BEEF CHUCK COMPOSITION AS RELATED TO USDA QUALITY AND YIELD GRADE

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Story in Brief

Beef forequarters were selected from 16 steer carcasses to determine the influence of USDA quality and yield grade on the beef chuck composition where visible epimysial connective tissue of individual muscle was removed. For chucks from U.S. Choice and Good grade carcasses, yield grade 3 chucks had significantly higher separable fat than yield grade 2 chucks (21.11% vs 18.08%). This was due primarily to differences in subcutaneous fat. U.S. Good Chucks tended to have higher separable lean and lower separable fat than U.S. Choice chucks (64.13% vs 62.47%, 18.50% vs 20.69%, respectively). Yield grade was more closely related to separable fat in beef chuck than quality grade (marbling). Further research is needed to determine the chemical, functional and sensory properties of chuck muscles to optimize their use in further processed products.

(Key Words: Beef Chuck Composition, USDA Quality Grade, Yield Grade)

Introduction

The beef chuck comprises about 26% of the beef carcass, but chuck has been traditionally merchandised in the form of low-priced roasts, stew or ground beef. However, current industrial technology, e.g. the boxed beef concept (Breidenstein, 1982) could make certain muscles or muscle groups from beef chucks available, economically, to beef processors who in turn could restructure these muscle(s) into high demand beef items for the modern consumer. Accordingly, detailed information about beef chuck composition would be of vital concern to meat processors.

This investigation was undertaken to determine the influence of USDA quality and yield grade on the beef chuck characteristics where visible epimysial connective tissue of individual muscle was removed.

Materials and Methods

Beef forequarters were selected from 16 steer carcasses (4 U.S. Choice, Yield Grade (YG) 2; 4 U.S. Choice, YG-3; 4 U.S. Good, YG-2; 4 U.S. Good, YG-3) in a commercial packing plant (USDA, 1975). Forequarters were held at 4 C for 4-5 days postmortem, and then fabricated into wholesale square-cut chucks (NAMP, 1983).

Chucks were trimmed of subcutaneous fat and dissected to facilitate the complete separation of the following 20 muscles: biceps brachii; brachialis; brachiocephalicus and omotransversarius

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group; complexus; deep pectoral; deltoideus; extensor carpi radialis; infraspinatus; latissimus dorsi; longissimus dorsi; rhomboideus; serratus ventralis; splenius; subscapularis; superficial pectoral; supraspinatus; teres; trapezius; triceps brachii lateral head; and triceps brachii long head. These muscles comprised approximately 70 percent of the lean meat in the square-cut chuck. The above 20 muscles were trimmed of intermuscular fat and visible epimysial connective tissue. The remainder of the chuck was separated into lean trim, intermuscular fat and bone. All compositions including separable lean (20 muscles or lean trim), separable fat (subcutaneous or intermuscular fat), epimysial connective tissue and bone were weighed and expressed as a proportion of the chuck weight. Tendons were weighed separately but included in bone for total bone weight.

Data was analyzed as a 2 x 2 factorial arrangement of treatments in a split-plot design using the Statistical Analysis System.

Results and Discussion

Quality and yield grade (YG) characteristics of steer carcasses used for square-cut chucks are shown in Table 1. Carcasses were selected for average Good and low Choice quality grades and YG-2 and 3. The data indicates that these selections were closely met.

Influence of quality and yield grade on separable composition of the square-cut chuck are shown in Table 2. Chucks from U.S. Good carcasses tended to have higher separable lean and lower separable fat than those from U.S. Choice carcasses (64.13% vs 62.47%, 18.50% vs 20.69%, respectively). Paterson and Parrish (1986) found that, for

Table 1. Quality and yield grade (YG) characteristics of steer carcasses used for square-cut chucks.

	YG-2 (N=8)[a]		YG-3 (N=8)[a]		
Trait	Good[a]	Choice[a]	Good[a]	Choice[a]	S.E.[b]
Carcass wt. (kg)	303.2	299.4	288.4	295.3	4.83
Ribeye area (cm^2)	83.35	80.97	74.52	76.90	2.39
Adjusted fat thickness (cm)	0.66	0.74	1.21	1.38	0.08
Kidney, heart & pelvic fat (%)	2.1	2.1	2.7	2.4	0.21
YG[d]	2.1	2.2	3.0	3.1	0.03
Maturity[ac]	157	160	163	173	3.26
Marbling[ad]	355	425	352	438	6.2
Chuck wt. (kg)	42.89	40.27	40.14	40.61	0.38

[a]Based on descriptions included in USDA (1975) beef grade standards.
[b]Standard error of the mean.
[c]100 to 199 = maturity A.
[d]300 to 399 = slight; 400 to 499 = small.

