The Influence of Growth Rate on the Carcass Traits, Meat Quality Traits, and Fatty Acid Profile in Broilers

Utjecaj brzine rasta na svojstva trupova, kvalitetu mesa i profil masnih kiselina broilera

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THE INFLUENCE OF GROWTH RATE ON THE CARCASS TRAITS, MEAT QUALITY TRAITS, AND FATTY ACID PROFILE IN BROILERS

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SUMMARY

This research investigates the growth rate of Ross 308 broilers (Group A <50g weight gain; Group B >50g weight gain) during a 42-day fattening period and its influence on the carcass traits and technological quality of breast meat by referring to the broiler sex and fatty acid profile in breast and thigh muscles. The portions of breasts, drumsticks with thighs, back, wings (%), and dressing percentage (%) are considered for the assessment of carcass traits. Technological quality is determined by reviewing the following indicators: pH_1, pH_2, ΔpH, drip loss, and the breast meat color (CIE L*, a*, b*) . This research confirms a significant influence of broiler sex and growth rate on the live weight gain and carcass weight ($p<0.001$) and the portions of breasts ($p=0.006$) and drumsticks with thighs ($p=0.004$) too. The growth rate has a significant influence on the portions of drumsticks with thighs and wings ($p<0.001$). Broiler sex exerts an influence on the differences in drip loss, % ($p=0.003$) and in the yellowness ($p=0.029$) of breast meat. There is a positive correlation determined between the pH_1 and pH_2 ($p<0.01$) in breast meat of the Group A, while a negative correlation occurs between the pH_1 and the CIE L* and CIE b* indicators ($p<0.01$), as well as between the CIE a* and CIE b* in both the A and B groups ($p<0.01$). The fattened broilers' daily gain had no effect either on differences in indicators of breast meat technological quality or on the fatty acid profile in breast meat ($p>0.05$). Highly significant differences ($p<0.05$) are determined, however, in the content of certain fatty acids between the breast and thigh muscles.

Keywords: growth rate, broilers, meat quality, fatty acid profile

INTRODUCTION

The production and consumption of poultry meat, especially of that of broilers, has been growing over the period of last thirty years. Such growth has been conditioned by a raised awareness concerning the nutritional value of poultry meat, its acceptable price, and its suitability for processing (Petracci et al., 2015). Bearing in mind the market demands, poultry producers have been adjusting their production objectives. From the initial selling of whole chicken carcasses, they have shifted to the production of ready-made meat cuts (breasts, drumsticks and thighs, wings and backs) and to the processing of meat into various products. Market demands also influenced the selection of broiler hybrids that provide the high portions of breasts, as this part of meat is especially cherished by consumers. Table 1 overviews production characteristics of broilers and portions of breast meat in carcass for a period from 1957 to 2019.

The overviewed data indicate a progress in the selection and production of broiler meat over the analyzed period. Available papers usually compare the production traits of different broiler hybrids, such as Cobb 500, Ross 308, Hubbard, Arbor Acres, and some autochthonous broiler proveniences suitable for fattening (Khalid et al., 2021). There is a lack of data referring to

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the growth intensity in modern broiler genotypes, which would explain the slower and faster growth rates within the same hybrid and the influence of such growth rates on meat quality. This paper deals with Ross 308 broilers, which are widely produced due to their good production performance and meat quality. Ross 308 broilers are fattened for 35 to 49 days, depending on the desired weight. An analysis of the published research documents different sets of results that depend on the investigated factors and their impact on production outcome. Ross 308 hybrid exhibited different body weights that varied from 1.65 kg to 2.80 kg, depending on the length of fattening, management, sex, veterinary measures, and the like (Khalid et al., 2021; El-Tahawy et al., 2017). Feed conversion ranged from 1.5 kg to 2.8 kg per kg of weight gain, along with a maximum mortality of 6% (Martínez and Valdivié, 2021; Kralik et al., 2022). The aim of the presented research is to determine the growth rate of broilers (Group A refers to a slow growth <50g, and Group B refers to a fast growth >50g,) being fattened over 42 days and its influence on the carcass traits and the broiler meat quality by analyzing the data referring to the broiler sex and fatty acid profile in breasts and thighs.

Table 1. Portions of breast meat in relation to broiler weight and age

Tablica 1. Prinosi prsnoga mesa u odnosu na tjelesnu masu i dob brojlera

Year	Hybrid / *Hibrid*	Body weight, g / *Tjelesna masa,g*	Age, days / *Dob, dana*	Breast meat[4] / *Prsno meso*	
				g	%
1957	A. Canad breed	2078	57	280	13.5
2001[1]	Ross 308	2207	43	349	15.8
2007[2]	Ross 308	2200	36	410	18.6
2012[2]	Ross 308	2200	35	464	21.1
2022[3]	Ross 308	2296	35	585	25.5

[1] Havestein et al. (2003); [2] Aviagen Ross 2007, 2012; [3] Avian brand, Ross 2022; [4] Breast meat without skin and bones

MATERIAL AND METHODS

Housing and feeding of broilers

The research was conducted on 200 Ross 308 chickens that were fattened with the standard feed mixtures for 42 days. Two groups of broilers were formed according to the growth rate. The first group included the broilers from 1100 to 2100 g (a lower growth rate, <50 g gain). The second group included the broilers from 2100 to 2800 g (a higher growth rate, >50 g gain). Within each group, the individuals were classified according to sex. The sample contained 168 Ross 308 broilers, ninety of which were male and seventy-eight were female. The other broilers from the experiment, with their final mass, deviated from the set limits of the lower or higher growth rate group. From day 1–22, broilers were fed starter mixture that contained 21.02 % crude protein and 13.5 MJ/kg ME, and from day 22–35, they are given grower feed containing 19.03% crude protein and 12.98 MJ/kg ME. From day 36-42, the feeding of broilers proceeded with a finisher mixture containing 18.05% of crude protein and 12.80 MJ/kg of ME. Table 2 presents a chemical composition of the feeding mixtures fed to broilers.

