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Impact of Clinoptilolites on litter quality and footpad lesions in turkeys

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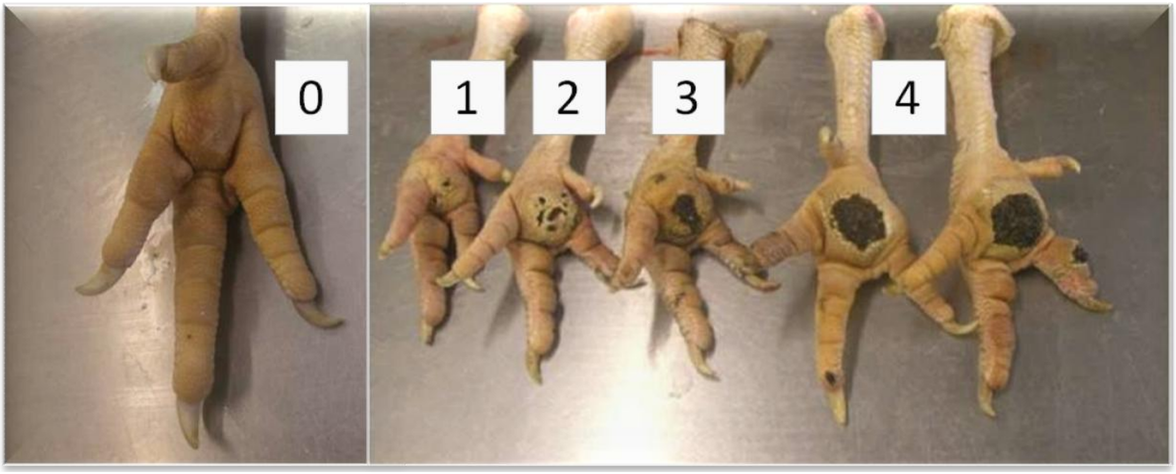
Introduction

Footpad lesions are important because of affecting performance due to low mobility of birds so litter quality is an important parameter regarding incidence and severity of footpad lesions. The incidence of footpad lesions is also an important welfare indicator. Moisture content is important, since wet litter has an influence on the occurrence of footpad lesions in broilers and turkeys (MAYNE, 2005). To overcome these problems clinoptilolites may be used in poultry diets as insurance against wet litter and severe footpad lesions. Basically, clinoptilolites are free flowing agents that bind water which gives benefits to the animal by increasing the dry matter content of faeces. Additionally clinoptilolites have a very high affinity to bind intestinal surplus ammonia and helps therefore to discharge liver metabolism concerning the detoxification of ammonia. Trial results in broilers clearly demonstrated the positive effects of clinoptilolites on better litter quality resulting in fewer problems with footpad lesions (KAMPF, VAN DER AA, 2008). Positive effects of clinoptilolites are described in literature i.e. on production parameter (SUCHÝ *et al.*, 2006; VAN DER AA, HANGOOR, 2009), as well as on reduced pathogenic pressure of the carcass (AL-NASSER et *al.*, 2011) or on the reduction of the transfer of radioactive compounds into animal tissues (MITROVIC *et al.*, 2007).
Aim of the presented investigation was the testing of a clinoptilolite under practical conditions on various turkey farms.

Material and Methods

A practical turkey trial was carried out to investigate the effects of a clinoptilolite of sedimentary origin at 3 farms (trial period from August 2010 (start 1st farm) until April 2011 (ending 3rd farm) in a cross over design (2 fattening rounds with in total about 27,000 animals (6 barns) per treatment). Clinotilolite was tested in fattening phase 3 and 4 (5th till 13th wk of age) at an inclusion rate of 1.5%. The feed additive was added on top to the commercial diets (based on wheat, soy, and corn; P3: 23.0% XP, 12.2MJ ME; P4: 20.0% XP, 12.5MJ ME) fed in the similar periods and farms. Due to the on top inclusion nutrient and energy levels of the diets were slightly reduced in the clinoptilolite treatment (P3: 22.6% XP, 12.0MJ ME; P4: 19.7% XP, 12.3MJ ME; calculated values). To avoid seasonal effects both treatments (with and without clinoptilolite) were tested at every farm at the same time respectively (2 identical stables next to each other, one for control, and one for clinoptilolite treatment). In the 2nd round the stables were used for the respective other experimental group. All farms used male BIG 6.
Trial results were obtained by the ordinary data collection system on the farm (mortality, body weight, and feed consumption per day per stable). Once a week (pooled sample of minimum 10 fresh droppings from minimum 5 different places in the stable) fresh droppings were taken from every stable to analyze DM, and nitrogen fractions of the faeces. Analysis was performed at the commercial accredited laboratory LKS Lichtenwalde (Germany). Beside that also ammonia air concentration (Dräger Pac 7000 NH_3) was measured at the same time of faecal sampling (at 10 different places in the stable, 25 cm above the ground, resp.). Also, about 50 feet from each stable were taken at random at slaughter to score footpad lesions. Due to the fact that slaughter dates varied the collected feet were cleaned and stored at -18°C and

