


Functional Meat Products with balanced ω -6/ ω -3 and antioxidants

Study of a real case

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Summary of the invention

Synergic combination of several **natural antioxidants** and **LC-PUFA** designed to positively influence in some physiological functions in the human being added to processed **meat products**

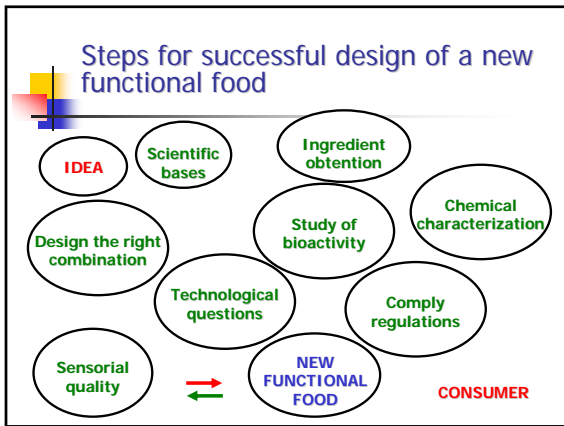
Food and health

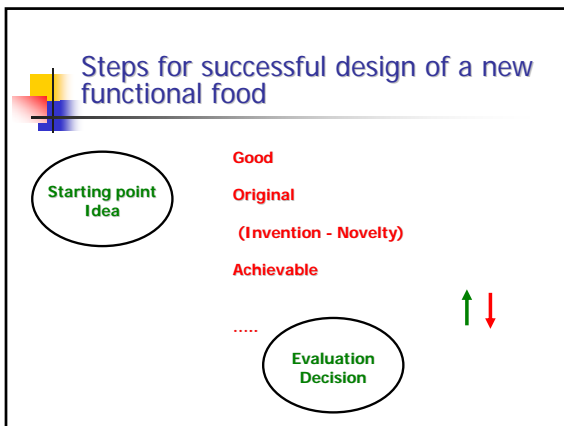
Scientific Foundations of Functional Foods

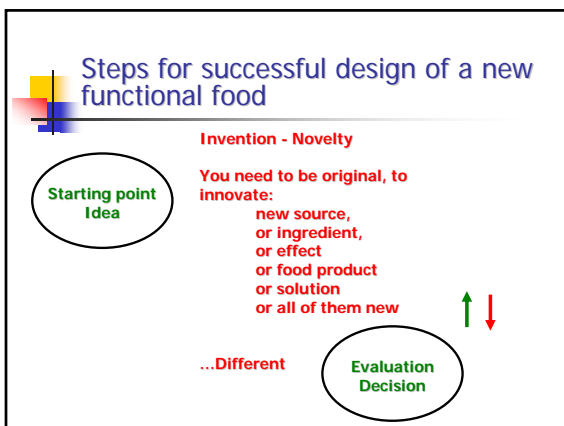
- Contribute to health promotion
- Reduce disease risk

