Value-added Processing Evaluations

Table 1. List of ingredients for cured and uncured brine and percentage of ingredients in final product

|  |  |  |
| --- | --- | --- |
| Product | Ingredient | Percentage in Final Product |
|  |  |  |
| Uncured | Water | 18.93 |
|  | Refined Sea Salt; Morton Salt, Chicago, Illinois | 1.20 |
|  | Evaporated Cane Juice Crystals; Florida Crystals Sugars, South Bay, Florida | 0.60 |
|  | Isolate Soy Protein, Supro-248; Solae Company, St. Louis, Missouri | 1.60 |
|  | PURE-DENT® Food Corn Starch, B-747; Grain Processing Corporation, Muscatine, Iowa | 0.75 |
| Cured | Water | 18.73 |
|  | Refined Sea Salt; Morton Salt, Chicago, Illinois | 1.20 |
|  | Evaporated Cane Juice Crystals; Florida Crystals Sugars, South Bay, Florida | 0.60 |
|  | Isolate Soy Protein, Supro-248; Solae Company, St. Louis, Missouri | 1.60 |
|  | PURE-DENT® Food Corn Starch, B-747; Grain Processing Corporation, Muscatine, Iowa | 0.75 |
|  | Veg Stable™ 504, Celery Powder; Florida Food Products, Inc., Eustis, Florida | 0.192 |
|  | Veg Stable™ 515, Cherry Powder; Florida Food Products, Inc., Eustis, Florida | 0.154 |

Table 2. Least Squares Means ± SEM of surface and interior L\*, a\* and b\* for diet and serving temperature

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | Treatment |  |  |  |  |
|  | Grassa |  | Graina |  | SEM |  | P > F |
|  | Served Hot | Served Cold |  | Served Hot | Served Cold |  |  |  | Diet | Serving Temperature | Diet\*Temperature |
| Surface L\* | 36.11 | 45.91 |  | 41.06 | 48.66 |  | 0.688 |  | <0.0001 | <0.0001 | 0.116 |
| Surface a\* | 8.86 | 9.73 |  | 9.04 | 8.94 |  | 0.247 |  | 0.211 | 0.128 | 0.057 |
| Surface b\* | 13.05d | 15.10bc |  | 14.58c | 15.39b |  | 0.212 |  | <0.0001 | <0.0001 | 0.005 |
| Interior L\* | 48.89 | 51.79 |  | 52.56 | 54.13 |  | 0.585 |  | <0.0001 |  0.0004 | 0.259 |
| Interior a\* | 10.73 | 12.37 |  | 9.80 | 10.65 |  | 0.377 |  | 0.001 | 0.002 | 0.302 |
| Interior b\* | 14.74 | 15.54 |  | 14.91 | 15.27 |  | 0.220 |  | 0.822 | 0.011 | 0.337 |

aGrass- animals finished on forage-based diet, Grain-animals finished on traditional grain-based diet

b,c,d Means in a row with different superscripts differ (P<0.05).

Table 3. Least Squares Means ± SEM of surface and interior L\*, a\* and b\* for diet and processing treatment

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | Treatment |  |  |  |  |  |
|  | Grassa |  | Graina |  | SEM |  | P > F |
|  | Controlb | Curedb | No Cureb |  | Control | Cured | No Cure |  |  |  | Treatment | Treatment\*Diet |
| Surface L\* | 39.08y | 45.21x | 38.75y |  | 41.55y | 48.89x | 44.15y |  | 0.842 |  | <0.0001 | 0.997 |
| Surface a\* |  9.15d | 10.58c |  8.18e |  |  8.56de | 11.14c |  7.27f |  | 0.302 |  | <0.0001 | 0.048 |
| Surface b\* | 15.34x | 13.21z |  13.67y |  | 16.05x | 13.87z | 15.03y |  | 0.260 |  | <0.0001 | 0.321 |
| Interior L\* | 49.33y | 50.39x |  51.31x |  | 51.69y | 53.79x | 54.55x |  | 0.716 |  | 0.005 | 0.732 |
| Interior a\* | 10.62y | 14.83x |  9.18z |  |  9.14y | 14.15x |  7.37z |  | 0.462 |  | <0.0001 | 0.457 |
| Interior b\* |  16.70x | 12.60z | 16.12y |  |  16.86x | 12.82z | 15.59y |  | 0.269 |  | <0.0001 | 0.311 |

