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Effects of calving difficulty on the subsequent reproductive performance and milk production of Holstein, Brown Swiss and their crosses

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ABSTRACT

Calving ease affects the welfare of cow and has economic implications for the farm. The degree of calving difficulty varies from no assistance needed to surgery being required. The aim of this study was to estimate the incidence of calving difficulty and evaluate the effects of calving ease on the subsequent reproductive and production performance of pure Holstein (HO), Brown Swiss (BS) and their F_1 crosses (BF) under Egyptian conditions. The pure BS and BF heifers had significantly ($P<0.05$) higher incidence of calving ease (87.9 and 83.8%, respectively) when compared with pure HO heifers (78.6%). Furthermore, the incidence of calvings of the most severe level was lowest in pure BS heifers. The reproductive function of pure BS and BF cows was not affected by difficult levels of calving, although their subsequent reproductive indices were reduced to some extent at the very difficult calving conditions (category C). In contrast, pure HO cows at very difficult level (category C) had significantly ($P<0.05$) longer calving interval and days open (474 and 198 d, respectively), compared with those calved without difficulty (396 and 149 d, respectively). Pure HO cows experienced very difficult calvings had decreased Total-MY, 305-MY and Peak-MY at a rate of 34.6, 35.2 and 40.9%, respectively when compared with those calved without difficulty. However, production indicators of pure BS and BF cows were more tolerant with conditions of calving difficulty. In conclusion, pure BS and BF cows can cope with the difficult levels of calving under Egyptian conditions, while pure HO had lower fertility and milk yield parameters under the same conditions.

1. Introduction

Calving is a key event for the dairy cow which is fundamental to the long-term sustainability of the farm. When complications at calving take place, this can lead to high labor and veterinary costs, which impact on the farm and ultimately the dairy industry. There is a wide array of definitions for calving difficulty ranging from the need for assistance, to major force or surgery being required to extract the newborn (Mee, 2008). Furthermore, calving difficulty has adverse effects on the health and performance of both dams and offspring. One important reason for considering calving ease is the high level of pain experienced by the dam during a difficult calving, which compromises animal welfare. Therefore, calving ease is indeed reported to be an economically significant non-production trait (Dematawewa and Berger, 1997). This is particularly important in first-calving heifers on account of their higher incidence of difficulty (Berry et al., 2007; Gevrekçi et al., 2011). Parturition in cattle is a complex process triggered by the fetus and involves a series of hormonal actions and physiological modifications. Thus, it seems rational that when complications occur, there likely is an effect on other normal reproductive functions (Senger, 2003). However, calving difficulty has received considerable attention, partly on account of its probable adverse effect on the cow's reproduction and production in subsequent lactations.

Categorical scoring scales that allow for different degrees of calving difficulty are usually used across species with ordinal scales with 3–5 rating points being popular in cattle (Mee, 2008). Lower scores are commonly given to the easiest births and highest scores to the most difficult ones. Numerous reports have detected a reduction in performance after a difficult calving, especially for fertility traits (Laster and Gregory, 1973; Tenhagen et al., 2007). However, several measures of fertility such as calving interval, days open, number of services to conception, and days to first service, revealed a decline in the performance. Alongside fertility traits, production traits are linked with calving ease. Cows experiencing difficulty at birth are more likely to suffer from

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postpartum diseases such as retained placenta, metritis and milk fever (Benzaquen et al., 2007), which might be explained by the potential of microbial contamination during assistance that combined with a depressed immune status during the peripartum period (Dohmen et al., 2000).

Failure to establish pregnancy can be the result of a malfunction at any link in the chain of events controlling the conception (Garnsworthy et al., 2008). However, the uniformity in reported results on days open suggests that problems start early in this chain after a difficult calving, with difficulties in returning to normal cyclic condition. Subsequent anestrus to the calving difficulty is due to a prolonged luteal phase (Peter et al., 2009). Furthermore, after calving the high energy requirements for milk production force the dam into a period of negative energy balance. To fulfill the energy requirements that are in excess of ingested energy, body tissue is depleted and consequently body condition score decreases. Further stress caused by calving difficulty might augment the negative energy balance through the appetite reduction (Ingvartsen et al., 2003).

It has been shown that calving difficulty reduces milk yield in the cow. Some authors seem to find a detrimental effect on the overall lactation of cows (Djemali et al., 1987; Dematawewa and Berger, 1997). However, other studies show shorter term effects that disappear beyond the first phase of lactation (Rajala and Grohn, 1998; Thompson et al., 1983; Tenhagen et al., 2007). Furthermore, the degree of difficulty at which milk losses are reported ranges from slight degrees of difficulty to more severe cases when surgery is needed (Djemali et al., 1987; Dematawewa and Berger, 1997; Tenhagen et al., 2007). Moreover, losses are thought to be greater with increasing degrees of difficulty (Djemali et al., 1987; Dematawewa and Berger, 1997). The reasons proposed for such variation include a range of factors such as animal genetics, different scoring methods, livestock management, calving management, or even evaluation methods. Furthermore, dystocial animals are more likely to die or be culled in the initial stages of their lactation (Tenhagen et al., 2007; Dobson et al., 2008).