Table 2. Influence of quality and yield grade on separable composition of the square-cut chuck.

Composition	Quality grade		Yield grade		S.E.
	Good	Choice	YG-2	YG-3	
Separable lean (%)	64.13	62.47	63.87	62.72	0.71
20 muscles[a]	45.49	44.36	45.25	44.59	0.64
Lean trim	18.64	18.11	18.62	18.13	0.41
Separable fat (%)	18.50	20.69	18.08[e]	21.11[f]	0.85
Subcutaneous	4.24	5.13	3.58[e]	5.79[f]	0.36
Intermuscular	14.26	15.56	14.50	15.32	0.55
Epimysial connective tissue (%)[b]	1.51[c]	2.00[d]	1.91	1.61	0.12
Bone (%)	14.77	14.42	15.10	14.09	0.50

[a] Epimysial connective tissue of 20 muscles was removed.
[b] Sum of 20 muscles.
[cd] Means in same main effect row with different superscripts differ ($P < .05$).
[ef] Means in same main effect row with different superscripts differ ($P < .01$).

chucks from YG-2 and 3 carcasses, U.S. Good chucks had ($P < .01$) higher percentage separable lean and lower percentage separable fat than U.S. Choice chucks. Hedrick et al. (1981) also reported higher ($P < .05$) percentage retail cuts and lower ($P < .05$) percentage fat trim for U.S. Good than for U.S. Choice grade carcasses, and attributed this difference to the removal of more intermuscular fat from U.S. Choice than from U.S. Good carcasses. For both U.S. Choice and Good grade carcasses, YG-3 chucks had lower separable lean and higher ($P < .05$) separable fat than YG-2 chucks (62.72% vs 63.87%, 21.11% vs 18.08%, respectively). The difference in separable fat was obvious in subcutaneous fat where YG-3 chucks had higher ($P < .01$) subcutaneous fat than YG-2 chucks (5.79% vs 3.58%). This result is consistent with that of Paterson and Parrish (1986), who reported that YG-3 chucks had ($P < .01$) lower percentage separable lean and higher percentage separable fat than YG-2 chucks. There were no differences ($P > .05$) for bone in square-cut chucks regardless of quality and yield grade. However, U.S. Choice chucks had higher ($P < .05$) epimysial connective tissue than U.S. Good chucks (2.00% vs 1.51%).

Partial correlation coefficients between selected carcass characteristics and composition of square-cut chuck are shown in Table 3. Yield grade was correlated positively with adjusted fat thickness ($r = 0.83$, $P < .01$) and kidney, heart and pelvic fat ($r = 0.45$), and correlated ($P < .05$) negatively with ribeye area ($r = -0.55$). Also, YG was correlated ($P < .05$) positively with separable fat ($r = 0.56$). A negative but non-significant ($P > .05$) relationship was found between YG and separable lean ($r = -0.39$). Marbling score did not show any strong relationship ($P > .05$) with ribeye area, adjusted fat thickness and kidney, heart and pelvic fat. Separable fat was correlated positively with adjusted fat thickness ($r = 0.68$, $P < .01$) and kidney, heart and pelvic fat ($r = 0.60$, $P < .05$), and correlated negatively with separable lean ($r = -0.76$, $P < .01$).

Table 3. Partial correlation coefficients between selected carcass characteristics and composition of square-cut chuck.

	Marbling	Ribeye area	Adjusted fat thickness	Kidney, heart & pelvic fat	Separable lean	Separable fat
YG	0.18	-0.55*	0.83**	0.45	-0.39	0.56*
Marbling		-0.06	0.18	-0.09	-0.18	0.31
Ribeye area			-0.10	0.12	0.36	-0.10
Adjusted fat thickness				0.50	-0.35	0.68**
Kidney, heart & pelvic fat					-0.14	0.60*
Separable lean						-0.76**

*$p < .05$
**$p < .01$

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