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Effects of anatomical location within pork tenderloins on the quality of fast thawed steaks

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Original scientific paper

ABSTRACT

The objectives of this research was to evaluate if the effects of very fast hot water thawing method on the meat quality attributes of pork tenderloin steaks are influenced by anatomical location of steaks within the tenderloin. Thawing was performed using a hot water bath at 39°C for 7 ± 0.5 min. Frozen steaks were cut approximately 2.5 cm thick with their thickness measured and accounted for individually for each steak after cutting. Starting from the tail end, steaks were identified as being from either the anterior (A), middle (M) or posterior (P) portions of the tenderloins. Minor but significant differences in thawing, cooking, and texture attributes of the steaks from various anatomical locations within the tenderloins were observed. When adjusted for SV, medium parts of tenderloin exhibited highest thaw drip loss. Cooking yield was influenced by steak location only when adjusted for SV ratio and increased from the anterior to the posterior end of the tenderloin. Location within tenderloin also influenced steak tenderness measurements. Steaks from medium parts of tenderloin had higher WBSF values compared to anterior and posterior parts of the steaks. Color changes in thawed steaks due to either thawing treatment or steak location were minimal and not detectable visually.

Keywords: *fast thawing; pork tenderloin; anatomical location; quality*

INTRODUCTION

A variety of thawing conditions are cited in literature, the most common of which is thawing under refrigeration (G.-D. Kim et al., 2013; Mortensen, Andersen, Engelsen, & Bertram, 2006). Other methods include meat thawing at room temperature (Lee et al., 2007), in cold water (Boles & Swan, 2002), in tap water (X. Xia, Kong, Xiong, & Ren, 2010), in hot water (Eastridge & Bowker, 2011; Tomasevic et al., 2015), using microwaves (T. H. Kim et al., 2011; Ku et al., 2014), using ultrasound (X. F. Xia, Kong, Liu, & Liu, 2009), ohmic (Icier, Izzetoglu, Bozkurt, & Ober, 2010), infrared (Hong, Shim, Choi, & Min, 2009), radio frequency (Farag, Duggan, Morgan, Cronin, & Lyng, 2009), impingement (Anderson & Singh, 2006), high pressure (Ken, Atsushi, Tadayuki, Yoshihide, & Hiroyuki, 2006) and thawing by cooking (Fulton & Davis, 1975).

In selecting a thawing system for industrial use, a balance must be struck between different important factors: thawing time, appearance, the bacteriological condition of the product, processing problems such as effluent disposal and the capital and operating costs of the respective systems. Of these factors, thawing time is the principal criterion that governs selection of the system (James & James, 2010).

In determining the impact of freezing and thawing on meat quality attributes, it is important to account for inherent differences in meat quality due to anatomical location within muscle. We already know that texture varies along the length of different beef and pork muscles (Janz, Aalhus, Dugan, & Price, 2006; Rhee, Wheeler, Shackelford, & Koohmaraie, 2004; Silva et al., 2014; Wheeler, Shackelford, & Koohmaraie, 2007). If the impact of thawing rate on meat quality is influenced by within-muscle variations in meat quality was investigated only in the case of beef strip loins (Eastridge & Bowker, 2011), so far.

Therefore, the objectives of this research was to evaluate if the effects of very fast hot water thawing

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method on the meat quality attributes of pork tenderloin steaks are influenced by anatomical location of steaks within the tenderloin.

MATERIALS AND METHODS

Muscle samples

Thirty boneless pork tenderloins were obtained from local pork slaughter plants between 2 and 9 days postharvest over several purchase dates. The tenderloins were vacuum packaged, frozen at −23°C, and stored for 6 months prior to use.

While the tenderloins were still frozen, IMPS 415 center cut tenderloin steaks (USDA-AMS, 1969) (9 steaks per tenderloin) were cut and identified sequentially starting from the tail end to the posterior portion of the tenderloins. Frozen steaks were cut approximately 2.5 cm thick with their thickness measured and accounted for individually for each steak after cutting. Starting from the tail end, steaks were identified as being from either the anterior (A; steaks 1 to 3), middle (M; steaks 4 to 6), or posterior (P; steaks 7 to 9) portions of the tenderloins. Each steak surface was traced onto acetate paper for determination of surface area, perimeter, and surface to volume (SV) ratio using image processing software (ImageJ 1.47v, National Institutes of Health, USA). Frozen steaks were individually weighed and vacuum packaged in 85 μm thick (PA/PE/PE) bags with the transmission rates of 60 ml O2; 12 ml N2; 180 ml CO2/m2/24h/1atm and the size of 100 mm × 140 mm. The bags were sealed with Minipack MV 35 (Minipack, Dalmine, Italy).

