REVIEW ON THE ASSOCIATION OF BIRTH WEIGHT OF CROSSBRED CALF FOR DYSTOCIA

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ABSTRACT

Nepalese policy makers and farmers are fascinated by exotic breeds of livestock species. It is in this pursuit that we have been spending billions to import livestock from different countries. Initially the plan and policies were to select indigenous animals and have them upgraded through cross breeding to improve milk production trait. With time the special idea to scan and select best performing indigenous animals from around the country got sidelined and competition to import pure exotic breeds began. Many issues, most importantly failing to provide standard husbandry, lack of multi utility of male calves have dampened the momentum. Alongside, for breeding involving big exotic sires like Holstein Frisian, Brown Swiss and Jersey with our nondescript dam is potential to dystocia because of relatively large birth weight of crossbred calf. Around 60% of dystocia are of fetal causes and birth weight is one major cause here in Nepal. Dystocia is associated with reduction in milk yield, poor cow fertility, poor health and pre-weaning mortality up to 50 percent. Crossbreed birth weight and dystocia are highly correlated. High occurrence of dystocia was reported with Holstein Frisian sire followed by Brown Swiss and Jersey when these sires were mated with nondescript dams. Proportionate and compatible selection of both sire and dam is important to avoid dystocia. Expected Progeny Differences (EPD) values for birth weight and calving ease would be a key for sire selection.

Keywords: *cow, community calves, exotic, non-descript, breeding policies*

INTRODUCTION

Livestock has been an important part of Nepalese rural livelihood contributing around 13% to national gross domestic product (GDP) (MOAD, 2016). Karki (2015) reported that 25.68% people in Nepal are involved in animal husbandry practices of one or other species. Cow is underlined livestock commodity in Nepal as it is one of the major dairy animals with imperative cultural values in Nepalese society. Cattle with over seven million head population in Nepal contributes 754 thousand metric ton of annual milk production which is 36% of the total production in Nepal (MoAD, 2019). Our local non-descript cows though have some excellent qualities like hardiness, disease resistance, good range of adaptation, fed in low input system but modest in milk yield trait (Neopane et al., 2002). Documenting the productive individuals and selection for further breeding of these indigenous treasures have been undermined and we are realizing the folly now. Hence, intervention of the exotic cows to improve milk production trait is widely adopted these days. The cross mating involving big exotic sires like Holstein Frisian, Brown Swiss and Jersey (adult weight ranging from 450-750 kg) with our non-descript dam (adult weight ranging from 120-300kg) is potential to cause dystocia as a result of relatively large birth weight of the crossbred calf.

There is still no extensive study neither on absolute dystocia nor on the potential dystocia because of the cross breeding in Nepal but quite a number of dystocia cases are often reported by farmers. However, a study done by Mee (2008) revealed that the rate of dystocia in dairy cattle was up to 7% around the world. Similarly, cattle and buffaloes are the species amongst the domestic animals which are considered to have highest incidence of dystocia (Purohit et al., 2011). Above all, the appearance of dystocia was seen in larger breeds like Holstein Frisian, Brown Swiss etc Larsen (1986). The aim of this paper is to comprehend how important factor is the birth weight of crossbred calf (particularly crossbred of exotic and nondescript breeds) for the occurrence of dystocia.

Causes of dystocia

The term dystocia is derived from the Greek words 'dys' meaning difficult and 'tokos' meaning birth. Dystocia is defined as the difficulty in calving following prolonged and spontaneous parturition process or prolonged or severe assisted extraction (Mee, 2012). However, McClintock (2004) stated that there is no such thing as an easy calving but there is just variation in the degree of difficulty from the dam's perspective which is parturating. In general, dystocia occurs when the size of the fetus is incompatible with the size of the pelvic opening of the cow, when the fetus is abnormally presented (breeched, head, or foot back), or when the cow does not experience normal parturition due to weakness, stress, or hormonal abnormalities. However, many other factors may also influence the incidence of dystocia, and these factors can be split into two categories: factors affecting the size and shape of the calf and factors affecting the ability of the dam to give birth (Roughsedge and Dwyer, 2006).

