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THE EFFECTS OF PARTIALLY SLATTED FLOOR DESIGNS ON SOME EARLY BEHAVIORAL TRAITS IN BROILER CHICKS

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Abstract: This study was carried out to determine the effects of different levels of slatted floor applications on some early behavioral characteristics of broiler chickens. In this study, male-female mixed 600 fast-growing broiler chicks (Ross308) were used. The experiment consisted of five treatment groups with 120 chicks each (7 chicks/m^2): fully littered, fully slatted, ½ littered+½ slatted, 1/3 littered+2/3 slatted, 2/3 littered+1/3 slatted. In the study, the feeding, drinking, resting, aggregation, other behaviors, and slatted floor preferences of the chicks were evaluated three times a day (at 9.00, 13.00, and 17.00 h) at 2, 5, 9 and 11 days of age. Each behavioral trait was expressed as a percentage of the total number of chicks showing the relevant behavior at the pen level. Different floor designs significantly affected the chicks' feeding, resting, aggregation behavior, and preference for being on the slatted floor ($P < 0.05$). Feeding behavior was higher in chicks reared on the fully slatted floor than in the others ($P < 0.001$). The percentage of chicks showing resting behavior was highest in the 2/3 littered+1/3 slatted floor application ($P = 0.001$). The 64.42% of the chicks reared in 2/3 slatted, 47.53% of those reared in ½ slatted, and 36.38% of those raised in 1/3 slatted preferred the use of the slatted floor. The percentage of chicks showing feeding behavior was highest at 5 (16.12%) and 2 d-old (15.73%) ($P = 0.001$). Resting behavior was highest at 2 (78.72%), 5 (76.89%), and 9 (72.82%) days of age ($P < 0.001$). In conclusion, this study revealed that different floor designs affect some behavioral characteristics in the early chick period. Since it is known that early rearing conditions affect later performance in broilers, slatted floor systems with higher feeding behavior can be an effective tool for better performance in broiler production.

Keywords: Broiler chick, Slatted floor, Litter, Behavior, Feeding, Resting

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1. Introduction

The rapid increase in the world population brings with it the need for adequate and balanced nutrition. At least 1/3 of the daily protein needs of humans in a quality and balanced diet should be of animal origin (Öztürk et al., 2013). Poultry products have an important place in meeting this demand. In recent years, with the increasing level of awareness on balanced and adequate nutrition, efforts to obtain more yield per unit area have accelerated. In commercial conditions, chicken meat production is commonly carried out in closed poultry houses on litter material. It is very important to keep the litter in the desired quality in these poultry houses, and dermatitis occurring on the foot pads, hock joints and breast meat are frequently encountered in animals due to poorly managed litter quality (Özbek, 2021). Alternative floor systems have come to the fore as a solution to the problems related to animal health and welfare that arise when litter management is not sufficient in broiler production (Çavuşoğlu and Petek, 2019). Although cage and grill floor applications have been known for many years in broiler production, they have not become widespread due to their negative effects on welfare, foot-leg health and behavioral characteristics (Zhao et al., 2009; Shields and Grager, 2013). It has started to be used again in chicken meat production due to the technological improvements made on the cage and slatted floor material. However, the restricted movement of animals in the cage system still causes concerns in terms of animal welfare. Therefore, it is thought that the partially or fully slatted floor system can be used in commercial production (Özbek, 2021). At this point, the search for alternative production systems has begun in order to eliminate some of the negative effects of intensive production in broiler breeding and laying hen farming, taking into account the physiological needs and natural behavior of animals, and appropriate housing, care, management, feeding and health protection. Since broilers spend their life-time on the litter material, the type and characteristics of the litter used are important (Sarıca and Erensayın, 2018). In traditional broiler production, littered, cage and slatted rearing systems are used. Although each of these systems has positive and negative aspects (Ghanima et al., 2020), the littered system is the most common, despite some disadvantages (Aviagen, 2018; Altan and Bayraktar, 2018; Çavuşoğlu et

