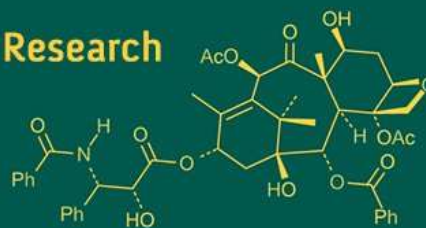
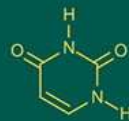
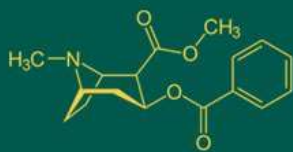


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Monmi Kalita
College of Veterinary Science,
Assam Agricultural University,
Guwahati, Assam, India

J Saharia
College of Veterinary Science,
Assam Agricultural University,
Guwahati, Assam, India

Purabi Kaushik
College of Veterinary Science,
Assam Agricultural University,
Guwahati, Assam, India

Dr. Papori Talukdar
College of Veterinary Science,
Assam Agricultural University,
Guwahati, Assam, India

Uddhab Kalita
College of Veterinary Science,
Assam Agricultural University,
Guwahati, Assam, India

Jakir Hussain
College of Veterinary Science,
Assam Agricultural University,
Guwahati, Assam, India

Chandrani Goswami
College of Veterinary Science,
Assam Agricultural University,
Guwahati, Assam, India

Corresponding Author:
Dr. Papori Talukdar
College of Veterinary Science,
Assam Agricultural University,
Guwahati, Assam, India

Productive performance of Sahiwal cattle on dietary supplementation of fenugreek seed (*Trigonella foenum-graecum*) powder

Monmi Kalita, J Saharia, Purabi Kaushik, Papori Talukdar, Uddhab Kalita, Jakir Hussain and Chandrani Goswami

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Abstract

A study was conducted on eighteen (18) Sahiwal cattle of almost similar lactation period (2nd to 4th lactation) group to observe the effect of fenugreek seed powder supplementation at two different levels of inclusion. The animals were divided into three experimental groups i.e. control group (T₀) was fed with balance concentrate along with paddy straw and green roughage *ad lib.*, T₁ (25 g of fenugreek seeds along with control ration) and T₂ (50 g of fenugreek seeds along with control ration). Milk yield was recorded fortnightly along with other milk constituents like total fat, SNF, lactose, protein, ash, specific gravity. Milk efficiency was significantly higher ($p < 0.01$) in treatment groups than in control. Also there was significant difference ($p < 0.01$) observed in fat, SNF, lactose, protein and ash content. The average digestibility coefficients of all the treatment groups were recorded and the data revealed significantly higher digestibility of the organic nutrients in herbal supplement fed groups than control group. It can be concluded that feeding of herbal supplements (fenugreek seed) @ 50 g/cow/day is economically beneficial and imparts better result in terms of milk yield, milk composition and digestibility of the nutrients.

Keywords: Fenugreek seeds, milk yield, milk constituents, Sahiwal cattle

Introduction

India is the leading producer of milk across the world contributing 24% of global milk production. As per 20th livestock census ^[1] there are 302.71 million bovines which showed an increase of 1% than the previous census. As 70% of rural population of India depends on livestock for their livelihood therefore livestock plays an important role in building socioeconomic status of the rural family. In India cattle industry has a huge impact on rural household socioeconomic growth (Bairwa *et al.*, 2013) ^[12].

India is the largest milk producer in the world owing to great demand for milk and milk products. In India milk production saw an increase of about 3.78% during 2023-2024 (Basic Animal Husbandry Statistics, 2024) ^[25]. The total milk production during the year 2023-2024 was 239.30 million tonnes. Along with this per capita availability of milk rose to 471 grams per day. Milk production in Assam was found to be 1092.230 thousand tonnes in the year 2023 which has a significant increase from previous years. Although due to various kind of diseases and managemental issues India's productivity per animal is very low compared to other developing countries (Mishra *et al.*, 2006) ^[33].