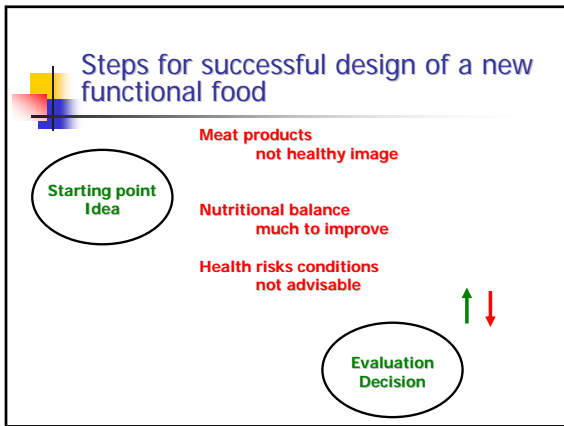
Benefit / Risk

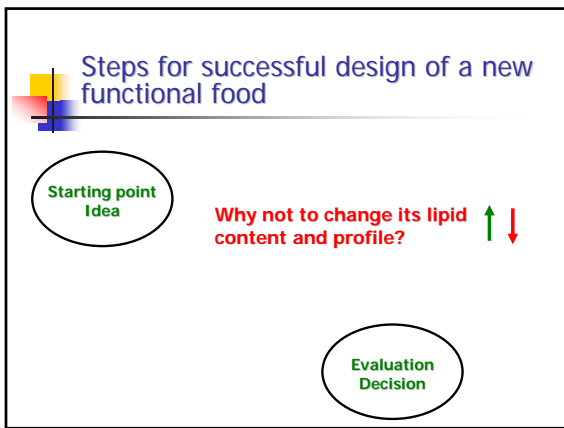


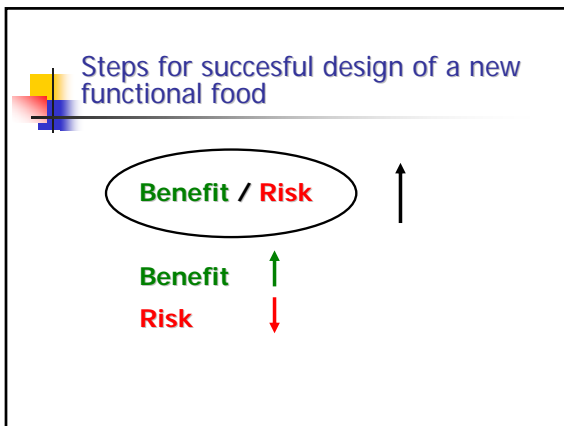


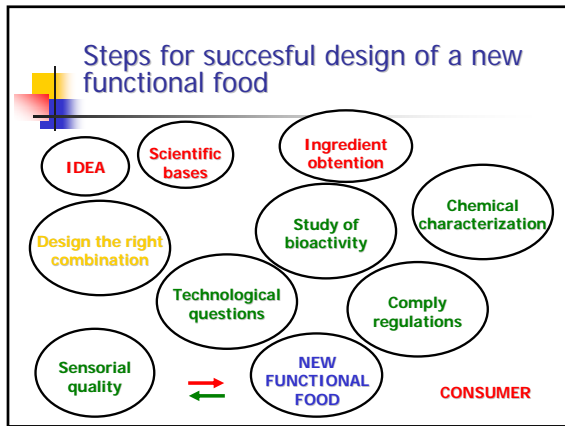


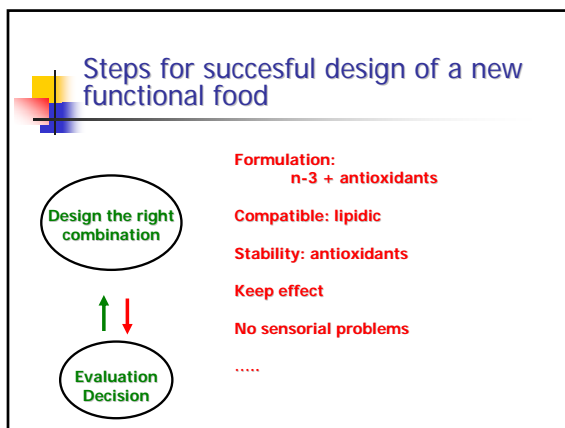


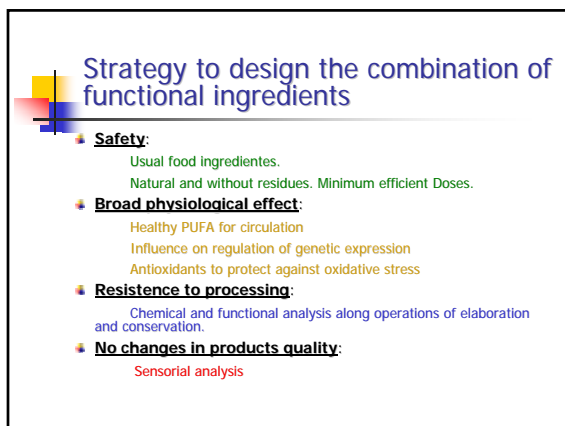


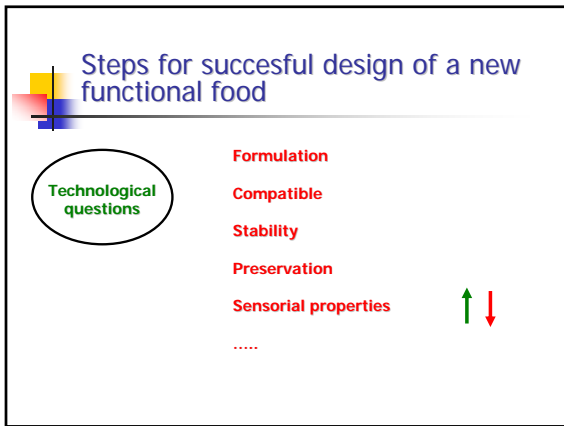


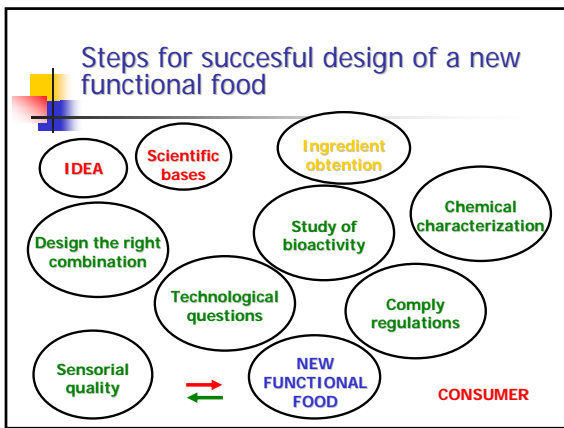


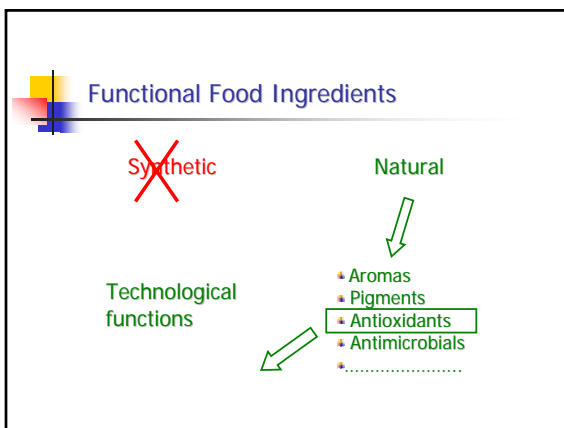













Food Ingredients. Natural and without residues

1.- **Starting point:**
Supercritical rosemary extract

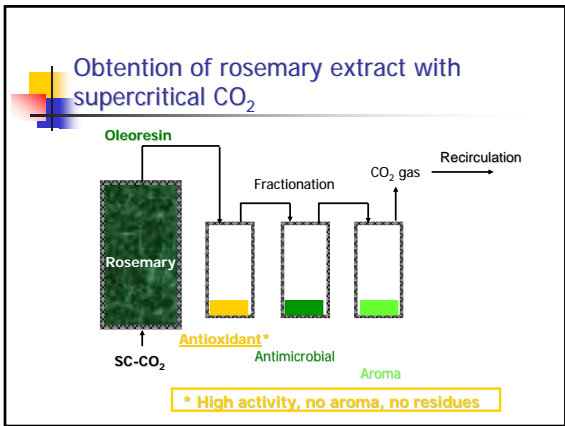
Functions:

- [Technological antioxidant](#)
- [Physiological antioxidant](#)

The main clean technology to obtain natural ingredients is supercritical fluid extraction



07/04/2006



Technological Antioxidant


- Rosemary compounds are good lipidic antioxidants

Phenolic diterpenes from rosemary as antioxidants in linoleic acid, methyl linoleate and corn oil triglycerides.