aGrass- animals finished on forage-based diet, Grain-animals finished on traditional grain-based diet

bProcessing treatment; Control=no pump, Cured=Pumped with brine and celery powder, No Cure=pumped with brine

c,d,e,f Means in a row with different superscripts differ (P<0.05) for Treatment\*Feed interaction

x,y,z Means in a row with different superscripts differ (P<0.05) for Treatment main effect

Table 4. Least Squares Means ± SEM of surface and interior L\*, a\* and b\* for aging period and processing treatment

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | Treatment |  |  |  |  |  |
|  | 0 d Age |  | 28 d Age |  | SEM |  | P > F |
|  | Controla | Cureda | No Curea |  | Control | Cured | No Cure |  |  |  | Age | Treatment\*Age |
| Surface L\* | 40.84 |  46.41 | 41.57 |  | 39.79 | 47.70 | 41.33 |  | 0.842 |  | 0.997 | 0.377 |
| Surface a\* | 9.23 |  11.17 |  7.74 |  |  8.47 |  10.55 |  7.71 |  | 0.302 |  | 0.063 | 0.447 |
| Surface b\* |  15.96 |  13.67 |  14.15 |  |  15.42 |  13.40 |  14.55 |  | 0.260 |  | 0.515 | 0.183 |
| Interior L\* |  49.52 |  51.54 |  53.62 |  |  51.50 |  52.64 |  53.24 |  | 0.716 |  | 0.040 | 0.629 |
| Interior a\* |  10.55c | 14.53a |  7.62e |  |  9.21d |  14.46b |  8.94d |  | 0.462 |  | 0.935 | 0.022 |
| Interior b\* |  16.84 | 12.75 |  15.75 |  | 16.72 |  12.67 |  15.95 |  | 0.270 |  | 0.995 | 0.812 |

aProcessing treatment; Control=no pump, Cured=Pumped with brine and celery powder, No Cure=pumped with brine

b,c,d,e, Means in a row with different superscripts differ (P<0.05) for Treatment\*Age interaction

Table 5. Least Squares Means ± SEM of surface and interior L\*, a\* and b\* for serving temperature and processing treatment

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | Treatment |  |  |  |  |  |
|  | Served Cold |  | Served Hot |  | SEM |  | P > F |
|  | Controla | Cureda | No Curea |  | Control | Cured | No Cure |  |  |  | Serving Temperature | Treatment\*Temperature |
| Surface L\* | 44.92 | 51.10 | 45.85 |  | 35.71 | 43.00 | 37.05 |  | 0.842 |  | < 0.0001 |  0.803 |
| Surface a\* |  9.69c | 10.56b |  7.76d |  |  8.01d | 11.16b |  7.69d |  | 0.302 |  |  0.128 |  0.002 |
| Surface b\* | 17.12b | 13.56de | 15.07c |  | 14.27d | 13.53e | 13.63de |  | 0.260 |  | < 0.0001 | < 0.0001 |
| Interior L\* | 52.57bc | 52.34bc | 53.97b |  | 48.44d | 51.85c | 51.89c |  | 0.716 |  |  0.0004 |  0.048 |
| Interior a\* | 11.59c | 14.17b |  8.76d |  |  8.17d | 14.81b |  7.80d |  | 0.462 |  |  0.002 |  0.0003 |
| Interior b\* | 17.39 | 12.70 | 16.12 |  | 16.17 | 12.71 | 15.59 |  | 0.269 |  |  0.0110 |  0.084 |

aProcessing treatment; Control=no pump, Cured=Pumped with brine and celery powder, No Cure=pumped with brine

b,c,d,e, Means in a row with different superscripts differ (P<0.05) for Processing Treatment\*Serving Temperature interaction

