

EVALUATION OF THE GROWTH AND SLAUGHTER VALUE OF THE ROSS 308 BROILER CHICKENS

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Abstract. The aim of this study was the evaluation of the growth of broiler chickens and their slaughter value from 1 to 42 days of age. The research material consisted of the Ross 308 chickens. At 42 days of rearing, the chickens reached the mean final body weight of 2229.9 g. During successive weeks of rearing, the weight of all elements, i.e. giblets, inedible parts and offal, increased with an increasing body weight of birds. At the same time, their percentage in the body weight decreased considerably, and the dressing percentage increased. At 42 days of rearing, the eviscerated carcass weight averaged 1697 g, the percentage of muscles was 46.7%, that of skin and fat was 11.0% and the remainders of the carcass (bones) accounted for 42.5%. During the rearing period, considerable changes in the tissue composition of carcass and their uneven growth were found. Moreover, the effect of age and type of muscle on the chemical composition of muscles was determined.

Keywords: broiler chickens, growth, slaughter value

INTRODUCTION

Production of broiler chickens accounts for over 20% of meat production in our country and approx. 28% of its consumption and an average household allocates 5% of food expenditures to poultry [Krawczyk and Sokołowicz 2005]. In 2009, mean poultry consumption was 24.3 kg per capita, of which the meat of broiler chickens accounted for over 70%.

In the national literature, much attention has been dedicated to broiler chickens. Part of the studies concerned the optimization of rearing conditions for chickens [Łambucki 2001, Krawczyk and Wężyk 2002, Mazanowski 2004, Gilewski et al. 2010], while others dealt with the slaughter value of birds, including the quality of the supplied material [Cytawa 1999, Grabowski 2002, 2003, Polak 2004]. In most conducted experiments, however, the slaughter value of broilers at the end of the rearing period, i.e. at the age of 5–6 weeks, was evaluated. Few studies involved the growth and changes in the slaughter value

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of chickens during their utilization. Therefore, the present research was undertaken. Its purpose was the evaluation of the growth of the chickens and their slaughter value during the rearing period.

MATERIAL AND METHODS

The research material consisted of the Ross 308 broiler chickens kept under standard environmental conditions. They were fed ad libitum full-ration diets, whose nutritive value is presented in Table 1. Chicks were reared for 42 days.

Table 1. Nutritive value and period of feeding standard feeds
Tabela 1. Wartość pokarmowa i okresy skarmiania mieszanek standardowych

Specification Wyszczególnienie	Feed type and period of use, days Rodzaj mieszanki i okres jej skarmiania, dni		
	KW-1 (1-10)	KW-2 (11-25)	KW-3 (26-42)
Metabolizable energy, kcal Energia metabol., kcal	2995	3050	3150
Crude protein, % Białko ogólne, %	22	20.2	19
Crude fibre, % Włókno ogólne, %	3.5	3.3	4.2
Lysine, % Lizyna, %	1.26	1.19	1.14
Methionine, % Metionina, %	0.58	0.55	0.54
Total Ca, % Ca ogólny, %	0.9	0.8	0.75
Available phosphorus, % P przyswajalny, %	0.45	0.42	0.38

During the whole rearing period, body weight of chickens was measured by individual weighing of randomly selected birds. Weighing was performed at 1, 7, 14, 21, 28, 35 and 42 days of age. Moreover, at each of the aforementioned dates, 10 birds were selected from among the weighed ones and slaughtered. After slaughtering, bleeding and plucking, birds were weighed and then the slaughter analysis was conducted according to the method of Ziotecki and Doruchowski [1989]. Carcasses chilled at 10°C were dissected after 24 hours. From each carcass, skin with the subcutaneous and abdominal fat, breast, thigh and shank muscles as well as so-called carcass remainders, were separated and weighed.

