Evaluation of efficacy of a novel neutraceutical formulation in reducing post-parturient disorders, improving reproductive health & increasing milk yield in periparturient cows

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ABSTRACT: Dairy profitability depends upon good production and reproduction of dairy animals. Post-partum complications like retention of placenta, milk fever, metritis and mastitis pose huge production losses and also delay the reproduction of animals. Delay in reproduction leads to loss of one or more complete production cycle(s) during the productive life span of the dairy animal.

The neutraceutical formulation used in the present study reduced post-partum complications, enhanced milk production besides regulating the good reproductive health of animal. In the study, among the control group three, five and one animals were positive for metritis, mastitis and milk fever respectively while in the group supplemented with neutraceutical formulation, none of the animals was found positive for any post-partum complications. Moreover, there was significant increase in milk production and milk fat in comparison to the control group animals.

1. Introduction: The post-partum period is a critical period in the life of dairy cattle and management of the most important problems/diseases at an early stage is the key to successful dairy herd management. Over the past few decades, a significant increase in milk yield has been observed in dairy animals (Leroy *et al*., 2008a; 2008b; Roche *et al*., 2011) as a result of intense genetic selection, improved nutrition, and better cow management (Lucy, 2001; Thatcher *et al.*, 2011). Mastitis, also known as udder inflammation, is a common problem in dairy herds causing increase in costs of milk production and also have negative impact on milk composition and its technological value (Kalińska A. et al., 2017). Retained placenta is the presence of fetal membranes 24 hr or longer postpartum and is one of the main causes of endometritis in cattle resulting in economic loss. Expulsion of the placenta usually takes less than 6 to 8 hr

after parturition in cows. The condition of retained placenta occurs in 4 to 18% of

calvings. Abnormalities in partus, parity, gestation length, calving season, and nutrition are also considered risk factors for retained placenta (Yeon-Kyung Han et al., 2005).

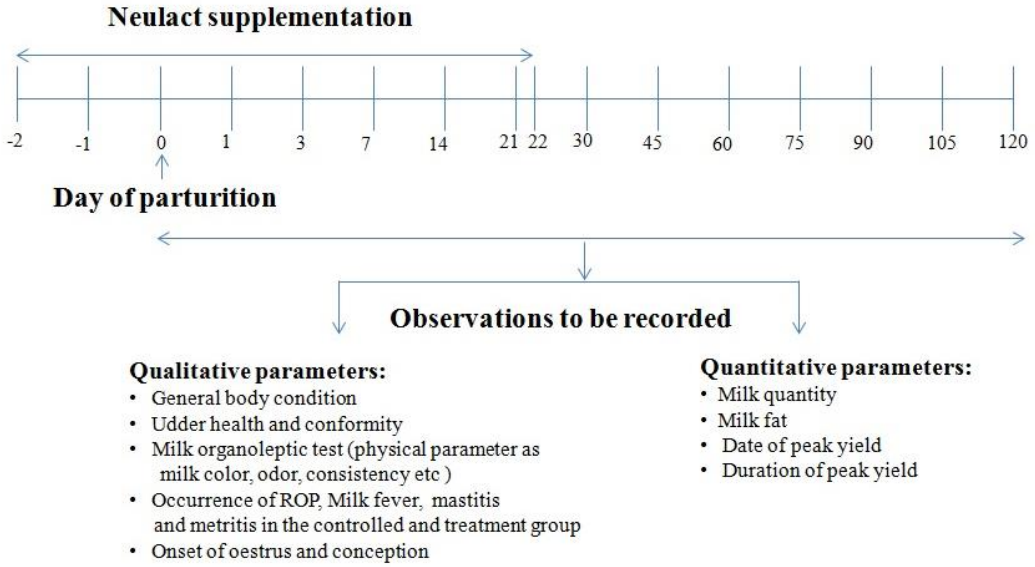
Retained placenta is a direct risk factor for postpartum reproductive and metabolic disorders, which may affect subsequent reproductive capability of dairy cows. In fact, a negative impact of retained placenta on reproductive performance of dairy cows has been widely documented (Yeon-Kyung Han et al., 2005).

