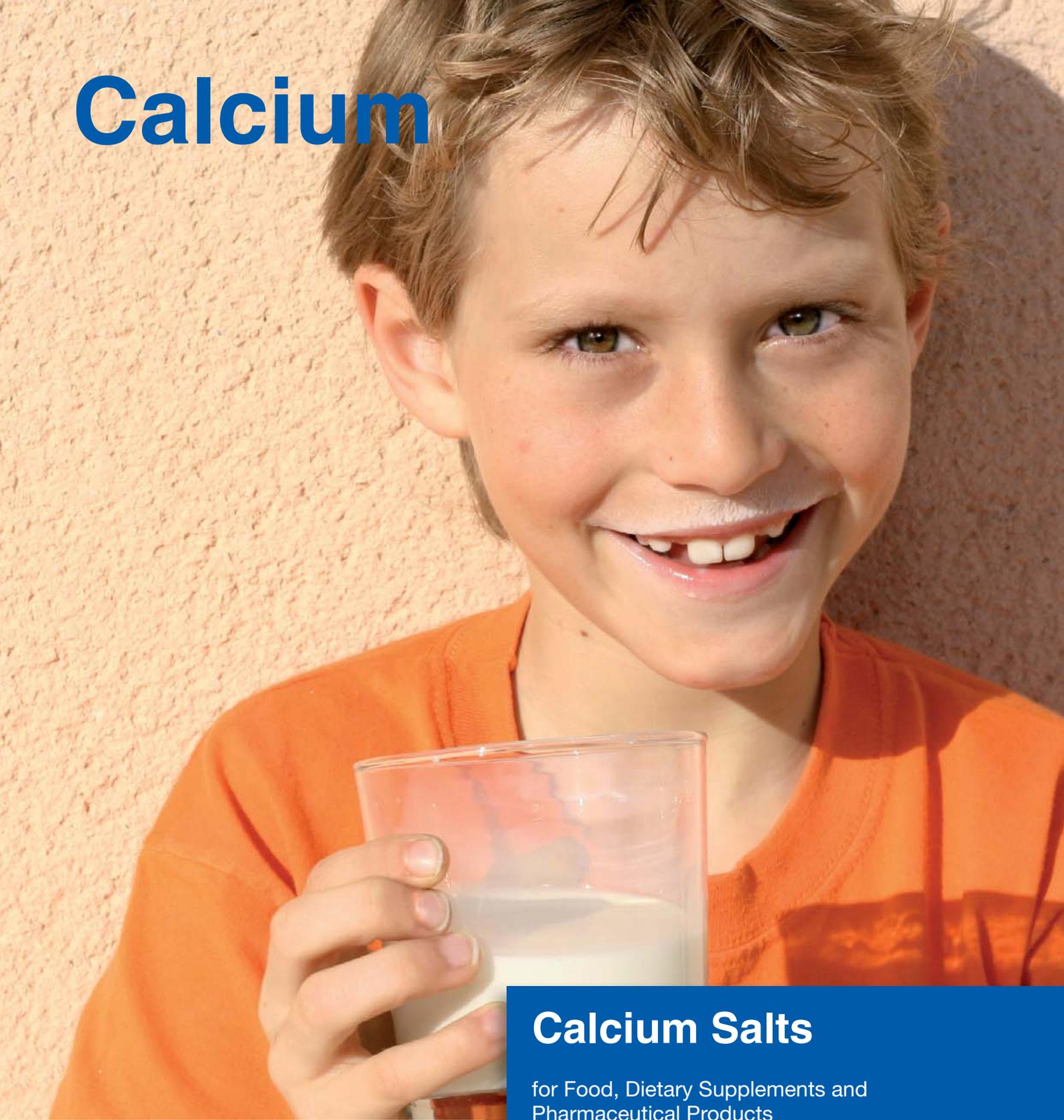


Calcium



Calcium Salts

for Food, Dietary Supplements and
Pharmaceutical Products



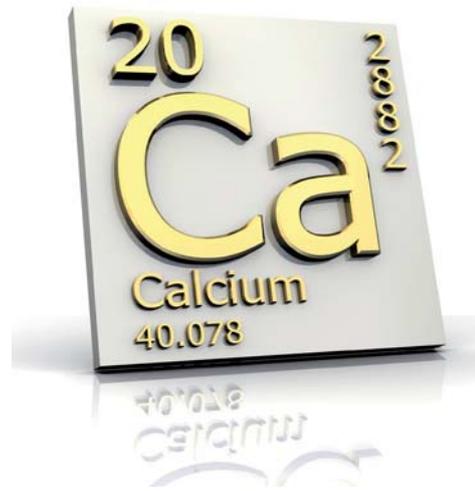
Dr. Paul Lohmann[®]

High value mineral salts

Calcium

As the fifth most abundant element in the Earth's crust, calcium is most often chemically bound where it occurs in nature. On Earth, calcium passes through a definable cycle, and is to a considerable extent involved in regulating the atmosphere's CO₂ content.

In the geological past, coral reefs slowly evolved into what today are gigantic calcium deposits in the form of pure limestone mountain ranges and underground deposits. ¹



Physiology of Calcium

Between 1000 and 1500 g of calcium are found in the adult human organism, depending on body size, calcium supply and age. Of this, the major part by far is localized in the teeth and bones - for the most part in the form of calcium hydroxylapatite. Hence, the largest calcium depot within the human body resides in the skeleton.

Only 1 % of the calcium is dissolved in blood plasma, half of which is retained as calcium ions. The rest is either bound to proteins or has formed complexes, such as calcium phosphate, calcium bicarbonate and calcium citrate.

Apart from the important function of calcium as a hard substance for teeth and bones, it also fulfills a variety of tasks in numerous physiological processes. For instance, calcium also functions as a signaling molecule for nerves and muscles, and many secretion processes are possible only in the presence of calcium.

Other important functions of calcium include its involvement in blood coagulation, the stabilization of cell membranes and controlling the activity of some key enzymes. ²



Calcium Requirement

During the growth phase, humans ingest more calcium than they release through the kidneys and intestines.³

Therefore, the importance of a sufficient calcium supply for children should never be underestimated.

Ideally, the adult organism maintains a balance between absorption and excretion.

This so-called calcium homeostasis is steered by hormones.³ However, this also requires a sufficient supply of dietary calcium with the food.