At the same time, samples for chemical analysis were collected from the separated muscles. The basic chemical composition was determined in muscle samples:

- dry matter according to PN-76/R-64752,
- crude protein with the Kjeldahl method according to PN-75/A-04018,
- crude fat with the Soxlet method according to PN-76/R-64753,

– minerals in the form of ash by burning in an oven at 550°C according to PN-76/R-64795. The obtained results were analysed statistically [StatSoft® 2001].

RESULTS AND DISCUSSION

The mean body weight of chickens in successive weeks of rearing is presented in Table 2.

Table 2. Mean values (in g) and coefficients of variation ($V_{\%}$) of chicken slaughter analysis
Tabela 2. Wartości średnie (w g) i współczynniki zmienności ($V_{\%}$) wyników analizy rzeźnej kurcząt

Specification Wyszczególnienie		Age, days – Wiek, dni						
		1	7	14	21	28	35	42
Body weight before slaughter Masa ciała przed ubojem	\bar{x}	36.5	142.4	399.5	643.4	1214.2	1682.3	2229.9
	$V_{\%}$	2.7	7.3	7.3	9.2	13.9	9.8	14.8
Blood and feather Krew i pierze	\bar{x}	2.2	2.2	11.0	47.5	60.2	81.5	89.8
	$V_{\%}$	0.2	0.2	1.1	2.8	4.6	6.3	7.9
Head Głowa	\bar{x}	2.4	9.2	17.3	24.6	30.2	43.1	50.4
	$V_{\%}$	1.0	3.0	2.1	2.7	3.2	3.3	3.7
Shanks Skoki	\bar{x}	2.1	6.5	17.5	27.8	46.1	74.4	85.5
	$V_{\%}$	0.3	1.7	2.5	3.3	4.4	4.8	6.7
Heart Serce	\bar{x}	0.3	1.2	3.3	5.2	7.4	12.4	18.5
	$V_{\%}$	0.3	0.2	0.3	0.2	0.7	2.3	3.7
Gizzard Żołądek	\bar{x}	1.9	5.6	9.5	11.5	19.4	26.7	38.3
	$V_{\%}$	0.3	0.7	1.2	3.1	4.0	2.3	1.3
Liver Wątroba	\bar{x}	1.3	6.2	17.6	27.1	40.4	80.1	92.0
	$V_{\%}$	0.2	1.2	2.0	4.3	4.0	4.1	7.1
Giblets Podroby	\bar{x}	3.6	13.0	30.4	43.8	67.2	119.2	148.8
	$V_{\%}$	0.7	2.3	3.2	2.7	4.3	7.0	8.2
Not edible entrails Wnętrzności niejadalne	\bar{x}	6.2	29.6	68.6	90.9	90.1	148.3	157.4
	$V_{\%}$	1.1	3.0	5.4	2.9	9.0	7.4	7.8
Not edible offals Odpady poubojowe	\bar{x}	6.7	17.9	45.8	99.9	136.5	199.0	225.7
	$V_{\%}$	0.9	2.1	3.2	7.1	4.0	6.2	7.1
Not edible entrails and offals Odpady poubojowe i wnętrzności niejadalne	\bar{x}	12.9	47.5	114.3	143.7	226.6	347.3	383.1
	$V_{\%}$	2.1	3.9	7.8	6.9	8.7	4.9	3.8

The body weight of day-old Ross 308 chicks averaged 36.5 g, and it was 2229.9 g at the end of rearing, i.e. at 42 days of age. The body weight of 6-week-old chickens obtained in the present study was higher than the results reported by other authors [Czaja and Gornowicz 2004]. The weight of all the elements, i.e. giblets, inedible parts and offal, increased with an increasing body weight of birds. The weight of giblets (heart, liver, gizzard) increased between the first and the last day of chickens' rearing from 3.6 to 148.8 g, that of inedible parts changed from 6.2 to 157.4 g and that of offal (head, tars metatarsi, blood and feathers) increased from 6.7 to 225.7 g. At the same time, the percentage of the aforemen-

tioned elements in the body weight of chickens prior to slaughter clearly decreased from 10.0 to 6.7%, from 17.0 to 7.1% and from 18.4 to 10.1%, respectively (Table 3).

