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Supplementation of Shatavari (*Asparagus racemosus* Willd.) powder in buffalo as a galactagoguePardeep Kumar[♦], Kuldeep Singh Maan^{*}, Pooja^{**}, Ruchi Sharma^{***} and Dhawalkant Yadav^{****}

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Abstract

A study was performed in the field in which Shatavari (*Asparagus racemosus* Willd.) powder was supplemented in the buffaloes of having history of decrease in milk yield in current lactation as compared to previous lactation. *A. racemosus* is an ethnopharmacologically acclaimed ayurvedic medicinal plant, and called as 'Queen of Herbs'. The rate of supplementation was 50 g per day mixed with concentrate. Supplementation was done for 8 weeks period and milk yield was recorded weekly. Results showed that there was an increase in milk yield about 12.7% during the study period. As milk yield is the main source of income from the lactating animals, this study also calculated benefit cost ratio which revealed that supplementation of *A. racemosus* powder is financially beneficial to the farmers and also improve well being of the udder. So at field level, this study can help the farmers to increase their income with a very low-cost input.

1. Introduction

Animal husbandry has long held a vital role in India's agricultural practices and remains significantly pertinent in contemporary times, with a substantial portion of society actively involved and reliant upon it. India boasts a wealth of livestock diversity, fostering numerous distinct breeds adapted to diverse climatic conditions. Notably, the livestock sector exhibited a notable growth, showcasing a compound annual growth rate (CAGR) of 7.9% from 2014-15 to 2020-21 (measured at constant prices). Its contribution to the overall agriculture gross value added (GVA) at constant prices escalated from 24.3 in 2014-15 to 30.1% in 2020-21 (ICAR, 2021). This sector plays a vital role in the national economy, contributing 5% and directly engaging 80 million dairy farmers in employment.

Conversely, dairy animal productivity in India faces significant challenges stemming from a multitude of factors such as underfeeding, malnutrition, diseases, stress, and more. These issues collectively impede the economic growth of the dairy industry. To increase their production lactating animals, not only treatment but management also plays an important role. We can increase their performance improving their feeding regime. A variety of herbal

feed additives have been identified to potentially enhance nutrient utilization efficiency or stimulate the mammary glands' milk-secreting tissues (Bakshi and Wadhwa, 2000). India boasts a deeply rooted history in herbal medicine, notably through Ayurveda, one of the oldest healthcare systems globally. Galactagogues, known for enhancing lactation performance, have garnered significant commercial attention. However, contemporary consumer preferences are leaning towards natural and organic food options, redirecting focus towards herbal products that offer benefits to milk production.

A. racemosus stands out as a widely utilized herb in traditional medicine, primarily for its steroidal saponins and sapogenins content (Krishana *et al.*, 2005). Its medicinal applications have been documented in the Indian and British Pharmacopoeias and revered in traditional medicinal systems like Ayurveda, Unani, and Siddha. Ancient texts such as Charak Samhita, Susruta Samhita, and Astanga Samhita extol its advantageous effects, functioning as a galactagogue by elevating blood prolactin levels and fostering mammary gland cellular division (Kumar *et al.*, 2014). Previous studies by Patel *et al.* (2017) and Degirmencioglu *et al.* (2016) have highlighted its positive impact on milk production in ruminants. Additionally, *A. racemosus* has demonstrated enhancements in feed palatability, utilization, and overall animal productivity, leading to increased animal products, particularly heightened milk yield and improved composition (Kumar, 2015). It has also shown benefits such as early calving, improved feed conversion efficiency and increased immunity.

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Considering the described attributes of *A. racemosus* and its positive impact on diverse physiological functions, the research was designed to investigate the influence of a diet enriched with *A. racemosus* in lactating buffaloes, aiming to achieve the following objectives:

- To study the effect of *A. racemosus* supplementation on lactation performance and udder health.
- To work out the economics of this supplementation with help of benefit cost ratio.

The study was carried out with a hypothesis that *A. racemosus* effect on the mammary glands, balances hormonal level that eventually increases the milk production and subsequently enhances the income of poor farmers, as all the farmers cannot afford costly galactagogue.

2. Materials and Methods

The present study was conducted at field to evaluate the effect of supplementation of *A. racemosus* root powder on milk production in buffaloes. A total of 40 lactating buffaloes in their 3rd and 4th parity, experiencing reduced milk yield in the ongoing lactation compared to their previous cycles, were chosen with the consent of the owners in Meham, Rohtak, Haryana. These animals exhibited normal body conditions. Subsequently, 50 g of *A. racemosus* powder, purchased from a local grocery shop, was mixed with their concentrates and fed once daily for an 8-week supplementation period. The milk yield was recorded for individual animals with fairly intension on weekly basis for the whole period.