Just the opposite, in old age the body's skeleton loses more calcium and at varying rates.³

A calcium deficiency may develop if the intake of dietary calcium in the growth phase of life was not sufficient. In this case, the most frequent secondary disease diagnosed later in life is osteoporosis.¹

A sufficient intake of dietary calcium is particularly important for:

- Children
- Pregnant women and lactating mothers
- Older people
- Post-menopausal women
- Athletes

	CALCIUM
US Reference Daily Intake (RDI)	1000 mg
US Dietary Reference Intake (DRI*)	1300 mg
EU Recommended Daily Allowance (RDA)	800 mg
D-A-CH recommendations*	1200 mg

* highest values of recommended intakes

The Reference Daily Intake (RDI) is the value established by the US Food and Drug Administration (FDA) for use in nutrition labeling (Daily Value (DV) in %).

The Dietary Reference Intakes (DRI) are the most recent set of dietary recommendations established by the US Food and Nutrition Board of the Institute of Medicine, 1997-2001. They replace previous American RDAs, and may be the basis for eventually updating the RDIs.

Recommended Daily Allowances (RDA) according to Regulation 2008/100/EC on nutrition labeling for foodstuffs. D-A-CH recommendations are the nutritional reference values in Germany, Austria and Switzerland.

Calcium Sources

The most important sources of calcium in human nutrition are cheese, milk and other dairy products. Some vegetables, such as spinach, broccoli or legumes are also rich in calcium. Same as with different types of nuts, they can contribute to meeting the individual calcium requirement.

Drinking water may also play a significant role in calcium supply; however, the calcium content of tap water varies strongly from one region to the next. Meat and meat products contain hardly any calcium.

Not always can the daily requirement be covered by a regular diet. This can pose a problem for people with a milk allergy, lactose intolerance and those on a vegan diet. In these cases, dietary supplements or food products fortified with calcium are recommended to bridge the mineral gap.

