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**An investigation into the nutritional and
physicochemical properties of extruded products
containing tomatoes**

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Abstract

Extruded expanded products are becoming an important part of the diet in today's fast-paced life, however due to the presence of high amounts of fully gelatinised starch and low amounts of other nutrients, regular consumption of these products can result in health issues such as obesity and cardiovascular disease. Limited information is available on the addition of tomato derivatives that contain fibre and lycopene, the red pigment of tomatoes, to extruded products. Furthermore, the effect of extrusion processing on lycopene, especially how this process may affect lycopene bioavailability is not known. The aim of the present study was to evaluate the possibility of adding tomato derivatives, mainly tomato waste skin, to improve the nutritional value of extruded snacks without detracting from their organoleptic properties.

Varying the formulation of the extruded products showed that ingredients that have higher starch contents such as corn and rice as compared with wheat, and also lycopene sources that are resistant to shear such as tomato skin as compared with tomato paste, result in higher lycopene retention values in the final products. Although, the utilization of tomato skin alone resulted in hard and dense products, the addition of limited amounts of tomato paste to the tomato skin resulted in consumer acceptable products.

In-vitro digestion of the extruded products containing tomato derivatives showed that a large portion of the lycopene in the extruded products was released into micelles, thus it was potentially bioavailable. The uptake rate by Caco-2 cells (a human carcinoma cell line) from the extruded product was similar to the unextruded control. The utilization of tomato paste powder in the extruded snacks significantly reduced the starch digestibility, while tomato skin was less effective.

Finally, the majority of lycopene present in the extruded products containing tomatoes was shown to be inaccessible to solvent extraction and only after digestion was it able to be extracted. Enzymatic hydrolysis of the extruded product confirmed that lycopene was associated with the starch component of the food matrix and an amylolytic digestion procedure was required to break the bonds with starch and release the lycopene.

The findings from the present study confirm that it is possible to produce consumer acceptable extruded tomato products that contain bioavailable lycopene and fibre. The results obtained improve our understanding on the fate of heat-labile molecules such as lycopene during extrusion cooking and can have potential applications for the industry.

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- Dehghan-Shoar, Z., Mandimika, T. Hardacre, A.K., Reynolds, G.W., Brennan, C.S. (2011). Lycopene bioaccessibility and starch digestibility for extruded snacks enriched with tomato derivatives. *Journal of Agricultural and Food Chemistry*, 59(22): 12047-12053.
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