
Critical Limit Summary for Shelf Stability of Beef Jerky and Related Products – includes SOPs for Vacuum Packaging of Heat-Treated, Shelf Stable Products, and Relating Product Yield to Water Activity and Moisture:Protein Ratio

During May – October, 2005, we conducted a study of the shelf-stability of jerky and related products during vacuum storage at room temperature. The results of this study have been published in a peer-reviewed scientific journal. A brief summary of the paper is provided below.

Background Current USDA standards require products labeled as jerky to have a Moisture:Protein Ratio (MPR) of 0.75 : 1 or lower. In the past meeting this labeling standard was regarded as also ensuring that pathogens wouldn't grow on the product, i.e. the product was shelf-stable. More recent guidance from USDA says that shelf-stability of jerky products should be evaluated in terms of water activity (a_w), not MPR.

Research Study: We evaluated the survival of *Staphylococcus aureus* and *Listeria monocytogenes* on 15 vacuum-packaged jerky-type products during room temperature storage. These two pathogens are the ones of greatest concern as post-processing contaminants. In particular, *S. aureus* is the pathogen best able to survive on products having a reduced a_w . Past microbiological research stated that *S. aureus* won't grow under anaerobic (no oxygen) conditions when the a_w is below 0.88.

Research Results The products tested had a_w ranging from 0.47 to 0.87. Neither of the pathogens grew on any of the jerky-type products. These results support the SOP for Oxygen-free packaging of heat treated, shelf stable products and the SOP for relating jerky yield to water activity and Moisture: Protein Ratio. Both of these SOPs follow.

Validated Critical Limits: Water activity of beef jerky must be no higher than 0.88 if product is to be stored in oxygen-free packaging or no higher than 0.85 if product is to be stored under air.

Ingham, S.C., G. Searls, S. Mohanan, and D.R. Buege. 2006. Survival of *Staphylococcus aureus* and *Listeria monocytogenes* on vacuum-packaged beef jerky and related products stored at 21°C. *Journal of Food Protection*. 69: 2263-2267. For more information contact: Steve Ingham, Extension Food Safety Specialist (608) 265-4801, scingham@wisc.edu August, 2007



SOP for Oxygen-Free Packaging of Heat Treated, Shelf Stable Products

All products will either be vacuum-packaged or an oxygen-scavenger will be inserted in the package along with the product and the bag then sealed under air. The bag size will be appropriate for the number of oxygen-scavenger packets added (per the oxygen-scavenger packet manufacturer's instructions).

All product packaged under oxygen-free conditions will be examined after sealing to ensure that the seal is secure. Product in packages that have a non-functional seal (e.g. leaking vacuum packages) will be re-packaged.

SOP for Packaging of Heat Treated, Shelf Stable Products under Air

All products packaged under air will be examined weekly. Any product with visible mold growth will be discarded.

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SOP for Relating Product Yield to Water Activity and Moisture:Protein Ratio

The following procedure will be followed FOR EACH FORMULATION OF PRODUCT.

1. Yield, water activity, and Moisture:Protein Ratio (MPR) will be determined for at least three lots. The sample size for each batch will be at least 6 pieces.
2. The data for calculating yield will be determined in-house by weighing the pieces at the start and end of processing. The yield will be calculated by dividing the finished weight by the starting weight, and then multiplying the resulting value by 100.
3. A testing laboratory will determine water activity, % moisture, and % protein on the same strips used for yield calculation. The MPR will be determined by dividing % moisture by % protein.
4. The results of each lot will be recorded.
5. To legally call a product jerky, it must have an MPR of 0.75 : 1 or lower. To ensure safety, the water activity must either be 0.85 or lower (product packaged under air), or 0.88 or lower (product packaged under oxygen-free conditions).
6. For other products, the MPR must be either 1.9 or lower, or 3.1 or lower with a pH of 5.0 or lower. The water activity must be either 0.92 - 0.95 if pH is 5.1 - 5.2, or no higher than 0.91.
7. The highest % yield for any lot that meets the applicable MPR and water activity limits will be noted. This value will be the targeted maximum % yield on future batches.
8. From this time on, the % yield for six pieces will be determined on each lot to ensure that drying is sufficient.
9. A sample of six pieces will be sent to a testing laboratory for water activity, % moisture, and % protein testing at least semi-annually, with one sampling during warm weather and one sample during cold weather. The maximum % yield value will be decreased if the semi-annual sampling indicates that water activity and MPR standards were not met.

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