For this purpose, Dr. Paul Lohmann® provides high-quality calcium salts, all in compliance with the requirements of currently valid pharmacopeias (Ph. Eur. / USP) and/ or relevant food regulatory guidelines (EU legislation/ FCC).

Properties of Calcium

OUR TOP PRODUCTS

Calcium Carbonate

- high calcium content
- neutral taste
- fine powder

Calcium Carbonate DC

- directly compressible granulate
- cost-efficient tablet production
- available with various granulating aids

Tricalcium Citrate 4-hydrate

- neutral taste
- applicable in sour pH area

Also available as DC
(Directly Compressible)

Tricalcium Citrate 4-hydrate, micronized

- micronized powder d50 approx. 2 µm
- optimal sensory / mouthfeel

Calcium Glycerophosphate

- water soluble
- neutral taste
- good source of phosphorus
- good bioavailability

Calcium Acetate, granulated

- good flowability
- low-dust processing
- without granulating aid

Calcium Lactate

- water soluble
- pH-neutral
- neutral taste

Calcium Lactate PLUS

- very well and fast soluble, unaffected by the pH-value
- high calcium content
- transparent in solution

Calcium Gluconate

- high solubility in water
- pH-neutral
- neutral taste

Calcium Phosphate PLUS

- completely soluble and stable over time
- good source of calcium and phosphorus
- pleasantly sour taste

Calcium Lactate Gluconate

- high solubility in water
- pH-neutral
- neutral taste

Calcium-L-Pidolate

- high solubility
- highly bioavailable



Bioavailability

The human body ingests calcium in the small intestine by means of a calcium-binding protein, calbindin, which facilitates active calcium transport. The functioning of this protein in turn depends on vitamin D. This is why a sufficient supply of vitamin D is essential for optimal calcium ingestion ².

The intake of dietary calcium with foodstuffs depends on their content of complexing agents, such as phytates or oxalates, among others. These agents noticeably reduce the absorption of calcium, so that the availability of this mineral from food is to a large extent decreased to only 30 - 50 %.

Saturated fatty acids or high concentrations of phosphates also have an adverse effect on calcium absorption in the body ^{2,3}.

INHIBITORS

Phytic acid

Oxalic acid

PROMOTERS

Vitamin D

Fructooligosaccharides

Inulin

Inhibitors reduce, whereas promoters improve the ability of the body to absorb calcium.

Calcium Deficiency

Calcium deficiency is mainly caused by a poor diet, but may also occur due to an increased demand, for example during pregnancy.

Chronic calcium deficiency during childhood can adversely impact skeletal mineralization and lead to the softening of bones and skeletal deformations. In addition, the risk of developing osteoporosis later in life increases significantly. ²

According to information by the WHO, osteoporosis is one of the ten most frequent diseases worldwide. That is why a sufficient calcium intake during bone growth is particularly important to prevent osteoporosis.

Data from observational studies also reveals evidence of an inverse relationship between the incidence of colon cancer and calcium intake. ²

Furthermore, calcium also has an impact on regulation of blood pressure. ²

Serum-calcium levels at < 2.0 mmol/l indicate hypocalcemia. ² This may have many different causes: Apart from a poor diet, it may develop from disorders of intestinal absorption, for instance, or hypoparathyroidism, vitamin D deficiency or chronic kidney failure. In any case, the actual individual cause of a calcium deficiency should always be diagnosed by a physician.

