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QUALITY OF MEAT FROM DIFFERENT CARCASS COMPONENTS OF TERMOND WHITE RABBITS

Sylwia Pałka[#], Aleksandra Bień, Agnieszka Otwinowska-Mindur, Michał Kmiecik

University of Agriculture in Krakow, Faculty of Animal Breeding and Biology, Al. Mickiewicza 24/28, 30-059 Krakow, Poland
[#]Corresponding author: dr inż. Sylwia Pałka, e-mail: sylwia.palka@urk.edu.pl

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Abstract

The aim of the study was to compare the quality of meat of Termond white rabbits from the two most important cuts in a rabbit carcass: the longest saddle muscle (m. longissimus lumborum) and the biceps leg muscle (m. biceps femoris). The experimental material was the meat of Termond white rabbits (n=93; 51♂, 42♀). Animals were slaughtered at the 84th day of life. After 45 minutes and 24 hours after slaughter, color indices (L - lightness, a* - red component, b* - yellow component, C* - color saturation and H* - color index), pH, temperature, texture (hardness , springiness, chewiness, cohesion, shear force) and thermal leakage were studied. In addition, an analysis of the profile of fatty acids present in meat was carried out. Based on the research, it was found that the pH indicators of the muscles: longissimus lumborum and biceps femoris were within the limits accepted for good quality meat, and their values were higher in the case of the biceps femoris muscle. The meat from the saddle (m. longissimus lumborum) was lighter in color than the meat from the leg, and the values of color chromaticity coordinates (a* and b*) increased over time. The results of measuring the texture and cutting force showed significant differences between the two examined elements of the carcass, which is related to the different content of fat and water in the meat and depends on the structure of muscle fibers. The analysis of the fatty acid profile in both examined muscles showed a favorable composition of fatty acids, which confirms the high dietary and nutritional value of rabbit meat.*

Keywords: Termond white rabbit, meat quality, m. longissimus lumborum, m. biceps femoris

Introduction

At the turn of the last few years, there has been an increased interest in rabbit meat. The popularity of this meat results from its outstanding taste and dietary qualities. The energy value per 100 grams is 114 kcal, which is definitely less than other types of meat. It is juicy, easily digestible, has small amounts of cholesterol and essential minerals and B vitamins. Dietary value of rabbit meat results not only from the low fat content, but also from the mutual proportion of fatty acids, and above all from the content of essential fatty acids (EFA), which include linoleic acid ($C_{18:2}$) and linolenic acid ($C_{18:3}$) as well as acids formed through metabolic changes. The amount of protein in rabbit meat ranges from 18–22%. In addition, rabbit meat is characterized by a very high protein assimilability by humans, nearly 90%, with red meat only 62% (Kowalska, 2006a; 2006b; Hernández, 2007; Kowalska, 2009; Rasińska, 2009; Kozioł et al., 2017) .

