Science- Market – Regulation 1 Report

DAIRY NUTRITIONAL AND NUTRACEUTICAL INGREDIENT MARKET

2009

This comprehensive report is based on in-depth interviews with food companies completed by a desk review. It provides for DECISION MAKERS a global understanding of the sector as well as an outlook on its future.

MARKET ANALYSIS

Trends and outlook
Use of ingredients: volume-value
Manufacturers profiles
Users opinions
Regulation

FOOD SEGMENTS

Food industry
Functional food
Food supplements
Sports food
Cosmetics & Oral care
Clinical nutrition

INGREDIENTS

Whey proteins and fractions
Bioactive proteins
Bioactive peptides
Lactose derivatives
Minerals, vitamins
Minor elements: growth factors, CLA, lyzozyme, proteose peptones, oligonucleotides,etc

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REPORT FOCUS

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Applications in food segments

Use of ingredients: volume-values

Outlook

MANUFACTURERS

Food industry usages and needs

RESEARCH

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INTRODUCTION

The concepts of food are changing from a previous emphasis on survival, hunger satisfaction, absence of adverse effects on health, and health maintenance to a current emphasis on the use of foods which promise to promote better health and well-being, thus helping to reduce the risk of chronic illnesses such as cardiovascular diseases, some cancers and obesity, and also to improve specific health functions such as joint pain, tooth decay, etc

These new concepts are of particular importance in the benefits that they bring to the health of the elderly, in the improved quality of their later life, the continuous increase in life expectancy, the increasing cost of health care, technical advances in the food industry, and the growing pressure on security issues related to food products.

A number of studies indicate the growing demand from consumers for improved health, and at the same time, an increasing awareness of the link between nutrition and health. A study made by the International Food Council revealed that, in the United States, 70% of consumers had modified their eating habits for health reasons during the previous five years.

This explains in part the rapid growth in the markets for healthy foods; functional yogurts, enriched cereals and milk, nutritional supplements and sports drinks have all laid the groundwork for the development of a large and global nutraceuticals market.

The enthusiasm of the scientists and the dynamism of the industry stimulated by the growth of demand is pushing the health food sector. The nutraceutical market reached in 2006 US$ 22 billions in the USA, US$ 18 billions in Japan and US$8.5 billions in EU. With a $620 million industry, dairy nutraceutical ingredients are today at the forefront of the nutrition sector.

The dairy nutraceutical market can be segmented in 6 main families:

- **Whey and protein fractions**
- **Bioactive proteins**
- **Bioactive peptides**
- **Lactose derivative**
- **Minerals**
- **Others minors elements, growth factors, etc**

Nutri-functional properties

The major protein fractions in bovine milk include α-LA (lactalbumine), β-LG (lactoglobuline), caseins, immunoglobulins, lactoferrin, proteose-peptide fractions (heat-stable, acid soluble phosphoglycoproteins), and minor whey proteins such as transferrin and serum albumin.

It is well established that in vitro incubation of these milk proteins with gastrointestinal proteinase preparations enriched in pepsin, trypsin, and chymotrypsin activities results in the release numerous active peptides. Therefore it is likely that bioactive (antihypertensive and other physiologically active) peptides are generated during gastrointestinal transport.

Bacterial and plant proteinases can also be used to release active peptides. Therefore hydrolysates of whole milk protein, caseinates, whey proteins, and fractions enriched milk proteins are potentially good sources of bioactive peptides. There is considerable evidence that many bioactive peptides serve in multifunctional capacities and often share common structural features based on a defined, biospecific role.

So, as the digestion of dairy proteins by gastro-intestinal proteolytic enzymes releases some peptides (which are cut out then, by peptidases, in amino acids) the same result is obtained during the fermentation of milk by the enzymes of lactic bacteria. The definite sequences of amino acids are called "functional or active peptides": they are inactive within their proteins of origin, but present particular properties once released by enzymatic action.

