Mineral Fortification of Food and Supplements

Calcium, Magnesium, Iron, Zinc and Vitamin-Mineral Premixes

Global with focus on USA, Europe, China, India, Indonesia

2009 - 2015

INTRODUCTION

The food fortification and supplements markets are continuing to attract significant interest. A healthy diet is increasingly ranked as very important by many consumers and there is a great deal of scientific information supporting the value of dietary mineral intake, even in the developed world where dietary patterns are not as optimal as one would believe them to be. Calcium is of particular interest because of its association with osteoporosis and the increasingly aging population. In the US alone, sales of calcium supplements exceed USD 1 bio per year. Lack of sufficient quantities of iron, and even magnesium, are also points of discussion at all levels of the society.

Advances in science have given rise to more complex mineral products with claimed higher bioavailability and the benefits of combinations of existing products, including encapsulated and chelated compounds, with ever wider health claims.

Minerals are supplied directly to end users as well as to premix suppliers. The latter mix both minerals and other components (mainly vitamins) to precise specifications. The supply structure is changing and premix suppliers are developing a strong position with end users. Premixes of minerals are increasingly used in both the food and supplement sectors, and hence this Giract study will cover for the first time these added-value premixes.

Giract, the food, food ingredients and technology specialist market research company has 40 years' experience in industrial market research and forecasting. It has unparalleled understanding of the market dynamics and also has privileged contacts with opinion leaders worldwide.

Clients of its previous report (2002) on mineral fortification in USA, Europe and Japan included Purac, Galam, Jungbunzlauer, Glucona, PMP/Fujisawa, Specialty Minerals, Rhodia, Taiyo Kagaku, EM/Merck, Roquette, Boehringer Ingelheim, EBS, Gadot, DMV, NZMP, etc. In addition, the Mineral Fortification Conferences organised by Giract have been very successful.

OBJECTIVES

- To determine the current size of the markets in food fortification and supplements for calcium, magnesium, iron and zinc salts and premixes in the given regions, and then to estimate global demand by sector and product based on the above regions
- To estimate volumes, prices and key suppliers
- To understand the structure of demand and attitudes of key players by sector to the benefits/weaknesses of each cation/anion, their use/non-use patterns and clarification of their reasons for such policies
- To understand the importance and influence of premixed products to end users and how this is changing the shape of the supply structure
- From the above, to forecast demand for 2015 for the selected cations and anions in the chosen countries.

PRODUCTS

Calcium, magnesium, iron and zinc salts, being inorganic salts: carbonate, chloride, oxide/hydroxide, phosphate, reduced metal (iron only), sulphate and organic salts: citrate, fumarate, gluconate, lactate. Other mineral compounds taken into consideration are amino acid chelates, whey/milk calcium, egg shell calcium, dolomite, etc. In addition, vitamin-mineral premixes were also be considered.

Note: the technical use of anions are not taken into account and very high cost anions such as picolinate etc. were only noted through any spontaneous reference by users

END-USE SECTORS

- Infant formulae and other infant food
- Dairy products
- Soft drinks and juices
- Dietetic products
- Flour/bakery/noodles
- Breakfast cereals
- Confectionery
- Vitamin/Mineral supplements

GEOGRAPHICAL Global, with in-depth study of USA, Europe (EU27, NO, CH), China, India and Indonesia

TIMESCALE Current 2009 status and forecast of demand developments to 2015

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Mineral Fortification of Food and Supplements 2009 – 2015 USA, Europe, China, India, Indonesia

MULTICLIENT REPORT - Table of Contents and Sample Pages Only

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1. INTRODUCTION

1.1. OVERVIEW

The food fortification and supplements markets are continuing to attract significant interest. A healthy diet is increasingly ranked as very important by many consumers and there is a great deal of scientific information supporting the value of dietary mineral intake. Calcium is of particular interest because of its association with osteoporosis and it has received substantial support from worldwide medical circles. In the US alone, the sales of calcium supplements exceed USD 1 bio per year.

Advances in science have given rise to more complex mineral products with apparently higher bioavailability as well as showing the benefits of combinations of existing products with ever wider benefits to health.

Minerals are supplied directly to end users such as food manufacturers as well as to premix suppliers. The latter mix both minerals and other components (e.g. vitamins) to precise specifications. The supply structure is changing and premix suppliers are developing a strong position with end users. Premixes of minerals are increasingly used in both the food and supplement sectors, and the coverage, for the first time, of these added-value intermediates is a unique feature of this Giract study.

