

## **The Effect of Intra-uterine Infusion of Diluted Iodine Compounds during Early Postpartum on Reproductive Efficiency of Cross-bred Dairy Cows**

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**Abstract:** This study was conducted to compare between the effects of intra-uterine infusion of diluted iodine compounds (1% Lugol's iodine and 2% Povidone iodine) on the postpartum (PP) reproductive efficiency in dairy cows having uterine bacterial infection. The reproductive efficiency during PP was evaluated by studying six reproductive traits. These traits were uterine involution (UI), appearance of the first dominant follicle (DF), recrudescence of the first oestrous (FO), length of days open (DO), number of service per conception (NSC) and calving interval (CI). Sixty cross-bred dairy cows (4 – 6 years) diagnosed having uterine bacterial infection during early PP were recruited for this study. The cows divided randomly into three equal groups (A), (B) and (C) 20 cows each. Group A and B were intra-uterine infused with 1% Lugol's iodine and 2% Povidone Iodine respectively on day 5 PP. Group C was left untreated to serve as a control. The above mentioned parameters were evaluated. The result of the current study showed that intra uterine infusion of 1% Lugol's Iodine or 2% Povidone Iodine during early PP significantly improved ( $P < 0.0001$ ) all reproductive traits compared to the control.

It is concluded that, the reduced reproductive efficiency of cross-bred dairy cows is most likely to be due to early PP uterine bacterial infection that decreases reproductive efficiency. Intra-uterine infusion of either 1% Lugol's Iodine or 2% Povidone Iodine could be applied successfully for improvement of the PP reproductive performance of cross-bred dairy cows.

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### **I. Introduction**

The Sudan is considered one of the countries depends on to participate in food security worldwide. This is due to the huge animals wealth endowed that estimated to be over 120 million heads of animals and this animal resources contribution in the national income is estimated to be 30% (FAO 2001). Thus, many experts strongly believed that it could be one of the great assets for any future development. Up to date more than 80% of the animal population in the remote rural areas under traditional system of management and it has a little economic value. The contribution of livestock to the national needs for beef is high with marginal for export when compared with milk production (Musa 2001). According to Ahmed and Elshiekh (2004, 2013, 2014), the prolonged pp and most reproductive failure during this critical period is mainly due to mismanagement of dairy herds. Reduced PP efficiency in dairy cows results in reduced milk yield, increased culling rates and magnified costs for replacement of animals. Over the last 10 years, intra-uterine infusion with diluted iodine compounds such as 1% Lugol's Iodine or 2% Povidone Iodine is applied routinely to improve the reproductive performance of PP in dairy cows (Geiser, *et al.*, 1995). Moreover, Koujan *et al.*, (1996) reported that intra-uterine infusion of diluted Lugol's Iodine (1%) or diluted Povidone Iodine (2%) is an efficient treatment which improves the PP reproductive performance of the dairy cows. In the Sudan neither 1% Lugol's Iodine nor 2% Povidone iodine are applied for management of PP reproductive problems in dairy cows so far. The main objectives of this study were to compare between the effects of intra-uterine infusion of Lugol's Iodine (1%) or Povidone Iodine (2%) on day 5 PP on the reproductive parameters mentioned above.

### **II. Materials And Methods**

#### **1. Animals:**

The study was conducted on 60 cross-bred Sudanese dairy cows (Friesian × Kenana) between 4 to 6 years old. Their body condition score (BCS) is between 2.00 to 3.00 according to the five-scale point system outlined by Wildman, *et al.* (1982). According to this scale, emaciated cows are scored 1, thin cows 2, average cows 3, fat cows 4 and obese cows are scored 5.

#### **2. Uterine involution:**

The genital tracts of all cows were examined every other day after parturition by trans-rectal palpation till uterine involution was completed (Sheldom and Dobson, 2000, Ahmed and Elsheikh, 2004). The uterine

body is described to be involuted when the size of uterine horn is equal two fingers and uterine body is palpated in the pelvic cavity (Elsheikh and Ahmed, 2004). The complete uterine endothelium involution is assumed when the ovaries are active and the animal display the first heat signs (Perez,*et al.*, 2003).

