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Effect of *Asparagus racemosus* Supplementation on Milk Yield and Composition During Summer Stress in Jersey Crossbred Cows

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ABSTRACT

The experiment was conducted at the Livestock Farm Complex, Veterinary College and Research Institute (VCRI), Tamil Nadu Veterinary and Animal Sciences University (TANUVAS), Orathanadu, Thanjavur, India to study the impact of *Asparagus racemosus* supplementation on milk yield and composition in Jersey crossbred cows during April–May, 2020 was studied. Twelve lactating crossbred cows were randomly assigned into two groups, as control and experiment. Experimental animals were given 200 mg kg^{-1} body weight of *Asparagus racemosus* root powder. The research carried out for the period of 30 days. The amount of milk produced was recorded daily. The composition of each animal's milk was analysed on weekly basis. The overall mean milk yield 6.38±0.13, 7.73 ±0.17 L, mean fat percentage 3.88±0.07, 4.68±0.12, mean protein percentage 3.46±0.02, 3.64 ±0.03, mean lactose percentage 3.65±0.04, 3.74±0.04, and mean solid non-fat percentage 7.73±0.06, 8.09±0.06 were obtained for control and experimental group respectively. The mean milk yield, fat percentage, milk protein percentage, lactose percentage and Solid Not Fat percentage were highly significant (p<0.01) in the experimental group as compare to control group. Supplementation with *Asparagus racemosus* substantially improved milk yield and milk composition in the present study. It can be used to alleviate the environmental heat stress in lactating Jersey crossbred cows.

KEYWORDS: Galactagogue, herbal, lactation, Shatavari, THI, heat

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Data Availability Statement: Legal restrictions are imposed on the public sharing of raw data. However, authors have full right to transfer or share the data in raw form upon request subject to either meeting the conditions of the original consents and the original research study. Further, access of data needs to meet whether the user complies with the ethical and legal obligations as data controllers to allow for secondary use of the data outside of the original study.

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1. INTRODUCTION

Livestock performance is affected by complex interactions between the individual animal and its environment (Lambertz et al., 2014). Many genetic and environmental factors, including as breed, lactation stage, and agro-climatic conditions, have been shown to alter the content of milk (Chandrakar et al., 2017). Climate change may have an impact on the welfare and output of livestock species. The higher environmental temperature experienced by dairy cows throughout hotter months has an effect on the animal's metabolism, physiology, productivity, and reproductive capacity (Bernabucci et al., 2010 and Bertocchi et al., 2014). Renna et al. (2010) found that milk fat, and protein composition decreased during the summer months of the year. The temperature humidity index (THI) may be used to determine the severity of heat stress on dairy cow productivity. Heat stress affects milk production when THI values exceed 72 (DuPreez et al., 1990).

India is one of the 17 larger biodiversity countries, with 15 agro-climatic zones. Among the 17000-18000 species of flowering plants in India, around 7000 have been identified as herbs. Medicinal plant-based formulations are generally used in Ayurveda, Siddha and Unani traditional medical systems (Anoymous, 2022). Plant-based medicine has been practised all over the world since ancient time. According to the World Health Organization, almost 80% of people depend on traditional herbal medicine system for basic health care (Anoymous, 1985). Therapeutic use of *Asparagus racemosus* has been recorded in the Indian and British Pharmacopoeias and in indigenous medical systems (Bopana and Saxena, 2007). Around 300 species of *Asparagus* are found all over the world, out of which 22 *Asparagus* species are found in India,

Asparagus racemosus is the most commonly utilised in traditional medicine. This genus is considered medicinally important due to the steroidal saponins and sapogenins found in different parts of the plant. Generally the roots are used in several therapeutic formulations (Bopana and Saxena, 2007). Ayurvedic system recommends *Asparagus* as a cooling agent and uterine tonic. The juice prepared with its root is quenching thirst, cool the body from summer heat, healing hyperacidity and peptic ulcers (Kumar et al., 2014). *Asparagus racemosus* contains the antitumor agent asparagine, which aids in the treatment of leukaemia. It also contains antispasmodic saponins, which have a specific effect on uterine contraction. It is an excellent uterine muscle relaxant, especially during pregnancy and is used to prevent preterm birth and preterm labour. It increases milk production in livestock such as cows and buffaloes (Kumar et al., 2014).

