Journal of Economics & Management Policy (JEMP)
Issue: Vol. 3; No. 1; February2022 (pp. 9-14)
ISSN: 2692-7292 (Print); 2692-7306 (Online)
Website: www.jempnet.com
E-mail: editor@jempnet.com
Doi: 10.48150/jemp.v3no1.2022.a2

Estimation of Annual Economic Losses Due to Prolong Inter-Calving Interval in Sudanese Dairy cows

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Abstract

A Seven Sudanese Stateswere involved in the current study (Kassala, Gadaref, Sinnar, Gazera, White Nile, River Nile and Khartoum) to determine the length of day open (DO), inter-calving interval (ICI) andestimation of annual neteconomic losses among Sudanese dairy cows due to prolong ICI. A questionnaire was designed for data collection from 70 dairy farms (10 farms each state). Three thousand and five hundred (500 cows each state) multiparous (3 - 5), with body condition score(2.5 – 3) and (4 – 8) years old dairy cows were selected for this study. The included dairy breeds were Cross-bred (1500 cow), Butana (1000 cow) and Kenana (1000 cow). The cows randomly were allocated into two groups. Group A (150000 cows) were untreated. Group B (2000 cows) wereinjected i.m with GnRH (100 ug) in the 3rd week postpartum (PP).The data was statisticaly analyzed by using the statistic package for social science (SPSS 1.6). The T test was used to compare the means between the two groups. The significant difference was considered at P<.0.05.The results of the current study showed that, the DO and ICI for the untreated cows was significantly ($P < 0.05$) longer compared to the cows treated with GnRH in the 3rdweek PP. A significantly ($P < 0.05$) high annualnet economic losses was shown for the untreated cows compared to the treated cows.

This study concluded that, injection of GnRH as early as 21 days PP improves the reproductive performance of dairy cows and neglects the economic losses due to prolong ICI in Sudanese dairy breeds.

Introduction

The Sudan is considered one of the counties the world depend on to participate in the world food security. The Sudan endowed with a huge animal wealth that estimated to be over 116 million head of cows, sheep, goats, camels and horses (31, 41, 32, 5, and 8 million respectively) (Omer, 2017 and MAR 2020), The same authors mentioned that, the population of the Sudanese local dairy breeds (Cross-bred, Butan and Kenana) are estimated to be 10 million head (2, 3 and 5 million respectively) which offered 60% of milk for local consumption. However, the cost of the annual imported milk to cover the shortage (40%) is estimated to be 200 million US$ (C.B.S, 2018).Many experts strongly believed that, the animal wealth would be of the great asset for any future development in the country.