Thawing treatment

Thawing was performed using a water bath (HH-S21.8, Biocotek, Ningbo, China) at 39°C for 7 ± 0.5 min. The degree of thawing was manually estimated 1 min prior to the target thawing time and adjusted in 30 s increments as needed until no icy core was detected, and total thawing time was recorded. Thawed steaks were removed from the vacuum packaging, lightly blotted, and weighed to determine thaw drip loss expressed as a percentage of the frozen steak weight.

Meat quality measurements

Steaks were allowed to bloom for 60 min prior to measuring Commission Internationale de l'Eclairage (CIE) color space values L* (lightness), a* (redness), and b* (yellowness) using a Chroma Meter CR-400 (Minolta Co., Ltd., Osaka, Japan) using D-65 lighting, a 2° standard observer angle and an 8-mm aperture in the measuring head (Honikel, 1998). The Chroma Meter was calibrated using a Minolta calibration plate (No. 11333090; Y=92.9, x=0.3159; y=0.3322). Color was measured at a minimum of 5 locations across the surface of each steak.

Total colour difference (ΔE*) was calculated according to the formula of MacDougall (1994):

$$\Delta E^{*} = \sqrt{(L_g^{*} - L_t^{*})^2 + [(a]_g^{*} - a_t^{*})^2 + [(b]_g^{*} - b_t^{*})^2}$$

where (g) subscript denotes values for grilled and (t) subscript denotes values for thawed samples.

Steaks were grilled on electric grill (HD4420, 2300W, Philips, Netherland) using the maximum heat setting (270 ± 5°C). Steaks were turned once when the internal temperature reached 39°C and continued grilling until 71°C endpoint (AMSA, 1995). Temperature of each steak was continuously monitored throughout grilling using a 2 channel Testo 925 Type K Thermometer (Testo AG, Lenzkirch, Germany) inserted into the geometric center of the steak. Data regarding cooking time and cooked weight after a 2 min rest were also obtained. Steaks were cooled to room temperature (RT) before determining tenderness instrumentally by shear force. Cores (3 to 5 per steak) for Warner-Bratzler shear force (WBSF) were removed parallel to the longitudinal orientation of the muscle fibers using a coring tool (1.27 cm inside diameter) and were sheared one time using TA.XT Plus texture analyzer (Stable Micro System, Godalming, UK). WBSF was measured at RT using a Warner-Bratzler meat shear cell with an inverted-V cut-out blade, 1.18-mm thick, at crosshead speed of 3.8 mm/s.

The pH of the steaks was measured using the portable pH meter (Consort T651, Turnhout, Belgium) equipped with an insertion glass combination electrode (Mettler Toledo Greifensee, Switzerland). The pH meter was calibrated before and during the readings using standard phosphate buffers (pH value of calibration buffers was 7.02 and 4.00 at 20 °C) and adjusted to the expected temperature of measured muscles (ISO, 1999).

Statistical analysis

Data were analyzed using SPSS Statistics 17.0 (Chicago, Illinois, USA) data analysis software. Significant differences ($P<0.05$) between means were identified using Tuckey analysis of Honestly Significant Difference (HSD).

RESULTS AND DISCUSSION

Physical characteristics of steaks

Due to intrinsic variations in the morphology of the m. psoas major from tail end to the butt end of the tenderloin, differences in the size and shape of the steaks were observed among steaks from different locations

(Table 1). The steaks from the anterior (A) were lighter ($P < 0.001$) than those from the middle (M) or from the posterior (P) part of the tenderloin.

