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Multi-Attribute Evaluation and Selection of Broiler House for the Low Prevalence of Footpad Lesion

ABSTRACT

Intensive broiler production requires large flock density, which compromises litter quality and increases the prevalence of footpad lesions. The present study aimed at comparing the incidence of footpad dermatitis of broilers reared in two different rearing environments. Data from two broiler houses were recorded during 42 d. Air temperature and relative humidity; litter moisture, pH, and temperature; footpad surface temperature; and the incidence of footpad lesions was investigated. Litter quality was analyzed in a 2 x 4 factorial arrangement, with two house types (dark house or open-sided house) and four rearing phases (21, 28, 35, and 42 d of growth), with four replicates per treatment using 12 replicates. Four replicates were used for analyzing the air environment data. For the footpad lesion identification, a randomly factorial scheme of recording the surface temperature was built (2 x 2) using two houses, and the broiler sex using 15 replicates in the grow-out stages. The measures of association (odds ratio and risk ratio) were calculated. The multi-criteria analysis (Analytic Hierarchy Process - AHP) was applied for estimating the house that provided less prevalence of lesions. The field data did not provide enough evidence for selection of a particular house with less incidence of footpad dermatitis. However, when applying the measures of association data, and corresponding literature data to the AHP, there was an indication that the dark-house provided broiler rearing condition that reduced the incidence of footpad lesions.

INTRODUCTION

Industrial broiler production applies high stocking densities, and some houses may rear up to 30,000 birds. In most tropical countries, broiler houses are built with open sides, which are closed with polypropylene curtains, and are equipped with ventilation fans and fogging systems to provide high-speed tunnel ventilation. This system provides good air movement and removes much of the heat generated inside the house. Some farms rear broilers in dark houses (DH), which are completely closed, and temperature and humidity is controlled by is provided by negative pressure ventilation (exhaustion fans) and cooling pads. Dark-houses (DH) and curtain-sided houses (CH) provide a good thermal environment for intensively-reared broilers during the grow-out period (Petek *et al.*, 2012; Carvalho *et al.*, 2015). By controlling the temperature and relative humidity inside the houses, broilers farmers can better maintain flock uniformity and provide a more adequate rearing environment (Purswell *et al.*, 2014). Proper ventilation inside the rearing environment leads to good air quality and appropriate litter quality (Garcês *et al.*, 2013; Taira *et al.*, 2014; Lima *et al.*, 2015).

High litter pH and temperature can cause damaging consequences to broilers (Jacob *et al.*, 2016). The increase in ammonia emission levels



due to poor litter quality affects the respiratory tract and may cause footpad dermatitis (FPD), hock burns, and breast lesions (Mendes *et al.*, 2012; Carvalho *et al.*, 2015). In addition, poor environment and litter conditions affect broiler welfare, and it may lead to leg conditions (Jonge and Van Trijp, 2013; Tuytens *et al.*, 2014; Souza *et al.*, 2015). The severity of the lesions caused by poor litter is correlated with the environmental rearing conditions (Hashinomoto *et al.*, 2011; Jacob *et al.*, 2016).

After the breast and wings, broiler feet are the third most important economic as they account for the third largest demand for exports (Jacob *et al.*, 2016). An important management criterion to broiler growers is the identification of broiler houses with high FPD prevalence, as this information may allow applying measures to mitigate possible losses during live production.

The multi-attribute/criterion analysis provides an appropriate evaluation for this particular scenario (Saaty, 1980; Almeida Paz *et al.*, 2010; Garcia *et al.*, 2012). Among the available multi-attribute approaches, the analytic hierarchy process (AHP) allows combining different types of criteria in a multi-level decision-making structure to obtain a single score for each alternative with a specific characteristic (Pilecco *et al.*, 2012; Nääs *et al.*, 2015). The purpose of the process is to provide a vector of weights expressing the relative importance of the alternatives for each criterion. The adopted scale of relevance was defined according to Saaty (1980), using a 1 to 9 scale for pairwise comparison. These pairwise comparisons yield a reciprocal ($n \times n$) matrix A , where $a_{ii} = 1$ (diagonal elements) and $a_{ji} = 1/a_{ij}$.

