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Effect of Retained Fetal Membranes on the Reproductive Performance of Holstein Frisian Cows in Northern Gezira Dairy Project (Al Bagair)

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ABSTRACT

The aim of this study was to investigate the effect of retained fetal membranes (RFM) on reproductive performance of Holstein Frisian cattle reared in the farm of the Arab Company for Agricultural Production and Processing (ACAPP), about 40 km south of Khartoum at Al Bagair area. A number of 1377 recorded cases of (RFM) covering the period from 1990 to 1999 were studied for their effect on reproductive performance under the prevailing management and environmental conditions. The traits examined were calving interval (CI), days open (DO), and number of services per conception (NS\C). Data were subjected to statistical analysis of variance. The results obtained showed that the overall mean (CI), (DO) and (NS\C), were 394 ± 45.87 days, 110.21 ± 45.75 days and 2.81 ± 1.1-63 respectively. The mean (CI) were highly significant (P≤ 0.01) affected by the level of (RFM). The results revealed were (402.73± 47.20, 392.42± 46.48 and 389.07 ± 42.55) at high, medium, and low level of (MS) respectively. The effect of (RFM) on (DO) was highly significant (P≤ 0.01) the results obtained for (DO) were (117.67± 47.46, 107.69± 46.39, and 106.05± 42.22). The effect on (NS/C) was also highly significant (P≤ 0.01). The results obtained for (NS/C) were (3.10± 1.75, 2.71± 1.61, 2.65 ± 1.48) at high, medium, and low level of (RFM) respectively. It is concluded that RFM significantly affected the reproductive performance of Holstein Friesian cows in the farm under study.

INTRODUCTION

Calving interval (time between successive calvings) and "days open" (count of days from calving to conception), and the number of services per conception (is the total number of services given to a group of cows eligible for service, divided by the number of conceiving cows) are used to assess the reproductive performance of dairy cows (Grohn *et al.*, 1998). Calving interval is probably the best index of a cattle herd's reproductive efficiency (Holness *et al*, 1980). Yet, higher producing cows are more likely to be inseminated more times and for longer than lower producers (Eicker *et al*., 1996). Days open is routinely used to assess reproductive performance and to make economic decision in dairy herds (Farin *et al*., 1994; Arthur *et al*., 2001). The "days open" period should not exceed 80-85 days if a calving interval of 12 months is to be achieved (Peters, 1984). The duration of this period is influenced by nutrition (Wiltbank *et al.*, 1962), season, milk yield, parity, suckling and uterine involution (Buck *et al*, 1975). NS/C is influenced by factors related to the cow, the bull, or artificial insemination (AI) and the farming system. It depends largely on the breeding system used. Choudhuri *et al.*, (1984) reported that heritability of NS/C is low and most of the variation in NS/C is attributable to environmental factors.

Retained placenta (RFM) is the failure to expel the fetal membranes within 12 to 24 hours after calving in bovines (Mohamed and Amer 2009). There are several potential causes for placental retention but the effects on the general health of the cow and her subsequent reproductive performance are costly events to the dairyman. RFM causes an increase in time to first service, lower first service conception rate and thus an increase in time to conception (Fourichon *et al*., 2000; McDougall, 2001).

The retention of placenta creates a number of potential problems due to the possibility of uterine infection, Borel *et al.*, (2006). RFM has a negative impact on the reproductive performance of cattle by causing delay in the period to first service (Stevens *et al*., 1997), reduction of pregnancy rate (McDougall *et al*., 2001), and increase in services per conception (Holt *et al*., 1989). RFM also leads to endometritis, puerperal metritis and mastitis (Bruun *et al*., 2002), and these diseases ultimately cause the reduction in the fertility and milk production of cattle (Laven *et al*., 1996). Mechanical, nutritional, management and infections are common factors attributed to retention of placenta, mechanical causes of RFM include difficult birth, caesarean section, uterine torsion, abortion, stillbirth, emphysematous fetus, and twin birth (Zainalabdein 2015). Some vitamins and minerals are also identified as causes of RFM (Akar and Yeldiz, 2005). Management causes of retained placenta include stress, hereditary, environmental factor, and obesity (Zainalabdein 2015). Infectious causes of placental retention include brucellosis, salmonellosis, leptospirosis, and listeriosis. Some viral diseases such as IBR/IPV and BVD as well as fungal diseases are also known to induce retention of fetal membranes (Krizanec and Kosec, 2003). During RFM, the vulva opens and fecal material and hence fecal microorganisms may enter the vagina and uterus. These microorganisms set up an active site of infection in the uterus and this can create a number of potential reproductive problems, Philips (2004). Some

