The inhibitory effect of a sodium free powder preservative on *Listeria monocytogenes* and lactic acid bacteria in turkey ham applications.

E. Heintz^{1*}, H.J. van Lent¹, K. Glass², M. Golden² and L.Vega³

¹Niacet bv., Tiel., Netherlands; ²Food Research Institute, Madison, Wisconsin;

³Niacet corp., Niagara Falls, New York. *Corresponding author email: Eelco.heintz@niacet.nl

Abstract – The research described in this short paper shows the antimicrobial efficacy of Provian[®] K, a sodium free powder antimicrobial for *Listeria monocytogenes* and Lactic acid bacteria in cured and uncured turkey ham applications. The high concentration of the product results in low dosage levels which are effective against *Listeria monocytogenes* and lactic acid bacteria. Moreover the concentrated powder formulation contributes to advantages in shipping and storage compared to often used liquids. The sodium free composition makes the product suitable for sodium reduction programs. This research provides the meat industry with a powerful acetate based antimicrobial to replace current sodium containing preservatives and liquids.

Key Words – Food safety, Shelf-life extension, Sodium reduction, Listeria control.

I. INTRODUCTION

Listeria monocytogenes is an opportunistic pathogen which is a threat for many foods which are kept refrigerated^{1,4}. Lactic acid bacteria (LAB) are a group of food spoiling bacteria which is usually not problematic for health. However, growth of food spoiling bacteria at refrigerated temperatures, even under modified atmosphere, causes much loss of foods.

Organic acids are proven effective antimicrobials against *Listeria monocytogenes* and LAB ^{2,3,5,6}. However, current organic acid based preservatives are diluted liquids in most cases and concentrated powder formulations are sodium based. This document evaluates the antimicrobial efficacy of an organic acid powder without any sodium content.

II. MATERIALS AND METHODS

<u>Manufacture of Turkey hams</u>: Deli-style turkey formulations were prepared using general FRI (WU) protocol. Analysed treatments: Control (no antimicrobials), 2.5% potassium lactate –sodium diacetate, 60% sol.(PL-SD), Provian[®]K, 0.25% 0.5% and 0.75%. Finished product targets included 75% moisture, 1.9% salt and 6.2-6.4 pH. Cured products contained 156ppm Na NO₂ and 547 Na-erythorbate. Turkey formulations in casings were cooked to 73.9°C (165°F), cooled overnight according to USDA Appendix B and aseptically sliced.

<u>Inoculum:</u> Surface was inoculated with approximately 3log CFU/g using a cocktail of various serotypes of *L. monocytogenes* or a cocktail or different species of LAB isolated from meat products. Inoculated slices were vacuum packaged in gas-impermeable bag. Packages were stored at 4° C and 7° C.

<u>Microbial analysis:</u> Inoculated samples of each treatment (n=3) were assayed by rinsing meat in Butterfield's phosphate buffer and hand massaging externally for 3 minutes. Rinsate was serially diluted and enumerated on appropriate media. *Listeria* populations were determined by surface plating on MOX agar (35°C, 48h); LAB plate counts were determined by plating on APT agar with bromcresol purple (25°C, 48h).

III. RESULTS AND DISCUSSION

The results are splitted in two subjects: 1. Food safety and 2. shelf-life extension.

1. Food Safety control in cured turkey and uncured turkey (Listeria inhibition), see figures 1-4.

- At 4°C all treatments show complete inhibition of *Listeria* for 12 weeks (Fig. 1 and 3).
- At 7°C 0.5% Provian[®]K shows comparable inhibition to with 2.5% PL/SD (P>0.05) (Fig. 4).
- In uncured meat 0.25% Provian[®]K shows comparable performance to 2.5% PL/SD (P>0.05) (Fig. 3).

2. Shelf life extension in uncured turkey (LAB inhibition), see table 1.

The results in table 1 are based on a challenge study in uncured turkey ham, inoculated with a cocktail of 4 LAB which were isolated from existing spoilage issues in the meat industry.

Treatment	Days to 6 logs at 4°C	Days to 6 logs at 7°C
No preservatives	5.5	2.5
KL/SD 2.5%	7.5	4.5
Provian [®] K 0.5%	9	5
Provian [®] K 1.5%	12	6.5

Table 1. Time (days) to end of shelflife (Lactic acid bacteria at 6 logs cfu/g)

Change in Populations of Listeria monocytogenes on Uncured



Figure 1. Change in populations of *Listeria monocytogenes* expressed as log CFU/ml rinse in uncured deli-style turkey breast during storage at 4°C for up to 6 weeks (n=3).



Figure 2. Change in populations of *Listeria monocytogenes* expressed as log CFU/ml rinse in uncured deli-style turkey breast during storage at 7°C for up to 6 weeks (n=3).



Figure 3. Change in populations of *Listeria monocytogenes* expressed as log Cfu/ml rinse in cured deli-style turkey breast during storage at 4°C up to 12 weeks (n=3)



Figure 4. Change in populations of *Listeria monocytogenes* expressed as log Cfu/ml rinse in cured deli-style turkey breast during storage at 7°C up to 10 weeks (n=3)

IV. CONCLUSION

This research shows the antimicrobial efficacy of a sodium free powder antimicrobial for *Listeria monocytogens* and Lactic acid bacteria. This implies that safety and shelflife can be increased by this product which provides the meat industry with a powerful acetate based antimicrobial to replace current sodium containing preservatives and liquids.

ACKNOWLEDGEMENTS

The authors would like to thank the knowledgeable and experienced team of FRI research and UW-Meat Science and Muscle Biology laboratory for the performance of this study.

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