Original Research

Effect of Feeding Synbiotic on Growth and Health Performance of Jersey Crossbred Calves

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Abstract

An experiment was conducted to study the effect of synbiotic formula (Lactobacillus rhamnosus NCDC 298 + Fructo-oligosaccharide) on growth (dry matter intake, body weight and body measurements) and health performance (disease incidences, faecal score and parasite oocyst count) of Jersey crossbred calves. The bacterial load was enumerated during the synbiotic feeding period of 42 days and post feeding up to 90 days of age. Study was carried out in Jersey crossbred calves maintained at NDRI-ERS, Kalyani from September 2017 to January 2018. The calves in the treatment group were fed 100 ml synbiotic having a bacterial load of 10^9 CFU/ml while control group were maintained in existing routine practices. There was significant improvement in final body weight (kg, $P<0.01$), average daily gain (g, $P<0.05$) and fecal score ($P<0.05$) in the synbiotic fed group. No trend was observed on the internal parasites even after feeding synbiotics. Therefore, it may conclude that feeding synbiotic to the calves had improved effect on the body weight gain with reduced diarrhoeal incidence during the study period.

Key words: Calf Health, Jersey Crossbred, Fructo-oligosaccharide (FOS), Synbiotics, *Lactobacillus rhamnosus* NCDC 298

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Introduction

Calf diarrhoea during early life leads to huge economic losses in dairy farms (Cho and Yoon, 2014). New born calf requires critical care and attention but it has been neglected by many dairy farmers. Since the gastrointestinal tract of the calf is sterile, it becomes vulnerable to many enteropathogens e.g. *Escherichia Coli*, *Salmonella spp*. rotavirus, bovine corona virus *Cryptosporidium parvum* etc. (Abou El-Ella *et al.*,

2013) often leading to increased mortality and morbidity (Islam *et al*., 2015). Antibiotic have been used with success but it decreases these beneficial bacteria (Ubeda *et al*., 2010) with increases the emergence of antibiotic resistance strains. Microbial colonization begins immediately after birth from the environment, fecal and vaginal flora during parturition which holds great importance in maturation of the gastrointestinal tract (Favier *et al*., 2002). Maintaining healthy microbial balance in calves leads to less immune disturbances as well as decrease health risk with optimal growth and production (Hill and Artis, 2009). Therefore, reduction of antibiotics with improved gut microbial balance can be introduced by feeding these good microbes during such colonization period (Malmuthuge *et al*., 2015). Synergistic effects was observed when probiotics and prebiotics are used simultaneously (Sekhon and Jairath, 2010). Therefore, the main objective of the experiment was to the study the effect of synbiotic on growth and health performance of the Jersey crossbred calves.

Materials and Methods

The study was carried out at ICAR, ERS-National Dairy Research institute, Kalyani, West Bengal. A total of twelve newborn Jersey crossbred calves were randomly allotted equally into two groups i.e. control and treatment group. The calves were separated from the dam immediately after birth and raised in groups up to 90 days of age. Colostrum was fed @1/10th of the body weight within one hour after birth followed by a second dose after 10-12 hour up to 3 days of age. Milk was bottle fed in two divided doses; morning (08.00 am) and evening (16.00 pm) hour up to 2 months of age @ 1/10th of body weight and 1/20th of the body weight on the 3rd month. *Ad libitum* supply of concentrate, green fodder and clean drinking water was available at all times. Treatment group was fed 100ml synbiotic consisting *Lactobacillus rhamnosus* NCDC 298 (10^9 CFU/ml) and Fructo-oligosaccharide (10%) mixed with colostrum and milk up to 42 days of age (Jenny *et al*., 1991 and Cruywagen *et al*., 1996).

Dry matter intake (DMI), body weight and body measurement were recorded at weekly interval. Dry matter from milk, concentrate and green fodder were analyzed as per AOAC (2005) on weekly basis. Faecal score was determined on the basis of faecal consistency which was observed daily by using a numerical score of 1 to 4 (1= normal consistency, 2= slightly liquid consistency, 3= moderately liquid consistency, 4= primarily liquid consistency) as proposed by Morrison *et al*. (2010). Faecal samples were collected at weekly intervals and stored at -20^{o}C for *Lactobacillus* load count and 10% formalin for quantitatively examination of faecal parasitic egg (Oocyst per gram, OPG) count using a Modified McMaster slide (Soulsby, 1982). *Lactobacillus sp*. load count was determined by diluting one gram of faecal sample in 9ml of 0.9% normal saline and tenfold dilutions were made up to 10^{-9} dilution.1ml of mixed dilution from each tube were transferred in respective petri dishes. For culture of *Lactobacillus*, MRS agar (Himedia®) was used by pour plate technique and incubated at 37^{o}c for 24- 48 hour. Colonies having 30-300 colony count

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were counted and number of colony forming units (CFU) was expressed as log colony-forming units per gram (log CFU/g) of faeces.

