soy protein isolate.

V. Cheese-like foods.
   1. Traditional (Oriental) unfermented and fermented.
      a. Tofu, kori-tofu, aburage; made from traditional soy milk by precipitation with calcium sulfate.
      b. Sufu, Chinese fermented bean curd by action of *Mucor* organisms.
   2. Simulated cream cheese, based upon soy protein isolate.
   3. Simulated cured and processed cheese and cheese food types, with cheddar characteristics. On the market based upon bovine caseinates. Attaining similar properties with soy protein isolate poses problems.
   4. Cheese spreads and dips.

VI. Frozen desserts, ice cream and sherbet types. Acceptable formulations can be made with respect to texture and overrun and meltdown. Flavor, other than chocolate, and possibly viscosity may pose problems. One company has marketed a dry mix based upon soy protein isolate.

VII. Whipped toppings. Several on market in dry powder, liquid, or aerosol dispenser form. Based upon caseinates for most part but some on soy protein isolate. Formulations available from ingredient purveyors (fats, proteins).

VIII. Substitute nuts and fruits.
   A. Nuts based on processed whole soybeans retaining macrostructure and oil content. Many methods of processing in literature.
   B. Simulated nuts based on dried, compressed protein-fat emulsions.
   C. Simulated bell peppers on market, also simulated mushrooms. Possibility of achieving textures of dried fruits (intermediate moisture); also of tomato paste (imitation tomato pastes are on the market as extenders, based upon starch). One can speculate on simulation of other textures, e.g. artichoke hearts.

IX. Table vegetable, green soybeans, and bean sprouts. Available in canned form, also fresh in season in some areas. Dry beans can be sprouted in home.

X. Soups. Protein fortification as thickener (soy flour, soy protein concentrate, or soy protein isolate) or in high protein noodles or croutons. Oriental use of yuba.

Soy Protein Isolates in Hypoallergenic Infant Formulations and Humanized Milks

ALAIN DECOCK, Purina Protein Europe, Brussels, Belgium

INTRODUCTION

For many years, in both the U.S. and Europe, a number of baby milks, based upon soy protein isolates, have been on the market.

The major reasons for these products was, not only to feed infants who were allergic to cows' milk, but also to replace hypoallergenic infant formulations based upon soybean flour. Since the term "hypoallergenic" generally is defined as an allergy of infants to animal protein, in this discussion we are only considering allergies to animal protein and not, as in some limited cases, allergies to soy proteins. Although soybean flour performed well in providing nutrition, it had some disadvantages, such as unpleasant flavor, and intestinal side effects (gas formation and colic), as well as an occasional tendency to increase dermatitis.

The real reason for infants' allergies to cows' milk is not clear. However, it has been proved that, in the blood of some of these allergic infants, antibodies are present. The cause of these antibodies to milk proteins is not 100% clear.

Nutrition-wise, proteins are the most important part of food and are the building blocks for new cell material. When using raw materials, such as soybean flour, with a protein content of ca. 50%, the presence of the nonprotein fraction also has to be considered carefully, because of secondary reactions. Soluble carbohydrates and insoluble polysaccharides affect the infant's metabolism. Examples are: (A) the effect upon the type of protein curd, (B) transit time from stomach to intestine, and (C) differences in enzymatic or bacterial degradation of components, like soluble carbohydrates and fibers.

SOY PROTEIN ISOLATES

Again, although the incorporation of soybean flour in hypoallergenic formulations was advantageous as far as nutrition was concerned, it also introduced unwanted products. An answer was the replacement of the flour by soy protein isolates, with a minimum protein content of 90%, combined with corn syrup solids, maltodextrins, or sucrose.

However, the nutritional properties of the proteins are important and depend upon production factors. It is apparent that, not only protein content, but also the protein efficiency ratio (PER) must be carefully considered.

In some applications where soy protein isolates are used for their functional properties, PER is not of primary importance; however, in dietetic formulations it is of the utmost importance. Highly nutritional soy protein isolates have a PER of 1.8-1.9. Standard casein, which is taken as a reference, has a PER of 2.5. If a PER of 2.5 is essential, one can supplement the soy protein isolates with methionine (1.0% of the isolate).

Hypoallergenic infant milks normally are produced from corn syrup solids, sucrose, soy protein isolates, and vegetable fats and are supplemented with vitamins and minerals. The protein content varies from 2-2.5% when reconstituted. Due to stable prices for soy protein isolates, as compared with milk proteins, so called hypoallergenic formulations are more and more widely produced to cover, not only the hypoallergenic field, but also to provide a modern food system which answers the nutritional requirements of healthy infants.

HUMANIZED MILKS

An extension of hypoallergenic formulations is the appearance on the market of the so called maternized or humanized milks. The purpose of such milks is to provide nutrition to infants who have not been able to receive maternal milk from time of birth. In such milks, one tries to reconstitute maternal milk with regard to lipids, proteins, lactose, minerals, and vitamin content.

As you may know, cows' milk, which is normally fed to infants, is quite different from maternal milk, not only as far as a level of essential major ingredients is concerned, but also in its chemical structure and composition.

The essential ingredient which is of interest to us today is the protein content. It is an accepted fact that, in cows'

milk, the ratio of albumin to casein is 20:80, while in maternal milk the ratio is 60:40. Here again, it is possible to use soy protein isolates in place of the globular protein casein.

