Effects of two antimicrobials on tenderness and shelf-life stability of enhanced top-round roasts from mature cows

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Abstract

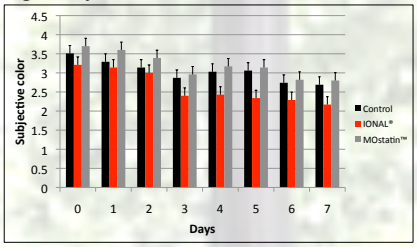
The purpose of this study is to examine the effects of MOstatin™ (MO), and IONAL® (IN) (WTI, Jefferson GA) on the physiochemical characteristics of top round roasts from mature cows (FPL Foods Inc., Augusta GA). Roasts were procured at day 3 after fabrication, and injected on day 4 to achieve a 10% pickup with 0.5% NaCL and 0.4% Sodium Tripolyphosphate in the final product. IN is composed of sodium citrate and sodium diacetate while MO is concentrated malt vinegar. After injection, samples were vacuum sealed and allowed to rest for 10d to mimic storage and transportation time. Before and after each injection pH measurements were taken as well as 10 days after. After day 10, 5cm roasts were fabricated for shelf-life and stored under luminescence at 4°C+/-1 for 7 days with subjective and objective(Minolta L*a*b*) color taken daily. Subjective color was evaluated on an 8 point scale in 3 categories: 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). At day 1, 7, 14 samples were removed for thiobarbaturic acid reactive substance analysis (TBARS). 5 cm steaks were fabricated at the same time fro Warner-Bratzler Shearforce (WBS). As roasts were prepared for WBS data was collected on thaw loss (TL), percent TL (PTL), cook loss (CL), percent CL (PCL), cook time (CT) and endpoint temperature (TEMP). Purge and pickup data was also evaluated.

After subjective measurements were taken it was observed that OA and COLOR decreased (P<0.05) as age increased. No treatment effects were recorded. For DIS there was a treatment x age interaction with an increase in DIS as age increased. L* values decreased (P<0.05) with age between day 0 and 7. Treatment had no effect and no interaction was observed. IN was shown to decrease (P<0.05) redness as compared to the control (CNT), and MO increased (P>.05) a* compared to IN. Also, a* decreased (P<0.05) over time between day 0 and day 7. A significant difference was observed between IN and MO with the b* of MO being more positive (P<0.05). Age also effected b* decreasing (P<0.05) the value from 0-7 days. A treatment x time interaction occurred for pH taken before, after, and 10 days after injection. IN and MO had significantly less (P<0.05) TL than CNT with MO being significantly greater (P>0.05) than IN. Age increased (P<0.05) TL between days 1 and 7, 1 and 14, and 7 and 21. There was no treatment x age interaction for P TL. CNT had a greater (P<0.05) P TL than IN or MO while IN exhibited reduced (P<0.05) PTL compared to MO. Also, increased (P<0.05) PTL was seen between day 1 and 7, 1 and 14 and day 7 and 21. No treatment x age interaction was observed for CL. A significant decrease (P<0.05) was observed in CL between CNT and both experimental treatments. CNT had an increase (P<0.05) PCL compared to both treatments, and IN show decreased (P<0.05) PCL when compared to MO. CT was significantly decreased (P<0.05) by age between 1 to 14, 1 to 21, and 7 to 21 days. There was no difference between treatment or aging for TEMP among treatments. MO was observed to have significantly more (P<0.05) purge loss than CNT and IN treatments. Brine pickup did not vary between treatments. WBS tenderness increased (P<0.05) between 1 to 7, and 7 to 21, but decreased (P<0.05) between 7 to 14 days.

Objectives

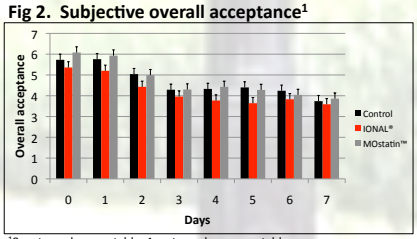
- Evaluate tenderness of roasts from each treatment via WBS at d1,7,14, 21.
- Evaluate and compare color readings both objective and subjective under retail conditions.
- Determine lipid oxidation over time and compare among treatments.