al., 2018; Sarıca and Erensoy, 2020). Numerous studies have been conducted to examine the performance and welfare characteristics of broilers reared using different litter, cage and wire materials (Petek et al., 2015; Kaukonen et al., 2017; Chuppava et al., 2018; Çavuşoğlu and Petek, 2019). However, there is a lack of studies evaluating plastic slatted and littered floor systems together. This study was carried out to determine the effects of different levels of floor design practices on some early behavioral characteristics of broiler chickens. Thus, it is aimed to minimize the negativities arising from both systems by combining the littered and slatted systems and to reveal the advantages of these systems by using them together.

2. Material and Methods

This study was carried out in Ondokuz Mayıs University, Faculty of Agriculture, Research and Application Farm, Poultry Production and Research Unit. In the study; five treatment groups were used: fully littered, fully slatted, ½ littered + ½ slatted, 1/3 littered + 2/3 slatted, 2/3 littered + 1/3 slatted. Five replicates (pens) were used for each treatment with a net floor area of 3.50 m2. A total 24 chicks (7 chicks/m^2) were placed in each pen. As the slatted system, plastic material produced at a height of 10 cm from the ground and with grid spacing of 1.5 cm was used. In the slatted system, in order to facilitate the movements of 0-7 d-old chicks, it was covered with a plastic sheet with 1x1 cm spacing on the slatted floor and this cover was removed at the end of the first week. On the other hand, 8-10 cm thick wood shavings were used in the groups in which the litter was used. As animal material, 600 fast growing broiler chicks (Ross308) at daily age mixed male-female were used. Initial weights were taken and 120 day-old chicks were randomly distributed to each treatment group. In the first week, 2 chick feeders and 3 chick drinkers were used in each pen. At the end of the first week, a tube feeder with a capacity of 15 kg and a drinker line with 5 nipples were used in each pen. In the house where the study was carried out, automatic heating and ventilation was carried out, and the temperature at the litter level, which was 33-34 °C on the first 3 days, and was gradually reduced to 28-29 °C until the age of 11 days. The lighting program was applied 24 hours for the first 3 days and 20 hours of light and 4 hours of darkness in the following days. Feeds were obtained from a commercial feed factory and broiler chick starter feed (23.0% CP and 3000 Kcal/kg) was used. Standard broiler rearing procedures were applied to chickens in all treatment groups. In the study, the feeding, drinking, resting, other behaviors, aggregation behaviors, and slatted floor preferences were evaluated three times a day (at 9.00, 13.00, and 17.00) of the chicks in each treatment group at the 2, 5, 9 and 11 days of age. Each behavioral trait was expressed as a percentage of the total number of chicks showing the relevant behavior at the pen level.

One-way analysis of variance was applied in the statistical analysis of behavioral traits. Since the percentage behavior data did not show normal distribution, statistical analysis was performed by applying arcsin square root transformation. However, actual averages were used to interpret the traits. In cases where the significance level between the means was $P<0.05$, multiple comparisons were performed with the Tukey test and SPSS 21.0 package program was used for statistical analysis.

3. Results and Discussion

The effects of floor design applications at different levels on some behavioral characteristics of broiler chicks are given in Table 1. Different floor designs significantly affected the chicks' eating, resting, aggregation behavior and the preference of being on the slatted floor ($P < 0.05$). Percentage of chicks showing feeding behavior was found higher in fully slatted system than in the other treatment groups ($F = 11.201$; $P < 0.001$), consistent with the fact that broilers housed on partially or fully slatted floors had no or limited access to the litter, leading their foraging behavior to the feeder rather than the litter (Chuppava et al., 2018). The highest level of resting behavior (77.47%) was observed in chicks reared on 1/3 slatted floor, while the lowest (68.66%) in chicks reared on fully slatted ($F = 5.393$; $P=0.001$). Since the chicks do not have the opportunity to show behaviors such as pecking, foraging and dust bathing in the fully slatted floor system, the absence of these behaviors may have led the chicks to more feeding behavior (Blokhuis, 1989; Chuppava et al., 2018). The feed consumption values that we evaluated within the scope of our other study also support this prediction by revealing higher feed intake in chicks reared on slatted floor system.