### **3. Postpartum (PP) Ovarian rebound:**

Postpartum (PP) ovarian rebound was assessed manually by rectal palpation every other day after parturition (Elsheikh and Ahmed, 2005). The PP ovarian activity was described to be rebound after the appearance of the first palpable DF (Perez,*et al.*, 2003)

### **4. Heat detection:**

Oestrus detection was performed by monitoring the daily oestrus behaviour of animals, thrice a day for 20 minutes. The cow is considered to be in oestrus when it stands to be mounted by others, a clear vaginal mucous discharge hangs from her vulva and when she bellows (Hafez, 1993).

### **5. Days open (DO):**

It was determined by counting the interval in days, from calving to the successful service date of those cows that conceived (Elsheikh and Ahmed, 2005).

### **6. Cow service:**

Cows displayed oestrus signs in a period less than 42 days PP were not inseminated. The insemination was started after 42 days PP for the cows, which displayed oestrus cycle after that time. The cows were inseminated with a cross-bred sire with a proven fertility (Elsheikh and Ahmed, 2005).

### **7. Number of services per conception (NSC):**

It was calculated according to Elsheikh and Ahmed, (2005). It is the number of service given to the experimental animals after recrudescence of the PP oestrus and resulted in a diagnosed pregnancy not less than 42 days after service.

### **8. Detection of pregnancy:**

It was carried out for none retain cows by rectal palpation at 60 days after last cow service (Elsheikh and Ahmed, 2005).

### **9. Early postpartum (PP) uterine swabs collection and bacteriology:**

A transcecal guarded sterile disposable swabs were collected from the endometrium of each cow on day 5 PP (Noakes,*et al.*, 1989 and Sheldon,*et al.* 2004). The swabs were transferred to sterile test tube and were cultured within 2 hours of collection. The swabs were cultured aerobically in pre-equilibrated sheep blood agar and on MacConkey agar and incubated at 37°C over-night. Identification of bacteria was based on the characteristic of colony, gram-stain and morphology (Barrow and Feltham, 1993). Bacterial growth on the cultured plates was scored semi-quantitatively depending on the number of bacterial colonies detected on the plate: 0: no growth; 1 < 10 colonies, 2, 10 to 100 colonies, 3, 100 to 500 colonies and 4 > 500 colonies (Noakes,*et al.*, 1999).

### **10. Early PP intra-uterine infusion of 1% Lugol's Iodine or 2% Povidone Iodine:**

One hundred and fifty milliliters of 1% Lugol's iodine (10% potassium iodide, 5% iodine, 85% and distilled water or 2% Povidone iodine (Polyvinylpyrrolidiodine) were infused on day 5 PP in the uteri of all selected dairy cows (Geiser,*et al.*, 1995). The apparatus used for PP uterine infusion consisted of a 2 liter stainless jug with a projected nozzle at the bottom. A rubber tube of 100 cm long connected with 30 cm catheter was fitted to the nozzle of the apparatus (Elsanousi and El taye, 1979).

### **11. Experimental design:**

This experiment was designed to determine the effects of intra-uterine infusion of Lugol's Iodine (1%) or Povidone Iodine (2%) on the PP reproductive efficiency of cross-bred Sudanese dairy cows suffering uterine bacterial infection. Sixty cross-bred dairy cows diagnosed having uterine bacterial infection during early PP were used in this study. The cows then divided randomly into three groups. Group (A), group (B) and group C (20 cows each). The cows in group A and B were intra-uteri infused with Lugol's Iodine 1% and Povidone Iodine 2% respectively on day 5 PP with 150 ml while group C untreated control (Mutiga, 1978 and Edwell,*et al.* 2004). The parameters in question were assessed as mentioned in the materials and methods.

