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Effect of Shatavari (*Asparagus racemosus*) root powder supplementation on milk somatic cell count, hematological profile and physico-chemical characteristics of milk in Sahiwal cows

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Abstract

The present study was conducted to evaluate the effect of dietary supplementation of Shatavari (*Asparagus racemosus*) root powder on milk somatic cell count, hematological profile, body condition score and physico-chemical characteristics of milk in lactating Sahiwal cows. Eighteen lactating Sahiwal cows were randomly allocated into three groups comprising six animals each based on body weight and initial milk yield. Animals in the control group received only the basal diet, whereas cows in the treatment groups received the basal diet supplemented with 30 g and 60 g of Shatavari root powder per animal per day for a period of 90 days. Milk temperature, milk acidity, and lactometer reading were evaluated periodically during the experimental period. Hemoglobin concentration, packed cell volume, total erythrocyte count, total leukocyte count and selected differential leukocyte counts were also assessed along with body condition score. The results revealed that milk temperature, milk acidity, lactometer reading and body condition score did not differ significantly among the experimental groups. Similarly, all hematological parameters remained within the normal physiological range and were not significantly influenced by Shatavari supplementation. However, milk somatic cell count was significantly lower in cows receiving 60 g of Shatavari root powder compared with the control group, indicating improved mammary gland health. The findings suggested that supplementation of Shatavari root powder at 60 g per animal per day improved mammary gland health without adversely affecting milk physico-chemical characteristics, body condition score or hematological profile in lactating Sahiwal cows. Therefore, Shatavari root powder may be considered a safe and effective herbal feed supplement for improving milk quality and udder health in dairy cattle.

Keywords: *Asparagus racemosus*, hematological profile, milk quality, Sahiwal cow, somatic cell count, udder health

Introduction

Shatavari (*Asparagus racemosus*) is an important medicinal herb widely used in the Ayurvedic system of medicine because of its galactagogue, antioxidant, adaptogenic and immunomodulatory properties [1, 2]. The roots contain several biologically active compounds including steroidal saponins, flavonoids, alkaloids and polyphenols, which are responsible for its diverse pharmacological activities [1, 2]. The use of herbal feed additives in dairy production has gained considerable attention in recent years owing to increasing concerns regarding antibiotic residues and consumer preference for natural products. Shatavari has traditionally been used as a natural galactagogue and several studies have reported beneficial effects of its supplementation on milk production and milk composition in dairy animals [3]. Apart from its lactogenic effects, Shatavari possesses antioxidant and immunomodulatory properties that may contribute to improved physiological status and disease resistance in dairy cattle [1, 2]. The immunomodulatory activity of Shatavari has largely been attributed to steroidal saponins, which stimulate immune responses and enhance host defence mechanisms. Milk somatic cell count is considered one of the most reliable indicators of mammary gland health and milk quality in dairy animals [4, 5]. Elevated milk somatic cell count is generally associated with intramammary infection and subclinical mastitis, resulting in reduced milk quality and substantial economic losses to dairy producers [4, 5].

Furthermore, increased milk somatic cell count adversely affects the manufacturing properties and shelf life of dairy products and is therefore widely used as an indicator of udder health and hygienic milk production in dairy herds [6]. Nutritional interventions aimed at improving immune competence and reducing mammary inflammation have received increasing attention as supportive strategies for maintaining udder health in dairy cattle. Herbal feed supplements possessing antioxidant and immunomodulatory properties may help in reducing mammary gland inflammation and improving host defence mechanisms, thereby contributing to lower milk somatic cell count values and improved milk quality. Hematological indices are important indicators of the physiological and health status of animals and are commonly employed to assess the biological response and safety of dietary interventions [9, 10]. Similarly, body condition score and physico-chemical characteristics of milk provide valuable information regarding nutritional status, milk quality and suitability for processing and consumption. Information regarding the influence of Shatavari supplementation on milk somatic cell count, hematological profile, body condition score and physico-chemical characteristics of milk in indigenous dairy cattle is limited. Therefore, the present study was undertaken to evaluate the effect of dietary supplementation of Shatavari root powder on these parameters in lactating Sahiwal cows.

Materials and Methods

Experimental animals and management

The experiment was conducted at the Livestock Farm Complex (LFC), College of Veterinary Science and Animal Husbandry, Uttar Pradesh Pandit Deen Dayal Upadhyay Pashu Chikitsa Vigyan Vishwavidyalaya Evam Go-Anusandhan Sansthan (DUVASU), Mathura, Uttar Pradesh, India. Eighteen healthy lactating Sahiwal cows in the mid-lactation stage were selected and maintained under identical managemental conditions throughout the experimental period. All animals were individually identified using ear tags. The cows were maintained in a loose housing system under standard management practices followed at the Livestock Farm Complex. Fresh and clean drinking water was made available ad libitum throughout the experimental period and proper hygienic conditions were maintained in the shed. The animals were fed according to the nutrient requirements recommended by the Indian Council of Agricultural Research for lactating cattle [7]. An adaptation period of seven days was allowed prior to commencement of the feeding trial.

