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RESEARCH ARTICLE

MASS EVALUATION OF A MINERAL BASED FORMULATION* FOR ESTROUS INDUCTION IN BOVINES SHOWING POST-PARTURIENT ANOESTROUS

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ABSTRACT

Livestock sector is the best and most effective tool for livelihood security and poverty alleviation. The present study was conducted between 1999 to 2012, covering the island ecosystem of Andaman & Nicobar islands, Terai belt and 6 districts of UP representing northern plains of India and having low levels of various micro-minerals. Area specific mineral mixture (15-20 days feeding), commercially available estrogenic substances feeding as per the prescribed schedule, hormonal interventions as follicular stimulating hormone, gonadotrophin releasing hormone (GNRH), lutelizing hormone (LH), and HCG were tried for correcting the hormonal imbalance. Keeping in view the lower success rate, a formulation was developed. The present formulation was fed orally for 10 days (in de-wormed animals directly). In random survey, out of 265 animals examined, palpable corpus luteum was observed in 37/156 cows (23.71%) and 19/109 buffaloes (17.43%). In majority of cases it was indistinct. The number of animals exhibiting estrous within 4-5 months of calving were 35 (24.6%) cows and 16 (18.6%) buffaloes, respectively. However, when the injection was given in animals having palpable corpus luteum, induction rate within 48-96 hrs was 93.2% in cows and 77.4% in buffaloes. The area specific mineral mixture was able to correct anestrous, by inducing estrous, in 33.33% (range 23-36%) of 462 oviparous animals. Various estrogenic products available commercially when given orally the induction rate varied widely with an average of 20.9% (range 11-29%). In oviparous cows the present formulation when given the induction rate was 92.3% (range 82-96%) while in buffaloes it was 73.1%. The conception rate in animals where estrous was induced by present formulation was 66.4% compared to 56.6% of area specific mineral mixture and 42.8% of estrogenic substances. Evaluation of cost showed that all the 3 treatment regimes have more or less similar cost which was around Rs. 80/- per animal. The area specific mineral mixture was not able to induce estrous beyond 36% in field animals which indicated that minerals are not alone responsible for follicular and corpus luteum development. Estrogenic substances provide estradiol which can help in inducing the estrous but cannot assure conception. The present formulation stimulated follicular and corpus luteum developments and thus corrected the cycle in the body which may be helpful in subsequent pregnancies and the cost is as low as mineral supplementation. This formulation has created a hope for poor dairy farmers facing the menace of infertility in their animals.

INTRODUCTION

Livestock sector is considered as the best and most effective tool for livelihood security and poverty alleviation. As per FAO report the Ginni coefficient of livestock is low, which means more equal distribution than crops and thus any positive intervention in the sector, particularly low input- high profitable technologies will have faster and better results in eradicating poverty in developing countries. It is estimated that Asia will contribute 31% and 40% of global milk and meat production, respectively by 2020. The increasing urbanization and human population have lead to reduction in land holdings and in countries like India, around 30% population has become landless in terms of cultivable land and about 40% population is of marginal farmers (NAIP Baseline survey, 2009; Engstrom *et al.*, 2010; Pelletier and Tyedmers, 2010). For sustainable livelihood of theses masses, livestock is the only option and among livestock, dairy farming is widely accepted activity (Carney, 1998; Carney *et al*., 1999). In dairy farming, the most important challenges eluding economical and reasonable solutions are: anoestrous resulting in prolonged inter-calving intervals particularly buffaloes, mastitis prevention and restoration of milk production and economical feeding (Nanda *et al.*, 2003; El-Wishy, 2007; Deb *et al*., 2013; Rai *et al.*, 2011 a,b and 2013). The profitability of the venture is highly influenced by reproductive performance of the animals. Buffaloes are seasonal breeder and crossbred being produced for augmenting the milk production are severely affected by high temperature and humidity, malnutrition and post-calving care (Roy and Prakash, 2007; Presicce, 2007). Common feeding practices prevalent in field conditions result in poor expression of estrous due to slow growth rate of animals along with sexual maturity at later stage as well as seasonality and higher age at first calving (Shelton, 1990; Agarwal and Tomar, 2003). In India more than 50% dairy animals are facing the problem of reproductive failure (anoestrous) under field conditions due to farmers following the traditional feeding practices and non-availability of balanced ration (Harendra *et al.*, 2013). The annual loss due to infertility in bovines in India is estimated to be more than Rs. 56 billion annually (www.sciquest.org; Ibraheem Kutty and Ramachandran, 2003).