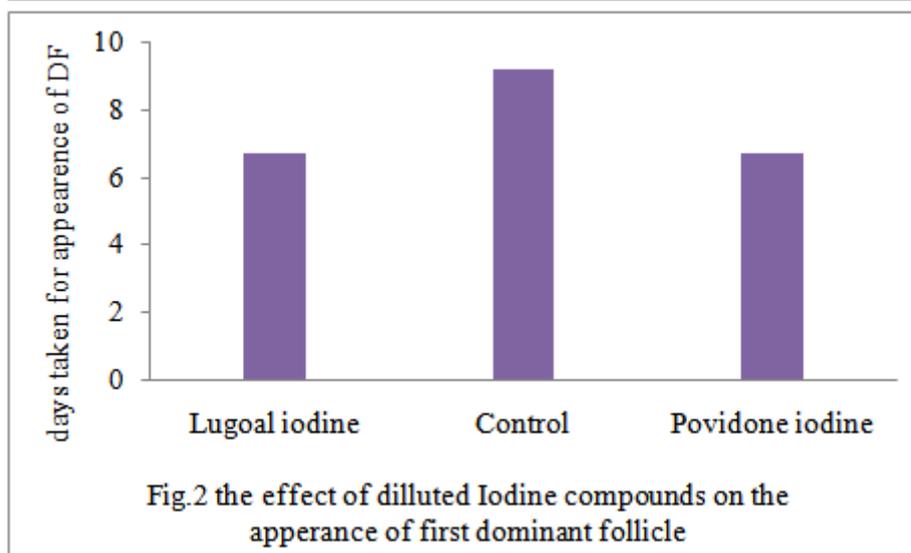
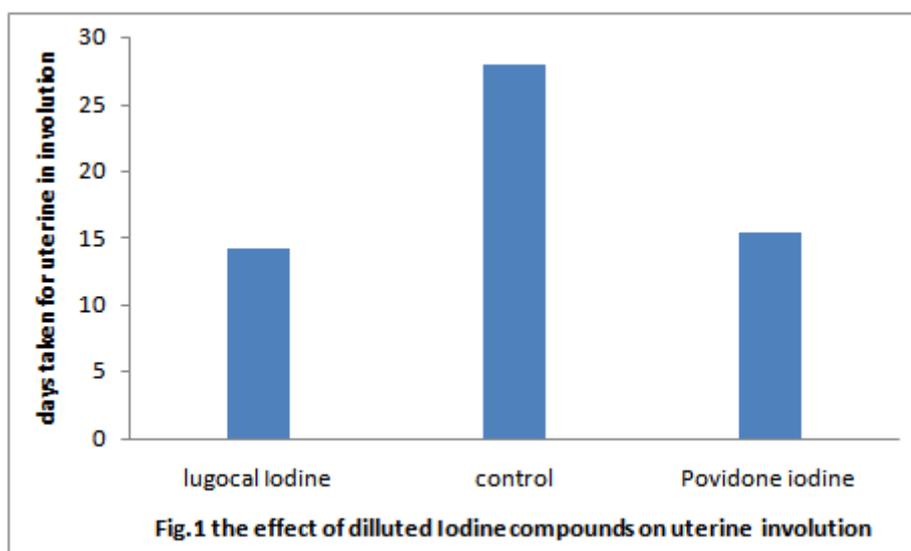
**12. Statistical analysis:**

The results were statistically evaluated by ANOVA followed by Fisher's protect least significant difference (PLSD). Significant differences at ( $P < 0.001$ ) were considered.

**III. Results**

**The effects of intra-uterine infusion of diluted Lugol's Iodine or Povidone Iodine during early postpartum (PP) on different reproductive traits**

**1. Uterine involution:** Infusion of diluted Lugol's Iodine or diluted Povidone Iodine on day 5 into the uteri of PP infected dairy cows significantly ( $P < 0.001$ ) accelerated uterine involution compared to the control (Figure1). Infusion of diluted Lugol's iodine or diluted Povidone Iodine during early PP accelerated uterine involution by about 20 and 16 day days respectively. The mean lengths of time taken for uterine involution of infused cows were  $13.10 \pm 0.40$  and  $17.20 \pm 0.30$  days respectively. These values were lower than that of the untreated control was ( $33.40 \pm 0.90$  days).