More categorical division of dystocia was done by Singh & Sciences (2019) on their review paper on bovine dystocia where they broadly categorized the causes of dystocia as fetal causes and maternal causes. Fetal cause comprises fetal maldisposition, fetal oversize and fetal monstrosities whereas a maternal cause includes incomplete dilation of cervix, narrow pelvis of cow, uterine torsion and uterine inertia. So far the chances of a particular category of dystocia is concerned, it is reported that 60.97% dystocia are fetal causes whereas 39.04 are maternal causes (Abdela & Ahmed, 2016). Dystocia was found to be affected by several genetic and non-genetic factors such as breed, parity of dam, sex of calf, birth weight of calf, pelvic size of dam, gestation length, nutrition, year and season of calving (Mee, 2008). Similar finding was affirmed by Purohit et al. (2011) where he explained age, parity of dam and sex of the calf as the non-genetic factors that affect dystocia. But many other findings did not consider sex of the calf as a factor that causes dystocia.

Loss due to dystocia

Different studies have presented dystocia as a causative factor for reducing the milk yield. Berry et al., (2007) found that milk yield was less in cows that experienced dystocia at calving compared with those that did not. Similar result was revealed by Abdela & Ahmed, (2016) where dystocia was found to be linked with the reduction in milk yield in the subsequent lactation. The same study also reported the association of dystocia with poorer cow fertility and health which created negative consequences on farm economics as well as for cow welfare. The finding was supported by López De Maturana et al. (2007) where poor fertility was observed in the cows with dystocia.

The adverse effect of dystocia was also observed on the reproductive performance and mortality rate of cows as well. The first estrus, first service, service period and calving interval were significantly longer ($P < 0.05$) in dairy Friesian cows that exhibited dystocia compared to normal cows (Gaafar et al., 2011). Calf dystocia was found to be associated with higher mortality in the immediate post-natal period and resulted in 50% of pre-weaned calf losses (Abdela & Ahmed, 2016). Of all pre-weaning deaths 45.9% can be attributed to dystocia. A study conducted in a certain line of California dairies resulted dystocia to be accountable for 6.4% of all cow deaths and 24% of deaths of first-calf heifers. Similarly, calf mortality was predicted to be four to eight times higher in dystocia cases than in normal births with majority of calf deaths (58%) occurring within the first 24 hours following calving (Patterson & Herring, 2017). The most significant result regarding long term effect of dystocia is that, cows once confronted dystocia are more likely to experience dystocia at the subsequent calving (Mee et al., 2011).

MATERIALS AND METHODS

This paper is a review article based on research articles and review papers from different journals, reference books, statistical books, farm herd data, other informal sources and author's perception on the base of science.

RESULTS AND DISCUSSION

Cross bred birth weight and dystocia incidence

Several studies have shown imperative relationship between the crossbreed calf and the dystocia incidence particularly if the sire and dam involved in cross mating were of different genetic worth in terms of their body weight. This category of dystocia is found common where sires like HF and BS are involved in mating with some other nondescript local dams. The additive genetic effect on the weight trait of fetus certainly increases the birth weight of calf significantly resulting dystocia. Likelihood of dystocia in crossbreeding was revealed in a study where sires of two beef breeds Charolais and Simmental (both having adult weight between 1000-1500 kg) and one dairy breed (Holstein) contributed to an increased incidence of dystocia due to heavy birth weight of their calves, whereas Angus and Jersey breed sires reduce the incidence of dystocia due to lower calf birth weights, where Hereford and Angus were the dams for each sires. (Purohit et al., 2012). Similarly, sire was the significant source of variation for dystocia while crossing the HF with Nigerian Bunaji cows as studies suggested that a significant effect of sire on birth weight and that higher birth weight was associated with dystocia (Sciences & Science, 2008). Holstein breed itself being prone to dystocia was suggested by Zaborski et al. (2009) where possibility of dystocia increased by 13% in Holstein for every 1 kg increase in calf weight.

