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Effect of Dietary Inclusion of Cumin Seed (*Cuminum cyminum*) on Voluntary Feed Intake, Milk Yield, Milk Quality and Udder Health of Dairy Cows

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ABSTRACT

Background: Plants containing essential oils can be a cost-effective means of improving efficiency of milk production and optimizing milk composition of dairy cows. *Cuminum cyminum* (green cumin) belongs to the Apiaceae family and is a well-known herbal medicine in Iran. The medicinal properties of cumin may have beneficial effects on milk production. However, very few studies have been reported whereby cumin has been fed to ruminants. Therefore, the present study is design to investigate the effect of cumin supplementation on milk yield, milk quality and udder health of lactating dairy cows.

Methods: Twelve multiparous lactating cows at early stage of lactation was selected and randomly allotted to two equal groups (n=6) on the basis of milk yield. In addition to normal routine feeds and fodders, cows in groups T1 was fed cumin seed @ 50 g/d/head for 90 days. Fortnightly body weight was determined on the basis of body measurement of animals. All feed samples was analysed for proximate composition, Ca and P. The daily milk yield (kg/d) of individual cows was recorded by weighing. Milk samples were collected after complete milking and thorough mixing for determination of milk composition. Udder health was monitored by MCMT (modified california mastitis test), measuring milk pH and SCC (somatic cell count) at fortnightly intervals.

Result: The results indicated that overall mean body weight, average DMI was statistically (P>0.05) similar in both the groups. The average milk yield (kg) of animals was statically non significant (P>0.05) but numerically 20.64% higher milk yield was observed in cumin seed supplemented group than control group. There was no effect of cumin supplementation on chemical composition (Fat, TS, SNF, Lactose and Protein) of milk in dairy cows. Overall mean milk pH and somatic cell count (SCC) in both the groups was statically similar but numerically lower in treatment group. The overall mean (%) of MCMT positive animals was 14.29 and 9.52 in T_0 (Control) and T_1 (Treatment) groups, respectively. From the results it can be deduced that the cumin seed (*Cuminum cyminum*) supplementation improves milk yield by 20.64%. However, it has no effect on composition of milk in dairy cows. Supplementation improved the udder health and found no effect on dry matter intake (DMI) in dairy cows.

Key words: Cumin seed, Milk yield, Milk composition, Udder health.

INTRODUCTION

Beneficial effects of herbs in farm animals may arise from the activation of feed intake and the secretion of digestive secretions, immune stimulation and antibacterial activity. Herbs can also contribute to the nutrient requirements of the animals, stimulate the endocrine system and intermediate nutrient metabolism. Plants containing essential oils can be a cost-effective means of improving efficiency of milk production and optimizing milk composition of dairy cows (Tassoul and Shaver, 2009). *Cuminum cyminum* (green cumin) belongs to the Apiaceae family and is a well-known herbal medicine in Iran. Herbal medicines and essential oils from cumin have been shown to have medicinal value for treating digestive disorders, toothaches, wounds, hoarseness, epilepsy and jaundice (Muthamma *et al.,* 2008; Moghaddam *et al.,* 2015). Moreover, Bhatt *et al.* (2009) reported that cumin has galactapoiesis properties and the fruits are used to stimulate breast milk production in Iranian traditional medicine (Hashemian *et al.,* 2013). The medicinal properties of cumin may have beneficial effects on milk production. Due to the above mentioned benefits of cumin

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feeding and very few studies have been reported whereby cumin has been fed to ruminants. Therefore, the present study is design to investigate the effect of cumin supplementation on milk yield, milk quality and udder health of lactating dairy cows.

MATERIALS AND METHODS

The experiment was conducted in month of September to December 2019 at Ahilyamata Gaushala, Indore (M.P.). Twelve multiparous lactating cows at early stage of lactation was selected and housed in a separate shed of having provision of both open and close space. Proper health management and sanitation conditions were maintained throughout the experimental period.

Animals were divided into 2 groups of 6 each on the basis of milk yield (4.72 kg) and body weight (407 kg) following randomized block design (RBD). The cow in group T_0 was not given any supplement (control). In addition to normal routine feeds and fodders, cows in groups T_1 was given cumin seed @ 50 g/d/head for 90 days. All the animals were fed standard seasonally available roughages *viz*. MP chari, wheat straw and concentrates mixture throughout the study period of 90 days to meet nutrient requirement (ICAR 2013). Chemical composition of the experimental feeds fed to the animals is presented in Table 1. The milking was performed twice daily at 5 AM and 4 PM and milk yield (MY) was recorded daily at each milking using an electronic digital balance. Fortnightly body weight was determined on the basis of body measurement of animals by using the Shaeffer's formula (Sastry *et al*., 1982). During experimental period, daily feed offered and residue leftover was recorded to determine voluntary feed intake at fortnightly intervals. All feed samples was analysed for proximate composition as per the standard procedures (AOAC, 2005) and fibre fractions (Van Soest *et al.,* 1991).

