

The effect of the type of litter on the occurrence of footpad dermatitis in broiler chickens

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Abstract: The aim of the study was to evaluate the effect of the type of litter on incidence of footpad dermatitis in broiler chicken. Ross 308 and Cobb 500 hybrids were used in this study. Broilers were fattened in aviaries. This monitoring was performed in two experiments. Each experiment lasted 35 days. In the first experiment, straw, wood shavings and lignocel were used as litter material. Wood shavings, lignocel and peat were used in second experiment. Litter temperature and litter humidity were measured as indicator of the quality of bedding. Temperatures of litter were observed weekly at 5 locations in aviary. Litter humidity was measured in 35 day age of broiler. Samples of litter were collected from 2 locations in each aviary. Scoring of the paws was done in slaughterhouse according to six-point scale (0-5) [2]. To facilitate the evaluation of the paws damage the numbers in scoring groups were summarized as follows: negligible damage (0+1), intermediate damage (2+3) and severe damage (4+5). There was no statistically significant effect ($P < 0.05$) between type of litter and litter temperature and litter moisture. The highest damage of paws was in boxes with the highest litter moisture (straw in first experiment and wood shavings in second experiment). These results show a tendency towards higher incidence of FPD depending on higher litter moisture.

Key-Words: broiler, footpad dermatitis, paws, litter

Introduction

Footpad dermatitis (FPD) is known by multiple names, such as pododermatitis and contact dermatitis, all of which refer to a condition that is characterized by inflammation and necrotic lesions, ranging from superficial to deep on the plantar surface of the footpads and toes. Deep ulcers may lead to abscesses and thickening of underlying tissues and structures [9]. The ulcers can cause swelling, redness, and heat under the skin and cause the surface area to thicken [16] and the ulcerations are often covered by crusts formed by exudate, litter and faecal material [9]. It is likely that FPD causes pain and therefore has a negative effect on bird welfare [13]. Animal welfare audits in Europe often use foot, hock, and breast burn-lesions as an indicator of housing conditions and the general welfare of the birds [12]. Concerns about the welfare of broilers have led to a new European Broiler Welfare Directive to be implemented by June 2010 [2]. Litter quality is of great importance for the welfare of broiler chicken, as they generally spend their entire life in contact with litter [18]. Litter serves several functions that include thermal insulation, moisture absorption, protective barrier

from the ground, and it allows for natural scratching behavior. Bedding material must not only be a good absorber of moisture but also have a reasonable drying time [10, 5]. A number of risk factors for wet litter have been suggested. High-moisture litter (i.e., $>30\%$), type or quality of bedding material in broiler production systems has been clearly associated with an increasing incidence and severity of FPD [6]. Litter materials with a high water-holding capacity, such as wood shavings from coniferous trees, are believed to result in better litter quality than litter materials with poorer absorption capacity, such as straw [19]. Stocking density has been reported to influence litter quality, with poor litter quality when stocking density is increased leading to an increase incidence of footpad dermatitis [7]. Climatic conditions influence litter quality, with high relative humidity both outdoors and inside the house being associated with poor litter quality [17].

The aim of the study was to evaluate the effect of the type of litter on the occurrence of footpad dermatitis.

Material and Methods

Birds and management

Broilers were housed in twelve boxes. Boxes were designed for animals. Six smaller boxes provided 3.04 m² of floor area and six bigger boxes provided 3.96 m². In boxes were feeders and nipple water dispensers. All broilers were fed of standard commercial diets for broiler. Broilers were allowed *ad libitum* access to the feed and water. First week of age broilers was used 24-h photoperiod of light. From second week of age broilers until the end of experiment was used 18-h photoperiod from 5.00 am to 23.00. Broilers were fattened 35 days in both experiments. Weight of broilers was measured at the beginning and the end of the experiments.

In the first experiment eight hundred and nine broilers were housed. Hybrid Ross 308 was used in first experiment. Broilers were one day old. Average stocking density was 36.4 kg live weight/m² at the end of experiment. Average live weight of broiler at the end of the fattening was 1.95 kg.