The present study aimed at comparing two different broiler rearing environments, which provided a combination of different factors, and to study the effect of these factors on the incidence of footpad dermatitis.

MATERIAL AND METHODS

The field trial was carried out in the Southwestern region of Brazil (longitude 54° 11' 6" W and latitude 23° 28' 26" S). Six dark housed (DH) and six curtain-sided broiler house (CH) were evaluated. DH houses (15-m wide, 150-m long and 3.2-m high) were equipped with forced ventilation by exhaustion fans (12 fans with an air flow of 580 m³ s⁻¹), a high-pressure fogging system, and internal masonry walls painted black. CH houses (15-m wide, 150-m long and 3.2-m high) were equipped with forced ventilation by

exhaustion fans (11 fans with an air flow of 450 m³ s⁻¹), a low-pressure fogging system, and sides closed off with yellow polypropylene curtains (0.17-mm thickness). The studied broiler houses were all on the same farm and oriented in the East-West direction.

A total of 31,500 one-d-old broiler chicks (half males and the half females) were reared in each house for 42 d. The adopted flock density was 14 birds m⁻², and birds were reared on re-used rice husks litter (10-cm deep). On the 27 d of the grow-out, the litter was revolved (which is a standard broiler house management in Brazil to reduce litter compaction), and hydrated lime (0.5 kg m⁻²) was spread on and mixed with the litter. The houses were virtually divided into three quadrants with the purpose of collecting the samples of the variables equally, and the recording was done in the geometric center of each quadrant.

Environmental temperature and relative humidity, and litter temperature were recorded from 8:00h to 10:00h. Litter samples of litter were collected and conditioned in plastic bags to determine their moisture and pH in the laboratory. The footpad of 20 birds (10 males and 10 females) as also examined during the same period. All data were recorded on d 21, 28, 35, and 42 of the grow-out period of the flock in three places per quadrant near the geometric center. The experimental procedure was approved by the Ethics Committee of the Federal University of Grande Dourados (protocol n. 012/2015).

Rearing environment data (air temperature and relative humidity) were recorded using a portable thermal-hygrometer (ICEL model HT-7020, Prismacom Inc., Rua Vaticano 269, Brazil) with the precision of ± 0.01 °C. Litter temperature at 5-cm depth was recorded using a digital probe thermometer (AKSO, AK05, Akso Inc., São Paulo, Brazil) with the accuracy of ± 0.5 °C and a range of -10 to 100 °C. Three samples of litter per quadrant were collected and placed in plastic bags and placed inside a cooler for subsequent analyses. Litter pH was determined using a pH meter (Hanna, HI-2210, Hanna Inst., São Paulo, Brazil) with precision of ± 0.01 pH and range of -2.0 to 16.0. Litter samples were diluted in distilled water (25 g litter per 70 mL distilled water) and homogenized (Camargo and Valadares, 1980). Litter moisture (LM) was determined placing a 100-g sample in a drying oven for 12 hours at 105 °C, as suggested by the Official Methods of Analysis (Helrich, 1990). LM value was calculated using Equation 1.

$$LM (\%) = \frac{(\text{initial weight} - \text{final weight})}{\text{initial weight} \times 100} \quad \text{Eq. 1}$$



Ten broilers (five males and five females) were randomly chosen in each quadrant, and their footpad surface temperature was determined using thermal images from a digital thermal camera (Testo 880®, Testo Inst., Lenzkirch, Germany) with the accuracy of ± 0.2 °C within the spectrum of 7.5 - 13 μm). The emissivity adopted was 0.95 (Nääs *et al.*, 2010). Three points within the broiler footpad image were selected and processed using the Testo thermal imager software (Testo IRSoft®, version 2.3, Testo Inst., Lenzkirch, Germany). Footpad surface temperature was analyzed as suggested by Jacob *et al.* (2016) and Roberto and Souza (2014).