The most important quality characteristics of meat include: acidity, color, smell, tenderness, water retention capacity and palatability. They depend on many factors, including breed, age, sex, and diet (Ramirez et al., 2004; Maj et al., 2011; Maj et al., 2012). Meat color is one of the most important indicators of consumer evaluation of meat. The process of water binding, which depends on the amount and degree of oxidation of heme dyes, has a significant impact on the color saturation. Parameters (XYZ), i.e. the dominant color wavelength, photometric color and colorimetric purity, are the main distinguishing features of meat color in the instrument assessment (Łapa et al., 2008). Currently, the CIE system is used, i.e. the L*, a* and b* discriminants, denoting color brightness and chromaticity coordinates, which describe the proportions of red color (a*) and yellow color (b*) and can take positive and negative values (Strzyżewski et al., 2008). The pigments present in the meat have the greatest impact on the color, among which the most important is myoglobin. It is a sarcoplasmic haem protein that has the ability to bind and store oxygen in skeletal and cardiac striated muscle (Loeffler, 2002; Mancini & Hunt, 2005; Surendranath & Poulson, 2013). An equally important indicator of meat quality, determining its durability, is the measurement of the concentration of hydrogen ions (pH). During slaughter, the muscle tissue of rabbits shows a reaction close to neutral (approx. 7). Reducing the pH value is associated with acidification of the environment, which is the only factor preventing the formation of decay processes (Strzyżewski et al., 2008; Bieniek et al., 2012). The correct acidity of rabbit meat, tested immediately after slaughter, is in the pH range between 6.1-6.9, which indicates a slightly acidic reaction or close to neutral (Chwastowska-Siwiecka et al., 2011; Pałka et al., 2017) . A significant impact on the final acidity of meat has many factors, among which the most important are the animal housing system, the size and type of muscles, and the physiological state of the animal (Strzyżewski et al. 2008). Another very important indicator of meat, next to color, taste and smell, is its texture. From the consumer's perspective, it is the texture that is the decisive value in assessing the quality of food. The main distinguishing features in the instrumental evaluation of the texture are the cutting force, hardness, chewiness, cohesion and elasticity of the meat. The measurement values between different individuals may differ, which is caused by the variable content of water and fat in the meat and the different structural structure of the muscles (Łapa et al., 2008; Kozioł et al., 2016).

Although rabbit meat is a raw material distinguished by excellent dietary and taste qualities, consumption in our country is relatively low compared to the rest of the European Union. As far as the type of meat utilisation is concerned, the medium-sized rabbit breeds are the most widely used in Europe, and thus in Poland, which includes the termond white (TW) rabbit breed (Rybarczyk i Łupkowska, 2016). Rabbits of this breed were bred as a result of the selection of Belgian white giant rabbits. In the 1970s, this breed was imported for the first time from

Belgium to the Experimental Department of the IZ in Chorzelów (Pałka et al., 2017). These rabbits are classified as medium-sized breeds, which are characterized by very good performance indicators for slaughter and fattening (Frindt, 1998; Pałka et al., 2017). Due to the high reproductive performance index (high fertility and fecundity), low feed consumption and fast growth rate, rabbits of this breed are used for intensive production of rabbits for slaughter (Kowalska, 2006a). Currently, Termonde white rabbits are among the most famous meat breeds in Europe (Składanowska-Baryza, 2017).

The aim of the study was to compare the quality of meat of Termond White rabbits from the two most important cuts in a rabbit carcass: the longest saddle muscle (*m. longissimus lumborum*) and the biceps femoris muscle (m. biceps femoris).

Material and methods

The research was carried out on meat taken from rabbits of the white Termond breed (n=93; 51♂, 42♀). All rabbits were kept in an insulated hall in wooden and two-level cages. The hall has a lighting installation, the task of which is to ensure the optimal length of the daylight (14L: 10D), a water installation, and a forced ventilation system. The animals were fed 'at will' with a complete pelleted feed containing 10.2 MJ of metabolic energy, 16.5% of total protein and 14% of crude fibre. At 84 days of age, the rabbits were subjected to daily starvation with constant access to drinking water. Before slaughter, the animals were weighed and their average body weight oscillated between 2.5–3 kg. The rabbits were stunned, bled, and then skinned and gutted. The carcass was weighed and then placed in a refrigerator for 24 hours at +4°C. After this time, three main cuts were separated from the carcasses: the front part, the saddle and the rear part, to be subjected to detailed dissection. The course of slaughter and the methodology of subsequent dissection were described by Barabasz and Bieńek (2003).