The most frequent symptoms of calcium deficiency are an increased irritability of muscles and nerves, muscle cramps, confusion, as well as mental changes including moods of depression. ²



Calcium - Our Product Range

Product	Art. No.	Quality	Physical Appearance
Calcium Acetate	515001002	E 263 or FCC or DAC or USP (without dialysis requirement) or BP or chem. pure	powder
	515001004	E 263 or USP	fine powder
	515001005	E 263 or USP or FCC	fine granulate
	515001009	E 263 or FCC or USP	granulate
	515001001	USP or Ph.Eur.; low in endotoxins	powder
Calcium Acetate Solution	515050001	chem. pure	solution
Calcium Carbonate DC 90S	512006004	Ph.Eur. or USP or E 170 with 10 % corn starch (Ph.Eur.)	granulate, directly compressible
Calcium Carbonate DC 95S	512006005	Ph.Eur. or USP or E 170 with 5 % corn starch (Ph.Eur.)	
Calcium Carbonate DC 90M	512006009	Ph.Eur. or USP or E 170 with 10 % maltodextrin (Ph.Eur. or USP/NF)	
Calcium Carbonate DC 95M	512006006	Ph.Eur. or USP or E 170 with 5 % maltodextrin (Ph.Eur. or USP/NF)	
Calcium Carbonate DC 97P	512006008	Ph.Eur. or USP or E 170 with 3 % polyvinylpyrrolidon (PVP) (Ph.Eur. or USP/NF)	
Calcium Carbonate heavy	512006210	Ph.Eur. or USP or BP	powder
	512006003	Ph.Eur. or USP or E 170	micronized powder
Calcium Carbonate light	512037000	E 170 or FCC or Ph.Eur. or Ph.Franc. or USP or BP	powder, precipitated
Calcium Chloride 2-hydrate	511030300	FCC or Ph.Eur. or E 509 or USP or BP	fine crystalline powder
Monocalcium Citrate 1-hydrate	502050001	E 333	powder
Tricalcium Citrate anhydrous	502042001	Food Grade or E 333 or USP	powder
	502042002		micronized powder
Tricalcium Citrate 4-hydrate	502041001	E 333 or FCC or DAC or USP or NF	powder
	502041002		fine powder
	502041006	E 333 or FCC or USP or Erg.B.6.	micronized powder
	502041009	High Purity Food Grade	micronized powder
Tricalcium Citrate 4-hydrate DC 100	502041011	E 333 or FCC or USP	granulate, directly compressible
Calcium Formiate	502068001	Food Grade	crystalline powder
	502068002	chem. pure	powder
Calcium Fumarate 3-hydrate	505023001	chem. pure	powder
Calcium Gluconate, anhydrous	503081100	inj. grade, USP	powder
Calcium Gluconate 1-hydrate	503071100	inj. grade, Ph.Eur. or BP	powder
	503071010	oral grade, Ph.Eur. or USP or BP	
Calcium Glycerophosphate	512049000	Ph.Eur. or BP or Ph.Franc.	powder
	512049010	FCC or NF	
Calcium Glycerophosphate Solution	512053001	chem. pure	solution
Calcium Hydroxide	512036200	E 526 or FCC or Ph.Eur. or USP or for water treatment according to DIN 19611	powder
Calcium Lactate	512001000	E 327 or FCC or Ph.Eur. or Ph.Franc. or USP or BP	granulated powder
	512001200	E 327 or FCC or JSFA	powder
Calcium Lactate PLUS	512083001	Food Grade	powder
	512083003		coarse powder
	512083004		granulate
	512079001		Food Grade
512079002			
Calcium Malate	503066001	E 352 or chem. pure	powder
Calcium Nitrate 4-hydrate	515043001	chem. pure	crystals
Calcium Nitrate Solution	515053002	chem. pure	solution
Calcium Oxalate 1-hydrate	515064001	chem. pure	powder
Calcium Peroxide	515076001	FCC	powder
Calcium Hydrogen Phosphate, anhydrous	512067040	E 341(ii) or FCC or Ph.Eur. or BP or USP	powder
	512067001	E 341 - low in aluminium	
Monocalcium Phosphate, anhydrous	512068000	E 341(i)	powder
Monocalcium Phosphate 1-hydrate	512018000	E 341(i) or FCC	powder
Calcium Phosphate PLUS	512018001	E 341 and FCC - water soluble	crystalline powder
Calcium Hydrogen Phosphate 2-hydrate	512017110	E 341 or Ph.Eur. or BP	powder
	512017001	E 341 or Ph.Eur. - low in aluminium	
Calcium Hydrogen Phosphate 2-hydrate DC 100	512017002	USP or Ph.Eur.	granulate, directly compressible
Tricalcium Phosphate	512035001	E 341 (iii) or FCC or Ph.Eur. - low in aluminium	powder
Tricalcium Phosphate heavy	512035200	E 341(iii) or FCC	powder
	512035000		E 341(iii)
Tricalcium Phosphate light	512035010	Ph.Eur. or BP	powder
	512003001		Erg.B.6
Calcium Phospholactate	512003001	Erg.B.6	powder
Calcium L-Pidolate	503094001	chem. pure	powder
	502022001	E 282 or FCC or Feed Grade or JECFA or JSFA	powder
	502022002	E 282	dust free powder
	502022003	E 282 or FCC or JSFA	fine granulate
	502022004		granulate
Calcium Hydroxide Saccharated	519036001	chem. pure	powder
Calcium D-Saccharate 4-hydrate	519029200	USP	powder
Calcium Stearate	512004000	Ph.Eur. or NF or JP	powder
Calcium Tartrate	503072001	chem. pure	powder