Maintaining health of the cattle during the post parturient period is important because during this period cattle may be infected, and chance of infection increase. In view of the above factor a study was undertaken to evaluate the efficacy of a neutraceutical preparation containing minerals, vitamins, probiotics and prebiotics in maintaining the reproductive health of dairy cows during post partum period.

2 Materials and methods

2.1 Experiment Design:

The trial was designed for 120 days including 24 days of neutraceutical supplementation during peri-parturient period starting from 2-3 days before parturition. High yielder cross bred dairy cows of average age 7 years (6-8 years) were selected for the trial. Forty animals were randomly divided in to two groups, each group consisting of 20 animals. Group I was categorized as control and Group II as treatment group. Treatment group cows were supplemented with neutraceutical formulation, 1 sachet orally b.i.d. for 24 days (starting from 2-3 days before parturition) peripartum. Other feeding practices and conditions were identical for both the groups. Observations were recorded for post-partum complications and onset of estrus after calving. Data were recorded at 1^{st} , 3^{rd} , 7^{th} , 14^{th} , 21^{st} , 30^{th} , 45^{th} , 60^{th} , 75^{th} , 90^{th} , 105^{th} and 120^{th} days for qualitative and/or quantitative parameters of milk production, udder health, estrus and post partum problems.



Protocol: To assess the efficacy of the Neutraceutical formulation in prevention of ROP, Mastitis and Metritis during susceptible period; increase in milk yield with enhanced duration of peak milk yield and onset of oestrus with conception rate.

2.2 Animals:

40 Dairy cows (Holstein Friesian crossbred cows) at Hayer Dairy farm, littran village, Nakodar town, Jalandhar, Punjab.

1) 20 cross bred cows assigned to Control group
2) 20 cross bred cows assigned to Treatment group

2.3 Supplementation:

The dosage of Neutraceutical formulation was 1 sachet orally b.i.d. per cow for 24 days.

Composition of Neutracetical formulation:

The Neutraceutical formulation contains macrominerals i.e. calcium, phosphorus, magnesium; microminerals i.e. Zn, Cu, Fe, Mn, Cr, Co, Se; Vitamins i.e. A, D_3, E, Biotin, Niacin; multi-probiotics i.e. Saccharomyces cerevisiae, Aspergillus oryzae, Bacillus coagulans, Bacillus subtilis, Bacillus licheniformis; prebiotics i.e. FOS;

limiting amino acid DL- methionine and immunomodulators i.e. . beta glucan, mannan oligosaccharide and grape polyphenols.

However complete composition is not being revealed as an application has been filed for patent (no. 285/DEL/2013) of the product.

2.4 Parameters:
Following qualitative and quantitative parameters were monitored:

Qualitative parameters:

1. General body condition
2. Udder health and conformity
3. Milk organoleptic test (physical parameter as milk color, flavour, consistency etc)
4. Occurrence of ROP, milk fever, mastitis and metritis in the control and treatment group
5. Onset of oestrus

Quantitative parameters:

1. Milk quantity
2. Milk fat
3. Date of peak yield
4. Duration of peak yield

2.5 Instrument used for Quantitative parameters:
Semi-automatic milk fat testing machine

Determination of Fat in Milk by Gerber Method

The complete observations were recorded on day 0 (day of parturition), 1 , 3 , 7 , 14 , 21 , 30 , 45 , 60 , 75 , 90 , 105 and 120. However, the daily milk recording for all the control and treatment group animals was done on daily basis.

	Control group	**Treatment group**
Animals	20 animals	20 animals
Life stage	Just before parturition	Just before parturition
Drug administration	Normal feeding as per the feeding schedule of the farm	Normal feeding as per the feeding schedule of the farm

		with supplementation of Neutraceutical formulation as per recommended dosage
Duration of study	120 days	120 days
Duration of drug supplementation	-	24 days starting from 2-3 days day before parturition

3. RESULT:

Effect of Neutraceutical supplement on milk yield, milk quality and reproductive health. All the parameters are summarised in table 1.