Milk fat, protein, solid not fat (SNF), lactose and total solids were analyzed by Electronic Lactoscan (Milk Analyser ISO 9001. 2000 and serial no. 5565). For the analysis, thoroughly mixed milk sample was taken in the bottle and transferred in a clean receptacle provided with lactoscan. Udder health indices; pH (Model pHep-HI 70300), Somatic Cell Count (Dang and Anand, 2007) and MCMT (Sastry, 1978) were measured fortnightly. Economics of feeding was calculated by considering expenditure on feeds and cumin seed and returns from the sale of milk. Data pertaining to feed intake, milk yield, milk composition and udder health were subjected to independent 't' test. All analysis were performed using statistical package SPSS (20.0).

RESULTS AND DISCUSSION

Effect of dietary inclusion of cumin seed on voluntary feed intake of dairy cows

Feeding cumin did not make any significant change in voluntary dry matter intake, but numerically the treatment group consumed more than the control (Table 2). Similar intake of DM is suggestive of no adverse effects of cumin seed on palatability. Similar, to our findings, Morsy *et al.* (2018) reported that there was no any effect on feed intake by supplementation of cumin seed in Dammascus goats. Patel *et al*. (2017) was also revealed no effect on feed intake by supplementation of herbal galactogogue. Similarly, Miri *et al.* (2013) were also recorded that the feeding of cumin seed in lactating goat did not affect the dry matter intake. In contrary to ours finding, some researchers observed variation in dry matter intake by supplementation of cumin seed in dairy cows (Ghafari *et al*. 2015; Durrani *et al.* 2007).

Effect of dietary inclusion of cumin seed on milk yield (kg/d) of dairy cows

In the present study, there was no significant (P>0.05) change in milk production was observed due to cumin feeding at different fortnights in both the groups (Fig 1), The results revealed that the fortnightly average milk yield (kg/d) at different fortnights were similar between the experimental groups and did not differ significantly (P>0.05). However, the percentage increased (P>0.05) in milk was 20.64% in cumin seed supplemented group. In agreement to this, Ghafari *et al.* (2015) observed that there was an increase in milk yield by supplementation of cumin seed in dairy cows. Morsy *et al.* (2018) was also revealed that there was increase in milk yield by supplementation of mustard and cumin seed in different groups of Damascus goats. Similarly, Bhatt *et al.* (2009) also reported that there was higher (P<0.05) milk yield in herbal preparation (Ruchamax or Payapro) supplemented lactating crossbred cows. Similar

Table 1: Chemical (% DM basis) composition of feed ingredients.

Particulars (%)	Concentrate mixture	MP chari	Wheat straw	Cumin seed
Dry matter (DM)	91.2	20.8	86.8	92.3
Crude protein (CP)	15.6	4.9	3.6	16.2
Ether extract (EE)	2.5	1.12	1.3	11.1
Crude fibre (CF)	9.4	34.0	38.0	39.0
Total ash (TA)	10.6	9.1	9.4	9.1
Nitrogen free extract (NFE)	61.9	50.8	47.7	24.6
Neutral detergent fibre (NDF)	34.4	60.6	71.3	32.8
Acid detergent fibre (ADF)	10.9	31.2	48.2	20.8
Calcium (Ca)	1.16	0.61	0.44	1.17
Phosphorus (P)	0.98	0.33	0.13	0.8

Table 2: Effect of dietary inclusion of cumin seed on dry matter intake, milk yield and milk composition of dairy cows.

Fortnights	T_0 (control)	T_1 (treatment)	Level of significance
Avg. DMI (Kg/d)	8.68±0.38	10.40±0.28	0.36
Avg. BW (Kg)	407±28.93	417±10.07	0.07
Overall mean milk yield (Kg/d)	4.31±0.33	5.20±0.61	0.43
% increased in milk yield	-	20.64 %	
Milk composition			
Milk fat (%)	4.42±0.02	4.28±0.01	0.41
Milk SNF (%)	8.24 ± 0.01	8.27±0.01	0.78
Milk lactose (%)	4.41±0.02	4.63±0.02	0.30
Milk protein (%)	3.24±0.03	3.45±0.02	0.58
Milk total solid (%)	12.66±0.03	12.53±0.02	0.65
Fat corrected milk (FCM) %	4.55±0.35	5.40±0.63	0.45
Solid corrected milk (Kg/d)	4.51±0.31	5.65±0.68	0.31
Energy corrected milk (Kg/d)	6.09±0.48	7.38±0.86	0.44
Milk gross energy (Kcal/kg)	755.49±1.88	741.01±1.28	0.42