Table 2. Chemical composition of feeding mixtures

Tablica 2. Kemijski sastav krmnih smjesa

Ingredient / *Sastojak*	Starter / *Starter*	Grower / *Grover*	Finisher / *Finišer*
Crude protein (%) / *Sirovi proteini*	21.02	19.00	18.05
Fat (%) / *Mast*	3.00	3.89	5.40
Crude fiber (%) / *Sirova vlakna*	5.60	5.80	3.40
Water (%) / *Voda*	9.60	9.30	9.80
Ash (%) / *Pepeo*	5.89	5.82	5.89
Calcium-Ca (g/kg) / *Kalcij*	7.80	6.80	7.00
Sodium-Na (g/kg) / *Natrij*	1.50	1.70	1.90
Phosphorus-P (g/kg) / *Fosfor*	5.30	5.10	4.90
Manganese-Mn (mg/kg) / *Mangan*	85.0	92.0	120

Methods applied for chemical analysis of feed: crude protein HRN ISO 1871:2017; fat RU-MET-258, version 0, 2019-03-11; crude fiber HRN EN ISO 6865:2001, version 0, 2020-08-17; water RUM-5.4-69, version 02, 2016-04-25; ash Mod. HRN EN ISO 2171:2010, EN ISO; calcium and sodium RU-MET-204, version 0, 2019-03-10 AAS; phosphorus KO-01/06c; manganese RU-MET-408 ICP-MS. / *Metode korištene za kemijsku analizu krmne*

smjese: sirove bjelančevine HRN ISO 1871:2017; Masti RU-MET-258, izdanje 0, 2019-03-11; sirova vlakna HRN EN ISO 6865:2001, izdanje 0, 2020-08-17; voda RUM-5.4-69, izdanje 02, 2016-04-25; pepeo Mod. HRN EN ISO 2171:2010, EN ISO; kalcij i natrij RU-MET-204, izdanje 0, 2019-03-10 AAS; fosfor KO-01/06c; mangan RU-MET-408 ICP-MS.

Determination of broiler meat quality

Subsequent to slaughtering, all 168 broiler carcasses are processed according to the Regulations on the Poultry Meat Marketing Standards (Official Gazette 63, 2022-915) and the Commission Regulation (EC) No. 543/2008. The research was conducted on both the male and female broiler carcasses, which were divided in two groups according to the growth rate achieved during fattening. Group A referred to the broilers with an average daily gain of <50g, and Group B referred to the broilers with an average daily gain amounting to >50g. In addition to the broiler live weight, the carcass traits were determined by calculating the portions of breasts, drumsticks, back and wings, the results of which are presented as relative (%) indicators. Furthermore, the technological properties of breast meat are also determined by measuring the pH_1 value (up to 45 min *post mortem – p.m.*), pH_2 value (24 hours *p.m.* cooled to +4°C), $\Delta pH = (pH_2 - pH_1)$, drip loss in %, and breast meat color (CIE L* degree of paleness, CIE a* degree of yellowness, and CIE b* degree of redness). The pH values in the breast meat were measured by a Mettler MP 120-B digital pH meter. Drip loss was determined according to Christensen's method (2003). Breast meat color was measured by Minolta Chroma CR 400 colorimeter. The device was calibrated on a white board with a light source D=64, with a standard viewing angle of 2°.

An analysis of fatty acids in broiler feed and in muscle tissue

In order to determine the fatty acid profile, the samples were prepared in a MARS 6 microwave device (CEM Corporation, Matthews, NC, USA), which employs the power of 1200 W of microwaves. At the end of the destruction process, the pentane samples were extracted, transferred to a vial, and analyzed on a SCION 436-GC gas chromatograph equipped with a flame ionization detector (SCION Instruments, Goes, the Netherlands). Fatty acids were separated in a FAMEWAX capillary column (30 m x 0.32 mm (internal diameter) x 0.25 μm (film thickness) (Restek Corporation, Bellefonte, PA, USA). The injected sample volume amounted to 1 μL, and the testing conditions were as follows: injector temperature 230 °C, detector temperature 230 °C, carrier gas flow (hydrogen) 2.5 mL/min. The heating of oven was set as follows: 20 °C/min from 50 to 160 °C, 10 °C/min from 160 to 225 °C, heating retained at 225 °C for nine minutes. The analysis lasted for 21 minutes. A standard mixture of 37 fatty acids (Food Industry FAME Mix, Restek Corporation, Bellefonte, PA, USA) was used for determination of individual fatty acids in the chromatogram. The fatty acid profile in muscle tissue of breasts and thighs was determined on 24 samples, and the fatty acids profile of broiler feed was determined on three samples, with each being analyzed in three repetitions. Table 3 presents the profile of fatty acids in broiler feed.

Table 3. Fatty acid profile in broiler feed (% of total fatty acids; mean ± sd)

Tablica 3. Profil masnih kiselina u smjesama za tov pilića (% ukupnih masnih kiselina; mean ± sd)

Fatty acid / *Masna kiselina*	Starter / *Starter*	Grower / *Grover*	Finisher / Finišer
Myristic C14:0 / *Miristinska*	-	-	0.08±0.00
Palmitic C16:0 / *Palmitinska*	10.42±0.24	9.98±0.16	14.14±0.29
Heptadecanoic C17:0 / *Heptadekanska*	-	-	0.09±0.00
Stearic C18:0 / Stearic	2.37±0.01	2.26±0.01	2.39±0.02
Arachidic C20:0 / Arahidonska	0.47±0.00	0.51±0.01	0.43±0.01
Behenic C22:0 / *Behenska*	0.40±0.02	0.37±0.02	0.30±0.00
Lignoceric C24:0 / *Lignocerinska*	-	-	0.29±0.00
∑SFA	13.66±0.24	13.12±0.16	17.72±0.27
Palmitoleic C16:1 / *Palmitoleinska*	0.17±0.01	0.21±0.02	0.16±0.03
Oleic C18:1/ *Oleinska*	39.14±0.15	40.71±0.15	25.55±0.57
Eicosenoic C20:1 / *Eikozaenska*	0.53±0.04	0.65±0.02	0.41±0.02
∑MUFA	39.84±0.18	41.57±0.14	26.12±0.52
Linoleic C18:2n6 / *Linolna*	43.99±0.07	42.23±0.08	53.65±0.44
∑n-6 PUFA	43.99±0.07	42.23±0.08	53.65±0.44
α- linolenic C18:2n-3 / α-*linolenska*	2.47±0.00	3.08±0.01	2.53±0.03
∑n-3 PUFA	2.47±0.00	3.08±0.01	2.54±0.03
n-6 PUFA/ n-3 PUFA	17.81±0.02	13.71±0.03	21.12±0.11