India has large number of cattle breeds with very wide range of genetic diversity (Economic Survey, 2023-2024) ^[25]. There are total 53 registered cattle breeds according to ICAR-NBAGR. Out of all the indigenous breeds Sahiwal is the best milch breed of India known for its highest milk production. Its origin lies in the Montgomery district of Pakistan. However, they are also found in the Indian states like Punjab, Haryana and Rajasthan. It is also known by other names such as "Lola", "Montgomery". Sahiwal is best known for producing high milk yield with various benefits. It can easily withstand harsh weather conditions with a very strong immune response. Average lactation yield ranges from 1600 kg to 2750 kg. However, there is a need for improving management conditions for more productivity.

The use of galactogogues is very popular in human and animals to increase milk yield (Allam *et al.* (1999); Al-Kudsi *et al.* (2011)) ^[7, 6].

Galactogogues are available both as synthetic or plant derived (Priyanjali *et al.*, 2005; Pujari, 2015) [39, 40]. Commonly used herbal galactogogues are asparagus, shatavari, fenugreek, alfalfa (Bhatt *et al.* (2009) [13]. These herbs are described in the Ayurveda to improve the immune system of humans as well as animals (Mohanty *et al.*, 2014) [34].

Herbal galactogogues play a significant role in safe milk production as it has little or no side effects (Dosky and Taher, 2015; El-Basheir, 2015) [19, 20]. Fenugreek (*Trigonella foenum-graceum*) is the most popular herbal galactogogues since ancient times (Al-Sherwany (2015); Babekir (2015) and Al-Wazeer (2017)) [9, 11, 10]. These herb's galactogogue property has beneficial effects on milk production have been previously documented by Patel *et al.* (2017) [38] for cattle, Alamer *et al.* (2005) [3] for goats and Degiemencioglu *et al.* (2016) [18] for buffaloes. A naturally occurring saponin named Diosgenin has got structurally similarities with oxytocin are found in fenugreek seeds (Cui *et al.* (2021) [17]. It helps in stimulating the release of growth hormone which leads to increase in milk production Sayed *et al.* (2005) [42]. But the galactogogue property of fenugreek has not been explored much in Sahiwal cattle breed. Hence the present work was carried out to study the effect of fenugreek seed on milk efficiency, productive performance and nutrient digestibility of pure Sahiwal breed.

Materials and Methods

The experiment was carried out at Sahiwal Cattle Farm, College of Veterinary Science, Khanapara, Guwahati, Assam. A total eighteen Sahiwal cattle of 2nd to 4th lactation group were selected. The animals were housed in existing conventional house of the farm. They were kept in tail-to-tail arrangement. The floor, feeding troughs and mangers were regularly cleaned and disinfected properly. For milking, full hand milking was practised under clean and hygienic conditions. The cows were milked twice in a day. Feeding trial was conducted for a period of 90 days followed by a digestibility trial for a period of 5 days. The selected animals were randomly divided into three groups viz., T₀ (control), T₁ and T₂ consisting of six animals in each group. Control group (T₀) was fed with balance concentrate along with paddy straw and green roughage *ad lib.*, T₁ (25 g of fenugreek seeds along with control ration) and T₂ (50 g of fenugreek seeds along with control ration).

During digestibility trial dry matter intake was calculated on fortnightly basis and DMI/100 kg body weight was calculated. Faeces were collected on 24 hourly basis during the period. Feed offered, faeces voided and residue left were collected and recorded to determine digestibility of various organic nutrients present in the feed. Proximate analysis of feed and faecal samples was done to determine the digestibility of dry matter, crude protein, crude fibre, ether extract, organic matter and nitrogen free extract as per procedures Association of Official Analytical Chemists (AOAC, 2007) [11].