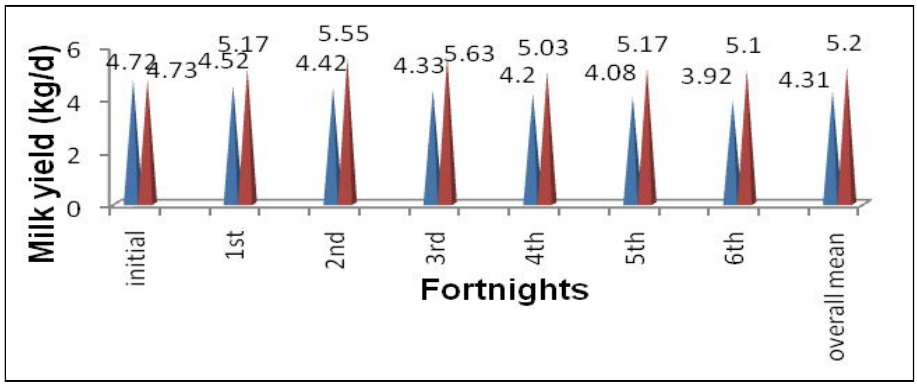

Fig 1: Effect of dietary inclusion of cumin seed on milk yield (kg/d) of dairy cows.

results were also observed by Patel *et al.* (2017) and Goswami *et al.* (2018) in dairy cows. In agreement with present results, Chandra *et al.* (2017) also observed that there was an increase in milk yield by supplementation of poly-herbal mixture in Murrah buffaloes. Like present experiment findings, many scientists also found that feeding cumin seedand other polyherbal preparation leads to increase in milk production in animals of different species (Mahmoud and Ghoneem (2014); Galbat*et al*. (2014); Ramesh *et al.* (2000); Kumar and Kumar (2018) and Gautam *et al.* (2019). Earlier scientists have found that feeding cumin brings about a significant change in feed utilization and rumen fermentation and for this reason there is an increase in milk production (Morsy *et al.* 2018). Feeding cumin seeds in the present study also have shown 20.64% increase in average milk yield in dairy cows, it might be due to galactagogues effect of cumin seed and its effect on ruminal fermentation and feed utilization.

Effect of dietary inclusion of cumin seed on milk composition of dairy cows

From the results, it may be deduced that the milk composition (Milk fat, SNF, lactose, milk protein, total solid, FCM, SCM, ECM and GE) has not affected by cumin seed supplementation in dairy cows (Table 2). Present findings were akin to that of Chandra *et al.* (2017) who also observed no significant change in milk protein, lactose and SNF but the values were numerically higher in poly-herbal mixture supplemented groups. Correspondingly, Miri *et al.* (2013) was also found that the cumin seed extract supplementation had no effect on milk fat, protein and lactose percentage in lactating dairy cows. In contrast to present results, Galbat *et al.* (2014) observed that feeding cumin rich feed additives significantly ($P<0.05$) increases milk protein, total solid and SNF in Egyptian dairy goats. Some scientists have also found that feeding herbal feed additives changes the chemical composition of milk in a meaningful way (Kumar and Kumar (2018); Patel *et al.* (2017); Mirzaei*et al.* (2012) and Mahmoud and Ghoneem, 2014)

Effect of dietary inclusion of cumin seed on udder health of dairy cows

For the study of udder health, we have mainly determined the somatic cell count, milk pH an MCMT in the milks of dairy cows and their results are presented in Table 3 and 4. In the current study, there was no significant ($p>0.05$) change in the pH value of milk in both the groups, but in the treatment group, milk pH was numerically higher than the control.

The blood-milk barrier is damaged in clinical mastitis and sub clinical mastitis (SCM) and mammary epithelial tight junctions become leaky, leading to the escape of blood and extracellular fluid components into the lumen of the alveolus and a decrease in milk secretion rate (Nguyen and Neville, 1998). Blood and extracellular fluid components in inflamed quarters mix with secreted milk (Zhao and Lacasse, 2008) and increase milk pH, with the magnitude of the increase being positively associated with the severity of the inflammatory process (Qayyum *et al.,* 2016). Similar to present experiment results, Preciado *et al.* (2011) observed that the 12 per cent reduction of milk pH by supplementation of herbal galactogogue in Holstein cows. Similarly, Garg and Singh (2008) and Bharti *et al*. (2015) also reported significantly higher (P<0.05) pH in mastitic milk compared to normal quarter milk. Similar results were also obtained by Kolte *et al.* (2008) in which they observed that the untreated control group showed non significant increase in pH throughout the experimental period.