SFA= saturated fatty acids / *zasićene masne kiseline*; MUFA= monounsaturated fatty acids / *mononezasićene masne kiseline; PUFA= polyunsaturated fatty acids / polinezasićene masne kiseline*

Statistical data analysis

The obtained data are processed by using the dplyr (Mailund, 2019) in the *R* software (R Development Core Team, 2020), and in the TIBCO® Data Science Workbench, version 14.0.0.15 (©1984-2020 Tibco Software Inc.), overviewed in tables by displaying the mean value (mean) and standard deviation (sd). A two-way analysis of variance (ANOVA) is applied between the treatments for a 2x2 factorial design (two growth rates and sexes and two growth rates and muscle tissue types). Statistical significance is tested by the Tukey post hoc test and by the Fisher's LSD test. A correlation between the meat quality indicators is shown by the Pearson coefficient as processed in *Excel*, and statistical significance is tested at the levels of $p<0.05$ and $p<0.01$.

RESULTS AND DISCUSSION

Carcass traits and indicators of the breast meat technological quality with respect to the average daily weight gains (Group A with a weight gain of <50 g, Group B with a weight gain of >50 g) are overviewed in Tables 4 and 5. The average live weight and slaughter weight of male broilers in Group B are for 0.69 kg and 0.54 kg, respectively, higher than that of Group A. Live weight and slaughter weight of female broilers in Group B are also for 0.62 kg and 0.50 kg, respectively, higher than that of broilers in Group A. In this research, an average live weight of Ross 308 broilers (A and B group) was 2.13 kg, and carcass weight was 1.50 kg (dressing percentage 71.08%). Male broilers of Group B exhibited a greater portion of breasts than Group A (36.17% and 33.23%, respectively) and a lower portion of drumsticks with thighs (30.31% and 31.59%, respectively). An analysis of portions of breasts and drumsticks with thighs (%) in female broilers also shows that Group B had a greater portion of breasts than Group A (37.03 % and 35.93%, respectively); yet, a portion of drumsticks with thighs (29.47 % and 30.13%, respectively) was lesser. On average, carcasses of Ross 308 male and female broilers of A+B groups have a greater portion of breasts and a lesser portion of drumsticks with thighs (34.98% and 30.81%; 36.25% and 29.94%, respectively). When referring to the broiler sex and the growth rate (Table 4), data analysis confirms significant differences between the carcass weights and portions of breasts and drumsticks with thighs ($p<0.001$). Sexual dimorphism is obvious in both fast- and slow-growing broilers. It is determined that the dressing percentage was greater in the heavier broilers of both sexes, but the differences are in favor of males ($p>0.05$). Fanatico et al. (2005) reported that the fast-growing broilers had a greater carcass gain. The data contained in Table 5 prove that the pH_1 and pH_2 values of breast meat were within the limits, although the males in Group B had a greater drop of the pH_2 value (ΔpH) than those in Group A (ΔpH 0.16: ΔpH 0.17, respectively). The pH value of breast meat before slaughter was >7.0, while at 6:00 p.m. it decreases to 5.8 - 5.9. There are two categories of PSE (pale, soft, exudative) meat, one referring to the meat in which the pH value at 1:00 p.m. drops below 6.0, and the other one referring to the meat in which the final pH value is lower than normal (<5.8). Both categories refer to the meat that is lighter in color and has a reduced water-holding capacity (Le Bihan-Duval et al., 2008; Petracci et al., 2015). The PSE meat occurs in chickens with a high glycolytic potential (acid meat). According to Berri et al. (2008), a high level of glycogen on the occasion of slaughter lowers the pH value, making it closer to an isoelectric point of myofibrillar protein. Alnahhas et al. (2014) pointed out that a selection of broilers with higher portion and weight of breast muscle led to an increase in the final pH value. However, the increase of final pH value can result in the DFD (dark, firm, dry) meat, with unfavorable organoleptic properties (Barbut et al., 2008). Schnaider et al. (2012) reported that the broiler sex influenced the final pH value in breasts. In female broilers, pH_K is lower than in males (5.87:5.96, respectively; $p<0.001$), and, consequently, a drip loss (%) is higher in female than in the male broilers (2.34%:1.93%, respectively; $p<0.001$). Fletcher (1999) stated that a higher pH value resulted in a darker meat color, which was also confirmed by Wattanacehat et al. (2004) and Anadon (2002). Moreover, Allen et al. (1997, 1998) pointed out that a high pH in darker meat could reduce the storage duration of meat. Drip loss (Table 5) is greater in female than in the male broilers of both groups (2.49% and 2.34%:1.58% and 1.81%, respectively). The differences in drip loss between the broiler sexes are significant ($p=0.003$), while the growth rate has no influence on this trait ($p=0.873$). The indicators of color, as those of the CIE L*, a*, and b* values, differ with respect to the growth rate as well as to the sex. In both groups, male broilers exhibited higher CIE L* values than females (49.04 and 50.02:47.55 and 49.03, respectively).

Table 4. Broiler carcass characteristics (mean±sd)

Tablica 4. Karakteristike trupova brojlera (mean±sd)

