

Title Active MAP of ready-to-eat lettuce: Efficient against browning and microbial spoilage, but not against *Salmonella* on the leaf surface

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Abstract

Oxidative enzymatic browning of cut edges and microbial spoilage caused by bacterial genera *Erwinia* and *Pseudomonas* are major deterioration causes in ready-to-eat lettuce. Furthermore, we have recently demonstrated that these two processes are interrelated and the presence of spoilage bacteria on cut surface significantly hastens the accumulation of phenolics in lettuce and concomitantly enhances browning severity. Modified atmosphere packaging (MAP) is commonly used to preserve the quality of minimally processed lettuce by inhibiting the oxidative browning and the growth of microbial populations. In passive MAP, generation of modified atmosphere by produce respiration typically takes one to several days. Initial displacement of air with a gas mixture of desired composition (active MAP) allows the avoidance of this transitional period, thereby improving the quality of the product. Sensory test has clearly demonstrated the superior quality of the produce in active MAP over the passive one in terms of appearance, taste and odor. The present work examined the effects of MAP on indigenous microbial populations and the survival of *Salmonella enterica* on the surface of the lettuce. Chlorine-washed leaves of romaine lettuce were inoculated with *S. enterica* serotype Typhimurium or not inoculated and packaged in one of the three systems: (a) passive MAP in polyethylene bags; (b) active MAP in the same bags with a gas mixture of 10% O₂, 10% CO₂, and 80% N₂; and (c) control without MAP. Active MAP had an antimicrobial effect on indigenous lettuce microflora, but not on *Salmonella* and even favored the survival of the pathogen, possibly due to the elimination of its natural antagonists. The effects of the passive MAP were less pronounced. Our findings demonstrate that, despite its effects against indigenous microflora, active MAP does not protect against *Salmonella enterica* on lettuce. The use of appropriate sanitation practices to prevent contamination remains the most important measure for ensuring the microbiological safety of ready-to-eat products.