Influence of food processing on quality of products

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ACTIA
Research & Development projects

National programmes
ACTIA centers
INRA
French Companies

European programmes
ACTIA centers
European Research Institutes
European Companies
National Programmes

- 2002.32 « Role and influence of food processing and preservation on fish fatty acids (PUFAs) »

- 2003.22 « Impact of food processing on nutritional quality – ETNA »
National Programmes

2002.32 « Role and influence of food processing and preservation on fish fatty acids (PUFAs) »

Objectives: to get a better knowledge of the influence of preservation and processing on different kind of « fat » fish species regarding their nutritional value for consumer
National Programmes

**Different steps:**

- Evaluation of impact of process and preservation units: refrigeration/freezing/sterilisation/pasteurization/smoke-curing/marinading on PUFAs composition from mackerel.

- Evaluation of the impact of preservation and transformation process on quality of processed fish with commercial interest.
National Programmes

- Evaluation of influence of different sorts of cooking by consumers and restauration on PUFAs from different species of fish (grill, traditional cooking, microwaves, boiling, frying…)

**Results:**

Stability of PUFAs content with refrigeration and ice/modified atmosphere/non acid marinades/pasteurization/soft smoke-curing…..
Objectives: Study, measure and modelisation of the evolution of nutritional markers during processing of 4 food models: fried potatoes, stewed apples, beef burger and cooked ham.
National Programmes

- Study of the behaviour of nutrients studied during process and regarding process units parameters.
- Find a methodology adaptable to other products studying modelisation of the impact of technologies on nutritional quality of food.
National Programmes

**Successful results:**

- Obtention of qualitative data for all products studied
- Obtention of precise data for extreme process conditions (degradation or preservation)
- Obtention of predictive mathematical models allowing to define nutritional quality regarding process conditions (fried potatoes, stewed apples)
- Definition of a methodology to adopt for such studies
European Programmes

- OPTIM’OILS
- ICARE
European project

Optim’Oils

Valorisation of healthy lipidic micro-nutrients by optimising food processing of edible oils and fats
<table>
<thead>
<tr>
<th>Instrument:</th>
<th>Specific Targeted Research Project</th>
</tr>
</thead>
<tbody>
<tr>
<td>Thematic Priority 5:</td>
<td>Food Quality and Safety</td>
</tr>
<tr>
<td>Project n°:</td>
<td>FP6 – 2005 – FOOD 36318</td>
</tr>
<tr>
<td>Duration:</td>
<td>2007-2009</td>
</tr>
<tr>
<td>Consortium:</td>
<td>14 partners</td>
</tr>
<tr>
<td></td>
<td>9 countries</td>
</tr>
<tr>
<td>Manpower:</td>
<td>443 men-months</td>
</tr>
<tr>
<td></td>
<td>12,5 persons during 3 years</td>
</tr>
<tr>
<td>Total budget:</td>
<td>2 721 067 €</td>
</tr>
<tr>
<td>EC contribution</td>
<td>1 950 000 €</td>
</tr>
</tbody>
</table>
Why this collaborative project?
To give an answer...

How to increase the positive contribution of fats and oils in the nutritional status of the European population?

How to find a new healthy value in addition or synergy with the well known PUFAs ω3 & ω6 actions?
by a better valorization of the natural pool of micronutrients present in the oilseeds

Levels of x100 mg to x g / 100 g
### Choice of 5 micronutrients groups

- 3 *lipophilic*
- 1 *hydrophilic*
- 1 *amphiphilic*

<table>
<thead>
<tr>
<th></th>
<th>Effect on cholesterol levels</th>
<th>Antioxidant function</th>
<th>Anti-inflammatory properties</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tocopherols</td>
<td><img src="structure1.png" alt="Tocopherol structure" /></td>
<td><img src="antioxidant.png" alt="Antioxidant" /></td>
<td><img src="anti-inflammatory.png" alt="Anti-inflammatory" /></td>
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<tr>
<td>Sterols</td>
<td><img src="structure2.png" alt="Sterol structure" /></td>
<td><img src="antioxidant.png" alt="Antioxidant" /></td>
<td><img src="anti-inflammatory.png" alt="Anti-inflammatory" /></td>
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<tr>
<td>Co Enzym Q10</td>
<td><img src="structure3.png" alt="Co Enzym Q10 structure" /></td>
<td><img src="antioxidant.png" alt="Antioxidant" /></td>
<td><img src="anti-inflammatory.png" alt="Anti-inflammatory" /></td>
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<tr>
<td>Phenols</td>
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<td><img src="antioxidant.png" alt="Antioxidant" /></td>
<td><img src="anti-inflammatory.png" alt="Anti-inflammatory" /></td>
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<tr>
<td>Phospholipids</td>
<td><img src="structure5.png" alt="Phospholipid structure" /></td>
<td><img src="antioxidant.png" alt="Antioxidant" /></td>
<td><img src="anti-inflammatory.png" alt="Anti-inflammatory" /></td>
</tr>
</tbody>
</table>

