

Salt – sodium reduction in food – possibilities and concepts

Sodium chloride or cooking salt (NaCl) is an all-purpose food stuff and its usage for seasoning and preservation of food can be traced back to the earliest of the ancient civilizations. In those times preservation played a particularly important role. Salt preserves food by inhibiting the growth of bacteria through osmotic deprivation of water. In addition, salt has essentially important sensory functions. Excessive consumption, however, may lead to high blood pressure.

Physiological function

Depending on age and gender, about 40 to 80 percent of the human body consists of water. Sodium ions are essential for the osmo-regulation of the human body. Aside from HCO_3^- , Na^+ and Cl^- are the most common ions within the extracellular liquid and significantly determine its volume and the osmotic balance.

The water and ion balance of the body is maintained by the kidneys' removing water and



Salt is won all over the world as for instance here in Bolivia
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ions from the blood and returning them selectively. Thus the function of the kidneys has a direct influence on the regulation of blood pressure. The impact of Na^+ on the blood pressure is described in detail in literature and is undisputed among experts^{1-4, 7-9}.

Sensory function

The exact flavour-imparting mechanism of salt is still disputed in literature. It is clear, however, that NaCl has the commonly known purely salty taste while other cations (K^+ , Mg^+) disturb the sensory impression for example by bitter qualities.

The salty taste can both intensify and impede the taste of other components since the individual flavours of food interact intensively.

Salt for example intensifies *umami* which is a



It is salt that gives a lot of foods their characteristic taste

hearty taste and confines sweet. This makes it an important ingredient in both spicy and sweet foods. A bitter taste is confined by *salty* which may turn the reduction of salt in foods into a sensible undertaking.

Technological functions

In **meat and sausage**, salt controls the water content and influences also the consistency via the protein structure. It increases the bonding capacity of meat which, for example, is important in the production of sausages or hamburgers and other products with ground meat.

In the **production of hard and soft cheese**, salt influences the maturing and the microbial growth. By its influence on the protein structure salt also has an important impact on the consistency of cheese.

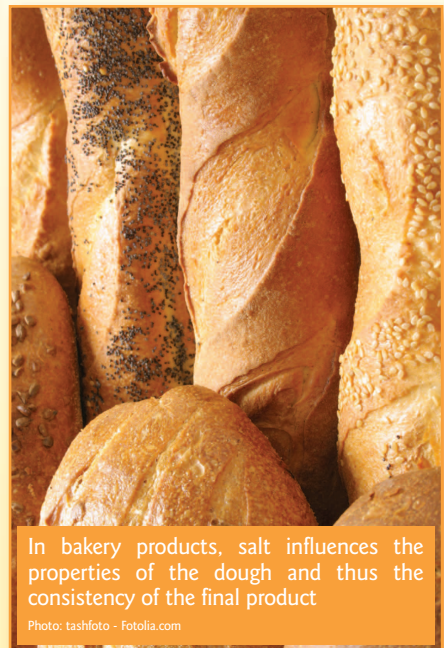
In **fermented vegetable products** such as for example sauerkraut or pickled gherkins, salt also influences the fermentation process. Aside of that, however, it also keeps the "crisp" consistency of the vegetables by rapidly extracting large quantities of water from the plant matter.

Many **breakfast cereals** contain salt as

flavour enhancer even if it does not obtrude with regard to taste.

In **bread and baked goods**, salt is also an universal ingredient which – aside from giving the taste – has an influence on the growth of the yeast and the gluten properties of the dough and the consistency of the final product.

In many **thermally preserved products**, salt supports the microbiotic stability over many years. Proverbial in this context has become the term spam: It originally was very strongly salted meat in cans.



