Losses of bioactive polyacetylenes during minimal processing of carrots


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Introduction
Vegetables of the Apioideae family such as carrots, parsnip, celery and parsley, contain in minor quantities, a group of bioactive aliphatic C17-polyacetylenes (falcarinol, falcarindiol, falcarindiol-3-acetate). Recent studies have highlighted important biological functions in vitro and in vivo (animal studies) although the beneficial effect in human nutrition attributable to an increased in polyacetylenes diet are yet to be confirmed (Lund, 1990).

Carrots not only contain relatively high polyacetylene content but also form a significant part of many countries' dietary habits. Carrots are also present in some ready-to-eat foods such as chilled freshly prepared salads, as part of the increasingly popular minimally processed foods. Whereas the effect of conventional processing (boiling, vacuum processing) on the levels of polyacetylenes has been relatively well studied, the effect of minimal mechanical operations such as “peeling”, “mechanical cutting” and “chlorine washing” remains unknown.

Aim of the study:
To investigate 1) the effect of standard minimal processing procedures in the retention of polyacetylenes in carrots and 2) their changes after subsequent chill storage.

Results and Discussion
Effect of minimal processing on the levels of polyacetylenes
The results showed that the initial total polyacetylene levels of unprocessed carrots (>500 mg/kg dry carrot) were significantly decreased (p<0.05) following peeling and remained lower at the end of the minimal processing (Figure 1). This decrease was more evident when carrots were cut in disks (5mm thickness), cubes (5.0x5.0x5.0cm) on batons (4.0x5.0x5.0cm) and less when shredded. In terms of individual polyacetylenes, the same trend was observed (Fig. 1: results for “disks” and “cubes” are not shown).

After the stage of peeling where significant decrease was observed, there was no significant difference in losses for all three polyacetylenes during cutting and chlorine washing. In can be noted that falcarinol, the most bioactive of the polyacetylene family, was retained better than the rest during minimal processing although there was some variation in the HPLC measurements.

Extraction & HPLC analysis:
Freeze dried carrots were extracted using Accelerated Solvent Extraction (ASE) using Dionex ASE 350 equipment. Chromatographic separation of polyacetylene extracts was achieved on an Agilent HPLC with UV 208 nm detector using a gradient system of water and acetonitrile.

Discussion & conclusion
This work showed that the levels of polyacetylenes in minimally processed carrots are affected particularly during the initial mechanical operations (mainly during peeling as carrot skin is rich in polyacetylenes) and remain rather stable during short term chill storage. As polyacetylenes are potential health promoting compounds, their retention could be considered. Even if these mechanical operations are essential, there is scope for optimisation of conditions during peeling (the time in contact with chlorinated water during washing or size of carrot cut) to minimise the losses of polyacetylenes. These optimisations - that could come in the form of recommendations for processors - should however take into account the microbiological safety, the organoleptic quality as well as the equal retention of other bioactive present in carrots such as vitamins and minerals.

References