Experimental design and dietary treatments

After the adaptation period, the animals were randomly allocated into three treatment groups consisting of six cows each based on their body weight and initial milk yield to ensure uniformity among groups. Animals in the control group received only the basal diet, whereas cows in the treatment groups received the basal diet supplemented with Shatavari (*Asparagus racemosus*) root powder at the rate of 30 g and 60 g per animal per day, respectively, for a period of 90 days.

The Shatavari root powder was thoroughly mixed with the concentrate mixture and offered once daily during afternoon feeding to ensure complete consumption by the animals. All experimental animals were dewormed using fenbendazole

boluses administered twice at an interval of two weeks prior to initiation of the experiment.

Collection of milk and blood samples

Milk and blood samples were collected at fortnightly intervals throughout the experimental period for analysis of milk physico-chemical characteristics, milk somatic cell count and hematological parameters.

Determination of milk physico-chemical characteristics

Representative milk samples (100 mL) were collected from each experimental animal at fortnightly intervals during the study period. Milk temperature, pH and lactometer reading were determined using an ultrasonic milk analyzer (Lactoscan MCCWS 3080, Milkotronic Ltd., Bulgaria) according to the manufacturer's instructions.

Estimation of milk somatic cell count

Milk somatic cell count was determined using a Lactoscan Somatic Cell Counter 6010 (Milkotronic Ltd., Bulgaria). The values were expressed as $\times 10^3$ cells/mL of milk.

Body condition score assessment

Body condition score of all experimental cows was assessed at the beginning and at the end of the experimental period using a five-point scoring system described by Wildman *et al.* [8]. Body condition scoring was performed independently by three trained observers to minimize subjective variation. The assessment was based on the degree of fat cover over the vertebral column, prominence of spinous processes, fat deposition around the tail head region and visibility of ribs.

Blood collection and hematological analysis

Blood samples were collected aseptically from the jugular vein of each experimental animal at fortnightly intervals during the study period. Samples intended for hematological analysis were collected in ethylenediaminetetraacetic acid-coated vacutainer tubes and analyzed immediately after collection.

Hemoglobin concentration, packed cell volume, total erythrocyte count, total leukocyte count and selected differential leukocyte count parameters including lymphocytes, eosinophils and monocytes were determined using an automated veterinary hematology analyzer (Celltac α VET Hematology Analyzer, Nihon Kohden MEK-6550K, Japan) according to the manufacturer's instructions.

Statistical analysis

The data were analyzed using repeated measures analysis of variance under a completely randomized design using SPSS statistical software version 20.0 (SPSS Inc., Chicago, IL, USA). Differences among treatment means were considered statistically significant at $p < 0.05$.

Results

Effect of Shatavari root powder supplementation on milk physico-chemical characteristics

The effect of dietary supplementation of Shatavari root powder on milk physico-chemical characteristics in lactating Sahiwal cows is presented in Table 1. The overall mean milk temperature values recorded during the experimental period were 35.19 ± 0.15 °C, 35.21 ± 0.16 °C and 35.18 ± 0.15 °C in the control, 30 g Shatavari and 60 g Shatavari groups, respectively. Similarly, the corresponding mean

milk pH values were 7.23 ± 0.01 , 7.21 ± 0.02 and 7.23 ± 0.02 , whereas the mean lactometer readings were 31.46 ± 0.50 , 31.55 ± 0.55 and 31.68 ± 0.34 , respectively.

Statistical analysis revealed that supplementation of Shatavari root powder at either 30 g or 60 g per animal per day did not significantly ($p > 0.05$) influence milk temperature, pH or lactometer reading in lactating Sahiwal cows.

Effect of Shatavari root powder supplementation on milk somatic cell count

The effect of dietary supplementation of Shatavari root powder on milk somatic cell count in lactating Sahiwal cows is presented in Table 2. At the beginning of the experiment, milk somatic cell count values were comparable among the treatment groups. However, a gradual decline in milk somatic cell count was observed in the Shatavari supplemented groups during the experimental period, particularly in animals receiving 60 g Shatavari root powder per day.