According to traditional medicine, *Asparagus* species overcomes all reproductive related problems and strengthens the general physiological system, including digestion, metabolism, defence system and reproductive system (Muwal et al., 2020). *Asparagus racemosus* was found to be aphrodisiac and galactopoietic in dairy animals (Kumar et al., 2010 and Santhosh et al., 2011). The indiscriminate use of feed additives, vitamins, minerals, hormones, medicines, and synthetic chemicals for an extended period of time is being used to increase milk production and this has a negative impact on normal health and is often prohibitively expensive. The herbal feed additives as alternative for safe and boost milk production in lactating animals (Behera et al., 2013).

Therefore, a supportive management intervention required which will reduce environmental stressors effect for improving general wellbeing and to improving productive performance in the cross bred cattle. The study was conducted to investigate the quantity of milk production and milk composition by feeding the root powder of *Asparagus racemosus* during the months of high environment temperature.

2. MATERIALS AND METHODS

The experiment was conducted at the Livestock Farm Complex, Veterinary College and Research Institute (VCRI), Tamil Nadu Veterinary and Animal Sciences University (TANUVAS), Orathanadu, Thanjavur, India, which is located in the Cauvery delta area of Tamil Nadu at a Latitude 10° 37' 0.12" N, Longitude 79° 16' 0.12" E and at an altitude of 57 metres above sea level. The trial was conducted in between April and May 2020, when the minimum and maximum temperatures were 24°C and 41°C respectively, with relative humidity (RH) ranging from 60–78 percentage (%) and THI between 82 and 86.

Twelve healthy lactating Jersey crossbred cows were randomly chosen and divided equally into (C) groups control and experimental (E) and based on, the stage of lactation (third to fourth month) parity (C =3.33, E =3.00) and body weight (C =332.33 kg, E =334.50 kg). Concentrate 4–5 kg day^{-1} was fed two times a day before milking based on the milk production. Dry fodder of 3–4 kg day^{-1} and green fodder 20 kg day^{-1} (Hybrid Napier variety Co 4, Co 5 and CoFS29) was fed on rotational basis. Animals were fed 10–12 kg dry matter and 650 grams digestible crude protein in a day. The animals were given formulated ration based on the farm's requirement (ICAR, 2010) and feeding schedule. Clean drinking water was provided *ad libitum*. Prophylactic steps against infectious diseases and parasites were implemented according to the farm's health calendar. The animals were housed in sheds. Animal sheds were well-ventilated with concrete floor and asbestos roofing which

sloped away from the drains to avoid wetness.

The research was conducted in between April and May 2020, when the ambient THI levels were gradually increasing. *Asparagus racemosus* roots were harvested and powder prepared at Herbal garden, Ethnoveterinary Herbal Research Centre, VCRI, TANUVAS, Orathanadu, Thanjavur, India. The experimental group were supplemented with *Asparagus racemosus* root powder @ 200 mg kg^{-1} body weight (Kumar et al., 2010). Milk output was calculated two times a day and averaged over the course of a week. Once in a week, the milk composition was examined using a milk analyser (AMA, Mini -40, Akashganga®). In due course, environmental parameters were recorded and averaged on a weekly basis (Table 1). Wind speed and solar radiation adjusted THI formula of Mader et al. (2006) was used to measure animal distress more precisely.

Temperature Humidity Index (THI)=(0.8×Ambient Temperature)+[(% Relative Humidity/100)×(Ambient Temperature–14.4)]+46.4.

