

## Age and sex effects on main welfare indicators of broiler in a commercial flock

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### SUMMARY

Various welfare parameters and growth period performance at 35 and 42 d of age of male and female broiler were investigated to determine the effects of sex and bird age on welfare of birds in a commercial flock in Turkey. It was observed that physiological responses of broiler chickens to in-house stressors increased with age. The effects of age and sex on feather coverage of abdomen ( $P<0.001$  and  $P<0.006$ ) and chest of broiler ( $P<0.002$  and  $P<0.001$ ) were found to be significant. It was found that the birds in both sex groups had a significantly dirty feather with age ( $P<0.001$ ) and the food pad quality of birds in both sex groups had worsened with age ( $P<0.001$ ). As expected, male broilers gained significantly more body weight ( $P<0.001$ ) and consumed less feed ( $P<0.001$ ). Age and sex interactions for all data obtained in this study were not to be found significant. As conclusion we can say that age and sex may be important signs of welfare risks in broiler chickens. More emphasis and attention on the care and management of the male birds should be given to control the house internal conditions and flock monitoring.

Keywords: Broiler, age, sex, welfare indicators, commercial flocks

### INTRODUCTION

Broiler chickens have been subjected to intense genetic selection for many years and broiler growth rates have increased by over 300-350% in the past 40-50 years (Bessei, 2006). On the contrary of the technical and economic development there is growing public concern about the broiler welfare because of many stress factors in the farm and their harmful effects such as impaired locomotion or contact dermatitis and high mortality. It was reported that factors influencing injuries and mortality of broilers in commercial production were temperature (Mayes, 1980), stocking density in farms (Petek et al., 2010) and per crate during catching and transportation (Scholtyssek and

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Ehinger, 1976), age at slaughter (Bingham, 1986), body weight (Mayes, 1980; Griffiths and Nairn, 1984), and sex of the broilers (Mayes, 1980). The physiological responses of broiler chickens to preslaughter stressors increased with age, most likely due to increasing body mass. (Yalcin et al., 2004). Bayliss and Hinton (1990) reported a correlation among age, sex, and mortality rate in broilers during transportation. Bilgili et al. (2006) showed that the proportion of birds with foot pad dermatitis tended to increase with the bird age until 49 day of growth period. Gouveia et al. (2009) reported that male broilers were more predisposed to breast blisters than females which are an important indicator of poor litter quality and welfare. Findings reported by Mc Lean et.al (2002) suggest that the age at slaughter and the sex of birds should be taken into account in future considerations of optimal maximum stocking density and bird welfare. The results of Dadgar et al. (2011) showed that older birds copped better with extreme conditions compared with younger birds. It has been shown that male broilers tend to have higher incidence and severity of food pad lesion than females (Bilgili et al., 2006; Nagaraj et al., 2007). Son (2010) suggests that, when male and female broilers reared together, sex ratio can influence welfare indexes of birds.

In general separate breeding of male and female broiler in commercial farm are not very common in Turkey. Together with bird age sex may be considered an important signs of welfare risks in broiler production. The aim of this study was to determine the effects of sex and bird age associated with the welfare indicators occurring during the growth period of broiler in a commercial flock in Turkey. Such knowledge may be helpful to indicate measures to reduce the poor welfare and increase the profitability in broiler production.

#### MATERIAL AND METHODS

The experimental procedures employed in this study were conducted in a commercial farm in Bursa in Turkey. A total of 24.200 day old broiler chicks (Ross PM<sub>3</sub>, 12.100 chicks each sex group) with a stocking density of 15 live birds/m<sup>2</sup> were used to monitor growth performance of broiler throughout the growth period. Individual data of male and female broilers were investigated to determine various welfare parameters at 35 and 42 d of age.

#### *Management*

Male and female chicks were brooded and reared separately in a deep-litter house at 30°C for the 1<sup>st</sup> weeks, 28°C for the 2<sup>nd</sup> week, 26°C for the 3<sup>rd</sup> week, and 21-24°C from the 28<sup>th</sup> day until 42 days of age. Standard commercial broiler feed were used during the treatment (220 g/kg protein and 3000

kcal/kg metabolisable energy from 1 to 14 d of age, 200 g/kg protein and 3050 kcal/kg metabolisable energy from 15 to 35 d of age, 180 g/kg protein and 3100 kcal/kg metabolisable energy from 36 to 42 d of age). All birds had *ad libitum* access to feed and water. Continuous (Twenty-four h) lighting was used throughout the growth period.

