Original paper

# CORRELATIONS BETWEEN INCIDENCE OF FOOT PAD LESIONS AND BODY WEIGHT OF BROILERS IN DIFFERENT REARING SYSTEMS

*Škrbić Z.[1*], Pavlovski Z.,[1] Lukić M.[1],Petričević V.[1], Tolimir N.[2], Stojanović Lj.[1]*

[1] Institute for Animal Husbandry, Autoput 16, 11080 Belgrade, Republic of Serbia
[2] Institute for Science Application in Agriculture, Bulevar despota Stefana 68b, 11000 Belgrade, Republic of Serbia
[*]Corresponding author: zdskrbic@gmail.com

**Abstract**

The incidence of foot pad lesions of broilers of moderate growth was investigated in order to establish correlations with body weight. Broilers were reared until the age of 42 days in the floor system in the poultry house and then were divided into two groups. The first group continued growing in the poultry house until the age of 84 days and the second group was growing in the free range system until the same age. Individual measurements of body weight and evaluation of the incidence of foot pad lesions of broilers were carried out at the end of the experiment. In a correlation analysis of previously transformed data on the percentage of broilers with lesions and body weight within each weight group, data were obtained that showed an association between these traits depending on the rearing system.

System of rearing had significant impact on the strength and direction of correlation between body weight and the incidence of foot pad lesions, in light of the determined correlation coefficient r = -0.95 at the significance level p=0.01 in the free range system, and r=0.56 (p>0.05) in chickens reared in the poultry house.

**Key words:** *body weight, broilers, lesions, rearing system*

## Introduction

The lesions on the foot pads of broilers usually represent the type of contact dermatitis, and depending on the degree of damage they can range from the level of surface inflammatory processes to necrotic changes in the deep layers of tissue. Their incidence is associated with rearing conditions (Meluzzi et al., 2008), stocking density (Ferrante et al., 2006; Škrbić et al., 2010), nutrition (Eichner et al., 2007; Škrbić et al., 2012), which exert their effects through litter quality considered as the most important factor for the development of various forms of dermatitis (footpad, hock burns, breast blisters) (Allain et al., 2009). Footpad dermatitis causes pain and affects the incidence of lameness (Sorensen et al., 2000) which can result in a lower gain and final body mass of chickens. In general, the footpad lesions pose a problem to the welfare and economic efficiency of broiler production. Research results of Kjaer et al. (2006) show significant differences in the incidence of footpad dermatitis in fast-growing and slow growing broiler hybrids. Đukić-Stojčić et al. (2013) have found differences in the frequency of footpad lesions in moderate growing broilers depending on the rearing system. Body mass of broilers is a potential

predisposing factor for the incidence of footpad lesions, given that male broilers showed a greater tendency towards more frequent incidence and more severe degrees than the female birds (Bilgili et al., 2006).

The aim of this study was to investigate the presence and nature of phenotypic correlations between body mass and frequency of broiler footpad lesions in the hybrids of moderate growth in terms of extensive rearing in the house and the traditional free range rearing system.

**Materials and methods**

The experiment was conducted on a total of 300 chickens of genetic potential for a moderate rate of growth (Redbro). By 42 days the chicks were reared in the poultry house in the floor rearing system. Conditions of feeding and breeding were typical for standard fattening. The chickens were housed in boxes, 50 birds/box or 12 birds/$m^2$. After 6 weeks, 150 broilers were transferred to the traditional free range rearing facility to the slaughter age (84 days), which was the same for chickens from each rearing system. Throughout the experiment, the diet was based on complete mixtures. The chicks were fed starter (22.2 % CP; 3100Kcal) grower (19.4 % CP; 3110Kcal) and finisher (17.3 % CP; 3170Kcal) diets, while the broiler in the free range system had available pasture area of 10$m^2$/bird. By individual measuring of chicks at the end of the experiment, in both rearing systems, the final body mass was determined. At the same time, the incidence and the degree of lesions on the foot pads were visually evaluated according to the method of Thomas et al. (2004), in which score 1 indicates the absence of lesions, score 2 presence of moderate lesions and score 3 the presence of severe lesions. Based on the measured body mass, chickens were divided into six weight groups : <2.0 kg, 2.0-2.5 kg, 2.5-3.0 kg, 3.0-3.5 kg, 3.5 - 4.0 kg and > 4.0 kg. Also, for the purpose of the data processing, the summary frequency of the incidence of foot pad lesions was taken into account, regardless of the degree of damage and the score.