A clear perceptive of crossbreeding impact on dams of different genetic group resulting dystocia is illustrated in (Table 1). The nondescript indigenous cattle mating with Holstein Frisian had significantly high percentage of dystocia. This imply that cross breeding between superiorly proven sire (heavily weighed) and nondescript dam which is generally small in size in comparison to other cross breeds and exotic breeds resulted high incidence of dystocia. The crossbred calves were possibly large (heavy) enough to parturate through relatively small pelvic area of non-descript indigenous cow.

Table 1. Incidence of Dystocia among different crosses of cattle in Gatsibo, Rwanda

Breeds of calf	No of parturitions	No of Dystocia	Dystocia rate (%)
HF × indigenous	1612	279	17.31
HF × crossbreds	3782	207	5.47
HF × pure exotic	217	10	4.61
Total	5611	496	8.84

Source: Mushonga et al., 2017

Nevertheless, the crossbreeding between two different genetic worth almost ensures the dystocia because of the increased birth weight of calf but increase in fetal size increases the probability of dystocia irrespective of calf being crossbred or not. In this line, the percentage of dystocia increment with increasing birth weight of born calves was observed significant ($P<0.05$) by Anderson, (1992). Similarly, Singh & Sciences, (2019) cited that a narrow pelvis and an oversized fetus were the causes of more than 50% cases of dystocia in cattle. Likewise, Mee, (2008) mentioned fetal size being an intermediate cause responsible for dystocia because it ultimately leads to feto-maternal pelvic disproportion.

Table 2. Relative significant factor for causing dystocia studied in 2 year old and first calved heifer

Factors affecting Dystocia	Significance level	Relative importance rating
Calf birth weight	P<0.01	3.05
Dam pre-calving pelvic area	P<0.05	1.16
Dam pre-calving weight	P<0.05	1.10
Calf sex	P<0.05	1.0

Source: Philosophy et al., 2018

A study revealed that the most significant (P<0.01) non-genetic factor among calf birth weight, dam pre-calving pelvic area, dam pre-calving weight and calf sex for the incidence of dystocia was the calf birth weight (Table 2). Birth weight as a major contributor to dystocia in cattle was also ranked by relative numerical ranking within four major factors affecting dystocia. Consequently, literatures suggest birth weight of calf to be a key factor contributing to dystocia in cattle. On top of that, birth weight of calf resulting from the crossbreeding of sire and dam from different genetic worth contribute even more in increasing the incidence of dystocia in cattle.

Cross breeding and dystocia in Nepalese breed

There are not too many scientific researches on different aspects relating cross breeding and incidence of dystocia in Nepal though related cases are often reported at farmer's level. Pandeya *et al*., (2019) reported the cases of dystocia based mortality because of the cross breeding of local Achhami cattle with other larger breeds in Far-western Nepal. The birth weight of some of the small indigenous cattle breeds in Nepal lies between 9 to 12 kg (Table 3). Similarly, average birth weight of calf observed from the mating of our nondescript cattle with different exotic sire lies between 16 to around 19 kg (Table 4). The differences of around 7 kg in both ranges are observed form the given information. Such disproportion in calf weight as a result of cross breeding could be the potential cause for dystocia incidence in cattle. The disproportion would be even high if the blood level of exotic breed is increased. We can observe the increment in body weight of crossbred calf when the exotic blood level was increased to 87.5%. The incidence of dystocia at different blood level in our crossbreds could be the area of further study.