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investigators indicated that RFM is one of the main causes of endometritis in cattle (Kanee and Miller, 1995; Philips, 2004; Han and Kim, 2005). A cow with infected and inflamed uterus takes much longer to clean and be ready for the next breeding season. Delayed uterine involution usually accompanies retention of placenta (Peters and Ball, 1995), and adversely affects reproductive performance (Swiefy, 2003). Cows with reproductive disorders had longer intervals from calving to first service and to conception and required more services per conception and lower pregnancy rate and conception to first service (Shiferaw *et al.,* 2005).The intervals from calving to first service and days open were prolonged in cows with retained placentas compared to the non-infected cows (Han and Kin, 2005). RFM resulted in a significant increase ($P<0.05$) in the period from parturition to first estrus (25.90 vs. 20.50 days) and first service (56.90 vs. 47.20 days), service period (57.70 vs. 46.10 days), open days (106.90 vs. 92.70 days), number of services per conception (3.50 vs. 2.60) and calving interval (395.20 vs. 372.90 days) (Gaafar *et al.,* 2010). Number of factors like dystocia, twin births, abortion, and increase in the age of animal are responsible for RFM (Han and Kim, 2005). Inadequate supplementation of a ration with vitamins A and E, β–carotene, iodine, selenium, copper and zinc may also induce abortion in cows with increased incidence of RFM (Markiewicz *et al*., 2001). In most circumstances, the nutritional management of mature cows for proper body condition and minimal cases of milk fever will also minimize the occurrence of retained placenta, (Charles Guard 1999).

The aim of this study was to investigate the effect of remained foetal membranes on reproductive performance of Holstein Frisian cattle reared in the farm of the Arab Company for Agricultural Production and Processing (ACAPP).

MATERIALS AND METHODS

Study area:

This study was carried out in the farm of the Arab Company for Agricultural Production and Processing (ACAPP) located about 40 km south of Khartoum at Al Bagair area.

a. **Management:** The farm under study was well established and strict hygienic measures were adopted. Vaccination against the major prevailing epidemic diseases in Sudan was a regular practice in the farm. The main diseases vaccinated against were Rinderpest, Anthrax, Black Quarter, Hemorrhagic Septicemia, Contagious Bovine Pleuropneumonia, Brucellosis, and Foot and Mouth Disease.

b. ***Data collection:*** The data for this study were compiled from the records of the Holstein- Friesian herd in the farm. A number of 1377 records of retained foetal membrane cases covering the period 1990 - 1999 were studied for their effect on:

i. Calving interval (period of time between two successive calving's).
ii. Days open. (Count of days from calving to conception).
iii. Number of services per conception. (The total number of services given to a group of cows eligible for service, divided by the number of conceiving cows)

The number of cases of each was divided into three groups; High, Medium, and Low according to the number of cases reported in each year as shown below:

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High ≥ 150
Medium 120 - 150
Low ≤ 120

c. Statistical Analysis

The data were analyzed by analysis of variance Acazel and Sounderpandian (2002). They were analyzed using SPSS Version 20 program. The one-way analysis of variance (ANOVA) was applied.

The following fixed model was used:

$Yijkl = \mu + ai + bj + ck + eijkl$

Where

Yijkl = calving interval, days open, and services per conception

μ = overall mean,

ai = effect of high incidence of infection

bj = effect of medium incidence of infection

ck = effect of low incidence of infection

and

eijkl = random error.

