MEAT QUANTITY ANALYSIS IN DIFFERENT AGE OF MAIWA YAK

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Abstract –Three parts of meat samples including supraspinatus muscle (SPM), longissimus dorsi (LD) and semitendinosus muscle (SDM) were selected to study the meat quality of 6- and 18-month old Maiwa yaks. The pH, chromatic aberration, cooking yield and shear force were valued. The results showed that the pH value of those three parts of meat have no differences. L*, a*, b*, C, H value of chromatic aberration have no significant differences within the same part of muscle in 6 and 18 months old yaks (*P*>0.05), but the values in different meat parts were different even for same age animals. Brightness value L*, yellow value b* and toning angle H value are the largest in SDM. The cooked rate of SDM is the highest. The cooked rate of 18-month old yaks is significantly higher than the 6-month old ones (*P*<0.05), but is lower in LD and SDM (*P*>0.05). The LD shear force of 18-month old yak is significantly higher than the 6-month old ones (*P*<0.05), while the SPM and SDM of 18-month old yaks were higher than 6-month ones (*P*>0.05). The results suggested that the SDM can be used for high quality meat products.

Key Words –Maiwa yak, physical base index, meat quality

I. INTRODUCTION

As global consumers become more concerned about the importance of livestock nutrition value, sources of information, production systems, environmental impact and welfare, yaks can produce “green” meat that has drawn attention both home and abroad. Zhang et al. [1] analyzed the physical base index (PBI), sarcomere length, diameter of muscle fiber, and the change of shear force. According to the change of physiological and biochemical indexes within 3 days, the forecasting model of yak meat tenderness was established. Carrick et al. [2] reported that he tenderness of longissimus dorsi in sheep meat matured in 35℃ for 0-72h was significantly better than 18℃ process. Stanton et al. [3-4] indicated that the connective tissue was damaged and the soluble collagen was increased during the process of maturation improving meat tenderness. In the present study, PBI of different parts of meat in male calf of Maiwa yak were determined.

II. MATERIALS AND METHODS

Animals

Male calves of Maiwa yak aged 6 months and 18 months were selected as experimental animals. Six-month old yaks were raised by whole nursing breeding, adding supplementary green hay 1 Kg/day in cold seasons, while 18-month old yaks suckled whole milk before six months, and supplementary cornmeal 0.1 kg/day in cold seasons was added.

Samples

The yaks were slaughtered on October 27, 2012 in the Hongyuan meat company. Supraspinatus muscle (SPM), longissimus dors (LD) and semitendinosus muscle (SDM) from left carcass were sampled after acid discharged for 24h.

PH value

The pH value was measured by pH SPEAR TEST 30 (Thermo, USA) when pH meter is inserted into the Meat samples in depth of 2 – 3 cm.

Chromatic aberration

Chromatic aberration was measured by chromatic aberration meter (CM-700d, Japan).We randomly measured the chromatic aberration in the three different positions that was uniformly distributed in the cross-sections of each muscle which were measured three times. According to records of the measured L*,a*,b* values and the conversion formula C=(a*²+b*²)0.5, H= Arctg (b*/a*), then we can calculated hue C and tonal Angle H value.

Cooking yieldmeat

Sample (2 cm×2 cm×3 cm) were weighed (m_1) and boiled in 80℃ water until the core temperature reaches 70℃. Samples were weighted after cooking (m_2). The cooking yield of meat (%) = $m_2/m_1 \times 100\%$.

Shear force

The shear force was measured according to standard methods of NY/T 1180-2006 using Tenderometer (CL-M) (Shanghai,P. R. China)

Statistical analysis

The data was processed by SPSS19.0.

III. RESULTS AND DISCUSSION

pH value

pH values of different parts of meat in 6- and 18-month old yak were shown in Table 1. Meat pH_{24} values in SPM, LD of 6-month yak significantly decreased (P<0.05) than pH_1, while most significantly decreased in SDM (P<0.01) than pH_1. 18-month old yak meat pH_{24} values of SPM, SDM was significantly decreased than pH_1 (P<0.01).

