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IMPACT OF VITAMIN-MINERAL MIXTURE ON OVARIAN RESUMPTION AND POST-PARTUM ANOESTRUS INCIDENCE IN CROSS-BREED (HOLSTEIN FRIESIAN X SAHIWAL) DAIRY COWS

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ABSTRACT

Minerals and vitamins are important regulators of reproductive performance of dairy cows so deficiencies of these nutrients in dairy cows cause reproductive problems. In this study the effect of provision of vitamin-mineral mixture during post-partum anestrous period, on resumption of ovarian activity was invdstigted. The study was conducted on cross-breed dairy cows (n=66) suffering from post-partum anestrous, being divided into treatment group (n=56). Treatment group, supplemented with vitamin-mineral mixture, resumed ovarian cyclicity within 8-62 days post treatment while only 20% of control group showed cyclicity in the same period. Regression analysis applied among variables i.e., age of animal, milk production and ovarian resumption showed the relation to be highly significant (P<0.001). It was observed that ovarian resumption has positive correlation with milk production (b=3.064) and age of the animal (b=0.469).

Keywords: cross-breed dairy cows, post-partum anestrous, ovarian resumption, vitamin-mineral mixture

INTRODUCTION

Nutrition plays an important role for optimum expression of genetic potential of livestock (Tiwary *et al.,* 2010). Milk production in the small holder dairy sector is mostly constrained by shortage of affordable appropriate nutritional regimes and overall management (Ngongoni *et al*., 2009). Economic output of milk production and hence of dairy farming can be maximized by acquiring calve from each cow per year, pre-requisite of acceptable reproductive efficiency (Sirois and Fortune, 1990; Filley *et al.,* 2000; Yavas and Walton, 2000). In rural areas, young cow's extended post-partum anoestrus is major obstacle in reproductive and economic efficiency by reducing the calf crop (Kumar and Kumar, 1993; Hawkins *et al.,*

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1999; Yavas and Walton, 2000). The poor reproductive performance results in economic losses as it decreases number of calves hence reduces number of lactations resulting in overall poor milk production (Bishop and Pfeiffer, 2008). Nutrition has an important impact on the reproductive performance of dairy cattle (Santos, 2001; Sarkar, 2006). One of the major causes of poor reproductive efficiency and economic losses in both dairy and beef industry is anoestrus. It not only reduces the overall number of pregnancies and farmer's financial returns in the form of milk or beef sales, by lengthening the post-partum interval but also increases cost of managing prolonged anoestrus animals. Anoestrus in cattle denotes a failure to manifest estrus and to ovulate at regular intervals of 18-21 days. The ovaries remain inactive basically because of a lack of FSH from the anterior lobe of pituitary gland, which may be predisposed by nutritional, hormonal, pathological, genetical or environmental factors, singly or in combination (Durrell, 1955).

As living organisms cannot synthesize mineral elements and availability of minerals also decreases with maturity of fodder. Livestock production is often badly influenced by mineral deficiencies and/or imbalances and this has an effect on productive and reproductive performance of animals through reduced feed conversion efficiency, delayed maturity, increase in age at first calving and prolonged calving intervals. Therefore, to overcome the detrimental influences of such deficiencies on animal performances, mineral supplementation is essential to the livestock (Tiwary *et al.,* 2010). Minerals are essential for growth and reproduction and are involved in large number of digestive, physiological and biosynthesis processes. In addition, they act as electrolyte, as constituent of body fluids and as catalysts of both enzyme and hormone system; recent data indicates that provision of micronutrient will enhance the production and plays a significant role in herd fertility (Boland, 2003). Age of animal, suckling of calf, nutritional deficiency, season of calving and several other factors influence the duration of ovarian resumption (Yavas and Walton, 2000). Restricted dietary intake causes deficiency of energy in post-partum cows which increase calving to estrus interval (De Castro *et al.,* 2006; Ngongoni *et al.,* 2006) through decreased secretion of leutinizing hormone (LH) and gonadotrophin releasing hormone (GnRH) (Dawuda *et al*., 2002; Kane *et al.,* 2004). A number of factors affect LH secretion and ovarian function in post-partum cows including: body condition score, plan of nutrition, energy balance and suckling frequency (Crowe *et al*., 1993; Yavas and Walton, 2000; De Castro *et al.,* 2006; Ngongoni *et al.,* 2006). Previous studies have highlighted the role of iodine (Sarkar, 2006), Cu and Zn (Ahmed *et al*., 2009), Se, Vitamin E, carotene, Mn and Co (Patil *et al.,* 2010), on reproductive performance of cows. Although identifying and treating a cow in anoestrus is important in reducing its impact on fertility but economically prevention is more effective. The purpose of this study was to evaluate the effect of vitamin-mineral mixture provision on resumption of ovarian cyclicity in post-partum anestrous cross-breed dairy cows in Pakistan and to enumerate the correlation between: age of animals, milk production and ovarian cyclicity resumption.