Significant differences ($p < 0.05$) among treatment groups became evident from the 45th day onwards. The overall mean milk somatic cell count values recorded during the study were $130 \pm 02 \times 10^3$ cells/mL in the control group, $107 \pm 04 \times 10^3$ cells/mL in the 30 g Shatavari group and $97 \pm 04 \times 10^3$ cells/mL in the 60 g Shatavari group. The lowest milk somatic cell count was observed in animals receiving 60 g Shatavari root powder supplementation.

Effect of Shatavari root powder supplementation on body condition score

The effect of dietary supplementation of Shatavari root powder on body condition score of lactating Sahiwal cows is presented in Table 3. The initial body condition scores were comparable among the treatment groups, indicating uniformity of experimental animals at the commencement of the study.

At the end of the experimental period, the mean body condition score values were 2.79 ± 0.10 , 2.96 ± 0.12 and 3.05 ± 0.04 in the control, 30 g Shatavari and 60 g Shatavari supplemented groups, respectively. The overall mean body condition scores recorded during the study were 2.82 ± 0.04 in the control group, 2.90 ± 0.08 in the 30 g Shatavari group and 2.94 ± 0.05 in the 60 g Shatavari group.

Statistical analysis revealed that dietary supplementation of Shatavari root powder at either 30 g or 60 g per animal per day did not significantly ($p > 0.05$) influence body condition score in lactating Sahiwal cows.

Effect of Shatavari root powder supplementation on hematological parameters

The effect of dietary supplementation of Shatavari root powder on hematological parameters of lactating Sahiwal cows is presented in Table 4. The overall mean hemoglobin concentrations recorded during the experimental period were 9.48 ± 0.15 , 9.59 ± 0.12 and 9.83 ± 0.09 g/dL in the control, 30 g Shatavari and 60 g Shatavari supplemented groups, respectively. The corresponding packed cell volume values were 28.4 ± 0.46 , 28.6 ± 0.37 and $29.5 \pm 0.27\%$.

Similarly, the overall mean total erythrocyte count values were 6.17 ± 0.11 , 6.04 ± 0.10 and $6.03 \pm 0.09 \times 10^6/\mu\text{L}$, whereas total leukocyte count values were 9.78 ± 0.23 , 9.43 ± 0.26 and $9.87 \pm 0.34 \times 10^3/\mu\text{L}$ in the control, 30 g Shatavari and 60 g Shatavari supplemented groups, respectively.

The overall mean lymphocyte percentages were 56.16 ± 1.23 , 57.94 ± 0.90 and $59.11 \pm 0.98\%$, while eosinophil percentages averaged 3.60 ± 0.37 , 3.47 ± 0.26 and $3.72 \pm 0.45\%$ in the respective groups. Similarly, monocyte percentages were 0.35 ± 0.03 , 0.35 ± 0.05 and $0.40 \pm 0.06\%$ in the control, 30 g Shatavari and 60 g Shatavari supplemented groups, respectively.

Statistical analysis indicated that dietary supplementation of Shatavari root powder did not significantly ($p > 0.05$) affect any of the hematological parameters evaluated during the study. All hematological parameters remained within the normal physiological range throughout the experimental period.

Discussion

The present study demonstrated that dietary supplementation of Shatavari root powder had no significant effect on milk temperature, milk pH and lactometer reading in lactating Sahiwal cows. The values of these parameters remained within the normal physiological range throughout the experimental period, indicating that Shatavari supplementation did not alter the physico-chemical characteristics of milk. Similar findings have been reported in studies evaluating the galactopoietic effects of *Asparagus racemosus* in dairy animals [3]. The absence of significant changes suggests that supplementation with Shatavari root powder did not interfere with normal mammary secretory functions or milk composition.

Milk somatic cell count is considered an important indicator of udder health and milk quality in dairy animals [4, 5]. In the present study, a gradual decline in milk somatic cell count was observed in Shatavari supplemented groups, particularly in cows receiving 60 g of Shatavari root powder per day. The significantly lower milk somatic cell count observed in the higher supplementation group may be attributed to the antioxidant and immunomodulatory properties of steroidal saponins and other bioactive constituents present in Shatavari roots [1, 2]. These compounds may enhance immune competence and reduce mammary inflammation, thereby improving mammary gland health and reducing somatic cell infiltration into milk. Reduced somatic cell count has been recognized as an indicator of improved udder health and milk quality [4-6].

Although numerically higher body condition scores were observed in the supplemented groups, the differences among treatments were not statistically significant. The maintenance of body condition score within an optimum range across all treatment groups indicated that Shatavari supplementation did not adversely affect nutrient utilization, body reserves or energy balance in lactating Sahiwal cows. Body condition score remains an important indicator of nutritional and metabolic status in dairy cattle [8, 11].