Color	Flavor	Metal Content (per 100 g)	Retest Period (Months)	Solubility (g/100g H ₂ O) 20°C	pH (1 % Solution / * Suspension)
white	bitter / sour	approx. 24 % Ca	36	approx. 40	approx. 8
colorless	bitter / sour	approx. 24 %; approx. 6 % Ca	24	solution	approx. 7
white to yellowish	neutral	approx. 36 % Ca approx. 38 % Ca approx. 36 % Ca approx. 37 % Ca approx. 39 % Ca	36	< 1	9-10*
white	neutral	approx. 40 % Ca	36	< 1	approx. 9.5*
white	neutral	approx. 40 % Ca	36	< 1	approx. 10*
white	bitter	approx. 27 % Ca	24	approx. 100	approx. 6
white	sour	approx. 9 % Ca	36	approx. 1	approx. 3.5
white	neutral / sandy	approx. 24 % Ca	24	< 1	approx. 6*
white	neutral / sandy	approx. 21 % Ca	36	approx. 1	approx. 6*
white	neutral / sandy	approx. 21 % Ca	36	< 1	approx. 6*
white	bitter / sour	approx. 30.5 % Ca	36	approx. 16	approx. 7
white	neutral / salty	approx. 19 % Ca	36	approx. 2	approx. 8
white	neutral	approx. 9 % Ca	36	approx. 3	approx. 7
white	neutral	approx. 9 % Ca	36	approx. 4	approx. 7
white	neutral	approx. 17 % Ca; approx. 13 % P	36	approx. 1.6	approx. 9
colorless to slightly yellowish	sweetish	approx. 50 %; approx. 4 % Ca	24	solution	approx. 4
white	bitter	approx. 54 % Ca	36	< 0,1	approx. 10*
white	slightly bitter	approx. 13 % Ca	36 24	approx. 10	approx. 7*
white	neutral, slightly sour	approx. 17.5 % Ca	24	approx. 11.5	approx. 5
white to off-white	neutral	approx. 10.5 % Ca approx. 13 % Ca	24	approx. 20	approx. 7
white	neutral	approx. 23 % Ca	36	< 1	approx. 7*
white	-	approx. 17 % Ca	24	approx. 260	approx. 6
colorless	-	approx. 65 %; approx. 11 % Ca	24	solution	approx. 6
white	neutral / sweetish	approx. 27.5 % Ca	36	< 1	approx. 6*
yellowish	neutral / slightly bitter	min. 60 % CaO ₂	24	< 1	approx. 12*
white	neutral	approx. 29.5 % Ca; approx. 22.5 % P	36	< 1	approx. 8
white	neutral	approx. 17 % Ca; approx. 26.5 % P	36	< 1	approx. 3*
white	fruity sour	approx. 16 % Ca; approx. 24.5 % P	36	< 1	approx. 3*
white	fruity sour	approx. 15 % Ca; approx. 27 % P	12	approx. 2	approx. 3
white	neutral	approx. 23 % Ca; approx. 18 % P	36	< 1	approx. 7,5*
white	neutral	approx. 40 % Ca; approx. 18 % P	36	< 1	approx. 7*
white	neutral	approx. 40 % Ca; approx. 18 % P	36	< 1	approx. 7*
white	neutral	approx. 40 % Ca; approx. 18 % P	36	< 1	approx. 7*
white	neutral	approx. 39 % Ca; approx. 19.5 % P approx. 40 % Ca; approx. 18 % P	36 36	< 1	approx. 7* approx. 7*
white	sour, slightly bitter	approx. 13 % Ca	24	approx. 5	approx. 4
white to yellowish	slightly bitter	approx. 13.5 % Ca	24	approx. 30	approx. 6
white	slightly sweetish / bitter	approx. 21 % Ca	36	approx. 26	approx. 9
white	sweetish	approx. 11.5 % Ca	24	approx. 3	approx. 12
white	neutral	approx. 12.5 % Ca	36	< 5	approx. 7*
white	neutral	approx. 7 % Ca	36	< 1	approx. 6,5*
white to yellowish	neutral / sandy	approx. 17 % Ca	36	< 1	approx. 6*