Indicator / *Pokazatelj*	Group A (<50g weight gain) / *Skupina A (< 50g prirasta)*		Group B (>50g weight gain) / *Skupina B (> 50g prirasta)*		Influence of growth / *Utjecaj prirasta*	Influence of sex / *Utjecaj spola*	Interaction / *Interakcija*	Groups A+B Males / *Skupina A+B muški*	Groups A+B Females / *Skupina A+B ženski*
	Males / *Muški*	Females / *Ženski*	Males / *Muški*	Females / *Ženski*					
Live weight, kg / *Živa masa*	1.72±0.38^{c}	1.52±0.20^{d}	2.41±0.21^{a}	2.13±0.48^{b}	<0.001	<0.001	<0.001	2.13±0.44	1.91±0.34
Carcass weight, kg / *Masa trupa*	1.18±0.34^{c}	1.06±0.14^{d}	1.72±0.17^{a}	1.51±0.17^{b}	<0.001	<0.001	<0.001	1.50±0.36	1.35±0.18
Dressing percentage, % / *Randman*	70.78±1.79	70.78±1.00	71.21±0.89	70.90±0.92	0.213	0.152	0.617	71.08±1.32	70.81±0.97
Breast, % / Prsa	33.23±3.51^{a}	35.93±3.01^{b}	36.17±2.39^{b}	37.03±3.07^{a}	<0.001	0.006	0.074	34.98±3.17	36.25±3.04
Drumsticks with thighs, % / *Bataci sa zabacima*	31.52±2.75^{a}	30.13±1.75^{b}	30.31±1.50^{a}	29.49±1.78^{b}	0.002	0.004	0.401	30.81±2.13	29.94±1.77
Back, % / *Leđa*	22.99±2.36	22.74±2.65	22.45±1.27	23.38±2.24	0.845	0.496	0.092	22.69±1.77	22.20±2.54
Wings % / *Krila*	12.75±3.52^{a}	11.20±1.58^{b}	11.26±1.58^{b}	10.12±1.43^{b}	<0.001	0.477	0.484	11.85±2.58	11.61±1.58

Letters in superscript ^{a,b} in table rows indicate significant difference at levels p<0.05; p<0.01 and p<0.001 / *Slova u superskriptu ^{a,b} u redovima tablice označavaju značajnu razliku na razinama p<0,05; p<0,01 i p<0,001*

Table 5. Indicators of technological quality of breast meat (mean±sd)

Tablica 5. Pokazatelji tehnološke kvalitete prsnoga mesa (mean±sd)

Indicator / *Pokazatelj*	Group A (<50g weight gain) / *Skupina A (< 50g prirasta)*		Group B (>50g weight gain) / *Skupina B (> 50g prirasta)*		Influence of growth / *Utjecaj prirasta*	Influence of sex / *Utjecaj spola*	Interaction / *Interakcija*	Groups A+B Males / *Skupina A+B muški*	Groups A+B Females / *Skupina A+B ženski*
	Males / *Muški*	Females / *Ženski*	Males / *Muški*	Females / *Ženski*					
pH_1	6.15±0.19	6.14±0.17	6.14±0.19	6.08±0.19	0.652	0.546	0.677	6.15±0.18	6.11±0.18
pH_2	5.98±0.17	6.00±0.17	5.68±0.93	5.94±0.17	0.251	0.368	0.467	5.83±0.66	5.97±0.17
ΔpH	0.17±0.09	0.13±0.12	0.16±0.07	0.15±0.07	0.986	0.439	0.617	0.16±0.08	0.14±0.09
Drip loss, %	1.58±0.54^{b}	2.49±0.73^{a}	1.81±0.60^{b}	2.34±0.99^{a}	0.873	0.003	0.417	169±0.57	2.41±0.85
CIE L*	49.04±4.66	47.55±2.72	50.02±5.52	49.03±3.76	0.372	0.369	0.853	49.53±4.99	48.29±3.30
CIE a*	1.49±0.54^{b}	2.32±1.21^{a}	1.36±1.30^{b}	1.93±0.57^{a}	0.395	0.029	0.688	1.43±0.97	2.12±0.94
CIE b*	9.92±1.72	9.11±1.77	8.98±1.92	10.17±1.94	0.918	0.739	0.094	9.45±1.84	9.64±1.89

Letters in superscript ^{a,b} in table rows indicate significant difference at levels p<0.05; p<0.01 and p<0.001 / *Slova u superskriptu ^{a,b} u redovima tablice označavaju značajnu razliku na razinama p<0,05; p<0,01 i p<0,001*

Breast meat of broilers with greater growth rate (group B) is lighter in color than the meat of the broilers with a lower growth rate (Group A). Meat yellowness (CIE a*) is more expressed in female than in the male broilers (2.62 and 1.93:1.48 and 1.36, respectively; $p < 0.029$). The CIE b* value referring to the meat redness is greater in male broilers with lower growth rate (9.92:8.98) than in female broilers (9.11:10.17). However, the differences between CIE L* and CIE b* values with respect to the broiler sex and growth rate are not significant (P>0.05). Widemann et al. (2016) argued that the meat color was a subjective characteristic depending on the consumers' preferences. When comparing more samples, instrumental method with colorimeter is applied to determine the CIE L*, CIE a*, and CIE b* values (Girolami et al., 2013) on a surface of 2 to 5 cm^2 (Kang et al., 2008). Samuel et al. (2010) considered the meat color as a main characteristic that consumers noticed when assessing the broiler meat quality. The authors have determined a negative correlation between the CIE L* value and the pH value, as well as between the CIE L* value and water-holding capacity of the breast muscle. There have been more samples with the CIE L* value >60 in the fast-growing broilers than in the slow-growing ones. Poltovich and Doctor (2012) concluded that the broilers' age had no effect on the meat color. The authors examined the breast meat quality of broilers aged 56 to 84 days. A lighter meat color (CIE L* 59.37), greater degree of yellowness

