

Bioactive Molecule Formation During Thermal Processing of Vegetable and Fruit Puree (Baby Food)

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Description

Are processed foods better or worse for the health? Processed foods can change their chemical composition and obtain end products that were not there at the beginning. Heat processing of foods has been traditionally considered as a possible source of components with adverse health effects for example, furan, acrylamide Hydroxymethylfurfural (HMF), or 3-Monochloropropano-1,2-Diol (3-MCPD) could be formed. Assessing whether treatments at high pressure and temperature (autoclave) applied in the processing of certain fiber-rich vegetable foods result in more or less healthy foods is a major challenge. In this case, the presence of an active molecule, the 4,5-Dihydro-2-Cyclopenten-1-one (DHCP), in heat-processed fruit and vegetable puree marketed as baby food has been investigated.

Baby food is subjected to high pressure and temperatures in order to sterilize and thus have a long shelf life. We have detected for the first time these DHCP during thermal sterilization of pectin rich foods [1]. Pectin is a water-soluble indigestible polysaccharide, present in all fruit and vegetable and in most plant-derived food and DHCP is a molecule that is formed from uronic acid, the main monomer of pectin, when the pectin is exposed to high temperature. This small molecule has shown high cytotoxic activity on several cancer cell lines [2], induces cell death in colon cancer cells via induction of mitochondrial ROS [3] and is able to inhibit CT-26 tumour growth in colon cancer cells implanted in mice [4].

In addition, DHCP attracts attention due to its potential antiviral and anti-inflammatory effects [5]. It becomes very important to determine whether DHCP can represent a health-promoting component. Its structural similarities to prostaglandins, a family of biologically active molecules present in the human organism, which are able to react with certain cellular proteins resulting in antioxidant, anti-inflammatory, anti-carcinogenic and antiviral effects [6,7], may explain the beneficial effects. The presence of a cyclopentanone ring and an α , β -unsaturated carbonyl group (*) in both DHCP and cyclopentenone prostaglandins is the key to this structural similarity (Figures 1-3). Its potent electrophilia is the reason for its high reactivity forming covalent adducts with nucleophilic residues -SH or -NH₂ of free amino acids and protein as we have demonstrated in the previous study [1]. Therefore, it is important to determine whether these adducts are bioactive, reversible, and safe. This high temperature/pressure treatment occurs not only during industrial production of fruit and vegetable purees as baby food, but also when using a pressure cooker at home in our daily life.

Vegetable and fruit purees marketed as baby foods are also used in some situations by the elderly. Children and elderly are two population groups in which good nutritional support is particularly important, especially when they suffer from certain pathologies that make digestion difficult, two population

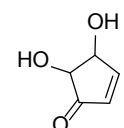


Figure 1. Chemical structure of 4,5-dihydroxy-2-cyclopenten-1-one (DHCP). **Note:** * electrophilic α , β -unsaturated carbonyl group.

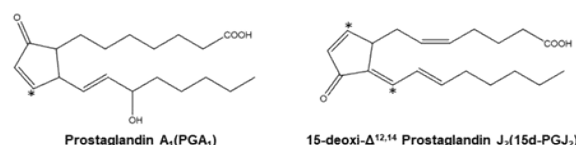


Figure 2. Molecular formula of cyclopentenone prostaglandins (cyPGs). **Note:** * electrophilic α , β -unsaturated carbonyl group.

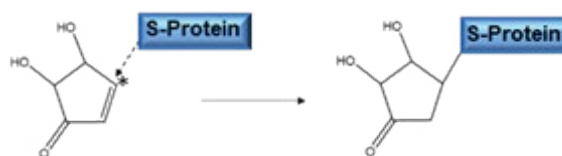


Figure 3. Mechanism of protein addition by DHCP. Electrophile, with α , β -unsaturated carbonyl, react with nucleophile group such as thiol group in protein and form adduct via Michael-type conjugation reaction.

groups in which good nutritional support is especially important, and when suffering certain pathologies that impair digestion. They are produced according to current legislation and following quality standards in order to provide appropriate nutritional value. The characterization of health-promoting properties in these products could have very positive repercussions for public health. But is this small active molecule and related adducts, formed in heat-processed foods rich in pectin, better or worse for health? Are homemade baby food made without heat treatment for sterilization healthier? Or do these compounds make it better? Only science will give that answer.

References

- Bermudez-Oria, A. et al. "Formation of a bioactive cyclopentenone and its adducts with amino acids in sterilized-fruits and vegetables baby foods. Formation of a bioactive cyclopentenone and its adducts with amino acids in sterilized-fruits and vegetables baby foods". *Food Chem.* 378 (2022):131983.
- Cheng, H., et al. "Comparative studies of the ant proliferative effects of ginseng polysaccharides on HT-29 human colon cancer cells". *Med Oncol.* 28.1(2011):175-181.
- Chen, L. et al. "Citrus-derived DHCPinhibits mitochondrial complex II to enhance TRAIL sensitivity via ROS-induced DR5upregulation". *J Biol Chem.* 296(2021).
- Guan, Y., et al. "Components of heat-treated *Helianthus annuus* L. pectin inhibit tumor growth and promote immunity in a mouse CT26 tumor model". *J Funct Foods.* 48(2018): 190-199.
- Koyama, N., et al. "Cyclopentenone, process for preparing the same, and the use thereof". *US patent.* 401: (2000).
- Oeste, CL., & Perez-Sala, D. "Modification of cysteine residues by cyclopentenone prostaglandins: Interplay with redox regulation of protein function". *Mass Spectrom Rev.* 33(2014):110-125.
- Grau, R., et al. "Inhibition of activator protein 1 activation,vascular endothelial growth factor, and cyclooxygenase-2 expression by 15-deoxy- Δ 12,14-Prostaglandin J2 in colon carcinoma cells: Evidence for a redox sensitive peroxisome proliferator-activated receptor- γ -independent mechanism". *Cancer Res.* 64 (2004): 5162-5171.