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Effect of Production System on Some Meat Quality Traits of Pekin Ducks

Yetiştirme Sisteminin Pekin Ördeklerinde Bazı Et Kalitesi Özellikleri Üzerine Etkisi

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EFFECT OF PRODUCTION SYSTEM ON SOME MEAT QUALITY TRAITS OF PEKIN DUCKS

ABSTRACT:

A total of 240 day old Pekin ducks were reared in indoor and free-range systems to determine the effect of production system on some meat quality traits. At 14 weeks of age, 16 birds (1 male, 1 female per pen) were slaughtered and carcass traits were determined after an 8-hr fasting period. Ducks achieved a live weight between 2600 and 2800 grams. Production system did not significantly affect the carcass part ratios and edible inner organ ratios. Meat pH and color was measured on breast and thigh meat after 12 hours at 4°C. There were not significant differences between the meat color (L*, a* and b*) of breast and thigh meat among production systems.

Keywords: *Pekin duck, Production system, Meat color, pH, Carcass*

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YETİŞTİRME SİSTEMİNİN PEKİN ÖRDEKLERİNDE BAZI ET KALİTESİ ÖZELLİKLERİ ÜZERİNE ETKİSİ

ÖZ:

Toplam 240 adet günlük yaşta Pekin ördeği, yetiştirme ssteminin bazı et kalitesi özelliklerine etkisini belirlemek için entansif ve gezintili sistemde yetiştirilmiştir. 14 haftalık yaşta, 18 saatlik aç bırakma periyodundan sonar 16 hayvan (her bölmeden 1 dişi, 1 erkek) kesilmiş ve karkas özellikleri belirlenmiştir. Ördekler 2600 ve 2800 gram arasında değişen canlı ağırlıklara ulaşmışlardır. Yetiştirme sisteminin karkas parça ve yenilebilir iç organ oranları üzerindeki etkisi önemsiz bulunmuştur. Et rengi ve pH'sı but ve göğüs etinde, 4°C'de 12 saat bekletildikten sonar ölçülmüştür. Yetiştirme sistemleri arasında, but ve göğüs etinde et rengi (L*, a* ve b*) bakımından farklılıklar önemli bulunmamıştır.

Anahtar Kelimeler: *Pekin ördeği, Yetiştirme sistemi, Et rengi, pH, Karkas*

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1. INTRODUCTION

The popularity of alternative poultry species is increasing in many countries (Isguzar et al., 2002). Related to this, number of ducks raised to 1.131 billion from 561 million between 1990 and 2014. The share of ducks in total poultry species (chicken, duck, goose and turkey) also increased to 4.85% from 4.77% in this period. Total duck meat production in 2013 was about 4.367 million tonnes. Asia has the highest production and accounted about the 83.81% of total duck meat whereas Europe had the share of 11.2% in 2013 (FAO, 2017). Ducks are mostly produced for meat because they are easy to raise and have resistance to many of common poultry diseases (Omojola, 2007). Pekin and Muscovy (mostly in France) are the main species used for meat production. Also mule ducks are produced mostly in France for fatty liver production (Baeza, 2005).

There are various systems used for duck production in the World. For example, developed countries prefer ducks to produce in fully controlled intensive houses or with access to outdoors. Also, sometimes they have an option of water for swimming (Baeza, 2005). Production in intensive systems resulted in remarkable increases in productive efficiency, but these systems had a negative effect on animal welfare (Mench, 1992). Therefore, use of ducks in extensive or semi-intensive systems improves the welfare of birds. On the other hand, foraging ability of the ducks make them natural controllers of weed and pests on field crops, particularly rice. Therefore, duck and ricc productions could be combined (Edar et al., 1996). These rice-duck and fish-duck combined systems are common in Asian Countries. However, there are also farms which only aimed to produce duck meat (Adamski et al., 2011).

There are non-genetic factors affecting slaughter, carcass and meat quality traits and production system is one of the important ones (Meluzzi et al., 2009). Effect of outdoor and indoor systems on some slaughter traits (live weight and slaughter weight, edible organ weights, carcass part weights and ratios, meat color and pH) of ducks were investigated in this study.