Footpad lesion was scored using the scale of Hashimoto *et al.* (2011) (Figure 1), where 0 = no lesions, 1 = lesion in 50% of the footpad area, 2 = lesion in 50-100% of the footpad area, and 3 = lesion in 100% of the footpad area and in surrounding areas.



Figure 1 – The degree of the lesion in broiler footpad (0 for sound footpad, 1 for footpad with less than 50% lesion, 2 for footpad with an injury between 50 to 100%, and 3 for footpad and digits with lesions; Hashimoto *et al.*, 2011).

between the variables. Means were compared by Tukey's test at a 95% confidence interval. The software Assistat (Silva & Azevedo, 2016) was used.

The incidence of footpad lesions was analyzed using the scores suggested by Hashimoto (2011). The measures of association (odds ratio and risk ratio) were calculated using logistic regression and Fisher's exact probability test for all four grow-out phases (21, 28, 35, and 42 d) at 95% confidence interval. The online software VassarStats (2016) was used.

Analytical Hierarchy Process (AHP) was applied for the multi-attribute/criteria analysis (Almeida Paz

Litter quality was analyzed according to a completely randomized experimental design in a 2 x 4 factorial arrangement was applied, consisting of two house types (DH and CH) and four grow-out phases (21, 28, 35, and 42 d), with 12 replicates per treatment, totaling 96 experimental units. The same experimental design was applied to analyze internal house environment (air temperature and relative humidity), but using four replicates, totaling 32 experimental units. Footpad surface temperature was analyzed by randomly selecting points in the thermal image of both feet (right and left) and applying a 2 x 2 arrangement with two house types (DH or CH) x sex (female or male) with 15 replicates in each of the four phases of growth (21, 28, 35, and 42 d of grow-out).

Statistical analysis

After checking the normality of the data Two-way ANOVA was applied to verify if there is an interaction

et al., 2010; Garcia *et al.*, 2012). The criteria were litter quality (litter temperature and pH), rearing environment (ambient temperature and relative humidity), broiler age (21, 28, 35, and 42 d), and sex (female and male). All criteria were considered using the results of the field experiment accurately compared, taking into account the statistical analysis and the association measurements. Information from the database set found in current references in Table 1 were also used to support specific attributes. The online software BPMSG (2017) was used to calculate the weight matrices.



Table 1 – Information from the database set found in current literature used to help weigh the attributes for processing the Analytic Hierarchy Process (AHP).

Author	Studied attributes			
	Litter quality	Rearing environment	Broiler age	Broiler sex
Pagazaurtundua andWarriss (2006)	X	X	-	-
Eichner <i>et al.</i> (2007)	X	X	X	-
Nagaraj <i>et al.</i> (2007)	X	X	-	-
Nowaczewski <i>et al.</i> (2007)	X	X	-	X
Bilgili <i>et al.</i> (2009)	X	X	-	-
Almeida Paz <i>et al.</i> (2010)	X	X	X	X
Shepherd <i>et al.</i> (2010)	X	X	-	-
Hashimoto <i>et al.</i> (2011)	-	X	X	-
El-Wahab <i>et al.</i> (2012)	X	X	X	-
Garcia <i>et al.</i> (2012)	X	X	X	X
Mendes <i>et al.</i> (2012)	X	X	X	-
Pilecco <i>et al.</i> (2012)	X	X	X	X
Almeida Paz <i>et al.</i> (2013)	X	X	-	X
Garcês <i>et al.</i> (2013)	X	X	X	-
Martins <i>et al.</i> (2013)	X	X	X	-
Sarica <i>et al.</i> (2014)	X	X	X	-
Taira <i>et al.</i> (2014)	X	X	X	-
Jacob <i>et al.</i> (2016)	X	X	X	X
Garcês <i>et al.</i> (2017)	X	X	X	-

RESULTS AND DISCUSSION

Higher litter pH ($p < 0.05$) was measured on d 28 and 35 than on the other phases (21 and 42 d), and lower in the final rearing week in DH compared with CH. Mean litter pH values were higher ($p < 0.05$) in CH than in DH (Table 2). Mean litter moisture values were similar between CH and DH ($p > 0.05$), and significantly decreased ($p < 0.05$) with grow-out phase in CH. An interaction between house type and broiler age was detected for litter pH and humidity results, indicating that house type influenced the internal environment and litter quality as a function of bird age (Table 2). In the current literature, several authors identified that litter quality was a primary concern in the prevalence of FPD (Eichner *et al.*, 2007; Nagaraj *et al.*, 2007;

Nowaczewski *et al.*, 2011; El-Wahab *et al.*, 2012; Garcês *et al.*, 2013).