In the second experiment five hundred seventy-five broilers of hybrid Cobb 500 were used. Broilers were one day old. Average stocking density was 25.9 kg live weight/m² at the end of experiment. Average live weight of broiler at the end of the fattening was 1.85 kg.

Broilers chickens were slaughtered in the slaughterhouse Modřice Vodňanská Drůbež a.s. company.

Litter management

Four type of litter were used in both experiments. It was straw, wood shavings, lignocel and peat. Quantity of litter used in boxes is shown in Table 1. Straw, wood shavings and peat were used in first experiment. Thus, broilers were divided into three groups according to type of litter and each type of litter was repeated in four boxes. In second experiment wood shavings, lignocel and peat were used.

Analysis and statistics

As parameters of litter quality were measured litter moisture and litter temperature. Both parameters were assessed 35 days of age of broilers. The temperature of the litter was measured at five locations in each box. Contact thermometer was used for measurement of litter temperature. Two samples were collected from each box for assessment litter moisture. First sample was collected between feeders and second sample was collected under the drinker system. Samples of litter were dried at 65 °C and moisture was calculated. Scoring of the paws was done in slaughterhouse according to six-points scale (0-5) Ask (2010). To facilitate the evaluation of the paws damage the numbers in scoring groups were summarized as follows: negligible damage (0+1), intermediate damage (2+3) and severe damage (4+5).

Data obtained from this experiment were analyzed using the single factor analysis of variation. Data were followed by LSD test using the software package Unistat 5.1 (UNISTAT Ltd, ENGLAND).

Table 1 Type of litter, quantity of litter and stocking density in experiment

Type of litter	1. experiment		2. experiment	
	Quantity of litter kg/m ²	Stocking density kg/m ²	Quantity of litter kg/m ²	Stocking density kg/m ²
Straw	0.72	36.5	-	-
Wood shavings	0.64	35.5	0.64	25.7
Lignocel	0.80	37.1	1.00	25.8
Peat	-	-	1.05	26.2

Results and Discussion

Litter temperature and humidity

Four type of litter were compared to ascertain their effect on litter temperature, litter moisture and occurrence of footpad dermatitis in broiler chickens. In Table 2 and Table 3 is expressed effect of the type of litter on litter temperature and litter moisture in both experiments. In first experiment average

temperature of the litter in the 5th week age of broilers was 33.3°C. The highest temperature of the litter was in boxes with lignocel and the lowest temperature of the litter was in boxes with straw (Table 2). There was not significantly difference (P<0.05) in litter temperature between different types of litter. In second experiment average temperature of litter was 30.8°C. The highest

Table 2 Effect of the type of litter on litter temperature and moisture in first experiment

Parameters	Type of litter		
	Straw	Wood shavings	Lignocel
Litter temperature (°C)	33.2 ^a	33.3 ^a	33.4 ^a
Litter moisture (%)	53.8 ^a	52.5 ^a	51.6 ^a

Table 3 Effect of the type of litter on litter temperature and moisture in second experiment

Parameters	Type of litter		
	Peat	Wood shavings	Lignocel
Litter temperature (°C)	31.0 ^a	30.8 ^a	30.7 ^a
Litter moisture (%)	45.6 ^a	50.2 ^a	46.6 ^a

temperature was in boxes with peat and the lowest temperature was in boxes with lignocel (Table 3). Statistically significant difference ($P < 0.05$) between litter moisture and type of litter was not found. Type of litter had not influence on litter temperature. The lower average temperature of litter in the second experiment could be due to lower stocking density in the second experiment than in the first experiment. The average moisture of litter in the 5th week age of broilers was 52.6% in first experiment. The highest moisture of litter was in boxes with straw and the lowest moisture was in boxes with lignocel. There was no statistically significant difference ($P < 0.05$) between litter moisture and type of litter. In second experiment the average litter

moisture was 47.5%. The highest moisture was in boxes with wood shavings and the lowest moisture was in boxes with peat. There was no statistically significant difference ($P < 0.05$) between litter moisture and type of litter. Type of litter had no effect on litter moisture. The lower average litter moisture in second experiment could be due lower stocking density in second experiment. [1] assumed that the “critical moisture content” for the development of FPD lesions as about 35% litter moisture content. Furthermore, doubling exposure time (4-8h) led to only slightly increased severity of FPD for the low litter moisture contents (35% and 50% moisture) and a higher rise for the wettest litter treatment (65% moisture) at the end of trial.