The quality analysis of the examined meat concerned acidity (pH), temperature, color, chemical composition, texture, thermal leakage of meat and fatty acid profile. Meat temperature and acidity (pH) were measured using a Consort C651 pH meter with an accuracy of 0.01. A glass electrode, part of the pH meter, was inserted into the muscle (*m. longissimus lumborum* and *m. biceps femoris*) on the right side of the carcass. Measurements were made 45 minutes and 24 hours after slaughter. The colour of the flesh (L* - brightness, a* - red component, b* - yellow component) was measured on the surface of the longissimus lumborum muscle (m. longissimus lumborum) and the biceps femoris muscle (*m. biceps femoris*) in the same place where its acidity was tested. Measurements were made using a Minolta CR-410 reflectance colorimeter, which calculated the final result by averaging three measurements made. In addition, the discriminants a* and b* were used to calculate the color saturation C* and the color index H*, which were subsequently calculated from the equations:

$$\mathbf{C^*} = \sqrt{a^{*2} + b^{*2}}$$

$$\mathrm{H^*} = \arctan \frac{b^*}{a^*}$$

For Texture Profile Analysis (TPA), carefully cut rectangular-shaped pieces were taken from the *m. longissimus lumborum* and m. *biceps femoris,* which were packaged and placed for 72 hours at -18°C. After this time, they were thawed at room temperature and cooked for 40 minutes in a water bath at 80°C. Texture parameters: hardness, elasticity, chewiness and cohesion were measured using a TA.XT plus texturemeter by Stable Micro Systems with a cylindrical attachment with a diameter of 50 mm. A double compression test up to 75% was carried out, in accordance with the methodology given in the work of Migdała et al. (2013). The remaining parameter determining the cutting force was measured with the same equipment by using an attachment with a triangular knife cut (Warner-Bratzler blade). Final results were generated automatically using Exponent (Stable Micro Systems) programme Version: 6, 1, 10,

0. Samples weighing about 50 grams were tightly packed in string bags. The material prepared in this way was placed in a water bath at 75°C for 50 minutes in order to inhibit the growth of pathogenic microorganisms while preserving the taste and nutritional value of the products. After pasteurization, the samples were cooled at room temperature, dried and weighed with an accuracy of 0.01. The percentage of thermal leakage was calculated for samples from *m. longissimus lumborum* and m. *biceps femoris* of rabbits using the equation:

$$WT\ (\%) = \frac{sample\ weight\ before\ boiling - sample\ weight\ after\ boiling\ x\ 100}{sample\ weight\ before\ boiling}$$

During the dissection, meat samples were also collected, in which the content of individual fatty acids was determined. Meat samples were extracted with a solution of chloroform and methanol according to the method of Folch et al. (1957). Fatty acid methyl esters were prepared according to the method of AOAC (1995). Weighed fat samples (10 mg) were saponified in 0.5 N KOH in methanol, then evaporated at 85°C and esterified in 1 ml of 12% BF_3in methanol, and again the samples were heated at 85°C. After cooling to room temperature, 1 ml of hexane and 5 ml of saturated NaCl solution were added to the samples. The chromatographic separation was carried out in a TRACE GC ULTRA gas chromatograph by Thermo Electron, equipped with a feeder (220°C) and a flame ionization detector FID (250oC). The chromatograph was equipped with a SUPELCOWAX 10 column with a length of 30 m and an internal diameter of 0.25 mm. The starting temperature of the column was 160°C with an increase of 3°C/min. up to 210°C. Helium with a flow rate of 1 ml/min was used as the carrier gas. Identification of fatty acid methyl esters in the tested samples was performed using the standard Supelco 37 Component FAME Mix mixture, and CLA isomers using Sigma-Aldrich standards.

Statistical analysis was performed using the SAS statistical package (2014) using the GLM procedure. Levene's test was used to check the homogeneity of variance. The linear model takes into account the constant effect of cut (*m. longissimus lumborum* and m.*biceps femoris*). The significance of differences between the means was tested using Tukey's test. The analysis was performed at the significance level of 0.05.

Results

Table 1 shows the mean and standard deviations of acidity (pH_{45} oraz pH_{24}) and temperature ($Temp_{45}$ oraz $Temp_{24}$) of the*longissimus lumborum*muscle and the*biceps femoris*muscle. The*biceps femoris*muscle was characterized by significantly lower acidity after 24 hours of cooling and temperature after 45 minutes after slaughter compared to the *longissimus lumborum muscle*.