The differences in litter pH related to broiler age is possibly due to the litter management. The typical procedure of adding hydrated lime and revolving the litter on d 27 d of the grow-out likely influenced the decrease in the pH in the following days. The high litter pH in the CH may indicate that birds reared in that environment may potentially have higher pododermatitis incidence during the final stage of production. However, litter moisture was close to 30% in both houses, leading to similar litter quality in both houses during the early stages of the grow-out. High litter moisture favors microbial replication and ammonia emissions, deteriorating air quality. Lima *et al.* (2015) found higher litter pH and temperature values in DH than in CH, resulting in higher ammonia emissions,

Table 2 – Average values of litter quality (pH and moisture) in the studied houses during the grow-out days.

Factor	Age of broilers (day)				Mean
	21	28	35	42	
House	Litter pH				
DH	8.1 bB	9.1 aA	9.0 aA	8.2bC	8.2 b
CH	9.0aB	9.2aAB	8.0bAB	9.0aA	9.1 a
CV (%) = 2					
	Litter moisture(%)				
DH	29.0aAB	32.1aA	27.0aB	27.1aB	29.1 a
CH	31.1aA	29.2bA	28.2aAB	25.1aB	28.2 a
CV (%) = 6					

Means followed by the same letter (lowercase in the column and column and uppercase in the line) did not differ by Tukey test ($p \geq 0.05$). CV = coefficient of variation. DH=dark house; CH=curtain-side house.



and, therefore, worse air quality. Bilgili *et al.* (2009), evaluating the influence of litter substrates on FPD severity of, determined high FDP incidence in 42-d-old broilers reared on high-moisture litter. Therefore, it is likely that the high litter moisture in DH induced the FPD observed in 42-d-old broilers in the present study.

Internal air temperature was not different ($p>0.05$) between DH and CH (Table 3). Mean air temperatures were higher ($p<0.05$) on d 21, 28 and 42 than on d 35 d. On the other hand, higher mean RH ($p>0.05$) was recorded in CH than in DH. Relative to broiler age, the highest RH were determined when broilers were 35-d-old (75%), and the lowest on d 28 (53.1%).

An efficient ventilation system provides fresh air to the birds and also improves litter quality, as it reduces litter moisture. The use of minimal ventilation systems

increases the removal of noxious gases, which also increase the prevalence of FPD in broilers (Czarick & Fairchild, 2007). The combined effect of temperature, relative humidity, air velocity, and particle and microorganism concentrations in the air determine the air quality within the rearing environment (Garcês *et al.*, 2017). A plausible explanation for a higher occurrence of FPD lesions in 42-d-old males reared in DH is the increase of air relative humidity as birds grew, impairing litter quality.

Footpad surface temperature results are presented in Table 4. No differences were observed on d 21. On d 28, birds reared in DH presented higher mean surface temperature in the right footpad (31.0 °C) than those in CH (30.1 °C), as well as in the left footpad, of 32.1 °C in DH-reared broilers and 30.1 °C in birds housed in

Table 3 – Mean air temperature (°C) and relative humidity (%) at the different houses for the studied broiler ages.

Factor	Age of broilers (day)				Mean
	21	28	35	42	
House	Air temperature (°C)				
DH	26.2	27.1	24.2	25.3	26.1 a
CH	26.1	26.2	24.1	27.0	26.2 a
CV (%) = 2.5					
	Air relative humidity (%)				
DH	61.0aB	53.1aC	75.0aA	55.1bBC	61.2 b
CH	65.0aC	36.1bD	74.2aB	82.2aA	64.1 a
CV (%) = 2.6					

Means followed by the same letter (lowercase in the column and column and uppercase in the line) did not differ by Tukey test ($p \geq 0.05$). CV = coefficient of variation. DH=dark house; CH=curtain-side house.