Table1.

Days	**Milk Yield**	**Milk Fat**	**ROP**	**Uterine infection**	**Mastitis**	**Milk fever**	**Onset of heat**
Control Group.							
1'st DAY	10	4.49	2	Nil	Nil	Nil	Nil
7'th DAY	15.8	4.49	Nil	Nil	1	1	Nil
14'th DAY	18	4.56	Nil	Nil	1	Nil	Nil
21'st DAY	18	4.62	Nil	1	1	Nil	Nil
30'th DAY	18	4.64	Nil	1	1	Nil	5
45'th DAY	20	4.63	Nil	1	Nil	Nil	15
60'th DAY	20	4.64	Nil	Nil	1	Nil	Nil
75'th DAY	20	4.64	Nil	Nil	Nil	Nil	Nil
90'th DAY	18.5	4.65	Nil	Nil	Nil	Nil	Nil
105'th DAY	17	4.66	Nil	Nil	Nil	Nil	Nil
120'th DAY	16.5	4.66	Nil	Nil	Nil	Nil	Nil
Supplemented Groups.							
1'st DAY	10	4.5	Nil	Nil	Nil	Nil	Nil
7'th DAY	17.2	4.51	Nil	Nil	Nil	Nil	Nil
14'th DAY	18	4.6	Nil	Nil	Nil	Nil	Nil
21'st DAY	19.1	4.68	Nil	Nil	Nil	Nil	2
30'th DAY	19.3	4.68	Nil	Nil	Nil	Nil	18
45'th DAY	20.5	4.7	Nil	Nil	Nil	Nil	Nil
60'th DAY	20.9	4.7	Nil	Nil	Nil	Nil	Nil
75'th DAY	20.9	4.72	Nil	Nil	Nil	Nil	Nil
90'th DAY	20.9	4.72	Nil	Nil	Nil	Nil	Nil
105'th DAY	20.9	4.76	Nil	Nil	Nil	Nil	Nil
120'th DAY	20.5	4.76	Nil	Nil	Nil	Nil	Nil

3.1) Effect of Neutraceutical formulation on Peak milk yield and total milk yield (Lit/day).

As shown in figure 1a, The peak milk yield significantly increased in cows supplemented with Neutraceutical formulation as compared to control group on 45th day and the peak milk duration also significantly increased. The peak milk duration was 51 days (from 62nd day to 113th day) in treatment groups cows supplemented with Neutraceutical formulation whereas in case of control group it was 31 days (from 51st day to 83rd day).The peak milk yield was sustained for a longer period by Neutraceutical supplementation. The overall milk yield was increased by 9% in the supplemented group in comparison to the control group. On the basis of the results of the study the Neutraceutical formulation increased total milk yield and peak milk yield in lactating cattle. The extrapolated lactation cure revealed a total increase of approximate 18.5% during the entire lactation of the treatment group in comparison to the control group as shown in fig.1b.

