

## ABSTRACT

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The nutritional status in 301 consecutive medical patients was studied using a combination of anthropometric variables, serum albumin levels and delayed cutaneous hypersensitivity reaction (DCH). The two latter factors were omitted as nutritional variables when they, for obvious reasons, were impaired by non-nutritional factors. Using this technique, 20-25% of emergency admissions with non-malignant diseases were diagnosed as malnourished in comparison with 2-4% of home-living, not necessarily healthy age-matched controls (n=100). Protein-energy malnutrition (PEM) was mainly associated with multiple organ disease, chronic heart failure and chronic obstructive lung disease. The malnourished patients had usually suffered from their disease(s) for several years and had gradually lost up to 25% of their weight over a long period of time.

In a cohort of 205 patients, the 9-month mortality was 44% in the malnourished and 18% in the well-nourished patients respectively. Excess mortality in association with PEM was mainly observed in subjects with congestive heart failure. PEM was also linked to an increased occurrence of infectious episodes and need for hospital care. Reduced dynamometric capacity and depressive tendencies were observed in the depleted individuals.

The malnourished subjects exhibited elevated serum concentrations of the acute phase reactant orosomucoid. In the 9-month follow-up, 9 out of 19 surviving malnourished patients had improved their nutritional status up to the low reference range. These beneficial effects were accompanied by a decline in serum oro-

somucoid. Those who remained malnourished displayed persistent elevations of the acute phase reactant. Since monocyte-produced cytokines regulate inflammatory reactions and promote cachexia, we analyzed the levels of such mediators *in vivo* and *in vitro*. Elevated serum interleukin (IL)-6 levels and increased monocyte production of IL-1 $\beta$  and IL-6 were displayed by the malnourished subjects both at baseline and at re-examination after three months. The highest serum IL-6 levels were observed in those patients who later died. Dietary intervention for three months caused a slight improvement in the nutritional status of malnourished outpatients. This finding was most pronounced among those who displayed normal levels of serum orosomucoid.

The serum fatty acids (FA) were decreased by approximately 33% in malnourished subjects. The decline was most pronounced for the  $\omega$ 3 FA. The serum concentrations of eicosapentaenoic acid (20:5 $\omega$ 3) and linoleic acid (18:2 $\omega$ 6), i.e. precursors of the immunoregulatory eicosanoids, were significantly correlated to the magnitude of DCH. This reaction, that indicates the cellular immunity state, was enhanced after three months of dietary intervention in parallel with increased serum concentrations of  $\omega$ 3 FA.

It is concluded that PEM is a major and often overlooked problem. This study points to underlying mechanisms not generally taken into account in the therapy of PEM. There is an urgent need to develop proper therapeutic guidelines for clinical practice.

**Keywords:** chronic disease, cytokines, essential fatty acids, immunocompetence, inflammation, monocytes, oral supplementation, protein-energy malnutrition