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## Effect of a pH-lowering litter amendment on animal-based welfare indicators and litter quality in a European turkey husbandry

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### Summary

The main effect from litter moisture on foot pad lesions is proved in several studies. Foot pad lesions can occur already very early. High prevalences were found in many studies. Therefore, management measures need to be developed to minimize the risk of footpad lesions and severe dermatitis in particular. The aim of the current study was to determine the possible effects of sodium bisulfate (SBS), litter parameters (dry matter content (DM) and pH-value (pH)) on the prevalence of foot pad dermatitis (FPD). On a research farm four groups were kept under conventional conditions. In each group 71 one-day old male turkey poults were placed and housed until slaughtering. Bedding material was wood shavings during rearing and chopped straw during fattening period. In two of the four groups 4g sodium bisulfate per 100g litter material was spread on top of the litter before poults placing. This was repeated at birds age of 14 days and at the first time when spread chopped straw. From that time on the interval of SBS application was every third date of dispersing chopped straw on top of the bedding. The other two groups were kept as control groups without SBS treatment (Con). Litter parameters, foot pads and body weights of the same randomly sampled birds were recorded weekly (rearing) or every second week (fattening). The study was repeated twice and SBS and Con pens varied between the two cycles. No significant ( $p > 0.05$ ) effect was found for mortality (SBS 10.4% vs. Con 12.2%). At time of slaughtering no differences were observed in body weight ( $p=0.815$ ,  $p=0.879$ ). The incidence of FPD was reduced in SBS groups compared to Con ( $p=0.001$ ,  $p=0.000$ ). DM was similar in SBS and Con groups during husbandry period, but before chicks, placing litter pH was reduced by

SBS application to 2.9, compared to 6.1 in Con groups. Litter pH in SBS groups increased over time and converged with pH of Con between day 36 and 50. The results of the present study indicate an effect of SBS treatment on foot pad health in turkeys without an influence on body weight development and mortality. Nevertheless, alternative supplementation rates of SBS need to be proved in further studies. Furthermore, different dispersal intervals, the influence of litter material on pH-value and FPD as well as climate parameters should be investigated and also proved in field trials.

## Introduction

Foot pad dermatitis (FPD) is one of the main welfare concerns in broiler and turkey husbandry (De Jong et al. 2014, Youssef et al. 2010). Litter moisture has been proven to be the main effect on foot pad health (Mayne et al. 2007, Wu and Hocking 2011, Youssef et al. 2010). Additionally, to litter moisture the pH-value and ammonia content of litter were pointed out to be closely related to the progress of FPD (Abd El-Wahab et al. 2012, Ziegler et al. 2013). To minimize the risk of foot pad lesions and severe dermatitis suitable management measures need to be developed. The application of a pH-lowering litter amendment, Poultry litter treatment (PLT), is a common and proven management measure in US poultry production (Li et al. 2013). The main effect is a reduction of pH value in litter, which reduces microbial activity, and thus reduces ammonia release (Li et al. 2013, McWard and Taylor 2000). Positive effects on foot pad health were proven in studies with broilers under US husbandry conditions, e.g. by Li et al. (2013) and Nagaraj et al. (2007), but not in turkey flocks yet. So the aim of the current study was to prove effects of a sodium sulfate-complex on the prevalence of FPD in turkey flocks, under consideration of performance data of the birds and litter quality parameters (dry matter content (DM) and pH-value (pH)).

