

Low-Fat Cheese and Cheese-like Products

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저지방 치즈와 치즈 유사제품의 개발현황

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적 요

최근 대부분의 구미지역 소비자들은 저칼로리, 저지방식품을 선호하고 있으며 이들 식품의 소비는 날로 증가하고 있는 추세이다. 특히 치즈 등 유제품에 있어서는 더욱 이러한 경향이 두드러지고 있다. 우리나라에서도 가까운 장래에 저칼로리, 저지방식품이 대중화 될 것으로 생각되어 저지방 치즈 및 식물성 지방이나 단백질 등의 non-dairy ingredients를 대체 원료로 이용한 치즈 유사제품에 대하여 제조시 문제점과 해결방법, 시장성 및 식품에의 이용에 대한 최근 경향을 알아보았다.

I. INTRODUCTION

During the last years, a lot of new products have been developed and marketed answering consumers' special needs. Thereby, the industry's main interest has been in the field of milk products and cheese. In these products, milk or milk constituents have been totally or partially replaced by other ingredients. Among other things, the reasons for this development were the costs of the raw material milk, the urge to diversify the product range, and special properties like a lower energy content. While this last point has led to the development of products of the "light"-range, more severe interventions have led to milk substitutes and cheese-like products.

II. LOW-FAT CHEESE

As for cheese, a consumer demanding a low-fat cheese some years ago only had the choice between a few special normal cheeses like fresh cheese, cottage cheese, sour milk cheeses, and some fat-reduced processed cheeses, which are traditionally low in energy. There did not exist any cheese of low caloric value, which copied in flavour and appearance the normal hard, semi-hard, or soft cheeses. The social trends towards fitness, health, and slimness, however, has urged the food industry to develop new products, because the consumers want to reduce the fat amount in their

diet. Generally, these developments tend to copy known products and do seldom lead to totally new product conceptions¹⁾.

The energy reduction of foods can be achieved by different means, as for example by a reduction in carbohydrates and/or fats, or a substitution of high-caloric food constituents by compounds of lower energetic value. Thereby, the consumers' demands of high sensory value and/or technological value have to be met.

The exchange of fats by carbohydrates or proteins can be achieved in meat products, and a reduction of carbohydrates can be realized by sweeteners and thickening agents. The dairy sector in general has applied these ideas, as can be seen in a large offer of light-yoghurts (made from skim milk with added stabilizers and sweeteners) and low-fat butter. However, these possibilities are not feasible for cheese.

For cheese, the most important means is the production of cheese from skim milk. However, this can lead to problems like bitterness, lack of flavour, and unsatisfactory body and texture (Bhowmik *et al.*²⁾ Rnak³⁾). A solution might be special starter cultures, which are well adapted to a fat-reduced environment. Bhowmik *et al.*²⁾ succeeded in making low-fat Cheddar that could not be differentiated from normal Cheddar by sensory tests: cheesiness, off-flavour intensity and overall preference were the same as in normal full-fat Cheddar. Peptidolytic and esterolytic strains of pediococci also led to an accelerated ripening of the cheese, which

showed in a sharp aged Cheddar flavour already after three months of curing and a higher content of volatile sulphur compounds. A defect, however, might be the development of calcium lactate crystals in the cheese containing pediococci. Bitterness can also be reduced by a *Lactococcus lactis* starter or by preparations of bacterial aminopeptidases⁴⁾.

The question arises if light products do really lead to a lower energy intake of the consumers. This cannot be answered in a general way: the composition of the total diet is of importance, and a few light products involved in a normal diet cannot lower the overall energy intake to a high degree. And the consumers can't be expected to compose their diet exclusively of light products¹⁾.

In Europe, there is a large range of low-fat cheeses on the market at present. Of greatest importance are fresh cheeses and process cheeses, which still show high increasing rates. The light types of hard cheeses (type Cheddar), semi-hard cheeses (type Gouda), and soft cheeses (type Camembert) have only recently gained importance, because flavour and texture problems had to be solved by the industry before. In 1990, 17% of the retail cheese in Germany belonged to the light products, showing an increase of 7% compared to the year before, although the prices of hard and semi-hard light cheeses are higher than those of the normal products⁵⁾.