scored altogether at the same time. For this a system was used recommended by Moorgut Kartzfehn (Bösel, Germany; graph 1).



Graph 1: Scoring system for footpad lesion score (0 – healthy to 4 – severe lesions) according to Moorgut Kartzfehn

Statistical evaluation carried out by the working group of biometry and agro informatics Halle-Wittenberg University, Germany. For body weight and feed consumption the corrected Akaike information criteria and a mixed linear model with the following effects was used:

- fixed effects: farm*fattening round, treatment
- fixed regression coefficients: treatment*day of age, treatment* day of age^2
- random serial correlation of successive measurements within the combination treatment*farm*fattening round

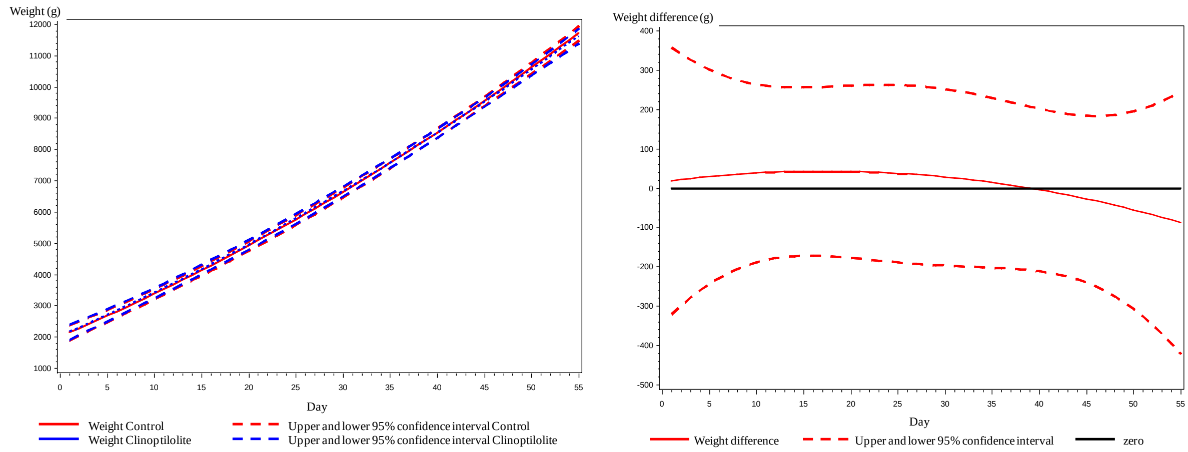
The analysis of losses based on the concept of survival analysis, which allows estimating the so-called survival functions. The analysis took into account the early depopulation of animals. Tests for significances were done with the Log-rank test (taking into account the differences of all days, not just the final value).
The footpad lesion scores were carried out by using the threshold model to provide so-called probabilities for the similar lesions scores (MCCULLAGH, 1980).