RESULTS AND DISCUSSION

Overall means:

The data showed that the overall means of calving intervals (CI), days open (DO), and number of services per conception (NS/C) throughout the period (1990 to 1999) was 394.51 ± 45.87, 110.21 ± 45.75, and 2.81 ±1063 as shown in (Table 1). Means and standard deviation for CI, DO, and NS/C are shown in tables (2, 3 and 4) respectively. The histograms illustrate the means of the three traits of reproductive performance; Calving intervals (CI), Days open (DO), and Number of services per conception (NS/C) through the years of the study.

Table 1: The overall Means ± std. dev. for Calving intervals, Days open, and Number of services per conception

Dependent variable	Mean	std.dev.
CI	394.51	45.87
DO	110.21	45.75
NS/C	2.81	1.63

Table 2: Means ± std. dev. for Calving intervals in cows suffering from Retained Foetal Membranes through years (1990 – 1999)

Dependent Variable	Year	Mean	std.dev.
Calving interval	90	390.50	56.86
	91	402.51	46.78
	92	392.88	42.40
	93	388.57	42.57
	94	391.58	45.27
	95	413.12	56.05
	96	388.10	36.13
	97	404.08	42.38
	98	390.98	39.00
	99	382.76	39.30
	Total	394.51	45.87

Table 3: Means ± std. dev. for Days open in cows suffering from Retained foetal Membranes through years (1990 – 1999)

Dependent Variable	Year	Mean	std.dev.
Days open	90	105.87	56.91
	91	117.37	46.64
	92	107.78	42.31
	93	103.38	42.37
	94	106.62	45.19
	95	126.76	56.52
	96	104.30	36.16
	97	120.82	42.06
	98	105.42	39.71
	99	103.76	39.08
	Total	110.21	45.75

Table 4: Means ± std. dev. for Number of services per conception (NS/C) through years (1990-1999)

Dependent Variable	Year	Mean	std.dev.
Number of services / conception	90	2.63	1.92
	91	3.01	1.69
	92	2.68	1.48
	93	2.64	1.46
	94	2.67	1.58
	95	3.46	2.16
	96	2.54	1.27
	97	3.14	1.56
	98	2.69	1.36
	99	2.60	1.39
	Total	2.81	1.63

Effect of retained foetal membranes on calving interval, days open, and number of services per conception:

The statistical analysis revealed that the effect of incidence of occurrences of uterine infection on CI, DO, and NS/C was highly significant ($P \leq 0.01$), Table (5).

The incidence of retained placenta was high on years (1990, 1991, and 1996), medium on years (1993, 1995, 1997, and 1998), and low on years (1992 and 1999). The frequency distributions of CI, DO, and NS/C are presented in Figures (1, 2, and 3) respectively.

The analysis of data showed that means and standard deviations of calving intervals, days open, and number of services per conception were higher during years of high incidence of retained fetal membranes Table (6)

Table 5: Analysis of variance for the effect of retained placenta on calving interval (CI), days opens (DO), and number of services per conception (NS/C)

Dependent variable	Source of Variation	Sum of Squares	df	Mean Square	F	Sig.
CI	Between Groups	54636.26	2	27318.13	13.16	.001
	Within Groups	3667820.11	1767	2075.73		
	Total	3722456.37	1769			
DO	Between Groups	43067.06	2	21533.53	10.40	.001
	Within Groups	3660139.01	1767	2071.39		
	Total	3703206.07	1769			
NS/C	Between Groups	65.00	2	32.50	12.41	.001
	Within Groups	4626.14	1767	2.62		
	Total	4691.14	1769			

Table 6: Means and St. Deviations of the three traits of reproductive performance at three levels of Retained placenta

Retained placenta	Incidence of infection	Mean	std.dev.
CI	High	402.73	47.20
	Medium	392.42	46.48
	Low	389.07	42.55
DO	High	117.67	47.46
	Medium	107.73	46.39
	Low	106.05	42.22
NS/C	High	3.10	1.75
	Medium	2.71	1.61
	Low	2.65	1.48