Table 1. Physical characteristics of of tenderloin steaks as affected by the anatomical location within tenderloin

	Location in tenderloin[a]			
	A	**M**	**P**	**SEM[b]**
Number of steaks	81	95	92	
Steak weights (g)				
Frozen	30.79[c]	38.04[d]	36.85[d]	0.41
Thawed	27.13[c]	32.86[d]	32.87[d]	0.38
Cooked	21.16[c]	24.76[d]	24.90[d]	0.33
Thickness (cm)	2.5	2.35	2.44	0.02
Surface area (cm^2)	12.18[c]	17.24[d]	17.25[d]	0.20
Steak perimiter (cm)	13.46[c]	15.89[d]	15.95[d]	0.10
Surface to volume (SV) ratio	1.94[c]	1.80[d]	1.78[d]	0.10

[a] Tenderloin steaks were cut sequentially from the tail of the *Psoas major muscle*. At least 3 steaks from each location within the tenderloin corresponding to the anterior (A) tail end, middle (M), and posterior (P) portions of the muscle were utilized in this study.
[b] SEM - Standard error of the mean
[c,d] Means in a row not sharing the same superscript are different ($P < 0.001$).

Steaks from the anterior (A) also exhibited smaller surface area (12.18 cm2) compared to the steaks of the middle (M) (17.24 cm2) or the posterior (P) (17.25 cm2) part of tenderloin. The A steaks also had a significantly smaller perimeter ($P < 0.001$) to the M and P steaks. As a consequence, the calculated SV ratio of A steaks was higher (1.94) then almost equal SV ratios calculated for M (1.80) and P (1.78) steaks. Variations in the size and SV ratios of steaks were evaluated as possible contributors to the differences observed in the cooking and thawing characteristics between tenderloin locations (Table 2).

Thawing and cooking characteristics of steaks

The effects of strip loin anatomical location on the thawing characteristics of steaks are reported in Table 2. Differences in thaw loss ($P < 0.001$) expressed as a percentage of frozen weight were observed between steaks from M (13.72%) and P (11.06%) part of pork tenderloin. When adjusted for SV ratio thaw loss almost equaled for A (6.30) and P (6.25) while it was significantly lower ($P < 0.001$) compared to the M (7.66) parts of the steaks (Table 2). The results of Eastridge and Bowker (2011) for beef strip loin steaks showed that differences in thaw loss among steak locations, expressed both as a percentage of frozen weight and adjusted for SV ratio, did not exceed 0.5%; however, thaw drip loss was lower for steaks from A (3.1%) compared to either M (3.5%) or P (3.6%).

Thaw loss is generally considered to be related to freezing rate while this phenomenon has been associated with the size and distribution of the ice crystals that form along the freezing gradient (Añón & Calvelo, 1980; Ngapo, Babare, Reynolds, & Mawson, 1999). Since our research and the research of Eastridge and Bowker (2011) used the same freezing rates for the pork and beef meat samples respectively, the difference in outcomes can be attributed to the difference in thawing rates between experiments. Thawing rates in our study was approximately 3.3°C/min compared to 2.0°C/min for very fast thawing method used in a research of Eastridge and Bowker (2011).

Table 2. Thawing and cooking characteristics of tenderloin steaks as affected by the anatomical location within tenderloin

	Location in tenderloin[a]			
	A	**M**	**P**	**SEM[b]**
Number of steaks	81	95	92	
Thaw drip loss (%)	12.23[c,d]	13.72[d]	11.06[c]	0.27
Thaw drip loss / SV ratio (%)	6.30[c]	7.66[d]	6.25[c]	0.16
Cooking yield (%)	77.59	75.22	75.72	0.43
Cooking yield / SV ratio (%)	40.18[c]	42.15[c,d]	42.80[d]	0.34
Total loss (%)	35.03[c]	38.50[d]	35.33[c]	0.52
Total loss / SV ratio (%)	18.03[c]	21.49[d,e]	19.59[e]	0.31
pH after thawing	5.89	5.90	6.25	0.09
pH increase after grilling	0.27	0.28	0.25	0.01

[a] Tenderloin steaks were cut sequentially from the tail of the Psoas major muscle. At least 3 steaks from each location within the tenderloin corresponding to the anterior (A) tail end, middle (M), and posterior (P) portions of the muscle were utilized in this study.
[b] SEM - Standard error of the mean
[c,d,e] Means in a row not sharing the same superscript are different ($P < 0.05$).

