Effects of ultra-high-pressure homogenization treatment on the lipolysis and lipid oxidation of milk during refrigerated storage


Free fatty acid (FFA) release and quantification and lipid oxidation extent of ultra-high-pressure homogenized (UHPH) milk samples were evaluated to assess the effect of UHPH on the susceptibility of milk lipids to lipolysis and oxidation. Milk was UHPH-treated at 200 and 300 MPa with inlet temperatures of 30 and 40°C. UHPH-treated samples were compared with high-pasteurized milk (PA; 90°C, 15 s). Results showed that all FFA increased significantly during storage only in 200 MPa samples. Lipid oxidation was measured as an accumulation of lipid hydroperoxides as the primary oxidation product and malondialdehyde and hexanal as the secondary oxidation products. Samples treated at 300 MPa presented higher malondialdehyde and hexanal content compared with 200 MPa treated-samples and to PA milk.

Formation of lipid oxidation and isomerization products during processing of nuts and sesame seeds


The aim of the present study was to quantify some nutritional and safety quality parameter changes that take place in nuts (roasting) and sesame seeds (dehulling, roasting, milling, and sterilization) during processing. Such evaluation was based on chemical analysis of various indicators of quality changes and tocopherols and γ-oryzanol concentrations in rice bran oil during the refining process, Pestana, V.R., R.C. Zambiasi, C.R.B. Mendonça, M.H. Bruscatto, M.J. Lerma-Garcia, and G. Ramis-Ramos.

Lipids (November)

- Effect of conjugated linoleic acid and fatty acid positional distribution on physicochemical properties of structured lipids, Rocha-Uribe, A., and E. Hernandez
- Discrimination of chain positions in mixed short/long-chain glycerophospholines by NMR chemical shift variations, D’Arrigo, P.A., Mele, C. Rossi, D. Tessaro, and S. Servi
- NMR, GC–MS and ESI-FTICR-MS profiling of fatty acids and triacylglycerols in some Botswana seed oils, Mitei, Y.C., J.C. Ngilja, S.O. Yeboah, L. Wessjohann, and J. Schmidt
- Desorption of fructose from a packed column to an oleic acid/fructose oleate mixture for employment in a bioreactor system, Pyo, S.-H., and D.G. Hayes
- Thermal stability of immobilized lipase from Candida antarctica in glycerols with various water contents at elevated temperatures, Kobayashi, T., T. Matsuo, Y. Kimura, and S. A dashi
- Antioxidant evaluation of coriander extract and ascorbyl palmitate in sunflower oil under thermoxidation, Angelo, P.M., and N. Jorge

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lipid alteration in raw and processed pistachios, almonds, peanuts, and tahina. Lipid oxidation was assessed by the evolution of lipid oxidation products including hydroperoxides, p-anisidine, and thiobarbituric acid-reactive substances, as well as carboxymethyllysine (CML) and trans fatty acids (tFAs). All these parameters were significantly affected by the different processing stages, especially by roasting and sterilization (tahina). Nut roasting and sesame heat treatment increased the primary (hydroperoxides) and secondary (aldehydic compounds) lipid oxidation products, with the p-anisidine value reaching 6–11.5 and thiobarbituric acid-reactive substances 3–5 mg/kg (equiv of malondialdehyde) in the different end products. In addition, roasting led to the formation of CML (between 12.7 and 17.7 ng/mg) and tFAs (between 0.6 and 0.9 g/100 g) in nuts and tahina, which were absent in the raw material. Roasting parameters appear as the critical factor to control to limit CML and tFA formation in the final product.

Effect of interfacial protein cross-linking on the in vitro digestibility of emulsified corn oil by pancreatic lipase


The objective of this study was to investigate the influence of globular protein interfacial cross-linking on the in vitro digestibility of emulsified lipids by pancreatic lipase. Corn oil-in-water emulsions (3% wt/wt) stabilized by either lecithin or [-lactoglobulin was prepared (pH 7). A portion of the [-lactoglobulin-stabilized emulsions was subjected to a heat treatment known to cross-link the adsorbed globular proteins (85°C, 20 min). Pancreatic lipase and bile extract were then added to each emulsion at 37°C (pH 7) and the evolution of the particle charge, particle size, appearance and free fatty acids released were measured over a period of 2 h. The rate and extent of lipid digestion did not differ greatly between lecithin and [-lactoglobulin stabilized emulsions, nor did it differ greatly for unheated (BLG-U) or heated (BLG-H) [-lactoglobulin-stabilized emulsions.

For example, the initial rate of lipid digestion was found to be 3.1, 3.4, and 2.3 mM fatty acids s⁻¹ m⁻² of lipid surface for droplets stabilized by BLG-U, BLG-H, and lecithin, respectively. Pancreatic lipase was able to adsorb to the droplet surfaces and access the emulsified lipids, regardless of the initial interfacial composition and the fact that some of the original emulsifier appeared to remain at the oil–water interface during digestion.

These results help to explain why the human body is so efficient at digesting dietary triacylglycerols.