Fig. 1 Classification of paws in groups in first experiment

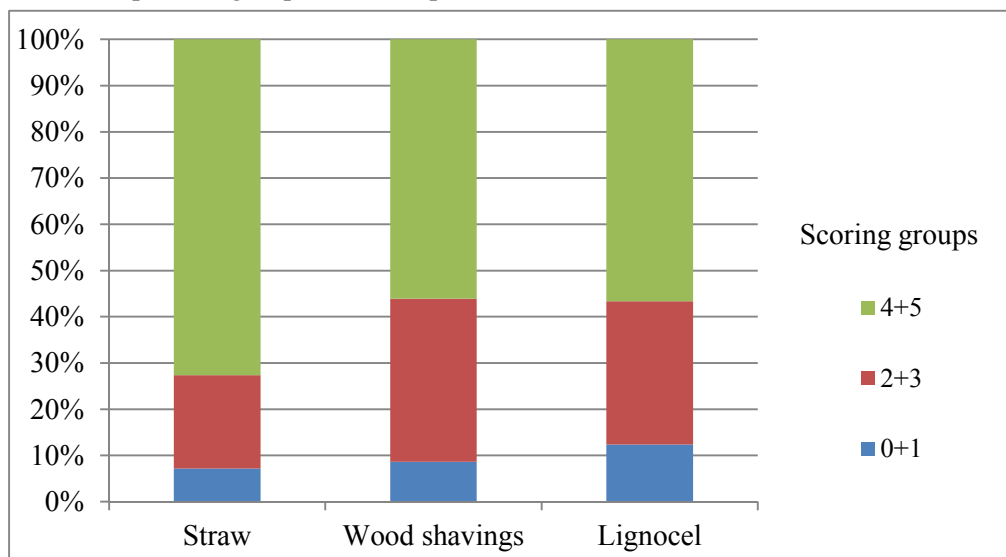
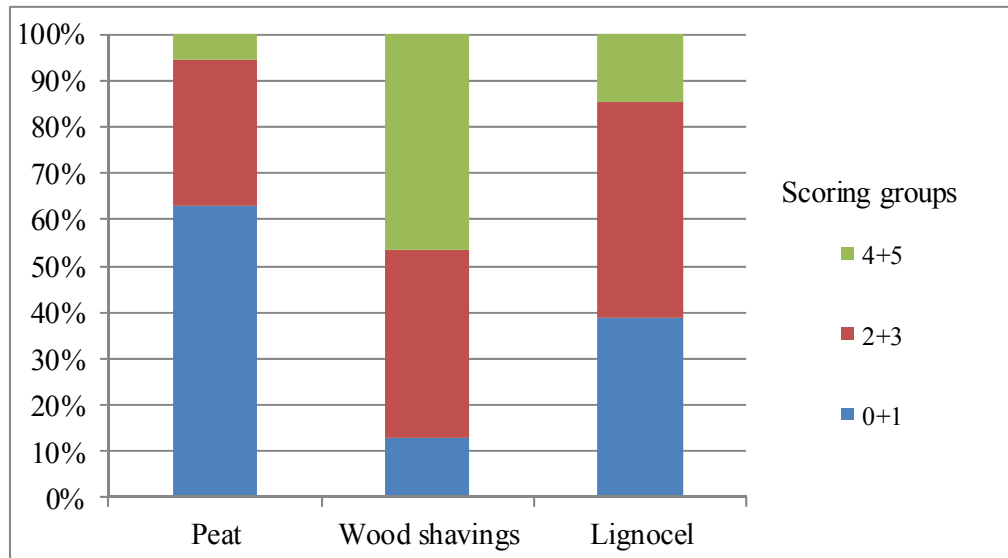