We can associate the percentage of chicks with resting behavior with the lowest (68.66%) and the highest (77.47%) feeding behavior on the fully slatted floor system. Because there is no litter material on the slatted floor, pecking behavior occurs during feeding (Blokhuis, 1989). Considering that the high feeding behavior is associated with the pecking behavior, we can say that the percentage of feeding behavior on the slatted floor increases. Aggregation score was higher in chicks reared on a fully littered (0.66) and 1/3 slatted system (0.56) than other groups ($F = 2.981$; $P=0.024$). This indicates that the chicks in the littered floor are more in a group during rest. However, we do not think that this is an indicator of fear behavior because the treatments did not affect the percentage of chicks exhibiting aggregation (fear) behavior. 64.42% of the chicks reared in the 2/3 slatted, 47.53% of the chicks reared in the ½ slatted and 36.38% of the 1/3 slatted chicks preferred the use of slats ($F = 52.833$; $P < 0.001$). This seems likely to be related to the slatted floor area per chick, as preference increased as slatted floor area increased and vice versa. It was determined that the different level of slatted floor designs did not have a significant effect on drinking and other behavioral characteristics.

The effects of age (2, 5, 9 and 11 days old) on some behavioral characteristics of broiler chicks are given in Table 2. The effects of age periods on behavioral traits of broiler chicks were significant (P < 0.01), consistent with Weeks et al. (2000), Bokkers and Koene (2003) and Giersberg et al. (2020). The percentage of chicks showing feeding behavior was highest at 5 (16.12%) and 2 d old (15.73%), and lowest at 9 d old (10.71%) (F = 6.295; P = 0.001). Our study results were inconsistent with Giersberg et al. (2020), who reported that feeding behavior increased from d-old to 12 days of age. In a previous study, the effect of pecking behavior on social behavior at an early age was evaluated, and as a result, the effect of pecking behavior on social behavior was found to be significant (Brown and Kiely, 1974). Considering the effect of pecking behavior on social behavior, it is thought that pecking behavior is replaced by feeding behavior and feeding behavior may increase in day-old chicks. In this study, drinking behavior was highest at 9 (14.81%) and 11 d old (9.90%), and lowest at 2 (4.70%) and 5 (6.95%) days of age (F = 18.811; P < 0.001). However, Giersberg et al. (2020) reported that drinking behavior is independent of age. Studies have shown that water intake generally increases at higher environmental temperatures (May and Lott, 1992). Another study investigated the effect of heat stress on feed and water intake and revealed that heat stress causes chicks to consume less feed and drink more water (Saeed et al., 2019) also explained this increased water intake as helping to lower body temperature in chicks. In our study, the effect of different floor designs on drinking behavior was found insignificant, and we can consider that the lowest water drinking behavior at 2 (4.70%) and 5 (6.95%) days of age, that is, at 2 and 5 days of age, is an indication that the temperature of the house is in suitable conditions. Resting behavior is observed to have the highest percentage of behavior at 2 (78.72%), 5 (76.89%) and 9 (72.82%) d old (F = 14,832; P < 0.001). Results from a study show that, if given the opportunity, d-old chicks spend a significant amount of time resting, which means rest is very important for them (Malleau et al., 2007) and these results show that most of the first 14 days in the early period are based on rest alone. Although it shows that it is important, it also shows that the chicks do not need a lot of time to perform other behaviors such as drinking. Consistent with Giersberg et al. (2020), the percentage of chicks showing resting behavior (sitting and lying) had the highest at 2 (78.72%), 5 (76.89%) and 9 (72.82%) d-old and decreased with advancing age. When we examine the other behavioral characteristics, it is seen that it has the highest percentage of behavior at the 11 d-old and the lowest at 2, 5 and 9 d old (F = 181.602; P < 0.001). The fact that the resting behavior was high at 2 (78.72%), 5 (76.89%) and 9 (72.82%) d old may have contributed to the low percentage of other behaviors. It was determined that the highest aggregation was observed on the 2 d-old (18.35%), and the lowest was observed at 11 d-old (2.56%). In the aggregation score, the highest value occurred at 2 d-old (0.84), while the lowest value occurred at 11 d-old (0.16). We can explain the fact that the aggregation score is highest at 2 d old and the lowest at 11 d-old, with the aggregation behavior. As stated in Giersberg et al. (2020), recognizing environmental stimuli with advancing age in broiler chicks causes a gradual decrease in fear behavior, which also supports our findings. We expected the chicks to get used to the slatted floor and use it more with advancing age, which partially happened. Although the use of slatted floor increased by 9 d-old, it surprisingly decreased by up to 40% at 11 days of age.

