INFLUENCE OF NUTRISIGMA® ON LACTATIONAL PERFORMANCE OF SAHIWAL COWS IN DECLINING MILK PRODUCTION STAGE

S. SOREN*, B. ROY, J. A. GORE¹, M. C. PAKHIRA² AND P. R. RAY³

*Department of Animal Nutrition
F/o Veterinary and Animal Sciences
West Bengal University of Animal and Fishery Sciences
37, K. B. Sarani, Kolkata – 700 037, W. B., India*

Twelve crossbred last stage lactating cattle of average 193.83 kg body weight and 4.775 kg milk yield were divided into three treatment groups of four animals each on the basis of milk yield and parity following completely randomized design. All the experimental animals were fed weighed quantities of paddy straw, green fodder and concentrate mixture to meet out the requirements as per the feeding standards. All the treatment groups (Control, T₁ and T₂) were offered same quantities of feed. NutriSigma®, a feed nutrition booster from IFB Agro Industries limited, Kolkata was offered 125 gm/day and 250 gm/day to T₁ and T₂ groups respectively, in addition to the basal diet. Results showed milk production from cows, fed control diet, declined in much faster rate than cows fed NutriSigma® 125 gm (T₁) and least declined was found in cows fed NutriSigma® 250 gm (T₂) in total mixed ration. Milk composition, body weight gain, body condition and faecal scoring among the groups did not differ numerically in control group, but improved results were obtained in T₂ and T₁ groups.

Key words: Body condition score, Faecal score, Milk production, NutriSigma®

Today in developing country like India, availability of feed ingredient for livestock is gradually decreasing. As a result, the cost of feed for livestock has increased sharply. The availability of low priced, high quality feeds is critical for the dairy industry. As good quality feeds are not available round the year, farmers are forced to provide poor quality feed ingredients which results poor milking potential of cows. NutriSigma® is

well balanced nutrition booster produced by IFB Agro Industries Limited, Kolkata which can enhance the value of total feed for cows. NutriSigma® is a feed supplement developed from distillers dried grain with soluble (DDGS) (Kleinschmt *et al.*, 2005). It is observed that better performance obtained from cows fed diets containing DDGS (Kleinschmt *et al.*, 2005). It is advised to use for feeding ruminants, both for beef and

*Corresponding Author

¹IFB Agro Industries Ltd. Sector-1, East Kolkata Township, Kolkata- 700107

²Department of Livestock Farm Complex, F/O Veterinary and Animal Science, WBUAFS

³Department of Dairy Chemistry, F/O Dairy Technology, WBUAFS, Mohanpur, Nadia

dairy cattle (Schingoethe, 2007). NutriSigma® is claimed as a valuable source of energy, protein, all essential fat soluble vitamins, macro and micro minerals for dairy animals along with buffering agent.

This study aimed to assess the milk production and milk quality of dairy cattle as influenced by the levels of NutriSigma® in the ration. An attempt was also made to assess the effect of NutriSigma® for body weight gain, faecal quality and body scoring of milch cattle.

MATERIALS AND METHODS

The study was conducted at Department of Livestock Farm Complex, West Bengal University of Animal and Fishery Sciences, Mohanpur campus, Nadia, West Bengal, India, in the month of August and September 2018. Twelve crossbred declining stage lactating cattle of average body weight 193.83 kg and 4.775 kg milk yield were divided into three treatment groups. These were Control (C) and treatment groups as

T₁ and T₂. Each group of four animals was in completely randomized design (CRD) on the basis of milk yield and body uniformity. All the experimental cattle were tied with rope in well ventilated feeding stall having arrangement for individual feeding. All the experimental animals were fed weighed quantities of paddy straw, green fodder and concentrate mixture to meet the requirements as per feeding standards (NRC, 2001). The basal diet was given to control group (C) as well as treatment (T₁ and T₂) groups. T₁ group received 125 gm/animal/day and T₂ group received 250 gm/animal/day NutriSigma® respectively in addition to basal diet. Prior to experiment, four month's milk yield data (April, 2018 to July, 2018) were collected from stock register of Livestock Farm Complex to study the trend of milk yield. Chemical composition of concentrate mixture was made as proximate analysis (AOAC, 1989), Table 1. The composition of NutriSigma® has been presented in Table 2 as per product literature.

