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PHYSICAL PROPERTIES OF GROUND BEEF PATTIES FROM CULL BEEF COWS ADMINISTERED BOVINE SOMATOTROPIN

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INTRODUCTION

The cattle industry must increase production of lean beef to remain competitive (Byers *et al.*, 1988). Exogenous somatotropin will increase leanness in farm animals (Etherton and Smith, 1991), but less is known about changes in the properties of meat and meat products from somatotropin treated animals. Cull cows provide a source of ground beef which accounts for about 45% of beef consumption in the U.S. Body mass was increased by feeding of cull cows before slaughter, but carcass fatness also increased (Matulis *et al.*, 1987). This study evaluated ground beef properties from cull beef cows given exogenous bovine somatotropin (bST) and slaughtered after 21 or 42 days on feed (DOF) in a feedlot.

MATERIALS AND METHODS

Forty-two cull beef cows randomly assigned to treatment groups of bST (0, 25, 50mg/hd/d) and DOF of 21 or 42 days before slaughter at the Auburn University Meat Laboratory. After a 24 hour chill period (3.2°C), carcasses were fabricated into primal cuts. Primal cuts of chuck rolls (USDA IMPS 116A) and inside rounds (*m.semimembranosus*) were transported under refrigerated conditions from Auburn, AL to Baton Rouge, LA. Three ground beef types (chuck, round, and round plus 0.5% carrageenan, salt, hydrolysed vegetable protein) were formulated from each treatment combination of bST and DOF. The different primal cut groups were ground (3.18mm) and formed into 111g patties of 120mm diameter and 9mm thickness. All patties were frozen in a CO_2 cabinet freezer (-62°C) and vacuum packaged for -15°C storage. All patties were thawed for 12 hours at 4°C before analyses. Moisture and fat determinations were made with a CEM microwave system and solvent extractor and Kjeldahl nitrogen and ash were determined by AOAC procedures (AOAC, 1990). Hunter colour values (L*, a*, b*) were measured on a Hunter LABSCAN-2 0/45. Patties were weighed and diameter and thickness measured with digital callipers before cooking on a Farberware electric grill for 13 minutes on one side and 8 minutes on the other side. Patties were cooled to room temperature, reweighed to determine cook loss and dimensions were remeasured to determine shrink changes. A square (50x50 mm) from the centre of each patty was sheared with an Instron 4501 Universal testing machine using a Kramer multiblade shear attachment. All data were analyzed by General Linear Models procedures (SAS, 1989).

RESULTS AND DISCUSSION

Means and ranges of the carcass characteristics for cows used in this study are in Table 1. Weights, backfat thicknesses and *m.longissimus* areas were consistent with those of cull cows routinely slaughtered in U.S. commercial facilities.

Fat content differed ($P<0.05$) for beef patties with bST level, DOF and cut type. Ground beef patties from chucks and rounds were leaner ($P<0.05$) from cows with 0mg/hd/d bST than with 50mg/hd/d (Table 2). Ground beef patties from chucks and rounds with added ingredients, but not from rounds, decreased ($P<0.01$) in fat percentage

with DOF. Matulis *et al.* (1987) found percent fat increased with time on feed even though cows were implanted with Synovex-H (20mg estradiol benzoate and 200mg progesterone). Moisture, protein and ash contents of beef patties in the present study generally followed trends opposite those observed for fat.

Hunter L* and a* values of ground beef patties (Table 3) were higher ($P<0.05$) with 0mg/hd/d compared with 50mg/hd/d. Increased D)F increased ($P<0.05$) redness values for patties. Patties from the chuck has increased ($P<0.05$) L*, a* and b* values compared with patties formulated from the round or round plus carrageenan. Round patties with added carrageenan were redder ($P<0.5$) than round patties without additives. Brewer *et al.* (1992) reported ground beef patties with carrageenan were redder than those without carrageenan. Other researchers have reported no difference in Hunter colour a* values between low-fat ground beef patties and low-fat ground beef patties with added carrageenan. Patties from chucks had higher ($P<0.05$) ■E values than either of the round formulations.

There were no differences ($P>0.10$) among treatments for cook loss, shear force or percent change in patty thickness. Cooking caused ($P<0.01$) differences in diameter shrinkage among cut types(chuck=14.75±0.65; round=12.50±0.67; round plus carrageenan=11.88±0.65% shrink) but not among bST or DOF treatments. Although no similar research was found for beef, lack of differences between bST-treated and non-treated beef patties is consistent with similar research on pork. Prusa *et al.* (1990) found that porcine somatotropin had no detrimental effects on yields, shear values or colour of processed pork products.