Table 1. The effects of partially slatted floor designs on some behavioral traits in broiler chicks (n = 600 chicks)

Behaviors	Fully slatted	$^2/_3$ slatted + $^1/_3$ littered	$^1/_2$ slatted + $^1/_2$ littered	$^1/_3$ slatted + $^2/_3$ littered	Fully littered	SEM	Treatment effect
Feeding, %	20.60a	14.04b	12.35b	11.65b	10.75b	1.002	F = 11.201, P<0.001
Drinking, %	7.10	9.99	9.53	8.00	10.85	0.960	F = 2.234, P=0.073
Resting, %	68.66b	71.88b	75.19ab	77.47a	74.30ab	1.496	F = 5.393, P=0.001
Others, %	3.60	3.98	2.89	2.84	4.20	0.557	F = 1.622, P=0.177
Aggregation, %	8.79	7.75	6.42	10.36	13.57	1.840	F = 2.442, P=0.053
Aggregation score [1]	0.48ab	0.35b	0.31b	0.56a	0.66a	0.082	F = 2.981, P=0.024
Slatted floor preference, %	-	64.42a	47.53b	36.38c	-	1.872	F = 52.833, P<0.001

[1]Aggregation score was determined by the scoring method on a 0-3 scale. 0= no aggregation (0-3 chicks), 1= little aggregation (4-6 chicks), 2= moderate aggregation (7-9 chicks); 3= high aggregation (10 chicks and above).

[a-c]The means shown with different letters on the same row differ from each other at the P<0.05 significance level according to the Bonferonni multiple comparison test. SEM= standard error of the mean.

The behavior of the chicks in the early period is an important indicator of adaptation to their environment. Behavior is one of the important indicators in the evaluation of animal welfare and provides us with comprehensive information about the emotional state and health of animals (De Jong et al., 2016), Observed behaviors help in regulating the indoor environmental conditions and the needs of the animal (Dawkins, 2003). Since all the chicks were reared under the same conditions in the data we obtained in the study, different levels of floor treatments, which were variable between groups, helped us to reveal the differences in behavioral characteristics.

4. Conclusions

This study revealed that different levels of slatted floor treatments affect some behavioral characteristics in the early chick period. Chicks reared on the slats showed less time to rest and more feeding behavior. The percentage of chicks showing resting and aggregation behavior decreased with advancing age, while the percentage of other behaviors increased. Since it is known that early rearing conditions affect later performance in broilers, slatted floor systems with higher feeding behavior can be an effective tool for better performance in broiler production.

Table 2. The effects of age and treatment x age interaction on some behavioral traits in broiler chicks (n = 600 chicks)

