Federal Department of Home Affairs FDHA
Federal Food Safety and Veterinary Office FSVO
Research Management

The use of roughages to improve health and welfare of male pigs

Mirjam Holinger[1], Barbara Früh[2], Peter Stoll[3], Edna Hillmann[1,4]
[1]Insitute of Agricultural Sciences, ETH Zurich, CH-8092 Zürich, [2]FiBL Research Institute of Organic Agriculture, CH-5070 Frick, [3]Agroscope, CH-1725 Posieux, [4]Current address: Humboldt-Universität zu Berlin, Institute of Agricultural and Horticultural Sciences, DE-10099 Berlin

Key words
Entire male pigs, roughages, chronic stress, gastric ulcers, cortisol, tail biting

Aim of the study
The aim of this project was to generate basic knowledge as well as possible solutions to the two following questions: (1) Does chronic stress level differ between entire and castrated male pigs? and (2) Is the provision of roughages, additionally to concentrate feed and straw, an appropriate measure to reduce the prevalence of gastric ulcers and damaging behaviours in fattening pigs? In order to look into interacting effects, the two questions were investigated both separately and in combination.

Material and methods
The first experiment in the research station of Agroscope comprised 147 entire and castrated male growing-finishing pigs in a 2x2x2 factorial design and housed in groups of three. The factors were castration (yes/no), chronic intermittent social stress exposure (with/without) and provision of grass silage (yes/no). Chronic stress was induced by repeated short-term confrontations with unfamiliar pigs as well as short-term separations. Parameters of interest were behaviour (play, resting, activity, feeding, damaging and agonistic behaviour), skin and tail lesions, circadian rhythm of cortisol, reaction of salivary cortisol to ACTH injection, gastric ulceration, performance, and meat and fat quality.
The second experiment was carried out under on-farm conditions on six organic farms. Two pens with growing-finishing pigs per farm received grass silage additionally to straw, and two pens acted as controls with straw only. Parameters of interest were behaviour (activity, feeding/occupation, play behaviour), skin and tail lesions, gastric ulceration and fat quality.

Results and significance
Experiment 1: Chronic intermittent social stress exposure affected behaviour, gastric health and lipid metabolism. Stress-treated pigs displayed less posture changes and less head knocking/biting. Their stomachs exhibited more pathological damages and gastric ulcers. Moreover, theses pigs had thicker backfat with a lower proportion of polyunsaturated fatty acids. We did not find evidence for a difference in baseline level of chronic stress between entire and castrated male pigs. However, interactions between stress treatment and castration suggested that the behavioural response to stress was more pronounced in entire male pigs. Castrated males, on the other hand, had a considerably higher concentration of basal salivary cortisol throughout the day, whereas the temporal course did not differ between entire and castrated males.
Giving pigs access to grass silage reduced pen-mate directed manipulations and prevalence of gastric ulcers. Feed conversion ratio was improved in groups with grass silage towards the end of the finishing period, probably due to a larger fill of the digestive system as indicated by the concomitantly lower dressing percentage. Meat and fat quality were hardly affected by grass silage provision.
Experiment 2: Observations from the on-farm experiment revealed that pigs with access to grass silage increased the overall proportion of time spent with either grass silage or straw. Prevalence of tail lesions was in general very low, and nearly absent in groups with grass silage. Severe damages of the gastric mucosa and gastric ulcers were found in pigs of two farms only and were less frequent in pigs with access to grass silage.

The results of this project can be summarized in the two following conclusions: (1) there were no indications that baseline level of chronic stress is increased in entire male compared to castrated male pigs and (2) the provision of grass silage is an appropriate method to reduce manipulative behaviours and gastric ulceration.

Publications, posters and presentations

Holinger, M. 2018. Roughages and chronic stress in entire and castrated male pigs: Effects on health, behaviour and performance. Doctoral thesis, ETH Zurich.

Holinger, M., Früh, B., Stoll, P., Pedan, V., Kreuzer, M., Berard, J., Hillmann, E. 2018. Long-term effects of castration, chronic intermittent social stress, provision of grass silage and their interactions on performance and meat and adipose tissue properties in growing-finishing pigs, *Meat Science*, 145, 40-50.

Holinger, M., Früh, B., Stoll, P., Graage, R., Wirth, S., Bruckmaier, R., Prunier, A., Kreuzer, M., Hillmann, E. 2018. Chronic intermittent stress exposure and access to grass silage interact differently in their effect on behaviour, gastric health and stress physiology of entire or castrated male growing-finishing pigs. *Physiology & Behavior,* 195, 58-68.

Holinger, M., Früh, B., Stoll, P., Kreuzer, M., Hillmann, E. 2018. Grass silage for growing-finishing pigs in addition to straw bedding: Effects on behaviour and gastric health. *Livestock Science,* 218, 50-57.

Wirth, S., Graage, R., Kreuzer, M., Hillmann, E., Holinger, M., Hilbe, M. 2018. Einfluss einer Verfütterung von Grassilage auf die Darm-Morphologie von Mastschweinen. In: Zukunft der Tierernährung zwischen Effizienz und Konsumentenansprüchen (Kreuzer, M., Lanzini, T., Liesegang, A., Bruckmaier, R., Hess, H.D. und Ulbrich, S.E., Hrsg.). ETH-Schriftenreihe zur Tierernährung, Bd. 41, Zürich, Switzerland, p. 117-120

Holinger, M., Früh, B., Stoll, P., Graage, R., Kreuzer, M., Hillmann, E. 2017. Änderungen in Verhalten und Gesundheit von männlichen Mastschweinen als Reaktion auf einen chronisch intermittierenden Stress. In: Aktuelle Arbeiten zur artgemässen Tierhaltung, KTBL-Schrift, Darmstadt, Germany, p. 138-148

Holinger, M., Früh, B., Stoll, P., Kreuzer, M., Hillmann, E. 2017. Does giving access to grass silage improve health of growing-fattening pigs in organic fattening farms? In: Proc. 7th Int. Conf. Assessment of Animal Welfare at Farm and Group Level (De Jong, I.C. and Koene, P., eds.). Wageningen Academic Publishers, Wageningen, The Netherlands, p. 151

Holinger, M., Früh, B., Stoll, P., Graage, R., Kreuzer, M., Hillmann, E. 2017. Reduziert die Vorlage von Grassilage das Auftreten von Magengeschwüren bei Mastschweinen? In: Klimawandel und Nutztiere: eine wechselseitige Beeinflussung (Kreuzer, M., Lanzini, T., Liesegang, A., Bruckmaier, R., Hess, H.D. und Ulbrich, S.E., Hrsg.). ETH-Schriftenreihe zur Tierernährung, Bd. 40, Zürich, Switzerland, p. 114-117

***Project** 2.15.03*

***Project duration** 01.05.2015-30.04.2018*