CH. When birds were 35 days old, lower mean left footpad surface temperature was measured in DH (30.1 °C) than CH (30.2 °C). At 42 days of age, there was no influence of housing type on footpad surface temperature. However, males presented higher average footpad surface temperature (34.0°C) than females in DH (32 °C), both in the right footpad (males = 34 °C and females = 32.1 °C) and in the left footpad (males = 34.0 °C and females = 33.2 °C). Surface temperature has been applied to determine the presence of lesions and heat stress (Nääs *et al.*, 2010; Nascimento *et al.*, 2014). The identification of FPD using footpad surface temperature was previously used by Jacob *et al.* (2016). These authors found a high correlation between the increase in footpad surface temperature as the lesion develops, indicating an inflammatory process. As the lesion progresses, tissues become necrotic, and surface temperature decreases.

At 21 d of age, the proportion of broilers with FPD scores 1 to 3 was 40% (12/30), and 60% (18/30) with score 0 in DH, and 93% (28/30) with scores 1 to 3, and 7% with score 0 in CH. The results of the measures

of association did not detect any association between broiler sex and FPD incidence in 21-d-old broilers either in DH or CH (Table 5). In addition, the factor house (DH vs. CH) did not influence FPD incidence at this age, with odds ratio (OR) and risk ratio (RR) of OR = 0.05 and RR = 0.43, respectively. The risk ratio (RR), also called relative risk, compares the risk of a health event (disease, injury, risk factor, or death) between one group exposed to the risk and a non-exposed group (Thompson *et al.*, 1998). However, when Fisher's exact probability test was applied, DH-reared birds presented lower incidence and lower FPD on d 21 ($p = 0.00001$) (Table 5).

At 28 d of age, the proportion of birds presenting FPD scores 1 to 3 was 70% (21/30) and 30% score 0 (9/30) in DH. In CH, 93% (28/30) of the broilers had 1-3 FDP scores, and 7% score 0 (2/30). A low association (RR = 0.73; OR = 0.91) was determined between FDP presence and broiler sex, whereas in CH, no association between sex and the presence of FDP lesions was detected (RR = 1.0 and OR = 1.0). Using Fisher's exact probability test, DH differed from CH (p



Table 4 – Right footpad surface temperature (RFST) and left (LFST) in the different broiler houses.

21 d old						
House	RFST			LFST		
	M	F	Mean	M	F	Mean
DH	32.0	32.1	32.2 a	32.1	32.1	32.2 a
CH	33.1	32.2	33.1 a	33.2	32.2	32.2 a
SD (RFST)= 2; SD (LFST)= 2; CV (RFST; %) = 6; CV (LFST; %) = 6						
28 d old						
DH	32.2	31.1	31.0 a	32.2	32.1	32.1 a
CH	30.0	30.2	30.1 b	30.0	30.1	30.1 b
SD (RFST)= 2; SD (LFST) = 2; CV (RFST; %) = 7; CV (LFST; %) = 7						
35 d old						
DH	30.0	30.1	30.1 a	30.2	29.3	29.2 b
CH	30.0	30.2	30.2 a	31.0	30.0	31.3 a
SD (RFST)= 2; SD (LFST) = 2; CV (RFST; %) = 6; CV (LFST; %) = 6						
42 d old						
DH	34.0	32.1	33.1 a	34.0aA	32.1aB	33.2 a
CH	33.2	33.1	33.2 a	33.2aA	33.2aA	33.1 a
SD (RFST)= 2; SD (LFST) = 2; CV (RFST; %) = 5; CV (LFST; %) = 5						

Means followed by the same letter (lowercase in the column and column and uppercase in the line) did not differ by Tukey test ($p \geq 0.05$). For the interaction at the 42 d of growth: column are in lowercase and lines are in uppercase. SD = Standard deviation. CV = coefficient of variation.