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Keeping in view the magnitude and complexity of the problem affecting the livelihood security and profitability of the venture, concept of stimulating corpus luteum and follicular development through mineral and vitamins was evaluated and for that a mineral based formulation was developed for estrous induction and comparative evaluation with existing available treatment regimes was made to assess its efficacy and cost in terms of estrous induction and conception under field conditions covering various agro-climatic conditions.

MATERIALS AND METHODS

The present study was conducted between 1999 to 2012, covering the island ecosystem of Andaman & Nicobar islands, and Terai belt and 6 districts of Uttar Pradesh representing northern plains of India and having low levels of various micro-minerals.

Survey on corpus luteum in random population

Random survey in oviparous cows and buffaloes in various agro-climates was conducted to assess the naturally developing corpus luteum after 3-7 months of calving by palpation method. Though number of animals varied but a minimum of 50 animals were observed in each agro-climate for an indication.

Evaluation of prostaglandins in induction of estrous

Synthetic commercially available prostaglandin (PGF_2 alpha) was given in random oviparous anestrous animals, either intra-muscularly or intra-vulvar route and estrous induction was observed between 48-96 hrs.

Evaluation of various estrous inducing regimes

Area specific mineral mixture (15-20 days feeding), commercially available estrogenic substances (product) feeding as per the prescribed schedules, hormonal interventions as follicular stimulating hormone, gonadotrophin releasing hormone (GNRH), lutelizing hormone (LH), and HCG were tried for correcting the hormonal balance, if any, commercially available supplements for inducing estrous were evaluated in oviparous animals and monitored for 2 months for induction and pregnancy. The present formulation was fed orally for 10 days and animals were given de-wormer prior to start of feeding (animals de-wormed within 1-1.5 months were given the formulation directly).

Evaluation of cost

A comparative approximate evaluation of treatment cost was made for each regime to know the economical regime.

RESULTS

A total of 265 animals randomly selected for assessing the reasons for anestrous after 3-7 months of calving, in various agro-climates, were examined for status of corpus luteum. Out of 265 animals, palpable corpus luteum was observed in 37/156 cows (23.71%) and 19/109 buffaloes (17.43%). In majority of cases it was indistinct. In order to correct anestrous and to induce estrous, prostaglandin (PGF_2 alpha) was injected in randomly selected 142 cows and 86 buffaloes. The number of animals exhibited estrous were 35 (24.6%) cows and 16 (18.6%) buffaloes, respectively. However, when the injection was given in animals having palpable corpus luteum, induction rate within 48-96 hrs was 93.2% in cows and 77.4% in buffaloes. Detail evaluation of various treatment regimes available to correct infertility/ anestrous under field conditions was conducted and results are presented in the table 1. The area specific mineral mixture was able to correct anestrous, by inducing estrous, in 33.33% (range 23-36%) of 462 oviparous animals (pooled population of cows and buffaloes). The hormonal treatment conducted in randomly selected animals by the veterinarians, without estimating the hormone levels, was able to induce estrous in 58% animals but the results were variable. Since this was not done on scientific lines, therefore it was used as an indicator and the cost per animal varied between Rs. 500-600/-. Various products (estrogenic substances) are available commercially and were given orally as per the recommendations printed to induce estrous. The induction rate varied widely with an average of 20.9% (range 11-29%). The present formulation, developed on the basis of our prolonged study on mineral profile of animals, fodder soil, seasonal variability etc, and critical observations recorded in cases of animals being reared on deficient diets, showed very promising results. The induction rate in oviparous cows were 92.3% (range 82-96%) while in buffaloes it was 73.1% (table 2). The animals exhibited estrous within 7-30 days of initiation of feeding. There was wide variation in artificial insemination success rate, therefore, it was not considered for calculating the conception rate. Natural service by available bulls, particularly buffaloes, is a common practice in villages and variations in conception rate are low; therefore it was taken to assess the conception rate resulting from the estrous induction. The conception rate in animals where estrous was induced by present formulation was 66.4% compared to 56.6% of area specific mineral mixture and 42.8% of estrogenic substances. Results are given in the Table 3.