Application of Calcium in Food and Pharmaceutical Products

Calcium salts are frequently used in food as well as in pharmaceutical products to **enrich** the final product with calcium, but also for calcium supplementation. Beverages in particular, such as fruit juice, near-water drinks or soft drinks can be fortified with water-soluble calcium salts. With the right choice of calcium salt (e.g. regarding solubility or particle structure) and an adequate dosage, there is no off-taste.

Milk products can also be enriched with calcium salts without the risk of curdling. We are pleased to offer relevant, specifically customized products for this purpose.

Apart from fortification, calcium salts are also used by the food and pharmaceutical industries for **technological purposes**. Because of their white color, calcium carbonates, for instance, are also used to brighten up other food colors.

Moreover, they are used in bakeries to prevent products from clumping or to maintain their flowability.

Calcium citrates, on the other hand, bond with the pectin contained in the peels or skin of many fruit varieties, and therefore are often used as a firming agent for fruit and vegetables.

Calcium salts are also used to regulate pH levels or stabilize medicinal and oral care products.

For the use in pharmaceutical products, e.g. for calcium supplements or medicinal products to treat hyperphosphatemia, we can provide various qualities in line with Ph.Eur., USP and other pharmacopeias.

In order to facilitate pharmaceutical registrations, we can provide a **Certificate of Suitability (CoS/CEP)** for **calcium acetate** or we can prepare an **European Drug Master File (EDMF)** for some calcium salts.

APPLICATION	CALCIUM COMPOUND	FUNCTION
Milk / dairy products	Calcium Carbonate	Fortification
	Tricalcium Citrate	
	Calcium Lactate PLUS	
	Calcium Glycerophosphate	
Effervescent tablets	Calcium Carbonate, heavy	Fortification, carrier substance
	Calcium Glycerophosphate	
	Calcium Carbonate DC	
Dietary supplements	Calcium Carbonate	Active ingredients in e.g. pills, effervescent tablets, liquid concentrates etc.
	Tricalcium Citrate	
	Calcium Gluconate	
	Calcium Lactate Gluconate	
	Calcium Glycerophosphate	
	Calcium Lactate	
Infant or follow-on formula based on milk powder	Calcium Chloride	Fortification
	Calcium Carbonate	
	Calcium Citrate	
	Calcium Glycerophosphate	
	Tricalcium Phosphate	
Bakery good / confectionery	Calcium Carbonate	Raising agent, acidity regulator
	Tricalcium Citrate	
	Tricalcium Phosphate	
Beverages / juice	Calcium Lactate PLUS	Fortification
	Calcium Phosphate PLUS	
	Calcium Citrate	Fortification, acidity regulator
	Calcium Gluconate	
Medicinal products	Calcium Lactate Gluconate	Active ingredients
	Calcium Acetate	
	Calcium Carbonate	
	Tricalcium Citrate	

Food Regulatory Aspects

Calcium is a popular mineral and frequently used in fortifying food and producing dietary supplements.

