Relationship between muscle fiber characteristics and water holding capacity of *Longissimus dorsi* muscle in Brahman × Thai native and Charolais × Thai native crossbred cattle

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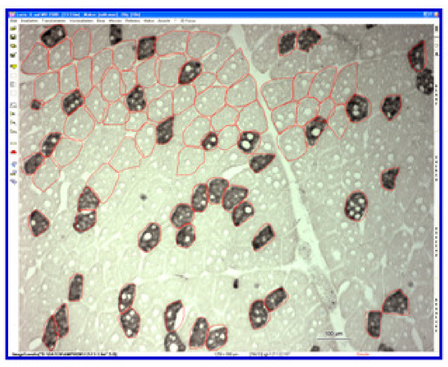
Introduction

Skeletal muscle fibers are classified depending on their contraction rate into slow- and fast-twitch fibers. There is a relationship between muscle fiber characteristics, sizes, and types with post mortal biochemical processes and meat quality. However, muscle fiber characteristics are influenced by many factors, e.g. genotype, sex, age, feed and management. The objectives of this study were to investigate effects of genotype and slaughter weight on muscle fiber characteristics and water holding capacity of the *Longissimus dorsi* (*Ld*) muscle in Brahman × Thai native (BRA) and Charolais × Thai native (CHA) crossbred bulls (Fig. 1), and to estimate the relationship between muscle fiber characteristics and water holding capacity of the *Ld* muscle.

Materials and Methods

The study was conducted on a commercial beef cattle farm in Northern Thailand. In total 34 BRA and 34 CHA were randomly selected and slaughtered at either 500, 550 or 600 kg live weight. Water holding capacity parameters were determined as drip, ageing, thawing, cooking and grilling loss. Muscle fiber characteristics were conducted for percentages and cross-sectional areas of slow- and fast-twitch fibers (Fig. 2). Correlation coefficients for muscle fiber characteristics and water holding capacity parameters were analysed.

Fig. 1 Brahman × Thai native (L) and Charolais × Thai native bulls (R)



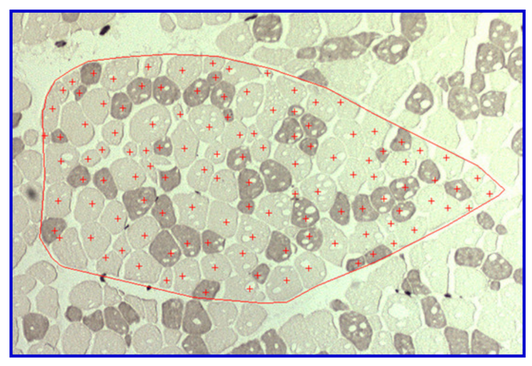


Fig. 2 Measuring muscle fiber cross-sectional area (L) and muscle fiber number (R): dark = slow-twitch fibers, light = fast-twitch fibers

Results

CHA meat had better water holding capacity (less ageing, thawing and grilling loss) compared to BRA (Tab. 1), whereas slaughter weight had no significant effect on these parameters. Furthermore, there were no significant differences between genotypes and slaughter weights in percentages and cross-sectional areas of slow- and fast-twitch fibers of *Ld* muscle. Slow- and fast-twitch fibers of all experimental groups averaged 24.4 and 75.6 %, respectively. Cross-sectional areas of fast-twitch fibers had almost twice the size of slow-twitch fibers (6,721 and 3,713 µm2, respectively). The correlation between muscle fiber area and water holding capacity indicated that muscles with larger fiber areas had a lower drip and ageing loss but a higher cooking and grilling loss (Tab. 2).

Tab. 1 Water holding capacity of LD muscle

Water holding capacity	Genotype	
	BRA	CHA
Drip loss, %	3.1	3.1
7-day ageing loss, %	3.0[a]	2.5[b]
14-day ageing loss, %	5.5	5.5
Thawing loss, %	10.5[a]	7.2[b]
Cooking loss, %	38.3	37.9
Grilling loss, %	33.1[a]	31.3[b]

[a, b]: $P < 0.05$

Tab. 2 Correlation coefficient between muscle fiber traits and water holding capacity

Correlations	Drip loss	Ageing loss		Thawing loss	Cooking loss	Grilling loss
		7 day	14 day			
Fiber type composition						
Slow-twitch fiber, %	ns	ns	ns	ns	ns	0.31
Fast-twitch fiber, %	ns	ns	ns	ns	ns	-0.31
Fiber area						
Slow-twitch fiber, µm^2	-0.28	-0.33	ns	ns	0.31	ns
Fast–twitch fiber, µm^2	-0.34	-0.27	ns	ns	0.32	0.41
Density, fiber/mm^2	0.36	ns	ns	ns	-0.30	-0.46

$P < 0.05$; ns = non significance

Conclusion

Muscle fiber characteristics were not significantly different between BRA and CHA. CHA meat had higher water holding capacity, therefore it may has better sensoric quality. Slaughter weights had no effects on water holding capacity and muscle fiber characteristics. Meat with large muscle fibers and low muscle fiber density are associated with low drip and ageing loss but high cooking and grilling loss.

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