(CIE a* 8.07; $p>0.05$), and a higher value of drip loss, % (1.20:0.86), were determined in the 56-day-old broilers. Bianchi et al. (2007) reported that the meat color was influenced by the carcass weight, as darker meat occurred in heavier broilers. However, this research proves otherwise, since the heavier male broilers have the meat of a lighter color. A greater degree of redness in broilers of less weight was reported by Bianchi et al. (2007). Soares et al. (2009) recommended the following criteria for broiler meat classification: $L^* \geq 53$ PSE, $L^* \leq 44$ DFD, and $44<L^*<53$ for normal meat quality. If applying meat classification as of the CIE L* values according to Soares et al. (2009) to our research, then the Group A counts two PSE samples, one DFD sample and seventeen normal samples of broiler meat. Group B contains four PSE samples and sixteen normal samples of meat. This research determines that the heavier broilers had greater portions of breast meat and greater occurrence of PSE meat. Allen et al. (1998) stated that the meat color was related to the pH value in a way that the muscles of lighter color ($L^* >50$) had a higher pH value than the darker muscles ($L^* <45$). Saláková et al. (2009) reported a negative correlation between the pH value and the CIE L* and CIE b* indicators but a positive correlation between the pH value and the CIE a* indicators. For Ross 308 broilers, Kralik et al. (2012) determined the following color indicators of: CIE L* 54.34, CIE a* 1.53, and CIE b* 6.82. In this research, the broiler meat color indicators are higher in both groups. Potowitch and Doctor (2012) determined that a heavier breast meat exhibited a higher final pH value and less drip loss. Bianchi et al. (2007) concluded that the broilers of lesser weight produced a breast meat with a lower pH value, which was also confirmed by Potowitch and Doctor (2012). El Rammouz et al. (2004) stated that the breast-meat pH_K values mostly depended on genotype, ranging from 5.73 to 5.95 ($p<0.001$). Glycogen contained in muscles on the occasion of slaughter is an important factor in anaerobic glycolysis. The accumulation of lactic acid and H^+ ions formed by the ATP hydrolysis cause the pH value to drop during the conversion of muscles into meat. Cygan-Szezegielnik and Bogucka (2021) researched Ross 308 broilers to determine that the broiler sex did not affect the pH values 15 mins. and 24 hours *postmortem*, nor did it influence the meat color (CIE L*, a*, b*) and water holding capacity ($p>0.05$). When determining the influence of broiler sex on the drip loss (%) and the CIE a* indicator, this research confirms a significant difference between the A and B groups ($p=0.003$ and $p=0.029$). A drip loss (3.32%) greater than that in our research was reported by Woelfel et al. (2002). Kralik et al. (2012, 2014) also reported the higher values for broiler breast meat, which were 2.72%, 2.93%, 2.30%, and 2.70%. Table 6 overviews the correlation coefficients (r) that refer to the relationships between the indicators of breast meat quality (pH_1, pH_2, drip loss, %, and CIE L*, a* and b*). There is a highly positive correlation determined between the pH_1 and pH_2 values in the breast meat of Group A ($r = 0.808$; $p<0.01$) and between the pH_1 and CIE L* value of Group A ($r = 0.393$; $p<0.05$) and group B ($r = 0.652$; $p<0.01$). A negative significant correlation is determined between the pH_1 and CIE L* value in Group A ($r = -0.399$; $p<0.05$) and Group B ($r = -0.692$; $p<0.01$), as well as between the pH_1 and CIE b* value in breast meat of the Group B only ($r = -0.574$; $p<0.01$). Furthermore, a highly significant negative correlation is determined between the CIE L* and CIE a* values of Group B ($r = -0.343$; $p<0.05$), as well as between CIE L* and CIE b* values of Group A ($r = -0.880$; $p<0.01$) and Group B ($r = -0.765$; $p<0.01$).

Table 6. Correlation (r) between indicators of technological quality of broiler breast meat

Tablica 6. Povezanost (r) pokazatelja tehnološke kvalitetu prsnoga mesa kod brojlera

Indicators / *Pokazatelj*	pH_1	pH_2	Drip loss	CIE L*	CIE a*
Group A (<50g weight gain) / *Skupina A (< 50g prirasta)*					
pH_1					
pH_2	0.807**				
Drip loss	-0.203	0.032			
CIE L*	-0.393*	-0.258	0.377		
CIE a*	0.034	0.069	0.149	-0.306	
CIE b*	-0.279	-0.150	0.334*	0.887**	-0.447**
Group B (>50g weight gain) / *Skupina B (> 50g prirasta)*					
pH_2	-0.131				
Drip loss	-0.669**	0.069			
CIE L*	-0.653**	0.001	0.488**		
CIE a*	-0.044	0.089	0.047	-0.343**	
CIE b*	-0.574**	0.065	0.640**	0.765**	-0.182

*p<0.05; **p<0.01

A research into a correlation between the pH_1 value and other breast-meat quality indicators are usually bearing a positive or a negative sign (+ or -); yet, there is a different strength of a relationship implied with respect to the broilers' growth rate, as supported by some authors' statements. Samuel et al. (2010) reported on a negative correlation between the CIE L* value and water-holding capacity (WHC, r= -0.35) and on a positive correlation

between the pH value and WHC (r=0.42), which was in line with the research results obtained by Le Bichan Duval et al. (2001). The aforementioned authors emphasized that the selection of broilers that produce heavier breast muscles did not affect the meat quality. This research confirms a positive correlation between the CIE L* value and the drip loss value in both groups of broilers. Samuel et al. (2010) determined significant difference between the CIE L* values in the breast meat related to the growth rate. The fast-growing broilers had a significantly higher CIE L* value than the slow-growing ones. In this paper, the CIE L* value of the breast meat is higher in the broilers of group B than in the broilers of Group A (50.02:49.04 for males, and 49.03:47.55 for females, respectively). The aforementioned authors did not find significant differences in the pH values of breast meat connected to the growth rate, which is also confirmed by this research.

Table 7 contains the data on a fatty acid profile in breast and thigh muscles (n=6/group: 3 individual females, 3 individual males). The fatty acid profile refers to the SFA, MUFA, n-6 PUFA, and n-3 PUFA, as well as the ratio of n-6 PUFA/n-3 PUFA). Data analysis shows that there were no differences between A and B groups referring to the fatty-acid content in breasts. There are significant differences (P<0.001) determined between the contents of specific fatty acids in breasts and thighs, as follows: palmitoleic (C16:1), heptadecanoic (C17:1), oleic (C18:1), eicosadienoic (C20:2), and dihomo-γ-linolenic (C20:3n6) fatty acids. Furthermore, significant differences are determined between contents of heptadecanoic (C17:0; p=0.005), eicosenoic (C20:1; p=0.018), arachidonic (C20:4n6; p=0.002), and α-linolenic (C18:3n3; p=0.009) fatty acids. Our results are in line with those published by Han et al. (2020) and Al-Raw et al. (2019), who stated that the fatty acids content in feed affected their deposition in broiler muscle tissue. They also pointed out that the fatty acid profile differed between breast and thigh muscles, which is also confirmed by our research. The ALA content is significantly less represented (p=0.009) in breasts than in the thighs of Group A (0.93:1.12) and of Group B (0.97:1.19), which affected higher ratio of ∑n6 PUFA/∑n3 PUFA.