### *Data*

The performance data for growing period and various welfare parameters were determined in this experiment. The following information will be recorded and measured from the flock at 35 and 42 days of age: Within the flocks, 200 male and 200 female birds were randomly selected in different areas of the house to measure live body weight, gait, plumage, foot pad lesion and feather cleanliness score. As well as individual body weight, body weight uniformity was calculated (% within  $\pm 10\%$  of BW mean). Feed consumption and mortalities were recorded as it required or occurred on a group (flock) basis. Total consumption was measured at 35 and 42 day of experiment. Feed conversion ratio in the groups was calculated by average feed consumed by the birds/average (individual) weight gain. Animal-based measures were used to assess welfare of the broilers (Anonymous, 2012). The scoring system developed by Kestin et al. (1992) was used to determine gait. The methodology consists of visual observations of how birds walk on a surface. The system is divided into six levels of observed leg weakness, as follows: 0 (sound bird); 1 (the bird moves fast, but a slight walking deficiency is observed); 2 (the bird moves fast, but there is significant walking deficiency); 3 (the bird moves fast, but it presents an important deficiency); 4 (the bird moves with serious difficulty); and 5 (the bird barely moves and often uses the wings for crawling).

Feather cleanliness were scored visually from 1 (very clean) to 8 (very dirty) as reported by Wilkins et al. (2003). Feather coverage of each hen was scored on a scale of 1 to 3 (Gyles et al., 1962). A plumage score of 1 indicated hens with poor feathering with a large amount of visible skin; a score of 2 indicated hens with medium feathering; a score of 3 described hens with good feathering showing some adult feathers. The visual ranking system used to score foot pad lesions indicated a score of 0 for no lesion present with mild discoloration, 1 for a mild lesion (minor superficial lesion), 2 for a medium lesion (moderate hyperkeratosis) and 3 for a severe lesion (deep and large epithelial necrosis) (Pagazaurtundua and Warris, 2006).

### *Statistical analysis*

The live body weight and all score values were analyzed by GLM univariate factorial design to determine the effects of age and sex. Mann Whitney U test

and chi-square tests were used to analyze feed conversion ratio and mortality rate among the groups (Snedecor and Cochran, 1989). No statistical test was done for body weight uniformity. All tests were performed using SPSS® computer software 13.00 (SPSS Inc, 2004).

## RESULTS

The growth period performance of the broiler in the groups is presented in Table 1. The body weight and feed conversion ratio of birds were significantly affected by broiler age and sex ( $P<0.001$ ,  $P<0.001$ ). The live body weight uniformity was found to be higher in male in both age groups. Not significant differences for mortality in male and female groups were observed for both 35 and 42 d of ages. There was significant age effect on mortality ( $P<0.05$ ) in the groups. Age x sex interaction for all performance data was not to be significant for 35 and 42 days of age.

Table 1: Growth period performance data in the main and interactive groups.

Treatment	Body weight, g	Body weight uniformity %	Feed conversion ratio	Mortality, %
Sex				
Male	2513.20±40.29	79.00	1.48	2.09
Female	2105.72±38.79	65.00	1.75	1.92
Age				
35 d	1995.50±28.54	69.00	1.58	1.78
42 d	2623.42±34.32	75.00	1.65	2.24
Int. Groups				
Male x 35	2182.00±28.70	78.00	1.43	1.83
Male x 42	2844.40±35.51	80.00	1.53	2.35
Female x 35	1809.00±31.32	60.00	1.73	1.72
Female x 42	2402.44±38.80	70.00	1.76	2.12
ANOVA				
Sex	0.001		0.01	n.s
Age	0.001		n.s	0.05
Sex x Age	n.s		n.s	n.s
SEM	31.41			

n.s.: not significant

The influence of broiler age and sex on main welfare indicators are showed in Table 2. No significant differences for the gait score in male and female broiler were observed in both age groups. There were significant effects of age and sex on feather coverage of abdomen and chest of broiler ( $P<0.001$  and  $P<0.006$ ,  $P<0.002$  and  $P<0.001$ ). It was found that the birds in both sex groups had a significantly dirty feather with age ( $P<0.001$ ). And also, the

food pad quality or foot pad score and feather cleanliness of birds in both sex groups had worsened with age ( $P < 0.001$ ,  $P < 0.001$ ). No significant age x sex interaction was detected for all scored values for both age periods.

Table 2: Average score values of broiler reared at male and female separately.