Fig 1. Subjective color redness[1]



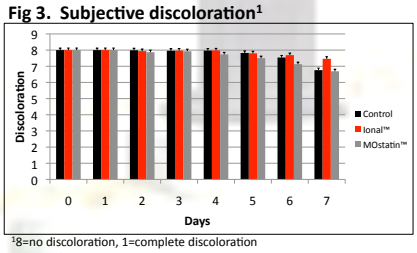
[1]8=light cherry red, 1=extremely dark red/brown
P<0.08 for treatment
P<0.001 for day

Fig 2. Subjective overall acceptance[1]



[1]8=extremely acceptable, 1=extremely unacceptable
P<0.27 for treatment
P<0.001 for day

Fig 3. Subjective discoloration[1]



[1]8=no discoloration, 1=complete discoloration
P<0.001 for treatment X day interaction

Table 1. pH variation due to injection

	Control	IONAL®	MOstatin™
Before[1]	5.56^{ax}	5.67^{ax}	5.55^{ax}
After[2]	5.72^{axy}	5.69^{ayz}	5.77^{ay}
Day 10[3]	5.78^{ay}	5.11^{az}	5.48^{by}

[1] Immediately before injection
[2] Immediately following injection
[3] 10 days following injection
SEM=0.05
^{abc} means in each row having different superscripts differ *(P<0.05)*
^{xyz} mean in columns with different superscripts differ *(P<0.001)*

Table 2. Warner-Bratzler shearforce

	Control	IONAL®	MOstatin™
Day 1[1]	3.12^{yz}	3.19^{y}	2.99^{yz}
Day 7[1]	2.86^{z}	2.52^{z}	2.71^{z}
Day 14[1]	3.89^{y}	3.17^{y}	3.21^{y}
Day 21[1]	3.26^{y}	3.01^{y}	2.77^{z}

P>0.05 for treatment
^{yz} means in columns with different superscripts differ *(P<0.001)*
SEM-0.20
[1]Days after 10 d storage period post injection

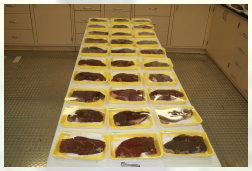


Table 3. Pickup and purge loss

	Control	IONAL®	MOstatin™	SEM	P value
Pickup[1]	9.87^{a}	11.17^{b}	10.44^{ab}	0.39	P<0.01
Purge [2]	2.44^{a}	2.48^{a}	3.54^{b}	0.22	P<0.01

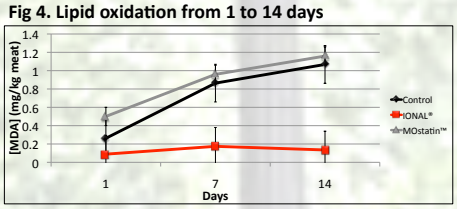
[1]Brine retained as a percent of green weight
[2]Purge loss after 10 days measured as a percent of injected weight
^{abc} means in rows with different superscripts differ

Table 4. Cook data from WBS preparation

	Control	IONAL®	MOstatin™	SEM	P value
%Thaw Loss[1]	2.04^{a}	0.75^{c}	1.28^{b}	0.14	P<0.01
%Cook Loss[2]	27.24^{a}	21.87^{c}	24.09^{b}	0.88	P<0.01
Cook Time[3]	59.33^{a}	60.73^{a}	58.63^{a}	1.18	P<0.01

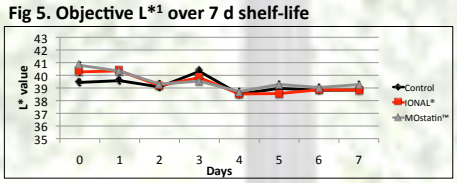
[1]Thawed weight/frozen weight X100
[2]Cooked weight/thawed weightX100
[3]Time in minutes for the roasts to reach 71°C internal
^{abc} means in rows with different superscripts differ

Fig 4. Lipid oxidation from 1 to 14 days



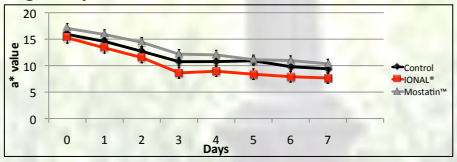
P<0.02 for treatment
P<0.001 for day

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



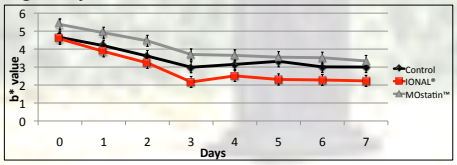
[1]0=black, 100=white
P<0.001 for day and treatment

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



[1]Higher values indicate increased redness
P<0.001 for day and treatment

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



[1]Higher values indicate more yellow color
P<0.001 for day and treatment

Conclusions:

- IONAL® impedes lipid oxidation over 14 d shelf life.
- Subjective and objective color decreased *(P<0.05)* over time.
- Overall acceptance decreased *(P<0.05)* overtime.
- Inclusion of IONAL® and MOstatin™ did not adversely effect tenderness or shelf-life stability of enhanced top round roasts from mature cows.