Table 1. Means ($\bar{x}$) and standard deviations (sd) for pH parameters and temperature of *m. longissimus lumborum* and m. biceps femoris in Termon White rabbits

Acidity and temperature	Muscle			
	m. longissimus lumborum		*m. biceps femoris*	
	$\bar{x}$	sd	$\bar{x}$	sd
pH_{45}	6.57	0.74	6.59	0.29
pH_{24}	5.85a	0.21	5.96b	0.22
$Temp_{45}$	19.7a	4.30	21.06b	3.27
$Temp_{24}$	8.17	1.15	8.31	1.19

Note: pH_{45} and pH 24 – pH 45 minutes and 24 h post-mortem, Temp 45 and Temp 24 – temperature 45 minutes and 24 h post-mortem. Mean values with different letters are significantly different at $p \leq 0.05$.

Another examined indicator of meat quality is its color, which determines the technological suitability of meat. Table 2 presents the mean and standard deviations of the color components of the *longissimus lumborum* and biceps femoris muscles in Termond white rabbits. In this study, the L* parameter defining the brightness of the *longissimus lumborum* muscle after 45 minutes was 59.30, and in the biceps femoris muscle it was 52.73. After 24 hours, a slightly lower average value in the saddle was recorded, equal to 55.45. In contrast, the average L* value in the leg increased to 54.99. The higher the L* index, the lighter the color of the meat. Significant differences in meat brightness occurred between measurements made 45 minutes after slaughter. There were no significant differences in color lightness (L*) 24 hours after slaughter.

Table 2. Means ($\bar{x}$) and standard deviations (sd) for color parameters of *m. longissimus lumborum* and *m. biceps femoris* of Termon White rabbits

Colour	Muscle			
	m. longissimus lumborum		*m. biceps femoris*	
	$\bar{x}$	sd	$\bar{x}$	sd
L^*_{45}	59.30a	3.46	52.73b	2.83
a^*_{45}	1.20a	2.34	3.37b	1.23
b^*_{45}	-1.87a	2.96	0.88b	1.69
C^*_{45}	3.93	1.90	3.86	1.24
H^*_{45}	0.08	1.05	0.21	0,47
L^*_{24}	55.45	2.35	54.99	2.13
a^*_{24}	6.05a	2.21	4.54b	1.50
b^*_{24}	4.53	1.82	4.12	1.63
C^*_{24}	7.64a	2.64	6.26b	1.81
H^*_{24}	0.63a	0.17	0.72b	0.25

Note: L^*_{45} and L* 24 – lightness 45 minutes and 24 h post-mortem, a* 45 and a* 24 – red color coordinate 45 minutes and 24 h post-mortem, b* 45 and b* 24 – yellow color coordinate 45 minutes and 24 h post-mortem, C^*_{45} and C^*_{24} – saturation 45 minutes and 24 h post-mortem, H^*_{45} and H^*_{24} – hue 45 minutes and 24 h post-mortem. Mean values with different letters are significantly different at $p \leq 0.05$.

The value of the red component (a*) measured on the surface of the *longissimus lumborum* muscle after 45 minutes (a^*_{45}) was 1.20, and on the *biceps femoris* muscle it was3.37. After 24 hours (a^*_{24}) , these values were respectively 6.05 and 4.54 in the saddle and leg. The obtained results allow us to observethat the parameter a* tends towards the red color. In the study, both the value of the red component after 45 minutes (a^*_{45}) and after 24 hours (a^*_{24}) after slaughter differed significantly. The value of the yellow component (b*) measured after 45 minutes (b^*_{45}) on the surface of the *longissimus lumborum* muscle was –1.87, and on the surface of the *biceps femoris* musclea value of 0.88 was recorded. After 24-hour cooling, the value of the discriminant (b^*_{24}) in the saddle muscle increased to 4.53, and in the leg muscle to 4.12. Positive values of the b* discriminant mean yellow color, and negative values blue color. It was found that only the values in the 45th minute after slaughter differ significantly.

