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Parteek Kr. Khera
M.V.Sc. Student, Department of LPM, College of Veterinary Science, Assam Agricultural University, Khanapara, Guwahati, Assam, India

J Hussain
Associate Professor, Department of LPM, College of Veterinary Science, Assam Agricultural University, Khanapara, Guwahati, Assam, India

JP Bordoloi
Professor, Department of LPM, College of Veterinary Science, Assam Agricultural University, Khanapara, Guwahati, Assam, India

J Saharia
Professor & Head, Department of LPM, College of Veterinary Science, Assam Agricultural University, Khanapara, Guwahati, Assam, India

AK Gohain
Professor, Department of ANN, College of Veterinary Science, Assam Agricultural University, Khanapara, Guwahati, Assam, India

T Borpuzari
Professor, Department of LPT, College of Veterinary Science, Assam Agricultural University, Khanapara, Guwahati, Assam, India

L Borah
Assistant Professor, Department of LFC, College of Veterinary Science, Assam Agricultural University, Khanapara, Guwahati, Assam, India

Sudhanya Nath
M.V.Sc. Student, Department of ANN, College of Veterinary Science, Assam Agricultural University, Khanapara, Guwahati, Assam, India

Corresponding Author:
J Hussain
Associate Professor, Department of LPM, College of Veterinary Science, Assam Agricultural University, Khanapara, Guwahati, Assam, India

Effect of dietary supplementation of Shatavari (*Asparagus racemosus*) on the production performance of crossbred cows

Parteek Kr. Khera, J Hussain, JP Bordoloi, J Saharia, AK Gohain, T Borpuzari, L Borah and Sudhanya Nath

Abstract
The present investigation was done to study the effect of Shatavari (*Asparagus racemosus*) on the performance of lactating crossbred cows. Twelve crossbred cows were divided into two groups *viz.* control (T0) and treatment (T1) with 6 cows in each group. The cows in each group were in uniform parity and same stage of lactation. Cows of both the groups were fed standard diet (NRC, 2001) consisted of concentrate, green fodder and paddy straw with supplementation of *Satomul* @ 100 gm daily in the treatment group for a period of 6 weeks. The parameters studied were dry matter (DM) intake, body weight (BW), body condition score (BCS), daily milk yield (DMY), milk composition and cost of milk production. The T1 group consumed significantly (p<0.01) more DM (9.68±0.17 kg) than the T0 group (9.11±0.12 kg). The overall average DMY was 7.72±0.11 and 8.74±0.16 litres in T0 and T1 groups. There was highly significant difference of DMY due to feeding of Shatavari respectively (p<0.01). However, body weight did not differ significantly (p>0.05). The overall average BCS of T0 and T1 groups was 3.41±0.05 and 3.51±0.07, respectively and they differed significantly (p<0.05). The overall average fat, solid-not-fat (SNF), protein, lactose and total solids (TS) was 4.32±0.11 and 4.99±0.09; 8.89±0.06 and 8.93±0.07; 3.41±0.03 and 3.54±0.05; 4.67±0.04 and 4.68±0.05 and13.21±0.14 and 13.92±0.12 percent in T0 and T1 groups, respectively. The treatment with Shatavari had significant effect on milk fat (p<0.01), protein (p<0.05) and TS (p<0.05). The variation of acidity of the milk was non-significant (p>0.05) between T0 (0.140±0.004%) and T1 (0.147±0.003%). The average daily feed cost in the T0 and T1 was Rs. 111.03 and 153.31, respectively. The daily net income per cow was Rs. 274.99 and 283.70 in T0 and T1 groups, respectively. The study revealed that feeding Shatavari had beneficial effect on dairy cows in respect of milk production and BCS. Rs.