Milk Quality and Quantity

Sahiwal cattle were milked twice daily during the whole experimental period. Milk samples were collected and average daily milk yield was recorded on fortnightly basis. Milk samples were also analysed for fat, protein, lactose content, ash and specific gravity using ultrasonic milk analyzer.

Cost of Feeding

The cost of feeding the animals was worked out considering the cost of concentrate, green grass, paddy straw and fenugreek seed. The cost of the herbal supplement fenugreek was calculated out based on actual market price.

Statistical Analysis

The experimental data was statistically analysed by using SPSS (Statistical Package for Social Science, version 20, Chicago, USA) [45] with randomised block design. For data analysis one way ANOVA was used (Snedecor and Cochran, 1994) [44].

Results and Discussion

Chemical composition of fenugreek seed powder was done for its proximate composition (Table 1) as per method described by AOAC (2007) [11].

Intake and utilization of nutrients

Overall mean of daily feed intake on dry matter basis in control (T₀), Treatment 1 (T₁) and Treatment 2 (T₂) were 10.01±0.02, 10.24±0.03 and 10.22±0.08, respectively (Table 2). Statistical analysis showed no significant differences ($p < 0.05$) between the three treatment groups with respect to overall mean. Similar findings were reported by Kirar *et al.* (2018) [27] who found that supplementation of herbal mixture did not show any effect on DMI as well as on DMI/100kg body weight.

The average digestibility coefficient (%) of dry matter in T₀, T₁ and T₂ are 71.12±0.27, 73.58±0.26 and 74.72±0.22, respectively. Results of Analysis revealed that supplementation of fenugreek seed had highly significant ($p < 0.01$) effect on digestibility of DM intake. The significantly higher digestibility of dry matter may be due to fenugreek contain saponins which are considered as an appetizer and helps in better digestion which lead to better utilization of nutrients. The results agree with the findings of Mirzaei *et al.* (2012) [32] who evaluated the effect of feeding fenugreek seed powder and found that total digestible nutrients contents improved in fenugreek seed fed group. Fenugreek seeds (2%) in basal fattening rations led to inconsiderable increase in ration palatability and reported significant increase in ($p < 0.05$) digestibility of DM.

The average digestibility coefficient (%) of crude protein in control (T₀), treatment 1 and treatment 2 were 67.89±0.11, 65.54±0.05 and 68.48±0.07, respectively. The present findings agree with the findings of Elmnan *et al.* (2013) [21] who investigated the effect of supplementation of fenugreek seeds on digestibility of Nubian goats and found that nutrient digestibility CP were higher in goats fed with fenugreek seeds than the control group. Mir *et al.* (2012) [31] examined the effect of raw fenugreek seeds at the rate of 3% DMI on nutrient utilization in goats and revealed that digestibility coefficient of crude protein, were significantly higher ($p < 0.05$) in treatment groups than in control groups. On the contrary Ali (2015) [5] conducted a study to determine the effect of fenugreek seeds which are natural supplement in Nubian goat diets. Results showed that the digestibility (%) of these nutrients were not significantly affected ($p > 0.05$) and addition of fenugreek seeds reduced digestibility (%) of CP in treatment group as compared to control group. The average digestibility coefficient of crude fibre in T₀, T₁ and T₂ were 48.80±0.37, 50.04±0.29 and 56.24±0.28, respectively. Statistical analysis revealed that

fenugreek fed groups had significantly better digestibility than the control groups. The highly significant ($p < 0.01$) increase in digestibility of CF may be due to better utilization of nutrients aiding to better digestion.