Table 3. Gibletes not edible entrails and offals content (%) in body weight

Tabela 3. Udział (%) w masie ciała podrobów, wnętrzności niejadalnych i odpadów poubojowych

Specification Wyszczególnienie	Age, days – Wiek, dni						
	1	7	14	21	28	35	42
Gibletes Podroby	10.0	9.1	7.6	6.8	5.5	7.1	6.7
Not edible entrails Wnętrzności niejadalne	17.0	20.8	17.2	14.1	7.4	8.8	7.1
Not edible offals Odpady poubojowe	18.4	12.6	11.5	15.5	11.2	11.8	10.1
Not edible entralis and offals Odpady poubojowe i wnętrzności niejadalne	35.4	33.4	28.6	22.3	18.7	20.6	17.2

With a decrease in the percentage of the above-mentioned elements in the body weight, the dressing percentage of birds increased from 55.2% at 1 day of rearing to 76.1% at 42 days of rearing (Table 4). The dressing percentage obtained in the present study was higher than that in the study by Skomiał et al. [2000], however, it was similar to results reported by Janocha and Milczarek [2006].

Not only body weight and dressing percentage, but also tissue composition of the carcass depends on the age of birds. With an increasing age of birds, their body weight increases irrespective of the rearing system and nutrition and so does the weight of the individual tissue components of the carcass. The proportions between these tissues also change. At present, lean-muscled birds without excessive fat deposition are preferred. In the body weight of 6-week-old broiler chickens, muscles account for approx. 41%, skin with subcutaneous fat makes up approx. 16% and bones account for 13%.

The mean values of the weight and tissue composition of the eviscerated carcass of broiler chickens in successive weeks of their utilization are presented in Table 4. The carcass weight of day-old chicks averaged 20.1 g, and it was 1697 g at the end of the rearing period, i.e. at 42 days. A similar carcass weight was reported by other authors [Janocha et al. 2008].

Table 4. Dressing percentage (%), mean values (in g) and coefficients of variation (V%) of chicken dissection analysis

Tabela 4. Wydajność rzeźna (%), wartości średnie (w g) i współczynniki zmienności (V%) wyników analizy dysekcyjnej kurcząt

Specification Wyszczególnienie		Age, days – Wiek, dni						
		1	7	14	21	28	35	42
Weight of eviscerated carcass	\bar{x}	20.1	81.9	254.9	408.4	920.5	1216.3	1697.0
Masa tuszki patroszonej	V%	1.7	7.0	2.8	4.3	4.4	12.8	12.8
Dressing percentage	\bar{x}	55.2	57.5	63.8	63.5	73.6	70.0	76.1
Wydajność rzeźna	V%	3.3	3.1	4.0	4.5	2.4	5.1	2.3
Breast muscles	\bar{x}	0.9	19.0	47.6	106.6	207.8	326.4	429.9
Mięśnie piersiowe	V%	0.2	1.7	2.3	7.9	11.7	12.9	6.8
Thigh muscles	\bar{x}	1.9	12.6	27.6	52.6	101.0	147.9	217.9
Mięśnie ud	V%	0.3	1.1	2.1	4.1	7.8	11.0	12.3
Drumstic muscles	\bar{x}	1.3	9.1	19.9	30.7	86.5	118.9	140.7
Mięśnie podudzi	V%	0.3	2.0	2.7	3.1	4.1	4.9	7.2
Thigh and drumstic muscles	\bar{x}	3.2	21.7	47.6	83.3	187.5	266.9	358.7
Mięśnie ud i podudzi	V%	0.3	3.0	2.9	2.8	11.9	6.9	12.3
Total muscles	\bar{x}	4.1	40.7	95.2	189.9	395.3	593.3	788.6
Mięśnie ogółem	V%	0.7	6.1	7.8	4.2	5.1	6.8	11.2
Skin with subcutaneous and abdominal fat	\bar{x}	6.5	10.7	28.0	57.2	110.5	170.3	186.7
Skóra z tłuszczem podskórnym i sadełkowym	V%	1.0	2.1	2.0	3.0	3.7	3.7	4.9
Carcass remainder (bones)	\bar{x}	9.0	30.6	131.7	161.3	414.8	442.8	721.8
Pozostałość tuszki (kości)	V%	1.1	3.2	7.1	3.9	4.3	9.2	9.1