Table 7. Fatty acid profile in breast and thigh muscles of Ross 308 broilers (% of total fatty acids; mean mean±sd)

Tablica 7. Profil masnih kiselina u mišićima prsa i zabataka pilića genotipa Ross 308 (% od ukupnih masnih kiselina; mean±sd)

Fatty acids / *Masne kiseline*	Group A (<50g weight gain) / *Skupina A (< 50g prirasta)*		Group B (>50g weight gain) / *Skupina B (> 50g prirasta)*		Influence of growth / *Utjecaj prirasta*	Influence of sex / *Utjecaj spola*	Interaction / *Interakcija*
	Breast / *Prsa*	Thigh / *Zabatak*	Breast / *Prsa*	Thigh / *Zabatak*			
Myristic (C14:0) / *Miristinska*	0.0±0.0^{b}	0.27±0.06^{a}	0.0±0.0^{b}	0.27±0.08^{a}	0.873	<0.001	0.873
Palmitic (C16:0) / *Palmitinska*	19.99±0.86	21.94±2.64	20.34±0.50	22.51±4.75	0.691	0.082	0.924
Heptadecanoic (C17:0) / *Heptadekanska*	0.0±0.0^{b}	0.17±0.02^{a}	0.0±0.0^{b}	0.14±0.09^{a}	0.901	0.005	0.901
Stearic (C18:0) / *Stearinska*	10.81±1.55	9.94±2.45	11.04±1.53	9.60±1.16	0.942	0.118	0.693
∑SFA	30.80±2.17	32.32±4.95	31.38±1.72	32.49±0.43	0.801	0.437	0.917
Palmitoleic (C16:1) / *Palmitoleinska*	1.88±0.16^{b}	2.75±0.32^{a}	1.90±0.26^{b}	3.25±1.19^{a}	0.331	<0.001	0.361
Heptadecanoic (C17:1) / *Heptadekanska*	0.89±0.30^{a}	0.45±0.13^{b}	0.83±0.25^{a}	0.44±0.08^{b}	0.682	<0.001	0.802
Oleic (C18:1) / *Oleinska*	32.09±3.29^{b}	37.50±2.67^{a}	31.62±3.81^{b}	38.27±5.28^{a}	0.924	0.001	0.698
Eicosenoic (C20:1) / *Eikozenska*	0.27±0.28^{b}	0.43±0.21^{a}	0.25±0.27^{b}	0.57±0.15^{a}	0.499	0.018	0.440
∑MUFA	35.13±3.39^{b}	41.13±2.94^{a}	34.60±3.97^{b}	42.54±6.46^{a}	0.808	<0.001	0.597
Linoleic (C18:2n6) / *Linolna*	26.18±1.44^{b}	29.94±4.24^{ab}	26.31±0.86^{b}	30.68±6.15^{a}	0.833	0.019	0.897
Eicosadienoic (C20:2n6) / *Eikozadienska*	1.16±0.35^{a}	0.53±0.29^{b}	1.21±0.58^{a}	0.61±0.13^{b}	0.652	0.001	0.905
Dihomo-γ-linolenic (C20:3n6) / *Dihomo-γ-linolenska*	1.00±0.34^{a}	0.43±0.24^{b}	1.13±0.60^{a}	0.50±0.09^{b}	0.531	0.001	0.854
Arachidonic (C20:4n6) / *Arahidonska*	4.95±1.27^{ab}	3.22±1.41^{c}	4.69±1.53^{bc}	2.75±0.78^{d}	0.495	0.002	0.838
∑n6 PUFA	33.29±2.02	34.12±5.49	33.34±2.80	34.48±6.46	0.913	0.605	0.934
α-linolenic (C18:3n3) / *α-linolenska*	0.93±0.01^{d}	1.12±0.12^{bc}	0.97±0.04^{c}	1.19±0.28^{ab}	0.393	0.009	0.829
∑n3 PUFA	0.93±0.01^{d}	1.12±0.12^{bc}	0.97±0.04^{c}	1.19±0.28^{ab}	0.393	0.009	0.829
∑n6 PUFA/∑n3 PUFA	35.80±5.44^{a}	30.46±3.46^{bc}	34.37±3.87^{ab}	29.24±7.68^{c}	0.300	0.003	0.823

SFA= saturated fatty acids / *zasićene masne kiseline*; MUFA= monounsaturated fatty acids / *Mononezasićene masne kiseline*; PUFA= polyunsaturated fatty acids / *Polinezasićene masne kiseline*; letters in superscript ^{a,b,c} in table rows indicate significant difference at levels p<0.05; p<0.01 and p<0.001/ *Slova u superskriptu ^{a,b,c} u redovima tablice označuju značajnu razliku na razinama p<0,05; p<0,01 i p<0,001*

CONCLUSION

Referring to the results obtained in this research, it is concluded that the broiler growth rate (A group <50 g of weight gain, B group >50 g of weight gain) and broiler sex have significant influence on live weight and carcass weight of broilers and on their interaction ($p<0.001$). The portions of breasts in carcasses (%) differed significantly with respect to the broiler sex ($p=0.062$) and weight gain ($p<0.001$), and so did the portions of drumsticks with thighs (%), ($p=0.044$, and $p=0.002$, respectively). It is determined that the broiler sex has a significant influence on the drip loss and on the CIE a* value ($p=0.0037$ and $p=0.029$, respectively). A positive correlation is determined between the pH_1 and pH_2 in the breast meat of Group A, as well as between the pH_1 and CIE L* and the drip loss in the A and B groups ($p<0.01$). A negative correlation is determined between the pH_1 and CIE L* and CIE b* values ($p < 0.01$), as well as between the CIE a* and CIE b* ($p < 0.01$) in the A and B groups. However, the contents of specific fatty acids differ significantly between the breast and thigh muscles, as well as the ratio of $\sum$n6 PUFA/$\sum$n3 PUFA ($p<0.05$).

