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Long-chain and Unsaturated Aldehydes Alter Enteric Microbiota

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When heated, unsaturated fats undergo peroxidation, leading to the formation of oxidation products. For example, heating *cis*-9,*cis*-12-C18:2 majorly forms 13OOH *cis*-9,*trans*-11-C18:2 (13HPOD), hexanal and *trans*-2,*trans*-4-decadienal (T2T4D). In ruminants, some studies using heated seeds and oils reported an effect of heated fats on ruminal metabolism of fatty acids, which could affect milk and meat fat qualities for consumers. One possible explanation is a modification of the ruminal bacterial community, as peroxides and aldehydes are known to have antimicrobial effects. In order to investigate the effects of these 3 oxidation products on ruminal microbiota, a long term in vitro study was conducted. Rumen fluid was incubated for 54h or 102h with addition of fermentation substrate and oxidation products every 24h. Blanks without oxidative products served as bacterial community controls.

Bacterial density (qPCR), diversity (Simpson index) and community structure (CE-SSCP) were determined in incubated ruminal cultures. Density and diversity indexes of bacterial community were analyzed using by analysis of variance. To compare the structure of the bacterial communities, pairwise Euclidean distances of the CE-SSCP profiles were calculated. Global analysis of similarity (ANOSIM) was performed to test the fixed effects of oxidation products. The ANOSIM-R value indicates the extent to which the groups differ and is between 0 (no separation) and 1 (well separated groups). Finally, an iterative Mann-Whitney test was carried out on the 1700 scans of the CE-SSCP profiles to estimate the percentage of population that differed between blank and the treatment.

Bacterial density was not modified by treatments: 1.10^{10} DNA copies / ml of cultures, on average. Hexanal and 13HPOD had no effect on ruminal bacterial diversity and community, whereas T2T4D reduced bacterial diversity (7.6 vs. 8.0 for controls) and strongly affected bacterial community. This effect increased with incubation duration: T2T4D affected ($P < 0.05$) 21% (R-ANOSIM = 0.46) and 49% of scans (R-ANOSIM = 0.92) after 54 and 102h of incubation, respectively.

Ruminal microbiota was strongly modified by T2T4D. Bacterial species sensitive to T2T4D need to be identified and whether it could also affect enteric microbiota in other species should be investigated.