Keywords: Hernia, buffalo bull, umbilical, herniorrhaphy

1. Introduction
Livestock farming is an integral part of Indian agricultural system. Livestock sector contributes 5.2 percent of total GVA to national GVA and 28.26 percent to agricultural GVA and the value of output from milk and milk products is 66.55 percent of total output from livestock. (Singh, 2021) [34]. India ranks first position in milk production in the world. Total annual milk production during 2020-21 was 209.96 million tones with daily per capita availability of 427 g (Anonymous, 2022) [1]. There is a great regional disparity in milk production. The milk production of Assam is only 0.88 million tonnes with per capita availability of 71 g per day. The utmost necessity has been felt to boost up the milk production in Assam and north-eastern region as a whole through different feeding and management tools. There are different types of galactagogue in the form of herbal preparations and other feed additives in animal diet to enhance milk production of dairy cows. The herbal preparations claim to be helpful to control stresses of different origin, improve nutrient utilization & availability and consequently enhance milk yield, its quality and maintain good health (Singh *et al.*, 1991, Mishra *et al*., 2006 and Bharti *et al*., 2012) [35, 24, 4]. Some of the herbs for increasing milk production of cows are satomul/ Shatavari (*Asparagus racemosus*), jiwanti (*Leptadenia reticulata*), bhringaraj (*Eclipta prostrata*), papaya (*Carica papaya*), methi (*Trigonella adscendens*) etc. *Asparagus racemosus*, is known as Shatavari in Indian Ayurveda, while it is known by different other vernacular names in different places like satavar in Hindi, satavali in Tamil, satawar in Rajasthani, satmooli in Madhya Pradesh, shatamuli in Bengali etc. (Sachan *et al.*, 2012) [31]. *Asparagus racemosus* contains various organic chemical compounds like steroidal saponins, glycosides, alkaloids, polysaccharides, mucilage, flavones

and isoflavones etc. (Thomsen, 2007) [40]. *Asparagus racemosus* (Shatavari) have various medicinal properties namely, galactagogue and mammogenic (Pandey *et al.*, 2005) [26]. Although in India, researches of *Asparagus racemosus* (satomul/Shatavari) root powder had been carried out in human, rats and guinea pigs, but few trial reports are available in lactating crossbred cows and buffaloes which are insufficient for scientific validation of its galactogogue effect. Therefore, more results from scientific trials in this respect will be of great utility for the scientific community and the dairy farmers. In view of above facts, the present study was designed to evaluate the effect of dietary supplementation of *Asparagus racemosus* root powder on the production performance of lactating dairy cows in an organized dairy farm.

2. Materials and Methods

The present experiment was conducted at the Instructional Livestock Farm (Cattle) of the College of Veterinary Science, Assam Agricultural Univeristy, Guwahati-781022 (Assam).in accordance with the approval of Institutional Animal Ethics Committee (Approval no. 770/Go/Re/S/03/CPCSEA/FVSc/AAU/IAEC/18-19/656 dtd. 28.12.2018). Twelve healthy Jersey crossbred cows were divided into two groups with six cows in each such as Control (C): without supplementation and Treatment (T): supplemented with *Asparagus racemosus* root powder @100 gm per cow daily. The average milk yield, body weight and parity of both the groups were similar. The cows of both the groups were fed (NRC, 2001) with roughages (paddy straw and green grass) *ad libitum* as basal diet and standard concentrate feed (DCP-16.46% and TDN-78.22%) was provided @ 4 per cent of body weight on dry matter (DM) basis. The cows were fed individually and leftovers in 24 hours were subtracted for calculation of daily dry matter intake (DMI). The experiment was conducted for a period of six weeks. The body weight was measured using the Shaffer's formula ($BW=L*G^2/660$, where BW in kg, L-body length & G-heart girth in inches), while the body condition score (BCS) was worked out adopting a 5-point scale method (Edmonson *et al*., 1989 and Elanco Animal Health Bulletin, 1996) [10, 11] at fortnightly interval. The milk composition such as fat, SNF, protein, lactose and ash was estimated with the help of a digital milk analyzer. The data was subjected to two way analysis of variance (ANOVA) and post-hoc test was performed as per standard method of Snedecor and Cochran (1994) [12].

3. Results and Discussion

3.1 Dry matter intake

The overall average daily DMI was found to be 9.11±0.12 (3.02% of body weight) and 9.68±0.17 (3.21% of body weight) kg in control and treatment groups, respectively and on 42nd day of experiment the daily average DMI was 9.12±0.09 (3.01%) and 10.27±0.11 (3.35%) kg in control and treatment groups, respectively. There was highly significant ($P<0.01$) difference of DMI between the two groups. The DM consumption gradually increased from 1st to 42nd day in the treatment group, but no such trend was observed in control group.