III. CHEESE-LIKE PRODUCTS

Cheese-like products contain non-dairy ingredients and have been developed with the objective of showing the special characteristics of normal cheeses. Two main approaches have to be discussed: German authors⁶⁾ differentiate on the basis of the ingredients between 'Imitation products' and 'Substitution products', whereas English and American authors⁷⁾ distinguish

'Filled cheese' and 'Cheese analogues' on the basis of the production method. By including both the nature of the ingredients and the way of processing, the two systems can be combined (see Table 1).

The German classification is applicable to all sorts of dairy products. Imitation products are analogue to conventional milk and milk products concerning composition, appearance, and purpose of use. They are produced by exchanging parts of the dairy compounds by vegetable fat or protein. Hence, milk or skim milk is still one of the raw materials. Vegetable proteins or fats are from soya, coconut, corn, or palm.

Milk substitutes, however, don't contain any dairy constituents any more, but still fulfill the functions of the products they copy. These products are mainly made from soya.

The Anglo-American classification is only for cheeses. If the manufacture follows the traditional way of cheese making with clotting of a liquid "milk" in the cheese vat and maturation, the products are called filled cheese. Filled cheeses, like light cheeses, show certain disadvantages. The necessary homogenization can lead to problems during curd syneresis, rennet action can be hindered, and the product can show an atypical flavour and a wet texture. Therefore, the majority of the cheese-like products is produced as cheese analogues.

Table 2. Ingredients for a Cheddar cheese analogue⁷⁾

Ingredient	%
Sodium caseinate	13.0
Calcium caseinate	13.0
Vegetable oil	25.0
Lactic acid	1.0
Stabilizer/emulsifier	1.0
Salt	1.5
Flavour	1.5
Water	34.0
Cheddar cheese	10.0

Table 1. Composition and manufacturing of light cheeses and cheese substitutes^{6,7)}

Anglo-american	German classification	Dairy ingredients	Non-dairy ingredients	Manufacturing method
Light cheese	Light cheese	Skim milk	none	Maturation
Filled cheese	Imitation product	Skim milk; Butterfat	Vegetable oil	Maturation
Filled cheese	Imitation product	Skim milk;	Vegetable oil	Maturation
Dairy cheese analogue	Imitation product	Casein or caseinates; Butteroil; Flavour	Flavour	like processed cheese
Partial dairy cheese analogue	Imitation product	Casein or caseinates; Flavour	Soya oil; Flavour	like processed cheese
Synthetic cheese analogue	Substitution product	none	Soya protein Soya oil; Flavour	like processed cheese

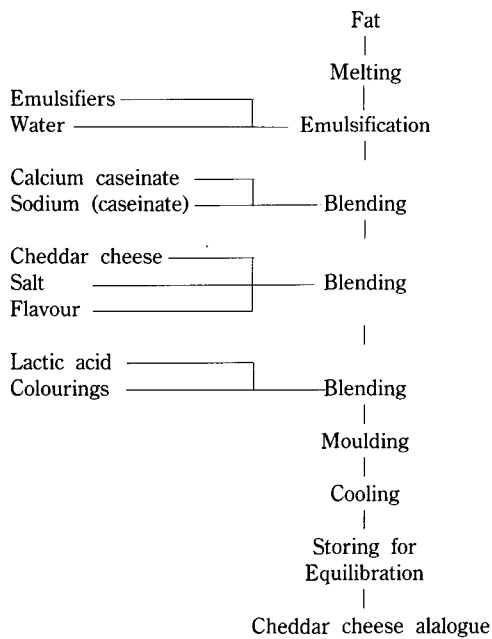


Fig. 1. Process scheme for a Cheddar cheeses analogue⁷⁾.

gues with processes known in processed cheese manufacturing being applied. Ingredients and a process scheme for a Cheddar cheese analogue are shown in Table 2 and Fig. 1.