1.2. OBJECTIVES

- To determine the current size of the markets in food fortification and supplements for calcium, magnesium, iron and zinc salts and premixes in the given regions and then to estimate the global demand by sector and product based on the regions
- To estimate the volumes, prices and key suppliers
- To determine the structure of demand and attitudes of key players by sector to the advantages/disadvantages of each cation. To evaluate their interest in increasing/ decreasing use, clarifying the resons for such policies
- From the above, to forecast demand for 2015 at a global level

1.3. SCOPE AND METHODOLOGY

1.3.1. PRODUCTS

Calcium, magnesium, iron and zinc salts, being inorganic salts: carbonate, chloride, oxide/hydroxide, phosphate, reduced metal (iron only), sulphate and organic salts: citrate, fumarate, gluconate, lactate. Other mineral compounds taken into consideration are amino acid chelates, whey/milk calcium, egg shell calcium, dolomite, etc. In addition, vitamin-mineral premixes are considered.

Note: the technical use of anions are highlighted where possible and very high cost anions such as picolinate are only noted through any spontaneous reference by users.

1.3.2. END USER SECTORS

- Infant formula and other infant food
- Flour/bakery/noodles
- Dairy products
- Breakfast cereals
- Soft drinks and juices
- Vitamin-Mineral supplements
- Dietetic products
- Confectionery

1.3.3. GEOGRAPHICAL

The report makes an in depth analysis of the following markets.

- EU27
- USA
- China
- India
- Indonesia

Other key markets have been reviewed and global demand estimation derived.

1.3.4. TIMESCALE

The 2009 status has been evaluated and forecast has been developed to 2015.

Prevalence of Osteoporosis and Low Bone Mass in People aged 50 and over, USA

mio people

	2002	2010	2020
Osteoporosis and Low Bone Mass in Women and Men	43.6	52.4	61.4
Osteoporosis in Women and Men	10.1	12.0	13.9
Low Bone Mass in Women and Men	33.6	40.4	47.5
Women with Osteoporosis or Low Bone Mass	29.6	35.1	40.9
Women with Osteoporosis	7.8	9.1	10.5
Women with Low Bone Mass	21.8	26.0	30.4
Men with Osteoporosis and Low Bone Mass	14.1	17.3	20.5
Men with Osteoporosis	2.3	2.8	3.3
Men with Low Bone Mass	11.8	14.4	17.1

Source: National Osteoporosis Foundation

In Europe, the European Union Parliament requested the European Commission to prepare recommendations aimed at prevention and management of osteoporosis and related fracture health care. These recommendations were published in 1998. In 2001, the International Osteoporosis Foundation (IOF) compiled an audit showing that there had been little progress in implementing the recommendations by the Member states. The European guidance for the diagnosis and management of osteoporosis in postmenopausal women was published a couple of years ago by the European Society for Clinical and Economic Aspects of Osteoporosis and Osteoarthritis (ESCEO). This ESCEO guidance was very timely as, across Europe, osteoporosis is a major public health problem with serious medical and economic impact. In 2000, throughout the region, there were an estimated 620 000 new hip fractures, 574 000 forearm fractures, 250 000 shoulder fractures and 620 000 spinal fractures in men and women aged 50 years or over, accounting for 34.8% of such fractures worldwide. There are more than 2.7 million osteoporotic fractures in men and women in Europe at a direct cost of EUR 36 billion. It is estimated that, by 2050, direct costs related to hip fractures will increase to EUR 76.7 billion.

Professor J. Kanis of the WHO Collaborating Centre for Metabolic Bone Disease estimated that the cost to European Health Care Agencies in Europe is above EUR 30 billion per year. This is expected to double by the year 2050.

According to the International Osteoporosis Foundation, the prevalence of osteoporosis in the Japanese female population aged 50-79 years has been estimated to be about 35% at the spine and 9.5% at the hip.