The color indicators, directly dependent on the red and yellow components, are C* color saturation and H* color index. If the C* parameter assumes values different from zero (below

or above), the color of the meat is more vivid, while when C* is within the range of zero, the color is less expressive. In this experiment, the H* parameter measured after 45 minutes (H^*_{45}) in the saddle muscle was 0.08 and in the leg muscle it was 0.21. After 24 hours, the value of this parameter (H^*_{24}) increased in the saddle muscle to 0.63 and in the leg muscle to 0.72. A similar relationship can be observed in the case of color saturation (C*). The value of the C* parameter 45 minutes after slaughter was 3.93 in the saddle muscle and 3.86 in the leg muscle, while after 24 hours this value increased and was equal to 7.64 and 6.26.

Table 3. Means ($\bar{x}$) and standard deviations (sd) for texture parameters and thermal loss of *m. longissimus lumborum* and *m. biceps femoris* of Termon White rabbits

Texture and cooking loss	Muscle			
	m. longissimus lumborum		*m. biceps femoris*	
	$\bar{x}$	sd	$\bar{x}$	sd
Shear force	2.01a	0.70	1.62b	0.66
Hardness	13.75a	3.49	10.27b	3,00
Springiness	0.46a	0.05	0.53b	0.06
Cohesiveness	0.43	0.03	0.42	0.04
Chewiness	2.83a	1.06	2.36b	0.89
Cooking loss	29.63a	2.62	26.02b	3.84

Mean values with different letters are significantly different at $p \leq 0.05$.

Table 4. Means ($\bar{x}$) and standard deviations (sd) for the content of some fatty acids in *m. longissimus lumborum* and *m. biceps femoris* of Termond White rabbits

Fatty acids	Muscle			
	m. longissimus lumborum		*m. biceps femoris*	
	$\bar{x}$	sd	$\bar{x}$	sd
$C_{10:0}$	0.11	0.11	0.13	0.15
$C_{12:0}$	0.56	0.16	0.48	0.06
$C_{14:0}$	2.41	0.91	1.92	0.44
$C_{14:1}$	0.20	0.20	0.22	0.22
$C_{15:0}$	0.53	0.05	0.51	0.06
$C_{16:0}$	24.95	1.10	25.38	2.25
$C_{16:1n-9}$	0.51	0.11	0,47	0.08
$C_{16:1n-7}$	2.14	1.65	2.42	1.87
$C_{17:0}$	0.56	0.06	0.55	0.08
$C_{17:1}$	0.23	0.06	0.25	0.05
$C_{18:0}$	5.91	0.41	5.88	0.69
$C_{18:1n-9}$	27.62a	2.95	24.10b	2.78
$C_{18:1n-7}$	1.47	0.26	1.43	0.18
$C_{18:2n-6}$	23.25a	2.08	25.98a	2.38
$C_{18:3n-6}$	0.06	0.02	0.07	0.02
$C_{18:3n-3}$	1.16	0.29	1.07	0.07
CLA	0.06a	0.02	0.03b	0.02
$C_{20:0}$	0.09	0.01	0.08	0.02
$C_{20:1}$	0.28	0.05	0.26	0.03
$C_{20:2}$	0.31a	0.03	0.36b	0.05
$C_{20:3n-6}$	0.34a	0.13	0.47b	0.08
$C_{20:4n-6}$	4.64	2.08	4.87	0.97
$C_{20:4n-3}$	0.04	0.01	0.04	0.01
$C_{20:5n-3}$	0.07	0.03	0.07	0.02
$C_{22:4n-6}$	1.36	0.59	1.61	0.39
$C_{22:5n-6}$	0.50	0.23	0.61	0.17
$C_{22:5n-3}$	0.49	0.22	0.57	0.13
$C_{22:6n-3}$	0.12	0.06	0.14	0.14
SUMA TOTAL	99.96	0.02	99.95	0.01

Mean values with different letters are significantly different at $p \leq 0.05$.

