Effects of Noni puree vs. clarified Noni juice on quality characteristics of fresh ground beef patties

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Introduction

Noni (Morinda citrifolia) is an evergreen plant found in tropical regions of the world, and for hundreds of years this plant has been used in homeopathic remedies to treat ailments ranging from sprains and strains to cancer. Recently, juices from Noni have become popular in nutraceutical drinks for their immune-stimulating and antioxidant properties. Noni supplements have also improved growth and health in growing cattle (Yancey et al., 2011). Previous research has shown beneficial effects of Noni puree when added to ground beef (Tapp et al., 2010), with patties containing Noni puree having greater shelf life in retail display by one to two extra days and were less rancid. Unfortunately, trained taste panels rated the Noni patties lower in beef flavor and off-flavors.

Clarified Noni juice is derived from a filtering and repasteurization process of the Noni puree, and this product has the potential to have a less offensive effect on the flavor of ground beef patties. Thus, the objective of this study was to compare the effects of Noni puree and clarified Noni juice on the fresh color stability and lipid oxidation during simulated retail display.

Materials and Methods

Ground beef (85% lean) was obtained from a commercial processor, transported to the University of Arkansas, and stored at 34°F. Beef was mixed with either Noni puree or clarified Noni juice at 0, 2.5, or 5% in 20-lb batches (5 treatments with 5 batches / treatment) and ground once through a 3/8-inch plate. Patties (1/3 lb) were formed using a commercial patty-forming machine, and two patties from each batch were packaged on foam trays with overwrap and placed in simulated retail display for 5 d for visual and instrumental color evaluation. One patty was vacuum-packaged and frozen at -4°F; whereas, two additional patties were prepared on foam trays with PVC overwrap and transported to the University of Arkansas, and stored at 34 °F. Beef was mixed with 0, 2.5 or 5% Noni puree or clarified Noni juice and formed into 1/3 lb. patties. Over-wrapped patties were placed in retail display and evaluated by visual panelists for instrumental color for 5 days. Additional patties were placed in retail display for TBARS measurement (oxidative rancidity).

Additional patties were prepared on foam trays with overwrap and placed in simulated retail display for 5 d for visual and instrumental color evaluation. No fewer than 8 experienced panelists evaluated the packages of patties daily across the 5 d of display. Considering both patties, the panelists scored each package for total color, worst-point color, and percent discoloration using the following scales:

Total color and worst-point color scales:
1 = very bright cherry red
2 = bright cherry red
3 = dull red
4 = slightly dark red
5 = moderately dark red to tan
5.5 = borderline panelist acceptable
6 = dark red to brown
7 = very dark red to brown

Percent discoloration scale:
1 = 0 to 5% discoloration
2 = 6 to 20% discoloration
3 = 21 to 35% discoloration
4 = 36 to 50% discoloration
5 = 51 to 65% discoloration
6 = 66 to 80% discoloration
7 = 81 to 95% discoloration
8 = 96 to 100% discoloration

Panelists were instructed to consider worst-point color as the worst point of discoloration on the two patties, about the size of a dime. To evaluate instrumental color values of L*, a*, and b* (lightness, redness, and yellowness, respectively), each package of patties was scanned three times using the HunterLab MiniScan XE Plus (Hunter Associates...
Laboratory Inc., Reston, Va.) with Illuminant A and the 1-inch aperture size.

For TBARS analysis, patties were removed from the retail display case at their designated time, vacuum packaged and frozen at -4 °F. The TBARS assay was carried out according to the methods described by Witte et al. (1970) with modifications of Apple et al. (2001).

