ISSN 1682-8356
ansinet.org/ijps

INTERNATIONAL JOURNAL OF

POULTRY SCIENCE

ANSInet
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International Journal of Poultry Science 5 (6): 530-533, 2006
ISSN 1682-8356

Study on Carcass Characteristics of Chicken Breeds Raised under the Intensive Condition

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Abstract: Anka and Rugao chicken breed were reared under the same environment and management. During 12 weeks age the growth rate of Anka breed was found better than Rugao, and similarly within breeds Males were grow faster than females. The results shows that (live weight, carcass weight, dressing out percentage, semi-eviscerated weight, eviscerated weight, breast muscle weight, leg muscle weight, heart weight, liver weight and abdominal fat weight) were significantly ($P<0.01$) different in Anka and Rugao breed, however the Abdominal fat % was statistically non significant ($P>0.05$) between breeds. Males compared to females shows significantly ($P>0.01$) higher live weight, carcass weight, semi-eviscerated weight, eviscerated weight, breast muscle weight, liver weight and abdominal fat weight within two breeds. However, Leg muscle weight, heart weight were non significantly different ($P>0.05$). In addition dressing out percentage was significantly ($P<0.05$) different between males and females in Anka breed and non significantly in Rugao breed. In Anka chicken breed abdominal fat weight was positively correlated with live weight, carcass weight, breast muscle weight, and percentage of abdominal fat weight; and it was negatively correlated with leg weight. In Rugao breed abdominal fat weight was positively correlated with live weight, carcass weight, breast muscle weight, leg muscle weight and percentage of abdominal fat. However, the percentage of abdominal fat weight was negatively correlated with live weight, carcass weight, breast muscle weight and positively with leg muscle weight and abdominal fat weight.

Key words: Breed, sex, correlation, carcass characteristics

Introduction

The primary goal of broiler breeding is to improve profitability of broiler meat production. Until recently most birds were sold whole, but there has been a dramatic increase in the proportion of birds being grown for portioning and further processing (Ewart, 1993). Poultry production and processing technologies have become rapidly accessible and are being implemented on a worldwide basis, which will allow continued expansion and competitiveness in this meat sector (Aho, 2001). Therefore, the success of poultry meat production has been strongly related to improvements in growth and carcass yield, mainly by increasing breast proportion and reducing abdominal fat. Intensive selection of meat-type chickens for growth for more than 50 year has increased growth rate, but rapid growth has been accompanied by a number of negative consequences, including an increase in fat deposition (Griffin, 1996). Proportions of major carcass tissues and distribution of these tissues throughout the carcass is important to carcass value. Manipulation of these traits depends on the combined genetic and nutrition.

Abdominal and subcutaneous fat deposition in chickens selected for rapid growth is associated with changing concentrations of hormones and neural control mechanisms (hunger-satiety control mechanisms) that regulate feed intake. Therefore, most modern meat type chickens eat more than they require for muscle growth and maintenance Smith and Pesti (1998). This excessive energy intake leads to increasing fat deposition in the body. Fat tended to accumulate differentially in different carcass parts and the patterns of accumulation varies with species. In chickens fat accumulates in great quantity in thigh followed by breast. The large differences between genetic and phenotypic correlations for carcass traits may imply a relatively large influence of environmental conditions for these traits. Our aim was to study the effect of breed and sex on carcass characteristics of chicken raised under the same intensive condition.

Materials and Methods

Experimental stocks: The 120 birds from Anka and Rugao chicken breed were reared under the same environment and management; the calculated nutrient analyses of the diets fed are reported in Table 1. Feed and water were provided ad libitum at all times during the study. Birds were reared in floor pens in a light-tight facility. Birds were weighed at two weeks intervals from 2 to 12 weeks age. The birds were fasted for overnight, weighed before slaughter and then were slaughtered, bled, plucked and weighed to determine blood and feather losses. After that carcasses were eviscerated and dissected manually.