Khan and Lentz (1977) indicated that the amount of drip loss during thawing of individually packaged portion-sized beef cuts from 5 muscles from the loin and round varied with sample weight and SV ratio. Since the pork tenderloin steaks used in our research were 10 times lighter and had SV ratios almost twice as high as the beef sir loin steaks used in the research of Eastridge and Bowker (2011), this can explain the differences in the observations of thaw drip loss. Surface to mass (volume) ratio of the pork tenderloin steaks in our research was large enough to prevent reabsorption of extracellular water therefore generating higher thaw drip loss with the increase of thawing rate applied.

The effects of rapid thawing and strip loin location on the cooking characteristics of steaks are reported in Table 2. Cooking yield was not influenced by the steak anatomical location. But, when was adjusted for SV ratio cooking yield increased from the anterior to the posterior end of the tenderloin with the significant difference observed between A and P ends of the pork muscle ($P < 0.05$). Significant location effects within different muscles for cooking loss were detected before by various authors (Eastridge & Bowker, 2011; Rhee et al., 2004; Smith, Carpenter, & King, 1969). We have also observed that total loss was significantly higher ($P < 0.05$) in M (38.50%) then in A (35.03%) or P (35.33%) parts of pork tenderloins. When adjusted for SV ratio values for total loss were lowest ($P < 0.001$) in A steaks.

The pH of meat that has been frozen and thawed tends to be lower than prior to freezing (Leygonie, Britz, & Hoffman, 2011). As pH is a measure of the amount of free hydrogen ions (H+) in a solution, it is possible that freezing with subsequent exudate production could cause denaturation of buffer proteins, the release of hydrogen ions and a subsequent decrease in pH. Alternatively, the loss of fluid from the meat tissue may cause an increase in the concentration of the solutes, which results in a decrease in the pH (Leygonie et al., 2011). The steak pH after thawing in our experiment was not influenced by the anatomical location of the steak within the tenderloin. The same was observed for the values of pH increase of the steaks after grilling (Table 2).

Color and texture characteristics of steaks

Slight variations in lightness (L*), yellowness (b*) and redness (a*) values of the thawed steaks were observed between steak locations. Lightness (L*) ($P < 0.03$) and redness (a*) ($P < 0.001$) values were higher in steaks from A compared to P; however, neither location was different from M. The differences in b* values between pork tenderloin locations was not observed ($P > 0.05$). Overall, color changes in thawed steaks due to steak anatomical location were minimal and not detectable visually.

Table 3. Color and texture characteristics of thawed tenderloin steaks as affected by the anatomical location within tenderloin

	Location in tenderloin[a]			
	A	M	P	SEM[b]
Number of steaks	81	95	92	
Thawed				
L* (lightness)	39.96[c]	39.70[c,d]	38.33[d]	0.26
a* (redness)	11.80[c]	12.26[c,d]	13.03[d]	0.13
b* (yellowness)	6.91	7.18	7.73	0.09
Grilled				
L* (lightness)	54.26[c]	51.61[d]	49.68[e]	0.31
a* (redness)	10.28[c]	11.82[d]	12.48[e]	0.13
b* (yellowness)	15.04[c]	15.49[c]	15.97[d]	0.09
ΔE*	16.96[c]	15.09[d]	13.92[d]	0.30
Warner-Bratzler shear force (N)	49.97[c]	53.49[d]	49.18[c]	0.58

[a] Tenderloin steaks were cut sequentially from the tail of the Psoas major muscle. At least 3 steaks from each location within the tenderloin corresponding to the anterior (A) tail end, middle (M), and posterior (P) portions of the muscle were utilized in this study.
[b] SEM - Standard error of the mean
[c,d,e] Means in a row not sharing the same superscript are different ($P < 0.05$).

Variations in grilled color measurements were also observed between steak locations. Steaks from the anterior part of the tenderloin (A) had the highest L* and the lowest a* values while the b* values were similar to M but lower compared to P steaks. The greatest total color change was calculated for A (16.96) followed by M (15.09) and P (13.92) samples ($P < 0.001$).

Location within tenderloin influenced steak tenderness measurements ($P < 0.01$). Steaks from M had significantly higher ($P = 0.005$) WBSF (53.49 N) compared to A and P steaks (49.97 and 49.18 N). Since the difference between M and P and M and A steaks in overall WBSF was only 4.31 N and 3.52 N respectivly, it could be argued that this difference in tenderness would not be detected by untrained consumers' perception of tenderness (Destefanis, Brugiapaglia, Barge, & Dal Molin, 2008). However, our results are in total concurrence with the findings of Eastridge and Bowker (2011). They also reported the significant influence of the location within the beef tenderloin muscle on its tenderness, like we did in pork tenderloin.