In formulating such products, some specialists insist on a ratio of albumin to globular protein of 20:80, while others prefer the 60:40 ratio like that of maternal milk. The former base their preference upon the higher methionine content of casein, while the latter base their choice on the biological superiority of albumin over casein.

I believe we may conclude that soy protein isolates of high quality and nutritional value can be considered as a perfect answer to feeding, not only hypoallergenic cases, but also normal healthy infants. Continual research and development, combined with nutritional studies, will broaden the areas of application of soy protein isolates where nutrition is of the utmost importance.

Use of Soy Protein Isolate in Slimming Food

ERICH KOLB, Firma Peter Eckes, Nieder-Mainz, West Germany

INTRODUCTION

The value of a balanced diet, which meets nutritive physiological needs, is being recognized more and more. At a time in which an alarming increase in illnesses connected with nutrition is being recorded in most highly developed industrial nations, healthy food is becoming more and more important both for its prophylactic and its therapeutic value.

The development of foods aimed at preventing the consumption of superfluous calories is especially important in this respect. Today it is generally recognized that, in large portions of the populations of technologically highly developed countries, there is a tendency to overeat, which is often the main cause of illness and high mortality rates. According to the 1972 Nutrition Report, an average of 400-700 calories too many/head/day are consumed in the Federal Republic of Germany (1). The result is an increase in the frequency of overweight among all age groups. In the Federal Republic of Germany ca. 10% infants and children and ca. 30% of adults are overweight.

Numerous investigations show what an unfavorable effect overweight has upon humans. It does not only spoil the figure, but also can lead to severe injury to health. Thus, apart from frequent psychological trouble (2,3), an increase in premature general hardening of the arteries (arteriosclerosis) leading to accelerated pulsation and a rise in blood pressure can be detected among overweight people. Furthermore, there is often an accumulation of signs of diabetes mellitus, endogenous hypertriglyceridemia, gout, kidney stones, gallstones, inflammation of the pancreas, etc. Finally, the general resistance of infections is less in obese people. There is a clearly greater risk attached to operations for obese people than for people of normal wt (4).

These serious complications of obesity lead to a shorter life expectancy among overweight people—a fact which has been clearly established by the statistical investigations of large international insurance companies. Even in the case of moderate obesity, i.e. when the normal wt of the body is exceeded by 15%, a reduction of life expectancy by ca. 10% must be reckoned with (5), in the case of an overweight of 25% a reduction of 20%, and in the case of an overweight of 37% a reduction of 50% (6).

Avoiding or reducing excessive wt is, therefore, one of the most urgent requirements for the preservation of public health. All meaningful measures must be aimed at correcting the disproportion which exists between the intake and loss of calories by a diet which maintains the balance of one's energy—or, in the case of overweight—forms it negatively. The slimming foods offered by the food industry can be a valuable aid in this respect.

FACTORS INVOLVED IN SLIMMING FOOD DEVELOPMENT

Development of this kind of food requires a great deal of knowledge about the physiological functions of humans under extreme conditions, such as reduced calorie intake. The terrible experiences from both world wars give a comprehensive insight into the effects of malnutrition on large parts of the population.

Today we know that many of these phenomena were caused not only by an insufficient calorie consumption but also by a one-sided, substandard diet. Modern dietetics knows that efficiency, good health, and disease resistance of the organism require a diet which has a certain calorie content and a balanced relationship between protein, fat, and carbohydrates, as well as an adequate intake of vitamins, minerals, and trace elements.

An unbalanced diet, in which a nutrient is arbitrarily restricted, leads to symptoms of malnutrition. An insuffi-

TABLE I

Essential Amino Acid Composition of Various Proteins (g/16 g N)

Protein	Protein content percent	Isoleucine	Leucine	Valine	Methionine	Phenylalanine	Threonine	Tryptophan	Lysine
Whole egg protein	46	3.06	4.05	3.42	1.44	2.66	2.29	0.76	2.94
Yolk protein		2.00	2.67	2.18	0.81	1.40	1.61	0.46	2.09
Egg white protein		5.00	6.80	6.02	3.01	4.94	3.41	1.18	4.64
Na-caseinate	94	5.50	9.70	6.90	2.80	5.30	4.80	1.60	8.30
Skim milk powder	35	2.24	3.43	2.40	0.86	1.70	1.61	0.49	2.72
Fish protein	90	5.10	8.50	6.20	3.60	4.60	5.10	1.60	9.80
Seaweed protein	62-73	3.60	5.60	4.50	2.00	2.90	4.00	0.90	6.50
Milk yeast	47	2.10	3.49	2.48	0.57	1.77	2.78	0.60	3.41
Beer yeast	45	2.24	3.16	2.57	0.72	2.05	2.25	0.55	3.72
Isolated soy protein	90	4.60	8.10	4.60	1.00	5.50	4.00	0.90	6.60
Peanut protein		4.10	7.10	4.60	0.80	4.90	2.80	0.80	3.50
Cotton seed protein	65	2.60	5.70	4.50	1.40	5.60	3.10	1.20	4.10
Maize protein	73	3.50	7.30	5.90	1.90	4.50	3.80	1.30	6.30
Potato protein	88	6.30	10.50	7.40	2.20	6.90	6.20	1.30	8.40