Hopia A.I., Shu-Wen H., Frankel E. *Food Chem.* 57 (1996) 57-67.

- Rosemary compounds are good antioxidants for PUFA

Activity of plant extracts for preserving functional food containing *n*-3-PUFA
Medina I., González M.J., Pazos M., Medaglia D.D., Sacchi R., Gallardo J.M.
European Food Res Technol. 217 (2003) 301 – 307.

Physiological Antioxidant

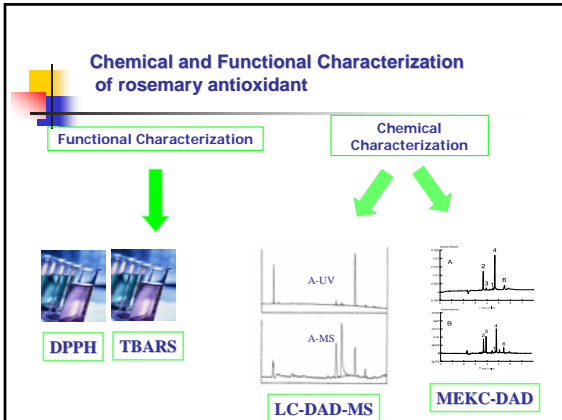


- Measurement of superoxide dismutase-like activity of natural antioxidants.
Seok J.K., Daeseok H., Kwang D.M., Joon S.R. *Biosci. Biotechnol Biochem* 59 (1995) 822-829.
- Antitumoral activity of rosemary components

Carnosic Acid Inhibits Proliferation and Augments Differentiation of Human Leukemic Cells Induced by 1,25-Dihydroxyvitamin Dsub3 and Retinoic Acid.
Steiner M., Priel I., Giat J., Levy J., Sharoni Y., Danilenko M.
Nutrition and Cancer 41 (2001) 135-144.