Table 1: Food formulation of chicken breed

Number of ration	CP	CF	Ash	Ca	P	NaCl	Meth	Water
510	≥ 21.0	≤ 5.0	≤ 7.0	0.8~1.3	≥ 0.60	0.3~0.8	≥ 0.37	≤ 13.0
511	≥ 19.0	≥ 5.0	≤ 7.0	0.7~1.2	> 0.55	0.3~0.8	≥ 0.32	≤ 13.0

510, 0-3week; 511, 4-12week

Table 2: Breeds effect on carcass characteristics of chicken

Breed	Anka	Rugao	P value
LW	3400.87±63.58	1113.80±22.65	0.0001
CW	3234.02±62.24	1006.33±21.17	0.0001
DR	94.44±0.35	90.29±0.22	0.0001
SEV	2675.955±6.57	850.18±23.21	0.0001
EV	2493.07±51.26	792.57±17.29	0.0001
BR	399.23±9.45	129.47±2.89	0.0001
LG	664.53±15.64	202.80±5.44	00001
HR	212.27±8.48	28.92±2.06	0.0001
LI	24.17±0.88	6.07±0.17	0.0001
FAT	55.99±1.26	16.69±0.39	0.0001
Fat %	1.75±0.05	1.67±0.03	0.1141

Data analysis: The data were estimated as means and standard error of mean and the significant difference between breeds and sex were determined by student t-test using SAS 9.0 software. Pearson correlation coefficients were computed between carcass traits. All statements of significance were assessed at P=0.05.

Results and Discussion

Effect of breed on carcass characteristics: Growth of chicken from 2 to 12 week of age was recorded, the growth of Anka breed was found better than Rugao (Fig. 1), and similarly Males were grow faster than females within breeds (Fig. 2, 3). The body composition is a function of body weight and birds of similar body composition have been shown to possess similar carcasses and slaughter by-products composition (Berg and Butterfield, 1972). In the present study carcass yield parameters of two chicken breeds are presented in Table 2. The results shows that (live weight, carcass weight, dressing out percentage, semi-eviscerated weight, eviscerated weight, breast muscle weight, leg muscle weight, heart weight, liver weight and abdominal fat weight) were significantly (P<0.01) better in Anka than Rugao breed, however the Abdominal fat % was statistically non significant (P>0.05) between breeds. Similarly (Karima and Fathy, 2005) reported that differences in live body between breeds were found to be significant. Peter *et al.* (1997) who found that the proportion of meat in valuable parts of the carcass was influenced less by diet and more by slaughter weight. It seems that the distribution of muscle is influenced by total carcass muscle not by nutritional treatments.

Abdominal and subcutaneous fat are regarded as the main sources of waste in the slaughterhouse. Because abdominal fat is highly correlated (0.6 to 0.9) with total carcass lipids, it is used as the main criterion reflecting excessive fat deposition in broilers (Chambers, 1990). Havenstein *et al.* (2003) described that fat in broiler (at 43 d of age) accounts for as much as 10 to 15% of the total carcass weight. Therefore, there is substantial potential to improve feed efficiency and carcass quality by further reducing fatness. In accordance with our results, increasing carcass yield and decreasing abdominal fat content in broilers has been reported (Sahin *et al.*, 2002

Effect of sex on carcass characteristics: Separate effects of breed, sex and nutrition on carcass composition of chickens were reported by Broadent *et al.* (1981); Marks (1990); Bartov and Plavnik (1998); Smith and Pesti (1998) and Wiseman and Lewise (1998). In the present study Males compared to females shows significantly (P<0.01) higher live weight, carcass weight, semi-eviscerated weight, eviscerated weight, breast muscle weight, liver weight and abdominal fat weight within two breeds. Leg muscle weight, heart weight were non significantly different. In addition dressing out percentage was significantly (P<0.05) different between males and females in Anka breed and non significantly (P>0.05) in Rugao breed. Sex significantly affected carcass composition, proportion of total carcass bone in wing, proportion of total carcass fat in thigh and neck Marks (1990). These differences probably arise from metabolic differences and from differences in the onset of fattening. Similarly, Merkley *et al.* (1980) found significant differences between sexes in the yield of all carcass parts. They found that compared with male broilers, females had greater breast and back but smaller legs.

Correlation analysis of carcass characteristics: Correlation between carcass characteristics and abdominal fat was estimated in the present study (Table 4). In Anka chicken breed abdominal fat weight was positively correlated with live weight, carcass weight, breast muscle weight, and percentage of abdominal fat weight; and it was negatively correlated with leg weight. The percentage of abdominal fat weight was negatively correlated with live weight, carcass weight, breast muscle weight, leg muscle weight and positively with abdominal fat weight. In Rugao breed abdominal fat weight was positively correlated with live weight, carcass weight, breast muscle weight, leg muscle weight and percentage of abdominal fat. However, the percentage of abdominal fat weight was negatively correlated with live weight, carcass weight, breast muscle weight and positively with leg muscle weight and abdominal fat weight.