CONCLUSION

Minor but significant differences in thawing, cooking, and texture attributes of the steaks from various anatomical locations within the tenderloins were observed. When adjusted for SV, medium parts of tenderloin exhibited highest thaw drip loss. Cooking yield was influenced by steak location only when adjusted for SV ratio and increased from the anterior to the posterior end of the tenderloin. Location within tenderloin also influenced steak tenderness measurements. Steaks from medium parts of tenderloin had higher WBSF values compared to anterior and posterior parts of the steaks. Color changes in thawed steaks due to either thawing treatment or steak location were minimal and not detectable visually.

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Utjecaj anatomskog položaja svinjskog filea na kvalitetu odrezaka kod brzog odmrzavanja

SAŽETAK

Ciljevi su ovog istraživanja bili procijeniti utječe li metoda vrlo brzog odmrzavanja mesa vrućom vodom na kvalitetu odrezaka s obzirom na anatomski položaj svinjskog filea. Odmrzavanje je provedeno uranjanjem u toplu vodu temperature od 39 °C, u trajanju od 7 ± 0,5 min. Smrznuti odresci rezani su na oko 2,5 cm debljine, a debljina je svakog pojedinog odreska izmjerena i određena nakon rezanja. Počevši od stražnjeg dijela svinjske polovice, određeno je pripadaju li odresci prednjem, središnjem ili stražnjem dijelu filea. Uočene su manje ali značajne razlike značajki odmrzavanja, kuhanja i teksture odrezaka filea različitog anatomskog položaja. Nakon prilagodbe za površinu-volumen, središnji dijelovi filea pokazali su najveći gubitak mesnog soka prilikom odmrzavanja. Utvrđeno je da smještaj odreska utječe na korisne učinke kuhanja isključivo kada se u obzir uzmu omjer površina-volumen i povećanje od prednjeg do stražnjeg dijela filea. Položaj unutar filea utjecao je i na izmjerenu mekoću odreska. Odresci od središnjih dijelova filea imali su veće vrijednosti WBSF u odnosu na odreske od prednjih i stražnjih dijelova. Promjene boje odmrznutih odrezaka uzrokovane bilo procesom odmrzavanja ili položaja samog odreska bile su zanemarive, odnosno nisu bile vidljive okom.

Ključne riječi: *brzo odmrzavanje; svinjski file, anatomski položaj, kvaliteta*

Einfluss der anatomischen Lage des Schweinefilets auf die Schnitzelqualität beim schnellen Auftauen

ZUSAMMENFASSUNG

Das Ziel dieser Arbeit war es einzuschätzen, ob bei der Anwendung der Methode des schnellen Auftauens von Fleisch mit heißem Wasser die anatomische Lage des Schnitzels im Filet die Qualitätsindikatoren der Schweineschnitzel beeinflusst. Das Auftauen bestand im Eintauchen in warmes Wasser mit einer Temperatur bis zu 39 °C in Dauer von 7 ± 0,5 Minuten. Die eingefrorenen Schnitzel wurden in circa 2,5 cm dicke Scheiben geschnitten; die Stärke eines jeden einzelnen Schnitzels wurde nach dem Schneiden gemessen und festgelegt. Beginnend vom hinteren Teil des Schweins wurde bestimmt, ob die Schnitzel dem vorderen (engl. anterior, A), mittleren (engl. middle, M) oder dem hinteren (engl. posterior, P) Filetteil angehören. Es wurden geringe, aber signifikante Unterschiede bei den Auftau-, Zubereitungs- und Texturmerkmalen der Filetschnitzel in Abhängigkeit von ihrer anatomischen Lage festgestellt. Nach der Anpassung für das Oberfläche-zu-Volumen-Verhältnis wurde bei den mittleren Filetteilen der größte Verlust an Fleischsaft beim Auftauen beobachtet. Es wurde festgestellt, dass sich die Position des Schnitzels auf die positiven Auswirkungen der Zubereitung nur dann auswirkt, wenn das Oberfläche-zu-Volumen-Verhältnis und die Steigerung vom vorderen zum hinteren Teil des Filets berücksichtigt werden. Die Lage innerhalb des Filets wirkte sich auch auf die gemessene Zartheit des Schnitzels aus. Die Schnitzel aus mittleren Teilen wiesen höhere WBSF-Werte im Vergleich zu Schnitzeln aus vorderen und hinteren Teilen auf. Die farblichen Veränderungen der aufgetauten Schnitzel, bedingt entweder durch den Auftauprozess oder durch die Lage des Schnitzels selbst, waren unbedeutend, beziehungsweise mit dem bloßen Auge nicht sichtbar.