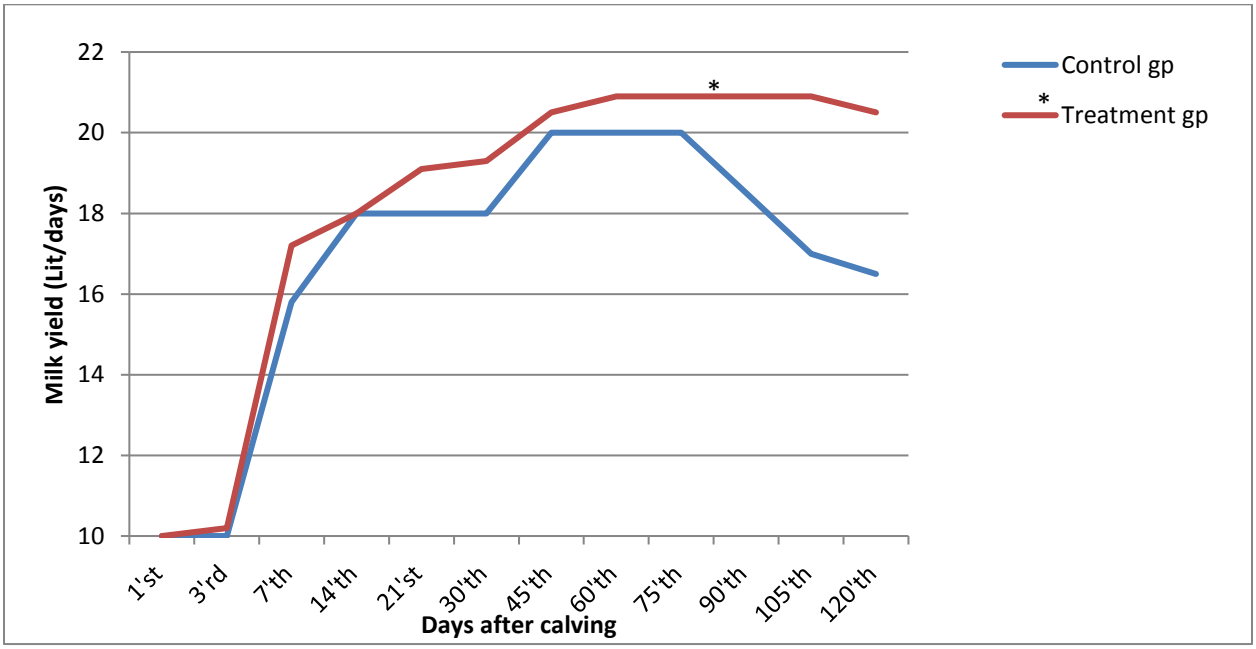


Fig1a. Effect of Neutraceutical formulation on peak milk yield (Lit/day).

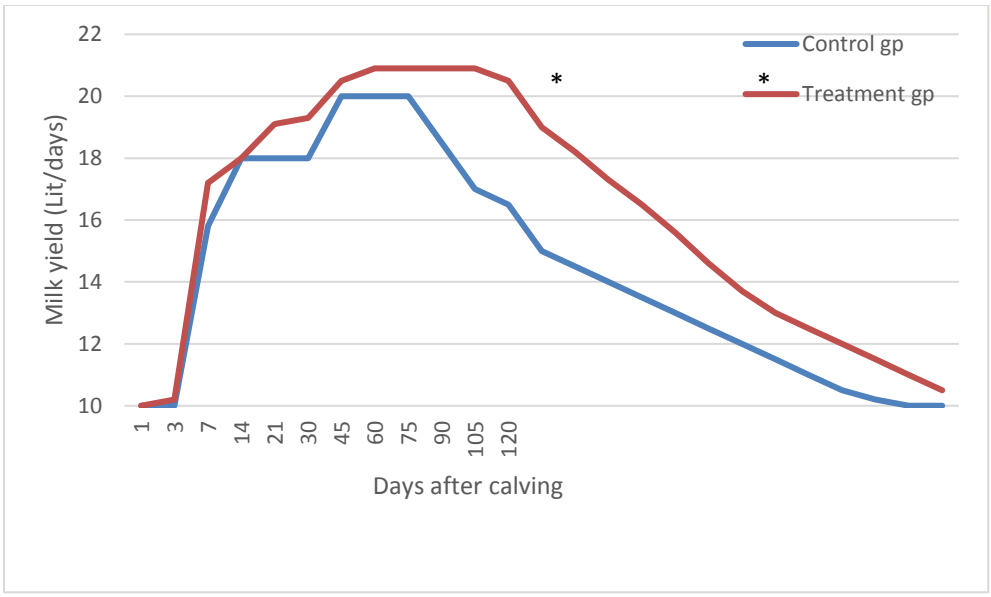


Fig.1b. Effect of Neutraceutical formulation on total peak milk yield (Lit/day) during entire lactation aft er extrapolation of graph of peak milk yield.