## Material and methods

On a research farm 71 birds were kept in each of four boxes under conventional conditions. In each box one-day old male turkey poults were placed and housed until slaughtering. Bedding material were wood shavings during rearing and chopped straw during fattening period. In two of the four boxes 4g of the salt-complex per 100g litter material was spread on top of the litter before poult placement (SBS group). This was repeated at

birds' age of 14 days and at the first time when chopped straw was spread. From that time on the interval of SBS application was every third date of dispersing chopped straw on top of the bedding. 20 litter treatments were conducted over the whole period. Birds in the other two boxes were kept as control group without a litter treatment except dispersing new bedding material on top (Con). Litter parameters, foot pad health and body weights of 60 randomly sampled birds per SBS and Con - group were recorded weekly (rearing) or every second week (fattening). The macroscopic foot pad scoring was in accordance to the five-point scale from Hocking et al. (2008). All feet were assessed post mortem. Litter pH-value was measured by a Microprocessor, which was calibrated using a buffer for pH 4.00, 7.00, and 9.20. DM content of the litter was determined 3 times according to weight loss after drying the pooled litter samples in a forced-draft oven for 24 h at 105°C (Darr method, DIN 52,183).

## Results and discussion

Mortality rate after 146 days was 12.7 % in SBS group and 12.0 % in Con group. The number of losses corresponds to 9 (SBS) or rather 8 birds (Con) and no effect on livability after using a pH-reducing litter treatment was published in several broiler studies (Li et al. 2013, McWard and Taylor 2000, Tasistro et al. 2007). At time of slaughtering the average body weight of birds in both groups were similar (SBS Mean 19,523.9 g, SD 1,556.6 and Con Mean 19,554.6 g, SD 1,417.0).

The incidence of FPD was significantly reduced in SBS groups compared to Con. Results are presented in Table 1, the effect was proven from the first week until slaughtering.

**Table 1:** Percentage of FPD prevalence at day 8, 36 and post mortem (p.m.), in accordance to the macroscopic scoring System Hocking et al. (2008), Score 0- unaffected foot pad to Score 4- more than 50% necrotic foot pad

Day	n/ group	SBS					Con					p
		Score					Score					
		0	1	2	3	4	0	1	2	3	4	
8	60	58.1	41.7	0.0	0.0	0.0	38.4	61.7	0.0	0.0	0.0	*
36	60	28.4	71.7	0.0	0.0	0.0	15.0	71.7	13.4	0.0	0.0	*
p.m.	230	5.2	38.3	35.7	17.4	3.5	0.0	13.9	48.7	33.9	3.5	**

p: Mann-Whitney U-test, significant differences between groups, \*  $p < 0.05$ , \*\*  $p < 0.001$

DM in litter was similar in SBS and Con groups during husbandry period. At time of turkey poult placement DM was about 88 % in both groups and decreased to 68 % (SBS) and 67 % (Con) at the end of rearing (day 36). At day 147 the average DM was 42.9 % in SBS group and 41.6 % in the Con group. In contrast to that litter pH-value was highly different between groups from day 1 to day 36. Litter treatment reduced the average pH-value to 2.9 in SBS group versus 6.1 without any treatment. Up to the end of rearing the mean pH-value increased to pH 5.2 in SBS group, compared to 6.8 in the Con group. That litter parameter ended up at pH 6.8 on SBS groups and 6.7 in Con group at day 147. The results show that hygroscopic characteristic of the salt-complex did not affect DM in litter (see Li et al. 2013). Bedding material seems to have an influence, due to the use of chopped straw after day 36 and a similar course of pH-value in both groups at the same time although litter treatment was at every third litter dispersing date during fattening. The better foot pad health with more unaffected feet in SBS group p.m. (5.2% vs. Con none) and less feet in noticeable categories Score 3 and 4 (SBS 20.9 % vs. Con 37.4%) would support the statement of an antimicrobial effect by a reduced pH in litter (see Blake and Hess 2001, McWard and Taylor 2000).

## Conclusion

The results of the present study indicate a positive effect of the litter treatment with a sodium sulfate-complex on foot pad health in turkeys, without an influence on body weight and mortality. Nevertheless, alternative supplementation rates of SBS need to be proved in further studies. Furthermore, different dispersal intervals, the influence of litter material on pH-value and FPD as well as climate parameters like ammonia should be investigated and also proved in field trials.

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