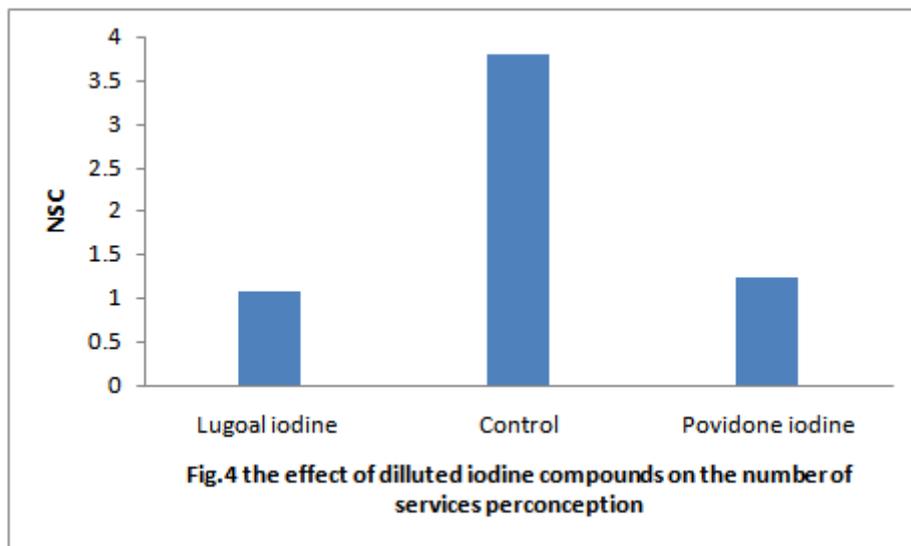
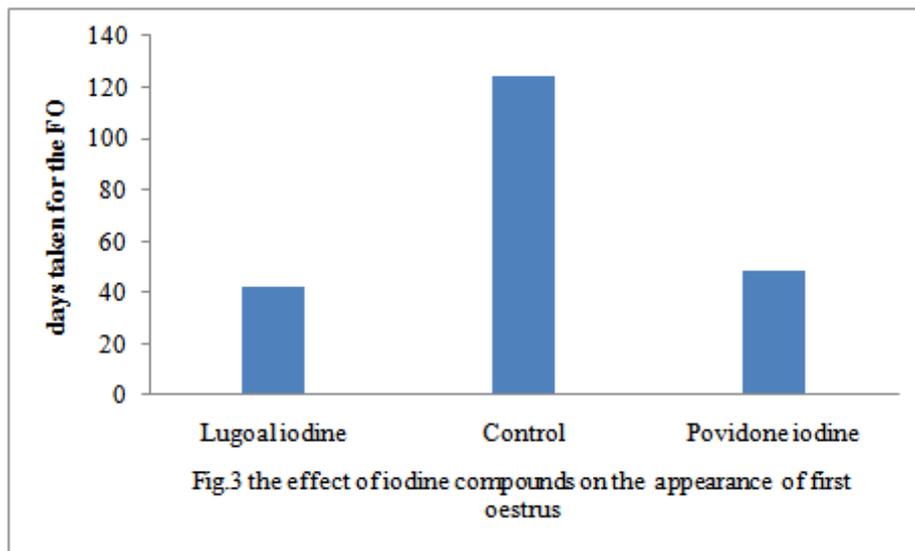