Chemical and Functional Characterization of rosemary antioxidant

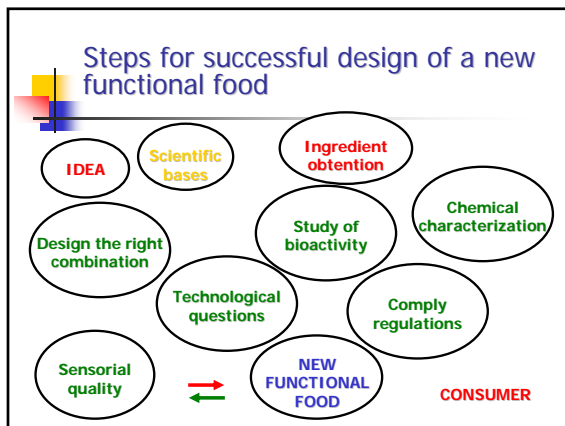
Functional Characterization Chemical Characterization

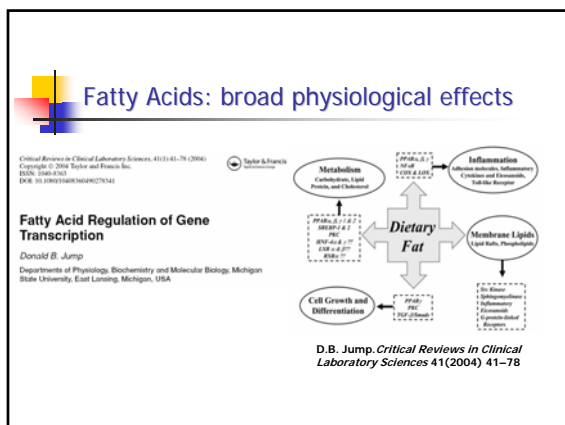


DPPH TBARS

A-UV A-MS

LC-DAD-MS MEKC-DAD





LC-PUFA: broad physiological effects

Table 2: Diseases affected by omega-3 fatty acid intake and potential mechanisms of action

Disease	Potential mechanisms of action of omega-3 fatty acids	Reference
Coronary heart disease and stroke	<ul style="list-style-type: none"> prevent arrhythmias (ventricular tachycardia and fibrillation) are prostaglandin and leukotriene precursors have anti-inflammatory properties inhibit synthesis of cytokines and mitogens stimulate endothelium-derived nitric oxide are antithrombotic have hypolipidemic properties with effects on triglycerides and VLDLs inhibit atherosclerosis 	31,33
Essential fatty acid deficiency during development	<ul style="list-style-type: none"> are an important constituent of the membrane phospholipids in the brain and retina 	34
Autoimmune disorders including lupus and rheumatoid arthritis	<ul style="list-style-type: none"> are involved in suppression of cell-mediated immune responses inhibit the function of macrophages inhibit the production or action of cytokines and eicosanoids stabilize renal function 	35,36
Inflammatory bowel disease	<ul style="list-style-type: none"> have anti-inflammatory properties inhibit interleukin-18 inhibit tumour necrosis factor production are free radical scavengers decrease platelet responsiveness 	37
Breast, colon and prostate cancers	<ul style="list-style-type: none"> inhibit tumour growth 	38
Rheumatoid arthritis	<ul style="list-style-type: none"> alter eicosanoid metabolism ameliorate inflammation 	39

Note: VLDL = very low-density lipoproteins.

LC-PUFA: main physiological effects

- PUFA n-6 and n-3 precursor of eicosanoids
- n-6 precursor of inflammatory eicosanoids

↓

Related to diseases like arterioesclerosis, diabetes, autoimmune diseases, ...

D.B. Jump. *Critical Reviews in Clinical Laboratory Sciences* 41(2004) 41–78

LC-PUFA: main physiological effect

- n-3 inhibit production of proinflammatory eicosanoids (especially long chain n-3 : EPA y DHA).

↓

DRI n-3: 150 mg (WHO) – 650 mg (ISSFAL)

i?