Table 1. Chemical composition of concentrate mixture

Sl. No	Component	Percentage on DM basis
1	DM	90.385
2	CP	13.125
3	EE	1.1
4	CF	16.2
5	Total Ash	10.7
6	Acid insoluble Ash	3.13
7	Ca	0.855

Table 2. Chemical composition of 'NutriSigma®'

Sl. No	Component	Per 250 gm
1	Protein	80 g
2	Fat	23 g
3	Macro & micro Nutrients	126 g
4	Vitamin A	50000 IU
5	Vitamin D3	5000 IU
6	Vitamin E	250 mg

Milk yield and milk quality: Daily milk yield of morning and evening of individual animal was recorded using digital balance. The milk was sampled at interval of fifteen days for each animal in separate containers of both morning and evening and mixed before proceeding for estimation of major constituents of milk. Fat percentage was estimated by Gerber method as described in BIS handbook (1981). Protein percentage was estimated by Kjehldahl method as described in BIS handbook (1981) and lactose was estimated with the help of Lane-Eyon method as described in BIS handbook (1981). Solid not fat (SNF) was estimated by specific gravity method as described in BIS handbook (1981) by the formulae: $SNF (\%) = CLR/4 + 0.25F + 0.44$, Where, CLR = Corrected lactometer reading at 27°C, F = Fat content of milk.

Body weight: The initial body weight of the experimental animals was obtained at the starting of experiment followed by

monthly weighing for two months. The average daily gain (ADG) was in weight of the dairy cattle was calculated by dividing the final weight with the number of feeding days.

Body condition score: Body condition scoring of experimental animals was followed a visual and tactile evaluation of body fat reserves using a 5-point scale. Body condition scores (BCS) were an indirect estimate of energy balance. A score of 1 denotes a very thin cow, while 5 denote an excessively fat cow, and 3 was considered as an average body condition. Evaluation focused on the backbone, hip and shoulder, ribs, tail head and body outline as describe by Michel, (2008); Table 3. Samples were scored for visual consistency by each member of a three person panel during sampling. Body condition score was recorded prior to the experiment followed by monthly interval for two months.

Table 3. Body condition scoring chart for dairy cows

	BCS 1	BCS 2	BCS 3	BCS 4	BCS 5
Backbone	Prominent	Visible	Visible faintly	Not visible	Not visible
Hips and shoulder	Prominent	Visible	Not visible	Not visible	Fat deposit
Ribs	Clearly visible	Visible faintly	Not visible	Well covered	Well covered
Tail head	Recessed	Slightly recessed	Not recessed	Slightly lumpy	Very lumpy
Body outline	Skeletal	Bony	Almost smooth	Rounded	Bulging due to fat
Remarks	Poor	Moderate	Good	Fat	Grossly fat

Table 4. Faecal condition scoring chart for dairy cows

	Consistency	Remarks
Score 1	This manure is very liquid with the consistency of pea soup. The manure may actually “arc” from the cow	Excess protein or starch, too much mineral, or lack of fiber can lead to this score
Score 2	This manure appears runny and does not form a distinct pile. It will measure less than an inch in height and splatters when it hits the ground or concrete	Cows on lush pasture may have this manure score. Low fiber or a lack of functional fiber can also lead to this manure score
Score 3	The manure has a porridge-like appearance, will stack up 1.5 to 2 inches, have several concentric rings, a small depression or dimple in the middle, make a plopping sound with it hits concrete floors, and it will stick to the toe	This diet is not lacking nutritionally
Score 4	The manure is thicker and stacks up over 2 inches	This manure indicates a lack of degradable rumen protein, excess low quality fiber or not enough carbohydrates in the diet
Score 5	This manure appears as firm fecal balls	This manure indicates the cow is eating a poor quality forage diet that is inadequate for protein and carbohydrates, and high in low quality fiber

Faecal scoring: Faecal samples were collected manually by rectal evacuation immediately after milking. Faecal sample of the experimental animals was obtained at the starting of experiment followed by monthly interval for two months. Samples were scored for visual consistency by each member of a three person panel during sampling. Defecation was simulated by dropping fresh feces from a consistent height of approximately 1 meter to a clean floor for visual observation. Faecal consistency (FC) was evaluated using the 5 points scale with a score of 1 being very fluid and 5 being extremely dry and

segmented and 3 were the ideal consistency for manure and the ration was visibly digested as proposed by Skidmore *et al.* (1996), Table 4.