Data were analyzed in a 2 × 2 factorial, plus a control treatment structure, with batch as the experimental unit, but analytical design varied. For instrumental color, there was a repeated measure of day. For visual color, there was a repeated measure of day and the data were blocked by panelist. For TBARS, the design structure was a split-plot, with Noni treatment as the whole plot and day as the sub-plot. All data was analyzed in the mixed models procedure of SAS using the LSMEANS statement with the PDIFF option to separate the means. Contrast statements were used to specifically compare differences in LSMEANS statement with the PDIFF option to separate the means. Contrast statements were used to specifically compare differences in controls vs. Noni, puree vs. juice, 2.5% vs. 5%, and the interaction of Noni product and inclusion level, excluding the control.

Results and Discussion

Total color scores increased (P < 0.05) with increasing time in display (Fig. 1), which indicated that the patties were perceived as less red and browner with extended time in display. Within each day, the Noni-treated patties (puree and juice) were similar (P > 0.05) to control patties until day 5, when all the patties received scores above 5.5 (borderline panelist acceptable). Similarly, discoloration scores were greater (P < 0.05) with increasing time in display, but, within each day, Noni-treated patties were similar to controls (P > 0.05) from day 0 to 4. At day 5, control patties had greater (P < 0.05) discoloration scores than those treated with Noni puree, but all the scores were greater than 5, indicating greater than 51% discoloration.

As expected, fresh patties in display became less red (lower a*; P < 0.05) with increasing time in display; however, the analysis of variance revealed no Noni treatment differences (P > 0.05) in instrumental redness values (Fig. 2). Nevertheless, when the contrast statements were analyzed, it was determined that the Noni puree-treated patties were redder (P = 0.045) than those treated with Noni juice. On day 1, patties were lightest (greatest L*; P < 0.05), but no differences in Noni treatments were detected in lightness (P > 0.05). Patties also became less yellow (P < 0.05) with increasing time in display, but no differences in yellowness (P > 0.05) due to Noni treatment were found (L* and b* data not graphically presented).

Day 0 patties treated with 5% Noni juice had greater (P < 0.05) TBARS (a measure of oxidation) than control. 2.5% juice, and 5% puree. It was determined this was a scientific anomaly that self-corrected in day 3 samples. As was expected, TBARS values increased (P < 0.05) in the control patties with increasing days in display, and, on days 3 and 5 of display control patties had greater TBARS values (P < 0.05) than those treated with Noni. In addition, TBARS of patties containing 2.5% puree also increased (P < 0.05) from day 0 to day 3, but values were similar (P > 0.05) to patties treated with 2.5% juice and 5% puree, with little change between day 3 and day 5. Moreover, TBARS values did not change during the 5 days of display for patties treated with 2.5% juice and both 5% treatments, indicating that Noni treatment successfully-inhibited lipid oxidation.

Unlike the previously reported study (Tapp et al., 2010), Noni puree did not significantly improve ground beef color stability in retail display, and findings for Noni juice were similar to that of Noni puree. Several factors affect the fresh color of ground beef and it is not known why this trial was not as successful as that of Tapp et al. (2010). According to the TBARS results, Noni puree and juice were successful at inhibiting lipid oxidation during retail display.

Implications

The TBARS results demonstrated that Noni-incorporations inhibited lipid oxidation in ground beef during retail display. It is possible that Noni products could be used in processed meat products, such as pre-cooked beef patties or sausages, to inhibit oxidation and the development of off-flavors. Furthermore, Noni products may have potential to improve fresh color and inhibit oxidation in meat products that are more susceptible to oxidation, such as forage-fed beef or ground turkey.

Literature Cited


Fig. 1. Mean total color and discoloration scores for ground beef patties treated with 0 (control), 2.5, or 5% Noni puree or clarified Noni juice.

Fig. 2. Redness ($a^*$) of fresh ground beef patties treated with 0 (control), 2.5, or 5% Noni puree or clarified Noni juice and displayed for 5 days.
Fig. 3. Mean values for thiobarbituric acid reactive substances (TBARS, a measure of oxidative rancidity) of fresh ground beef patties treated with 0 (control), 2.5, or 5% Noni puree or clarified Noni juice and displayed for 5 days.