Strategy: Minimum effective quantity

LC-PUFA are easily oxidised:

- In food
- In human body
 - Oxidative stress
 - LDL oxidation

- Combination with antioxidants
- Avoid high concentration

ω-3 + antioxidants: Need of synergic combination



B. Demmig-Adams and W.W. Adams, III. *Science* 298 (2002) 2149-2153

Importance of antioxidants

✦ Rosemary: similar antioxidant activity for n-3 than olive oil polyphenols

Activity of plant extracts for preserving functional food containing n-3-PUFA.
Medina I., González M.J., Pazos M., Medaglia D.D., Sacchi R., Gallardo J.M. *European Food Res Technol.* 217 (2003) 301 – 307.

✦ High oleic sunflower protects LDL against oxidation less than olive oil

Sunflower oil does not protect against LDL oxidation as virgin olive oil does in patients with peripheral vascular disease.
Aguilera C.M., Mesa M.D., Ramirez-Tortosa M.C., Nestares M.T., Ros E., Gil *Clinical Nutrition* 23 (2004) 673–681.

Synergic Antioxidants


Tocopherols ↔ **Phenolic Diterpenes** ↔ **Carotenoids**

Effect of different lipid systems on antioxidant activity of rosemary constituents carnosol and carnosic acid with and without α-tocopherol.
Hopia A.I., Shu W.H., Schwartz K., German J.B., Frankel E.N. *J. Agric. Food Chem.* 44 (1996) 2030-2036.

Lycopene synergistically inhibits LDL oxidation in combination with vitamin E, glabridin, rosmarinic acid, carnosic acid, or garlic.
Fuhrman B., Volkova N., Rosemblat M., Aviram M. *Antioxid Redox Signal.* Fall/2 (2000)491-506.

Serum Carotenoids and α-Tocopherol and Risk of Nonmelanoma Skin Cancer.
Dorgan J.F., Boakye N.A., Fears T.R., Schleicher R.L., Helsel W., Anderson C., Robinson J., Guin J.D., Lessin S., Ratnasinghe D., Tangrea J.A., *Cancer Epidemiology Biomarkers & Prevention* 13 (2004) 1276-1282.

Synergistic Anti-Oxidative Effects of Lycopene with Other Bioactive Compounds.
Shixian O., Dai Y., Kakuda Y., Shi J., Mittal G., Yeung D., Jiang G. *Food Reviews International* 21 (2005) 295 – 311.




Vidalim®: n-3 Dosification

Strategy: Minimun effective quantity

American Heart Association Studies

n-3 Long-chain polyunsaturated fatty acids reduce risk of coronary heart disease death: extending the evidence to the elderly.
Harris WS. *Am J Clin Nutr* 77 (2003) 279-280.


Omega-3 fatty acids and cardiovascular disease: New recommendations from the American Heart Association.
Kris-Etherton PM, Harris WS, Appel LJ. *Arterioscler Thromb Vasc Biol* 23 (2003) 151-152.



Vidalim®: Dosification of ω-3 FA


The importance of the ratio omega-6/omega-3 essential fatty acids.
A.P. Simopoulos. *Biomedicine and Pharmacotherapy* 56 (2002): 365-379.

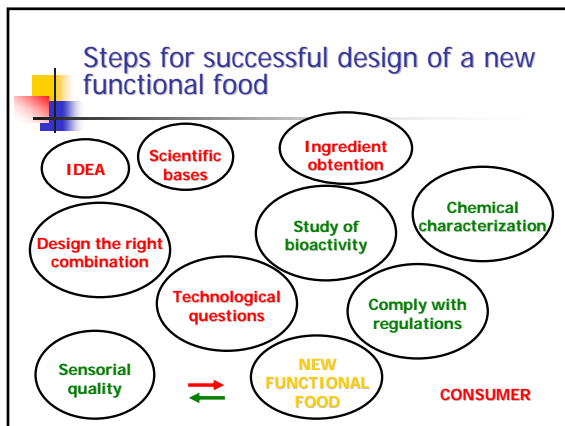
Origins and evolution of the Western diet: health implications for the 21st century.
Ordain L., Eaton S.B., Mann N., S. Lindeberg, Walkings N.B., O'Keefe J.H., Brand-Miller J. *American Journal of Clinical Nutrition* 81 (2005) 341-54.