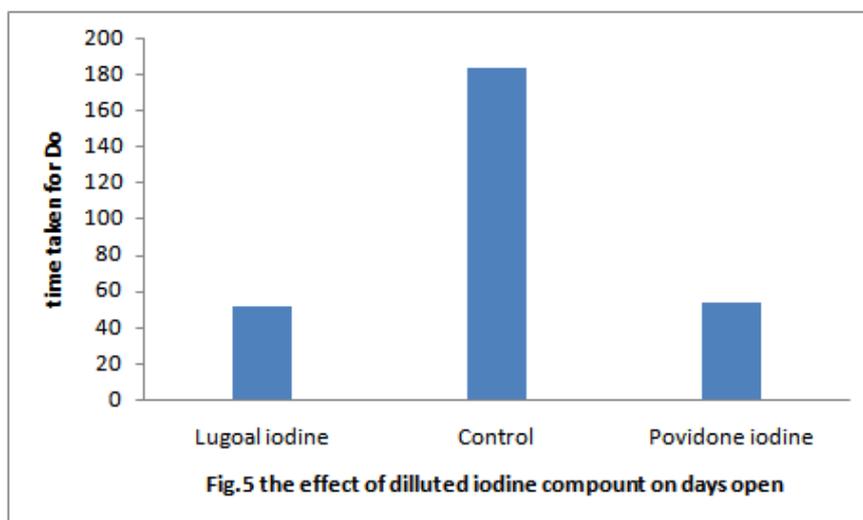
**2. Appearance of first dominant follicle (DF):** As showed in figure (2) the time taken for appearance of the first DF for the cows that were infused either with diluted Lugol's Iodine or diliuted Povidone Iodine on day 5 PP was significantly reduced ( $P < 0.001$ ). The mean length of the time taken for the appearance of the first DF for these cows was  $6.50 \pm 0.20$  and  $6.75 \pm 0.30$  daysdaysrepectively. These values were shorter than of the control ( $9.60 \pm 0.40$  days).

**3. Recrudescence of the first oestrus (FO):** Figure (3) showed that, the dairy cows suffered uterine puerperal infection that were infused with diluted Lugol's Iodine or diluted Povidone Iodine on day 5 PP hadsignificantly

( $P < 0.001$ ) reduced the time taken for resumption of the FO compared to the control. The recrudescences of the FO in the treated cows were minimized by 91 and 85 days respectively. The mean length of the time taken for appearance of the FO in treated cows was  $42.70 \pm 1.90$  and  $48.80 \pm 1.20$  days respectively. These values were shorter than that of the untreated control ( $133.90 \pm 4.40$  days).

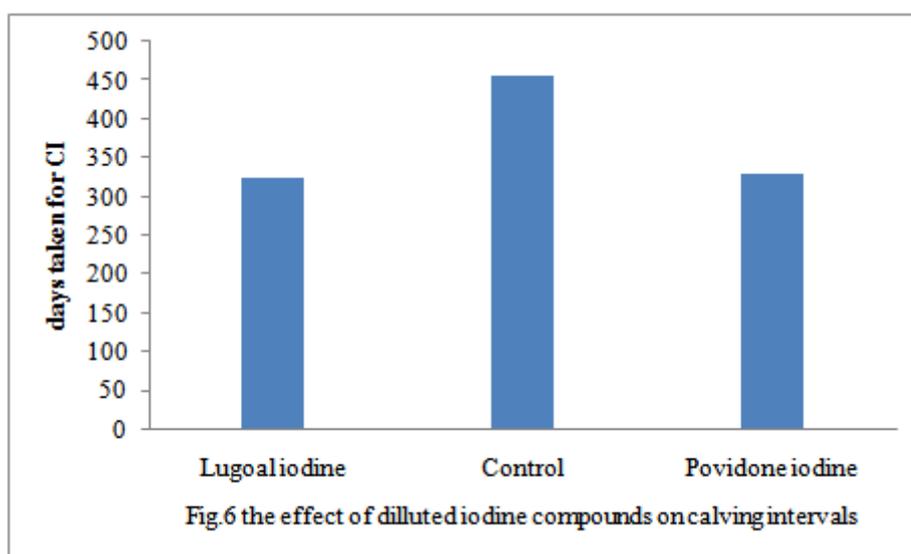
**4. Days open (DO):** Figure (4) showed that, the DO of the treated cows significantly ( $P < 0.001$ ) reduced compared to that of the control. The DO of the treated cows was reduced by 160 and 155 days respectively. The mean length of the DO of the treated cows were  $52.10 \pm 2.00$  and  $57.20 \pm 2.60$  days, while, that of the untreated control was  $212.40 \pm 8.20$  days.





**5. The number of service per conception (NSC):** As showed in figure (5) the rate of service per conception was improved ( $1.10 \pm 0.10$  and  $1.40 \pm 0.10$ ) for the treated cows respectively. This value was significantly ( $P < 0.001$ ) lower than that of the untreated control ( $4.50 \pm 0.20$ ).

