Influence of dietary Quebracho tannin extract on milk fatty acid composition in dairy cows.
(Einfluss von Quebrachotanninextrakt in der Ration auf das Milchfettsäuremuster bei Milchkühen)

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Beside the ability of condensed tannins to form reversible complexes with feed proteins, they are also able to inhibit rumen microbial growth and activity. Hence, the milk fatty acid composition could be altered caused by a modulation of rumen biohydrogenation (RBH). Therefore, the aim of our study was to evaluate the effect of Quebracho tannin extract (QTE) on saturated (SFA) and unsaturated fatty acids (USFA) as well as on linoleic acid, linolenic acid, rumenic acid, vaccenic acid and stearic acid as indicators for modulation of RBH.

Methods: Fifty Holstein dairy cows were divided into two groups according to milk yield, lactation number, days in milk (DIM) and body weight (33.2 ± 8.2 kg/d, 2.30 ± 1.59, 114 ± 73 d and 638 ± 58 kg, respectively). Cows were fed a basal diet as total mixed ration as control treatment (Con), based on grass/maize silage and concentrate (65:35). The QTE was supplemented to the basal diet at levels of 15 ($QTE_{1.5}$) and 30 g/kg DM (QTE_{30}). The study was performed with six experimental periods (P) of 21 days (13 days of adaptation and 8 days of feed and milk sampling). Due to technical limitations only two treatments could be tested simultaneously. Treatments were arranged along the six P as follows: P1, Con-Con; P2, Con-QTE_{15}; P3, QTE_{15}-Con; P4, Con-QTE_{30}; P5, QTE_{30}-Con; P6, Con-Con, respectively. Milk samples were collected from every cow once a day, alternating between morning and afternoon milking from d 14 to 21, and pooled per cow according to milk yield. Milk fatty acid composition (g/100 g fatty acids) of pooled samples was determined by gas chromatography. The statistical program R was used. In order to adjust the treatment effect, milk yield [kg/d] and DIM were taken as covariates and an analysis of covariance was conducted. Multiple contrast tests were followed to test for interactions between P and treatment and to determine effect of treatment. Afterwards, the QTE effects were estimated for an experimental cow with an average milk yield, lactation day and DIM of 32.4 kg/d, 178 d and 2.3, respectively, based on linear regression equation. Significant effects were declared at $P<0.05$.

Results: The milk SFA content decreased and, simultaneously, milk PUFA content increased when feeding 15 and 30 g QTE/kg DM. The ratio SFA/USFA in the milk fat showed a decrease with increasing level of QTE. Both QTE treatments resulted in a stepwise increase of linoleic (*c9c12*-C18:2) and linolenic acid content (*c9c12c15*-C18:3), and decrease of rumenic acid content (*c9t11*-C18:2) as the main isomer of conjugated linoleic acid. Compared with Con, the QTE decreased the content of vaccenic acid (*t11*-C18:1). Interestingly, the end product of RBH, stearic acid (C18:0) was higher in QTE_{15} and QTE_{30}.

Fatty acid	Intercept			Slope of covariate		Estimated QTE effect		
(g/100 g FA)	Con	QTE_{15}	QTE_{30}	b_1	b_2	Con	QTE_{15}	QTE_{30}
SFA	$63.3^a \pm 0.19$	$62.7^b \pm 1.39$	$61.7^c \pm 1.35$	1.201*	0.020*	66.7	66.1	65.1
PUFA	$4.17^c \pm 0.18$	$4.37^b \pm 0.18$	$4.83^a \pm 0.17$	-0.142*	0.013*	4.26	4.46	4.92
SFA/USFA	$1.78^a \pm 0.12$	$1.74^b \pm 0.12$	$1.64^c \pm 0.12$	0.113*	0.002*	2.10	2.06	1.96
Linoleic acid	$1.79^c \pm 0.08$	$1.98^b \pm 0.08$	$2.31^a \pm 0.08$	-0.058*	0.004*	1.78	1.97	2.3
α-Linolenic acid	$0.63^c \pm 0.03$	$0.67^b \pm 0.03$	$0.78^a \pm 0.03$	-0.022*	0.0001	0.58	0.62	0.73
Rumenic acid	$0.50^a \pm 0.05$	$0.46^b \pm 0.05$	$0.42^c \pm 0.05$	-0.032*	0.003*	0.52	0.48	0.44
Vaccenic acid#	$1.32^a \pm 0.21$	$1.20^b \pm 0.21$	$1.20^b \pm 0.20$	-0.088*	0.014*	1.56	1.44	1.44
Stearic acid	$10.9^c \pm 0.55$	$11.2^b \pm 0.55$	$12.3^a \pm 0.54$	0.002	-0.029*	9.97	10.3	11.4

b_1, slope of covariate lactation number; b_2, slope of covariate milk yield (kg/d); PUFA, poly unsaturated fatty acids; #Detected incl. *t10*-C18:1; abcDifferent superscripts indicate significant treatment effects ($P<0.05$), *indicates significant effect of covariates ($P<0.05$)

Conclusions: The milk fat composition was modified by feeding 15 and 30 g QTE/kg DM. The simultaneous increase of linoleic and linolenic and the decrease of rumenic and vaccenic acid in milk fat indicates for modulation of RBH at initial step of isomerization. The latter was probably either due to a direct inhibition of rumen microbes or of their enzymes. Dietary QTE have the potential to improve the milk quality regarding the PUFA.