Table 1 pH value of different parts of meat in 6 and 18 months age yak

age	Samples(n)	pH	SPM	LD	SDM
6 months	6	pH_1	6.36±0.24*	6.51±0.40*	6.87±0.39**
		pH_{24}	5.84±0.11*	5.49±0.25*	5.72±0.43**
18 months	10	pH_1	6.54±0.12*	6.69±0.47**	6.47±0.03*
		pH_{24}	5.74±0.26*	5.54±0.36**	5.58±0.05*

Note: indicates more significant different (p<0.05), and ** indicates most significant different (p<0.01), Same meaning as below.*

pH is an important indicator that reflects muscle glycolysis rate after yak were slaughtered. It is also one of the important bases to determine the abnormal and normal quality of meat. Within 1 hour after yak were slaughtered, the muscle normal pH value should be between 6 and 7, then decrease eventually to 5.4 - 5.6 when the muscle absolutely reached stiffness, afterwards the pH value rises again[5]. In our study, pH_1 value in SPM, LD and SDM were between 6 and 7 and pH_{24} were between 5.49 and 5.85, which indicates that pH values are normal scope in three kinds of

muscle of Maiwa yak at the age 6 months and 18 months.

Chromatic aberration

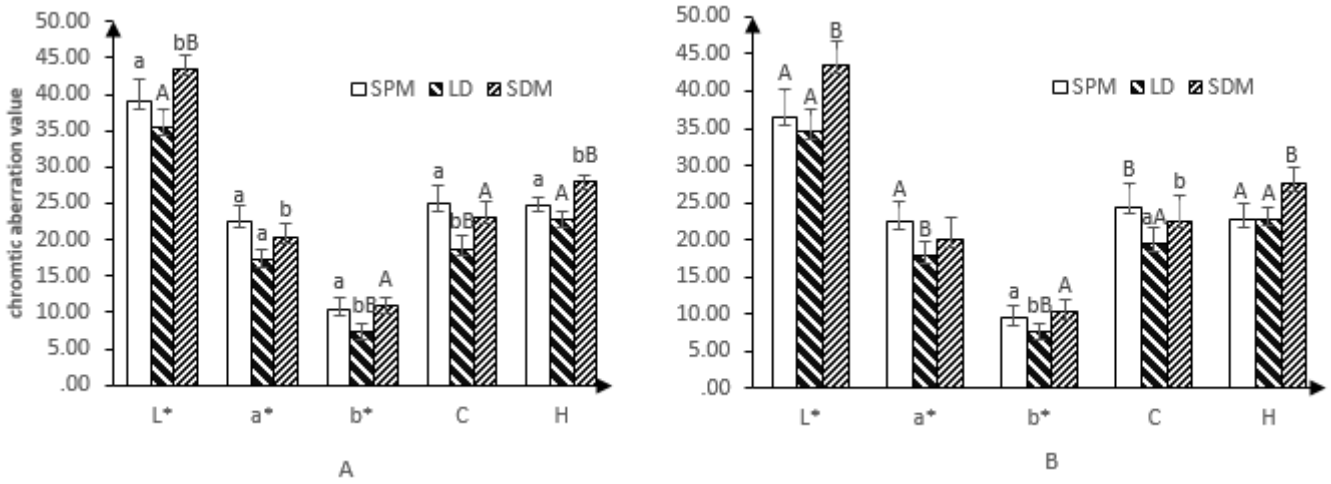
The meat Chromatic aberration of different age were shown in Table 2 and Fig. 1. In the 6-month old yak, brightness value L* of SDM was significant higher than in LD (P<0.01) and SPM (P<0.05). The red color degree a* were highest in SPM, and significantly higher than LD and SDM (P<0.05). The value b*, C, H in SDM was most significantly higher than in LD (P<0.01).

In the 18-month old yak, the value L* were significantly different among SDM, SPM and LD (P<0.01). The value a* and b* in LJT was most significantly higher than in LD (P<0.01), they were also significantly higher in SDM than in LD (P<0.05).

Table.2 chromatic aberration of different parts of meat in 6 and 18 months age yak

location	months	Samples	L*	a*	b*	C	H
SPM	6	6	39.02±3.09	22.59±2.20	10.49±1.41	24.92±2.57	24.77±1.06
	18	10	36.43±3.92	22.50±2.75	9.46±1.76	24.42±3.12	22.66±2.29
LD	6	6	35.41±2.66	17.29±1.49	7.27±1.09	18.76±1.80	22.69±1.29
	18	10	34.56±3.12	17.84±2.03	7.56±1.27	19.38±2.33	22.82±1.61
SDM	6	6	43.57±1.80	20.42±1.81	10.86±1.09	23.13±2.09	28.02±0.90
	18	10	43.50±3.30	20.00±3.01	10.37±1.68	22.55±3.34	27.54±2.29

Fig.1 chromat aberration of different parts of meat in 6 month age (A) and 18 months age (B) of male calf of maiwa yak



Note: the lowercase letters mean more significantly difference (P<0.05) and the capital letters mean most significantly difference (P<0.01) within the same set of date in the both figures.