In Europe, the acceptable application areas for the individual calcium salts are defined in EU Community lists specified in various regulations and directives. Apart from the fortification options, the technological functions of calcium salts also have advantages.

If used as a colorant, an acidity regulator or separating agent to improve flowability, calcium salts are generally approved as additives without quantitative ceilings for many foods („quantum satis“).

In addition to the European requirements for using mineral salts, the relevant national regulations must also be met.

In the US, only calcium salts that have GRAS status (Generally Recognized As Safe) as specified by the Food and Drug Administration (FDA) can be used for food fortification and as technological additives.



Application as Nutrients

Calcium salts approved by the EU for fortification:

	Food ⁱ	Dietetic Foods ⁱⁱ	Infant formulae and follow-on formulae ⁱⁱⁱ	Processed cereals-based foods and baby foods for infants and young children ^{iv}	Food Supplements ⁱ
<i>Calcium acetate</i>					✓
Calcium bisglycinate		✓			✓
<i>Calcium carbonate</i>	✓	✓	✓	✓	✓
<i>Calcium chloride</i>	✓	✓	✓	✓	✓
<i>Calcium citrate malate</i>	✓	✓			✓
<i>Calcium gluconate</i>	✓	✓	✓	✓	✓
<i>Calcium glycerophosphate</i>	✓	✓	✓	✓	✓
<i>Calcium hydroxide</i>	✓	✓	✓	✓	✓
<i>Calcium lactate</i>	✓	✓	✓	✓	✓
Calcium L-ascorbate					✓
Calcium L-lysinate					✓
<i>Calcium L-pidolate</i>		✓			✓
Calcium L-threonate					✓
<i>Calcium malate</i>	✓	✓			✓
Calcium oxide	✓	✓		✓	✓
Calcium pyruvate					✓
<i>Calcium salts of citric acid</i>	✓	✓	✓	✓	✓
<i>Calcium salts of orthophosphoric acid</i>	✓	✓	✓	✓	✓
Calcium succinate					✓
<i>Calcium sulphate</i>	✓	✓			✓

Blue / cursive = in the Dr. Paul Lohmann® portfolio



Application as Additive

Calcium salts approved by the EU as technological additives:

E-NO.	COMPOUND	TECHNOLOGICAL FUNCTION
E 170*	Calcium carbonate	Colorant, acidity regulator, separating agent, raising agent
E 263	Calcium acetate	Acidity regulator, preservative
E 282	Calcium propionate	Preservative
E 327	Calcium lactate	Humectant, acidity regulator
E 333*	Calcium citrate	Complexing agent, acidulant, acidity regulator, emulsifying salt
E 341*	Calcium phosphate	Baking agent, acidity regulator, separating agent
E 352	Calcium malate	Acidity regulator
E 354	Calcium tartrate	Raising agent, complexing agent, acidulant, acidity regulator
E 470a	Calcium salts of fatty acids (e.g. calcium stearate)	Emulsifier, stabilizer, separating agent, glazing agent
E 509*	Calcium chloride	Firming agent, flavor enhancer, stabilizer
E 516*	Calcium sulfate	Firming agent, acidity regulator, carrier substance
E 526*	Calcium hydroxide	Acidity regulator
E 529	Calcium oxide	Acidity regulator
E 578	Calcium gluconate	Complexing agent, acidity regulator, stabilizer

* Food additives and processing aids in accordance with the EU Regulation on organic products.

CALCIUM SALTS WITH GRAS** STATUS

Calcium ascorbate

Calcium acetate

Calcium carbonate

Calcium chloride

Calcium citrate

Calcium gluconate

Calcium glycerophosphate

Calcium lactate

Calcium oxide

Calcium phosphate

Calcium propionate

Calcium stearate

Calcium sulfate

Calcium hydroxide

**21 CFR184 and 182 Substances affirmed as GRAS
(Generally Recognized As Safe)



Overview of our Competencies

DC Granulates

Our DC granulates are manufactured using a special procedure that allows the granulates to be compressed directly into tablets. This enables cost-efficient production of compact and firm dietary supplements and pharmaceutical products.