Treatment	Gait score	Feather Score		Feather cleanliness score		Foot pad score
		Abdomen	Chest	Abdomen+ chest	Back	
Sex						
Male	0.28±0.05	1.17±0.04	2.53±0.05	4.03±0.14	1.80±0.11	1.90±0.10
Female	0.29±0.06	1.42±0.05	2.68±0.05	3.99±0.13	1.34±0.06	1.61±0.01
Age						
35 d	0.25±0.06	1.21±0.04	2.25±0.05	3.23±0.10	1.11±0.03	1.46±0.09
42 d	0.32±0.05	1.38±0.05	2.96±0.02	4.79±0.11	2.03±0.11	2.05±1.09
Int. groups						
Mx35	0.22±0.07	1.12±0.05	2.14±0.05	3.22±0.17	1.10±0.04	1.44±0.14
Mx42	0.34±0.08	1.22±0.06	2.92±0.04	4.84±0.15	2.50±0.16	2.36±0.11
Fx35	0.28±0.01	1.30±0.07	2.36±0.07	3.24±0.12	1.12±0.05	1.48±0.11
Fx42	0.30±0.07	1.54±0.07	3.00±0.09	4.74±0.17	1.56±0.11	1.74±0.16
ANOVA						
Sex	0.902	0.001	0.002	0.797	0.001	0.028
Age	0.389	0.006	0.001	0.001	0.001	0.001
Sex x Age	0.538	0.255	0.152	0.699	0.010	0.013
SEM	0.403	0.032	0.0353	0.0948	0.0647	0.070

## DISCUSSION

As expected, we found that male broilers significantly gained more body weight and consumed less feed in this study. The apparent differences for live body weight and feed conversion ratio in both age period indicated that male broilers use the feeds more efficiently than females. In general, flock uniformity is a major concern for farmers. The body weight uniformity of live birds in male group was better than females and it's getting better with bird age. Moreover a longer slaughter age length seems to lead to a more uniform flock in both sex groups (Table 1). Mortality rate in male broiler was found to be greater than female broiler in both age groups.

In this study there were no significant differences for the gait score of male and female birds and age of the birds had no significant effect on locomotion. The gait score is an estimation of locomotion deficiency and it is based on the visual observation of the ability a broiler on a surface. High or worse gait score were related to the poor environmental conditions inside the broiler house and the rearing environment of broiler is considered to be one of the main factors related either to the success or failure of production (Cordeiro

et al., 2009). Due to the fast growth rates and inactivity of the broiler chickens there is a gradual increase in the rate of occurrence in metabolic and locomotion problems (Petek et al., 2005).

In this study female broiler had a good feathering throughout the experiment. This was similar with the findings of Moreira et al. (2006) who was reported that females had better feathering in comparison to males. In normally, the feathering rate increased with age and feather cleanliness score worsened with age in poultry. Also, there might be a relationship between feather score and body weight. From this point of view the birds with the best feather condition were lighter live weight than birds with less feather coverage. There was a quantitative increase in abdomen and chest feathering in males and females in both phase form 35 to 42 days of rearing. In a study (Edens et. al., 2001) it was found that females approached full feathering at 35 d of age, but males lagged behind females even at 42 d. In general, along with the bird age poor feathering in broiler chickens may be due to inadequate nutrition, genetic inheritance and harsh environmental conditions.

In this study, there were considerable increase for the feather cleanliness score throughout the growing period, but most birds were given scores of 5 or 6. The average scores were 3.23 and 4.79 for abdomen+chest and 1.11 and 2.03 for the back in 35 and 42 days of ages, respectively. These figures were 4.03 and 3.99 for the abdomen+chest, 1.80 and 1.34 for the back in male and females, respectively. It can be said that all average figures for feather cleanliness were acceptable level.

As reported previously by Bilgili et al. (2006) male broilers had significantly higher incidence of foot pad dermatitis than female broilers at d 35 and 42 and the severity of the lesions increased with slaughter age in this experiment. In this study, the mean percentage of foot pad lesion score in male and female birds were 1.90 and 1.61, respectively. These averages are not too bad and can be said as mild lesion. Gouveia et al. (2009) showed that male broilers were more predisposed to ammonia lesions than females and the oldest birds showed the greatest incidence of foot pad dermatitis. The greater incidence of food pad lesions in male broilers could be related to great body size and therefore more weight is placed on their foot pads.

In broiler production foot pad lesions or other welfare indicators is a complex, multifactorial parameters. Despite genetics, sex and age all influence the incidence and severity of foot pad dermatitis, husbandry and management factors such as litter and air humidity have increasingly been shown to be key areas involved in the appearance of foot pad dermatitis in a flock (Grist and Rizvi, 2011). Moreover, it was reported that a strong seasonal effect on foot pad dermatitis (Haslam et al. 2007). Apart from animal welfare aspects, foot pad lesion is relevant to the poultry meat industry for several reasons. It can

lead to big economic losses because broilers with severe foot-pad dermatitis show slower weight gain and economical value of their foot might be decrease due to severe pad lesions.

Based on the result of this study we can say that age and sex may be important signs of welfare risks in broiler chickens. In general males have dirtier feather and have more severe lesions on their foot. More emphasis and attention on the care and management of the male birds should be given throughout the growth period. Also a strict control of the house internal conditions and flock monitoring such as increasing depth of litter, adding fresh litter and slaughtering male birds at an earlier age are very important to reduce poor welfare and increase economic productivity in broiler production

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