The results indicated that the *Asparagus racemosus* fed cows consumed significantly higher ($p<0.01$) DM than the cows of the control group. On week basis, cows of the supplemented group consumed significantly higher ($p<0.01$) DM from 14th to 42nd day. Different workers found *Asparagus racemosus* to relieve environmental stress (Rege *et al*., 1989; Kamat and Venkatachalam, 2004) [29, 16], also to act as an appetizer and digestive tonic (Dalvi *et al.*, 1990) [7] and to increase digestibility of feed nutrients. Thus cows eating *Asparagus racemosus* powder might had appetite for which they consumed more feed on DM basis. Other previous workers Mishra *et al.* (2008) [23] and Kumawat *et al*. (2017) [19] while feeding Shatavari *(Asparagus racemosus)* found to increase DM intake significantly in crossbred lactating cows. Mahanta *et al.* (2003) [20] found dietary Shatavari supplementation to increase DM intake significantly in buffaloes. Manju *et al.* (2013) [21] also fed poly herbal preparation containing Shatavari *(Asparagus racemosus)* and observed significant improvement in dry matter intake in sheep.

3.2 Milk yield

The overall average milk yield was 7.72±0.11 and 8.74±0.16 litres in control and treatment groups, respectively. The mean values (litres) of milk yield of the cows of control and treatment groups in different periods were 7.68±0.27 and 7.71±0.47 on day-1; 7.75±0.42 and 8.40±0.33 on day-7; 7.65±0.29 and 8.55±0.51 on day-14; 7.78±0.29 and 8.71±0.35 on day-21; 7.76±0.34 and 8.93±0.39 on day-28; 7.79±0.33 and 9.17±0.34 on day-35 and 7.63±0.34 and 9.70±0.32 on day-42. The analysis of variance revealed that the cows of the Shatavari *(Asparagus racemosus)* fed treatment group produced significantly ($p<0.01$) higher milk than the control group. The significantly higher milk production started from 7th day of feeding. The higher milk production in Shatavari *(Asparagus racemosus)* supplemented treatment group could be attributed to some active components in it, which stimulated hypothalamus or pituitary gland leading to release of prolactin hormone (Sabnis *et al.*, 1968; Ghosh *et al.*, 1987) [30, 13]. This prolactin hormone together with estrogenic effect of Shatavari on mammary gland stimulated the alveolar secretary epithelial cell division and proliferation in the lumen of the duct of mammary gland (Sabnis *et al*., 1968; Pandey *et al*., 2005) [30, 26] and resulted in more supply of pro-milk constituents from blood which could have resulted in more milk synthesis. Mahantra *et al.* (2003) [20] reported that feeding herbal formulation containing 25 percent Shatavari enhanced milk production (25.1%) significantly over control group. Previous scientist (Somkuwar *et al.*, 2005; Mishra *et al.*, 2008; Tanwar *et al.*, 2008 and Dangi, 2011) [36, 23, 39, 8] reported significant improvement in milk yield in crossbred cows and buffaloes with feeding of Shatavari. The higher DM consumption in treatment group also aided to higher milk yield (Christensen and Fehr, 2000) [6].

3.3 Fat

The average fat content in milk of crossbred cows was 4.60±0.34 and 4.85±0.29 on day-1; 4.52±0.24 and 5.28±0.27 on day-7; 4.33±0.31 and 4.93±0.19 on day-14; 4.25±0.24 and 4.78±0.27 on day-21; 4.23±0.39 and 5.12±0.20 on day-28; 4.12±0.37 and 4.95±0.30 on day-35 and 4.18±0.32 and 5.00±0.19 on day-42 in control and treatment groups, respectively. Analysis of variance revealed significantly higher ($p<0.05$) fat content of milk in the treatment group.

In support of the present finding, former workers (Kumar *et al.*, 2009; Sukla, 2009; Dangi, 2011 and Soni *et al.*, 2016) [17, 38, 37, 8] also found significantly higher fat percentage of milk in Shatavari supplemented dairy cows and buffaloes.