Statistical Methods

All the data were analyzed using SPSS; Analysis of variance (ANOVA) was carried out to analyze the data. The analysis of oocyst per gram (OPG) data was carried out by least-squares analysis of variance (Harvey, 1990). The faecal oocyst counts were log-transformed in order to stabilize variance. The results were back-transformed by taking antilogarithm of least-squares means (LSM) and presented as Geometric means of faecal oocyst count (GFOC).

Results and Discussion

The results obtain for dry matter intake, body weight and body measurements are given in Table 1.

Table 1: Effect of synbiotic on DMI, body measurements and body weight of Jersey crossbred calves during 90 days of experiment period

Parameters	**Control**	**Treatment**
Total DMI (kg/animal/day)	1.00±0.06	1.04±0.07
DMI/100 kg Body weight	3.06±0.19	3.01±0.16
Body length (cm)		
Initial	55.46±1.52	54.19±1.42
Final	75.78±1.34	76.83±1.72
Heart girth (cm)		
Initial	66.46±1.38	67.73±0.85
Final	82.11±2.02	85.99±2.70
Wither height (cm)		
Initial	67.66±0.88	66.89±1.07
Final	80.89±2.38	81.61±1.78
Body weight (kg)		
Initial	23.16±1.19	23.41±1.91
Final	46.75±3.36	52.50±2.25
Total body weight gain (kg) in 90 days	23.58 ± 2.38^{x}	29.08 ± 0.90^{y}
Average daily gain in 90 days (g)	262.03 ± 0.03^{x}	323.14 ± 0.01^{y}

^{xy} differences in superscript in row indicate significance at P<0.05

The results indicated that dry matter intake/100 kg body weight did not differ between the groups. This may be due to similar feeding and management conditions of the experimental calves though it was expected to be higher in the treatment group. Roodposhti and Dabiri (2012) studied effect of feeding multi-strain probiotics with prebiotic (Tipax) in claves and found no significant effects in weekly dry matter intake. Various workers, after feeding probiotics such as *L. acidophilus* 27SC (Abu-Tarboush *et al*., 1996), *Lactobacillus acidophilus* (Cruywagen *et al*., 1996), probiotic containing *Lactobacillus spp.* (Agazzi *et al*., 2014), mixture of *Lactobacillus* strains (Bayatkouhsar *et al*., 2013), *L. plantarum* and *Bacillus subtilis* (Zhang *et al*., 2016) in Holstein calves found no changes in the DMI. On the contrary, Gupta *et al*. (2016)

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found significant higher dry matter intake in the calves supplemented with *Lactobacillus acidophilus* and *Lactobacillus plantarum*. The result obtain from body measurement (cm) included body length, heart girth and wither height had no significant differences between the groups although overall gain in the respective measurements was numerically on higher side for the synbiotic fed group. The increasing trend was also reported by Nageshwar *et al*. (2016) without any significant differences between the groups of calves fed with or without probiotic. Higginbotham *et al*. (1998), Heinrichs *et al*. (2009), Riddell *et al*. (2010) observed similar results in the calves fed with probiotics.

The initial body weight was similar in both the groups whereas final body weight (kg) was significantly (P<0.01) higher in the treatment group (52.50±2.25). Average daily gain (ADG; g) was also significantly higher (P<0.05) in the synbiotic fed group (323.14 ± 0.01) when compared to control group (262.03± 0.03). The results are in agreement with the results of Roodposhti and Dabiri (2012) who reported significantly higher average daily gain (g) in the calves fed synbiotic. Increase in body weight due to synbiotic supplementation in calves was also reported by Hasunuma *et al*. (2011) and Dar *et al*. (2017). Besides synbiotic use, probiotics such as, *L. plantarum* and *L. acidophilus* (Gupta *et al*., 2016), *L. sporogenes* and *S. cerevisiae* (Nageshwar *et al*., 2016) etc. have reported significant increase in body weight gain and average daily gain in the calves. However, Kawakami *et al*. (2010) found no significant effects of lactic acid bacteria in the body weight gain of calves. The result obtain from *Lactobacillus* load count, faecal score, disease incidences and OPG count are given in Table 2.