3.2) Effect of Neutraceutical formulation on quality of milk (Milk Fat %)

In the study, Neutraceutical formulation supplemented group showed 5.8% increase in the milk fat from the initial milk fat record whereas the increase in fat observed in the control group was 3.8 percent. In treatment group, milk fat significantly increased as compared to control group (Figure 2).

Fig 2. Effect of Neutraceutical formulation on quality of milk (Fat%)

3.3) Effect of Neutraceutical formulation on Reproductive Health

3.3.1) Effect of Neutraceutical formulation on Retention of placenta (ROP).

During the previous lactation, the treatment group animals had shown 15% incidence of retention of placenta (ROP). In contrast, no case of ROP was recorded during the current lactation after supplementation with Neutraceutical formulation. Two cows suffered from retention of placenta (ROP) in control group as shown in table 2.

Table 2

Data for Impact over Reproductive health		
Animal	ROP	
No	Control gp	Treatment gp
20	2	Nill

3.3.2) Effect of Neutraceutical formulation on Uterine infection.

As shown in Table 3, three animals of control group developed uterine infection, having purulent foul smelling vaginal discharge. In treatment group, however, no animal developed uterine infection although during previous lactation the treatment group animals had shown 25% incidence of uterine infection.

Table 3

Animal	Uterine infection	
No.	Control Group	Treatment Group
20	3	Nil

3.3.3) Effect of Neutraceutical formulation on mastitis.

During previous lactation, the treatment group animals had shown 30% incidence of mastitis, whereas no case was noticed the during current lactation after supplementation with Neutraceutical formulation. Conversely, 5 cows showed up clinical mastitis in control group as shown in table 4.

Table 4

Animal	Mastitis	
No.	Control Group	Treatment Group
20	5	Nill

3.4) Effect of Neutraceutical formulation on milk fever.

The treatment group animals did not suffer from milk fever. Conversely, one cow showed milk fever in control group as shown in table 5.

Table 5

Animal	Milk fever	
No.	Control Group	Treatment Group
20	1	Nil

3.5) Effect of Neutraceutical formulation on onset of heat

Neutraceutical formulation supplemented cows showed signs of oestrous after 25 days of calving whereas the control group cows took 37 days to show signs of oestrous (Fig. 3).

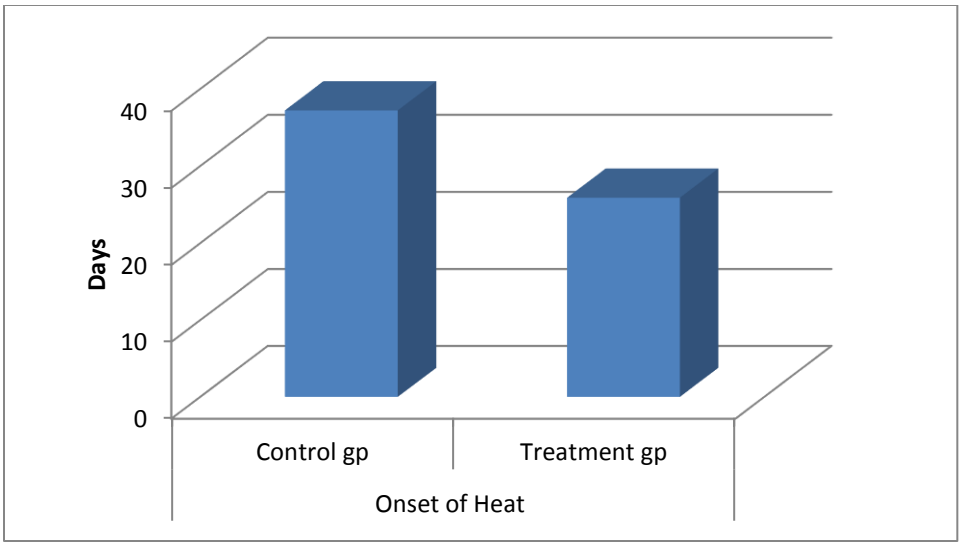


Fig 3. Effect of Neutraceutical formulation on onset of heat.