MATERIALS AND METHODS

Selection of animals

Cross-breed of Holstein Friesian and Sahiwal dairy cows (n=66) of varying calving intervals (1-8), milk production (7-32 liter per head per day) and age ranging from 38 to 157 months were selected for this study, in 2010, at the Ch. Tufail Dairy Farm in Shujabad, Multan (Lat: 25°10'N, Long: 65°30'E), Pakistan. All the animals were identified by ear tags, number; weight was noted by using a portable scale, and body condition score was also determined (0-9: desireable 5). The animals were divided into two groups: Group A (n=56) was supplemented with mineral mixture and Group B (n=10) without any supplementation was kept as a control group. During the trial period, the cows were allowed to graze 5-6 hours during daytime and green fodder (barseem, sorghum, maize, oats) was provided on adlibitum basis in the evening, along with rice straw and wheat straw as roughages. Cotton seed oil cake, wheat bran and rice polish as a concentrate were also offered to animals according to their productivity while water was available on adlibitum basis. Experimental animals were housed with stanchions in covered area and kept free in open paddock.

Vitamin-mineral mixture

The vitamin-mineral mixture was given 60 days post-partum to the experimental animals with dose rate of 100g/head/day. Its composition is tabulated in Table 1.

Estrus detection

Estrus was detected thrice a day in summer and twice a day in winter season in the expected date with the help of teaser bull, by visual method via stockman and by rectal examination. In visual method stockman observed the animals for behavioral changes e.g. frequent urination, rising of tail, bellowing, restlessness, sniffing, licking and rubbing of external genitalia with another animals, and also for physical changes e.g. vulvular edema and mucus discharge from reproductive tract (Esslemont *et al.*, 1985; Dawuda *et al*., 2002). Stand to be mounted was observed as the cardinal sign (Mukasa-Mugerwa, 1989). Experimental anoestrus animals were properly restrained and clinically examined for rectal palpation, by using disposable sleeve lubricated with K-Y jelly, as described by Talukder *et al*. (2005). To differentiate anestrous cows from cyclic, the same procedure as adopted by Amjad *et al*. (2006) was employed. The experimental animals observed for showing visual heat signs were confirmed by rectal palpation. All the animals were served by the same veterinarian.

Data analysis

Correlation was found between given variables by analyzing the data using MS Excel software package to determine the significant level of relationships and results were interpreted according to Zar (1996).

RESULTS AND DISCUSSION

The experiment was conducted on (n=66) post-partum anestrous crossbred (Holstein Friesian and Sahiwal) dairy cows. When vitamin-mineral mixture was given to group A (n=56) with a dose rate of 100g/head/day, cows showed 100%

response in terms of resumption of ovarian cyclicity within 8-62 days post supplementation (Table 2), while in the same period, within control group B (n=10), only two animals resumed cyclicity at day 22nd and 26th. The body condition was also improved and body weight increased day by day, probably due to increased metabolic activity of the body which may be due to satisfactory level of Iodine action. Regression analysis was applied which showed the relation of given variables to be highly significant (P<0.001).

Table 1. Composition of vitamin-mineral mixture

Nutrient	**Part/1000 g mixture**
Micro minerals	
Zn	4000 mg
Mn (oxide)	1800 mg
Fe (sulphate)	7000 mg
Se (selenite)	30 mg
Cu (sulphate)	1000 mg
I_2 (potassium iodide)	30 mg
Co (sulphate)	70 mg
Macro minerals	
Ca (carbonate)	200 mg
Salt (sodium chloride)	10 mg
P (monocalcic phosphate)	150 mg
Na	2 mg
S	3 mg
Mg (magnesium chloride)	10 mg
Vitamins	
Vitamin-A	450000 i.u
Vitamin-B_3	90000 i.u
Vitamin-E	200 mg
Nicotinic acid	50 mg

It was found that milk production had positive correlation with resumption of ovarian cyclicity (b=3.064) (Table-6) so milk production is directly related with the number of days which an animal takes to resume cyclicity. Relationship between ovarian resumption and milk production showed the positive correlation (b=3.064), as the milk production increases the duration of ovarian resumption also increases.

As prolonged post-partum anoestrus extends the period from calving to first AI (Artificial Insemination) and reduces fertility and resumption of ovarian activity in high yielding dairy cows is correlated with energy status of the animal (Santos, 2008). So, it can be concluded from above discussion that our animals are facing malnutrition which results in prolonged post-partum anoestrus and many other health problems. Present studies showed that reproductive efficiency is depressed due to high level of production as no compensatory nutrient intake is achieved according to demands of animal. Similar results also reported by Santos (2008) that as the milk production increases after parturition in first 4 to 6

weeks so negative energy balance will be experienced and cause reduced reproductive performance.