Table 1: Number of animals per Farm (A, B, C) and fattening round (1, 2) at trial start and number of foots taken for footpad scoring for control and clinoptilolite treatments

Farm	Fattening round	Treatment	No. of birds	No. of scored footpads
A	1	Clinoptilolite	5160	29
		Control	5194	31
	2	Clinoptilolite	5317	52
		Control	5317	57
B	1	Clinoptilolite	5220	126
		Control	3480	100
	2	Clinoptilolite	3578	50
		Control	5354	51
C	1	Clinoptilolite	4116	0
		Control	4053	65
	2	Clinoptilolite	4077	101
		Control	4096	50

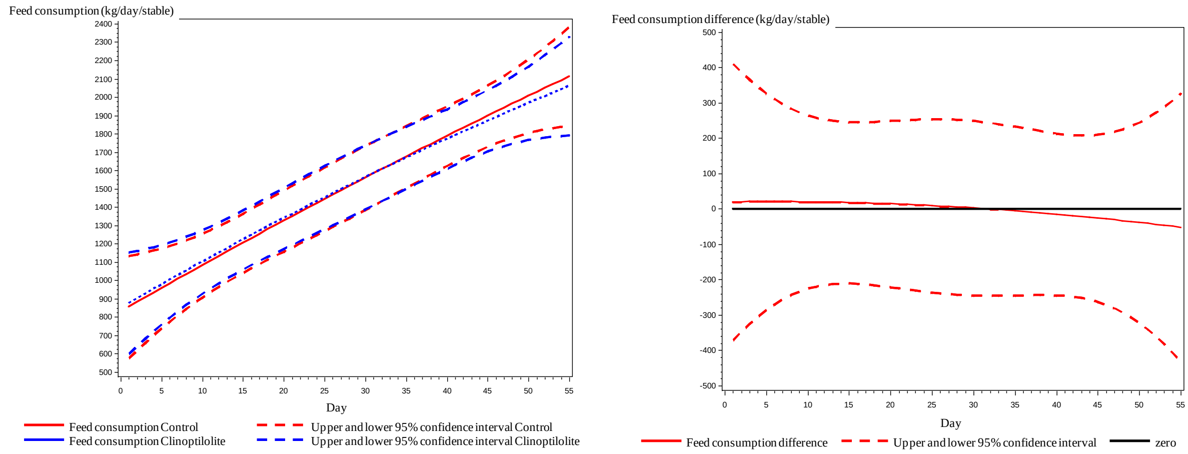
Results and Discussion

The clinoptilolite and control group showed almost identical trends in body weight gain (graph 2). Accordingly, the difference between the groups in the course of development confirmed only minor deviations from zero (graph 3). Due to the fact that the confidence interval of the difference included continuously zero, no significant difference was detected on any examination day. The final body weight (at the end of the trial period) did not differ between control and clinoptilolite treatment (11.72±0.12 vs. 11.63±0.12 kg, resp.) as well as the final body weight at slaughter (21.12 vs. 21.10 kg).



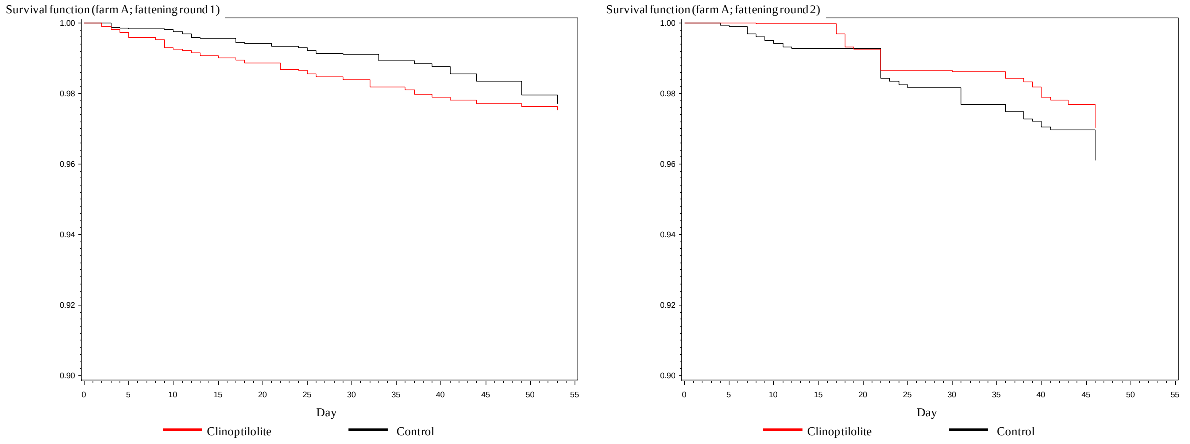
Graph 2 + 3: Body weight gain and difference curve of the weights (experimental minus control) of control and experimental group and the two-sided confidence interval (P=0.95)

Feed consumption for the experimental and control group showed almost identical estimates, too (graph 4). The differences between the groups varied only in small deviations from zero and no difference was significant at a significance level of 5% (graph 5). Average feed consumption per day per stable was with 2,353 in control and 2,344 kg in the clinoptilolite group on the same level. Concluding from body weight gain and feed consumption the energy and nutrient dilution of the diets by clinoptilolite did not negatively affect the production parameters.