The value C in SPM was most significantly higher than in LD (P<0.01), and significantly higher in SPM than LD (P<0.05).The value H in SDM was most significantly higher than in SPM and LD (P<0.01).

We use L*, a*, b* value to represent muscle colors, L* value means brightness, a* indicates red degree value, b* indicates yellow degree value. Beef color is the first impression of consumers buying beef. In the normal range, it does not affect the nutritional value of meat, but it is the major factor of consumer judgement of beef quality especially in fresh meat[6-7]. Niu et al[8] studied meat color in supraspinatus muscle, semitendinosus muscle, longissimus dorsi and psoas in 18-month old Simmental bulls. Our results showed that L* value in semitendinosus muscle was 43.57 in 6-month old yak, a* value in supraspinatus muscle of 6-month old yak was 22.59 and b* in semitendinosus muscle of 6-month old yak was 10.86. The values were all lower than that of Niu's results. In this study, brightness value L*, yellow degree value b* and hue angle value H of semitendinosus muscle were maximum, red degree value a* and Chroma value C of supraspinatus muscle were maximum, indicating that color of semitendinosus muscle was lighter and color of supraspinatus muscle was bright. It agrees with results of Niu (2011). The brightness value L* in male calves of Maiwa yak is significantly lower than in Simmental bulls. This may be due to the lower muscle fat content in yak, according to the fact that intramuscular fat can lead to an increase in L* values.

Cooking yield and shear force

Cooking yield and shear force were shown in Table 3. Along with in the increment of age from 6 months to 18 months, the cooking yield and shear force were increased in SPM, LD and SDM (Table 3). Cooking yield of SPM was more significantly higher in 18-month than that in 6-month old yaks (P<0.05). The cooking yield of LD and SDM of 18-month old yak is higher than that in 6-month old ones, but they were not significantly different (P>0.05). It's indicated that cooking yield of SDM were highest in three different parts of meat, both in 6 and 18 months old yak, reaching 81.7% and 78.0%, respectively. Shear force in LD of 18-month old yak (6.4 kg) was significantly higher than 6-month old animals (5.16 kg) (P<0.05). There were significant difference in SPM and SDM of 6- and 18-months old yak (P<0.05).

Cooking yield of meat is an important indicator that reflect the weight loss during cooking [9]. In this study, semitendinosus muscle cooking yield of 6- and 18-month old male calf yak were highest among three kind of muscles.

Table.3 Cooking yield and shear force in different parts of meat in 6 and 18 months old yak

months	Samples	SPM		LD		SDM	
		Rate of cooked meat	Shear force	Rate of cooked meat	Shear force	Rate of cooked mea	
6	6	63.50±23.14*	5.08±1.46	76.95±10.97	5.16±1.07*	81.73±8.78	5.60±1.95
18	10	71.72±8.44*	5.41±1.25	75.57±9.76	6.40±1.97*	77.97±8.12	5.73±1.39

A higher cooking yield of semitendinosus muscle means a better production performance than muscle of other parts. Due to moisture loss reduction, the meat nutrition, taste, smell, juiciness, appearance and tenderness will be better preserved[10].This results showed that semitendinosus muscle quality is better in 6- and 18-month old Maiwa male yak.

The shear force value is one of the most important index reflecting meat tenderness. The influencing factors of beef tenderness mainly include breed, age, gender, cut position, nutrition level, stress reaction and cooling mode, carcass hanging method, mature time, cooking methods and time, etc[11-12].

IV. CONCLUSION

The results showed that 6- and 18-month old male Maiwa calf yak have good meat quality features. The color of semitendinosus muscle is lighter, supraspinatus muscle is bright. Semitendinosus muscle has a good production performance. Meat tenderness of 6-month old yak is better than 18-month olds, and can be used for veal production.

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