Statistical analysis was performed using the software program Statistica (Stat.Soft, Inc. 8 version) and was based on the determination of the parameters of descriptive statistics and correlation analysis of body mass of broilers and the incidence of lesions on the foot pads of broilers within weight groups depending on the rearing system. Data expressed in percentages were previously transformed to *arc sin*.

**Results and discussion**

Based on the average scores for footpad lesions we can state in general that the condition of leg pads in each rearing system was satisfactory (Table 1), which is partly the effect of the genotype of moderate growth broilers. In the free range rearing system, average scores, depending on the weight group, ranged from 1.0 to 1.25, and in the rearing system in the poultry house, from 1.0 to 1.20. Results obtained by Kjaer et al. (2006) point out the important role of genotype for the development of dermatitis, in terms of less sensitivity to their development in the slow growing hybrids. As for the rearing system in the poultry house, in the first two groups of broilers with the lowest body mass the incidence of footpad lesions was not recorded. In contrast, in the free range rearing system, in these groups, the highest percentage of broilers with footpad lesions was determined (33.33% and 18.75%).

**Table 1.** *Frequency of incidence and average score of footpad lesions in broiler weight groups and rearing systems*

| Weight group | Rearing system | Average body weight, kg (mean ±SD) | Incidence of footpad lesions, % | Average score of footpad lesions |
|---|---|---|---|---|
| < 2.0 kg | free range | 1.71 ± 0.18 | 33.33 | 1.25 |
| | poultry house | 1.77 ± 0.06 | 0 | 1.0 |
| | average | 1.73 ± 0.15 | 22.22 | 1.17 |
| 2.0-2.5 kg | free range | 2.33 ± 0.13 | 18.75 | 1.16 |
| | poultry house | 2.25 ± 0.14 | 0 | 1.0 |
| | average | 2.30 ± 0.14 | 10.71 | 1.09 |
| 2.5-3.0 kg | free range | 2.79 ± 0.16 | 5.66 | 1.05 |
| | poultry house | 2.78 ± 0.15 | 10.34 | 1.12 |
| | average | 2.78 ± 0.15 | 7.32 | 1.07 |
| 3.0-3.5 kg | free range | 3.21 ± 0.15 | 4.17 | 1.04 |
| | poultry house | 3.26 ± 0.15 | 16.0 | 1.2 |
| | average | 3.23 ± 0.15 | 8.22 | 1.09 |
| 3.5-4.0 kg | free range | 3.77 ± 0.14 | 2.13 | 1.04 |
| | poultry house | 3.76 ± 0.13 | 11.43 | 1.13 |
| | average | 3.77 ± 0.14 | 6.10 | 1.08 |
| > 4.0 kg | free range | 4.26 ± 0.20 | 0 | 1.0 |
| | poultry house | 4.35 ± 0.29 | 7.69 | 1.12 |
| | average | 4.31 ± 0.25 | 4.25 | 1.06 |

Different conditions in the studied rearing systems influenced the opposite direction of the correlation between body mass of broilers and frequency of lesions of the foot pads. In the free range rearing system, correlation coefficient of r = -0.95 (p=0.01) indicates a strong negative correlation, i.e. significantly lower incidence of foot-pad dermatitis in broilers of greater body mass (fig. 1). In the floor rearing system, in the poultry house, a medium strong positive correlation was found (r=0.56, p>0.05). However, given the lack of statistical significance of determined correlation coefficient, regardless the strength of correlations, it can be argued that there is a correlation between body mass of broilers and the incidence of footpad lesions in the floor system of rearing in the poultry house (Figure 2). In accordance, the weak, insignificant correlation between the foot pad dermatitis and the body mass of broilers was determined also by Kjaer et al. (2006).

