**Comparison of the nutritional quality of sous vide and conventionally processed carrot and Brussels sprouts**

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*Background and motivations of the work:*
In the last years, the "sous-vide" technique is increasingly gaining interest in both catering trade and in gastronomy. In such system of processing, foodstuffs are heated in a vacuum-packed container followed by rapid chilling and storage at 0-3 °C. Therefore, the lack of exposure to exogenous water and oxygen would be expected to preserve losses of antioxidants of vegetables due to leaching and oxidation. As this heat treatment is mild, most research has concentrated on the safety aspects, whereas few studies have tried to confirm the suggested nutritional advantages.
Recent studies seem to defy the notion that processed vegetables have lower nutritional quality than the raw ones, especially when the antioxidant capacity and profile are considered. In addition, different heating processes have different effect on such parameters depending on the vegetable composition.
In the present study the influence of the sous-vide technique on the nutritional quality of two vegetables (carrot and Brussels sprout) is analyzed and compared to oven steaming, a cooking practice commonly used in catering operation.

*Material and method:*
Freshly harvested carrots (*Daucus carota* L.) and Brussels sprouts (*Brassica oleracea* L. cv. *gemmifera*) of a single batch were purchased from a local market. Carrots, peeled before processing, were prepared by cutting off the top and bottom ends with a knife and extracting cylindrical specimens (diameter, 25 mm, height, 25 mm). Brussels sprouts were deprived of the external leaves. For sous-vide processing, a portion of each vegetable was evacuated in vacuum bags and cooked for 21 min in a steamer under steam at 98 °C, then the vegetables were chilled a rapid refrigerator and stored in a climatic chamber for up 10 days at 4 °C. At the 1$^{st}$, 5$^{th}$ and 10$^{th}$ day of storage, the sous-vide processed vegetables were reheated for 20 min in a water bath at 60 °C and chilled immediately. For each analysis, fresh carrot and Brussels sprouts were conventionally steamed in a Combi-Steal SL oven at 100 °C under atmospheric pressure for 30 and 17 min, respectively.
Carotenoids, polyphenols and ascorbic acid content were determined by HPLC. Total antioxidant capacity (TAC) was analyzed by three assays (ie., TEAC, TRAP and FRAP), as previously described (1). One-way-analysis of variance (ANOVA) at a 95 % confidence level was performed on results expressed on dry weight basis.

*Results:*

Preliminary results show that both heating procedures, sous-vide and steaming, had a positive effect on TAC and antioxidant profile values of carrot and Brussels sprouts, confirming previous results (1,2). However, during the storage of sous-vide vegetables analyzed a significant reduction of nutritional quality was observed.

*Conclusion:*
Our preliminary results seem to not confirm the suggested nutritional advantages of this technique compared to steaming, even though a slight different behavior was observed between the two vegetables analyzed.

Keywords: sous-vide; vegetables; oven steaming; total antioxidant capacity; polyphenols; carotenoids; ascorbic acid.

References:

Miglio C, Chiavaro E, Visconti A, et al. Effects of different cooking methods on nutritional and physico-chemical characteristics of selected vegetables. J. Agric. Food Chem. 2008, 56, 139-147.
Pellegrini N, Chiavaro E, Gardana C, et al. Effect of different cooking methods on colour, phytochemical concentration and antioxidant capacities of raw and frozen *Brassica* vegetables. J. Agric. Food Chem. 2010, 58, 4310–4321.