2.1 Shatavari (*A. racemosus*)

Shatavari (*A. racemosus*), referred to as the ‘Queen of Herbs’ in Ayurveda that has galactagogue properties in traditional medicine, undergone scrutiny by several researchers. Their investigations revealed the potential of its roots and extracts to address lactational inadequacies in lactation animals. The lactogenic impact was studied across various subjects, including guinea pigs, goats, buffaloes, and humans, yielding statistically significant results. Bharti and Kumar (2019) detailed *A. racemosus* as a common asparagus species found throughout India, typically reaching a height of 1 to 2 meters. Berhane and Singh (2000) provided insights into the root powder’s composition, *i.e.*, dry matter, crude protein, ether extract, ash, and nitrogen-free extract to be 91.0, 3.85, 0.66, 8.32, 13.15 and 74.02 per cent, respectively. *A. racemosus* was procured from local markets, sun-dried, ground, and then stored in airtight plastic bags. The term “Shatavari” (*A. racemosus*) translates to “curer of a hundred diseases” (shat meaning hundred and vari meaning curer), also known as Shatavar and Shatmul. Belonging to the Asparagaceae family, it is a renowned plant in ethnopharmacology and Ayurvedic medicine. Its medicinal applications have been acknowledged in the Indian and British Pharmacopoeias, as well as in traditional medical systems like Ayurveda, Unani, and Siddha. Ancient texts such as Charak Samhita, Susruta Samhita, and Astanga Samhita have also documented its advantageous effects

2.2 Mechanism of action

Feeding of *A. racemosus* root as supplements leads to an increase in the weight of mammary and adrenal glands. It also increases the release of ACTH (Adrenocortico tropic hormone) as a result of well-

developed lobular and alveolar tissues of mammary gland. Due to the mammogenic property on udder, *A. racemosus* is an effective enhancer of milk production. Prolactin plays a major role in lactogenesis. Chemical components of Shatavari (*A. racemosus*) root like saponins, shatavarside A and B along with filiasparoside-C act on pituitary and adrenal glands to release ACTH and prolactin. These hormones improve cell differentiation in mammary gland and thus increase the milk production.

2.3 Animals

A total number of 40 lactating buffaloes (3rd and 4th parity) were selected which had decreased milk production in comparison to previous lactation due to some disease in previous parity or in early lactation in current parity, with the consent of their owner. Buffaloes were fed on Barseem, Sorghum (according to the availability), wheat straw and concentrate (mainly cotton seeds). A full case history, owner complains and general health condition of each animal was recorded. Total supplementation period was of 8 weeks in which each animal was supplemented with 50 g *A. racemosus* powder once in day with concentrate. Maximum number of buffaloes were accepted it from first day of feeding.

2.4 Milk yield record

Milk yield was recorded just from 0 day, *i.e.*, before supplementation and on weekly basis upto 8th week regularly during supplementation period. Then mean milk yield of before supplementation and after supplementation (average of all the weeks) was compared.

2.5 Benefit cost ratio

After recording the milk yield and assessing cost of feeding of *A. racemosus* powder, benefit cost ratio was calculated.

2.6 Statistical analysis

The mean values (\pm SE) for milk yield of buffaloes were calculated on before supplementation and after supplementation. To determine the significance difference between both values, two sample independent *t*-test was applied using statistical package SPSS.

3. Results

A. racemosus powder supplementation had great effect on the average milk yield of the animals (Table 1). A total 12.27% increase in milk yield was documented just after supplementation of *A. racemosus* powder for only 8 weeks. The overall pharmacological attributes of Shatavari contribute to its galactagogue and mammogenic properties. It is due to its functions by elevating blood prolactin levels and stimulating cellular division within the mammary gland (Kumar *et al.*, 2008). Jingar *et al.* (2018) similarly arrived at the conclusion that *A. racemosus* exhibits lactogenic properties, enhancing milk production and the economic aspects of feeding dairy animals. Their findings indicated a 9.67% increase (0.60 ± 0.27 kg/day) in milk production in buffaloes following the supplementation of *A. racemosus*. Similarly, Kumar (2015) noticed that *A. racemosus* enhanced significantly added (10.43%) on daily milk production in buffaloes. The active principles, Shatavarin-I, II, III and IV stimulates the hypothalamus or directly pituitary gland and is antagonist to dopamine receptors, which in turn increases the prolactin secretion (Baig and Bhagwat, 2009), resulting in increased milk yield. In harmony of these findings, Sorathiya *et al.* (2023) also concluded that was nearly 11% rise in milk yield

was observed after supplementation of herbal galactogogue containing *A. racemosus*. The herbal galactogogue might be associated with stimulation of proliferation of alveolar secretory epithelial cells which are responsible for milk synthesis. Moreover, these herbs could have optimized the ruminal fermentation leading to

increased availability of nutrition for better production (Patel *et al.*, 2017). Samkuwar *et al.* (2005) reported comparable results, noting a substantial 10.43% increase in daily milk production in buffaloes within the treatment group due to *A. racemosus* supplementation. Tanwar *et al.* (2008) also observed a similar feeding pattern, indicating a 9% increase in milk yield.

