Physical,Chemical and Sensory Properties of Yellow Cattle Beef as Compared with Other Breeds.

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Introduction

The yellow cattle is one of Taiwanese indigenous breeds. Farmers use them to pull carts and do farm work. In recent years, the heads of the yellow cattle were reduced due to the mechanization of Agriculture in Taiwan. They still can be seen predominately in the eastern part of the island, Penghu and provincial Livestock Research Institute. They are rarely seen in other places. Over 90 % of the frozen beef available on the market is imported from America, Australia and New Zealand. Taiwanese indigenous beef is limited to a small number of water buffalo, Holstein cattle and yellow cattle and thus the Livestock Research Institute, Hunchuan Bunch is launching into the breeding plans. Hopefully we can maintain a certain number of yellow cattle population. There is very little information about the characteristics of the yellow cattle beef being reported (Guo et al., 1995; Chen et al., 1995). The purpose of this research is to find out whether yellow cattle can be accepted and palatable to the consumers. The differences in collagen content , sensory and rheological properties among these four different kinds of beef were investigated.

Materials and Methods

Feeding and Slaughter The yellow cattle and Brahman were fed on a diet containing alfalfa haylage ,silage, distillers dried grains and corn until slaughter at two and half years of age. The Holstein steer was given the same feed as the yellow cattle, and slaughtered at two years of age. The fresh beef was chilled for 24 hr, then cut. The imported beef from American was purchased from the local meat company.

Sample preparation and evaluation The sample of loin was cut into 2 cm thick and was cooked on an preheated electronic hot plate to an internal temperature of 70 ℃ (the samples were roasted to medium of doneness about 5 min. Then turned over to be roasted for 1 min. to medium) , then cut into 1 cm^3 for juiciness, tenderness and overall flavor and odor evaluation by an 110-member untrained sensory panel. A 6-points structured scale (6=extremely satisfactory, 1=undesisable) was used to carryout the panel test.

Rheological measurements The roasted loin samples were chilled to room temperature and measured using a texture analyzer (SMS-XT.RA Dimension analyzer, England). The objective portion of the texture profile was partitioned into chewiness, cohesiveness, hardness and springiness attributes. The conditions were as follows :

force units:grams	pre-test speed: 5.0 mm/sec	adapter contact area:1.13 mm^2
test speed and post speed : 5.0 mm sec	strain: 30 %, time:50 sec	contact force:5.0 g

Collagen determination Samples were treated using the procedure reported by Hill (1966), collagen and soluble collagen contents were measured by the methods of Stegeman and Stalder(1967).

Statistical analysis Data were analyzed using a statistics' software package(SAS Institute Inc., 1987). ANOVA and the Duncan's multiple range test were used to test for the difference of data.

Results and discussion

Sensory panel attributes of the roasted loin from different beef were shown in Table 1. The yellow cattle beef was the highest for juiciness and overall acceptability. The imported frozen beef was the highest for tenderness and Brahman was the highest for flavor palatability among the beef from different sources.. Holstein beef was the worst in the palatability among all the beef samples. From Table 1. it could be observed that the scores of overall acceptability for Holstein beef were below 4 points (it was between like and dislike). The imported frozen beef was the second lowest in scores. It was significantly better than Holstein beef ($p<0.05$).The beef samples of yellow cattle and Brahman were well accepted, both got 4.4 points.

The odor of beef samples was also measured.. The panelists response was between a little bit odor and slight odor when the sensory evaluation was performed. Although the odor in Holstein beef was more obvious, the statistical result did not show significant differences as compared with the other beef samples($p>0.05$). When we roasted loin, we found Brahman had stronger flavor, most panelists considered that the beef had much more flavor in meat, so it got the highest scores in flavor. Umami also described from panelists were presented both yellow cattle beef and Brahman. Frozen beef had better acceptability for tenderness and flavor than yellow cattle beef. The decrease in juiciness was related to the drip loss during thawing process in frozen beef. However, it was closely related to tenderness.

The results of rheological measurement were shown in Table 2. The measures of chewiness, gumminess and hardness were the highest for Brahman and the lowest for yellow cattle beef, Holstein and the imported frozen beef in the descending order. Cohesiveness and springiness were the highest for Holstein beef and decreased in the order of the imported frozen beef, Brahman and yellow cattle beef. However, the chewiness, gumminess and hardness were presented as the level of chew and bit when eating.

Table 3 indicated the collagen content from different beef samples. Data showed that the frozen beef (2.701 mg/g) was significantly highest($p<0.05$) in collagen among all the beef samples. Brahman was the second and Holsteins were the third at 2.643 and 2.606 respectively. The collagen content of yellow cattle beef was the lowest among all the samples (2.426 mg/g) . Soluble collagen content was higher for the imported frozen beef than the others, but not significantly different ($p>0.05$) .