Their physiological role can be exerted remotely in the organism or locally in the digestive tract. In the first case these peptides must be absorbed on the level of the intestine then transported by blood circulation, in the second case, they must resist the digestive enzymes during time necessary to their action.

Milk potentially contains major peptide fractions that elicit behavioral, neurological, physiological, and vasoregulatory responses.

Outlook of the market

Often, these peptides display multifunctional properties. Current knowledge on the identified physiological roles of functional peptides of milk makes it possible to distinguish six main effects:

- **hypotensive,**
- **antithrombotic,**
- **calcium & minerals transport,**
- **immunomodulation,**
- **opioid like,**
- **antimicrobial.**

These functions are detailed in the following table which also mentions the less important antioxidant and hypocholesterolemic action of milk peptides.

Effect	Active substance /effector
Opioid antagonist	Lactoferroxins, casoxins
Opioid agonist	α-lactorphins, β-lactorphins, casomorphin
Antimicrobial	lactoferrin, lactoferricin
Immunomodulatory	immunopeptides
Hypotensive (ACE inhibitors)	lactokinins, casokinins
Antioxidant	peptides derived from α-LA and β-LG
Hypocholesterolemic	peptides derived from β-LG
Antithrombotic	casoplatelin, casopiastrin
Mineral binding	caseinophosphopeptides

NEW MARKET TRENDS

Protein fractions

For example, the biological function of ***α-lactalbumin*** is to support the biosynthesis of lactose, one of the key osmotic regulator of milk secretion. Other biological functions are inhibition of epithelial cell growth, induction of apoptosis and a cell lytic activity, impact on serotonine metabolism in the brain and therefore influence on mood, stress, depression and sleep. Major application is infant formula. Other usages are in food supplements.

Casein Glyco Macro Peptide has been linked to the release of cholecystokinin (CCK) also called the satiety hormone. cGMP has therefore been shown to have an influence on the appetite control and satiety. CGMP is mainly used in food supplements today.

Other attractive fractions are lactoferrin, lactoperoxidase, lyzozyme, proteose-peptones.

Bioactive peptides

Casein phosphopetide has a remarkable ability to stabilize calcium phosphate in solution and to substantially increase the level of calcium phosphate in dental plaque. Laboratory studies have shown that casein phosphopeptides (CPP) have anticaries activity. Major applications are in oral hygiene. Recaldent™ a product marketed now by Cadbury Schweppes has sales over 200 mio $.

Lipid fractions

Conjugated Linoleic Acid also shows anti-atherogenic, immunomodulating, growth promoting, and anti-obese properties. CLA have also been reported recently to possess anti-diabetic properties. Certain strains of propionobacteria, commonly used as dairy starter cultures, were shown to be able to convert free linoleic acid to CLA, suggesting that it may be possible via fermentation to produce fermented food products enriched in CLA.

CLA has already debuted in foods and beverages in Europe, gained GRAS approvals in the U.S. and producers are making some major investments in consumer education. CLA may be about to become a lot more prominent on food developers' radar screens. It is considered as a possible next ingredient in the dairy consumer product market. Besides CLA others lipids fractions such as sphyngolipids are of interest.

Lactose derivatives

As prebiotics and sugar substitutes lactose derivatives covers a large and growing market.

Growth factors

Are also example of milk ingredients with potential interest and many products in development.