Table 3: Sex effect on carcass characteristics of chicken breeds

Breed	Anka			Rugao		
Sex	Male	Female	P value	Male	Female	P value
LW	3809.70±47.89	2992.03±51.26	0.0001	1242.50±22.45	985.10±21.00	0.0001
CW	3627.73±47.50	2840.30±53.08	0.0001	1126.40±20.53	886.27±20.19	0.0001
DR	95.22±0.39	93.66±0.54	0.0384	90.66±0.32	89.92±0.28	0.0821
SEV	3064.47±35.38	2287.43±36.86	0.0001	946.89±34.61	753.47±18.68	0.0001
EV	2839.07±33.89	2147.07±35.91	0.0001	891.60±15.70	693.53±17.13	0.0001
BR	457.60±8.39	340.87±7.62	0.0001	140.40±3.95	118.53±3.19	0.0001
LG	658.00±20.66	671.07±23.81	0.7223	197.47±8.25	208.13±7.11	0.3298
HR	194.83±10.72	229.71±12.53	0.0378	30.77±3.01	27.13±2.82	0.3585
LI	28.44±0.92	19.89±1.02	0.0001	6.94±0.21	5.20±0.16	0.0001
FAT	60.02±1.24	51.96±1.96	0.0020	18.26±0.55	15.14±0.39	0.0003

LW, live weight; CW, carcass weight; DR, dressing out percentage; SEV, semi-eviscerated weight; EV, eviscerated weight; BR, breast muscle weight; LG, leg muscle weight; HR, heart weight; LI, liver weight and FAT, abdominal fat weight

Table 4: Correlation coefficient matrix of carcass characteristics within chicken breeds

Parameters	LW	CW	BR	LG	FAT	FAT%
LW	1	0.968**	0.840**	-0.177	0.443**	-0.416**
CW	-0.267	1	0.846**	-0.211	0.474**	-0.415**
BR	0.759**	0.775**	1	-0.121	0.240	-0.495**
LG	-0.022	-0.021	-0.083	1	-0.304*	-0.118
FAT	0.714**	0.737**	0.501**	0.045	1	0.558**
FAT %	-0.267	-0.244	-0.293	0.082	0.471**	1

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). LW, live weight; CW, carcass weight; BR, breast muscle weight; LG, leg muscle weight; FAT, abdominal fat weight and Fat% percentage of abdominal fat weight

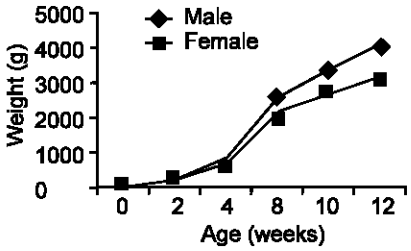

Fig. 1: Effect of sex on growth rate of Anka chicken breed

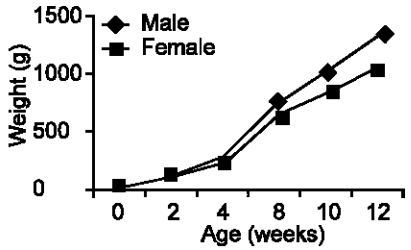

Fig. 2: Effect of sex on growth rate of Rugao chicken breed

Previously positive genetic correlations were observed between body weight and fat production traits (abdominal fat weight, Almost all estimates of the genetic correlations of body weight with (abdominal fat weight and abdominal fat percentage that have been published are unfavorably positive (Chambers, 1990; Le Bihan-Duval *et al.*, 1998; Deeb and Lamont, 2002). There was a high genetic correlation between abdominal fat weight and skin weight (0.54), whereas

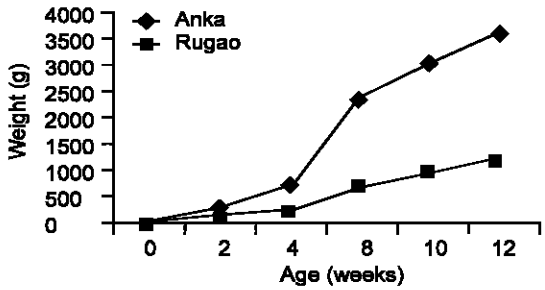

Fig. 3: Effect of breed on the groweth rate of chicken

the genetic correlation between abdominal fat weight and intramuscular fat percentage was almost zero (0.02) (Evans, 1977). On the other hand, Cahaner *et al.* (1986) found that considerable changes in the size of adipose tissue are not accompanied by substantial changes in inter- or intramuscular fat in the chicken.

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