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308 Lasani Town, Sargodha Road, Faisalabad - Pakistan
Mob: +92 300 3008585, Fax: +92 41 8815544
E-mail: editorijps@gmail.com

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Breed and Sex Effect on Meat Quality of Chicken

H.H. Musa[1,2], G.H. Chen[1]*, J.H. Cheng[1], E.S. Shuiep[2] and W.B. Bao[1]
[1]College of Animal Science and Technology, Yangzhou University, Yangzhou, 225009, China
[2]Department of Animal Production, Faculty of Veterinary Science, University of Nyala, Sudan

Abstract: Total of 120 chickens from Anka and Rugao breed includes (60 individual per breed and 30 individual per sex) were taken as a representative sample and were slaughtered at Jiangsu Poultry Institute, China, and then the carcasses were dissected manually. Water holding capacity, color density, pH and tenderness were estimated from breast muscle. Breeds were found differed significantly ($P<0.05$) in color density, pH and tenderness. Regarding to water holding capacity no significant ($P>0.05$) different were noted between breeds. Tenderness, the values for shear force were significantly ($P>0.01$) higher in males than females in two chicken breeds. In addition color density, pH and water holding capacity were non significantly difference ($P>0.05$). In Anka chicken breed color density was positive correlated with pH, tenderness and water holding capacity, and similarly pH was positively related with tenderness. While in Rugao all meat quality traits shows negative correlation with each others, specially tenderness was observed positive correlation with color density.

Key words: Breed, sex, correlation, meat quality

Introduction

One of the most important problems in the poultry processing industry is the development of the pale, soft, and exudative (PSE)-like condition. Pale, soft, and exudative-like meat is caused by a rapid decrease in pH early postmortem when carcass temperatures are still elevated (Galobart and Moran, 2004).The possibility of genetically improving carcass quality by selection depends on the genetic variability of body weight and body composition. Water holding capacity, pH, color density and tenderness, usually determined in breast muscles are crucial for the culinary value and technological properties of chicken meat and have been investigated by many authors (Pikul *et al*., 1987, Knust and Pingel, 1992, Witkiewicz, 2000). Body composition also can be significantly improved by selection, as shown by the level of breast muscle heritability ranging from 0.53 and 0.65 in the studies of Le Bihan-Duval *et al*. (1998), and Rance *et al*. (2002). The fatty acid composition can be an important criterion of carcass quality and is significantly influenced by the fatty acid pattern of the diet (Yau *et al*., 1991; Roth *et al*., 1993; Scaife *et al*., 1994). The use of certain fats or of free fatty acids may even have an impact upon subjective or organoleptic traits of meat quality (Zollitsch *et al*., 1992; Roth *et al*., 1993). Many authors were reported the correlation between pH after 24h postmortem, lightness and PSE problems for poultry meat, confirming the importance of correct measurement of color parameters (Galobart and Moran, 2004). Evidence shows that a strong negative correlation exists between poultry breast muscle lightness, pH, and water-holding capacity (Barbut, 1996; Le Bihan-Duval *et al*., 1998). The aim of the present experiment was to investigate the effect of breed and sex on breast muscle meat quality.

Materials and Methods

Stocks and meat quality analysis: The 120 chickens from Anka and Rugao breed includes (60 individual per breed and 30 individual per sex) were taken as a representative sample and were killed by cervical dislocation, at Jiangsu Poultry Institute, China, and then the carcasses were dissected manually and the intact carcass was weighed (Zollitsch *et al*., 1997). Breast muscle was transported to the College of Animal Science laboratory, Yangzhou University, China. Water holding capacity was estimated by placing 1g of breast muscle into the middle of 16 filter paper covered by hard plastic plate, pressed slowly until 35kg for 5 min., and then (WHC) was calculated as: weight of sample before pressing - weight of sample after pressing)/ weight of sample before pressing x 100. Shear force was evaluated on cores (1.25x2cm) obtained from the maid portions of the breast samples by cutting them perpendicularly to fiber direction, using an Instron equipped with a Warner-Bratzler Shear (Castellini *et al*., 2002). The color was measured after homogenizing 3g breast muscle with 4 ml distilled water for 10 min, and then centrifuged for 5 min at 3500 rpm. The supernatant was transferred into color tube and the OD was measured at 540 nm using Spectrophotometer. The same supernant was similar used for pH determination using pH meter.