Model studies on the degradation of phenylalanine initiated by lipid hydroperoxides and their secondary and tertiary oxidation products


The reaction of methyl 13-hydroperoxyoctadec-9,11-dienoate (MeLOOH), methyl 13-hydroperoxyoctadec-9,11,15-trienoate (MeLnOOH), methyl 13-hydroxyoctadec-9,11-dienoate (MeLOH), methyl 13-oxyoctadec-9,11-dienoate (MeLCO), methyl 9,10-epoxy-13-hydroxy-11-octadecenoate (MeLEPHOH), and methyl 9,10-epoxy-13-oxygen-11-octadecenoate (MeLEPCO) with phenylalanine was studied to determine the comparative reactivity of primary, secondary, and tertiary lipid oxidation products in the Strecker degradation of amino acids. All assayed lipids were able to degrade the amino acid to a high extent, although the lipid reactivity decreased slightly in the following order: MeLEPCO ≥ MeLCO > MeLEPHOH ≥ MeLOH > MeLOOH ≈ MeLnOOH. These data confirmed the ability of many lipid oxidation products to degrade amino acids by a Strecker-type mechanism and suggested that, once the lipid oxidation is produced, a significant Strecker degradation of surrounding amino acids should be expected.

The contribution of different competitive mechanisms to this degradation is proposed, among which the conversion of the
different lipid oxidation products assayed into the most reactive MeLEPCO and the fractionation of long-chain primary and secondary lipid oxidation products into short-chain aldehydes are likely to play a major role.

Lipid characterization of Mortierella alpina grown at different NaCl concentrations


Effects of sodium chloride (NaCl) concentration on the lipid and fatty acid profiles of the polyunsaturated fatty acid (PUFA)-producing fungus, Mortierella alpina SC9, were investigated. The cells were cultivated in the medium with four different NaCl concentrations (0, 1, 2, 4%) for 6 days. The lipid and fatty acid profiles were analyzed by thin-layer chromatography and gas chromatography. In the cultures with NaCl concentration up to 2%, PUFA accounted for over 50% of the total fatty acids (TFAs) of the cells.

Triacylglycerol (TAG) was the major lipid class, followed by monoacylglycerol (MAG) and diacylglycerol (DAG). TAG contained the highest proportion of arachidonic acid (C20:4n-6, AA), suggesting that AA was mainly stored in the TAG. Comparing cultures at different NaCl concentrations indicated that TFA and TAG contents were higher in cells grown at 2% NaCl. Similar results were found when 2% NaCl was added at day 3 of cultivation (late log phase).

In addition, the gene expression level of a TAG biosynthesis enzyme, diacylglycerol acyltransferase 2 (DGAT2), was higher in the NaCl-treated cells. This suggested that the increase of TFA and TAG contents might be related to the NaCl-stimulated DGAT2 expression.

Size-dependent lipid content in human milk fat globules


Human milk fat globules (HMFG) are considered to constitute a triglyceride-rich source of fat and energy. However, milk contains lipid particles at different sizes ranging from tens of micrometers to less than 1 μm. In particular, the physical, chemical, and biological properties of submicron sized particles are poorly described. Individual HMFG were analyzed using laser trapping confocal Raman spectroscopy, and their chemical signature was obtained and compared to 1, 5, and 10 μm globules. Significant differences in both lipid composition and relative lipid content were found between the classes of particles with different diameters.

A strong Raman peak at 1742 cm$^{-1}$ corresponding to the triacylglycerol core was detected in the 5- and 10-μm diameter globules, whereas in the smaller HMFG no detectable peak was found. In addition, the submicron particles produced Raman signals consistent with large quantities of unsaturated fatty acids. Moreover, cis and trans isomers of unsaturated fatty acids were found to be unequally distributed between large and small milk fat globules. Interestingly, trans unsaturated fatty acids were found only in 1- and 5-μm globules although more prominent in the 5 μm diameter range. This is the first evidence for size related differential lipid composition of various diameter classes of HMFG. The results suggest that the milk fat globule size distribution determines milk lipid composition.

In addition, large portions of the HMFG are secreted into milk conspicuously not for fat delivery. Thus, small HMFG may offer novel metabolic and nutritional functions.

Dietary combination of conjugated linoleic acid (CLA) and pine nut oil prevents CLA-induced fatty liver in mice


Conjugated linoleic acid (CLA) strongly prevents fat accumulation in adipose tissue of mice, even if hepatic fat deposition and insulin resistance are concomitantly observed. This study investigated the possibility of maintaining the antiadiposity properties of CLA while preventing adverse effects such as liver steatosis and hyperinsulinemia. To this end, mice were divided into three groups and fed a standard diet (control) or a diet supplemented with 1% CLA (CLA) or a mixture of 1% CLA plus 7.5% pine nut oil (CLA + P).

The combination of CLA + P preserved the CLA-mediated antiadiposity properties (70% fat reduction), preventing hepatic steatosis and a sharp increase in plasmatic insulin starting from the eighth week of CLA treatment. The assay of both fatty acid synthesis and oxidation in the CLA + P mice revealed a time-dependent biphasic behavior of the corresponding enzymatic activities.

A sudden change in these metabolic events was indeed found at the eighth week. A strong correlation between the changes in key enzymes of lipid metabolism and in insulin levels apparently exists in CLA-fed mice.

Furthermore, lower levels of lipids, in comparison with values found in CLA-fed mice, were observed in the liver and plasma of (CLA + P)-fed animals.