Animal Feed Science and Technology 210 (2015) 276–280

Contents lists available at ScienceDirect

Animal Feed Science and Technology

journal homepage: www.elsevier.com/locate/anifeedsci

Short communication

Cumin seed improves nutrient intake and milk production by dairy cows

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A R T I C L E I N F O

Article history:
Received 28 August 2015
Received in revised form 31 October 2015
Accepted 1 November 2015

Keywords:
Cumin
Essential oils
Performance
Blood metabolites

A B S T R A C T

A study was conducted to determine the effects of dietary supplementation with cumin seed (*Cuminum cyminum*) on nutrient intake, milk production and blood metabolites of lactating dairy cows. Eight Holstein dairy cows (average days in milk, 35 ± 5; body weight, 660 kg ± 15) were allocated to a replicated 4 × 4 Latin square design with four 21-d periods. Experimental diets contained increasing doses of cumin seed: 0 (control group), 100, 200 and 300 g/cow/d. Diets were prepared as a total mixed ration and delivered four times daily. Each period included 14 d of adaptation and 7 d of sampling for dry matter intake (DMI), milk production and composition, and blood metabolites. The DMI increased curvilinearly ($P \leq 0.05$) from 22.8 to 25.2, 26.0 and 25.8 kg/d when 0, 100, 200 and 300 g/d cumin seed were fed, respectively. Also, milk yield increased curvilinearly with level of cumin seed (average 47.9, 52.5, 55.1, and 53.6 kg/d for the four levels, respectively; $P \leq 0.05$). The yield of milk components was similar to milk yield ($P \leq 0.05$) except for fat and 4% fat-corrected milk yields, which were not significantly affected by the treatments. The concentration of glucose, blood urea nitrogen, and beta-hydroxybutyric acid in the blood were unaffected by the treatments but the concentration of cholesterol tended to be decreased ($P = 0.08$) with increasing cumin seed in the diet. In general, our findings indicate that supplementing lactating dairy cow diets with up to 200 g/d of cumin seed could improve performance, but a further increase in level of supplementation might result in reduced efficiency.

1. Introduction

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, 2008). *Cuminum cyminum* (green cumin) belongs to the Apiaceae family and is a well-known herbal medicine in Iran. *C. cyminum* has its origins in Egypt, Turkistan, and the eastern Mediterranean area. It is cultivated widely in Iran, China, India, Morocco, southern Russia, Japan, Indonesia, Algeria, and Turkey (Tuncturk

Abbreviations: ADF, acid detergent fibre; BHBA, beta-hydroxybutyric acid; BW, body weight; CP, crude protein; DM, dry matter; DMI, dry matter intake; ECM, energy corrected milk; EE, ether extract; FCM, 4% fat-corrected milk; aNDF, neutral detergent fibre assayed with a heat stable amylase and expressed inclusive of residual ash; NE_L, net energy of lactation; OM, organic matter; SNF, solids-not-fat; TS, total solids.

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http://dx.doi.org/10.1016/j.anifeedsci.2015.11.001
0377-8401/

Table 1
Composition and nutrient content of the diet and cumin seed.

Item	Diet	Cumin seed
Ingredients (g/kg of DM)		
Alfalfa hay	163	–
Maize silage	203	–
Beet pulp	56	–
Ground barley grain	199	–
Ground maize grain	131	–
Soybean meal	105	–
Extruded soybean seed	36	–
Whole cotton seed	52	–
Fish meal	23	–
Sodium bicarbonate	11.6	–
Calcium carbonate	7.7	–
Salt	3.9	–
Vitamins	4.5	–
Minerals	4.5	–
Chemical composition[a] (g/kg of DM unless otherwise stated)		
DM (g/kg of as fed diet)	450	952
OM	921	912
CP	186	221
EE	41	146
aNDF	320	328
ADF	195	208
NFC[b]	375	324
Gross energy[c] (Mcal/kg DM)	–	5.1
Total phenolic content (μg/mg extract)	–	40
Total flavonoid content (μg/mg extract)	–	11.5

[a] DM, dry matter; OM, organic matter; EE, ether extract; aNDF, neutral detergent fibre assayed with a heat-stable amylase and expressed inclusive of residual ash; ADF, acid detergent fibre; NFC, non-fibre carbohydrates.
[b] Calculated as 1000 – (g/kg NDF + g/kg CP + g/kg fat + g/kg ash).
[c] GE was not measured for diet as there was no sample remaining.

and Tuncturk, 2006). 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). Cumin can also activate digestive enzymes (Muthamma et al., 2008). An in vitro study showed preventive effects of cumin on growth and acid production of *Lactobacillus plantarum* (Kivanc et al., 1991). 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. However, only one study has been reported whereby cumin has been fed to ruminants; dairy goats supplemented with cumin seed showed improvements in milk production, rumen fermentation and milk fatty acid (FA) composition (Heidarian Miri et al., 2013). Therefore, a study was conducted to determine the effects of feeding varying levels of cumin seed on nutrient intake, milk production and blood metabolites of lactating dairy cows.

2. Materials and methods

The experiment was conducted at the milk and meat producing company of Sultan Mohammadi (Isfahan, Iran). Animals were cared for according to the guidelines of the Iranian Council of Animal Care (1995) with approval from the Institutional Animal Care Committee for Animals Used in Research. Eight multiparous lactating Holstein dairy cows (660 ± 15 kg body weight (BW); mean ± SD) averaging 35 ± 5 d in milk and producing 47 ± 2 kg/d of milk were used. Cows were blocked by parity (4 with parity of 2 and 4 with parity of 3) and randomly assigned to a replicated 4 × 4 Latin square experimental design with four dietary treatments: 0, 100, 200, and 300 g/d of ground (daily) cumin seed (*C. cyminum*) seeds. All diets were formulated to meet the requirements of a 680 kg multiparous cow producing 47 kg/d of milk according to NRC (2001) (Table 1).

Experimental periods were 21 d in duration, with 14 d for diet adaptation followed by 7 d for data collection. Cows were individually fed and housed in pens (3 m × 3 m) in an open sided barn. Diets were offered as total mixed rations four times daily and at two of these feedings, the appropriate amount of cumin was mixed with 4 kg of ration and offered to the cows. Cows were fed for ad libitum intake allowing for 10% refusals.

On the last 7 d of each period, dry matter intake (DMI) was determined for each cow, with samples of ration offered and refused (orts) weighed daily. Samples were collected daily and pooled by period (and by cow for the orts) and dried at 55 °C in a forced-air oven for 48 h and ground to pass a 1-mm screen using a Wiley mill (Arthur H. Thomas Co., Philadelphia, PA, USA). The following analyses were conducted on feed samples: crude protein (CP) (AOAC, 2000: method 955.04), ether extract (EE) (AOAC, 2000: method 920.39), heat-stable amylase neutral detergent fibre (aNDF) (Sigma A3306; Sigma–Aldrich, Steinheim,