= 0.041), with lower risk of FPD incidence (RR = 0.17 and OR = 0.75) in DH (Table 5).

At the phase of 35 d old the proportion of broilers with scores 1 to 3 was 57% (17/30) and score 0 was 7% (2/30) in DH. Considering the factor sex no association was found between the bird's sex and the housing alternative, and the risk was low in both tested houses. When using Fisher exact probability test for the factor house (DH vs. CH), the incidence of FPD was lower in DH ($p=0.002$ (Table 5).

At 42 d of age, the proportion of DH-reared birds with no FPD lesion (score 0) was 57% (17/30) and 43% (13/30) scores 1-3, whereas in the CH, 13% (4/30) birds had no FDP lesions (score 0) and 87% (26/30) FPD scores 1-3. There was a significant effect of the factor sex (male vs. female) during the last stage of rearing, when FPD occurrence was 1.31-fold higher in males than in females. The relative risk of males presenting FDP were 1.71 times higher in those reared in DH than in CH. Fisher's exact test result showed a significant association ($p=0.0009$) between house type and FPD incidence on d 42 of the grow-out period, consistent with the lower rate of footpad lesions observed in DH-reared broilers relative to CH. A plausible explanation for a higher occurrence of FPD in 42-d-old males compared with females is the combination of higher males weight gain and the better-controlled environment in HD. Studies have shown that footpad lesions gradually progress as the bird grows (Sarica *et al.*, 2014; Shepherd and Fairchild, 2010). Hashinomoto *et al.* (2011) found that 7-d-old broilers already present subclinical footpad lesions, which increase in area

and become more severe as the birds age. At 21 d of age, the macroscopic changes in the footpad are characterized by the presence of crusts in the footpad and digit articulations (Jacob *et al.*, 2016). Litter quality and material may also cause footpad lesions (Bilgili *et al.*, 2009; Shepherd & Fairchild, 2010).

The Analytic Hierarchy Process (AHP) was applied due to the high complexity and the multi-attribute factors interfering in the analysis of the causes of FPD in broilers during the grow-out stages. Published literature results were used to complement the data of the current study for the AHP (Table 1). The output results of the present experiment were also used as input to determine the weights applied in AHP calculations. The AHP results suggest that broilers reared in DH showed lower incidence of footpad dermatitis (0.61) than CH (0.39), as shown in Figure 2. The source criteria that led to these findings were litter quality and rearing environment of DH (Figure 3). The calculated matrix was consistent, and the consistency index (CI, Eq 2) values were adequate. In all tested comparisons, the consistency ratio (CR) compared to the consistent index (RI) ($CR = CI/RI$) was acceptable (≤ 0.1).

$$CI = \frac{\lambda_{max} - n}{n - 1} \quad \text{Eq. 2}$$

The overlapping of the applied criteria and weights are shown in the graph in Figure 3, indicating higher weights for litter quality and rearing environment in DH than in CH. The prevalence of FPD is highly correlated with rearing environment and litter quality (Garcês *et al.*, 2013; Garcês *et al.*, 2017). As broilers age, they become



Table 5 – Measures of association (odds ratio and risk ratio) of footpad dermatitis in broilers reared in two different houses from 21 to 42 d of grow-out.

		Measures of association						
Age (day)		21	28	35	42			
Factor	OR	RR	OR	RR	OR	RR	RR	
M vs. F (DH)	0.57 (- 0.13 + 2.50)	0.71 (- 0.29 + 1.75)	0.73 (- 0.15 + 3.49)	0.91 (- 0.57 + 1.45)	0.24 (- 0.05 + 1.13)	0.54 (- 0.27 + 1.09)	1.31 (- 0.31 + 5.58)	1.17 (- 0.51, + 2.66)
p-value*	0.71	1.00	1.00	1.00	0.14	0.99		
M vs. F (CH)	1.00 (- 0.06 + 17.62)	1.00 (- 0.83 + 1.21)	1.00 (- 0.06 + 17.62)	1.00 (- 0.83 + 1.21)	1.00 (- 0.06 + 17.62)	1.00 (- 0.83 + 1.21)	0.29 (- 0.03 + 3.12)	0.86 (- 0.64 + 1.14)
p-Value*	1.00	1.00	1.00	1.00	1.00	0.60		
DH vs. CH	0.05 (- 0.01 + 0.24)	0.43 (- 0.27 + 0.67)	0.17 (- 0.03 + 0.85)	0.75 (- 0.58 + 0.97)	0.09 (- 0.02 + 0.46)	0.61 (- 0.44 + 0.84)	0.12 (- 0.03 + 0.42)	0.50 (- 0.32 + 0.77)
p-value*	0.00	0.04	0.00	0.00	0.00	0.00		