Table 2. Overall comparison between treated and un-treated anestrous cross-breed dairy cows with vitamins-mineral mixture to induce estrous cyclicity and fertility%

Groups	Total No. of animals under trial	No. of animals showed cyclicity	No. of animals declared pregnant	Overall fertility%
A=Treated animals	56	56 (100%)	32	57.14%
B=Control animals	10	02 (20%)	01	10.00%

Table 3. Anestrous cross-breed dairy cows started estrous cyclicity after days

Groups	Total animals	Animal treatment period (days)	No. of animals showed estrous cyclicity	Overall % of estrous cyclicity
A=Treated animals		08	06	75.00%
		17	13	76.47%
		25	14	56.00%
		37	15	40.54%
		49	05	10.20%
		62	03	4.83%
Total	56	-	56	100%
B=Control animals		22	01	4.57%
		26	01	3.84%
Total	10	-	02	20.00%

Table 4. Overall effects of vitamins-mineral mixture on post-partum anestrous cross-bred (Friesian and Sahiwal) dairy cows to induce estrous cyclicity and fertility

Group	Parameters	Results
A=Treated animals	Total number of anestrous animals	56
	No of animals showed estrous behavior	56
	No of animals declared pregnant	32
Overall	Percentage of fertility rate	57.14%
B=Control animals	Total number of anestrous animals	10
	No of animals showed estrous behavior	02
	No of animals declared pregnant	01
Overall	Percentage of fertility rate	20.00%

Table 5. Age of animal versus ovarian resumption crossbred (Holstein Friesian and Sahiwal) dairy cows

Relationships	r	a	b	S. E. (b)
Age of animal, (x) Ovarian resumption (y)	0.952***	-14.815	0.469	0.0206

****P* < 0.001, r = correlation coefficient, a = intercept, b = regression coefficient, S.E (b) = standard error of b

Table 6. Milk production of animal versus ovarian resumption Cross bred (Holstein Friesian and Sahiwal) dairy cows

Relationships	r	a	b	S. E. (b)
Milk production, (x) Ovarian resumption, (y)\	0.872***	-39.522	3.064	0.235

****P*< 0.001, r = correlation coefficient, a = intercept, b = regression coefficient, S.E (b)= standard error of b

Adequate nutrition and sound management have been shown to offset depression of fertility. According to Santos (2001) lactation onset causes huge drain of nutrient which antagonizes the resumption of estrus activity in high yielder animals; this may be due to inadequate nutrition. However, adequate nutrition and sound management may offset this depression of resumption of estrus cycle. Above discussion shows that indigenous breeds (Boss indicus) of Pakistan have superiority in producing more number of offsprings as they are average milk producer. When correlation was calculated of variables ovarian resumption and age then it was found that at early ages, age has positive influence on ovarian resumption (b=0.469) (Table 5) but at advanced age it has negative influence on ovarian resumption. This may be due to larger ovaries in cows at advanced age as they have larger number of follicles and they are more productive than heifers if other factors are kept constant (Cushman *et al*., 2010). Regression analysis applied on variables ovarian resumption and age of animal, which shows these parameters are highly significant (*P*< 0.001).

According to Cushman *et al*. (2010), fertility declines as the animal is aged, mainly due to depletion of the number of follicles in the ovary. Larger ovaries will have greater numbers of follicles and greater productivity, low follicle number is associated with decreased heifer pregnancy rate, poor oocyte quality, decreased superovulatory response, impaired corpus luteum function and increased ovulation failure chances. The number of follicles was greater in mature cows than in cows less than 3 years of age; however, beyond 6 years of age, follicle numbers declined. Interestingly, although follicle numbers declined, ovarian size continued to increase in cows of advanced age. Variation of results to some extent in present study may be due to suckling of calf, that play pivotal role in resumption of ovarian cyclicity as reported by Yavas and Walton, (2000). Ovarian function is suppressed due to suckling stimulus results in inhibition of LH and GnRH secretion and their action rather than their synthesis in dairy cows and lengthening the postpartum anoestrus interval (Williams, 1990; Crowe *et al*., 1993; Yavas and Walton, 2000; De Castro *et al.,* 2006; Ngongoni *et al.,* 2006). Some other factors also affect LH, including energy balance, body score and

plane of nutrition of dam (Crowe *et al*., 1993; Yavas and Walton, 2000; De Castro *et al.,* 2006; Ngongoni *et al.,* 2006).

CONCLUSION

Treatment of cows with provision of vitamin-mineral mixture suffering from post-partum anoestrus came in heat with 100% results and fertility rate of 57.14% which was satisfactory.

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