Data analysis: Data were statistically analyzed using means and standard error of means, the effect of breed

and sex was determined by student t-test and correlation coefficient matrix of meat quality by Pearson coefficient correlation, all analysis was performed by MATLAB 6.5 software.

Table 1: The effect of breed on meat quality of chicken

Breed	Anka	Rugao	P. value
OD	0.82±0.04	0.63±0.04	0.001
pH	5.72±0.01	5.68±0.01	0.028
WHC	0.33±0.01	0.32±0.01	0.165
Tenderness	3.27±0.09	2.63±0.08	0.000

The sample size for each breed was 60 individual

Results and Discussion

Effect of breed on meat quality: The effect of breed on qualitative characteristics of meat is reported in (Table 1). Breeds were differed significantly (P<0.05) in color density, pH and tenderness. Regarding to water holding capacity no significant (P>0.05) different were noted between breeds (table 1) similar results were reported by Preziuso and Russo, 2003. In contrast Roberson *et al*. (2004) found there were no significant effects on lightness or redness of breast meat. The lower pH of chicken could be due to the better welfare conditions that reduce the stress pre-slaughter and thus consumption of glycogen (Castellini *et al*., 2002). While Enfalt *et al*., (1997) suggested that the lower pH found in outdoor reared pigs could be the consequences of better capacity to utilize substrate other than glycogen during transport to the slaughter house. It could be supposed that genetic strain has a role in the improvement of customer appraisal of poultry meat (Abeni and Bergoglio, 2001).

Effect of sex on meat quality: Tenderness, the values for shear force were significantly (P<0.01) higher in males than females in two chicken breeds. However color density, pH and water holding capacity were non significantly difference (P>0.05) Table 2. Similarly Zollitsch *et al*., (1997) was reported that there were no significant differences in various characteristics of subjective quality traits of breast meat. Kirchgessner *et al*. (1992) found the slight improvements of juiciness and overall classification of breast meat with high dietary levels of linoleic acid. In addition Touraille *et al*. (1991) observed that tenderness was high in all cases but decreased with age. However, Sonaiya *et al*., 1990 found no difference due to age. Also the production system affected the shear value that was higher in either the breast or drumstick of the organic animals (Farmer *et al*., 1997).

Correlation analysis of meat quality: In Anka breed color density was positively related with pH, tenderness and water holding capacity, and similarly pH was positively related with tenderness. Negative correlation was also found between pH and water holding capacity,

Table 2: The effect of sex on meat quality of chicken

Parameters	Male	Female	P. value
Anka			
OD	0.89±0.06	0.76±0.06	0.213
pH	5.73±0.02	5.69±0.02	0.211
WHC	0.32±0.04	0.34±0.01	0.075
Tenderness	3.56±0.64	2.97±0.11	0.000
	Male	Female	P. value
Rugao			
OD	0.67±0.05	0.60±0.05	0.423
pH	5.69±0.01	5.67±0.01	0.316
WHC	0.31±0.01	0.32±0.01	0.396
Tenderness	2.94±0.11	2.32±0.09	0.000

The sample size for each males and females within breeds was 30 individual

Table 3: Correlation coefficient matrix of meat quality in two chicken breeds

Parameters	OD	pH	WHC	Tenderness
OD	1	0.437**	0.061	0.199
pH	-0.020	1	-0.216	0.328*
WHC	-0.148	-0.239	1	-0.282*
Tenderness	0.026	-0.006	-0.088	1

OD, color density; WHC, water holding capacity. Above the diagonal was Anka breed and below the diagonal was Rugao breed. **Correlation is significant at the 0.01 level (-tailed). *Correlation is significant at the 0.05 level (-tailed)

and between water holding capacity and tenderness. While in Rugao all meat quality traits shows negative correlation with each others, specially tenderness was observed positive correlation with color density (Table 3). And that was in agreement with (Barbut, 1996; Le Bihan-Duval *et al*., 1998).

Measures of sensory palatability incorporate attributes such as tenderness, juiciness, and flavor (Oddy *et al*., 2001). Nishimura *et al*. (1999) reported that intramuscular fat in longissimus muscle may physically alter connective tissue structure and thereby reduce toughness of the meat. Although intramuscular fat plays a major role in broiler meat quality flavor and juiciness (Chizzolini *et al*., 1999).

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