**6. Calving interval (CI):** Figure, (6) explains that the infusion of diluted Lugol's Iodine or diluted Povidone Iodine on day 5 PP significantly ( $P < 0.001$ ) reduced the CI. Infusion with diluted Lugol's Iodine or diluted Povidone Iodine on day 5 PP shortened the CI by about 158 and 151 days respectively. The mean length of the CI reported for the treated cows was  $324.90 \pm 6.50$  and  $331.70 \pm 2.9$  days respectively while the CI of the untreated control was ( $482.50 \pm 9.00$  days).



#### IV. Discussion

This study confirms that, the reduced PP reproductive efficiency in the Sudanese dairy cows is mainly due to uterine bacterial infection. Furthermore, this study indicated that, these problems could be solved by intra-uterine infusion of diluted iodine compounds such as (1%) Lugol's iodine or (2%) Povidone Iodine. According to Leslie (1983) 40% of dairy cows were diagnosed with and treated for PP uterine bacterial infection. In particular 90% of bovine uteri are infected up to day 15, 78% up to day 30, 50% up to day 45 and 9% up to day 60 PP (Sheldon, *et al.*, 2002; Sheldon, *et al.*, 2003, Sheldon, *et al.*, 2006; Foldi, *et al.*, 2006). This uterine bacterial infection disturbs the PP reproductive efficiency of the dairy cows (Bartlett, *et al.*, 1986, Huszenicza, *et al.*, 1999). The uteri of 92% of the PP cows used in this research were found infected during early PP. Thus, they experienced a dramatic decrease in PP reproductive efficiency. The results of this study demonstrated that, intra-uterine infusion of 1% Lugol's Iodine or 2% Povidone Iodine during the first week PP accelerated uterine involution of the treated cows. These diluted Iodine compounds are known to increase slight

hyperemia of the endometrium, increases its blood supply and the Iodine when its absorbed transferred to the thyroid gland where associated with thyroid binding globulin (TBG) in the thyroid gland to produce thyroxin under control of hypothalamus (TRH) and pituitary gland (TSH) which is essential for internal cellular metabolism, improvement of follicular development, ovulation and maintenance of pregnancy (Yu and Tak-yin, 1993). These activities of Iodine will enhance the healing of the endometrium and restoration of its activities to produce PGF<sub>2α</sub>, which is responsible for the accelerated uterine involution of the dairy cows. The internal cellular metabolism of the reproductive system including the ovaries will also be improved by infusion of diluted Iodine compounds (Sarkar, 2006). Thus, in this study the initiation of the first follicular wave, the appearance of the first DF and the recrudescence of the FO were accelerated. The DO and CI were reduced. Moreover, the number of service per conception (NSC) at subsequent breeding was improved. These results are in agreement with those of Knutti *et al.*, (2000) and Edwelle *et al.*, (2004) who reported that intra-uterine infusion of diluted Iodine compounds during early PP reduces the time taken for uterine involution, resumption of the first follicular wave and appearance of the first DF, recrudescence of the FO, minimizes DO, CI and reduces the number of service per conception in severely uterine bacterial infected dairy cows. This reduced number of services per conception is probably due to the improvement of the uterine environment, as a result of the potent bactericidal effect of these diluted Iodine solutions. When the uterine environment is improved the ovary could be able to produce high quality oocyte and the uterus could be capable to produce more uterine milk which helps embryo implantation (Oakley, 1992). From the result of this study, intra-uterine infusion of diluted Lugol's Iodine (1%) is relatively better in the improvement of PP reproductive performance in dairy cows when compared with infusion of diluted Povidone Iodine (2%) and this is due to the potent antimicrobial effect and rapid absorption of diluted Lugol's Iodine. Iodine deficiency is mainly exaggerated by heat stress that is common in the Sudan. The reduced Iodine in the body of the dairy cows will lead to reduction in thyroxin release that is essential for herd fertility (Sarkar, 2006).

It is concluded that, the reduced fertility during early PP is likely to be due to endometritis. This PP infertility could be managed successfully by intra-uterine infusion of diluted Iodine compounds as early as the fifth day.

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