The effects of two antimicrobials on tenderness and shelf-life stability of enhanced top sirloins from mature cows

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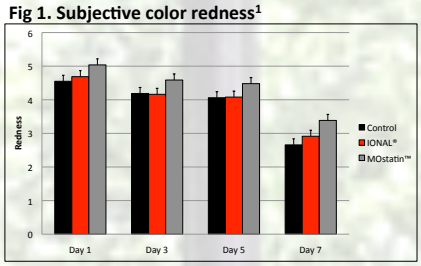
The objective of this study was to analyze the effects of MOstatin™ and IONAL® (World Technology Ingredients Inc., Jefferson GA) on cow top sirloins IMPS 184B (FPL Foods LLC, Augusta GA) in cooperation with FoodPAC (Food Processing Advisory Council) of Georgia. Top Sirloins (n=60) were procured on d 3 after slaughter, and injected on d 4 to achieve a 10% pickup with 0.5% NaCl and 0.4% Sodium Tripolyphosphate in the final product for control (CNT) plus 2% MOstatin™ (MO) or 1% IONAL® (IN). Muscles were then vacuum-packaged and allowed to rest for 10 days (0°C) to mimic storage and transportation time. Objective color (Minolta L*a*b*) and pH samples were taken before, immediately after, and 10 d after injection. After the 10 d rest period, steaks were cut (2.54 cm) and packaged (PVC overwrap) for shelf-life (SL) and stored under luminescence at 4±1° C for 7 d with objective and subjective color scores recorded daily. Subjective color was taken in 3 categories on an 8 point scale: overall acceptance (OA; 8=very acceptable, 1=unacceptable), color (COLOR; 8=light reddish-pink, 1=dark purple, brown), and discoloration (DIS; 8=no discoloration, 1=complete discoloration). Samples were taken on days 1, 7, and 14 for lipid oxidation analysis (TBARS). Steaks (2.54 cm) were also cut and aged (0°C) for Warner-Bratzler shear force (WBS) for analysis on d 10, 17, 24, and 31 post-injection. As these steaks were prepared for WBS, data for percent thaw loss (PTL), percent cook loss (PCL), cook time (CT), and endpoint temperature (TEMP) was collected. Pickup and purge data was collected.

There was a significant (P<0.05) decrease in L* values from before injection to 10 d after. An age x treatment interaction (P<0.05) was observed for both a* and b* values from before injection to 10 d after injection. There was a treatment x time interaction (P<0.05) for pH before, after, and 10 d after injection. L* values decreased significantly (P<0.05) from d 0 to d 7 of SL, however, there was no treatment or interaction effect (P>0.05). Values also decreased significantly (P<0.05) from d 0 to d 7 for a* and b*. Overall acceptance decreased (P<0.05) with age, but treatment had no effect (P>0.05). Subjective COLOR decreased (P<0.05) with age, while an age x treatment interaction was also observed (P<0.05). For DIS there was an interaction observed (P<0.05). There was an interaction (P<0.05) observed for TBARS, where IN TBARS level increased much slower over time than that of CNT and MO. Both treatments exhibited significantly (P<0.05) less PTL as compared to the CNT over time. The treatments also had significantly (P<0.05) lower PCL over time when compared to CNT. No significance (P>0.05) was observed for CT or TEMP. There was no significant difference (P>0.05) observed between age and treatment for WBS. The inclusion of MOstatin™ or IONAL® in enhancement solutions does not negatively impact the quality characteristics of cow top sirloin steaks.

Objectives

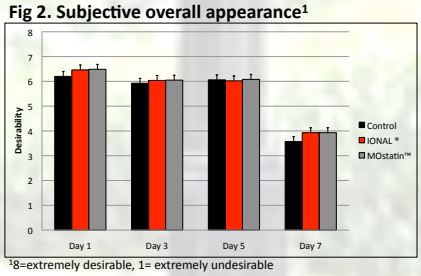
- To evaluate the tenderness of 184b steaks from each treatment using WBS at days 1, 7, 14, and 21
- To evaluate both objective and subjective color under shelf-life conditions
- To evaluate and compare lipid oxidation over time from each treatment

Fig 1. Subjective color redness[1]



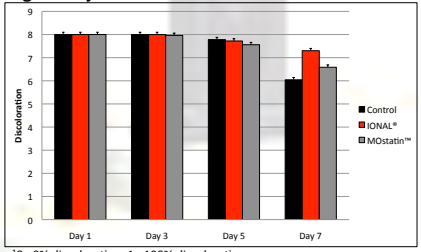
[1]8=light cherry red, 1=extremely dark red/brown
P<0.0001 for age
P<0.05 for treatment