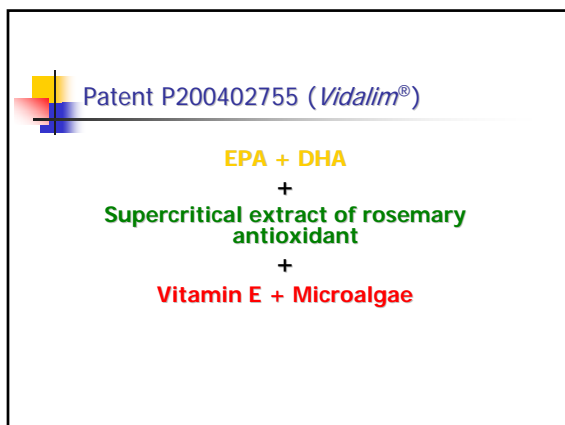


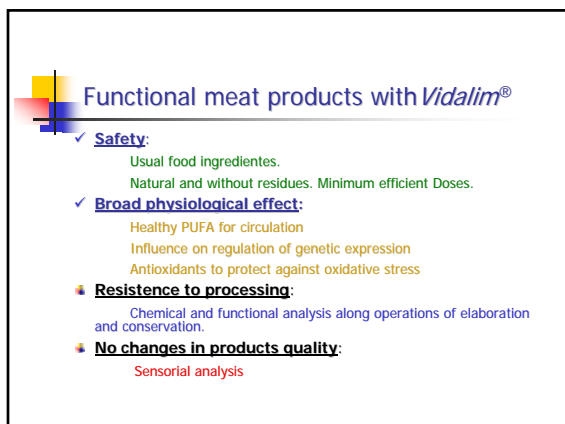
Vidalim®: efficient doses of n-3. Balanced

$n-6/n-3 < 4$









Functional meat products with *Vidalim*[®]

Results:
 Different Products (pork, turkey, etc)
 roasted, dry sausages, cooked,
 90 days in refrigeration
 90 days in refrigeration + frying

- ✦ **Keeping of PUFA profile**
- ✦ **Ok Antioxidant profile and activity**
- ✦ **No increasing in Oxidation Index**
- ✦ **No alteration of sensorial properties**

Results New Meat Product in the Market
 Patent P200402755 (*Vidalim*[®])

EPA + DHA
 +
Antioxidant of rosemary
Supercritical extract
 +
Vitamin E + Microalgae



Functional meat products with *Vidalim*[®]

- ✓ **Safety:**
 Usual food ingredients.
 Natural and without residues. Minimum efficient Doses.
- ✓ **Broad physiological effect:**
 Healthy PUFA for circulation
 Influence on regulation of genetic expression
 Antioxidants to protect against oxidative stress
- ✦ **Resistance to processing:**
 Chemical and functional analysis along operations of elaboration and conservation.
- ✦ **No changes in products quality:**
 Sensorial analysis

Functional meat products with *Vidalim*[®]

-  **Safety**
-  **Healthier meat products**
(n-6 = n-3)
-  **Heart protection effect**
[50 - 200 mg/100g n-3 long chain (between 1/3 and all DRI-WHO)]
-  **Contribuye a la prevención de enfermedades crónicas**
(n-6/n-3 < 4 + synergic combination of natural antioxidants)



Results New Functional Meat Product in the Market


High benefit with low risk



Functional Meat Products with balanced w-6/w-3 and antioxidants

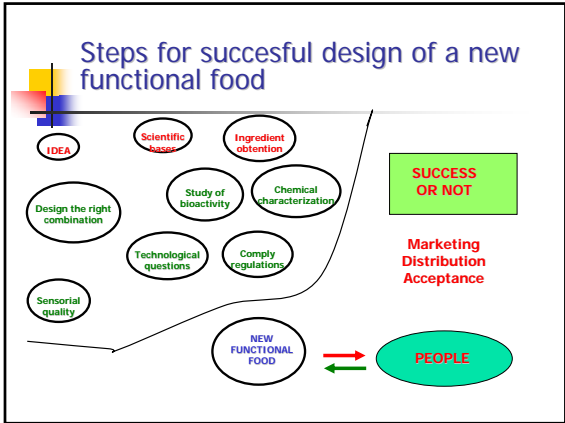
"Oily mixture of natural bioactive ingredients to prepare an enriched food product"

Patent P200402755 UAM-GRUPO FRIAL



Post-launching follow-up:
Functional meat products with *Vidalim*®

- Long-term studies
- Clinical studies (diabetes and Antioxidant activity)
- Quality control (changes in production or ingredients, No increasing in Oxidation Index, No alteration of sensorial properties, etc)



Acknowledgements

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