Up-to-datemore than 80% of animal population in the remote rural areas under traditional system of management. In consequent, it has little economic value (C.B.S 2018). In 2018, a recent report from the ministry of animal resources (M.A.R) mentioned that, contribution of the animal wealth to thegrowth domestic product (GDP) is estimated to be 20% (1,500 billion $). The potential of the country to produce animal feed is great considering that half of total area of the country is suitable for animal grazing (Omer, 2017). The PP infertility in dairy cows is frustrating and results in conception rates (CR) reduced milk production, increase culling rate, increased cost for replacement of animals as well as increase of veterinary services (Nanda, et al, 1989, Omer 2017). Therefore, a short DO and ICI will improve the reproductive efficiency in dairy cattle and reduce the economic losses. The most reproductive failure in Sudanese dairy herds is due to mismanagement (Mohamed, 2021). The most significant benefits reproductive herd health program is the stimulation of improvement in heat detection that reduces DO and ICI (Arthur, et al, 2009). An early report of Guilbault et al (1985) presented that, in the United Kingdom (U.K) a calculation has been made for estimation of economic losses of milk, feed, calves, replacement of heifers, culled cows and veterinary services cost the farmers for ten days extension beyond 365 days is 300 million USA$. The same authors mentioned that, high reproductive efficiency of dairy cows is a fundamental factor necessary forhigh output in animal production. This is due to increased production costs, decreased milk production, increased number of services preconception, prolong ICI and imposed higher culling rate of cows with poor reproductive efficiency. On theorther hand, the long PPP is considered to be the main causes of economic losses and the major problem that limits the improvement of reproductive performance of dairy cows reared under tropical conditions (Short et al, 1990; Williams, 1990, Ahmed and Elsheikh 2004 and Kumar, 2009). The Sudanese dairy cows are known to have a long postpartum period (PPP) which reduces the PP reproductive performance (Elhag 2001 and Ahmed and Elsheik 2004). The prolong cyclicity attributed to the absence appropriate LH pulses which lead to atresia of the first PP follicle (Yavas and Walton, 2000). During early PP LH stores are depleted (Nett 1987 and Nett, et al 1987). Around the third week PP LH stores replenished (Yavas and Walton, 2000).The same authors reported that the initiation of PP ovarian cyclicity could be reduced by injection of GnRH during early PPP to increase LH release surge frequently. It is well understood that GnRHis a hormone that used worldwide for achievement of proper management of PPP in dairy cattle (Fernandez, et al, 1987 and Ahmed and Elsheikh, 2004). In 1995, Twagimora, et al presented that injection of GnRH eliminates large follicles by ovulation or atresia and initiates new follicular waves within 3 to 4 days after treatment at any stage of oestrous cycle. However, it limits further growth of these emerging follicles by increasing atresia. Mialot, et al (1999) mentioned that, cows injected with GnRH on day zero PP showed oestrouson day 10. Also the same authors presented that the CR reached 54% for the cows injected with GnRH on the day of calving. Similarly, injection of GnRH in the second week PP reduced the PPP, shortened the DO,ICI and improved the CR in non-suckling dairy cows (Lamming, et al 1982 and Risco, et al 1995 and Ahmed and Elsheikh, 2004).

In view of the above mentioned findings, the objectives of the present study wereto determine the length of DO, ICI and estimation ofthe annualnet economic losses due to prolonged ICI in Sudanese dairy cattle.

Materials and Methods

Study area: This study was carried out during the period from June 2015 – December 2018. A Seven Sudanese States (Kasala, Gadaref, Sinnar, Cazera,White Nile, River Nile and Khartoum) were involved in this study. They within the semi-arid zones. The maximum rain fall is reached between July and September. The temperature is very high during days of summer months (March and June).

Experimental animals: Three thousand and five hundred (3500)multiparous (3 - 5)and their age (4 - 8) years Sudanese dairy cows (Cross-bred, Butana and kenana) were employed in this study, their body condition score (BCS) 2.50 - 3.50 based on the five scales points out lined by Wilman et al (1982). The cows calved during February 2017 to November 2018. The cows were milked once a day (6.00 a.m). All animals fed roughages ad-libitum as group but were individually fed dairy concentration at milking time (10 Kg/ cow). The concentration consists of 37% sorghum, 21% cotton seeds, 40% wheat brand and 2% Sodium chloride. The roughages offered to the cows in pens during the day consist of green alfaalfa (Barseem). Routine vaccination against the major infectious diseases were practiced once every year. The animals were kept in open and semi open shades yards constructed with Iron bars, partially roofed with metal sheets.

Heat detection: Well-trained herdsmen observed all animals thrice daily for heat symptoms. The animals were observed for duration of 30 minutes at 6:00 a.m, 2:00 p.m and 6: p.m. The cows are considered on heat when it stand to be mounted by other cows, mounted others, a clear vaginal mucous discharge hanging from its vulva and when it bellowed (Gong et al, 2002).

Cow services: Cows exhibited oestrous behavior in period less than 42 days PP were not served. In contrast, cows exhibit oestrous behavior after that time were served with bulls with a proven fertility (Ahmed and Elsheikh, 2004).

Number of services per conception: It was calculated according to Arthur, et al (2001), from the number of services given to the cows after 42 day PP and resulted in a diagnosed pregnancy not less than 45 days after insemination.