Fig 2. Subjective overall appearance[1]



[1]8=extremely desirable, 1= extremely undesirable
P<0.0001 for age
P>0.05 for treatment

Fig 3. Subjective discoloration[1]



[1]8= 0% discoloration, 1= 100% discoloration
P<0.0001 for treatment X day interaction

Table 1. 184b pH before, immediately after, and 10 days post-injection

	Control	IONAL®	MOstatin™
Before	5.30^{az}	5.28^{by}	5.29^{bz}
After	5.59^{ay}	5.33^{ay}	5.38^{ay}
Day 10	5.68^{ax}	5.65^{ax}	5.65^{ax}

^{ab} Means in each row with different superscripts differ *(P<0.01)*
^{xyz} Means in each column with different superscripts differ *(P<0.0001)*
SEM=0.03

Table 2. Warner-Bratzler Shearforce

	Control	IONAL®	MOstatin™
Day 1[1]	2.96	2.53	2.84
Day 7[1]	2.65	2.42	2.71
Day 14[1]	2.85	2.54	2.60
Day 21[1]	2.90	2.61	2.66

P>0.05 for both treatment and age
SEM= 0.17
[1]Days after 10 d storage period post injection

Table 3. Cook data from WBS preparation

	Control	IONAL®	MOstatin™	SEM	P value
% Thaw loss[1]	2.55^{a}	1.09^{b}	1.69^{c}	0.16	P<0.0001
% Cook loss[2]	20.40^{a}	16.97^{b}	16.10^{b}	0.99	P<0.0001
Cook time[3]	29.38^{a}	26.2^{ab}	25.73^{b}	1.12	P<0.0001

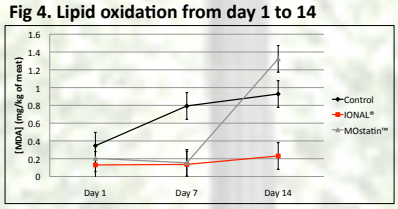
[1]Thawed weight/frozen weightX100
[2]Cook weight/thawed weightX100
[3]Time in minutes for the steaks to reach an internal temperature of 71°C
^{abc} Means within rows with different subscripts differ

Table 4. Pickup and purge loss

	Control	IONAL®	MOstatin™	SEM	P value
Pickup[1]	11.5970^{a}	9.8985^{b}	10.2355^{b}	0.43	P<0.0001
Purge[2]	1.8960^{a}	1.8905^{a}	2.2020^{a}	0.12	P<0.0001

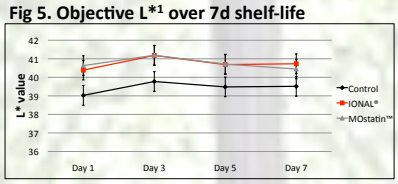
[1]Brine retained as a percent of green weight
[2]Purge loss after 10 days measured as percent of injected weight
^{abc} means in rows with different superscripts differ

Fig 4. Lipid oxidation from day 1 to 14



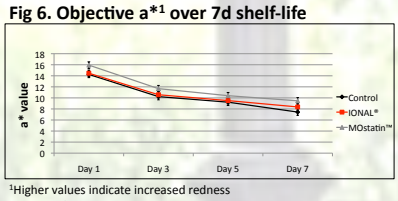
P<0.0001 for treatment X day interaction

Fig 5. Objective L*[1] over 7d shelf-life



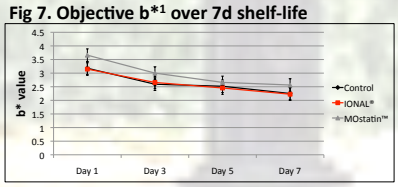
[1]0=black, 100=white
P<0.0001 for age
P>0.05 for treatment

Fig 6. Objective a*[1] over 7d shelf-life



[1]Higher values indicate increased redness
P<0.0001 for age
P>0.05 for treatment

Fig 7. Objective b*[1] over 7d shelf-life



[1]Higher values indicate increased yellow color
P<0.0001 for age
P>0.05 for treatment

Conclusion

- Both subjective and objective color decreased overtime.
- Overall acceptance also decreased overtime.
- Injection of IONAL® and MOstatin™ did not adversely affect tenderness or shelf-life stability in top sirloin steaks.
- IONAL® was found to impede lipid oxidation over a 14 day shelf-life.