

Effect of Non-Hormonal Interventions in Improving Conception Rate in Repeat Breeder Dairy Cows

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Abstract: Ethiopia is believed to have the largest livestock population in Africa. This livestock sector has been contributing considerable portion to the economy of the country and still to rally round the economic development of the country. However, the level of the contribution from the livestock sub-sector is generally low compared to the other African countries. There are a multitude of constraints that influence the productivity of livestock. One of the major constraints of profitable dairy farming is low conception rate. The study was conducted in Mekelle the capital city of Tigray regional state from January 2013 to June 2014 with the objective to assess the effectiveness of non-hormonal interventions in improving conception rate. A total 36 dairy cows 12 crossbreed cows/heifers and 24 multiparous cows were included in the present study. From the total repeat breeder cows 12 were inseminated once, 12-18 hours after the start of oestrus and were kept as control, while 16 cows/heifers were divided into two treatment groups. In the treatment group I, 12 repeat breeder cows were inseminated twice, first at 12-18 hours after the start of oestrus and then 12-24 hours later. In treatment group II, 12 repeat breeder cows/heifers were inseminated once at 12-18 hours after the start of oestrus and were then subjected to a forced racing for at least 30 minutes. The conception rates recorded 90 days after the respective inseminations were 16.7%, 50% and 75% in the control group, treatment group I and treatment group II, respectively. These results indicate that forced racing may be a good practical and economical tool to improve conception rate in repeat breeder cows where the problem is due to delayed ovulation in the absence of anatomic malformation and other pathologic conditions. In conclusion, racing stress and other non-hormonal interventions discussed in this paper could be employed to induce ovulation in repeated breeder cows which is an economical and practical method to increase conception rates.

Key words: Dairy Cows • Non-Hormonal Therapy • Prevalence • Repeat Breeder Syndrome

INTRODUCTION

Agriculture in Ethiopia is the foundation of the country's economy, accounting for 43% of Growth Domestic Product (GDP) and 86% of export earnings and the sector employs about 85% of the population [1]. Livestock production is an integral part of the country's agricultural production system. A recent study by Agricultural Sample Survey (CSA) [1] indicated that the livestock sector contributes 26% of the agricultural GDP and 12% to the national GDP. Among livestock species, cattle have significant contributions to the livelihoods of the farmers. It serve as a source of draught power for the rural farming population, supply farm families with milk, meat, manure, serve as source of cash income and play significant role in the social and cultural values of the

society. Cattle contribute nearly all the draught power for agricultural production at smallholder level in Ethiopia [2]. Cattle are also used to generate critical cash in times of scarcity, provide collateral for local informal credit and serve other socio-cultural functions in Ethiopia [3].

Ethiopia's livestock population is the largest in Africa. In 2008/09, Ethiopian sedentary private holdings were estimated at about 49 million heads of cattle [1]. These livestock population estimates exclude the livestock population for pastoral areas, as there are no official statistics for those areas. Some rough expert estimates indicate that pastoral areas account for about 20% of the country cattle population [4]. Thus, including these rough estimates for the pastoral areas, the estimates of national livestock populations for 2008/09 was 59 million cattle. However, in Ethiopia with this much cattle

population, livestock production is below the potential due to many limitations such as inadequate feeding, mismanagement in reproduction, prevalence of diseases and lack of effective veterinary support.

One calf by cow in a year is the reproductive objective in dairy cow farms. It means that cows must get pregnant after AI, maintain the pregnancy, have parturition after 270 days and wait for a period of 40-50 days to be successfully inseminated again. Nevertheless, this is not always attained and cows must be re-inseminated during several consecutive cycles [5]. In this context appears the repeat breeder syndrome (RBS), comprising a heterogeneous group of subfertile cows, without anatomical abnormalities nor infections, that exhibit a variety of reproductive disturbances in a consistent pattern during the course of three or more consecutive estrous cycles of normal duration (17-25 days) [6- 8].

The term repeat breeder or RBS was created to describe cows that failed to conceive after three or four inseminations with a fertile bull or fertile semen. Repeat breeder females return to service repeatedly after being bred with a fertile male or inseminated with a fertile sperm. These cows exhibit normal signs of estrus every 18 to 24 days but require more than three services to become pregnant [9].

Repeat breeding of bovine has been recognized as one of the most serious reproductive problems. It is the main reason of infertility and has long been a problem worldwide to dairy farms. This syndrome leads to prolonged time at first calving age, prolonged inter-calving interval and economic losses due to loss of one calf per year per cow and milk loss for lactation [9].

The success of a hormone therapy to improve conception rates in repeated breeder cow has been practiced all over the world for the last decades and is being introduced to Ethiopia [13]. But the efficacy of non-hormonal remedies on improving conception rate has not properly been documented in Ethiopia and yet in the study area and this should have been the first work that has to be done.