3.6) Effect of Neutraceutical formulation on udder health and conformity

Neutraceutical formulation supplemented cows showed improvement of udder size and shape after 45 days of supplementation. Supplemented group showed increase in the rear udder height and width indicating more udder capacity for milk synthesis.

Supplemented group showed improvement in teat placement with vertical alignment and square orientation of teats. Median suspensory ligament was prominent. This facilitates quick milking. Whereas control group showed weak median suspensory ligament with loose and pendulous teat.

Both the improvements in udder size, udder suspension and teat placement enhances value of the lactating animal.

3.7) Effect of Neutraceutical formulation on general body condition

Neutraceutical formulation supplemented cows showed an overall good body condition. Some of the cows showed significant weight gain also.

3.8) Effect of Neutraceutical formulation on organoleptic parameters of milk

Neutraceutical formulation supplemented cows showed mild improvements in the organoleptic parameters of milk. The colour, consistency and pH was normal, flavour

was slightly improved with aroma of freshness.

Discussion

During the periparturient period the demands for calcium are increased, which can result in subclinical or clinical hypocalcemia. Periparturient cows also experience significant immune suppression. Because intracellular calcium signaling is a key early feature in immune cell activation, the increased demand for calcium in periparturient cows may adversely affect intracellular calcium stores of immune cells. This reduction in intracellular calcium stores in immune cells could blunt intracellular calcium release following an activating stimulus, contributing to the immune suppression seen in these animals. (Kimura et al., 2006)

Vitamin and mineral deficiency conditions such as selenium, vitamin E and vitamin A, β-carotene and disturbed C/P (1.5/1) ratio can impair general immunity (Sheldon et al., 2004) and may alter the competence of cellular self-defence mechanism and can increase the risk for placental retention and metritis. Ahmed et al. (2009) reported that ROP was associated with oxidative stress as shown by the obvious increase of blood malondialdehyde and nitric oxide and decreases of catalase, superoxide dismutase, ascorbic acid, glutathione reduced and total antioxidant capacity values with low zinc, copper, iron and selenium concentrations.

A balanced supply of micronutrients, such as vitamins A and E and the trace elements zinc (Zn), copper (Cu) and selenium (Se) is very important particularly during the late dry period and early stages of lactation as deficiency of these micronutrients have been associated with an increased incidence of diseases. These micronutrients are cellular antioxidants which prevent peroxidative damage, either in cell membranes (vitamins) or in the cytoplasm (trace elements), and are essential for a normal functioning of the immune system. (Anjali Aggarwal, 2012)

Prepartum supplementation of vitamin E and selenium significantly reduce the incidence of Retained placenta, metritis and cystic ovary. (Harrison et al., 1984)

Bacilli present in the udder microbiota of healthy cows (Bacillus subtilis) can produce a variety of broadly active inhibitors of Gram-positive bacteria, including potential mastitis pathogens. (Al-Qumber and Tagg., 2006)

Conclusion

In this study we found that supplementation of cows with Neutraceutical formulation resulted in significant increase in peak milk yield and total milk yield The increase in the milk yield of the treatment group was 9% during first 120 days of lactation. The extrapolated lactation cure revealed a total increase of approximate 18.5% during the entire lactation of the treatment group in comparison to the control group. None of the cows under treatment group showed retention of placenta (ROP) and no animal developed uterine infection. However, the same cows during previous lactation had shown 15% and 25% incidence of retention of placenta (ROP) and uterine infection respectively. No incidence of milk fever was observed in treatment group. Neutraceutical formulation decreased occurrence of mastitis. In the treatment group, during previous lactation the incidence of mastitis was observed to the tune of 30% whereas no case of mastitis was reported during period of the study. Treatment group cows exhibited signs of oestrous after 25 days of calving whereas the cows belonging to the control group showed signs of oestrous after 37 days of calving.

On the basis of our results, the Neutraceutical formulation was found to be an effective supplement which resulted in the control of the post-parturient disorders like retention of placenta, mastitis, Uterine infection and milk fever; early onset of oestrous in bovines after calving; increased milk production with better milk quality; and increased peak milk yield duration.

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