RESULTS

Milk production: Daily milk yield of experimental animals were presented in Table 5 and Fig. 1. The data obtained at the time of two months experiments showed clearly that milk production from cows fed control diet declined in much faster rate than cows fed NutriSigma® @ 125 gm (T_1) and least declined was found in cows fed NutriSigma® @ 250 gm (T_2) in total mixed ration during the course of feeding.

Table 5. Effects of NutriSigma® on the milk production performance among the experimental animals

	April'18 (kg)	May'18 (kg)	June'18 (kg)	July'18 (kg)	August'18 (kg)	September'18 (kg)
Control	6.024	5.418	5.28	4.552	4.014	3.065
T_1	8.329	7.925	6.988	5.023	4.533	4.291
T_2	6.444	6.384	5.974	4.75	4.608	4.429

Fig. 1. Effects of NutriSigma® on the milk production performance among the experimental animals

Milk quality: Milk nutrient component such as: fat, protein, lactose and solid non-fat (SNF) is presented in Table 6. In the present study data revealed that supplementation of NutriSigma® (T₂ and T₁) had improved milk nutrient component than the control group. In milk, fat percentage improvement was 12.04% (T₁) and 19.51% (T₂). But in control group this improvement was very negligible (0.22%). Same trend was observed in milk protein percentage, lactose percentage and SNF percentage. Data revealed improvement of milk protein percentage were 3.74% (T₁), 3.98 % (T₂) and -0.57% (C); lactose percentage was 5.2% (T₁), 5.46% (T₂) and -0.54 (C); SNF percentage was 2.07% (T₁), 2.17 % (T₂) and 0.46% (C).

Body weight gain: Average body weight gain is presented in Table 7. It is clear that

average body weight gain was improved in T₁ (5.11%) and T₂ (6.27%) groups than the control (1.57%) group.

Body condition scoring: Average body condition score was presented in Table 8. Here, it is clear that initial body condition score were almost same. After two months of experiment better body condition score were obtained in 3 (T₁) and 3.2 (T₂). But body condition score did not improve in case of control group.

Faecal scoring: Average body faecal score was presented in Table 8. The initial faecal score among the treatment groups were almost same. After two months of experiment faecal score was improved in case of T₂ (3.25) and T₁ (3.5). But in case of control group faecal score did not differ from the initial score.

Table 6. Effects of NutriSigma® on the milk composition among the experimental

Milk quality	animals	Attributes	Control	T ₁	T ₂
Fat (%)		Initial	4.5	4.65	4.61
		Final	4.51	5.2	5.5
		Difference	0.01	0.56	0.6
		Improvement (%)	0.22	12.04	19.51
Protein (%)		Initial	3.53	3.557	3.568
		Final	3.5	3.69	3.71
		Difference	-0.02	0.133	0.142
		Improvement (%)	-0.57	3.74	3.98
Lactose (%)		Initial	4.65	4.675	4.76
		Final	4.625	4.918	5.02
		Difference	-0.025	0.243	0.26
		Improvement (%)	-0.54	5.2	5.46
SNF (%)		Initial	8.65	8.71	8.74
		Final	8.69	8.89	8.93
		Difference	0.04	0.18	0.19
		Improvement (%)	0.46	2.07	2.17

Table 7. Effects of NutriSigma® on body weight among the experimental animals

	Initial (kg)	Final (kg)	Body weight gain (Numerical)	Body weight gain (%)
Control	190.5	187.75	-2.75	-1.44
T ₁	195.75	205.75	10	5.11
T ₂	195.25	207.5	12.25	6.27

Table 8. Effects of NutriSigma® on body condition score and faecal score among the experimental animals

	BCS		Faecal score	
	Initial	Final	Initial	Final
Control	2.4	2.5	4.5	4.25
T ₁	2.5	3.0	4.5	3.5
T ₂	2.5	3.2	4.25	3.25