Behaviors	2 d old	5 d old	9 d old	11 d old	SEM	Age effect	Treatment x age effect
Feeding, %	15.73a	16.12a	10.71b	12.94ab	0.897	F=6.295, P=0.001	P=0.197
Drinking, %	4.70b	6.95b	14.81a	9.90a	0.960	F=18.811, P<0.001	P=0.860
Resting, %	78.72a	76.89a	72.82a	65.58b	1.338	F=14.832, P<0.001	P=0.230
Others, %	0.85bc	0.04c	1.66b	11.58a	0.498	F=181.602, P<0.001	P=0.007
Aggregation, %	18.35a	10.37b	6.23bc	2.56c	1.645	F=17.662, P<0.001	P=0.384
Aggregation score [1]	0.84a	0.57ab	0.33bc	0.16c	0.074	F=15.870, P<0.001	P=0.141
Slatted floor preference, %	40.49b	54.54a	62.77a	39.98b	2.162	F=23.492, P<0.001	P=0.494

[1]Aggregation score was determined by the scoring method on a 0-3 scale. 0= no aggregation (0-3 chicks), 1= little aggregation (4-6 chicks), 2= moderate aggregation (7-9 chicks); 3= high aggregation (10 chicks and above).

[a-c]The means shown with different letters on the same row differ from each other at the P<0.05 significance level according to the Bonferonni multiple comparison test. SEM= standard error of the mean.

Author Contributions

H.Ç. (50%) collected data and conducted the experiment, (100%) wrote and (50%) edited manuscript. M.S. (100%) initiated the research idea, developed the project and supervised the research. K.E. (100%) suggested the research methods, analyzed the data, (50%) edited the manuscript and (100%) interpreted the results. R.A. (50%) collected data and conducted the experiment. All authors reviewed and approved final version of the manuscript.

Conflict of Interest

The authors declared that there is no conflict of interest.

Ethical Consideration

The authors confirm that the ethical policies of the journal, as noted on the journal's author guidelines page, have been adhered to. Ethical approval was obtained from the Ondokuz Mayıs University Ethical Committee for Experimental Animals according to the decision dated 29.04.2021 and numbered 2021/25.

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References

Altan A, Bayraktar H. 2018. Tavukçuluk bilimi, yetiştirme, besleme, hastalıklar: kümesler ve donanımları. Bey Ofset, Ankara, 5th ed., pp 190-236.

Aviagen. 2018. Ross broiler pocket guide. Newbridge: Aviagen Ltd. https://en.aviagen.com/assets/Tech_Center/Ross_Broiler/Ross-Broiler-Pocket-Guide-2020-EN.pdf. (accessed date: September 18, 2021).

Blokhuis HJ. 1989. The effect of a sudden change in floor type on pecking behaviour in chicks. Appl Anim Behav Sci, 22(1): 65-73. https://doi.org/10.1016/0168-1591(89)90080-4.

Brown CP, Kiely PC. 1974. The role of early experience and emotionality in social facilitation of pecking in chickens. Anim Behav, 22(1): 100-109. https://doi.org/10.1016/S0003-3472(74)80058-8.

Bokkers EA, Koene P. 2003. Behaviour of fast-and slow growing broilers to 12 weeks of age and the physical consequences. Appl Anim Behav Sci, 81(1): 59-72. https://doi.org/10.1016/S0168-1591(02)00251-4.

Çavuşoğlu E, Petek M. 2018. Genotip ve zemin tipinin etlik piliç büyüme performansı ve ekonomik verimlilik üzerine etkisi. J Res Vet Med, 38(1):18-28. https://doi.org/10.30782/uluvfd.420306.

Çavuşoğlu E, Petek M. 2019. Effects of different floor materials on the welfare and behaviour of slow-and fast-growing broilers. Arch Anim Breed, 62(1): 335-344.

https://doi.org/10.5194/aab-62-335-2019.

Chuppava B, Visscher C, Kamphues J. 2018. Effect of different flooring designs on the performance and foot pad health in broilers and turkeys. Animals, 8(5): 70. https://doi.org/10.3390/ani8050070.

Dawkins MS. 2003. Behaviour as a tool in the assessment of animal welfare. Zoology, 106(4): 383-387. https://doi.org/10.1078/0944-2006-00122.

De Jong IC, Hindle VA, Butterworth A, Engel B, Ferrari P, Gunnink H, Perez Moya T, Tuyttens FAM, Van Reenen CG. 2016. Simplifying the Welfare Quality® assessment protocol for broiler chicken welfare. Animal, 10(1): 117-127. https://doi.org/10.1017/S1751731115001706.