2. Material and Methods

This study was performed at the Research Farm of Ondokuz Mayis University Agricultural Faculty. A total of 240 day old ducklings were bought from a commercial farm and transferred to house after hatching. Ducklings were randomly placed to pens in windowed house which heated with infrared heaters. One side of the house had access to outdoor area. Each system (outdoor and indoor) had 8 pens and each pen had 15 ducklings. Pens were in dimensions of 3.5 x 3.5 m. Each pen had own feeder and drinker. Wood shavings were used as litter material. Lighting

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program was started with 24-h lighting for first 3 days and incrementally decreased to 20 hours untilthe end of 2 weeks and then remained constant until 3 weeks. From this age to slaughter approximately 14 hours of natural lighting was applied. When ducks reached 3 weeks of age, birds in the outdoor system had access to outdoor pens. Outdoor areas of each pen were in dimensions of 14 x3.5 m.

Feed and water were ad libidum. Commercial broiler chicken diet was used as feed (Crude protein ratio 23% and 12.8 MJ Metabolized Energy).

At 14 weeks of age, 16 birds (1 male, 1 female per pen) were weighed and slaughtered after an 8-hr fasting period. Hot-carcass weights were recorded after slaughter. 12 hours chilling at 4°C was applied to carcasses and cold carcass weights were determined. Carcass parts were recorded as ratio to cold carcass weights.

Breast and thigh meat pH was measured at 3 different points after 12 hours at 4°C (Model PC 510, Cyber scan, Singapore). Meat color (L* a* b*) was evaluated with a colorimeter (Konica Minolta CR-400 colorimeter) at 2 different points of breast and thigh meat.

2.1 Statistical analysis

Data was analyzed with the software SPSS with OMU license (Version 16). Variance analysis with a factorial arrangement (production system and sex) was used to test the effects of production system, age, and the interactions between production system, age and gender. Data was subjected to arc-sine transformation, and genotype and slaughter age means were separated using Duncan's multiple range test. A level of $P<0.05$ was considered statistically significant.

3. Results and Discussion

Body weights and carcass weights of the ducks and dressing percentages after slaughter for both systems were given in Table 1. Ducks achieved to a mean live weight around 2800 g both in free-range and barn conditions. As an expected result, males were higher than females in both systems, but the differences were not significant. These values were lower than the results of Adamski et al. (2011) who found the live weight of Pekin ducks around 3 kg at 7 weeks of age. Origin of the birds is the most important factor on live weight gain. Selection in live weight and feed conversion shortens the production period and increases the achieved live weight in this period. However, there were no reported studies on the selection of Pekin ducks reared in Turkey. Isguzar et al. (2002) reported the mean body weight of Turkish Pekin ducks between 1.8 and 2.0 kg at 12 weeks of age. Results obtained in this study were similar to these findings. Cold dressing percentages obtained in

barn conditions were relatively higher than free-range system, but the difference was not significant. Our cold dressing percentage results were between 68.02 and 71.77% and similar to the findings of Erisir et al. (2009) who reported the cold dressing percentages of Pekin ducks between 68.2 and 70.3 %.

Table 1. Some slaughter traits of ducks in different production systems

Çizelge 1. Farklı yetiştirme sistemindeki ördeklerin bazı kesim özellikleri

Production system	Gender	Live weight (g)	Hot carcass weight (g)	Cold carcass weight (g)	Hot dressing percentage (%)	Cold dressing percentage (%)
Free-range	M	2884.4	2048.8	1962.0	71.03	68.02
	F	2745.2	1998.4	1900.8	72.80	69.24
Barn	M	2869.5	2103.0	2015.0	73.29	70.22
	F	2617.2	1878.4	1799.2	71.77	71.77
SEM		91.24	70.84	66.63	0.41	0.32
			Effects			
Production system		NS	NS	NS	NS	NS
Free-range		2814.8	2023.6	1931.4	71.75	68.51
Barn		2729.3	1978.2	1895.1	72.44	69.41
Gender		NS	NS	NS	NS	NS
Male		2877.8	2072.9	1985.6	72.01	68.99
Female		2681.2	1938.4	1850.0	72.14	68.89