The present findings are concurrent to the results of Mir *et al.* (2012) [31] who examined the effect of raw fenugreek seeds at the rate of 3% DMI on nutrient utilization in goats and revealed that digestibility coefficient of crude fibre was significantly higher ($p < 0.05$) in treatment groups than in control group. Similarly there was higher digestibility coefficient of ether extract in fenugreek fed groups. This might be due to efficient utilization of nutrients in fenugreek fed diet which leads to improved digestion. Similar findings were found by Kumar *et al.* (2021) [29] who studied effect of adding fenugreek seeds (2%) in basal fattening rations and found that there was improved digestibility of EE in fenugreek fed diet. The average digestibility coefficient of NFE in T₀, T₁ and T₂ were 77.14±0.15, 77.35±0.04 and 78.13±0.09, respectively. The present results agree with the findings of El-Rawi (2012) [23] noted that adding fenugreek @ 2% in the ration of turkey increases NFE digestibility. Also, El-Tarabany *et al.* (2017) [24] recommended that fenugreek seeds might have a direct effect on the hypothalamus and trigger hunger center in the brain which leads to desire for eating and hence improved appetite and digestion. There was also increase in digestibility coefficient of organic matter in fenugreek fed group. The improvement could be justified on the basis of that fenugreek seeds contain saponins which might stimulate an aerobic fermentation of organic matter that improved efficiency of nutrient utilization (Elmnan *et al.* (2013); Kumar and Kumar (2018)) [21, 28]. The findings of the study are in close agreement with the results of Nasser *et al.* (2012) [35] who experimented the effect of fenugreek seeds and asparagus roots on *in vitro* nutrient digestibility and found that fenugreek seeds increased *in vitro* organic matter digestibility.

Milk Yield and milk constituents

The average fortnightly milk yield (kg) of the experimental cows has been presented in Table 3. The overall mean of fortnightly milk yields were 7.00±0.05, 7.56±0.08 and 7.99±0.10, respectively. This improvement in milk yield may be attributed to fenugreek seeds as feed additive in the treatment groups. Fenugreek seeds might increase prolactin hormone secretion which is considered as one of the major hormones for milk synthesis and secretion (El-Nor 1999) [22]. The results also agree with the findings of Hassan *et al.* (2006) [26] who observed the milk production by supplementing fenugreek seeds in lactating animals and found higher milk production in fenugreek fed group. He concluded that fenugreek supplementation enhanced milk production by increasing nutrient utilization of the feed. Also, Al-Shaikh *et al.* (1998) [8] investigated the effect of fenugreek seeds on lactational performance of dairy goats and observed increased level of milk yield in fenugreek fed group than the other groups. Mahgaub *et al.* (2016) [30] stated that the prolactin level might have increased hormone levels due to galactopoietic effects of fenugreek (Sharma *et al.* (2017) [43].

Among the milk constituents (Table 3) milk fat percentage of treatment group differ significantly from the control group. The higher fat percentage in supplemented group (T₁

and T₂) might be due to high fibre intake which leads to more production of acetate ultimately lead to more production of fat percentage in milk. The presents findings are similar with the findings of Al-dain and Jarjeis (2015) [4]; Abu *et al.* (2018) [2]; Revathi *et al.* (2020) [41] who found that fenugreek seed supplementation in cross bred cattle and buffaloes had positive effect on milk composition and showed significantly higher values in fat percentage. Milk lactose percentage was higher ($p < 0.05$) in Sahiwal cattle fed fenugreek seeds than control. The correspondence increase in lactose percentage may be attributed to better assimilation of feed. The present findings agree with the findings of Biggs (2022) [14] who found significant increase in lactose content in Holstein cows fed with herbal galactagogue. There was increase in SNF percentage of milk in supplemented group might be attributed to the effect of fenugreek seed to act as appetite stimulant which lead to proper utilization of nutrients which ultimately increased solid-not-fat content (Bipate and Misra, 2020) [15]. The findings are comparable to the results of Revathi *et al.* (2020) [41] who found significantly higher SNF percent in fenugreek fed diet in crossbred cattle. Overall average protein percentage in T₀, T₁ and T₂ were 3.49±0.01, 3.52±0.01 and 3.59±0.02, respectively. Increase in protein percentage may be attributed to better utilization of feed which leads to increased energy density of the feed following increased milk yield and milk composition. Similar findings are observed by El-Nor (1999) [22] who evaluated the impact of fenugreek seeds on lactating buffaloes fed diets comprising 100 g and 200 g of fenugreek seeds and reported that total protein content increased as the amount of fenugreek seeds in the diet increased. Ash content in milk was also slightly in higher level in fenugreek fed groups than control. This increase in ash content might be the effect of mineral mixture which is being fed to the experimental animals during the whole period. The results agree with the findings of Choubey *et al.* (2017) [16] who studied the effect of different herbal supplements including fenugreek in lactating buffaloes and found that total ash contents were significantly higher in treatment groups as compared to control group. Although the values of specific gravity are within the normal range, statistically there were no significant differences between the treatment groups. The results agree with the findings of Patel *et al.* (2013) [37] who examined the combined effects of Shatavari, Jivanti and Fengreek on production performance of lactating Kankrej cows and found that there were no significant change in milk composition.