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REFERENCES

1. Allen, C. D., Fletcher, D. L., Northcutt, J. K., & Russell, S. M. (1998). The relationship of broiler breast color to meat quality and shelf-life. *Poultry Science*, *77*(2), 361-366. https://doi.org/10.1093/ps/77.2.361
2. Allen, C. D., Russell, S. M., & Fletcher, D. L. (1997). The relationship of broiler breast meat color and pH to shelf-life and odor development. *Poultry Science*, *76*(7), 1042-1046. https://doi.org/10.1093/ps/76.7.1042
3. Alnahhas, N., Berri, C., Boulay, M., Baéza, E., Jégo, Y., Baumard, Y., ... & Le Bihan-Duval, E. (2014). Selecting broiler chickens for ultimate pH of breast muscle: analysis of divergent selection experiment and phenotypic consequences on meat quality, growth, and body composition traits. *Journal of Animal Science*, *92*(9), 3816-3824. https://doi.org/10.2527/jas.2014-7597
4. Al-Rawi, M.N., Mousa, B.H. and Al-Hamadani, A.A. (2019). Effect of supplementation broiler diets with different levels of polyunsaturated fatty acids on productive and some biochemical traits. *Plant Archives*, 19(2), 3535-3540.
5. Anadon, H.L.S. (2002). Biological, nutritional, and processing factors affecting breast meat quality of broilers. Ph.D. Thesis, Virginia Polytechnic Institute and State University, Blacksburg, VA, 24061, USA
6. Aviagen Ross 308 (2007). Ross 308 broiler performance objectives in - house publication, Global. Aviangen Ltd; Newbridge, UK.
7. Aviagen Ross 308 (2012). Ross 308 broiler performance objectives in - house publication, Global. Aviangen Ltd; Newbridge, UK.
8. Avian brend, Ross (2022). Performance objectives, 0822-AVNR-157.
9. Barbut, S., Sosnicki, A. A., Lonergan, S. M., Knapp, T., Ciobanu, D. C., Gatcliffe, L., ... & Wilson, E. W. (2008). Progress in reducing the pale, soft and exudative (PSE) problem in pork and poultry meat. *Meat Science*, *79*(1), 46-63. https://doi.org/10.1016/j.meatsci.2007.07.031
10. Berri, C., Besnard, J., & Relandeau, C. (2008). Increasing dietary lysine increases final pH and decreases drip loss of broiler breast meat. *Poultry Science*, *87*(3), 480-484. https://doi.org/10.3382/ps.2007-00226
11. Bianchi, M., Petracci, M., Sirri, F., Folegatti, E., Franchini, A., & Meluzzi, A. (2007). The influence of the season and market class of broiler chickens on breast meat quality traits. *Poultry Science*, *86*(5), 959-963. https://doi.org/10.1093/ps/86.5.959
12. Christensen, L. B. (2003). Drip loss sampling in porcine m. longissimus dorsi. *Meat science*, *63*(4), 469-477. https://doi.org/10.1016/S0309-1740(02)00106-7
13. Cygan-Szczegielniak, D., & Bogucka, J. (2021). Growth performance, carcass characteristics and meat quality of organically reared broiler chickens depending on sex. *Animals*, *11*(11), 3274. https://doi.org/10.3390/ani11113274
14. El Rammouz, R., Berri, C., Le Bihan-Duval, E., Babile, R., & Fernandez, X. (2004). Breed differences in the biochemical determinism of ultimate pH in breast muscles of broiler chickens--a key role of AMP deaminase?. *Poultry Science*, *83*(8), 1445-1451. https://doi.org/10.1093/ps/83.8.1445
15. El-Tahawy, A.A.S., Taha, A.E. and Adel, S.A. (2017). Effect of flock size on the productive and economic efficiency of Ross 308 and Cobb 500 broilers. *European Poultry Science,* 81, pp.1-10. https:// doi: 10.1399/eps.2017.175
16. Fanatico, A. C., Pillai, P. B., Emmert, J. L., & Owens, C. M. (2007). Meat quality of slow-and fast-growing chicken genotypes fed low-nutrient or standard diets and raised indoors or with outdoor access. *Poultry science*, *86*(10), 2245-2255. https://doi.org/10.1093/ps/86.10.2245
17. Fletcher, D. L. (1999). Broiler breast meat color variation, pH, and texture. *Poultry science*, *78*(9), 1323-1327.

https://doi.org/10.1093/ps/78.9.1323

18. Girolami, A., Napolitano, F., Faraone, D., & Braghieri, A. (2013). Measurement of meat color using a computer vision system. *Meat science*, *93*(1), 111-118. https://doi.org/10.1016/j.meatsci.2012.08.010
19. Han, M., Chen, Y., Li, J., Dong, Y., Miao, Z., Li, J. and Zhang, L. (2021). Effects of organic chromium sources on growth performance, lipid metabolism, antioxidant status, breast amino acid and fatty acid profiles in broilers. *Journal of the Science of Food and Agriculture*, *101*(9), 3917-3926. https://doi: 10.1002/jsfa.11053
20. Havenstein, G. B., Ferket, P. R., & Qureshi, M. A. (2003). Carcass composition and yield of 1957 versus 2001 broilers when fed representative 1957 and 2001 broiler diets. *Poultry science*, *82*(10), 1509-1518. https://doi.org/10.1093/ps/82.10.1509