Another examined meat quality indicator was thermal leakage and meat texture, which consists of shear force, hardness, chewiness, cohesion and elasticity. The collected measurement results are summarized in Table 3. In the case of thermal leakage and most of the texture parameters, significant differences were found between the cuts. The exception was meat consistency, which did not differ significantly between the examined parts of the carcass.

Meat hardness measured in the saddle and leg was 13.75 kg and 10.27 kg, respectively. The firmness of the meat is related to its chewiness. This indicator measured in the saddle muscle was 2.83 kg, while in the leg muscle, a slightly lower chewiness value of 2.36 kg was noted. In addition, it was observed that meat characterized by greater hardness was also distinguished by higher chewiness.

Table 4 summarizes the characteristics of the content of fatty acids present in the longest muscle of the loin and leg. Significant differences were found in the content of oleic acid ($C_{18:1n-9}$), linoleic acid ($C_{18:2n-6}$), eicosadienoic acid ($C_{20:2}$), dihomo-γ-linolenic acid ($C_{20:3n-6}$) and conjugated acid linoleic acid (CLA) between the examined cuts. Among the monounsaturated acids, the highest content was found in oleic acid ($C_{18:1n-9}$), and the lowest in tetradecenoic acid ($C_{14:1}$). In the group of polyunsaturated acids, linoleic acid ($C_{18:2n-6}$) predominated in both parts of the carcass. In the saddle muscle, the lowest content was found in eicosatetraenoic acid ($C_{20:4n-3}$), and in the leg muscle – CLA.

Discussion

The acidity of rabbit meat immediately after slaughter should be in the range of 6.1-6.9, while after 24 hours there should be a slight decrease in pH to a value close to 5.8 (Bielański, 2004). The average pH value after 45 minutes measured in the *longissimus lumborum* and *biceps femoris* muscles was close to neutral and amounted to 6.57 and 6.59, respectively, which indicates good quality meat. After 24 hours, the examined meat showed a slightly acid reaction. The pH value in the saddle was 5.85 and in the leg 5.96. This indicates the start of the glycogenolysis reaction, i.e. the breakdown of glycogen into lactic acid. Glycogen is the main energy store in muscles in life conditions. The phenomenon of glycogenolysis leads to acidification of meat, thus stopping the development of microorganisms. The results presented in the paper by Kmiecik et al. (2017), who studied the effect of breed and sex on the acidity and color of the meat of Termond white rabbits and Californian, Popielno white and Belgian gray giant rabbits, confirm that the meat of Termond white rabbits is characterized by the lowest acidity among the other breeds tested, and the measured acidity after 45 minutes was 6.50 and after 24 hours 5.79. Pałka et al. (2018) in their work examined the impact of the housing system and rabbit breed on growth, slaughter performance and meat quality parameters. These authors obtained slightly higher meat acidity values of *m. longissimus lumborum* and m. biceps femoris in Termond white rabbits in comparison with the results presented in this study. At 45 minutes after slaughter, the pH value of the longissimus lumborum muscle was 6.79, and at 24 hours it was 5.97. On the other hand, the acidity values of the biceps femoris muscle were 6.80 and 6.10, respectively. Maj et al. (2012) observed that the pH value of the *m. longissimus lumborum* 45 minutes after slaughter was 6.82, and after 24 hours it was 5.55. In turn, the acidity of *m. biceps femoris* at the 45th minute was 6.83, and after 24 hours it was 5.83. Barròn i in. (2004) studied the effect of genotype and sex on the pH of rabbit meat. The pH value was measured after 20 minutes (pH: 7.0-7.4), 3 hours (pH: 6.6-6.8), 6 hours (pH: 6.2-6.4) and 24 hours (pH: 5.9–6.2). These authors obtained higher pH values than the results presented in this paper. The main factor that could have contributed to the differences in pH values was the different measurement time and the use of different breeds than in the experiment carried out in this work.