Cost of Feeding

The daily cost of feeding per cow was calculated and found to be Rs. 182.20 in T₀, Rs. 190.20 in T₁ and Rs. 195 in T₂, respectively. The lowest cost of production in terms of milk production in treatment group might be due to higher milk yield in treatment groups as compared to control group. This indicated that feeding of fenugreek seeds had positive impact on the economic efficiency.

Table 1: Chemical composition of fenugreek seed powder (% DM basis)

Nutrient (%)	DM	CP	EE	CF	NFE	Ash
Composition	92.44	26.78	4.03	6.76	53.50	3.89

Table 2: Average digestibility of various nutrients in lactating Sahiwal cattle in different treatment groups

Digestibility co-efficient	Treatment groups			P - value
	T ₀	T ₁	T ₂	
DM	71.12 ^a ±0.27	73.58 ^b ±0.26	74.72 ^c ±0.22	<0.001
CP	67.89 ^a ±0.11	65.54 ^b ±0.05	68.48 ^c ±0.07	0.005
CF	48.80 ^a ±0.37	50.04 ^a ±0.29	56.24 ^b ±0.28	0.005
EE	70.70 ^a ±0.05	70.98 ^a ±0.09	72.06 ^b ±0.08	0.002
NFE	77.14 ^a ±0.15	77.35 ^a ±0.04	78.13 ^b ±0.09	0.002
OM	72.97 ^a ±0.08	73.78 ^b ±0.06	75.34 ^c ±0.09	0.004

*^{ab} Mean values with different superscripts within row differ significantly.

Table 3: Average milk yield and milk composition of different treatment group during the experimental period

Sl. No.	Parameters	Treatment group			p-value
		T ₀	T ₁	T ₂	
1	Milk yield (lit)	7.00 ^a ±0.05	7.56 ^b ±0.08	8.39 ^c ±0.10	0.04
2	Fat (%)	4.18 ^a ±0.03	4.16 ^a ±0.04	4.35 ^b ±0.04	0.05
3	SNF(%)	8.65 ^a ±0.02	8.69 ^a ±0.03	8.75 ^b ±0.03	0.02
4	Lactose (%)	5.32 ^a ±0.02	5.37 ^a ±0.01	5.49 ^b ±0.03	0.02
5	Ash (%)	0.78 ^a ±0.02	0.78 ^a ±0.01	0.84 ^b ±0.01	<0.001
6	Specific Gravity	1.036±1.91	1.036±1.22	1.033±1.60	NS
7	Protein (%)	3.49 ^a ±0.01	3.52 ^a ±0.01	3.59 ^b ±0.02	0.05

*^{abc} Mean values with different superscripts within row differ significantly.

Conclusion

Based on the present findings it might be concluded that feeding of herbal supplement (Fenugreek seed) had shown encouraging results in the treatment group. Therefore, it can be concluded that feeding of herbal supplements (fenugreek seed) @ 50 g/cow/day is economically beneficial and imparts better result in terms of milk yield, milk composition and digestibility of the nutrients. However, further study may be carried out with more numbers of animals for a longer period to extend collaborate findings obtained in the present experiment.

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