Table 3. Average birth weight of some indigenous cattle breeds in Nepal

Local cattle	Birth weight (kg)	Citation
Achhami	12.5	(ABD, 2012/13)
Achhami	10.69	(DAR, Doti, Herd Register, 2020)
Lulu	8.95	(NCRP, Herd Register, 2020)
Lulu	12.3	(NABGRC, Herd Register, 2020)

Meanwhile, a study done by Shrestha and Pradhan, (1991) ranked the dystocia incidence in different crosses. It was observed that the highest number of dystocia cases was shown by F1 of Nepali Non-descript x Holstein Friesian followed by Nepali Non-descript x Brown Swiss F1 crossbreds although the proportions of dystocia among different groups were not significantly different and number of crosses in each case was not clear. The informal information from the herd book of Nepalese cattle farms also suggest more incidence of dystocia in HF cross in comparison to Jersey and other crosses. In the same line Cole et al., (2005) who investigated genetic evaluation of dystocia in Brown Swiss and Jersey breeds proved that Jersey bulls caused easier calving than Brown Swiss ones, whereas Brown Swiss bulls caused easier calving than Holstein ones in which pure breed calving was observed in each case. Similarly, Heins et al., (2006) also estimated that Holstein bulls caused more dystocia cases (16.4%) in heifers than Scandinavian Red bulls (5.5%). Additionally, Holstein bulls caused an increased incidence of dystocia than Brown Swiss bulls did (12.5%), Holstein Frisian being a dam in all above three cases. Likewise, (Maltecca et al., 2006) also observed that calves sired by Holstein bulls had 0.24 times higher probability of dystocia than sired by Jersey× Holstein bulls. So, dystocia incidence in local cow can be predicted high if HF sire is involved in comparison to the involvement of BS and Jersey sire.

Table 4. Average birth weight of cross breeds cattle in Nepal.

Case 1	*(Shrestha and Pradhan, 1991)*		
(1991)	Non-Descript × HF	18.6 (F1)	Highest number of dystocia
	Non-Descript × BS	18.4 (F1)	2nd highest number of dystocia
	Non-Descript × Jersey	16.0 (F1)	-
	Non-Descript× Ayrshire	16.4 (F1)	-
Case 2	*(NABGRC, Herd Register, 2020)*		
(2020)	Pahadi × HF	33.7	(At 87.5% blood level)
	Pahadi × Jersey	24.7	(At 87.5% blood level)

HF=Holstein Friesian; BS=Brown Swiss, BW= Birth weigh

Management of dystocia

The elimination of dystocia might not be possible but the adequate management of nutrition, selection of sire, selection of dam and some proper management practices can reduce the incidence of dystocia significantly. Selection of sire breed that have been proven to produce proportionate birth weight calves should be done to reduce the possible calving tension. Selection of sires within each breed that can cause easy calving when bred to certain dams is another important dimension of selection. Avoiding large framed sires to small framed heifers is utmost important. Relatively large framed sire can be used in mating when heifers mature into cows. The breeding sire should be selected on measures of direct calving ease by using EPD (expected progeny differences) values for birth weight and calving ease (Bolze, 1985). Past calving record is very important for the estimation of EPD. Heifer with good body condition into calving period (minimum body condition score of 5 out of 10-point scale) is highly desirable. Also, heifers should weigh 65-70% of their mature body weight at the time of first breeding.

Selection of dam with proper pelvic size is another important area of selection. Patterson & Herring (2017) in a study at University of Nebraska suggested the ratio of pelvic area of yearling heifer (prior to breeding) and calf birth weight to be nearly 2:1 (unit in cm^2 an lbs respectively) for easy calving. The pelvic size of Nepalese indigenous cows is still underexplored. So, the successful use of pelvic area and birth weight ratio to reduce calving difficulty can be verified by further research in our context.

CONCLUSION

This review can conclude that the crossbred birth weight and dystocia are highly correlated. Selection of both the sire and dam relatively proportionate and compatible to each other in terms of birth weight trait would be very important measure to avoid dystocia incidence. EPD values for birth weight and calving ease would be a key for sire selection. Jersey could be a better option for most of the Nepalese non-descript cow than HF to avoid dystocia.

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