Table 1: Weekly mean of temperature humidity index

Sl. No.	Week	THI
1.	1	84.08±0.29
2.	2	84.63±0.29
3.	3	84.24±0.32
4.	4	84.08±0.35

Statistical analysis of experimental data was performed using the independent student "t" test (Snedecor and Cochran, 1994)

3. RESULTS AND DISCUSSION

Data refer to the effect of *Asparagus racemosus* supplementation on milk production and composition is presented in Table 2. In the control and experiment groups, the overall mean milk yield was 6.38±0.13 and 7.73±0.17 litres (L), respectively (Table 2). When compared to the control group, supplemented crossbred cows should led to an increase in milk yield. Mean milk yield of experiment animals was significantly (p<0.01) higher when compare the control animals. The milk yield of the control animals decreased at the end of the trial, while it was increased during first two weeks and remained merely constant during last two weeks in experiment animals (Table 3).

In the control and experiment groups, the overall mean milk fat content was 3.88±0.07 and 4.68±0.12%, respectively (Table 2). The results indicated that fat percent was significantly (p<0.01) higher in *Asparagus racemosus* supplemented animals when compared to control animals. The milk fat in the control group decreased steadily till the end of the experiment, while it was remained stable in the experiment animals, despite a minor fluctuation in the third week (Table 3).

Table 2: Effect of *Asparagus racemosus* supplementation on overall mean of milk yield and its composition

Sl. No.	Parameters	Control Mean±S.E	Experiment Mean±S.E
1.	Milk yield (L)	6.38±0.13	7.73 ±0.17
2.	Fat (%)	3.88 ±0.07	4.68±0.12
3.	Protein (%)	3.46±0.02	3.64 ±0.03
4.	Lactose (%)	3.65±0.04	3.74±0.04
5.	SNF (%)	7.73±0.06	8.09±0.06

The overall mean milk protein content in control and trial groups was 3.46±0.02 and 3.64±0.03 per cent respectively (Table 2). The results indicated that milk protein was significantly (p<0.01) higher in *Asparagus racemosus* given animals when compared to control animals. The milk protein of the control group was maintained the same level in the first two weeks and then slightly decreased during the last two weeks, while in experimental animals it was maintained, though there was a slight fluctuation in the first week (Table 3).

In the control and experiment groups, the overall mean milk lactose content was 3.65±0.04 and 3.74±0.04 %, respectively (Table 2). The results indicated that milk lactose was significantly (p<0.01) higher in *Asparagus racemosus* given animals when compared to control animals. The milk lactose of the control group was slightly increased in the second week and decreased till the end of the experiment, whereas in experimental animals, it was maintained even though a slight variation was present in the second week (Table 3).

The overall mean milk Solid not Fat (SNF) in control and experiment groups were 7.73±0.06 and 8.09±0.06%, respectively (Table 2). The results indicated that SNF was significantly (p<0.01) higher in *Asparagus racemosus* supplemented animals when compared to control animals. The milk SNF of the control group slightly increased in the second week and decreased until the end of the research, whereas in experiment animals, it was maintained even though slight instability was present in week three (Table 3).

The results of the study group in terms of milk yield, fat, protein, lactose and SNF percent were agreed with those of Kumar et al. (2012) and Patel et al. (2016) who also found significant results in the experiment group except lactose increased non significantly reported by Kumar et al. (2012).