Micronized mineral salts

Micronizing is one of our processes by which particles are reduced to a size below 10 µm. Thus, our mineral salts maintain their special properties and become even more attractive for their specific applications.

This means the dispersion behavior in suspensions is improved, the specific product surface increases (potential enhancement of

bioavailability) and soluble mineral salts dissolve even better. Insoluble mineral salts of such fine particle structure are no longer perceivable in the mouth (no grittiness).

Microencapsulated products

In microencapsulation, the individual mineral salt particles are covered with a protective layer of vegetable fat. In this process, the mineral salts and the surrounding product are separated from each other in order to prevent chemical reactions or alterations in taste.

Micro2

The two positive characteristics of micronizing and microencapsulation are combined in our Micro2 products. As such, they offer considerable benefits when used in food, dietary supplements and pharmaceutical products.

Research & Development (R&D)

Every day we deal with new challenges in application science and technology. That is why we also develop products and procedures in close collaboration with our customers.

Our R&D labs offer a wide variety of possibilities to develop products and applications, and give you an opportunity to work together with us on your application at our plant in Emmerthal/Germany.



Manufacturing and certification

Our company is GMP and DIN EN ISO 9001:2008 certified, and our products are: Made in Germany.

In March 2012 our production site in Emmerthal was successfully inspected by the FDA (U.S. Food and Drug Administration) in the context of FSMA (food safety modernization act).

References

- 1 Hahn, A., Ströhle, A., Wolters, M.: Ernährung. Wiss. Verlagsgesellschaft Stuttgart, 2005
- 2 Hahn, A.; Schuchardt, J.-P.: Mineralstoffe - Stoffwechsel, Funktionen und Bedarf. Behr's Verlag, Hamburg 2011
- 3 Biesalski, H.K., Köhrle, J., Schümann, K.: Vitamine, Spurenelemente und Mineralstoffe. Thieme-Verlag, Stuttgart, 2002

GRAS Substances (SCOGS) Database;

<http://www.fda.gov/Food/FoodIngredientsPackaging/GenerallyRecognizedasSafeGRAS/GRASSubstancesSCOGSDatabase/default.htm>

Relevant EU Regulations and Directives:

Fortification:

I Commission Regulation (EC) No 1170/2009 and (EC) No 1161/2011

amending Directive 2002/46/EC of the European Parliament and of Council and Regulation (EC) No 1925/2006 of the European Parliament and of the Council as regards the lists of vitamin and minerals and their forms that can be added to foods, including food supplements

II Commission Regulation (EC) No 953/2009 and (EC) No 1161/2011

on substances that may be added for specific nutritional purposes in foods for particular nutritional uses

III Commission Directive 2006/141/EC

on infant formulae and follow-on formulae and amending Directive 1999/21/EC

IV Commission Directive 2006/125/EC

on processed cereal-based foods and baby foods for infants and young children

Directive 2002/46/EC

on the approximation of the laws of the Member States relating to food supplement

Regulation (EC) No 1925/2006

on the addition of vitamins and minerals and of certain other substances to foods

Commission Directive 96/8/EC

on foods intended for use in energy-restricted diets for weight reduction

Technological additives:

Regulation (EC) No 1333/2008 and (EC) No 1129/2011

on food additives

Directive No 95/2/EC

on food additives other than colours and sweeteners

Commission Directive 2008/84/EC

laying down specific purity criteria on food additives other than colours and sweeteners

Commission Directive 2008/128/EC

laying down specific purity criteria concerning colours for use in foodstuffs

Directive No 94/36/EC

on colours for use in foodstuffs

Commission Regulation (EC) No 889/2008

laying down detailed rules for the implementation of Council Regulation (EC) No 834/2007 on organic production and labelling of organic products with regard to organic production, labelling and control

The information given in the document corresponds to our current knowledge. We warrant in the frame of our General Terms and Conditions of Sale that our products are manufactured in accordance with the specifications. However, we disclaim any liability with regard to the suitability of our products for a particular purpose or application or their compatibility with other substances. Tests have to be performed by the customer who also bears the risk in this respect. Nothing herein shall be construed as a recommendation to use our products in conflict with third parties' rights.

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