Table 1: Difference in milk production after *A. racemosus* supplementation

| Animal | Average milk yield on before <i>A. racemosus</i> supplementation (Liter/day) | Average milk yield on after <i>A. racemosus</i> supplementation (Liter/day) | Average increase in milk yield due <i>A. racemosus</i> supplementation (Liter/day) | Percentage increase |
|----------|--|---|--|---------------------|
| Buffalo* | 7.19 ± 0.15 | 8.08 ± 0.22 | 0.89 ± 0.16 | 12.37% |

*Average of 40 buffaloes' production.

The livestock sector significantly contributes to the rural economy by providing household income and creating valuable employment opportunities in rural areas (Deokaran *et al.*, 2019). Herbal galactogogues are the cheapest source that can increase milk production. Our study revealed that the benefit cost ratio of the *A. racemosus* supplementation is 5.62:1 (Table 2). Supplementation costs only Rs 9.5 per day as compare to the cost of milk produced is Rs. 53.4. So, we can conclude that this supplementation is financially feasible at field level. Jinger *et al.* (2018) also revealed

that supplementation of *A. racemosus* in buffalo returned net income by Rs. 12.00/day/buffalo and the benefit cost ratio (B: C ratio) were 2.28:1 in buffalo. In addition to this, Meena *et al.* (2020) also concluded that farmers can earn an additional income of Rs. 60.50/day/animal by spent of additional Rs 10 for *A. racemosus* powder feeding. Similar to present findings, other workers (Sukanya *et al.*, 2014; Galbat *et al.*, 2014) reported that dietary supplementation of herbal galactogogue in dairy animals significantly increased milk yield.

Table 2: Benefit cost ratio of supplementation of *A. racemosus* powder

| Parameters | Values |
|--|-----------------------|
| Milk yield increases per day (Liter) | 0.89 ± 0.16 Per day |
| Cost of increased milk per day (Average cost of milk Rs. 60 per Liter in cooperatives dairy) | 0.89 x 60 = Rs. 53.4 |
| Cost of <i>A. racemosus</i> intact | 190 Rs per kg |
| Cost of daily feeding (50 g) per day | 190 x 0.05 = Rs. 9.5 |
| Net benefit | 53.4 - 9.5 = Rs. 43.9 |
| Benefit cost ratio | 5.62:1 |

Along with these findings, buffaloes' owners also observed that proper stimulation of milking response, well built udder, proper teat engorgement during milking, no incidence of mastitis in selected animals. Gabay (2002) articulated that the galactogogues *A. racemosus* is recognized for their ability to modify hormonal responses, primarily by exerting antagonistic effects on dopamine receptors, which result in increased prolactin secretion. Furthermore, these compounds play a role in stimulating alveolar tissue, thereby enhancing secretion, restoring, and regulating milk yield.

4. Discussion

Following an 8-week period of *A. racemosus* powder supplementation, a cumulative rise of 12.27% in milk production was documented in our study. Similarly, Samkuwar and colleagues in their study from 2005 documented comparable results, noting that *A. racemosus* caused a noteworthy surge of 10.43% in daily milk output among the buffaloes in the treatment group in our study. The expense for supplementation stands at a mere Rs. 9.5,

while the production cost of milk is considerably higher at Rs. 53.4. Likewise, Tanwar *et al.* (2008) reported analogous observations in their study, indicating a 9% increase in milk production through comparable feeding practices. Similarly, the investigation conducted by Jinger *et al.* (2018) and discovered that incorporating Shatavari supplementation for buffaloes resulted in a net daily profit of Rs. 12.00 per buffalo. The benefit-cost ratio (B:C ratio) for buffaloes was calculated to be 1:2.28.

5. Conclusion

A. racemosus, recognized for its galactogogue properties and as a tonic for mammary glands, stands out as an excellent herb. Its utilization not only enhances the health and productivity of animals but also aids farmers in increasing their income by boosting milk production. Consequently, it can be inferred that *A. racemosus* presents a cost-effective option as a galactogogue and is feasible for practical supplementation at the field level.

Conflict of interest

The authors declare no conflicts of interest relevant to this article.

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