CVD risk

OPTIM'OILS project presentation - January 2009 - a.rossignol-castera@iterg.com
(oleic) sunflower, rapeseed, soybean

16% 42% 35%

93% of the European oil market
How could we increase the pool of micronutrients in edible oils without supplementation?
By a new approach & optimization of the industrial oil technology
Of course, with respect of:

Sensorial acceptance

Safety
Quality
Stability
Cost
OPTIM’OILS is an exemple of the new Food Science approach of « reverse engineering »
Seeds → ??? Unit operation → Edible oils

Choice of oil markers = MICRONUTRIENTS + Optimization crushing and refining steps

Additional nutritional value $t = 0$ et $t = \text{end of shell life}$

New healthy claims EFSA/2010
The ICARE project
ICARE Project – COLL-CT-2005-516415

Impeding neoformed Contaminants Accumulation to Reduce their health Effects

➢ Reason of being of the project:
  possible health impact of severely heat-treated foods due to NFC formation

➢ Strategy adopted
  Evaluate NFC distribution in European food products
  Understand the impact of processing on NFC accumulation
  Develop a rapid, simple and low cost method for NFC monitoring
  Propose strategies to improve the final NFC content in foods

Kick off meeting 19-20 Jan 2006
The ICARE project
ICARE Project – COLL-CT-2005-516415

A collective research centered on Food Industry National Associations
ANIA – France
FIAB – Spain
FIPA – Portugal
FEDERALimentare – Italy
FFDI – Czech Republic

5 research centers and 3 technical centers
Agroparistech, LaSalle beaufvais – France
ITERG, CTCPA, IFBM, ACTIA centers – France
UNINA – Italy
DFA – Germany
CSIC – Spain
SMUIPCM – Slovakia

12 SMEs in potato crisps, bread crisps, biscuits, malt and infant formulas
ICARE
The objectives

Technological Devt
Reactions Modelling
Impact of processing
Alternative technologies

Analytical Control
Development and validation of an analytical tool for online monitoring of food NFC

Clinical studies
• Health impact of grilled versus steam diet in young healthy adults
• Health impact of infant formula versus Breast milk in infants

Validation at industrial scale
Of food safety improvement

Certification procedures
Analytical methods and process
General background of the ICARE clinical study

Some arguments for a role of heat-treated foods

- Mutagenic and carcinogenic NFC in heat-treated foods
  Hydrocarbon polycyclic hydrocarbons; Heterocyclic amines; Nitrosamines; acrylamide; furane; cyclic monomers...

- Pro-inflammatory and cytotoxic Maillard products
  Advanced Maillard products; carboxymethyllysine, oxysterols

- Increased consumption of severely heat-treated foods
  Extrudated, oven baked and/or fried cereal/potatoe products especially consumed by children and young adults

- Complexification of the food formulas
  Fortification with labile nutrients, source of NFC: infant formulas
Distribution of acrylamide level (µg/kg) in manufactured chips
A new technology

A sensor based on fluorescence analysis to measure in real time NFC composition in process food

ICARE European project
Fluorescence: a very sensitive technique of analysis to evaluate thermic treatment
Chimiometric tools to analyse images

Factor 1

Factor 2

Factor 3
Predictive models for prediction of NFC during process: example of acrylamide

ICARE Results
Activity

Impact of processing food on health

www.spectralys.fr
contact@spectralys.fr
Studies, diagnostic and advice

To improve quality of food products

Physicochemical analysis
Identify critical steps of processing
Evaluate performance of new technologies
Programmes for the future

KBBE-2010-2-4-02: Identification of the effect of processing on food contaminants
Thank you for your attention!