The most valuable tissue of the carcass is the muscle tissue [Biesiada-Drzazga 2007]. In poultry, muscles weight is mainly affected by the weight of breast muscles and leg muscles, which has been proved in many studies [Bochno 1985, Janiszewska 1993, Janocha et al. 2008].

The weight of breast muscles of day-old chicks was 0.9 g and increased to 430 g at 6 weeks of rearing, whereas that of leg (thighs and shanks) muscles changed from 4.1 to 788.6 g, respectively. On the other hand, the weight of the less desirable components of the carcass, that is, skin with fat and the weight of so-called carcass remainders, increased in the analysed period from 6.5 to 186.7 g and from 9.0 to 721.8 g, respectively. It should be added that the so-called carcass remainders, that is, i.a. bones, neck and remaining muscles are sold as so-called broth meat. Often these parts of the broiler carcass are also intended for the processing separately or with other types of meat.

The percentage of tissue components in the broiler carcass in successive experimental periods is presented in Table 5.

Table 5. Content of carcass components in eviscerated weight (%)

Tabela 5. Procentowa zawartość składników tkankowych w masie tuszki patroszonej

Specyfication Wyszczególnienie	Age, days – Wiek, dni						
	1	7	14	21	28	35	42
Weight of eviscerated carcass Masa tuszki patroszonej	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Breast muscles Mięśnie piersiowe	4.5	23.2	18.7	26.1	22.6	26.8	25.3
Thigh muscles Mięśnie ud	9.7	15.4	10.8	12.9	11.0	12.2	12.8
Drumstic muscles Mięśnie podudzi	6.3	11.1	7.8	20.4	9.4	9.7	8.3
Thigh and drumstic muscles Mięśnie ud i podudzi	16.0	26.5	18.7	20.4	20.4	21.9	21.1
Total muscles Mięśnie ogółem	20.5	49.7	37.4	46.5	43.0	48.7	46.4
Skin with subcutaneous and abdominal fat Skóra z tłuszczem podskórnym i sadełkowym	32.2	13.0	11.0	14.0	12.0	14.0	11.0
Carcass remainder (bones) Pozostałość tuszki (kości)	44.4	37.3	51.7	39.5	45.1	36.4	42.5

The obtained results indicate substantial changes in the tissue composition of the carcass with an increasing age of birds. In the carcasses of day-old chicks, breast muscles accounted for 4.5% of the eviscerated carcass weight. The respective values for leg muscles, skin with fat and bones (so-called carcass remainders) were: 16.0%, 32.2% and 44.4%. During the 42-day rearing period, we found a significant increase in the percentage of the breast muscles in the eviscerated carcass weight to 25.3%, a slight increase in the percentage of legs to 21.1% and a clear decrease in the percentage of skin and subcutaneous and abdominal fat to 12%. The obtained results for the tissue composition of the carcasses of 6-week-old chickens are similar to those obtained by other authors [Chołocińska and Wężyk 1999, Skomial et al. 2000, Pieszka et al. 2004].

Moreover, it is worth indicating that the 5-week-old broiler chickens were characterized by somewhat more favourable tissue composition of the eviscerated carcass than were 6-week-old chickens. It was visible as a better conformation of breast part and legs and a lower bone content in the carcass (Table 5). Consequently, it can be concluded that the slaughter of the Ross 308 broiler chickens can be performed from the fifth week of their rearing, taking into consideration, however, the obtained body weight of broilers at this time.