Modified California mastitis test (MCMT) were assessed following 0, 1st, 2nd, 3rd, 4th, 5th and 6th fortnight of experimental period and the data generated are presented in Table (3). Results of modified california mastitis test (MCMT) revealed that the overall mean (%) of the MCMT positive animals was 14.29 and 9.52 in T_0 (Control) and T_1 (Treatment) group, respectively. Similar to these findings, Sharma *et al*. (2014) reported reduced occurrence of subclinical mastitis in cows with supplementation of poly herbal in dairy cow. Nurdin *et al*. (2011) reported that the decrease of mastitis by feeding of herbs in dairy cow. Kumar *et al.* (2011) also revealed reduction of subclinical mastitis by supplementation of *shatavari* in crossbred cows. Weghmare (2005) also found that 52.38 per cent decrease subclinical mastitis by therapeutic efficacy of autogenous vaccine with herbal drugs in lactating cows.

Table 3: Effect of dietary inclusion of cumin seed on modified california mastitis test of dairy cows.

Fortnights	T_0 (control)	T_1 (treatment)
	No. of test (Positive)	
Initial	03	02
1st	01	01
2nd	00	00
3rd	00	00
4th	01	00
5th	00	00
6th	01	01
Overall mean%	14.29	9.52

Effect of dietary cumin seed supplementation on somatic cell count

In dairy cows, the somatic cell count (SCC) is a useful predictor of subclinical mastitis and therefore, it is an important component of milk in terms of quality, hygiene and mastitis control (Harmon, 1994). The SCC plays a protective role against infection in bovine mammary gland as a normal part of defense mechanism. The SCC below 5 x 10^5 cells/ml is considered to be normal (Youl and Nicholls, 1987). In the present study the overall mean values of somatic cell count (10^5) were 2.37±0.05 and 1.98±0.09 in T_0 and T_1 group, respectively and it lies within the normal physiological range (SCC, 1.91-2.43) in dairy cattle (Youl

Table 4: Effect of dietary cumin seed supplementation on milk somatic cell count and milk pH of dairy cows.

Fortnights	T_0 (Control)	T_1 (Treatment)	Level of significance
Somatic cell count			
Initial	2.43± 0.14	2.42±0.14	0.96
1st	2.37±0.11	1.99±0.13	0.86
2nd	2.35±0.08	1.93±0.12	0.50
3rd	2.28±0.07	1.82±0.10	0.36
4th	2.43±0.03	1.80±0.08*	0.05
5th	2.35±0.05	1.91±0.05	0.19
6th	2.42±0.03	2.02±0.05	0.35
Overall mean ±SE	2.37±0.05	1.98±0.09	0.40
Milk pH			
Initial	6.90±0.05	6.84±0.05	0.67
1st	6.79±0.06	6.57±0.08	0.62
2nd	6.85±0.06	6.51±0.06	0.99
3rd	6.79±0.07	6.40±0.03*	0.03
4th	6.69±0.06	6.35±0.05	0.22
5th	6.91±0.06	6.61±0.06	0.79
6th	6.73±0.09	6.55±0.08	0.43
Overall mean±SE	6.81±0.02	6.55±0.02	0.74

*shows significance at 5% level as compared to control group (P <0.05).

and Nicholls, 1987). In the present study, the values of SCC were approaching towards lower in the T_1 group during all fortnights although statistical difference was non- significant ($P>0.05$), it means udder health might be improved due to cumin seed supplementation. Increase of SCC indicated inflammatory reaction and might be due to shift of leucocytes to the udder after entry of infection in the mammary gland and as a protective mechanism against infection (Murcus *et al.*, 1994). Current results corroborated well with the findings of other workers (Sharma *et al.* 2014; Singh *et al.* 2019; Kumar *et al.* (2011); Azadi *et al.* (2011) and Preciado *et al.* (2011). In Corroboration, Chandra *et al.* (2017) also observed that the Somatic cell count (SCC) was significantly ($P<0.05$) lower in poly-herbal mixture and butyric acid supplemented groups as compared to control group in Murrah buffaloes.

From the results it can be deduced that the cumin seed (*Cuminum cyminum*) supplementation improves the milk yield However, it has no effect on chemical composition of milk in dairy cows. Supplementation also improves the health of the udder in the treatment group while, supplementation did not affect the voluntary dry matter intake in dairy cows.

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