DAIRY NUTRACEUTICAL INGREDIENTS

Category	Ingredients	Nutraceutical properties
PREBIOTICS	Lactulose Lactitol Lactobionic acid Galacto Oligo Saccharides	Replacement of sugar, fat, calorie reduction Fibre enrichment Reduction of tooth decay Increasing of colonic bifidus
MILK PROTEINS	Milk proteins Whey proteins Casein	Stimulation of the immune system Antioxydant effect Satiety/ Bio transfer / antithrombic /immunomodulator
PURIFIED MILK FRACTIONS	Alpha-lactalbumin	Nervous system and behaviour Immune system defense
	Beta lactoglobulin	Pro vitamin A /rich in cystein
	Lactoferrin	Body fortification Immun system defense
	Lactoperoxidase	Intestinal confort Body's defense
	Proteose peptone	Anti toxin / calcium absoption
	Lyzozyme	Bacterial disease / biopreservative
BIOACTIVE PEPTIDES	CPP / cGMP/caseinopeptides	Body fortification /Satiety Nervous system and behaviour Immune system defense Intestinal transit
	Glutamine peptide	Energy/ wound healing/ critical ill neonates
	Anti hypertensive /stress peptides	Hypertension/stress
	Growth factors	Repair process/ bone healing/ CVD/Cancer
OTHERS	CLA	Anti artherogenic/obesity / immunologic
	Colostrum/ IgG	Immune system / gastrointestinal (GI) damage
	Phosphopeptide	Osteoporosis
	Oligonucleotides	Gastro intestinal/immune system
	Milk calcium	Body fortification
	Vitamins	Cancer prevention / Energy

Application SEGMENTS

The marketing of nutraceuticals remains a complex task. In Japan, for instance, according to CSPI, most products approved failed to address major public health issues.
Functional Food

The Dairy product segment is very dynamic with many new products appearing each year. If minerals and vitamins have taken the largest part due to an extensive communication making consumers more aware of their nutritional role, pre and probiotics, new peptides or protein fractions are taking their marks. New yoghurts have been launched with relaxing or sleeping aid peptides.
If Japan remains globally the most advanced market, where nutraceutical dairy products represents up to 44% of the total dairy market, other Asian markets but also the U.S. and some European markets are following this trend.
Other segments, like the **meat** industry have also started to use antibacterial products such as lactoferrin.

In **confectionery**, there is a worldwide tendency to fortify gummy and candies with nutritional supplements and, in the future, this market may replace that of food supplements as it combines both pleasure and health. It includes lactoferrin, CPP and other bioactive ingredients.

In **beverages,** innovation that started with enriched drinks, (whether with vitamins or with nutritional fibres), continues with whey proteins (e.g. Sustecal, Ensure, Advera) and protein/ peptide fractions. For example, Snow-Brand uses PP8 as anti-ulcer agent.

In the **Bakery / Biscuits / Snacks** sector the trends are: industrialisation and the return to traditional and natural products for cakes and biscuits. Milk calcium is used to enrich breads. Whey ingredients are in development.

The **infant formula** market is one of the most developed sectors for the use of nutraceutical dairy ingredients.
In a few years, we have seen the generalisation of specific infant formulas such as hypoallergenic formulas, pre-term formulas or formulas to prevent diarrhea using milk hydrolysates and other specific dairy ingredients. Today, the infant formula manufacturers target formulas that mimic mother's milk, at least for the most advanced countries. Besides Pufa's and pre and probiotics, dairy protein fractions such as alpha-lactalbumin, cGMP, are in growing development. Substantial research is also done on new nutrients to reproduce mother's milk.

The **sport foods** market is a major segment for dairy ingredients. Thus, WPI is still preferred to fractions for the moment as it contains these fractions at a lower price.

Food supplements

Food supplements sales are increasing rapidly in many countries. This market segment is very important for dairy ingredients, and is now opening to a number of fractions such as alpha-lactalbumin in relaxation products, lactoferrin in blends, ß-lactoglobulin in products for high blood pressure, cGMP in appetite regulation, IgG supplement to antiobodies.

Clinical nutrition

Several bioactive ingredients find applications in clinical nutrition, such as bactericide (lactobionic acid), to prevent diarrhoea (IgG, cGMP,), to repair injuries (growth factors), α-lac and BlG to prevent/treat HIV, IgG to treat chronic pain and immune disease.

