

## PALATABLE ELEMENTAL MEDICAL FOOD

## FIELD OF THE INVENTION

This invention relates to improved enteral nutritional hypoallergenic formulas and more particularly to hypoallergenic formulas which taste good. In addition, the nutritional product of this invention provides a nutritionally complete hypoallergenic food for individuals with multiple food allergies, short gut syndrome, cystic fibrosis, pancreatic disease, gastroenteritis, inflammatory bowel disease, intractable diarrhea, malnutrition, protein maldigestion, infectious diseases or for patients with hypermetabolism, such as burn and trauma victims or cancer patients.

## BACKGROUND OF THE INVENTION

Hypoallergenic formulas or compositions which are also referred to as elemental formulas, are characterized in that they contain immunologically unreactive protein hydrolysates or free amino acids. The protein hydrolysates comprise short peptide fragments and/or free amino acids instead of the intact protein found, for example, in cow's milk and soy protein based formulas. These short peptide fragments and free amino acids have been found to be less immunogenic or allergenic than intact proteins.

In addition to the protein hydrolysates and/or free amino acids, most nutritionally balanced elemental or hypoallergenic formulas contain carbohydrates, lipids, vitamins and minerals to provide a nutritionally complete formula. These formulas are utilized for feeding infants, children and adults who have allergies or sensitivities to intact protein and are often medically used in the treatment of cystic fibrosis, chronic diarrhea, small bowel resection, steatorrhea and protein-calorie malnutrition.

One well known problem in the preparation of elemental or hypoallergenic formulas is product instability. Extensive hydrolysis of the protein by acids, or enzymes is necessary to provide the short peptides and amino acids utilized in the formulas to render such formulas hypoallergenic. These extensively digested proteins or free amino acids have undesirable characteristics such as bad taste and loss of capacity to emulsify fat and thereby fail to form physically stable emulsions that do not evidence phase separation.

U.S. Pat. No. 4,414,238 to Schmidl et al. discloses an elemental diet composition comprising carbohydrates, amino acids and/or low molecular weight peptides and lipids. The elemental diet of this patent has a lipid component in the form of an emulsion consisting of lipids, an emulsifier selected from the group consisting of mono- and di-glycerides, and a starch modified with succinic anhydride.

U.S. Pat. No. 4,670,268 to Mahmoud discloses an enteral nutritional hypoallergenic formula which uses a starch modified by octenyl succinic anhydride, which is utilized as the sole lipid emulsifier, to provide a nutritionally well-balanced dietary formula that possesses excellent physical stability.

U.S. Pat. No. 5,411,751 to Crissinger discloses infant formulas which contain no more than subirritant levels of free, long-chain ( $C_{16}$ - $C_{22}$ ) fatty acids and triglycerides thereof. This patent teaches that digestion products of triglycerides, in particular, long-chain fatty acids and monoglycerides, can damage the intestinal epithelium of infants and thus could mediate the onset of disorders such as necrotizing enterocolitis. This patent does not suggest or disclose a palatable elemental or hypoallergenic medical food that is essentially free of L-glutamic acid and L-aspartic acid.

U.S. Pat. No. 5,234,702 to Katz et al. discloses a powdered nutritional product that uses an antioxidant system to protect the oil component comprising ascorbyl palmitate, beta carotene and/or mixed tocopherols and citrate. The teachings of this patent are incorporated herein by reference.

U.S. Pat. No. Re. 35,233, discloses a method of treating atrophy of skeletal muscle and intestinal mucosa which comprises enterally administering glutamine or a functional derivative thereof in the range of 0.4 to 3.0 g/kg/day.

The nutritional formula according to this invention has been carefully formulated to provide a nutritional product that can be the sole source of nutrition for patients consuming it. To provide effective nutrition to human infants, children and adults, the present invention, in its most specific embodiments, carefully considers the bioavailability of trace and ultratrace minerals and the dietary interactions involving trace elements. Thus, the teachings of Forbes et al, *Bioavailability of Trace Mineral Elements*, Ann. Rev. Nutr. 1983, 3:213-231 and Mills, *Dietary Interactions Involving the Trace Elements*, Ann. Rev. Nutr. 1985, 5:173-193, are incorporated herein by reference.

U.S. Pat. Nos. 5,326,569 and 5,550,146 to Acosta et al. disclose a generic powder base, rich in fats, carbohydrates, vitamins, minerals and trace elements which are admixed with specific amino acids to yield several different therapeutic products which are used in the nutritional support of adults and children having various inherited metabolic diseases. These patents do not suggest or disclose the nutritionally complete hypoallergenic formulas of this invention which are essentially free of L-glutamic acid and L-aspartic acid.

The etiology of a number of gastrointestinal conditions has been demonstrated to be caused in some cases by food protein allergens. One such gastrointestinal condition is eosinophilic gastroenteritis. Eosinophilic gastroenteritis is characterized by peripheral eosinophilia, eosinophilic infiltration of the bowel wall, and various gastrointestinal symptoms. In pediatric cases, food antigens are the most common cause of eosinophilic gastroenteritis. Administration of an elemental, hypoallergenic diet may be required for rapid recovery as even extensively hydrolyzed casein-based formulas such as Alimentum® Protein Hydrolysate Formula With Iron (Ross Products Division, Abbott Laboratories, Columbus, Ohio) contains peptide fragments large enough to evoke an allergic reaction in the most sensitive of allergic individuals.

U.S. Pat. No. 5,492,899 to Masor et al. discloses an enteral nutritional formula containing ribonucleotides at specified levels. The formula of this patent comprises carbohydrates, lipids, proteins, vitamins and minerals and four (4) specified nucleotides at specific levels and ratios. One preferred embodiment of the present invention includes the presence of nucleotides in the elemental hypoallergenic medical food. The teachings of U.S. Pat. No. 5,492,899 are incorporated herein by reference.

U.S. Pat. No. 5,340,603 to Neylan et al. relates to a hypercaloric formula which provides nutritional support for human infants having chronic lung disease. The formula of this patent has a Caloric density of at least 800 kcal per liter of formula and wherein not less than 56% of the total Calories in said formula is derived from fat. In addition, the hypercaloric formula of this reference contains not more than 15% of total Calories derived from a high quality protein source and from about 20 to 27% of total Calories from a carbohydrate source. The formula of this patent also includes m-inositol at a concentration of at least 50 mg per liter of formula.