Table 6. Least Squares Means ± SEM of Warner Bratzler shear force for serving temperature and aging period

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  | Treatment |  |  |  |  |  |  |
|  | Served Cold |  | Served Hot |  | SEM |  | P > F |
|  | 0 d Age | 28 d Age |  | 0 d Age | 28 d Age |  |  |  | Temperature | Age | Temperature\*Age |
| Kilograms | 3.99b | 3.92b |  | 3.91b | 4.43a |  | 0.145 |  | 0.160 | 0.137 | 0.047 |

a,bMeans in a row with different superscripts differ (P<0.05)

Table 7. Least Squares Means ± SEM of Warner Bratzler shear force for feed and processing treatment

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  | Diet |  |  |  | Treatment |  |  |
|  | Grassa | Graina | SEM | P > F |  | Controlb | Pumped-No Cureb | Pumped-Curedb | SEM | P > F |
| Kilograms | 4.29 | 3.84 | 0.103 | 0.003 |  | 4.55c | 3.83d | 3.81d | 0.146 | 0.0001 |

aGrass- animals finished on forage-based diet, Grain-animals finished on traditional grain-based diet

bProcessing treatment; Control=no pump, Cured=Pumped with brine and celery powder, No Cure=pumped with brine

c,d Means in a row with different superscripts differ (P<0.05)

Table 8. Least Squares Means ± SEM of thiobarbituric acid reactive substance (TBARS) assay for serving temperature and processing treatment

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | Treatment |  |  |  |  |
|  | Served Hot |  | Served Cold |  | SEM |  | P > F |
|  | Controla | Cureda | No Curea |  | Control | Cured | No Cure |  |  |  | Temperature | Treatment | Temperature\*Treatment |
| mg MDA/kg wet tissue | 1.77b | 1.10cd | 1.22bcd |  | 0.762d | 1.01cd | 1.39bc |  | 0.213 |  | 0.0806 | 0.449 | 0.019 |

aProcessing treatment; Control=no pump, Cured=Pumped with brine and celery powder, No Cure=pumped with brine

b,c,d Means in a row with different superscripts differ (P<0.05)

Table 9. Least Squares Means ± SEM of pump %, tumble % and cook loss % for feed and processing treatment

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | Treatment |  |  |  |  |
|  | Grassa |  | Graina |  | SEM |  | P > F |
|  | Controlb | Curedb | No Cureb |  | Control | Cured | No Cure |  |  |  | Diet | Treatment | Diet\*Treatment |
| Pump % |  0.088f | 37.45c | 37.22c |  |  0.16f | 27.50e | 30.19d |  | 0.008 |  | <0.0001 | <0.0001 | <0.0001 |
| Tumble % |  0.05e | 30.77c | 31.76c |  |  -0.11e | 22.66d | 23.18d |  | 0.010 |  | <0.0001 | <0.0001 | <0.0001 |
| Cook-Loss % | 33.25 | 34.03 | 34.33 |  | 32.27 | 32.82 | 33.32 |  | 0.010 |  | 0.191 | 0.557 | 0.993 |

aGrass-animals finished on forage-based diet, Grain-animals finished on traditional grain-based diet

bProcessing treatment; Control=no pump, Cured=Pumped with brine and celery powder, No Cure=pumped with brine

c,d,e,f Means in a row with different superscripts differ (P<0.05)

Table 10. Least Squares Means ± SEM of pump %, tumble % and cook loss % for serving temperature and aging period

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | Treatment |  |  |  |  |
|  | 0 d Age |  | 28 d Age |  | SEM |  | P > F |
|  | Hot | Cold |  | Hot | Cold |  |  |  | Age | Serving Temperature | Age\*Serving Temperature |
| Pump % | 21.7 | 22.0 |  | 22.0 | 22.7 |  | 0.007 |  | 0.454 | 0.524 | 0.770 |
| Tumble % | 17.7 | 18.0 |  | 17.9 | 18.7 |  | 0.008 |  | 0.556 | 0.518 | 0.796 |
| Cook-Loss % | 41.8a | 26.5c |  | 37.8b | 27.2c |  | 0.008 |  | 0.052 | <0.0001 | 0.005 |

a,b,c Means in a row with different superscripts differ (P<0.05)