The reduction of milk yield, fat, protein, lactose and SNF in control group were due to summer stress and in agreement with Nasr and Tarabany, 2017 and Kumar et al., 2019.The reduction of milk yield, fat, protein, lactose, and SNF was in

Table 3: Effect of *Asparagus racemosus* supplementation on weekly mean of milk yield and its composition

Sl. No.	Week	Milk yield (L)		Fat (%)		Protein (%)	
		Control Mean±S.E	Experiment Mean±S.E	Control Mean±S.E	Experiment Mean±S.E	Control Mean±S.E	Experiment Mean±S.E
1.	Pre	7.03 ±0.68	7.18±0.77	4.12±0.12	4.57±0.31	3.55±0.04	3.65±0.04
2.	1	6.7±0.27	7.53±0.33	4.12±0.15	4.67±0.34	3.57±0.05	3.72±0.09
3.	2	6.4±0.27	7.85±0.34**	3.95±0.13	4.62±0.43	3.5±0.06	3.60±0.06
4.	3	6.24±0.28	7.79±0.36**	3.88±0.1	4.82±0.19**	3.4±0.03	3.62±0.10
5.	4	6.20 ±0.23	7.76±0.33**	3.58±0.14	4.63±0.12**	3.38±0.05	3.63±0.08**

Table 3: Continue..

Sl. No.	Week	Lactose (%)		SNF (%)	
		Control Mean±S.E	Experiment Mean±S.E	Control Mean±S.E	Experiment Mean±S.E
1.	Pre	3.80±0.09	3.60±0.15	8.07±0.14	8.19±0.10
2.	1	3.68±0.08	3.65±0.13	7.86±0.1	8.07±0.17
3.	2	3.87±0.08	3.9±0.11	8.00±0.12	8.21±0.19
4.	3	3.57±0.08	3.67±0.08	7.56±0.12	7.95±0.13
5.	4	3.50±0.04	3.73±0.03**	7.47±0.08	8.16±0.03**

Means bearing "**" mark within a row, within the parameter differ significantly (p<0.01)

agreement with Ahmad et al. (2018). According to Gaafar et al. (2011) heat stress decreased milk fat, protein, lactose, and SNF value from 3.79, 3.20, 4.78, and 8.69 % during the winter months to 3.49, 3.07, 4.59, and 8.34 % respectively during the summer months in Egypt's delta region.

High THI had a major impact on milk yield and composition. Reduced feed intake and nutrient absorption by the cow portal vessels drained viscera might be the cause for reduced milk output during heat stress (Gantner et al., 2011). Blood flow directed towards peripheral tissues for thermoregulation can change nutrient metabolism and lead to reduced milk production in hot weather (Gantner et al., 2011).

As the temperature of the atmosphere rises, fatty acid synthesis decreases, which results drop in milk fat (Yasmin et al., 2012). Reduced milk protein content may be attributed to a decrease in dry matter consumption and a decrease in energy intake (Yasmin et al., 2012). Furthermore, high THI can infuriate the neuroendocrine system, which can impact on energy and water balance, hormonal balance, and body temperature, disrupting development, reproduction, milk production and the body defence system (Cappa, 1998).

To the fullest extent of literature search, no literature exists to compare the effect of *Asparagus racemosus* on milk production and its quality during summer heat stress.

Herbal feed supplement may influence feeding patterns, promote the growth of beneficial microorganisms in the rumen and stimulate the secretion of various digestive enzymes. This may improve nutrient utilisation efficiency or stimulate the milk secreting tissue in the udder, resulting in increased dairy animal productivity and reproduction (Bakshi and Wadhwa, 2000).

A herbal formulation containing *Asparagus racemosus* was found to have immense adaptogenic activity was reported by considering chronic stress induced metabolic, physiological and behavioural changes could be reversed (Singh and Geetanjali, 2016). The fluctuations happened in present experimental values might be because of *Asparagus racemosus* supplement adaptogenic actions. During the environmental heat stress, *Asparagus racemosus* adaptogenic and feed additive properties can help to combat heat stress and maintain milk production and its composition.

4. CONCLUSION

A supportive management intervention by supplementing *Asparagus racemosus* reduced summer stress effect and improved productive performance in the crossbred cattle. Therefore, *Asparagus racemosus* can be supplemented to alleviate the summer heat stress which maintains productivity in lactating Jersey crossbred animals.

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