Relative bioavailability of commonly used iron fortification compounds from human isotope absorption studies

Category	Compound	Iron content %	Relative Bioavailability (relative to iron sulphate)
Category 1: Water Soluble	Ferrous sulphate 7H20	20	100
	Ferrous sulphate dried	33	100
	Ferrous gluconate	12	89
	Ferrous lactate	19	67/106
	Ferric ammonium citrate	17	50-70
Category 2: Poorly water soluble	Ferrous fumarate	33	30/100
	Ferrous succinate	33	92
Category 3:Water Insoluble	Ferric pyrophosphate	25	21-75
	Ferric orthophosphate	29	15-93
Elemental Iron	Hydrogen reduced	96	13-148
	Electrolytic	97	75
	Carbonyl	99	5-20
Category 4: Chelates	Ferrous bisglycinate	20	90-350
	NaFeEDTA	13	200-400

Source: Adapted in Nutritional Anemia, Sight and Life 2007 from Hurrell 2002

Studies with encapsulated iron by Chandrani Liyanage *(Food and Nutrition bulletin volume 23 no 3, 2002)* and Michael B Zimmerman *(The American Society for Nutritional Sciences, Journal of Nutrition, December 2004)* show that the relative bioavailability is generally less than 100.

1.6.3.5 ORGANOLEPTIC ISSUES

In the case of iron fortificants in food, the two most common problems are increased rancidity due to oxidation of unsaturated lipids and unwanted colour or flavor changes. The colour changes can include green or blue colours in cereals.

Ferrous sulphate is suitable for fortifying dry compounds such as pasta and milk powder/infant formula. Ferrous sulphate has been known to cause unacceptable colour changes in cocoa products, infant cereals, salt, and extruded rice. It often causes a metallic taste in liquid products and can precipitate peptides in products like fish sauce.

Demand for Calcium in Food and Supplements as Calcium Salts - Global 2009

tons

Salt (anion)	Inf. Formula/ Food	Dairy	Juice	Soy Milk	Soft Drinks	Flour/ Rice	Breakfast Cereals	Slimming Meals	Cereal Bars	Confec-tionery	Sup-plements	Total
Inorganic												
Carbonate												
Chloride												
Oxide												
Hydroxide												
Phosphate												
Sulphate												
Sub Total Inorganic												
Organic												
Citrate												
Gluconate												
Glycerophosphate												
Lactate												
Sub Total Organic												
Exotic												
Amino Acid Chelates												
Egg Shell Calcium												
Bone & Coral												
Milk Calcium												
Sub total Exotic												
Other / Unident.												
Others												
Grand Total												

3.2.1.2 PRICING

Prices of Food Grade Calcium Salts – USA – 2009

Product	Price USD/kg
Calcium Carbonate	
Calcium Chloride	
Calcium Citrate	
Calcium Lactate	
Calcium Hydroxide	
Calcium Gluconate	
Calcium Phosphate	
Calcium Oxide	
Calcium Sulphate	
Calcium Fumarate	
Amino Chelates	
Egg Shell Calcium	
Milk Calcium	
Other including Marine	

Source: Giract, based on interviews

Prices for different applications can vary significantly. Basic calcium carbonate for the flour industry is perhaps the cheapest form at about USD ##/kg. Calcium carbonate for infant food needs special testing for heavy metals and usually requires a specific particle size specification and can be at USD ##/kg. At the top end of the scale, direct compressible products for the supplements industry can be at USD ##/kg.

This scale can be somewhat similar for all mineral products.

In addition, the price varies with volume, packaging and delivery specifications.

Huber

Huber is family owned and part of the J.M. Huber Corporation established in 1883. With over USD 2 billion revenue, J.M. Huber Corporation is a diversified, multinational supplier of engineered materials, natural resources and technology-based services to customers spanning many industries.

In 2004, J.M. Huber Corporation acquired CP Kelco, a leader in xantham gum, carrageenan and pectin and recognised globally for food and beverage ingredient technology.

Huber produces calcium carbonate from oyster shells and naturally mined sources.

Huber also produces magnesium hydroxide.

ICL Performance Products LP

ICL Performance Products LP, headquartered in St. Louis, Missouri, is a wholly owned subsidiary of Israel Chemicals Limited (ICL), based in Tel Aviv, Israel.

ICL Performance Products LP is a worldwide leader in the manufacturing and marketing of phosphates, phosphoric acid, and phosphorus chemicals. Its food phosphates are high-performance ingredients, combining the nutritional benefits of calcium, potassium, phosphorus and magnesium (Mag-nificent) with versatility in functionality.

Innophos

Innophos was formerly part of the Rhodia group and was acquired by Bain Capital in 2004. Innophos IPO took place in November 2006 and it is now a stock market listed company. The company claims to be the largest speciality phosphate producer in North America. About 25-30% of the company revenue (USD 935 mio in 2008) is in the food and beverage application area.

