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RESEARCH OPINIONS IN ANIMAL & VETERINARY SCIENCES

Comparative study of some meat quality traits of three local strains of turkey in Sulaimani city, Iraq

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Abstract

This study was conducted to compare some meat quality traits in three strains of turkeys in Sulaimani city. For this purpose, three strains (White, Red and Black) of turkey birds (15 from each strain) were collected. Meat from thigh, breast and wing of each bird was processed for moisture, protein, fats, ash, pH, water holding capacity and taste and flavour. Higher moisture content was recorded in Breast Red strain (71.11%) and lowest in wing meat of Black strain (66.47%). Higher protein content was recorded in the wing meat of Black strain (24.80%) while lower content was recorded in the thigh meat of Red strain (21.66%). Highest fat content was recorded in thigh meat of White strain (7.67%) while lowest in breast meat of Red strain (1.32%). Ash contents were lowest in thigh and wing meat of Black strain than other strains. Among physical parameter, higher pH value was recorded in thigh meat of White strain (6.52) while a lowest pH value was recorded in breast meat of Black strain (6.14). Higher water holding capacity was recorded in thigh meat of White strain (49.57%), while lowest percentage was recorded in breast meat of Black strain (36.41%). Cooking loss percentage was lowest in the thigh meat of White strain. However, regarding sensory evaluations, the differences were observed in tenderness and colour traits. While no significant difference was noticed for other sensory traits. It can be concluded that thigh meat of all strain recorded most acceptable results of the most traits under study.

Keywords: Meat traits; Turkey; Iraq

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Introduction

The consumers demand for high quality meat products. The turkey meat has high intramuscular fat which enhances flavour, texture and meat juiciness (Tor et al., 2005). The changes from whole bird to further processed meat products increase the incidence of noticeable change in physical appearance. Topical changes are myopathies or the appearance of pale, soft and exudates (PSE). These meat alternations are related to the intensive selection and rapid growth of birds for increase live weights and breast yields (Bianchi et al., 2006; Fraqueza et al., 2006).

Such alternations are not only unacceptable for consumers, but also give rise to problem in the poultry industry during processing (Warner et al., 2008). One of the meat important problems in the poultry processing industry is the development of PSE caused by a rapid pH decline combined with high meat temperature and accelerated protein degeneration. The PSE condition leads to a pale colour, changes in appearance and poor water binding capacity (Lawrie, 1998; Alvarado and Sams, 2004; Galobart and Moran, 2004). The possibility of genetically improved meat quality by selection depends on the genetic variability of meat composition, water binding, colour and tenderness (Witkiewicz, 2000). Meat quality of turkey depends on weight, fattening condition and skin colour. The objective of the study was to compare the meat quality, chemical composition and sensory evaluation of turkey as influenced by meat- type strain.

Materials and methods

Three strains (White, Red and Black) of turkey birds (15 turkeys from each strain) were collected from

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different regions of Sulaimani governorate. Average weights of these birds were about 3 kg and 4 months old. After slaughtering, thigh, breast and wing muscles were excised. Breast and thigh and wings muscles were separated from each carcass and packed in polyethylene bags. Carcasses were allowed to chill overnight at a temperature of 4°C. Percentage of moisture, protein, fat and ash content were determined in meat samples according to the Association of Official Analytical Chemists (AOAC, 2000).

The pH of the meat samples was measured according to Naveena and Mendiratta (2001) using a pH meter. Water holding capacity (WHC) was measured according to Wardlaw et al. (1973). Cooking loss was measured according to the method of Cyril et al. (1996).

For organoleptic evaluation, the meat samples were placed in open aluminium boxes and cooked for 15 min in a pre-heated oven at 200°C (Castellini et al., 2002). After cooking, nine teaching staff of the Department of Animal Production, Agricultural Science Faculty, University of Sulaimani gave their opinion for the sensory evaluation. The data obtained was subjected to ANOVA with the general linear model procedure of SAS (1985).