Table 11. Sensory scores as affected by feed, serving temperature and aging period

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | Treatment |  |  |  |  |  |  |  |  |
|  | Grassa | Grassa |  | Grain | Grain |  |  |  |  |  |  |  |  |
|  | Served Cold | Served Hot |  | Served Cold | Served Hot |  | SEM |  | P>F |
|  | 0 Day | 28 Day | 0 Day | 28 Day |  | 0 Day | 28 Day | 0 Day | 28 Day |  |  |  | Feed | Serving Temp | Age | Temp\*Age | Feed\*Temp\*Age |
| Beefyb | 41.4gh | 38.0hi | 34.7i | 40.9gh |  | 41.2gh | 43.2g | 43.0g |  39.7gh |  | 1.62 |  | 0.010 | 0.246 | 0.728 | 0.353 | 0.002 |
| Saltyb |  29.9 | 29.1 | 27.2 | 25.2 |  | 25.5 | 22.7 | 24.8 | 23.3 |  | 1.98 |  | 0.009 | 0.252 | 0.225 | 0.958 | 0.682 |
| WOFb | 19.1hi | 19.4hi | 28.5g | 22.9gh |  | 22.7gh | 19.8hi | 14.8i | 22.2h |  | 2.13 |  | 0.091 | 0.225 | 0.897 | 0.459 | 0.011 |
| Soyb |  19.5 | 20.9 | 22.1 | 22.2 |  | 12.9 | 17.5 | 18.9 | 20.0 |  | 2.46 |  | 0.032 | 0.082 | 0.305 | 0.498 | 0.742 |
| Sweetb | 2.4 |  6.3 |  5.9 |  6.9 |  |  5.9 |  4.9 |  5.9 | 6.2 |  | 1.11 |  | 0.660 | 0.090 | 0.184 | 0.613 | 0.174 |
| Grassb | 3.7 |  5.9 |  5.4 |  7.1 |  |  3.0 |  2.4 |  1.6 | 2.6 |  | 0.99 |  | 0.001 | 0.584 | 0.135 | 0.711 | 0.476 |
| Otherb |  10.9 | 13.9 |  6.3 |  6.3 |  | 12.8 | 12.7 |  3.3 | 4.2 |  | 2.06 |  | 0.446 | 0.001 | 0.524 | 0.738 | 0.480 |
| Tenderc |  61.8 | 62.2 | 49.8 | 54.5 |  | 56.6 | 60.4 | 50.5 | 57.1 |  | 2.31 |  | 0.568 | 0.001 | 0.021 | 0.277 | 0.821 |
| Texturec |  44.5 | 44.1 | 40.3 | 41.6 |  | 46.3 | 43.2 | 43.8 | 47.7 |  | 2.38 |  | 0.125 | 0.484 | 0.804 | 0.211 | 0.432 |
| Juicyc |  65.2d | 63.1d | 42.2f | 51.4e |  | 54.5d | 54.2d | 40.0f | 46.5e |  | 2.30 |  | 0.002 | 0.001 | 0.046 | 0.008 | 0.497 |

aGrass-animals finished on forage-based diet, Grain-animals finished on traditional grain-based diet

bFlavor scores based on 100 point scale, 0=very bland and 100=very strong

cSensory scores based on 100 point scale, 0=very tough, very cohesive and very dry and 100=very tender, very mealy and very juicy

d,e ,f Means in a row with different superscripts differ (P<0.05) for Serving Temperature\*Aging Period

g,h,i Means in a row with different superscripts differ (P<0.05) for Feed\*Serving Temperature\*Aging Period

Table 12. Sensory scores as affected by feed, processing treatment and serving temperature