The quality of litter or bedding is a crucial factor for the development of dermatitis. In terms of free range rearing it is anticipated that this problem is less pronounced. Physical activity of broilers, or freedom of movement, exposure to natural rearing conditions (grassy range, air, sun), contribute to the overall better shape of legs (Kestin et al., 1992). In such conditions, footpad lesions were more common in groups with lower body mass maybe due to "inherited" condition of the poultry house, where the chickens were reared the first six weeks. Footpad lesions cause a painful condition that affects the ability to move and thereby reduce competition for food and weight gain. In the floor system of rearing, in the poultry house, the condition of foot pads continuously deteriorated with the increase in body mass due to intense and prolonged contact with wet litter until the age of slaughter. In this sense, the management of production is of great importance for the maintenance of environmental conditions in the house (air temperature, relative humidity), satisfactory quality of litter (Wang et al., 1998, Allain et al., 2009). A negative correlation between the serious footpad dermatitis and live mass of broilers, i.e. meat yield, is determined by Hashimoto et al. (2013) and indicates the possibility of improving these production parameters through control of the incidence of footpad dermatitis.

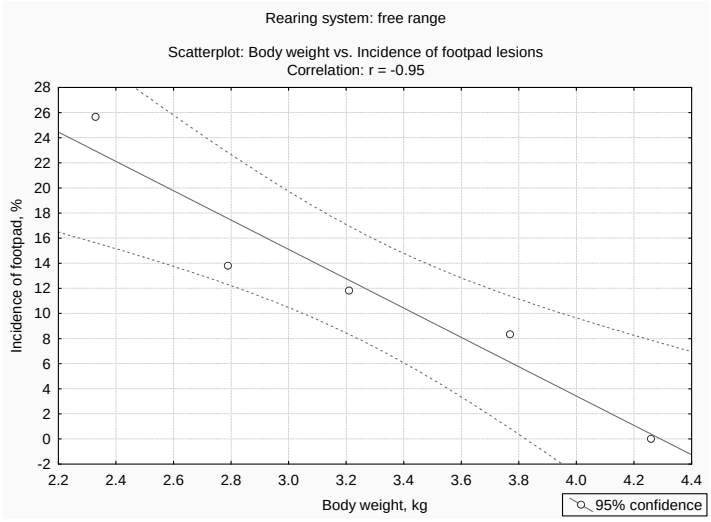


**Figure 1.** *Correlation between body mass and incidence of footpad lesions in the free range rearing system*

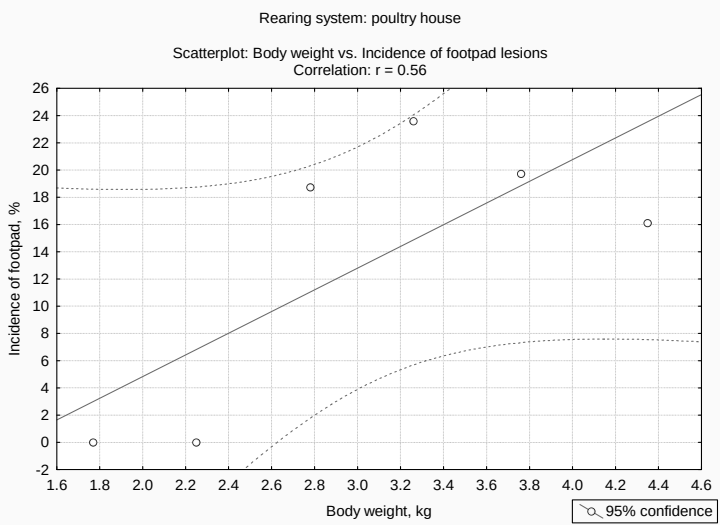


**Figure 2.** *Correlation between body mass and incidence of footpad lesions in the floor rearing system*

## Conclusion

The system of rearing of broilers exhibited a significant effect on the correlation between the body mass and incidence of footpad lesions. In the free range rearing system, the body mass and the incidence of footpad lesions were in strong negative phenotypic correlation, while in the floor rearing system, in the poultry house, phenotypic correlation between these traits was not statistically confirmed.