Repeated breeding is most of the times associated with dairy cow reproductive mismanagement other than hormonal inherited problems which signifies very less. The repeat breeder syndrome can be a problem due to management or a lack thereof. Reproductive mismanagement practices are the common causes of repeat breeding cows. Some possible management factors to be considered to improve conception rates are as follows: improper timing of insemination (too late, early,

already pregnant, etc.), insemination of cows not in estrus, inadequate estrus detection, improper semen handling and insemination placement, improper cooling and cow comfort, poor transition and nutrition management [6- 8]. Therefore, it is possible to increase the conception rate of a repeat breeder cow through non-hormonal method which is a less costly approach which contributes almost similar result to the highly expensive hormonal therapy in increasing conception rate in repeat breeding cows.

There are controversial reports in the literature regarding the effect of stress factors including transportation, heat, excitation and exercise on induction of ovulation. The present study was undertaken to observe whether the stress due to forced racing induces ovulation and increases conception rate in the repeat breeder heifers and cows [10]. Therefore, the objective of the present study was:

- To evaluate the success of racing stress and other reproductive management approaches as a non-hormone therapy in improving conception rate in repeated breeder cows.

MATERIALS AND METHODS

Study Area: This study was conducted in Mekelle the capital city of Tigray regional state from November 2013 to April 2014. Mekelle is located between 13°29' north latitude and 39° 28' east longitude and covers a total area of 3500 hectares in the north highlands of Ethiopia and located at 783 km of north of Addis Ababa. The elevation of the city measures 2000 - 2270 meter above sea level. The maximum and minimum average temperature per year is 24.1°C 11.1°C respectively and also average annual rain fall is 579-650mm [11].

Animals: All dairy cow species of domestic animals with or without the history of repeat breeding owned by selected households and farm animals brought to Mekelle city veterinary clinics, Kuha and AI service station for insemination with superior bulls semen distributed by the national AI center at Kaliti were included in this study.

Equipment and Tools: Different equipments and materials including liquid nitrogen container, liquid nitrogen, thermometer, warm water, semen in straw, scissor, towel, AI sheath and gun, gloves, Petridish and microscope slide which are used by AI technicians were used for this study.

Study Design: The contacted time observation was design to determine the influence of breed and age on the prevalence of repeat breeder syndrome in Mekelle city and the influence of racing stress on conception rate.

All animals with/without the history of repeat breeding were rectally examined to note the clinical status of the reproductive organs and consistency and thickness of cervical vaginal discharge. During rectal palpation, mucus was squeezed out from the reproductive tract and collected in a glass beaker only from animals with the history of repeat breeder. Immediately after collection, mucus samples were examined for physical characteristics including color and consistency. The color of mucus was visually assessed and classified as transparent, translucent, or whitish. For determination of consistency, a drop of mucus was put on a glass slide held in a sloppy. On the basis of consistency mucus was classified thick, thin, or viscous.

Animals showing signs of true heat without any palpable clinical abnormality and had been serviced at least twice but failed to conceive were included in the study. All Selected animals were divided into three groups, with 12 cows/heifers for each group.

The first group (12 cows/heifers) were inseminated once, 12-18 hours after the start of oestrus and were kept as control, while 24 cows/heifers were divided into two treatment groups. In the treatment group I, 12 repeat breeder cows were inseminated twice, first at 12-18 hours after the start of oestrus and then 12-24 hours later. In treatment group II, 12 repeat breeder cows/heifers were inseminated once at 12-18 hours after the start of oestrus and were then subjected to a forced racing for at least 30 minutes.

Sample Size Determination: Purposive sampling was applied to select the most desired sampling units. The mucus samples were taken by detecting of heat, inseminating and record keeping from heifers and cows during standing heat.

Data Analysis: The data was first enter in to Microsoft Excel work sheet and analyze using Statistical Package for Social Sciences (SPSS) software version 16 using descriptive statistics and chi square test was used to find the magnitude of variation in conception rates among animals of the three groups and to see the variation in conception rates with physical characteristics of cervical vaginal mucus. In all chi-square test applications, probability of $P < 0.05$ were considered as significant.

RESULTS

Effect of Non-Hormonal Interventions

Racing, Frequency of Insemination and Time of Insemination: The conception rates in the three groups are given in the table 1. These results indicate significant differences in conception rates among animals of the three groups ($P < 0.05$). The poorest result was recorded in the control group of repeat breeders, while the best results were noted in cows of treatment group II subjected to forced racing. The conception rates among the three groups were 16.7%, 50% and 75% in control group, treatment group I and treatment group II, respectively.