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  |  | Treatment |  |  |  |  |
|  | Grassa | Graina |  |  |  |  |
|  | Control | Cured | Uncured | Control | Cured | Uncured | SEM | P>F |
|  | Cold | Hot | Cold | Hot | Cold | Hot | Cold | Hot | Cold | Hot | Cold | Hot |  | Trt | Temp | Trt\*Temp | Feed\*Trt\*Temp |
| Beefyb | 41.9g | 28.3h | 38.8g | 42.4g | 38.4g | 42.8g | 43.7g | 38.3g | 40.3g | 41.9g | 42.3g | 43.9g | 1.97 | 0.023 | 0.246 | 0.001 | 0.091 |
| Saltyb | 1.7 | 3.4 | 40.3 | 31.4 | 46.5 | 44.1 | 2.0 | 3.0 | 35.7 | 31.8 | 34.6 | 37.3 | 2.43 | 0.001 | 0.252 | 0.066 | 0.634 |
| WOFb | 22.3lmno | 33.1k | 11.8q | 14.4pq | 23.6lmn | 29.6kl | 27.9klm | 18.0nopq | 15.6opq | 16.1opq | 20.3nop | 21.5mnop | 2.60 | 0.001 | 0.225 | 0.692 | 0.030 |
| Soyb | 3.2e | 1.9e | 31.3d | 32.1d | 26.1d | 35.5d | 2.2e | 4.9e | 22.2d | 25.0d | 21.4d | 28.5d | 3.01 | 0.001 | 0.082 | 0.322 | 0.922 |
| Sweetb | 0.4f | 3.2f | 6.5d | 9.4d | 6.1e | 6.6e | 0.7f | 1.4f | 10.4d | 10.1d | 5.2e | 6.8e | 1.36 | 0.001 | 0.090 | 0.931 | 0.500 |
| Grassb | 8.9 | 9.8 | 0.9 | 2.8 | 4.7 | 6.2 | 4.3 | 2.2 | 1.0 | 1.8 | 2.9 | 2.2 | 1.21 | 0.001 | 0.584 | 0.528 | 0.855 |
| Otherb | 14.3 | 10.2 | 9.9 | 1.4 | 13.1 | 7.3 | 11.9 | 5.6 | 12.5 | 2.8 | 13.9 | 2.8 | 2.52 | 0.097 | 0.001 | 0.509 | 0.819 |
| Tenderc | 50.1e | 36.0e | 65.4d | 59.6d | 70.6d | 60.9d | 50.1e | 43.3e | 62.9d | 56.4d | 62.6d | 61.6 d | 2.83 | 0.001 | 0.001 | 0.392 | 0.456 |
| Texturec | 31.3j | 37.4i | 46.9gh | 41.3hi | 54.7g | 44.2gh | 35.6j | 42.4i | 50.5gh | 45.9hi | 48.2g | 48.9gh | 2.91 | 0.001 | 0.484 | 0.010 | 0.357 |
| Juicyc | 55.9h | 27.6i | 69.3g | 56.3h | 67.3g | 56.6h | 46.2h | 28.7i | 61.2g | 49.8h | 55.7g | 51.2h | 2.82 | 0.001 | 0.001 | 0.001 | 0.509 |

aGrass-animals finished on forage-based diet, Grain-animals finished on traditional grain-based diet

bFlavor scores based on 100 point scale, 0=very bland and 100=very strong

cSensory scores based on 100 point scale, 0=very tough, very cohesive and very dry and 100=very tender, very mealy and very juicy

d,e,f, Means in a row with different superscripts differ (P<0.05) for Processing Treatment

g,h,i,j Means in a row with different superscripts differ (P<0.05) for Processing Treatment\*Serving Temperature

k,l,m,n,o,p,q Means in a row with different superscripts differ (P<0.05) for Processing Treatment\*Serving Temperature\*Feed

Figure 1. Grassy off-flavor scores as affected by feed, processing treatment and aging period

b

c

c

c

bc

 Figure 2. Grassy off-flavor scores as affected by processing treatment, serving temperature and aging period

cd

cd

cd

d

d

bc

ab

ab

a

bcd

bc

bc