Schlüsselwörter: *schnelles Auftauen, Schweinefilet, anatomische Lage, Qualität.*

La influencia de la localización anatómica del lomo de cerdo sobre la calidad de los filetes durante la descongelación rápida

RESUMEN

Los objetivos de este trabajo fueron evaluar si la localización anatómica del lomo de cerdo influye sobre los indicadores de calidad de filete de cerdo durante el método de la descongelación rápida. La descongelación fue hecha sumergiendo las muestras en el agua caliente de 39 °C, durante 7 ± 0,5 minutos. Los filetes congelados fueron cortados a 2,5 cm y cada espesor de filete fue medido y definido despues de cortar. Fue determinado si los filetes pertenecen a la parte delantera (ingl. anterior, A), a la parte central (ingl. middle, M) o a la parte posterior (ingl. posterior, P) del filete, empezando por la parte posterior del cerdo. Fueron notadas pequeñas pocas pero significantes diferencias entre las características de la descongelación, cocción y las texturas de los filetes de las localizaciónes anatómicas diferentes. Después del ajuste a la superficie y al bolumen, los partes centrales del filete mostraron la mayor pérdida del juego de carne durante la descongelación. Fue determinado que la localización del lomo influye sobre los efectos beneficiosos de la cocción únicamente cuando se toma en cuenta la proporción de la superficie y del volumen y el incremento desde la parte anterior hasta la parte posterior del filete. La localización dentro del filete influyó también sobre la medida blandura del filete. Los filetes hechos de la parte central tuvieron los valores de WBSF más altos en comparación con los filetes hechos de las partes delanteras y posteriores. Los cambios en color de los filetes descongelados causados por el proceso de la descongelación o por la misma localizacíon fueron irrelevantes, es decir, no eran visibles por el ojo.

Palabras claves: *descongelación rápida, filete de cerdo, localización anatómica, calidad*

Incidenza della posizione anatomica del filetto suino sulla qualità delle fettine sottoposte a scongelamento rapido

SUNTO

Gli obiettivi di questa ricerca consistono nel valutare l'incidenza della posizione anatomica delle fettine di filetto sugli indicatori della qualità delle fettine di suino sottoposte a processo di scongelamento molto rapido con acqua calda. Lo scongelamento avviene immergendo la carne in acqua calda a 39 °C per una durata di 7 ± 0,5 min. Le fettine congelate hanno uno spessore di circa 2,5 cm. Lo spessore di ogni singola fettina viene misurato e stabilito dopo il taglio. Partendo dalla parte posteriore del maiale, va stabilito se le fettine appartengono alla parte anteriore (in inglese anterior, A), mediana (in inglese middle, M) o posteriore (in inglese posterior, P) del filetto. Sono state evidenziate alcune minori ma significative differenze nelle caratteristiche di scongelamento, cottura e consistenza delle fettine di filetto di differente posizione anatomica. Dopo l'adattamento di superficie e volume, le parti mediane del filetto, sottoposte allo scongelamento, hanno fatto registrare la maggior perdita di succhi. È stato accertato che la posizione anatomica della fettina incide sugli effetti utili della cottura esclusivamente quando vengono presi in considerazione il rapporto superficie-volume e l'aumento dalla parte anteriore a quella posteriore del filetto. La posizione mediana ha anche influito sulla morbidezza della fettina di filetto. Le fettine della parte mediana del filetto hanno fatto registrare, infatti, valori di WBSF più alti rispetto alle fettine delle parti anteriore e posteriore. Le variazioni cromatiche delle fettine scongelate, causate sia dal processo di scongelamento, sia dalla posizione della stessa fettina, non sono significative, ossia non sono visibili a occhio nudo.

Parole chiave: *scongelamento rapido, filetto di maiale, posizione anatomica, qualità*