Fig. 1 shows the percentages of different degrees of damage of paws in the first experiment with different type of litter. Better results were obtained in boxes with wood shavings and lignocel. The

lowest percentage of representation paws with severe damage (group 4+5) was observed in these both types of litter. Paws classified in group 4+5 are considered as paws with ulcer, which occurs over

Fig. 2 Classification of paws in groups in second experiment



almost the entire plantar surface (25-80%) [2]. Moreover, lesions on the paws may be a gateway for bacteria which might affect carcass quality [14]. The highest percentage of paws with negligible damage (group 1+2) was found with lignocel. The worst damage of paws was observed at broilers fattened in boxes with straw. Also, the highest litter moisture was found in this type of litter. On the other hand, the best results of classification of paws were achieved in boxes with lignocel, which had the lowest litter moisture. Fig. 2 shows the percentages of different degrees of damage of paws in the second experiment with different type of litter. Markedly better results were obtained in boxes with peat. The lowest percentage of representation paws with severe damage was observed in this type of litter. The worst damage of paws was observed in boxes with wood shavings. Even in this case, the highest damage of paws was in boxes with the highest litter moisture. These results show a tendency towards higher incidence of FPD depending on higher litter moisture. Footpad dermatitis lesions have been found to be more severe as litter moisture increases, especially when the litter contains high moisture with sticky fecal droppings [9]. In general, a high incidence of FPD can be produced in broilers by increasing the moisture level of the litter, as suggested earlier by [11]. According to research conducted with broilers and turkeys, litter conditions (i.e., type, particle size, and moisture level) are significant factors in the development of FPD [6]. This study shows a tendency towards higher incidence of FPD in broiler chickens depending on higher litter moisture. [15] also reported that FPD lesion scores increased rapidly following wetting litter after 1 wk. More

recently, [14] showed a similar effect in turkey poult and concluded that water alone was sufficient to cause FPD in a very short time. However, the FPD lesions appeared to regress (i.e., improve) in birds with time, especially with improvements in litter conditions. As the conditions under which broilers are raised vary between different parts of the world, it is extremely difficult to give efficient general advice on how to prevent contact dermatitis [3]. One thing that is common among most previous research is that litter moisture is a significant factor in the onset of FPD.

Wood shavings and lignocel were used in the first experiment and in the second experiment. Better results in the classification of damage of paws in boxes with these both type of litter was achieved in the second experiment. Better results in the second experiment could be due to lower stocking density in the second experiment than in the first experiment. Some studies have reported that higher stocking densities are associated with a greater incidence of FPD than lower stocking densities [12, 16]. The sudden onset of poor litter conditions associated with higher stocking densities is considered to be the biggest influence on the development of FPD. Litter conditions deteriorate rapidly and litter moisture increases as stocking density increases [4]. [8] found that as stocking density increased, water consumption increased per bird. As birds drink more water, their feces may become more watery and thus contributes to overall litter moisture.

Conclusion

There was no statistically significant effect ($P < 0.05$) between type of litter and litter temperature and

litter moisture. In the first experiment the highest temperature of the litter was in boxes with lignocel and the lowest temperature of the litter was in boxes with straw. The highest moisture of litter was in boxes with straw and the lowest moisture was in boxes with lignocel. The lowest percentage of representation paws with severe damage (group 4+5) was observed in boxes with wood shavings and lignocel. The worst damage of paws was observed at broilers fattened in boxes with straw. In second experiment the highest temperature was in boxes with peat and the lowest temperature was in boxes with lignocel. The highest moisture was in boxes with wood shavings and the lowest moisture was in boxes with peat. The lowest percentage of representation paws with severe damage was observed in boxes with peat. The worst damage of paws was observed in boxes with wood shavings. The highest damage of paws was in boxes with the highest litter moisture. These results show a tendency towards higher incidence of FPD depending on higher litter moisture.

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