The hematological parameters evaluated during the study remained within normal physiological limits and did not differ significantly among treatment groups. The absence of significant changes in hemoglobin concentration, packed cell volume, total erythrocyte count, total leukocyte count and differential leukocyte counts indicated that supplementation of Shatavari root powder was physiologically safe and well tolerated by the animals. Hematological indices are widely used to assess the physiological and health status of animals receiving dietary interventions [9, 10]. The results further suggest that Shatavari supplementation had no adverse effect on hematopoiesis, immune competence or general health status of lactating cows.

Table 1: Effect of Shatavari (*Asparagus racemosus*) root powder supplementation on physico-chemical characteristics of milk in lactating Sahiwal cows

Parameter	T ₁ (Control)	T ₂ (30 g)	T ₃ (60 g)
Milk temperature (°C)	35.19 ± 0.15	35.21 ± 0.16	35.18 ± 0.15
pH	7.23 ± 0.01	7.21 ± 0.02	7.23 ± 0.02
Lactometer reading	31.46 ± 0.50	31.55 ± 0.55	31.68 ± 0.34

Values are presented as overall mean ± SE. Differences among treatment groups were non-significant ($p > 0.05$).

Table 2: Effect of Shatavari (*Asparagus racemosus*) root powder supplementation on milk somatic cell count ($\times 10^3$ cells/mL) in lactating Sahiwal cows

Days	T ₁ (Control)	T ₂ (30 g)	T ₃ (60 g)
0	125 ± 09	130 ± 05	121 ± 08
15	127 ± 08	125 ± 07	117 ± 07
30	127 ± 07	119 ± 07	110 ± 05
45	132 ^b ± 07	107 ^{ab} ± 10	102 ^a ± 06
60	133 ^b ± 07	99 ^a ± 11	91 ^a ± 08
75	137 ^b ± 06	89 ^a ± 13	74 ^a ± 10
90	132 ^b ± 06	76 ^a ± 17	64 ^a ± 10
Overall mean ± SE	130 ^b ± 02	107 ^b ± 04	97 ^a ± 04

Values are expressed as mean ± SE. Means bearing different superscripts (a, b) within a row differ significantly ($p < 0.05$). SCC = Somatic cell count.

Table 3: Effect of Shatavari (*Asparagus racemosus*) root powder supplementation on body condition score of lactating Sahiwal cows

Observation	T ₁ (Control)	T ₂ (30 g)	T ₃ (60 g)
Initial BCS	2.85 ± 0.06	2.84 ± 0.30	2.83 ± 0.08
Final BCS	2.79 ± 0.10	2.96 ± 0.12	3.05 ± 0.04
Overall mean ± SE	2.82 ± 0.04	2.90 ± 0.08	2.94 ± 0.05

Values are presented as mean ± SE. Differences among treatment groups were non-significant ($p > 0.05$). BCS = Body condition score.

Table 4: Effect of Shatavari (*Asparagus racemosus*) root powder supplementation on hematological parameters of lactating Sahiwal cows

Parameter	T ₁ (Control)	T ₂ (30 g)	T ₃ (60 g)
Hemoglobin (g/dL)	9.48 ± 0.15	9.59 ± 0.12	9.83 ± 0.09
Packed cell volume (%)	28.40 ± 0.46	28.60 ± 0.37	29.50 ± 0.27
Total erythrocyte count ($\times 10^6/\mu\text{L}$)	6.17 ± 0.11	6.04 ± 0.10	6.03 ± 0.09
Total leukocyte count ($\times 10^3/\mu\text{L}$)	9.78 ± 0.23	9.43 ± 0.26	9.87 ± 0.34
Lymphocytes (%)	56.16 ± 1.23	57.94 ± 0.90	59.11 ± 0.98
Eosinophils (%)	3.60 ± 0.37	3.47 ± 0.26	3.72 ± 0.45
Monocytes (%)	0.35 ± 0.03	0.35 ± 0.05	0.40 ± 0.06

Values are presented as overall mean ± SE. Differences among treatment groups were non-significant ($p > 0.05$).

Conclusion

The present study demonstrated that dietary supplementation of Shatavari root powder in lactating Sahiwal cows improved mammary gland health as evidenced by reduced milk somatic cell count, particularly at the supplementation level of 60 g per animal per day. Supplementation did not adversely affect milk physico-chemical characteristics, body condition score or hematological profile, indicating that Shatavari root powder was safe and well tolerated by the animals. Therefore, Shatavari root powder may be considered a potential herbal feed supplement for improving milk quality and maintaining health status in dairy cattle.

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Conflict of Interest

The authors declare that there is no conflict of interest associated with this study.

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