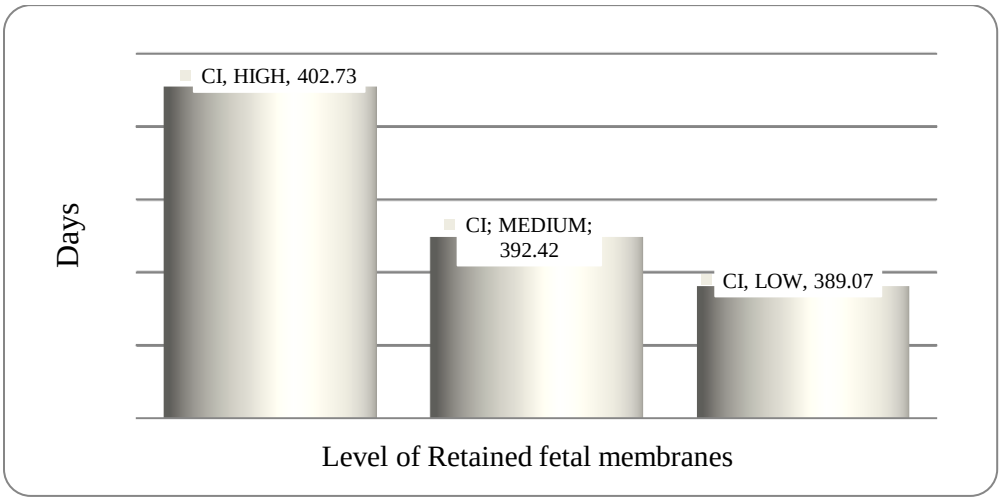

Figure 1: Effect of level of retained placenta on calving interval

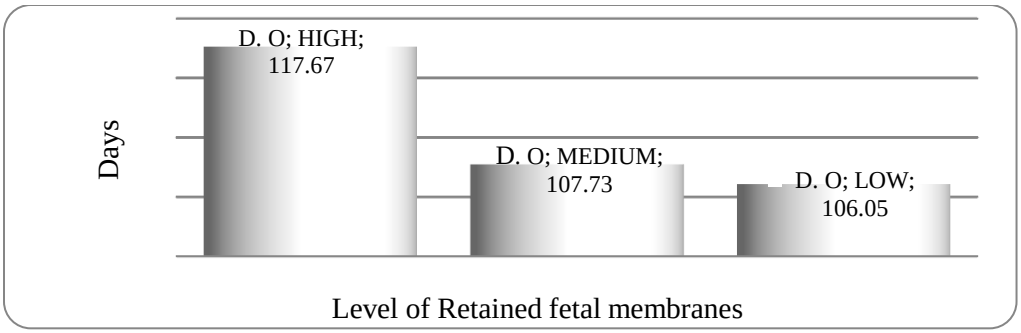

Figure 2: Effect of level of retained placenta on days open

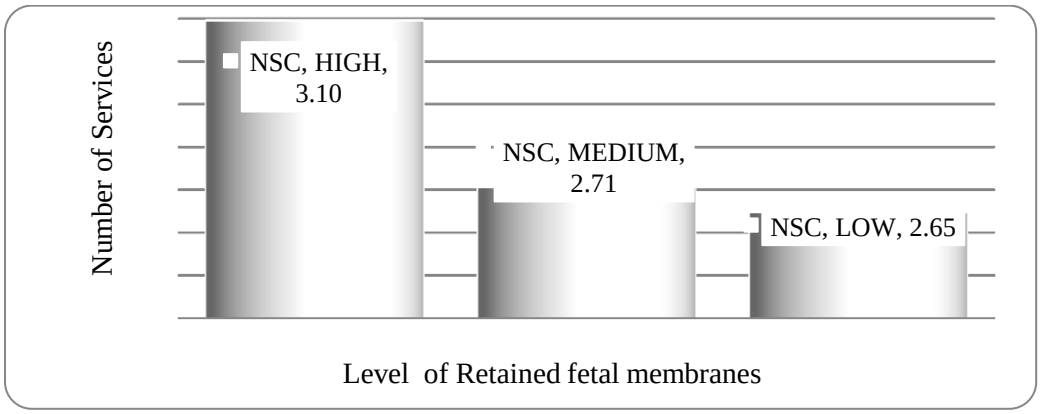

Figure 3: Effect of level of retained placenta on number of services per conception