Maj et al. (2012) examining the effect of age and sex on the meat quality indices of rabbits slaughtered in the 12th week, obtained the value of the L* parameter after 45 minutes (L^*_{45}) of 59.24 in the saddle and 57.75 in the rear part of the carcass. After storage in refrigerated conditions for 24 hours (L^*_{24}), the L* value in the saddle and leg was 56.60 and 57.77, respectively. These results are comparable with the results obtained in our own research in the *longissimus lumborum* muscle, while in the biceps femoris muscle they show differences. Different values may be the result of using other breeds of rabbits as research material. In studies conducted by Virág et al. (2008) on New Zealand White rabbits, the value of the parameter after 24 hours of cooling (L^*_{24}) ranged from 50.74 to 53.12 in the saddle muscle and 51.62 to 52.60 in the leg muscle. Differences in the obtained results may be related to the use of feed additives (vitamin E) or the use of rabbit breeds other than in this study. Kmiecik et al. (2017) in their study found that the meat of the longissimus loin muscle of Termond white rabbits is characterized by a darker color compared to other meat breeds tested. The L* parameter after 45 minutes was 57.59 and after 24 hours it was 57.04. The results obtained indicate a large number of red muscle cells, which are characterized by a low content of fibrils, but are rich in sarcoplasm and myoglobin (Loeffler, 2002).

In experiments conducted by other authors, the component values a* and b* often differ from the results obtained in this paper. For example, Maj et al. (2012) in their study obtained higher values of the a^*_{45} parameter in rabbits at the age of 12 weeks. The a^*_{45} component measured on the saddle and leg surfaces was 9.35 and 11.60, respectively. However, after 24 hours the a* values increased to 14.04 in the saddle muscle and 13.87 in the leg muscle. For a change, parameter b* assumes values similar to those obtained in this work. In the saddle muscle, the b* parameter was -2.52 after 45 minutes, and 3.11 after 24 hours. The same parameter measured on the surface of the leg muscle in the 45th minute showed a value of 0.58, and after 24 hours it was 3.97. Bieniek et al. (2012) while studying the meat performance indices of Burgundian rabbits and their hybrids with New Zealand White rabbits obtained significantly higher values for the colour component a*. a* values obtained by Bieniek et al. (2012), measured on the surface of the *longissimus lumborum* muscle ranged from 12.44 to 16.79 (depending on the breed). In this case, different results may result from the use of other breeds in the tests.

Significantly higher values for the parameter H^*_{24} than those calculated in this study were reported by Virág et al. (2008), who found that for the saddle muscle, the parameter values ranged from 90.40 to 97.60, and for the leg muscle, from 56.00 to 58.50. In turn, the values of the C* parameter measured after 24 hours are close to those obtained in our work. Trocino et al. (2003) determined a lower saturation component (C*) and a lower color index (H*). The C* parameter measured in the *longissimus lumborum* muscle ranged from 3.46 to 4.0, and in the *biceps femoris* muscle from 3.00 to 3.24. Color index H* measured by Trocino et al. (2003) ranged from -0.67 to -0.53 in the saddle and from -0.37 to -0.18 in the leg. The negative values of the H* component are due to the negative values of the yellow component (b*) obtained by these authors.

Different values of the hardness of the *longissimus lumborum* and biceps femoris muscles in the rabbits of the tested breed testify to the varied fat content, and the higher value of the saddle muscle hardness parameter results from the lower fat content in this cut. Kozioł et al. (2017), examining the impact of breed and gender on meat texture confirm that meat from Termond White rabbits was the toughest (12.06 kg) compared to the other breeds studied, i.e. Belgian Grey Giant, Californian, New Zealand White and Popielno White. However, the authors obtained a similar value of chewiness (2.45 kg) in the *biceps femoris*muscle, confirming the result obtained in this experiment.