21. Kang, S. P., East, A. R., & Trujillo, F. J. (2008). Colour vision system evaluation of bicolour fruit: A case study with 'B74'mango. *Postharvest Biology and Technology*, *49*(1), 77-85. https://doi.org/10.1016/j.postharvbio.2007.12.011
22. Khalid, N., Ali, M. M., Ali, Z., Amin, Y., & Ayaz, M. (2021). Comparative Productive Performance of two Broiler Strains in Open Housing System. *Advancements in Life Sciences*, *8*(2), 124-127.
23. Kralik, G., Djurkin, I., Kralik, Z., Skrtic, Z., & Radisic, Z. (2014). Quality indicators of broiler breast meat in relation to colour. *Animal Science Papers and Reports*, *32*(2), 173-178.
24. Kralik, G., Kralik, I., Jelić-Milković, S. (2022). Proizvodno ekonomski pokazatelji u tovu brojlera. Zbornik radova 57. hrvatskog i 17. međunarodnog simpozija agronoma. Antunović, Z., Majić, I. (ur.). Osijek: Fakultet agrobiotehničkih znanosti Osijek, 157-161.
25. Kralik, Z., Kralik, G., Grčević, M., & Radišić, Ž. (2012). Kvaliteta trupova i mesa pilića hranjenih smjesama s dodatkom selena. *Krmiva: Časopis o hranidbi životinja, proizvodnji i tehnologiji krme*, *54*(4), 123-132.
26. Le Bihan-Duval, E., Berri, C., Baéza, E., Millet, N., & Beaumont, C. (2001). Estimation of the genetic parameters of meat characteristics and of their genetic correlations with growth and body composition in an experimental broiler line. *Poultry Science*, *80*(7), 839-843. https://doi.org/10.1093/ps/80.7.839
27. Le Bihan-Duval, L., Debut, M., Berri, C. M., Sellier, N., Santé-Lhoutellier, V., Jégo, Y., & Beaumont, C. (2008). Chicken meat quality: genetic variability and relationship with growth and muscle characteristics. *BMC genetics*, *9*(1), 1-6.
28. Mailund, T. (2019). Manipulating data frames: dplyr. In *R Data Science Quick Reference* (pp. 109-160). Apress, Berkeley, CA.
29. Martínez, Y. and Valdivié, M. (2021). Efficiency of Ross 308 broilers under different nutritional requirements. *Journal of Applied Poultry Research*, *30*(2), 100140. https://doi: 10.1016/j.japr.2021.100140
30. Petracci, M., Mudalal, S., Soglia, F., & Cavani, C. (2015). Meat quality in fast-growing broiler chickens. *World's Poultry Science Journal*, *71*(2), 363-374. https://doi.org/10.1017/S0043933915000367
31. Poltowicz, K., Doktor, J. (2012). Effect of slaughter age on performance and meat quality of slow-growing broiler chickens. *Annals of Animals Sciences*, *12*(4), 621-631. https://doi.org/10.2478/v10220-012-0052-0
32. Pravilnik o tržišnim standardima za meso peradi (2022). NN 63/2022, 915, 24.
33. R Development Core Team. R: A Language and Environment for Statistical Computing Version 4.0.2.; 2020.
34. Saláková, A., Straková, E., Válková, V., Buchtová, H., & Steinhauserová, I. (2009). Quality indicators of chicken broiler raw and cooked meat depending on their sex. *Acta Veterinaria Brno*, *78*(3), 497-504. https://doi.org/10.2754/avb200978030497
35. Samuel, D. D., Billard, L., Pringle, D., & Wicker, L. (2012). Influence of growth rate on occurrences of pale muscle in broilers. *Journal of the Science of Food and Agriculture*, *92*(1), 78-83. https://doi.org/10.1002/jsfa.4544
36. Schneider, B. L., Renema, R. A., Betti, M., Carney, V. L., & Zuidhof, M. J. (2012). Effect of holding temperature, shackling, sex, and age on broiler breast meat quality. *Poultry Science*, *91*(2), 468-477. https://doi.org/10.3382/ps.2010-00952
37. Soares, A. L., Marchi, D. F., Matsushita, M., Guarnieri, P. D., Droval, A. A., Ida, E. I., & Shimokomaki, M. (2009). Lipid oxidation and fatty acid profile related to broiler breast meat color abnormalities. *Brazilian Archives of Biology and Technology*, *52*, 1513-1518. https://doi.org/10.1590/S1516-89132009000600023
38. Uredba komisije (EZ) (2008). 543/2008 od 16. lipnja 2008. o utvrđivanju detaljnih pravila za primjenu Uredbe Vijeća (EZ) br. 1234/2007 u pogledu tržišnih standarada za meso peradi. https://eurlex.europa.eu/legaLcontent/HR/TXT/PDF/?uri=CELEX:32008R0543.
39. Wattanachant, S., Benjakul, S., & Ledward, D. A. (2004). Composition, color, and texture of Thai indigenous and broiler chicken muscles. *Poultry science*, *83*(1), 123-128. https://doi.org/10.1093/ps/83.1.123
40. Wideman, N., O'bryan, C. A., & Crandall, P. G. (2016). Factors affecting poultry meat colour and consumer preferences-A review. *World's Poultry Science Journal*, *72*(2), 353-366. https://doi.org/10.1017/S0043933916000015
41. Woelfel, R. L., Owens, C. M., Hirschler, E. M., Martinez-Dawson, R., & Sams, A. R. (2002). The characterization and incidence of pale, soft, and exudative broiler meat in a commercial processing plant. *Poultry science*, *81*(4), 579-584. https://doi.org/10.1093/ps/81.4.579

UTJECAJ BRZINE RASTA NA SVOJSTVA TRUPOVA, KVALITETU MESA I PROFIL MASNIH KISELINA BROILERA

SAŽETAK

U radu se istražuje utjecaj intenziteta prirasta Ross 308 brojlera (< 50g prirasta, skupina A; > 50g prirasta skupina B) u tovu do 42 dana na karakteristike trupova, tehnološku kvalitetu prsnoga mesa s obzirom na spol i profil masnih kiselina u mišićima prsa i zabataka. Karakteristike trupova određene su na osnovi udjela (%) prsa, bataka sa zabatcima, leđa, krila i randmana (%). Za vrjednovanje tehnološke kvalitete korišteni su sljedeći pokazatelji: pH1, pH2, ΔpH, gubitak mesnoga soka i boje (CIE L*, a*, b*) prsnoga mesa. Utvrđen je statistički značajan utjecaj spola i intenziteta prirasta za živu težinu brojlera, masu trupova ($p<0.001$) te udjele prsa ($p=0.006$) i bataka sa zabatcima ($p=0.004$). Intenzitet prirasta statistički je značajno utjecao na udjele bataka sa zabacima i krila ($p<0.001$). Spol pilića utjecao je na razlike gubitka mesnoga soka, % ($p=0.003$) i razlike stupnja žutila ($p=0.029$) prsnoga mesa. Ustanovljena je pozitivna korelacija između pH1 i pH2 ($p<0.01$) vrijednosti prsnoga mesa kod A skupine, a negativna korelacija između pH1 te CIE L* i CIE b* pokazatelja ($p<0.01$), kao i između CIE a* i CIE b* kod A i B skupina ($p<0.01$). Visina dnevnih prirasta u tovu brojlera nije utjecala na razlike u pokazateljima tehnološke kvalitete prsnoga mesa niti na profil masnih kiselina u mišićima prsa ($p>0.05$). Utvrđene su statistički visoko značajne razlike ($p<0.05$) u sadržaju pojedinih masnih kiselina između mišića prsa i zabataka.

Ključne riječi: brzina rasta, brojleri, kvaliteta mesa, profil masnih kiselina

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