Heart, liver, gizzard and abdominal fat and total edible inner organ weights, and their ratios to cold carcass weight are given in Table 2. Production system did not have a significant effect on heart, liver, gizzard and total edible inner organ weight and ratio and abdominal fat weight. Sex had a significant effect on heart weight but did not affect other traits. Total weights of edible inner organs were 146.9 g for males and 137.8 g for females and 147.3 g for free-range system and 140.8 g for indoor system. However, the differences were not significant and the ratio of edible inner organs was similar in outdoor and in indoor birds and in both genders. This was related to the similar live weights of birds in both systems and genders. Edible inner organs ratio was around 5% and this was similar to the findings of Onbasilar et al. (2013) who found the ratio between 5 % and 5.5 % but lower than the results of Adamski et al. (2011) who found the ratio between 7% and 8%.

Table 2. Effects of production system and gender on edible inner organs

Çizelge 2. Yetiştirme sistemi ve cinsiyetin yenilebilir iç organlara etkisi

Production system	Gender	Heart weight (g)	Liver Weight (g)	Gizzard weight (g)	Abdominal fat (g)	Edible inner organ weight (g)	Edible inner organ ratio (%)
Free-range	M	16.4	50.8	83.6	9.2	150.8	5.2
	F	15.0	49.5	78.5	11.5	143.0	5.2
Barn	M	17.3	55.3	78.0	6.0	150.6	5.3
	F	15.2	38.0	81.6	4.4	134.8	5.2
SEM		0.798	1.914	3.143	1.494	3.795	0.001
			Effects				
Production system		NS	NS	NS	NS	NS	NS
Free-range		15.8	50.2	81.3	10.2	147.3	5.1
Barn		16.0	44.5	80.3	5.0	140.8	5.1
Gender		NS	*	NS	NS	NS	NS
Male		16.0	51.6	79.3	8.0	146.9	5.1
Female		14.6	44.0	79.2	7.6	137.8	5.2

**: P<0.01, NS: Insignificant, M: Male, F: Female, SEM: Standard Error of Means.*

Carcass part weights and ratios are given in Tables 3 and 4, respectively. Carcass part weights was not significantly affected by production system and gender, but ducks reared in barn condition had significantly higher breast ratio (P<0.01) and lower thigh ratio (P<0.05). Breast is the most edible an preferred part of the poultry carcass. Therefore, breast ratio is an important factor for consumption. In chicken broilers, it is over 35% (Yamak et al., 2014). While previous studies reported duck breast ratios to be between 28% (Onbasilar, et al., 2013) and 32% (Erisir et al., 2009). This study found breast ratios of 34.3 % for free-range birds and 36.2% for indoor birds. Indoor birds had significantly higher breast ratios than free-range birds (P<0.05). Thigh ratio was significantly affected by production system and ducks reared in free-range system had significantly higher thigh ratio (P<0.01). Thigh ratios in this study were similar to those reported by Onbasilar et al. (2013), which were between 16.81% and 17.72%, but lower than the values of Erisir et al., (2009) which were around 20%.

Table 3. Effects of production system and gender on carcass part weights

Çizelge 3. Yetiştirme sistemi ve cinsiyetin karkas parça ağırlıklarına etkisi

Production system	Gender	Breast weight (g)	Thigh weight (g)	Back weight (g)	Neck weight (g)	Wing weight (g)
Free-range	M	668.4	367.9	438.3	233.5	262.3
	F	658.9	349.0	408.0	216.8	255.3
Barn	M	742.4	341.1	422.3	247.9	267.9
	F	645.3	311.3	377.6	219.9	257.2
SEM		28.254	10.727	16.124	8.907	7.769
Effects						
Production system		NS	NS	NS	NS	NS
Free-range		663.7	358.5	423.2	225.1	258.8
Barn		668.4	324.5	397.4	232.3	262.0
Gender		NS	*	NS	NS	NS
Male		701.3	356.0	431.1	240.0	264.8
Female		652.1	330.2	392.8	218.4	256.3