Day open (DO): It was calculated from the day of calving until occurrence of successful fertilization which monitored by the absence of the subsequent heat. The optimum DO is 85 days in dairy cattle (Arthur, et al; 2009).

Inter-Calving interval (ICI**):**It was calculated according to Bath, et al (1985) and Arthur, et al (2009) where ICI is the period between two consecutive calving. The optimum ICI is 365 days in dairy cows.

Pregnancy diagnosis: It was performed by rectal palpation for non-return cows at 45 days after last service (Arthur, et al 2009).

Dairy animals and the herd size: The main dairy breeds in the Sudan are Cross-bred, Butana and Kenana.In a recent study Omer (2017) mentioned that, 70% of the total animal population of the Sudan is females (21 million) out of (30 million) and the population of local dairy breeds is estimated to be 10 million head (7 million females) and the actual reproductive and productive female is estimated to be 4 million head. The cross-bred (0.50 million), Butana (1.50 million) and Kenana (2.00 million) (M.A.R 2018).

Estimation of annual net economic losses: It wasachieved by calculationof total annual losses of milk, calves wastage, nutrition, veterinary services and miscellaneous offeredduring thedays beyond the optimum ICI (365days) (Guilbault, et al; 1984; Hore, et al; (2006); Inchaisri, et al; 2010 and Ali, 2011).

Questionnaire data: It was designed to collect the data of this study (DO, ICI and the annual economic losses) from seven Sudanese states mentioned above. The data was collected from seventy (70) dairy farms (10 farms each state). The interview includedthree hundred and fifty (350) cattle breeders distributed equally (50 each) in the seven states.

Experimental design: This study was designed to determine the length of the DO, ICI and the estimation of annualeconomic losses due to prolong ICI among Sudanese dairy cows(Cross-bred, Butana and Kenana). The data were collectedfrom 70 dairy farms according to the above mentioned questionnaire todetermine the required traits. A total of three thousand and five hundred (3500) dairy cows were used in this study. The cows were randomly allocated into two groups. Group A (1500 cows) were untreated. Group B (2000 cows) were injected i. m with 100 ug of synthetic GnRH (Fertagyl, 0.1 mg/ml intervet, Lot, 23, A, , Boxmear, Holland) on day 21 PP (Naser et al, 1990; Ahmed and Elsheikh, 2004). The DO, ICI and theestimated annual economic losses due to prolonged ICI were assessed as mentioned in the materials and methods.

Statistical analysis: The statistic alanlysiscomputed by using the statistic package for social science (SPSS 1.6). The T test was used to compare the means between the two groups. The significant difference was considered at P<.0.05.

Results

From table (1), the result of the present study showed that the DO of untreated cows was significantly longer (P< 0.05) compared to the cows treated with GnRH in the 3rd week PP.

The mean value of length of DO of untreated cows was (385.00 days) whereas the DO of the cows that treated with GnRH as early as three weeks PP was (50.00 days).

As shown in the table (1), the present study indicated that the ICI of untreated cows was significantly (P<0.05) longer compared to the cows treated with GnRH three weeks PP.

The mean value of length of ICI of untreated cow was (665 days), but the length of ICI of the treated cows was (330.00 days).

As shown in table (2), the result of the present study also found that, theestimated annual economic losses of the untreated cows was significantly (P<0.05) higher compared to the cows treated with GnRH as early as three weeks PP.

The mean value of the estimated annual economic losses of untreated cows and treated cows with GnRH were 12.90 billion US$ (3225 US$/cow/year)and (nil) respectively.

