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A Systematic Review of Alginate-Based Edible Coatings with Lemongrass Extract for Shelf-Life Extension of Fresh Beef in Nairobi, Kenya

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Abstract

Food loss in the meat supply chain, particularly within developing urban centres, presents considerable economic and public health challenges. In Nairobi, Kenya, the shelf life of fresh beef in butcheries is primarily limited by microbial spoilage and oxidative rancidity. Alginate-based edible coatings and lemongrass extract have been identified as potential natural preservation technologies, but their combined application for beef in this specific context lacks a systematic evaluation. This systematic literature review aims to synthesise existing research on the development and efficacy of alginate-based edible coatings incorporating lemongrass extract for extending the shelf life of fresh beef. It seeks to identify optimal formulations, application methods, and mechanisms of spoilage inhibition, with a specific focus on relevance to the Nairobi market context. A systematic search was conducted across multiple academic databases using predefined search strings. Studies were screened against strict inclusion and exclusion criteria, focusing on primary research involving alginate coatings, lemongrass extract, and fresh red meat. Data from selected studies were extracted and synthesised narratively to address the review objectives. The synthesis indicates that alginate coatings form a semi-permeable barrier, reducing moisture loss and oxidation. Incorporating lemongrass extract provides significant antimicrobial and antioxidant activity, primarily attributed to its citral content. A key finding is

that a lemongrass extract concentration within a specific range in the coating matrix optimally balances sensory acceptance with spoilage inhibition, extending beef shelf life by several days under refrigerated storage. Alginate-lemongrass edible coatings show promise as a natural intervention for preserving fresh beef. The technology aligns with trends towards clean-label products and could mitigate economic losses in Nairobi's butcheries. However, successful implementation requires consideration of local supply chains, cost, and consumer acceptance. Further research should focus on validating efficacy under local storage conditions, assessing cost-effectiveness for small butcheries, and evaluating consumer perceptions in Nairobi. Development of standardised protocols for coating preparation and application is also recommended. edible coating, alginate, lemongrass extract, beef preservation, shelf-life extension, food process engineering, Nairobi, Kenya. This review consolidates and critically evaluates the relevant scientific literature to inform the potential development and application of a specific natural preservation technology within the African food processing context, providing a focused evidence base for researchers and industry stakeholders.