Results and Discussion

Chemical composition of turkey meat

The chemical composition of the thigh, wing and breast meats of turkey strains are shown in Table 1. The muscle types differed significantly ($P<0.05$) in protein, moisture, fat and ash contents in all strains. It is also clear from Table 1 that the birds of the Black strain had significantly higher protein content (24.80%) in the wing meat, followed by Red strain (23.83%) in the breast meat, whereas, the lowest protein content (21.66%) of the thigh meat was found in Red strain. Birds in the Red strain had higher moisture content (71.11%) of the breast meat than other strains. Within the White, Red and Black strains, the moisture contents were similar in all meats, whereas the Black strain had lowest moisture content (66.47%) in wing meat. Fat content of thigh meat, the bird of the White strain had the highest content (7.67%), followed by the Black strain (6.83%), whereas the lowest fat content of breast meat ($P<0.05$) was in all strains. The ash content of thigh and wing meat in Black strain was lower than other strains. Paleari et al. (1998) recorded 20.4% protein, 74.8% moisture, 3.85% fat and 1% ash in turkey's meat. Evaluation of the chemical composition of turkey meat in relation to the growth capacity is rare. Warner et al. (2008) showed that birds in the But big 6 and Kelly B88 strains had lower protein and fat contents of breast meat. These authors stated that the differences can not be logically explained and have no practical influence on the quality of breast meat. For other poultry species, inconclusive results have been presented. Castellini et al. (2006) determined a greater fat content and similar protein, ash and moisture contents in different strains of chickens. A clear influence of strains on proximate composition of the breast meat and a real practical influence on the product quality are not apparent (Fernandez et al., 2008).

Physical traits

The results of quality parameters of thigh, wing and breast meat of turkey strains are shown in Fig. 1. Among strains considered, the lowest pH value (6.14) of breast meat was found in Black strain followed by Red strain (6.17), whereas, the highest pH value of thigh meat (6.52) was recorded in White strain followed by Red and Black strains. The results of WHC of thigh, wing and breast meat are shown in Fig. 2. The WHC of the thigh meat was higher (49.57%) in the White strain followed by Red strain (48.91%). The lowest WHC of the breast meat (36.41%) was seen in Black strain when compared to the other strains.

The cooking loss of the thigh, wing and breast meats are presented in Fig. 3. The cooking loss of these muscles differed significantly among strains. The thigh meat had less cooking loss, which were 13.93, 15.57 and 17.45% for the White, Red and Black strains, respectively by comparison with other meats, whereas the breast meat had higher cooking loss.

The results revealed that the thigh meat had higher pH value than the breast meat in all strains. This result coincided with previous report in chicken meat (Castellini et al., 2002; De Marchi et al., 2005). The difference may be due to the different type of muscle that predominate in the thigh meat (oxidative muscle vs glycolytic muscles in the breast meat), or it also may be due to change in the proportion of the muscle fibre that are responsible for different pattern of muscle metabolism (Kadim et al., 2006). Results indicated that the thigh meat had higher WHC and less cooking loss than breast meat in all strains, possibly due to the increase in pH value as a result of the decrease in amount of glycogen which result in less glycolysis. Also results could be attributed to the different pH values of the muscles. Therefore, the proteins are more functional, resulting in lower cooking loss (Lawrie, 1998). The breast meat is susceptible to soft, pale and exudative lesions, so it is possible that the PSE of turkey meat lead to a fast decline in pH in early postmortem. This condition also results in lower WHC and more exudative contents (Sante et al., 1991; Roberson et al., 2003).