Confidence interval: 95%. Inferior limit (-); Superior limit (+). * p-Value calculated using Fisher Exact Test. M = male; F = female. DH= dark house; CH = curtain-side house. OR= odds ratio An odds ratio (OR) is a measure of association between an exposure and an outcome. RR = risk ratio.

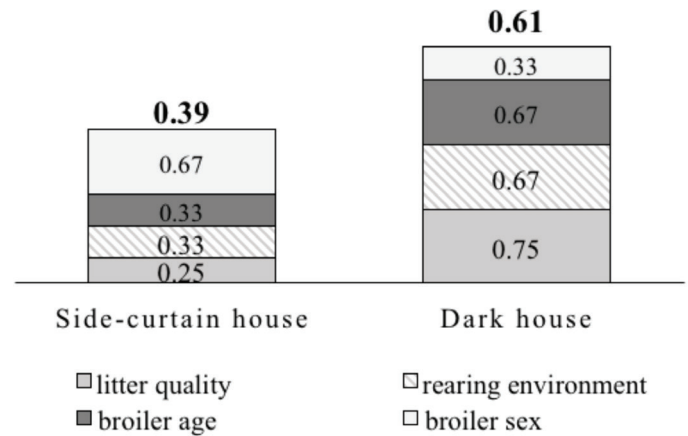


Figure 2 – Total weight of the alternatives (dark-house, DH and side-curtain house, CH) comparison and the assessment of the calculated weight of each criterion within each tested housing alternative for a broiler house with less incidence of footpad dermatitis.

heavier, increasing the incidence of FPD, as stated by Hashimoto *et al.* (2011) and Giloh *et al.* (2012).

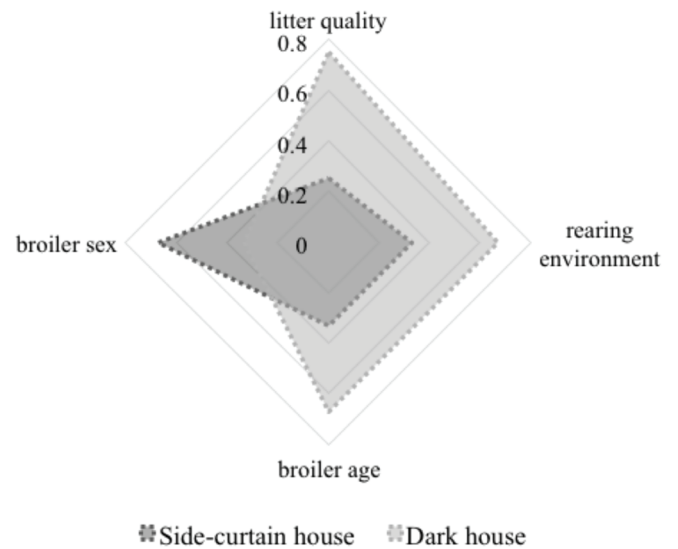


Figure 3 – Profile of the weight distribution of the criteria used as input in the Analytic hierarchy process (AHP) calculation to select a broiler house in the tested alternatives of the dark-house (DH) and the curtain-side house (CH).

Determining house types where the prevalence of footpad dermatitis is lower is a complex task. The multi-factorial scope of this condition indicates that each variable in each broiler house type have different influence on the incidence and severity of FPD. The results of the current study suggest that broilers reared in dark houses have lower risk of presenting FPD.

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