The present study showed that the biceps femoris muscle had a higher content of polyunsaturated fatty acids, in particular linolenic acid and conjugated linoleic acid. It is worth

noting that linoleic acid is one of the essential fatty acids (EFA). The biceps femoris muscle was characterized by a higher content of other fatty acids. Among the saturated fatty acids, palmitic acid ($C_{16:0}$) was characterized by the highest content in meat. Palmitic acid is a component of vegetable and animal fats, which is believed to have an adverse effect on the human body by increasing the concentration of cholesterol in the blood, in particular its LDL (low density lipoprotein) fraction. Chwastowska-Siwiecka et al. (2014), examining the effect of freezing storage time and thawing methods on the fatty acid profile of intramuscular fat in rabbit meat, also observed a dominant share of palmitic acid in the biceps femoris muscle. In addition, the amount of oleic and linoleic acids was at a high level, which confirms the correctness of the results obtained in this study. Cygan-Szczegielniak et al. (2010), examining the effect of diet on the content of CLA, cholesterol and fatty acids in rabbit meat, reported similar results to those obtained in this study. Palmitic acid ($C_{16:0}$) and stearic acid ($C_{18:0}$) were dominant among the saturated acids, while oleic acid ($C_{18:1}$) was predominant among the monounsaturated acids and linoleic acid ($C_{18:2n-6}$) in the polysaturated acids.

Summary

The pH indices of the meat of the Termond white rabbits from the two most valuable cuts: saddle (*m. longissimus lumborum)* and legs (*m. biceps femoris)* were within the limits specified for good quality meat. The acidity of meat from the *biceps femoris* muscle, both in the 45th minute after slaughter and after 24-hour cooling, was lower than in the longissimus lumborum muscle, which indicates better technological properties of this part of the meat. Meat coming from the longissimus lumborum muscle (m. longissimus lumborum) was lighter than meat coming from the biceps femoris muscle (m. biceps femoris), which was directly related to the values of the chromaticity colour coordinates measured on the muscle surface. The texture of the meat from the two parts of the carcass differed significantly, which is related to the different content of fat and water in the meat of the examined cuts and depends on the structure of muscle fibers. The analysis of the acid profile confirmed the high nutritional and dietary values of rabbit meat from both tested elements.

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QUALITY OF MEAT FROM DIFFERENT CARCASS COMPONENTS OF TERMOND WHITE RABBITS

Sylwia Pałka, Aleksandra Bień, Agnieszka Otwinowska-Mindur, Michał Kmiecik

SUMMARY

The purpose of this study was to compare the quality of meat from Termon White rabbits derived from the two most important parts of the rabbit carcass: loin (*m. longissimus lumborum*) and leg (m. biceps femoris). The investigated material consisted of Termond White rabbits (n=93; 51♂, 42♀). Rabbits were slaughtered at 84 days of life. Color coordinates (L* – lightness, a* – redness, b* – yellowness, C* – chroma, H* – hue angle), pH, temperature, texture (hardness, springiness, chewiness, cohesiveness, shear force) and cooking loos were measured. Additionally, the profile of fatty acids present in the meat was analyzed. The analysis carried out showed that the rabbit meat (*m. longissimus lumborum* and m. biceps femoris) pH indicators were within the limits accepted for good quality meat and their values were higher for m. biceps femoris . Loin meat (*m. longissimus lumborum*) was characterized by a lighter color than thigh meat, and the chromaticity coordinate values (a* and b*) increased with time. The measurement results of texture and shear force revealed significant differences between the two studied carcass parts, which is related to the different fat and water content in meat and depends on the structure of muscle fibers. Analysis of the fatty acid profile of the two muscles tested showed a favorable fatty acid composition, which confirms the high dietary and nutritional value of rabbit meat.

Keywords: rabbit, meat quality, *m. longissimus lumborum, m. biceps femoris*