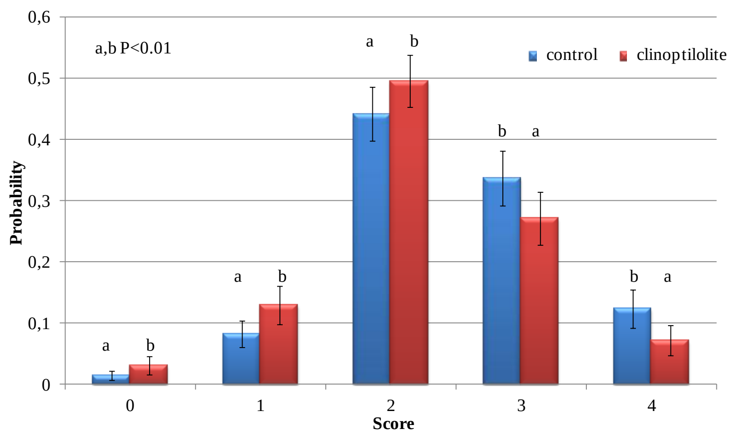
Graph 4 + 5: Feed consumption and associated difference curve (experimental minus control) of control and experimental group and the two-sided confidence interval (P=0.95)

Mortality data showed an overall very low level of losses (survival function 0.978±0.011 in control and 0.981±0.007 in clinoptilolite group) and no significant differences were obtained between the two treatments. Based on the differences between experimental and control group only for Farm A (round 1 in favour of the control group, round 2 in favour of the experimental group) clearer differences were determined ($P<0.01$) but it seems to be related to the stable on that farm (graph 6 + 7).



Graph 6 + 7: Survival function of experimental and control group for Farm A

Footpad lesions scores differed significantly between experimental and control group (graph 8). In the experimental group the probabilities for the scores 0-2 were always significantly higher (and therefore improved) for which scores > 2 always showed significantly lower values in contrast to the control group. This is an advantage with respect to better footpads which can derived for the clinoptilolite group.



Graph 8: Probabilities for the occurrence of footpad lesions in dependence of the use of clinoptilolites

Table 2: Faecal composition and air NH_3 concentration of control and experimental group

Parameter	Unit	Control		Clinoptilolite	
		mean	SD	mean	SD
Faeces DM	g/kg	211	15	215	14
Faeces N	g/kg DM	52.8	15.3	52.9	14.3
Faeces NH_4	g/kg DM	5.0	1.5	4.7	1.3
Faeces pH		6.07	0.35	6.07	0.38
Faeces Uric acid	g/kg DM	61.7	20.5	68.3	30.9
Air NH_3	ppm	37.8	27.7	31.3	18.5

The analysis of faecal nitrogen fractions did not show any significant effect of the Clinoptilolite treatment. Only numerically higher faecal uric acid and lower air NH_3 concentration were detected but due to the high standard deviations it is not possible to argue so it remains difficult to conclude on the actual influencing factors on the improved footpad quality.
From the practical point of view an interesting observation was made on the decreased requirement for additional fresh litter in the treatment in contrast to the control stables (3.8 vs. 4.5 times per trial period and stable).

Summary

A practical trial was carried out to investigate the influence of clinoptilolites on litter quality and the occurrence of footpad lesions in turkeys. In this trial 1.5% clinoptilolite of sedimentary origin was used on top to a commercial diet in fattening period 3 + 4 where the biggest problems with wet litter occur and as a consequence the risk for footpad lesions is increased. The use of clinoptilolite and the energy and nutrient dilution of the feed resulted in similar growth parameter as in the control group. Furthermore, a significantly higher probability for less footpad lesions was measured by the supplementation of clinoptilolites. Finally these results confirm results which are obtained in broilers as well as comparable production parameters, and reduced footpad lesions.

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