**: P<0.01, NS: Insignificant, M: Male, F: Female, SEM: Standard Error of Means.*

Table 4. Effects of production system and gender on carcass part ratios

Çizelge 4. Yetiştirme sistemi ve cinsiyetin karkas parka oranlarına etkisi

Production system	Gender	Breast Ratio (%)	Thigh Ratio (%)	Back Ratio (%)	Neck Ratio (%)	Wing Ratio (%)
Free-range	M	34.0	18.8	22.4	11.9	13.4
	F	34.6	18.5	21.4	11.5	13.5
Barn	M	36.6	17.1	20.9	12.3	13.5
	F	35.9	17.3	21.0	12.2	14.3
SEM		0.466	0.266	0.336	0.220	0.234
Effects						
Production system		*	**	NS	NS	NS
Free-range		34.3	18.6	21.9	11.7	13.5
Barn		36.2	17.2	21.0	12.2	13.9
Gender		NS	NS	NS	NS	NS
Male		35.2	18.0	21.7	12.1	13.4
Female		35.2	17.9	21.2	11.8	13.9

**: P<0.01, **: P<0.05, NS: Insignificant, M: Male, F: Female, SEM: Standard Error of Means.*

Table 5. Effects of production system and gender on breast and thigh meat color (L*. a*. b*) and pH values

Çizelge 5. Yetiştirme sistemi ve cinsiyetin göğüs ve but etinin renk ve pH'ına etkisi

Production system	Gender	Breast meat color			Thigh meat color			Breast pH	Thigh pH
		L*	a*	b*	L*	a*	b*		
Free-range	M	51.85	9.60	2.64	47.77	11.62	3.42	5.96	6.77
	F	54.51	9.09	3.42	51.43	11.36	5.41	6.09	6.63
Barn	M	53.94	9.12	2.87	48.36	11.61	3.15	6.07	6.97
	F	54.88	9.10	3.20	49.07	11.34	3.32	6.12	6.87
SEM		0.960	0.289	0.307	0.788	0.361	0.355	0.039	0.068
Effects									
Production system (PS)		NS	NS	NS	NS	NS	NS	NS	NS
Free-range		53.18	9.34	3.03	49.60	11.49	4.42	6.03	6.70
Barn		54.46	9.11	3.06	48.76	11.46	3.24	6.10	6.91
Gender (G)		NS	NS	NS	NS	NS	NS	NS	NS
M		52.78	9.39	2.74	48.03	11.62	3.30	6.01	6.86
F		54.69	9.09	3.31	50.25	11.35	4.37	6.11	6.75

NS: Insignificant, M: Male, F: Female, SEM: Standard Error of Means

Table 5 represents the meat color and pH values. Production system and gender all had not significant effects on color and pH values of breast and thigh meat. Meat quality is affected by genetic and environmental factors (Rehfeldt et al., 2004). Meat color is important for consumers (Fanatico et al., 2007) and can be affected by gender, age of the bird, genotype, feed content, intramuscular fat, moisture of the meat, pre-slaughter conditions and stress, and processing variables (Yang and Jiang, 2005). There were not significant differences between L*, a* and b* values of breast and thigh meat of ducks reared in different systems. pH is another important factor affecting meat quality and shelf life. Environment becomes more favorable for bacteria when pH value rises and this results with decreased shelf life for the meat (Aberle et al., 2001). Similar to meat color values, pH values of breast and thigh meat were not affected by production system or gender.

4. CONCLUSION

According to results obtained from the study showed that using free-range systems for duck production is more suitable for animal welfare. Although, there were not significant differences slaughter and carcass traits of ducks reared indoor or free-range. Therefore, according to the demands of duck meat market, free-range system could be more compatible for duck meat production.

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