Sensory evaluation

The results of the sensory evaluation of thigh, wing and breast meats for turkey strains are shown in Table

Table 1: Effect of strain and muscle type on chemical composition of turkey meat

Strain	Moisture (%)			Protein (%)			Fat (%)			Ash (%)		
	Thigh	Wing	Breast	Thigh	Wing	Breast	Thigh	Wing	Breast	Thigh	Wing	Breast
White	68.69± 0.40^{c}	68.37± 0.24^{c}	69.95± 0.17^{b}	21.78± 0.45^{d}	22.96± 0.34b^{c}	23.02± 0.12b^{c}	7.67± 0.28^{a}	5.90± 0.20^{c}	4.75± 0.28^{d}	1.61± 0.28^{ab}	1.77± 0.11^{ab}	1.93± 0.11^{a}
Red	70.10± 0.14^{b}	70.45± 0.25^{b}	71.11± 0.10^{a}	21.66± 0.29^{d}	22.24± 0.17^{cd}	23.80± 0.19^{b}	6.23± 0.17^{bc}	6.65± 0.29^{b}	4.19± 0.17^{d}	1.55± 0.25^{ab}	1.33± 0.12^{bc}	1.32± 0.11^{bc}
Black	68.82± 0.21^{c}	66.47± 0.20^{d}	69.95± 0.08^{b}	22.39± 0.39^{cd}	24.80± 0.11^{a}	22.54± 0.23^{c}	6.83± 0.22^{b}	6.81± 0.22^{b}	4.84± 0.23^{d}	1.34± 0.19^{bc}	0.97± 0.05^{c}	1.75± 0.09^{ab}

Means with different letters in a column for each parameter differ significantly (P<0.05)

Table 2: Effect of strain and muscle type on sensory evaluation of turkey meat

	Thigh meat						Wing meat						Breast meat					
	Tenderness	Juiciness	Flavor and aroma	Colour	Appearance	Over acceptable	Tenderness	Juiciness	Flavor and aroma	Colour	Appearance	Over acceptable	Tenderness	Juiciness	Flavor and aroma	Colour	Appearance	Over acceptable
White	3.17^{a}	3.16^{a}	2.67^{ab}	3.67^{a}	3.17^{ab}	3.50^{a}	1.67^{bc}	2.00^{abc}	1.67^{b}	2.33^{b}	2.00^{b}	2.17^{ab}	2.50^{ab}	2.50^{abc}	2.67^{ab}	2.50^{b}	3.17^{ab}	3.00^{ab}
Red	2.67^{ab}	2.83^{ab}	3.00^{a}	4.33^{a}	2.83^{ab}	3.00^{ab}	2.67^{ab}	2.66^{abc}	3.17^{a}	2.00^{b}	3.33^{ab}	3.00^{ab}	1.17^{c}	1.33^{c}	2.00^{ab}	2.33^{b}	2.83^{ab}	2.00^{b}
Black	2.67^{ab}	2.66^{abc}	3.16^{a}	4.17^{a}	3.17^{ab}	3.33^{ab}	2.00^{bc}	2.00^{abc}	2.17^{ab}	2.33^{b}	2.50^{a}	2.33^{ab}	1.83^{bc}	1.67^{bc}	2.33^{ab}	2.33^{b}	3.33^{ab}	2.17^{ab}

Means with different letters for each muscle type differ significantly (p<0.05).

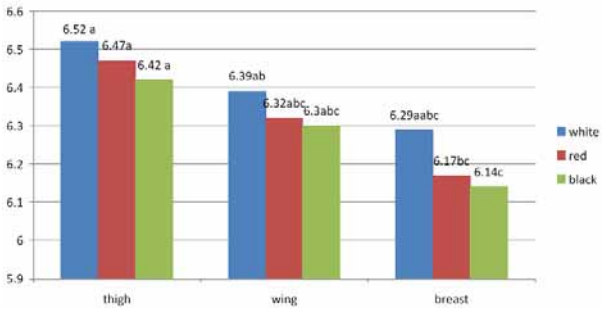

Fig. 1: Effect of strain and muscle type on pH of turkey meat. Means with different letters differ significantly (P<0.05)