In bakery products, salt influences the properties of the dough and thus the consistency of the final product
Photo: tashfoto - Fotolia.com

Results of in-house baking tests with Dr. Paul Lohmann Salt Substitute

	Standard (NaCl)	Premix Salt substitute (50% Na red.)	50% NaCl / 50% salt subst. (25% Na red.)
Baking yield/ Spec.vol. (ml/100g)	302	353	350
Crust	Typically light/ brown; medium hard	Darker / harder than standard	Typically light/brown; medium hard
Taste / aroma	Typical	A little less salty; acceptable	Almost typical
Crumb /elasticity	Very good	Very good	Very good
Pore structure	Consistently fine to medium pores	Almost consistent pores	Consistently fine to medium pores
Mouthfeel	Typically soft; good taste	Typically soft; good taste	Typically soft; good taste

Functional **beverages** contain a defined quantity of salt to control the osmotic properties and, with sports and isotonic drinks, to remineralize the body.

Sodium reduction – restriction of salt consumption

With both adults^{4,7} and children and adolescents³ the connection between salt consumption and blood pressure has been investigated and identified. Both national^{1,2,8} and international⁹ health authorities consider the presently consumed daily quantity of salt in many countries of the world too high and recommend to reduce the quantity of salt to six grams per day^{1,2,8}. This corresponds to a quantity of 2,400 mg sodium per day.

The reduction of salt in food may among other things be achieved via a gradual decrease of the salt quantity ("reduction by stealth"). Although



Worldwide, health organisations demand to reduce sodium in foods © Bild: paradoksB - Fotolia.com

individual producers could save up to 33% of the originally used salt this way, there is, however, a risk that the trait of a food is lost and it thus becomes unattractive to consumers. A pure reduction of salt, however, does not only hold the risk of loss of taste but may furthermore reduce the shelf life of food.

Sodium reduction – substitution of salt with other substances

Another possible approach is to substitute cooking salt with other ingredients such as spices or other strongly aromatic ingredients. Substances like amino acids, glycine or glutamate can intensify a salty or *umami* taste and thus compensate sensory losses to a limited extent.

Another way of substituting cooking salt is the use of other mineral salts. In particular potassium chloride is being used here which substitutes up to 50% of the sodium. However, potassium chloride has a distinctly bitter taste. Since the sensory sensitiveness towards bitter may be very strong for genetic reasons, the usage of KCl in sodium reduction is clearly restricted. The same applies to calcium chloride or various salts of magnesium. In addition, the latter also have a laxative effect which forbids intensive use.

Furthermore, at present possibilities are investigated to achieve a higher saltiness via special emulsion techniques of saline solutions or by manipulating physical parameters. However, development is still in a beginning state and the applications are likely to be limited here, too.

Taste decides

In his wide range of products, Dr. Paul



Dr. Paul Lohmann develops customer-specific solutions to replace common salt

Lohmann has an interesting choice of salty tasting mineral salts that can be combined for various applications. The **Premix Salt Substitute** is a completely mineral mixture of various salts. The mixture contains 20% of sodium which represents a reduction of the sodium content of 50% compared with usual cooking salt (40% Na⁺).

The decisive factor for the consumer's acceptance of a salt substitute is its taste profile. The **Premix Salt Substitute** tastes familiarly salty with regard to both flavour and intensity. A careful selection of ingredients prevents an acerb taste. The individual components are generally approved as food and food additives and unproblematic as far as declaration is concerned. Dr. Paul Lohmann's salt substitute does not contain glutamate or any other flavoUr enhancers like amino acids. Thus allergic reactions are extraordinarily unlikely.

Already successfully in use

In particular in the production of sodium-reduced pastries, the Lohmann salt substitute is already successfully applied in practice. Further possible application areas are sausage and meat

products, fish products, salty snacks and breadsticks, cheese and dairy products as well as the usage in ready-made meals, in gastronomy, in condiments or for direct consumption out of the salt shaker at table.

Dr. Paul Lohmann is in a position to develop customer-specific solutions for special applications such as completely sodium-free salt mixtures or special mixtures with magnesium. The following potassium and magnesium salts are approved for use in food within the EU^{10,11}:

Potassium Citrate
Potassium Bicarbonate
Potassium Phosphate
Potassium Chloride
Magnesium Sulfate
Magnesium Chloride

This makes a declaration of these substances unproblematic. With regard to the declaration of individual components contained in mixtures, Dr. Paul Lohmann offers adequate and competent advice.

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