There appears to be an agreement in the literature that health and reproductive problems mentioned in the current study have adverse effects on the health (Borel *et al.*, 2006), production, and reproduction indices of the dairy cow Fourichon *et al*., (2000). Development of practical management strategies to cope with the negative effects associated with reproductive and health problems on dairy farms is critical. The reproductive problems mentioned in the current study are the most important conditions that limit cow's performance and considerably erode the profit, Zainalabdein (2015). Maintaining the general health and immune function of cattle is also important in minimizing the risk of health problems El Fagir, (2007). Providing an adequate amount of a properly formulated and delivered ration (Butler, 2005), and providing a clean, comfortable and minimal-stress environment is also essential to accomplishing this task, M'hamdi *et al.*, (2012). Generally in this study it appears that the performance in years 1991, 1995, and 1997 was poor while there was some years in which the performance was good, (1993, 1996, and 1999) and this could be attributed to management mainly nutrition.

The effects of retained fetal membranes on CI, DO, and NS/C were statistically highly significant ($p \leq 001$ for all traits). The average mean of CI was higher in years of high incidence of retained placenta (1995, 1997, 1998) than in years (1992, 1994, 1999) of low incidence (402.73 ± 47.20, versus 389.07 ± 42.55) respectively. The average mean of DO was higher in years

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of high incidence of retained placenta than those in years of low incidence (117.67 ± 47.46, versus 106.05 ± 42.22) respectively. The average mean of NS/C was higher in years of high incidence of retained placenta than those in years of low incidence (3.10 ± 1.75, versus 2.65 ± 1.48) respectively. These results were in accordance with (Peters and Ball, 1995; Shiferaw *et al.*, 2005, and Han and Kim 2005). Gaafar *et al.*, (2010) reported 395.20 days for CI, 106.90 days for DO, and 3.5 for NS/C, which were consistent with the results of this study.

The factors to be avoided are: high body condition score at calving, dietary deficiencies of vitamins A, D and E and deficiencies in selenium, iodine and perhaps zinc and hypocalcaemia (Han and Kim, 2005). However, the role of minerals and vitamins fed at this time on subsequent fertility is poorly understood (Wilde, 2006). Cows in a greater degree of negative energy balance prepartum are 80% more likely to have RFM (Le Blank et al., 2004). Thus, higher energy consumption during the last weeks of the dry period might reduce disease risk at parturition. Apart from that, the rate of cows with RFM was rather high in our investigation, which is in accordance with Bell and Roberts (2007), who did not find differences between cows fed low-concentrate diet and cows fed high-concentrate diet in chance of having RFM. .

According to Wilde (2006), RFM can be reduced by prevention of hypocalcaemia and also adequate Selenium status of the dairy cow. Vitamin E in combination with Se, as antioxidant is well known for its beneficial influence on fertility in animals (Ishii et al., 2002). Although the requirement for Se is relatively low, feedstuffs produced in many areas of the world contain considerably less than 0.3 mg/kg, necessitating the need for supplementation (Spears and Weiss, 2008).

CONCLUSION AND RECOMMENTATIONS

The performance of animals depends not only on their genetic merits, but also on other factors. Appropriate herd health measures can directly influence the reproductive performance of a dairy herd. The effect of retained foetal membranes on reproductive performance of Holstein Frisian cows in the farm under study was highly significant. So a proper management of the prepartum and postpartum cow is vital for its reproductive future. This includes good nutrition during the dry and transitional periods, sanitary calving pens, hygienic interventions and a clean surrounding environment. Proper and keen utilization of herd records is also imperative to avoid malpractices that jeopardize the reproductive future of the herd.

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