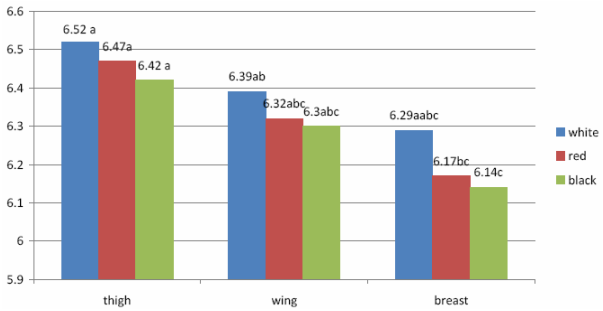

Fig. 2: Effect of strain and muscle type on WHC % of turkey meat. Means with different letters differ significantly (P<0.05)

2. In sensory evaluation, the highest score indicated more preferred and acceptance. The differences were observed in tenderness, colour attributes, where higher scores were more given by panellists to thigh meat than wing meat in White strain. The results indicated no significant difference concerning the scores given by panellists for other sensory traits (juiciness, flavour and acceptable) in all muscle of White strain. The panellists gave higher scores to the tenderness, juiciness and colour in thigh meat than breast meat for Red strain.

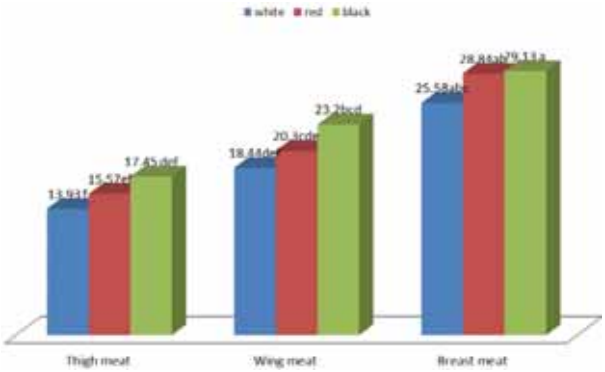

Fig. 3: Effect of strain and muscle type on cooking loss percentage of turkey meat. Means with different letters differ significantly (P<0.05)

The results of colour showed it was high in thigh meat than breast and wing meat in all strains, which may be (Du and Ahn, 2002). The panellists gave higher score to thigh meat than breast and wing meat in all strains in sensory traits. Moreover, higher scores for tenderness, juiciness, colour and acceptability traits were given by the panellists to thigh meat in White strain compared with these traits in breast meat for Red and Black strains. These results were confirmed from acceptance of most of sensory traits by panellists, who showed a tendency towards the thigh meat in all strains followed by the wing meat. The lowest sensory score for the

breast meat in Red strain may be due to PSE. This characteristic is associated with protein denaturizing, which resulted in lower WHC and more exudative appearance. Also fast decline in the meat pH, led to drop in the sensory traits. Quality assessment parameters of meat, including sensory flavour and texture profiles, cooking loss and shear force have been widely used in scientific studies to validate pre-processing treatments and postharvest processing technologies for chicken meat (Swatland, 1999; Lyon and Lyon, 2001). The score of juiciness depends on moisture content in the meat and on the fat content with WHC (Mckee, 2007). Genetic strain is the further inherent factor that affects meat texture (Lyon et al., 2004). It was known that flavour and aroma are influenced by age, diet and diet ingredients, strain, environmental conditions (litter, ventilation, etc.), temperatures, product packaging and storage (Mead, 2004; Du and Ahn, 2002; Terra et al., 2009; Northcutt, 2009). Thigh muscles (High used muscles) are darker than breast muscles (less used muscles) due to the higher quantity of myoglobin (Ahn and Maurer, 1990), which has a direct effect on muscles browning colour on cooking.

Conclusion

It can be concluded that there are significant differences between the strains for the proximate analysis. Also thigh meat had high WHC and lower cooking losses than the breast meat in all strains. The sensory trait of thigh meat was higher in all strains.

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