From the above observations we can see that beef must be tender and elastic for Chinese plates. Brahman beef was tough, but it was elastic and juicy meat, panelists preferred it. The yellow cattle beef was tougher than Holstein and the imported frozen beef, but it was higher in elasticity and cohesiveness. Chinese like the flavor of the yellow cattle beef and it was generally were accepted. The hardness of the imported frozen beef was lower, but its tenderness was well accepted.

To compare the data of rheological measurements, the yellow cattle beef was the same acceptability as the frozen beef while Brahman beef was different. During feeding period, yellow cattle grew and developed slowly. The steer was 259.5 Kg at age of one year and the heifer was 220.2 Kg. The daily gain of the steer after fattening （120 day） was 0.64 Kg. Robertson et al.(1984) Indicated that animal age had little effect on the mean peak of shear force values of beef or buffalo until cooking temperatures above 60 ℃. There were species differences in the mechanical properties of undenatured as well as partially denatured connective tissue. However, the data indicated that the rheological properties and collagen contents from different species were different. Many researchers discussed that the relationship between collagen, protein and tenderness. Burson and Hunt (1986) documented that connective tissue was a major factor affecting tenderness, since total collagen crosslinking. Seideman (1986) reported that significant differences in the connective tissue content had been affected by species, grades, sex, breed and age. In his research he also suggested that the quality of total collagen was found to be highly correlated to sensory tenderness , the correlation between percentage collagen solubility and tenderness was -0.71 for bulls and -0.36 for steers.

Crouse and Koohmaraie (1990) concluded that meat cooked after freezing had greater cooking loss. It agreed with our research since frozen beef was lower in juiciness than the other beef samples.

Conclusion

At present, beef supply for our consumption was dependent upon importation from Australian, New Zealand, Canada and America. Taiwan is located in the subtropical area, the climate is not suitable for beef cattle production. Therefore, we have to make efforts to improve the feeding, fattening of the indigenous cattle and the quality of beef by aging & processing for the domestic market. The fresh beef was more acceptable than the frozen beef to Chinese. This experiment indicated that the yellow cattle beef had desirable acceptability. However, the technology to produce high quality beef as well as conservation of the yellow cattle all needs to do more further work.

References

Burson,D.E. and M.C. Hunt,1986. Proportion of collagen types I and III in four bovine muscles differing in tenderness.J. Food Science.51:51-53.

Chen,M.T., H.S. Guo,Q.K. Wei and G.F. Lee,1995. Nutritional composition and flavor compounds of Taiwan yellow cattle beef. 2nd. APCoMT.p.115-116.

Crouse,J.D., and M. Koohmaraie,1990. Effect of freezing of beef on subsequent postmortem aging and shear force. J. Food Science.55:573-574.

Guo,H.L.,M.T. Chen ,D.C.Liu, and G.F. Lee,1995. The functional properties and volatile flavor compounds of Taiwan yellow cattle beef. 2 nd. APCoMT.p.115-116.

Hill, F.,1966. The solubility of intramuscular collagen in meat animals of carious ages. J. Food Science. 32:161-166.

Seideman,S.C.,1986. Methods of expressing collagen characteristics and their relationship to meat tenderness and muscle fiber types.J. Food Sciences. 51:273-276.

Stagemann,H., and K. Stalder, 1967. Determination of hydroxyproline. Clin.Chem. Acta. 18:267-273.

Table 1. The sensory evaluation of the roasted loin from four different sources of beef.*

	yellow cattle	frozen beef	Brahman	Holstein
flavor	4.4[a]	4.4[a]	4.5[a]	4.1[b]
juiciness	4.5[a]	4.3[ab]	4.5[a]	4.1[b]
tenderness	4.6[a]	4.7[a]	4.1[b]	4.4[ab]
meaty odor	3.6[a]	3.5[a]	3.7[a]	3.8[a]
overall	4.4[a]	4.3[ab]	4.4[b]	3.9[b]

*:1=extremely undesirable, 6=extremely satisfactory.

a,b,c,d: Data with different row are significantly different ($p<0.05$).

Table 2. The rheological properties of the roasted loin from four different sources of beef.

	yellow cattle	frozen beef	Brahman	Holstein
chewiness（g）	342.72[b]	108.28[d]	414.67[a]	189.25[c]
cohesiveness（g）	0.6291[c]	0.6703[b]	0.6366[c]	0.7097[a]
gumminess（g）	502.0[ab]	138.0[b]	566.1[a]	253.9[ab]
hardness（g）	486.44[b]	203.85[d]	785.41[a]	347.23[ab]
springiness（g）	0.7007[b]	0.7703[a]	0.7154[b]	0.7785[a]

a,b,c,d: Data with different row are significantly different ($p<0.05$).

Table 3. The collagen content of the roasted loin from four different sources of beef.

	yellow cattle	frozen beef	Brahman	Holstein
total collagen（mg/g）	2.426[b]	2.701[a]	2.643[ab]	2.606[b]
soluble collagen（mg/g）	0.392[a]	0.464[a]	0.408[a]	0.423[a]

a,b,c,d: Data with different row are significantly different ($p<0.05$).