# ELEMENT ENTERAL NUTRITIONAL PRODUCT

This application is a continuation of Ser. No. 09/071,639 and Filed May 1, 1998, now U.S. Pat. No. 6,194,379 the contents of which are hereby incorporated by reference.

## TECHNICAL FIELD

The present invention relates generally to an elemental nutritional product useful for providing nutritional support to patients suffering from malabsorption conditions.

## BACKGROUND OF THE INVENTION

Although nutrients may be provided by either parenteral or enteral routes, clinicians are making greater efforts to use the enteral route in light of research showing that enteral feeding confers certain physiologic benefits not seen with parenteral feeding. Published studies have reported that early enteral feeding provides energy and nutrients essential for optimal healing and immunocompetence, helps maintain the gut mucosal integrity, and may blunt catabolic effects and normalize blood glucose levels.

For optimal recovery, traumatized patients require proper nutritional intake. Proper nutritional intake is particularly critical for patents suffering from malabsorption conditions such as, for example, Crohn's Disease, short bowel syndrome, pancreatitis and other diseases and illnesses which cause malabsorption of essential nutrients. Lack of proper nutrition can result in malnutrition-associated complications, including prolonged negative nitrogen balance, depletion of somatic and visceral protein levels, immune incompetence, increased risk of infection, and other complications associated with morbidity and mortality. A primary objective of nutritional support for the traumatized person is to replace or maintain the body's normal level of nutrients by providing adequate energy substrates, protein, and other nutrients essential for tissue repair and recovery.

Appropriate enteral nutrition following injury may minimize malnutrition, provide nutrients to the immune system and maintain the gut epithelium, which acts as a barrier to translocation of bacteria. This may help prevent the development of sepsis. Malnutrition may compromise the immune system and contribute to septic complications. It has been reported that cell-mediated immunity is reduced in proportion to the level of malnutrition of the critically ill patient.

Persons suffering from malabsorption conditions are deprived of essential bodily fuels or their precursors thus compromising their nutritional status and more specifically, the integrity of the intestinal tract, especially during times of stress. Often, such patients are intolerant of dietary fiber. Patents suffering from malabsorption syndromes often have a diminished capacity to absorb water and electrolytes. This further challenges the nutritional status of the patient and may lead to dehydration.

To aid persons suffering from malabsorption conditions, enteral diets are desirably provided in an "elemental" state. Strictly speaking, an elemental diet would be one in which all components of the formulation are present in their simplest molecular state. For example, the protein source would be provided as amino acids. The carbohydrate source would be simple sugars. However, such compositions are difficult to formulate and are sometimes not well tolerated by the patient.

One difficulty in preparing products containing high levels of free amino acids is that such products will not form



stable emulsions suitable for long term storage. Thus such products are only available in a powdered form requiring reconstitution prior to usage. Health care providers and ambulatory patients typically prefer products that are provided as a liquid and require no reconstitution. A further disadvantage of powdered products is that the high concentration of free amino acids are noted for their extremely objectionable taste. Unfortunately this objectionable flavor can lead to noncompliance with the feeding regimen in patients who would benefit from elemental diets. Examples of such patients include those suffering ulcerative colitis, Crohn's disease, short bowel syndrome, and pancreatitis. Noncompliance with a proper feeding regimen will eventually lead to malnutrition in these patients.

Examples of powdered elemental nutritional products, whose protein source is predominantly amino acids, are Vivonex TEN™, and Vivonex Plus™, and Stresstein™, all of which are manufactured by Novartis.

Further developmental efforts with elemental diets focused on preparing products that would form stable liquid emulsions so that the products could be sold as ready to feed liquid nutritionals, which are typically preferred by health care providers and patients. One way to formulate an "elemental" nutritional product that is stable for extended periods as a liquid, has been to utilize a protein system for the product which incorporates a hydrolyzed protein. Hydrolyzed proteins are desirable because they provide the nutritive equivalent of the original protein in the form of its constituent amino acids and peptides of varying lengths. One useful hydrolyzed protein has been found to be soy protein hydrolysate. However, nutritional products incorporating high concentrations of hydrolyzed soy protein do not yield stable products in the absence of an intact protein. Once a soy protein is hydrolyzed, it loses its primary and secondary structure and consequently some of its functionality, including emulsifying properties. For that reason, it does not have surfactant properties and is unable to stabilize a formulation which results in phase separation.

For example, U.S. Pat. No. 5,403,826 to Cope, et al., discloses a nutritional product for persons infected with HIV. This product includes a soy protein hydrolysate and a second source of protein which comprises a source of intact protein, in a quantity sufficient to yield a stable emulsification of the soy protein hydrolysate and the intact protein. This product does not yield a shelf stable product in the absence of the intact protein. Typically, the intact protein will be present in an amount from about 10% to about 30%. The product also includes a source of fat which is formed from a blend of canola oil, medium chain triglyceride (MCT) oil and fish oil. The '826 patent does not teach the desirability of incorporating a structured lipid into an elemental diet.

As another example, U.S. Pat. No. 5,514,655 to DeWille, et al., teaches an enteral nutritional product with a protein system containing soy protein hydrolysate and intact protein. Approximately, 50% to 90% of the protein system consists of soy protein hydrolysate and the remainder includes not more than 50% of one or more intact protein sources, such as sodium caseinate and whey protein concentrate. The system also includes an emulsifier selected from the group consisting of diacetyl tartaric acid esters of monodiglycerides and sodium stearoyl lactylate.

As still another example, U.S. Pat No. 5,547,927 to Cope, et al., describes an enteral nutritional product for patients undergoing radiation therapy and/or chemotherapy. This product includes a protein system comprising, in a preferred embodiment, about 60% of a soy protein hydrolysate; about