Ghanima MMA, Abd El-Hack ME, Othman SI, Taha AE, Allam AA, Abdel-Moneim AME. 2020. Impact of different rearing systems on growth, carcass traits, oxidative stress biomarkers, and humoral immunity of broilers exposed to heat stress. Poult Sci, 99(6): 3070-3078. https://doi.org/10.1016/j.psj.2020.03.011.

Giersberg MF, Poolen I, de Baere K, Gunnink H, van Hattum T, van Riel JW, de Jong IC. 2020. Comparative assessment of general behaviour and fear-related responses in hatchery-hatched and on-farm hatched broiler chickens. Appl Anim Behav Sci, 232, 105100. https://doi.org/10.1016/j.applanim.2020.105100.

Kaukonen E, Norring M, Valros A. 2017. Perches and elevated platforms in commercial broiler farms: use and effect on walking ability, incidence of tibial dyschondroplasia and bone mineral content. Animal, 11(5): 864-871. https://doi.org/10.1017/S1751731116002160.

Malleau AE, Duncan IJ, Widowski TM, Atkinson JL. 2007. The importance of rest in young domestic fowl. Appl Anim Behav Sci, 106(1-3): 52-69. https://doi.org/10.1016/j.applanim.2006.06.017.

May JD, Lott BD. 1992. Feed and water consumption patterns of broilers at high environmental temperatures. Poult Sci, 71(2): 331-336. https://doi.org/10.3382/ps.0710331.

Özbek M. 2021. Effects of housing system and genotype on meat quality, slaughter and carcass characteristics of broiler. PhD thesis, Bursa Uludağ University, Institute of Health Science, Bursa, pp. 69.

Öztürk AK, Türkoğlu M, Eleroğlu H. 2013. Türkiye'de organik hayvansal üretimde kanatli yetiştiriciliği. Doğu Karadeniz 1. Organik Tarım Kongresi, 26-28 Haziran, Kelkit, pp 100-1058.

Petek M, Çavusoglu E, Topal E, Ünal C, Abdourhamane IM. 2015. Effects of slatted floor housing on animal welfare in broiler production. In: Proceedings of the 3rd International Poultry Meat Congress, 22-26 April 2015, Antalya, pp 22-26.

Saeed M, Abbas G, Alagawany M, Kamboh AA, Abd El-Hack ME, Khafaga AF, Chao S. 2019. Heat stress management in poultry farms: A comprehensive overview. J Therm Biol, 84: 414-425. https://doi.org/10.1016/j.jtherbio.2019.07.025.

Sarıca M, Erensayın C. 2018. Tavukçuluk bilimi, yetiştirme, besleme, hastalıklar: etlik piliç yetiştiriciliği. Bey Ofset, Ankara, 5th ed., pp 237-265.

Sarıca M, Erensoy K. 2020. Effects of using hazelnut husk, wood shaving and of the mixture at different thicknesses on broiler performances, some organ weights, foot-pad dermatitis and litter traits. TURJAF, 8(6): 1399-1404. https://doi.org/10.24925/turjaf.v8i6.1399-1404.3536.

Shields S, Greger M. 2013. Animal welfare and food safety aspects of confining broiler chickens to cages. Animals, 3: 386–400. https://doi.org/10.3390/ani3020386.

Weeks CA, Danbury TD, Davies HC, Hunt P, Kestin SC. 2000. The behaviour of broiler chickens and its modification by lameness. Appl Anim Behav Sci, 67(1-2): 111-125. https://doi.org/10.1016/S0168-1591(99)00102-1.

Zhao FR, Geng AL, Li BM, Shi ZX, Zhao YJ. 2009. Effects of environmental factors on breast blister incidence, growth performance, and some biochemical indexes in broilers. J Appl Poult Res, 18(4): 699-706. https://doi.org/10.3382/japr.2009-00018.