Innophos is an international supplier of phosphates to many industries. The company has a range of products for the food industry used as food ingredients as well as some special products for the dietary supplements and food fortification industries. The product range includes practically all forms of calcium and magnesium phosphate.

Interhealth Nutraceuticals, Inc.

L-OptiZinc is a unique patented form of methionine-bound zinc supplied by Interhealth Nutraceuticals, that claims to dramatically increase the bioavailability of zinc in formulations.

ISP

ISP has elemental iron production

3.3. DEMAND

3.3.1. BREAKFAST CEREALS

Market Size and Growth

Breakfast Cereals – USA Market **kt**

	2005	2007	2009	AAGR%
Breakfast Cereals	#	#	#	#

Source: Euromonitor

The total US market for cold cereals is valued at about USD 8 billion per annum. The cold cereal category value growth is estimated to be #% AAGR since 2005 and about #% volume growth.

Breakfast Cereals – USA Producers and Market share, 2009

	%
Kellogg's	#
General Mills	#
Post (Ralcorp)	#
Others	#
Total	**100**

Source: Giract, based on interviews

Kellogg's

Kellogg's reported 2009 sales of USD 12.6 billion for the global business. This was slightly down from the 2008 reported figure of USD 12.8 billion, however on a currency neutral and equal basis, the company grew by 3% in value.

The Kellogg Company is the world's leading producer of cereals and has expanded its product portfolio to include cookies, crackers, toaster pastries, cereal bars, frozen waffles, and meat alternatives. The company's brands include Kellogg's, Keebler, Pop-Tarts, Eggo, Cheez-It, Club, Gardenburger, Nutri-Grain, Rice Krispies, Special K, All-Bran, Mini-Wheats, Morningstar Farms, Famous Amos, Ready Crust and Kashi.

Kellogg's has 32000 employees and 59 manufacturing facilities.

In North America, the company reported net sales of USD 8.7 billion for 2009. North American cereals grew by 4% above 2008 for the same period. The North American sales are made up of cereals (40%), snacks (50%), the rest being frozen and speciality.

All of the North American products contain iron as a mineral with between 25% and 50% of the RDA per serving of about 30g. On some brands, the iron is labelled as reduced iron and for other just iron. Only one product - Kellogg's Cocoa Krispies - was found containing calcium carbonate.

3.3.6.4 OTHER DAIRY BASED PRODUCTS

Dairy based puddings contain calcium sulphate or calcium phosphate.

Other Dairy– Key Formulations - USA

Brand	Relevant Mineral Ingredients
Jello SF Pie filling	Calcium ##
Wegmans Choco pudding	Calcium ##
Jello Sugar Free	Calcium ##
Hunts Tapioca	Calcium ##

Source: Giract, based on interviews

3.3.6.5 DAIRY PRODUCTS: INGREDIENTS SUMMARY

Dairy – Mineral Fortification Summary 2009 - USA

	Volume kt	% market fortified	Compound	Volume cation tons
Milk drinks	##	##%	Calcium Carbonate	##
Milk drinks	##	##%	Calcium ##	##
Milk Drinks	##	##%	Magnesium ##	##
Yogurt	##	##%	##	##
Cheese Shredded	##	##%	##	##
Cheese Processed	##	##%	##	##
Puddings	##	##%	##	##
Puddings: Jello	##	##%	##	##

Source: Euromonitor, Giract

Calcium

Calcium lactate is the only form of calcium used, mainly for its good solubility.

The annual consumption of calcium lactate is 8 tons. Suppliers are from Europe and China.

Magnesium

Magnesium carbonate is mixed with citric acid to increase the solubility. Magnesium carbonate usage is about 6 tons per annum.

The company strictly abides by the regulations of the European Union. No new product launches are expected for 2010. The trend in minerals usage is stable.

Premixes

The company uses only vitamin premixes. The usage trend is more or less stable.

4.4.3. ARKOPHARMA – SUPPLEMENTS - FR

Arkopharma is a European company focusing on phytotherapy and nutritional supplements. For more than 25 years, Arkopharma Laboratories has been developing new health medicines based on natural products.

Calcium, magnesium, iron and zinc are used in food supplements targeted at consumers of all ages.

Calcium:

Calcium phosphate, calcium carbonate and calcium oxide are used. These compounds are used as excipients and sources of calcium intake.