Numerous studies have documented the impact of crossbreeding on calving difficulty and stillbirths, but they have been mostly limited to crossbreds of Holstein, Brown Swiss, Jersey, Ayrshire, and Guernsey (Donald, 1963; Hollon and Branton, 1975; Vesely et al., 1986; Touchberry, 1992). Furthermore, pure Holsteins had the highest incidence of stillbirths at first calving when compared with crossbred cows sired by either Holstein or Brown Swiss bulls (Hollon and Branton, 1975). A long-term crossbreeding trial with Guernsey and Holstein documented significantly fewer calves dead within 24 h after birth of crossbred than purebred (Touchberry, 1992). In recent studies, pure Holstein cows had more calving difficulty than Jersey × Holstein crossbreds (McClintock et al., 2004). Heins et al. (2006) reported that pure HO had significantly ($P < 0.05$) more calving difficulty than Normande × Holstein crossbreds (11.6%), and pure HO (17.7%) had significantly ($P < 0.01$) higher calving difficulty than Montbeliarde × Holstein (7.2%) and Scandinavian Red × Holstein (3.7%) crossbreds at first calving. To our knowledge, this is a one of few recent studies investigating the effects of calving ease on subsequent reproductive and production performance of crosses originated from two temperate breeds and managed under subtropical Egyptian conditions. Therefore, the objectives of this study were to estimate the incidence of calving difficulty and to evaluate the effects of calving ease on the subsequent reproductive and production performance of the pure Holstein (HO), Brown Swiss (BS) and their F_1 crosses under subtropical Egyptian conditions.

2. Materials and methods

2.1. Animals and management

This study was conducted at AL-Kawther farm, Ismailia road, Cairo. Recently, to overcome the higher incidence of health problems and lower fertility of the Holstein (HO), the breeders tended to crossbred Brown Swiss (BS) with the HO. The herd consisted mainly of 1000 purebred HO and 112 purebred BS cows. Crossing the two breeds resulted in 211 F_1 crossbred cows (BF; 50% BS and 50% HO). All purebred and crossbred heifers and cows were inseminated by imported purebred HO semen. All heifers and cows were housed in a dairy barn with sand-bedded free stalls, milked 3 times daily with milk yield recorded at each milking and the cows were fitted with pedometers. The Total mixed ration (TMR) has been provided twice daily for all cows. The ration was mixed daily and modified according to the body condition score of the cows and exact milk production. The TMR was formulated to meet the predicted requirements of energy, protein, minerals and vitamins. The TMR was sampled monthly and analyzed by wet chemistry methods. The primary analysis of TMR include crude protein (16.91%), neutral detergent fiber (24.83%) and net energy for lactation (Mcal/kg = 1.76). Alfalfa hay was the primary forage. The reproductive data (insemination, reproductive problems, and so forth) were recorded and tracked using a commercial on-farm computer software program (AfiFarm version 4.1). In the region where the farm was located, average minimum and maximum temperatures were 10.6 and 20.7 °C in the cold season, and 22.9 and 35.2 °C in the hot season.

2.2. Reproductive performance

According to the usual reproductive management, the breeding season extended from September to June. Heifers and cows thought to be in heat from visual inspection or evidenced by high levels of activity through pedometer records, were inseminated 14 h later and concomitantly received a dose of GnRH (10 μg, Buserelin; Receptal; Intervet). The HO, BS and BF cows received 2870, 512 and 976 inseminations, respectively. All purebred and crossbred heifers and cows were inseminated with purebred HO semen by three proven inseminators, approximately with the same efficiency. The HO semen has been imported from progeny- or genetically-tested bulls. The main consideration during semen selection for heifers and cows was given to the calving ease index and the predicted transmitted ability for milk production. Thirty days post-insemination, ultrasound examination was performed to determine the conception in the heifers and cows and also a confirmatory pregnancy diagnosis was done at 75 d post-insemination.

The reproductive performance including date of calving, calving score, birth type (single, twin, or abort), parity number, calving interval, days open and number of inseminations per parturition were estimated for all heifers and cows in the farm over a period of 4 years between September 2009 and October 2013. Abortions and twin births were excluded from the data. Calving ease records of all genetic groups were restricted to the first parity (heifers). The actual number of first parity records of pure HO, BS and BF were 930, 108 and 202, respectively. Calving ease was generally scored on a categorical scale designed to be practical yet minimizing room for subjective interpretation. Scoring was conducted according to a 3-grade scale as: A: normal, easy or minimum assistance, but no calving difficulty; B: difficult with veterinary assistance; and C: very difficult, including cesarean (Kaya et al., 2015).