DISCUSSION

Milk production: In the present study the cows selected for experiment were in the declining phase of milk production. The results of present study show the declining trend of milk production is prevented in the T₁ and T₂ groups. This prevention of declining of milk yield was may be due to effect of NutriSigma® as it contains high protein, complete feed supplement enriched with all essential vitamins, minerals, macro and micro nutrients. The results conformed to the study of Brun-Lafleur *et al.* (2010) that higher dietary rumen degradable protein (RDP) concentrations are proposed to increase ruminal microbial growth and digestion, which leads to an increase in milk yield. Other possible factors, that influence of NutriSigma® on milk production may relate to less digestive disturbance, as observed by the Mpapho *et al.* (2006). He

included dried distillers grains with soluble (DDGS) in the diet of dairy cattle during prolong period but less digestive disturbance was occurred. Similar results were observed by Owen and Larson (1991) and Kleinschmt *et al.* (2005), they observed in their studies that cows fed diets containing DDGS showed better performance. In contrast to the present study Voss *et al.* (1988), Nichols *et al.* (1998) and Liu *et al.* (2000) did not report any differences in milk yield for cows fed diets containing dried distillers grains with soluble (DDGS) in their studies.

Milk quality: The results of present study show that milk fat% has improved in the treatment groups due to supplementation of NutriSigma®. More improvement was notice in T₂ group than T₁ group. This may

be due to increasing amount of NutriSigma®. This observation was in agreement with the finding of Taylor *et al.* (2017), reported that increasing DDGS supplement increased milk fat.

Milk protein% and SNF% was improved with T₁ and T₂ groups. These findings were supported by Testroet *et al.* (2015), where the treatments included 10% and 25% DDGS in total mixed ration.

Lactose percentage of the milk improved numerically with T₁ and T₂ groups, which supports the findings of Tanaka *et al.* (2011), who observed higher lactose content in milk when fed with 20% DDGS compared with control group. The US grains council (2012) also found a non-significant ($P>0.05$) increase in lactose content when cows were fed with 10% DDGS. In contrast to the present finding Janicek *et al.* (2008), Nichols *et al.* (1998), Liu *et al.* (2000) and Dunkel (2005) reported that milk composition was not affected by feeding DDGS.

Body weight gain: The result of present study showed that supplementation of NutriSigma® has better effect on body weight gain. It was hypothesized that more frequent daily supplementation of NutriSigma® may increase the total amount of organic matter intake and thus improve cow performance as it satisfies the requirement of protein, vitamins, and macro and micro nutrient to great extent.

The present study is in agreement with the finding of Gross *et al.* (2016) who concluded that daily feeding protein from DDGS @0.35% of body weight, increased average daily gain was greater. Similar result was obtained by the findings of Radunz *et al.* (2010) and Engle *et al.* (2016).

Body condition scoring (BCS): The result of present study showed that supplementation of NutriSigma® has better effect on body condition score. Positive BCS changes recorded in this study can be attributed mainly due to the nutrient content of NutriSigma® which is rich in bypass protein, bypass fat, vitamins and mineral nutrients.

Faecal scoring: In present study it was observed that better faecal score were obtained in the treatment groups than the control group. In control group, average manure score was 4.5; this indicates that the diet was lack of degradable rumen protein. But better manure score was observed in T₂ (3.25) and T₁ (3.5). According to Skidmore *et al.* (1996) faecal score more than 4 reflects the manure is thicker and stacks up over 2 inches. This manure indicates a lack of degradable rumen protein, excess low quality fiber or not enough carbohydrates in the diet. Again in faecal score 3 reflects, the manure has a porridge-like appearance, will stack up 1.5 to 2 inches, have several concentric rings, a small depression or dimple in the middle, make a plopping sound with it hits concrete

floors, and it will stick to the toe. This score indicates that this is the optimum score that means the diet is not lacking nutritionally.

So, the better faecal score may obtained in T₂ and T₁ groups due to supplementation of NutriSigma® as it contains high protein, complete feed supplement enriched with all essential vitamins, minerals, macro and micro nutrients.

NutriSigma® is a feed supplement developed with bypass protein, bypass fat, fat soluble vitamins in significant quality, with high calcium and phosphorous content

with micronutrients. In present study NutriSigma® was used in the last stage of lactation. Though apparently milk yield was not improved but it is clearly indicated that declining of the milk yield was prevented. So, it can be conclude that milk production may be improved if it supplement at the early stage of lactation or last stage of gestation.

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