3.4 SNF

The average SNF content was 8.97±0.19 and 8.77±0.16 on day-1; 9.00±0.18 and 8.70±0.15 on day-7; 9.07±0.19 and 8.77±0.17 on day-14; 8.87±0.08 and 8.85±0.09 on day-21; 8.77±0.17and 9.08±0.14 on day-28; 8.72±0.15 and 9.18±0.22 on day-35 and 8.87±0.18 and 9.18±0.22 on day-42. Result of analysis of variance indicated no significant effect of dietary supplementation of Shatavari on SNF content in milk of crossbred cows.

It was evident that SNF content in milk increased from Day-28 to Day-42 in treatment group. The similar content of lactose and ash had resulted non-significant effect of Shatavari on SNF in milk. In conformity with the present results, Baig and Bhagwat (2009) [2] and Patel *et al.* (2013) [27] also did not find any significant effect on SNF content in milk due to galactin bolus containing Shatavari with some other herbs in dairy cows and poly herbal galactogogue biscuit in buffaloes, respectively. Some other workers (Berhane and Singh, 2002; Somkuwar *et al*., 2005 and Kumawat *et al*., 2017) [3, 36, 19] also found that SNF content increased non-significantly with dietary supplementation of Shatavari in dairy cows and buffaloes.

3.5 Protein

The average protein content in milk of the control and treatment groups was observed to be 3.28±0.12 and 3.25±0.32 percent on day-1; 3.43±0.02 and 3.48±0.01 percent on day-7; 3.47±0.07 and 3.58±0.05 percent on day-14; 3.40±0.04 and 3.57±0.06 percent on day-21; 3.38±0.03 and 3.60±0.07 percent on day-28; 3.35±0.05 and 3.62±0.07 percent on day-35 and 3.58±0.07 and 3.65±0.03 percent on day-42; respectively. The analysis of variance of the data revealed significant effect (p<0.05) of treatment on overall protein content in milk (3.54±0.05 *vs.* 3.41±0.03 percent). However there was no significant difference in different periods.

The reason for the significantly higher protein content in milk may be due to modification of rumen ecosystem (Pradhan,1995 and Bhatt, 2015) and better nutrients digestion and utilization (Tiwari *et al.*, 1993 and Mishra *et al.*, 2009) [41, 22] leading to more availability of necessary precursors from blood for protein synthesis in milk. In support of the present finding, workers like Mishra *et al.*, (2008) [23], Kumar *et al.* (2009) and Kumawat *et al.* (2017) [19] also found significantly higher protein content in milk of dairy cows and buffaloes supplemented with Shatavari.

3.6 Lactose

The average lactose content in the milk of crossbred cows of control and treatment groups was 4.79±0.17 and 4.75±0.24 percent on Day-1; 4.80±0.12 and 4.60±0.10 percent on Day-7; 4.77±0.08 and 4.65±0.11 percent on Day-14; 4.72±0.09 and 4.60±0.11 percent on Day-21; 4.62±0.04 and 4.70±0.12 percent on Day-28; 4.50±0.10 and 4.70±0.07 percent on Day-35 and 4.50±0.06 and 4.75±0.06 percent on Day-42; respectively. The analysis of variance revealed no significant (p>0.05) effect of dietary supplementation of Shatavari on lactose content in milk. Keeping similarity with the present findings; Imtiwati (2014), Kumar *et al.* (2014) and Kumawat *et al.* (2017) [19] found that lactose content in milk remained unaffected due to dietary supplementation of Shatavari in dairy cows.

3.7 Total Solids

The average total-solids content in the milk of crossbred cows of control and treatment groups was observed to be 13.57±0.45 and 13.62±0.20 percent on Day-1; 13.52±0.34 and 13.98±0.33 percent on Day-7; 13.40±0.47 and 13.70±0.29 percent on Day-14; 13.11±0.28 and 13.63±0.24 percent on Day-21; 13.00±0.40 and 14.21±0.22 percent on Day-28; 12.84±0.41 and 14.13±0.50 percent on Day-35 and 13.05±0.35 and 14.18±0.39 percent on Day-42, respectively. The analysis of variance showed significant effect (p<0.05) of Shatavari on total solids content in milk. The overall total solids content (13.92±0.12%) was significantly higher (p<0.01) in the cows feeding Shatavari root powder.

