensity of estrous expression leading to silent

Table 1. Definitions and descriptive statistics of repeat breeding in different breeds of cattle and buffaloes, in KPK, Pakistan (2012-2013).

Variable code	Description	Values/level	*RB Incidence[%(n/N)]	P-value
Host specie	Cattle/Buffaloes	Cattle	21.67 (127/586)	<0.05
		Buffaloes	33.04 (192/586)	
Geography	Climate based	Semi-Arid	28.23(83/294)	0.071
		Sub-Humid	22.15(76/343)	
		Humid Region	29.94 (159/531)	
Breed	Cattle breeds	Zebu cattle (Achai)	20.68 (6/29)	<0.05
		Cross bred	18.06 (58/321)	
		Exotic Breeds	15.23 (16/105)	
		Non descriptive	35.87 (47/131)	
	Buffalo breeds	Nili Ravi	34.59 (137/396)	<0.05
		Aza-kheli	26.60 (29/109)	
		Non descriptive	34.21 (26/76)	
Season	Winter	(Dec-March)	16.61(53/319)	<0.05
	Summer	(Apr-June)	23.00(73/319)	
	Monsoon	(July-Sep)	34.00(107/319)	
	Post Monsoon	(Oct-Mid Dec)	26.29 (86/319)	
Age	Cow's Parity	Primiparous	16.45 (38/231)	<0.05
		Multiparous	25.07 (89/355)	
	Buffalo's Parity	Primiparous	33.14 (59/178)	0.500
		Multiparous	33.00 (133/403)	

*n=number of repeat breeders, N= total animals observed.

Figure 1. Geographic representation of the study Area KPK, Pakistan.

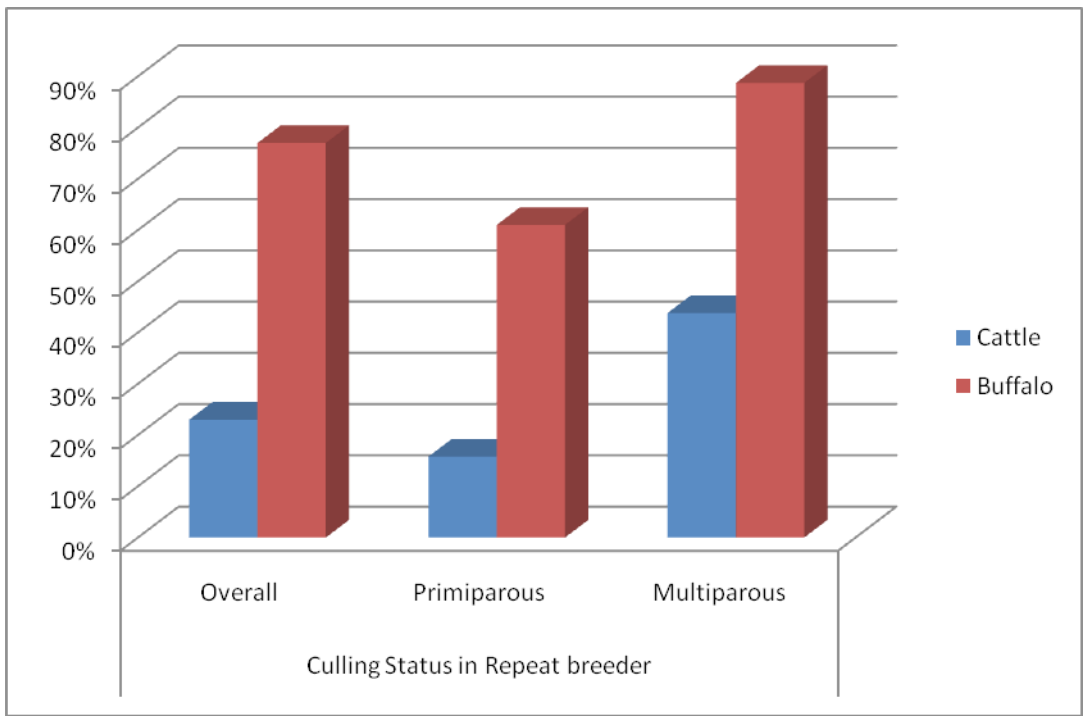

Figure 2. Showing the culling status of repeat breeders in the cattle and buffalo population in the studied animals.

ovulation. These variations are also similar to the findings of (Agrawal *et al*., 2003).

The astonishing major factor that is the economic loss for the smallholder dairy farmers in this region of the study observed was the culling of RB, s. Where 62.70% repeat breeders were culled in one year period that in much higher than (39.17%) reported by Rabbani *et al*. (2010) from Pakistan five years back. As can be judged in Figure 2 higher culling percentage is for multiparous buffalo repeat breeders as compare to cows. It is because of the higher RB incidence rate for that group and low conception rate after calving. Also the RB season played an important role in mass culling because of feed scarcity at that season. The longer the animal will take to conceive the greater chance it has to be culled. These involuntary culling of RB reduces the rural farmer's profitability significantly because it is never correlated with dairy production.

CONCLUSION

To increase the reproductive performance of cattle and buffaloes in future in warming environmental challenges strategies shall be adopted, making selection of breeds for adequate production purpose. Accordingly the genetics must match the environment in future.

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