Calcium is the largest consumed mineral -around 6 tons per annum.

Calcium salts are generally cheaper than other mineral salts. Calcium carbonate, phosphate and oxide are priced between EUR 1-3 per kg.

Magnesium

Magnesium lactate is used in the liquid form. It is soluble and may improve the taste of the supplement. Usage is around 500kg per annum.

Magnesium lactate is priced EUR 10 per kg.

Iron

Iron gluconate and fumarate are used in solid forms as hard capsules. Other minerals are also used in the iron-containing capsules.

Only about 500kg of iron compounds are used per year.

The price of iron fumarate is EUR 5-6 per kg; that of iron gluconate is around EUR 10 per kg.

5. CHINA

5.1. LEGISLATION

In infant formula, mineral fortification shall follow regulations and rules as per GB14880-94 and GB2760-2007.

The state specifications for iron fortified candy can be found in GB 10772-1989.

5.2. SUPPLY MINERALS

5.2.1. SUPPLIERS

5.2.1.1 BEIJING VITA

Beijing Vita is believed to produce small amounts of sodium iron EDTA and is relatively new to the market.

5.2.1.2 GALACTIC

Galactic has activities with its joint venture in China started in 2002 with Anhui BBCA called B&G. Additionally; it has a strong sales force in the USA based in Milwaukee.

5.2.1.3 GOODLACTIC

Goodlactic from China claims to produce 3000 calcium lactate.

5.2.1.4 JINDAN

The company produces a range of lactates including calcium lactate.

The company reports a production of 80 000 tons of lactic acid and capacity of 100 000 tons and to be the largest producer in China.

5.2.1.5 LIANYUNGANG HENGSHENG FINE CHEMICAL CO., LTD.

This is a minor company located in Lianyungang, Jiangsu.

Products include zinc, calcium, magnesium citrate.

These products are not frequently used in China, as they are relatively expensive (RMB 8–9/kg). Moreover, a product like calcium citrate has low solubility. It is most suited for calcium tablets.

5.2.1.6 LIANYUNGANG RUIFENG CO. LTD

The company was established in 1978 and is located in the city of Lianyungang. It is a manufacturer of a range of phosphates and citrates which are used in food, pharmaceutical and feed industries.

Calcium, magnesium, iron and zinc are used in premixes with vitamins. Some of the calcium forms used in premixes are calcium carbonate, calcium phosphate and calcium citrate.

The supplements trend is increasing annually by 10-20%. Minerals usage in supplements is based on customer requirement.

6.5.4. COCA COLA INDIA - PREMIXES

Coca Cola, the corporation nourishing the global community with the world's largest selling soft drink concentrates since 1886, returned to India in 1993 after a 16 year hiatus. In the same year, the company took over ownership of the nation's top soft-drink brand and bottling network.

The Indian operations comprise 50 bottling operations, 25 owned by the company, and another 25 being owned by franchisees. That apart, a network of 21 contract packers manufactures a range of products for Coca Cola.

Currently, fortification is undertaken as part of the corporate social responsibility (CSR) programme which has been in operation for the last 1 year in coordination with regional NGOs. Currently, Orissa is the only state where such a programme is being implemented using the S.H. Micro (micro-finance) network. Under this project, the sachets are distributed to S.H. Micro agents, who in turn deal them out to their local representatives, generally low income women, to sell the sachets at a price of INR 2 each to consumers. The target group is adolescent girls (according to Coca Cola, about 80-90% of adolescent girls are malnourished in India) and each woman sells around 5 000 sachets per month in Orissa district. In the last 8 months, Coca Cola has distributed about 500 000 sachets in Orissa alone. Coca Cola expects to take this programme to other states such as Andhra Pradesh, West Bengal, Chattisgarh, Karnataka and Tamil Nadu in 2010.

The fortified 18g premix sachet, branded Vitimgo, includes iron (4.7mg), vitamin C (280mg), zinc (1.2mg), folic acid (32mcg) and vitamin A. All the minerals are currently imported and processed at the Coca Cola India plant. Current consumption of iron and zinc is negligible at about 2-3kg and about 1kg respectively. However, if this CSR programme is implemented, it is expected to consume about 1 tpa of minerals in total.

6.5.5. DABUR - BEVERAGES

Dabur India operates in key consumer products categories like beauty care, health, home care and foods.

It mainly uses calcium for its Glucose D product.

The company does not use any premixes.