In the slaughter poultry production, the aim is not only to obtain a large amount of material, but also one of good quality. Extensive data from the literature indicate the complexity of the issue of poultry quality, including that of broiler chickens. Muscle tissue traits in poultry are, first of all, determined by genotype, type of muscle and bird age and, additionally, by broadly defined environmental factors [Połtowicz 1999, Gornowicz and Dziadek 2001]. Of the environmental factors, the nutrition of chickens during the rearing pe-

riod is the most significant factor affecting the chemical composition of muscles and thus their nutritional value as well as sensory and physicochemical properties [Korelski et al. 1998, Baleri et al. 2001, Osek et al. 2002]. The nutritional quality or the nutritional or dietary value of meat is evaluated paying special attention to the content of the complete protein and highly unsaturated fatty acids [Grabowski 2002]. Poultry is characterized by a high nutritional and dietary value being the source of complete protein, vitamins, minerals and low amount of fat [Cytawa 1999].

The performed analyses showed an effect of chicken age on the chemical composition of breast muscles as well as thigh and leg muscles (Table 6).

Table 6. Chemical composition of muscles, %

Tabela 6. Skład chemiczny mięśni, %

Specyfification Wyszczególnienie	Age, days Wiek, dni	Dry matter Sucha masa	Crude ash Popiół surowy	Crude protein Białko ogólne	Crude fat Tłuszcz surowy
Breast muscle	35	24.43	1.12	21.58	1.30
Mięśnie piersiowe	42	26.12	1.17	23.03	1.38
Thigh and drumstick muscles	35	24.13	1.02	18.02	4.76
Mięśnie ud i podudzi	42	25.34	1.00	19.11	5.52

The analysed muscles of younger birds (at 35 days of age) contained clearly less dry matter and crude protein than did the muscles of older birds (at 42 days of age). Moreover, breast muscles contained clearly more crude protein and less crude fat compared with leg muscles, irrespective of chicken age. Czaja and Gornowicz [2004], in the study on the Ross 308 broilers, obtained somewhat higher content of crude protein in the breast muscles and a lower one in the leg muscles as well as lower fat content in both analysed muscles.

CONCLUSIONS

The mean body weight of the 42-day-old Ross 308 broiler chickens was 2229.9 kg. During the rearing period, considerable changes in the tissue composition of the carcass and their uneven growth were found. Between 1 and 42 days of rearing, the percentage of breast muscles in the carcass increased from 4.5 to 25.3%, that of leg muscles changed from 16.0 to 21.1% and that of skin and subcutaneous fat as well as carcass remainders (bones) decreased from 32.2 to 11.0% and 44.4 to 42.5%, respectively. Moreover, the effect of age and type of muscle on the chemical composition of broiler muscles was recorded.

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OCENA WZROSTU I WARTOŚCI RZEŻNEJ KURCZĄT BROJLERÓW ROSS 308

Streszczenie. Celem badań była ocena wzrostu kurcząt brojlerów i ich wartości rzeźnej od 1. do 42. dnia życia. Materiał badawczy stanowiły kurczęta Ross 308. W 42. dniu odchowu kurczęta osiągnęły średnią końcową masę ciała 2229,9 g. W kolejnych tygodniach odchowu, wraz ze wzrostem masy ciała ptaków wzrastała masa wszystkich elementów, tj. podrobów, wnętrzności niejadalnych i odpadów poubojowych. Jednocześnie ich udział w masie ciała znacząco malał, a wydajność rzeźna zwiększała się. W 42. dniu odchowu masa tuszki patroszonej wynosiła średnio 1697 g, mięśnie stanowiły w niej 46,7%, skóra z tłuszczem 11,0%, a pozostałość tuszki (kości) 42,5%. W okresie odchowu stwierdzono znaczne zmiany składu tkankowego tuszki i nierównomierny ich wzrost. Ponadto ustalono wpływ wieku i rodzaju mięśnia na skład chemiczny mięśni piersiowych i mięśni nóg u brojlerów.

Słowa kluczowe: kurczęta brojlery, wartość rzeźna, wzrost

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