Title	Physicochemical, microbial, and sensory parameters as indices to evaluate the quality of minimally-processed carrots
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Abstract

The quality of minimally-processed carrots was studied during storage at 4 and 10 °C by evaluating: (a) the physicochemical indices, namely: chlorogenic acid, carotenoids, sugars, and whiteness index (WI); (b) the microbial indices, namely: total bacterial count (TBC), coliforms, lactic acid bacteria, yeasts; (c) the sensory attributes, namely: fruity aroma, color (whitening), and off-odor. The kinetics of quality indices variation was determined, and the relationships between sensory perception of undesired changes, microbial contamination thresholds, carotenoid degradation, and physicochemical indices were investigated in order to select the most significant parameters to be controlled for evaluating carrot stability during storage. Results showed that chlorogenic acid concentration and WI increased following a pseudo-first order and a zero-order kinetics, respectively. Microbial population growth, fitted with the Gompertz model, showed that TBC and total coliforms reached the threshold concentration in a shorter time than other microbial groups (7 days at 4 °C and 3 days at 10 °C, respectively). Although the above described changes indicate that carrots underwent degradation, no carotenoid loss was observed during storage at 4 and 10 °C. Whitening and decrease in fruity aroma were perceived by a trained sensory panel of assessors after 5 days of storage at 4 °C (prior to the maximum acceptable microbial contamination), whereas off-odor was perceived 2 days later, when carrots attained the microbial contamination threshold. WI was correlated to the visual appearance of whitening and to the perception of off-odor. No correlation was found between the other physicochemical and microbial parameters and sensory attributes. Based on these results, WI was the most sensitive indicator of sensory quality of processed carrot sticks, and TBC together with total coliforms allowed the evaluation of their microbial quality.