Physical Characteristics of Mucus, Ai and Conception

Rate: Physical characteristics of oestrus mucus including color and consistency were investigated in repeat breeder cows and heifers. As the result indicated the color of mucus was transparent in 38.9%, translucent in 52.8% and whitish in 8.3% repeat breeder cows and in addition to that the consistency was thin in 38.9%, thick in 55.6% and viscous in 5.5% (table 2).

The relationship between colors of mucus and conception rate in repeat breeder was significant as the result indicated in table 3. The poorest result was recorded in the whitish color of mucus, while the best result was investigated in the transparent color of mucus on case of color. The poorest conception rate was observed in viscous and the best one was investigated in

Table 1: Conception rates in cows/heifers of the three groups

Groups	Conceived	Not conceived	Total
Control group	2(16.7)	10(83.3)	12(100.0)
Group I	6(50.0)	6(50.0)	12(100.0)
Group II	9(75.00)	3(25)	12(100.0)
Total	17(47.2)	19(52.8)	36(100.0)

$X^2 = 6.903$ $P = 0.032$

Table 2: Physical characteristics of mucus in repeat breeder cows

Mucus character	No. repeat breeders	Percent
Color		
Transparent	14	38.9
Translucent	19	52.8
Whitish	3	8.3
Consistency		
Thin	14	38.9
Thick	20	55.6
Viscous	2	5.5

Table 3: Conception rate in relation to physical characteristics of mucus of repeat breeder cows

Mucus character	Conceived	Total	X ²	P value
Color				
Transparent	11(78.6)	14(100.0)	11.518	0.003
Translucent	4(21.1)	19(100.0)		
Whitish	0(0.0)	3(100.0)		
Consistency				
Thin	10(71.4)	14(100.0)	6.841	0.003
Thick	4(20.0)	20(100.0)		
Viscous	0(0.0)	2(100.0)		

thin mucus consistency. The conception rate from the three color of mucus was 78.6% in transparent, 21.1% in translucent and 0% in whitish colors of mucus of repeat breeder. Conception rate at different consistency mucus were 71.4% in thin, 20.0% in thick and 0% in viscous.

DISCUSSION

Low pregnancy rate observed in the control group might due to delayed ovulation which took place at the time when the sperms were aged and this resulted either in fertilization failure or early embryonic death. Jainudeen and Hafez [12] have reported that aging of spermatozoa in the female tract is accompanied by a gradual decrease in their fertilizing capacity, resulting in fertilization failure or embryonic death. In treatment group I, where insemination was done twice the conception rate was highly improved. A significant ($P < 0.05$) increase of repeat breeders, was found in treatment group I than the control group. This clearly indicates that double insemination during the same oestrus significantly increases the conception rate. These results are supported by Verma and Mohan [13], who reported that double insemination at 24 hours interval increased the conception rate from 47.61 to 63.63%. The results of the present study are also favored by the findings of VanRensburg and deVos [14], who recommended that if ovulation had not occurred by 24 hours after service, the cow should be re-inseminated. In this way fresh viable sperm cells would be available at the time of ovulation. In treatment group II, highest conception rates were observed in repeat breeder, which were significantly higher than the control group and the treatment group I ($P < 0.05$). Higher pregnancy rates observed in treatment group II support the idea that stress due to forced racing can induce ovulation. Mental or physical stress can excite the sympathetic nervous system to provide extra activation of the body (sympathetic alarm reaction) due to release of

norepinephrine [15]. Since luteinizing hormone-releasing hormone (LH-RH) release is under the control of catecholaminergic neurotransmitters, norepinephrine acts as a stimulatory agent for the release of LH-RH, whereas Dopamine inhibits LH-RH secretion [16].

Apparently, the translucent colored mucus sample was found more frequently in repeat breeder cows/heifers. Similar findings were reported [17, 18]. Generally, clear/transparent colored cervical mucus has been reported to be a conducive factor for sperm penetration and conception whereas, turbidity/translucent in cervical mucus arrests sperm motility [19]. The majority of cervical mucus from repeat breeder cows/heifers was thick type. Similar findings of cervical mucus consistency have been reported in repeat breeder cattle [20, 21].

CONCLUSION

From the finding of this study it is very clear that racing stress and other non-hormonal interventions discussed in this paper could be employed to induce ovulation in repeated breeder cows which is an economical and practical method to increase conception rates.

- ▶ Non- hormonal interventions to improve repeated breed syndrome is equally important to the hormonal interventions which is a costly practice and should be encouraged.
- ▶ Repeat breeder should be inseminated twice, first at 12–18 hours after the start of oestrus and then 12- 24 hours later to increase conception rate.

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