In most cases, flavours have to be added to the products. These can be artificial or of the enzyme-modified cheese type. Fermentative flavour concentrates can also be applied.

IV. NUTRITIONAL QUALITY OF LIGHT CHEESE

Light cheese shows the advantages of low energetic value and low cholesterol. Protein quality, minerals and water-soluble vitamins are not changed compared to normal cheese. The content of the fat-soluble vitamins is lowered, as they are removed together with the milkfat, but the contribution of cheese to the supply of these vitamins is not very important.

V. NUTRITIONAL QUALITY OF CHEESE PRODUCTS ON SOY BASIS

Renner⁸⁾ lists the disadvantages of soy-based imitation products compared to milk-based products. Soy protein has a lower protein value than milk protein, which is due to a lower content of all of the essential

amino acids. By mixing soy and milk proteins in the correct relation, however, a higher biological value than of milk protein alone can be achieved.

Imitation products contain less calcium than normal cheese if not enriched with calcium salts. Riboflavine concentrations are much lower than in milk.

Imitation products contain relatively much iron if produced on base of soy, but the intestinal absorption seems to be less intense than in milk products.

Several controlled experiments did not show significant differences in the allergic potential of weaning foods on soy and cow's milk basis.

However, Shaw⁷⁾ writes that "the regular substitute is at least equivalent to the natural cheese, while the fortified product is superior with regard to certain vitamin and mineral levels".

Soy oil contains up to 60% polyunsaturated fatty acids and nearly no cholesterol. The other vegetable oils used, like coconut oil, however, contain only little PUFA. The single declaration "vegetable oil" thus renders the valuation of the product impossible, as the origin of the fat can't be found out⁶⁾.

VI. LEGAL ASPECTS

In the U.S., imitation milk and milk products can be sold with sufficient declaration since 1983 in all states. Already since 1896 and 1923, filled cheese resp. filled milk are allowed to be marketed in some states of the U.S.⁹⁾

In Germany in 1990, the milk law had to be adapted to the possibilities of imitation milk and milk products, because it had not been allowed to imitate milk products and to market them. As already in 1987, the European Community enacted a directive which confined expressions like milk and cheese only to products exclusively made of milk components.

VII. MARKETING EVALUATIONS

Hülsemeyer¹⁰⁾ names the following reasons for the marketing successes of imitation milk products:

- convenience
(longer shelf life, more comfortable packaging)
- nutritional aspects
(low fat, low energy, low cholesterol, high PUFA)
- high expenditures for advertising and sales promotion
- the intention to make products which are as near as possible to the original product

- attractive profit margins
- sometimes lower consumers' prices
- products answering to the special needs of trade (bakers).

The main advantage for the manufacturer are the low-cost raw materials. However, this does not always lead to low consumers' prices, these products may even cost more than normal cheese. Disadvantages of cheese-like products are flavour and an often unnatural image⁷⁾.

According to Shaw⁷⁾, cheese substitutes "represent little threat to the continued consumption of natural cheeses" in the U.K. Rather than being used as direct replacements for natural cheese, cheese substitutes have an additional effect on overall cheese market rate.

Retail sale of cheese substitutes is not very important. Main customers in the U.S. are pizza manufacturers (60% of all products), school lunch programmes and fast food outlets. Therefore, the most popular cheese substitutes are the Cheddar and Mozzarella types⁷⁾. In France, 80% of the pizzas produced contain cheese imitates⁶⁾.

The expected overall substitution effects for cheese imitates are 5% for Germany and 10% for the European Community¹¹⁾.

Milk products and cheese are not a traditional part of the Korean diet, and only slowly people are becoming familiar with these products. By laying stress upon the "light"-image of those products, however, new consumers might be found which would not be willing to try natural cheese. Not being able to compare, they may acquire a taste for these products. This

change in diet customs achieved, the consumers might want to try natural cheeses by curiosity. The introduction of cheese substitutes could thus lead to the extension of the consumption of natural cheese.

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