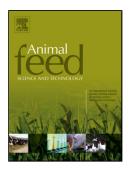
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Title: Effects of *Radix Bupleuri* extract supplementation on lactation performance and rumen fermentation in heat-stressed lactating Holstein cows



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ACCEPTED MANUSCRIPT

1 Effects of *Radix Bupleuri* extract supplementation on lactation performance and

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rumen fermentation in heat-stressed lactating Holstein cows

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8 ABSTRACT: Radix Bupleuri extract (RBE) has been shown to mitigate negative effects of high ambient temperature. This 9 experiment was conducted to investigate effects of RBE supplementation on lactation performance and rumen fermentation in 10 Holstein cows under heat stress. Forty Holstein cows (75±15 d in milk, 37.5±1.8 kg of milk/d, and 1.7±0.4 parity) were randomly 11 assigned to one of four groups (n=10). One of four treatment diets, assigned randomly to one of four groups, consisted of RBE 12 supplementation at 0, 0.25, 0.5 or 1.0 g/kg of the basal diet (concentrate and roughage) based on dry matter (DM). Cows were 13 housed in a tie-stall barn and were individually fed the treatment diets. The experiment lasted for 10 wk in hot summer. During 14 the experiment, average ambient temperatures and temperature-humidity indexes (THI) were respectively 27.5±1.5°C, 15 29.8±1.9°C and 28.1±1.7°C, and 78.2±2.7, 79.8±3.3 and 78.3±3.4 at 0600, 1400 and 2200 h. Average respiration rates (RR) with 16 RBE at 0.25, 0.50 and 1.0 g/kg were 65.6, 60.3 and 67.4, respectively vs. 71.4 (breaths/min) for the control (P<0.01). Average 17 rectal temperatures (RT) were 39.1, 39.0 and 39.1 vs. 39.3°C for the control (P<0.01). Moreover, cows supplemented with RBE 18 increased dry matter intake (DMI, 22.8, 21.6 and 22.1 vs. 20.9 kg/d) (P<0.05) and milk production (34.2, 33.4 and 32.4 vs. 31.6 19 kg/d) (P<0.01) compared with control. Percentages of milk protein and fat were similar among groups, while milk protein yield 20 increased with increasing level of RBE (0.97, 0.95 and 0.92 vs. 0.89 kg/d for the control) (P<0.01). Milk fat yield also increased 21 with RBE (1.13, 1.12 and 1.09 vs. 1.02 kg/d for the control) (P<0.05). There was no treatment effect on diet apparent 22 digestibility or volatile fatty acid (VFA) concentration among groups. Overall, supplemental RBE at 0.25 or 0.5 g/kg could 23 mitigate the negative effects of heat stress on production in lactating Holstein cows. 24 Keywords: Dairy cow; Radix Bupleuri extract; Heat stress; Lactation performance; Rumen fermentation

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Abbreviations: RBE, *Radix Bupleuri* extract; DM, dry matter; DMI, dry matter intake; THI, temperature-humidity index; RR,
respiration rate; RT, rectal temperature; VFA, volatile fatty acid; AOAC, Association of Official Analytical Chemists; CP, crude
protein; EE, crude fat ether extract; C, control; SCC, somatic cell count; SCC, milk urea nitrogen; FCM, 4% fat-corrected milk;
ECM, energy-corrected milk.

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31 1. Introduction

Environmental-induced hyperthermia compromises efficient animal production and jeopardizes animal welfare and therefore is a significant financial burden in the dairy industry (Wrinkle et al., 2012). Dairy cows suffering from heat stress during the summer markedly decreased feed intake and milk yield (Wheelock et al; 2010), compromised rumination and nutrient absorption (Collier et al., 1982), and increased respiratory rate and sweating (West, 2003). Unabated heat stress could decrease more than 50% of feed intake and more than 10% of milk production (Wheelock et al; 2010). Additional maintenance requirements were thought to exceed 30% for homeothermia in heat-stressed cows (Fox and Tylutki, 1998). Heat-stressed lactating cows presented a negative energy balance due to these collective changes. The decline in nutrient intake has previously

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