Low average footpad lesion scores, i.e. satisfactory condition of foot pads of broilers in both rearing systems, provide confirmation of the importance of genotype for the development of dermatitis.

**Acknowledgments**

This research is part of the Project EVB: TR-31033 financially supported by the Ministry of Education, Science and Technological Development of the Republic of Serbia.

**References**

1. Allain V, Mirabito L, Arnould C, Colas M, Le Bouquin S, Lupo C and Michel V 2009. Skin lesions in broiler chickens measured at the slaughterhouse: relationships between lesions and between their prevalence and rearing factors. British Poultry Science 50, 407-417.
2. Bilgili SF, Alley MA, Hess JB and Nagaraj M 2006. Influence of Age and Sex on Footpad Quality and Yield in Broiler Chickens Reared on Low and High Density Diets. Journal Applied Poultry Research 15, 433–441.
3. Đukić Stojčić M, Milošević N, Perić L and Bjedov S 2013. Plumage condition and foot pad lesions of medium growing broilers reared extensively in the poultry house and in traditional free range. 10th International Symposium Modern Trends in Livestock Production, Belgrade, Serbia, 6 pp.
4. Eichner G, Vieira SL, Torres CA, Coneglian JLB, Freitas DM and Oyarzabal OA 2007. Litter Moisture and Footpad Dermatitis as Affected by Diets Formulated on an All-Vegetable Basis or Having the Inclusion of Poultry By-Product. Journal Applied Poultry Research 16, 344-350.
5. Ferrante V, Lolli S, Marelli S, Vezzoli G, Sirri F and Cavalchini LG 2006. Effect of light programmes, bird densities and litter types on broilers welfare. XII European Poultry, Conference, Verona, Italy. Word's Poultry Science Journal 62 (supplement), 586.
6. Hashimoto S,Yamazaki K, Obi T and Takase K 2013. Relationship between Severity of Footpad Dermatitis and Carcass Performance in Broiler Chickens. The Journal of Veterinary Medical Science 75, 1547–1549.
7. Kestin SC, Knowles TG, Tinch AE and Gregory NG 1992. Prevalence of leg weakness in broiler chickens and relationship with genotype. Veterinary Record 131, 190-194.
8. Kjaer JB, Su G, Nielsen BL and Sorensen P 2006. Foot pad dermatitis and hock burn in broiler chickens and degree of inheritance. Poultry Science 85, 1342–1348.
9. Meluzzi A, Fabbri C, Folegatti E and Sirri F 2008. Survey of chicken rearing conditions in Italy: effects of litter quality and stocking density on productivity, foot dermatitis and carcase injuries. British Poultry Science 49, 257-264.
10. Škrbić Z, Pavlovski Z, Lukić M and Petričević V 2010. Assessment of Broiler Welfare in Different Stocking Densities. XIII European Poultry Conference, Tours, France, 4 pp.
11. Škrbić Z, Pavlovski Z, Lukić M, Petričević V, Miljković B and Marinkov G 2012. The effect of the diet on incidence of footpad lesions and productivity of broilers. Biotechnology in Animal Husbandry 28, 353-360.
12. Sorensen P, Su G and Kestin SC 2000. Effects of Age and Stocking Density on Leg Weakness in Broiler Chickens. Poultry Science 79, 864-870.

13. Thomas DG, Ravindran V, Thomas DV, Camden BJ, Cottam YH, Morel PCH and Cook CJ 2004. Influence of stocking density on the performance, carcass characteristics and selected welfare indicators of broiler chickens. New Zealand Veterinary Journal 52, 76-81.

14. Wang G, Ekstrand C and Svedberg J 1998. Wet litter and perches as risk factors for the development of foot pad dermatitis in floor-housed hens. British Poultry Science 39, 191-197.