Evaluation of cost showed that all 3 treatment regimes have more or less similar cost which was around Rs. 80/- per animals.

Table 1. Comparative evaluation of various treatment regimes

Infertility treatment regime (animals)	Estrous induction (%)
Area specific mineral mixture (462)	33.3
Estrogenic substances (388)	20.9
Present formulation (16542)	85.94

Table 2. Estrous induction rate with present formulation

Treated animals (No.)	Animals showed estrous (%)
Cows (11066)	92.3
Buffaloes (5476)	73.1

Table 3. Comparative conception rate after natural service

Treatment regime (animals)	Conception rate (%)
Area specific mineral mixture (136)	42.3
Estrogenic substances (78)	56.6
Present formulation (1842)	66.4

DISCUSSION

The problem of infertility/ anestrous is wide spread (Lucy, 2001; Wiltbank *et al.*, 2002; Rai *et al.*, 2011b). In villages whose livelihood is dependent on the animals reared for milk production and resultant calves/ heifers/ young adults are fed with kitchen waste, some cakes (limited to lactating animals) and varying quantity of grains. The fodder or roughage availability in desired quantity is never available. The changing agricultural practices are a serious problem for dairy animals as the availability of roughages and waste of crops are diminishing significantly. The result is inadequate/ imbalanced feeding (McMichael *et al.*, 2007; Capper *et al.*, 2009). For optimum level of reproductive performance, the nutrient level in the body must be maintained at higher level. In cases of shortages (may not be deficiency status), though production is comparatively less affected but reproduction is hampered severely (Rai *et al.*, 2011a). Many a times interaction of micro- and macro-elements with each other of the non-nutritive factors present in the diet, interfere with their absorption (Andrieu, 2008; Siciliano-Jones *et al.*, 2008). The acyclicity in bovines has been attributed to improper follicular development, improper growth of corpus luteum (CL), particularly secretary/ granular cells and general hormonal imbalances (Short *et al.*, 1990; Presicce, 2004; Perera, 2011, Harendra *et al*., 2011). The growth of follicles is regulated by hormones and it needs various elements as co-factor in energy synthesis (Dobson and Kamonpatana, 1986). We observed that whenever, Ca availability is low, animals rarely exhibit estrous while lower availability of P (as in acid soil) the estrous is weak, prolonged and animal never conceive (Das *et al.*, 2002; Sharma *et al.*, 2004). Many vitamins play crucial role in development of corpus luteum (Beam and Butler, 1997; Beever, 2006). Prostaglandin

regresses only developed CL and is unable to induce estrous if CL is not developed. In the present study, like other reports (Rowson *et al*., 1972; Odde, 1990; Wenzinger and Bleul, 2012), we observed developed CL in around 22% animals but when it was given in animals having developed/ palpable CL, induction was very high. The area specific mineral mixture is based on the status of minerals in the area but it was also not able to induce estrous beyond 36% in field animals which indicated that minerals are not alone responsible for follicular and CL development. Estrogenic substances provide estradiol which can help in inducing the estrous but cannot assure conception (Chauhan *et al.*, 1984; Porter *et al.*, 1996). The present formulation stimulated follicular and CL developments and thus corrected the cycle in the body which may be helpful in subsequent pregnancies and the cost is as low as mineral supplementation. Since all the animals are from field conditions, the results obtained represent actual situation. This formulation has created a hope for poor dairy farmers facing the menace of infertility in their animals.

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