Table 2: Effect of synbiotic feeding on recovery of *Lactobacillus* in feces, disease incidences, fecal score and parasitic oocyst count

Parameters	Control	Treatment
Faecal *Lactobacillus* load count (log CFU) /g of faeces		
Before start of feeding trail	1.87±0.14^{a}	1.95±0.19^{b}
Overall Faecal Lactobacillus load count	4.62±0.15^{a}	5.86±0.14^{b}
Disease incidences		
Diarrhoea		
No. of calves	5	4
No. of incidences	8	9
Fever		
No. of calves	4	4
No. of incidences	4	2
Faecal score	1.07±0.02^{x}	1.02±0.01^{y}
Log transformed OPG count (GFOC)	5.56±0.16 (160)	5.33±0.16 (106)

$^{(abc)}$ Means with different superscripts in a row differ significantly at (P<0.01); ^{xy}Means with different superscripts in a row differ significantly irrespective of week (P<0.05)

The result indicated that recovery of *Lactobacillus* was significantly higher (P<0.01) throughout the study period in the calves fed synbiotic as compare to control group this may be due to colonization and

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development of *Lactobacillus sp.* in the intestine with intestinal microbial balance. The results are in agreement with the findings of Quezada-Mendoza *et al*. (2011) who also found significant higher *Lactobacillus* count in calves fed *Lactobacillus* and *Propionibacterium spp.* Similarly, Lee *et al*. (2012) reported higher faecal *Lactobacillus* load count after offering *Latobacillus plantarum* and *Bacillus subtilis.* Oli *et al*. (1998) reported recovery of *Lactobacillus* in pigs fed with Fructo-oligosaccharide. However, Hasunuma *et al*. (2011) reported no effect of synbiotic feeding on fecal *Lactobacillus sp.* count.

During the study period of 90 days, no disease incidences were observed other than diarrhoea and fever in both the groups. The number of calves suffered due to diarrhea (incidence days) was n=4/6 (9 days) in treatment and n=5/6 (8 days) in control groups respectively. Timmerman *et al*. (2005) and Mokhber-Dezfouli *et al*. (2007) also who also reported significant decrease of calf diarrhea when treated with lactic acid bacteria. Besides diarrhea, the experimental calves also suffered from fever though the numbers were same n=4, the sick days was 4 in control and 2 in the treatment group respectively. Likewise, Maldonado *et al*. (2017) reported that the calves treated with lactic acid fermented milk did not suffer from fever. Better faecal score was observed in the treatment group. It was significantly ($P<0.05$) higher in control group (1.07 ± 0.02) than the calves in the treatment group (1.02 ± 0.01). This might be due to *Lactobacillus* strains which interfere with the adherence and development of pathogenic microorganisms by maintaining tight junction in the intestine (Berg, 1996). The findings corroborated with Hasunuma *et al*. (2011) who observed better faecal score in the calves fed synbiotic. Lee *et al*. (2012) also reported significantly better faecal score when claves were fed *Lactobacillus plantarum* and *Bacillus subtilis*. Similarly, Bayatkouhsar *et al*. (2013) and Agazzi *et al*. (2014) observed reduced faecal score in calves treated with *Lactobacillus* strains compared to control group.

The overall mean log transformed OPG count (GFOC) during 90 days experimental trail was 5.56 ± 0.16 (106) and 5.33 ± 0.16 (106) in control and treatment group respectively and no significant differences have been observed between the groups although it was numerically lesser in the synbiotic fed group. Several workers have found non-significant effect on OPG counts after feeding lactic acid producing bacteria (Harp *et al*., 1996), mixture of probiotics (Higginbotham *et al*., 1998), mannan oligosaccharide (Terre *et al*., 2007) and *Lactobacillus sp*. (Frizzo *et al*., 2010).

Conclusion

Synbiotic supplementation enhanced body weight gain and ADG in Jersey crossbred calves. However, there was no change in dry matter intake and body measurements. Synbiotic feeding also reduced the number of sick calves with less number of days suffered and better faecal score. Though non-significant, the synbiotic fed calves also had lower OPG count. It may be concluded that supplementation of synbiotic had beneficial effects on the growth and health of the calves.

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