The total solids percentage value of the control group was well comparable with the findings of Hussain (2018) who reported 13.92±0.04 percent total solids in milk of Jersey cows. In support of the present finding, Kumar et al. (2014) and Kumawat et al. (2017) [19] found Shatavari feeding to increase total-solids percentage of milk significantly (p<0.05) in crossbred cattle.

3.8 Acidity

The average titrable acidity in the milk of crossbred cows of control and treatment groups was 0.140 ±0.004 and 0.147 ±0.003 percent on 42nd day of feeding. There was non-significant (p>0.05) difference between the groups. Divya *et al.* (2015) also found non-significant effect (p>0.05) of Shatavari feeding on milk acidity and pH which has supported the present finding.

3.9 Body weight

The final body weight of the crossbred cows on 42nd day was found to be 303.21±11.89 kg and 306.89±11.42 kg in control and treatment groups, respectively. The body was apparently higher in the treatment group. However, there was no significant (p>0.05) effect of Shatavari *(Asparagus racemosus)* on the average body weight of crossbred lactating cows.

Shatavari is an appetizer (Dalvi *et al.*, 1990) [7] and has anabolic action (Sharma *et al*., 1986) which ultimately resulted in higher gain in body weight. But, the present investigation showed non-significant effect of it on body weight. However, workers like Kumar *et al.* (2014), Singh *et al.* (2014) and Kumawat *et al.* (2017) [19] found significant effect of feeding Shatavari on body weight gain in crossbred cows and Sahiwal heifers.

3.10 Body condition score

The mean BCS of crossbred cows were found to be 3.46±0.04 and 3.63±0.09 on 42nd day and overall mean was 3.41±0.05 and 3.51±0.07 in control and treatment groups, respectively. The dietary supplementation of Shatavari *(Asparagus racemosus)* had significant effect (p<0.05) on BCS and it was also revealed the effect was increased significantly (p<0.05) with the increased days of feeding. The higher BCS in the treatment group indicated higher tissue reserve under the skin and maintained better physical health. The cows in the treatment group consumed more feeds on DM basis. The ingested feed might had digested and utilized in the body more efficiently than in the control group, resulting in significantly higher (p<0.05) BCS in the treatment group. In support of the present finding, Kumawat *et al.* (2017) [19] while feeding Shatavari *(Asparagus racemosus)*, found BCS to increase significantly (p<0.01) in crossbred cattle. Anabolic action of Shatavari (Sharma *et al*., 1986) may be also a contributing factor for the cows of the treatment group to

attain significantly higher (p<0.05) BCS in the present investigation.

3.11 Cost of production

The average daily feed cost in the control and treatment group was Rs. 111.03 and Rs. Rs. 153.31. The production cost of per litre of milk was Rs.14.38 and Rs. 17.54 in control and treatment groups, respectively. The daily money receipt per cow from sale of milk @ Rs.50/litre was Rs. 386.00 and 437.00 in control and treatment groups, respectively. Daily net income after deduction of their feed costs was found to be Rs. 274.99 and Rs. 283.70. Daily net income was Rs. 8.71 (3.17%) more in the treatment group than the control.

Dalvi *et al.* (1990) [7], Mahantra *et al.* (2003) [20] and Mishra *et al.* (2008) [23] found that dietary Shatavari supplementation increased DM intake and simultaneously increased in feed cost of experimental animals. Tanwar *et al.* (2008) [39] reported that Shatavari supplementation was economically viable and generated additional income of Rs.7.49/animal/day. In conformity with the present findings, Kumar *et al.* (2009) [17] and Dangi (2011) [8] found that dietary supplementation of Shatavari significantly (p<0.05) increased economic return in dairy buffaloes. Findings of Kumar *et al.* (2014) [18] and Imtiwati (2014) [15] also revealed that Shatavari supplementation increased net profitability by 10.99 percent in Karan-Fries crossbred cows and Imtiwati (2014) [15] revealed increased profitability in milk production of Sahiwal cows.

4. Conclusion

The cows receiving dietary supplementation of Shatavari powder consumed significantly higher (p<0.01) DM and produced significantly more milk. The fat, protein and total solids content in milk was also significantly (p<0.05) higher due to Shatavari supplementation. The study revealed that the performance of dairy cows can be improved through feeding of Shatavari (*Asparagus racemosus)* root powder.

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