CONCLUSION

Bovine somatotropin administration to cull cows had no negative effects on physical characteristics of ground beef patties. Cook loss and shear force were not affected. DOF and bST improved leanness of beef patties which matches consumer demands for leaner meat products. Increased DOF improved redness values of beef patties.

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Table 1. Carcass characteristics of cows administered bST.

Variable	Mean	Minimum	Maximum	Std Dev.
Live weight, kg	547.47	455.41	631.41	43.24
Hot carcass weight, kg	351.17	259.09	487.27	47.24
13th rib backfat, cm	1.11	0.31	2.92	0.53
m.longissimus areas, cm^2	88.28	63.36	139.48	14.33

Table 2. Proximate composition of ground beef patties from cows administered bST.

Primal cut Variable Level bST Days on feed	Chuck Moisture	Fat	Protein	Ash
0 bST				
21 days	63.03^{x}	17.64^{v}	19.80	0.84^{x}
42 days	65.24^{y}	14.49^{w}	21.30	0.86^{x}
25 bST				
21 days	65.06^{y}	15.96^{x}	18.87^{x}	0.87^{x}
42 days	69.54^{z}	9.33^{y}	23.10^{y}	0.95^{y}
50 bST				
21 days	65.12^{y}	16.65^{vx}	19.80	0.82^{x}
42 days	69.08^{z}	10.39^{z}	20.80	1.06^{y}
s.e.m.[a]	0.43	0.35	1.31	0.04

Primal cut Variable Level bST Days on feed	Round Moisture	Fat	Protein	Ash
0 bST				
21 days	69.93^{x}	6.60^{x}	22.63	1.01
42 days	73.26^{y}	3.72^{y}	21.97	1.03
25 bST				
21 days	72.16^{y}	4.03^{yz}	19.70	1.10
42 days	68.84^{x}	4.90^{z}	24.60	1.04
50 bST				
21 days	72.99^{y}	4.16^{yz}	20.87	1.07
42 days	72.70^{y}	4.70^{yz}	21.83	1.04
s.e.m.[a]	0.43	0.35	1.31	0.04

[a] Standard error of least squares means for duplicate patties.

^{vwxyz} Least squares means in each column with same superscripts are not different ($P<0.05$).

Table 2 (cont). Proximate composition of ground beef patties from cows administered bST.

Primal cut Variable Level bST Days on feed	Round Plus Moisture	Fat	Protein	Ash
0 bST				
21 days	72.60^{x}	4.45^{x}	24.10^{x}	1.16^{x}
42 days	72.26^{x}	4.21^{xy}	24.03^{x}	1.18^{x}
25 bST				
21 days	74.51^{y}	3.38^{yz}	19.60^{yz}	1.32^{y}
42 days	75.15^{y}	3.16^{z}	20.23^{yz}	1.21^{x}
50 bST				
21 days	74.62^{y}	3.82^{xyz}	19.00^{y}	1.15^{x}
42 days	74.05^{y}	3.07^{z}	20.67^{xz}	1.35^{y}
s.e.m.[a]	0.43	0.35	1.31	0.04

[a] Standard error of least squares means for duplicate patties.
[vwxyz] Least squares means in each column with same superscripts are not different (P).

Table 3. Hunter colour values[a] of ground beef patties from cows administered bST.

Variable	Hunter L*	Hunter a*	Hunter b*	■E[a]
bST, mg/hd/d				
0	33.73^{x}	6.66^{x}	7.73^{x}	35.68^{x}
25	32.59^{y}	5.23^{y}	7.39^{yz}	33.48^{y}
50	32.55^{y}	5.62^{y}	7.49^{xz}	33.88^{y}
s.e.m.[b]	0.27	0.16	0.09	0.27
Days on feed				
21 days	33.17^{x}	5.60^{x}	7.62^{x}	34.51^{x}
42 days	32.75^{x}	6.07^{y}	7.46^{x}	34.16^{x}
s.e.m.[b]	0.22	0.13	0.08	0.22
Primal cut				
chuck	35.24^{x}	6.65^{x}	8.23^{x}	36.80^{x}
round	31.69^{y}	5.09^{y}	7.04^{y}	32.87^{y}
round plus	31.94^{y}	5.77^{z}	7.35^{z}	33.33^{y}
s.e.m.[b]	0.27	0.16	0.09	0.27

[a] Index = $(L^2 + a^2 + b^2)^{1/2}$
[b] Standard error of least squares means of Hunter L, a, b and ■E values.
[x,y,z] Means in columns for each variable with same superscripts are not different ($P<0.05$).