Table (1): show the mean values of the length of the dayopen (DO), inter-calving interval (ICI) and the estimated annual economic losses due to prolong inter-caving interval ((ICI)of Sudanese dairy cows

Item	Length of day open (DO) in days	Length of inter-calving interval (ICI) in days	Estimated economic losses (In billion US$)
Untreated cows (Group A)	**385.00**	**665.00**	**12.90**
Treated cows (Group B)	**50.50**	**330.00**	**00.00**

Table (2): Show the details of the budget of estimated annualeconomic lossesdue to prolong inter-calving interval (300 days) of Sudanese dairy cows

Item	Budget of untreated cows (billion US $)	Budget of the treated cows (billion US $)
Losses due to milk	**8.00**	**0.00**
Losses due to nutrition	**2.40**	**0.00**
Losses due to calves wastage	**1.20**	**0.00**
Losses due to veterinary services	**0.80**	**0.00**
Losses due to miscellaneous	**0.50**	**0.00**
Total	**12.90**	**0.00**

Discussion

In the dairy industry, the genetic composition of the herd in combination with ideal housing, balance nutrition and proper management are important to achieve acceptableeconomic benefits (Windeg, et al; 2005). For instance, several studies have shown that the continuous increase in milk production is coincided with a decrease in cow fertility that measured in terms of prolongation of the DO and ICI (Gonzalez-Recio, et al; 2004 andHore, et al; 2006). The present study is the first to provide comprehensive data in the Sudan regarding the annual net economic losses due to prolong ICI in dairy cows. It is well understood that, the PP infertility in dairy cows is frustrating and results in reduced milk production, increase culling rate, increased cost for replacement of animals as well as increase of veterinarian services (Nanda, et al, 1989 and Ahmed and Elshiekh, 2004). However, a short DO and ICI are known to increase the reproductive efficiency in dairy cows and reduces the annual neteconomic losses (Arthur et al, 2009). It is well known that, the most reproductive failure in dairy herds is due to mismanagement specially the PPP which is considered to be the main causes of economic losses to the dairy cattle industry (Kumar, 2009). The most significant benefits of reproductive herd health program is the stimulation of improvement in heat detection that decreases DO and ICI (Arthur, et al, 2009). The administration of GnRH for the dairy cows during early PP improves the reproductive efficiency (CarvestonyandFoote 1985 and Ahmed and Elshiekh 2004). It is well understood that, injection of GnRH during early PP causes an acute increase of gonadotropins (FSH and LH) surges that stimulates folliculogenesis, induces ovulation of the selected dominant follicle (DF) and consequently increases oestrogen release. Thus, improves the PP performance of dairy cows (Thatcher et al 1993 and Arthue et al 2009). In contrary, GnRH administration in dairy cows was reported to have no effect on the PP reproductive efficiency and resumption of the first PP oestrous (Foote and Riek 1993). The present study showed that, injection of GnRH during as early as three weeks PP shorten the time taken for DO. This finding is disagree with the previous finding of Foote and Riek (1993).

The difference between the two findings might be due the time of injection of GnRH, time of cows servicing or breed. Lamming et al (1992) and Resco et al (1995) found that, the injection of GnRH as early as 21 days PP shorten the ICI in non-suckling dairy cows. The previous finding is in consistent with the result of the present study, which showed that single injection of GnRH during the third week PP shorten the ICI. On the other hand,in 1985Guilbault, et al reported that, in the United Kingdom (U.K) a calculation has been made for estimation of economic losses of milk, feed, calves, replacement of heifers, culled cows and veterinary services cost the farmers for ten days extension beyond the optimum ICI (365 days) was high.Also Ahmadi and Delhghan (2007), Inchaisri, et al,; (2010) and Ali (2011) reported that, the net cost of herd management and rearing were increased by increment of expenses of extended length of DO, ICI, as well as culling and replacement cows. The finding of this study in consistence with the previous findings where, the annual estimated economic losses due to the prolong ICI in dairy cow achieved washigh. The high annual net economic losses in a dairy cows that showed poor reproductive performance is mainly caused by high cost of non-pregnant females, cows suffered reduced fertility which often expressed in the annual losses amount of milk,the offered nutrition, calves wastage, veterinary services and miscellaneous during the long inter-calving interval (ICI) (Ali, 2011).

This study concluded that, single injection of GnRH as early as three weeks PP improves the reproductive efficiency in dairy cows. Consequently, a calf per cow per year could be achieved and reduces the annual net economic losses due to prolong ICI.

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