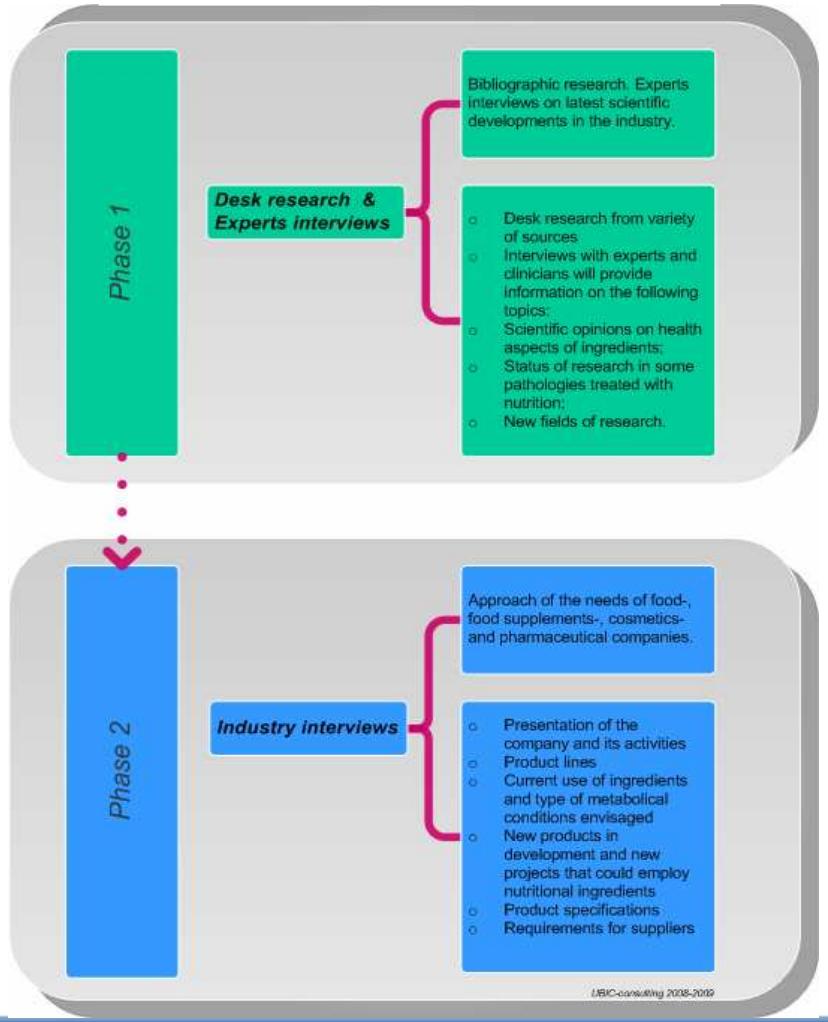
However clinical nutrition though rewarding, is a difficult market to penetrate. It requires near-to pharmaceutical product qualities and competencies.

Cosmetics & Oral care

Oral care is a particularly demanding segment for antimicrobial agents, where Lactoperoxydase and lactoferrin are of increasing use. CPP also find applications in toothpaste, as lyzozyme.

Cosmetics are a field of application for various molecules: LF and LP as antimicrobial, beta-lactoglobulin as a tensing factor for the skin.

METHODOLOGY



CONTENT

LIST OF TABLES

PUBLICATION: 2009 UPDATE

Complete Study	❒ All sections	€4,900
Summary - conclusions	❒ Pages 1 - 54	€ 1,590
COST BY SECTION	❒ Milk proteins –Casein- MPC- Nutritional hydrolyzed proteins	€ 1,390
	❒ Lactose and its derivatives	€ 1,390
	❒ Purified milk fractions	€ 1,990
	❒ Bio active peptides	€ 1,690
	❒ Minerals, Vitamins, Nucleotides, Others	€ 890
	•TWO SECTIONS	•-10% of the total cost of the 2 above selected sections

COMPANY_____

Name_____Position_____

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☎_____Date_____

Signature_____