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Letter to the Editors

Nutraceutical and functional food ingredients for food and pharmaceutical applications

Food-derived bioactive peptides represent a source of health enhancing components that may be incorporated in functional foods and in pharmaceutical preparations. These peptides are potential modulators of various regulatory processes in the body. Milk proteins are precursors of many different biologically active peptides, e.g. peptides having opioid, hypotensive (angiotensin-converting enzyme-inhibitory), immunomodulating or antimicrobial activities (for reviews, see Meisel, 1997; FitzGerald & Meisel, 2000). The intrinsic bioactivities of the peptides encrypted in major milk proteins are latent until they are released and activated by enzymic hydrolysis, e.g. during gastrointestinal digestion and/or food processing. Several studies have been performed in the last two decades on caseinophosphopeptides (CPP), which may function as carriers for different minerals, especially Ca (for review, see FitzGerald, 1998). It has been proposed that CPP, which form soluble complexes with calcium phosphate *in vitro*, can lead to enhanced Ca absorption by limiting the precipitation of Ca in the distal ileum.

Considerable controversy exists as to the ability of CPP to enhance dietary Ca absorption. This probably arises from compositional differences in the phosphopeptide preparations. In most studies, chemically ill-defined peptide mixtures were used that can differ significantly in mineral-binding activity. Futhermore, it is not yet clear if CPP can be released during digestion of a milk meal. In addition, as a prerequisite for their function as mineral carriers, CPP must, at least partially, resist enzymic digestion during intestinal passage. Accordingly a major task of our ongoing EU-funded project 'Caseinophosphopeptides (CPPs)–Nutraceutical/Functional Food Ingredients for Food and Pharmaceutical Applications' (FAIR-CT98-3077) was to perform human feeding studies on milk as well as selected CPP preparations. These studies have found CPP in ileostomy fluid, collected at 2 h intervals for 10 h post milk and CPP ingestion, from four ileostomists. The findings are based on HPLC analysis in combination with peptide-bound P determination, thin-layer electrophoresis, amino acid analysis along with ELISA studies using polyclonal antibodies raised against a large set of CPP to detect immunoreactive CPP in ileostomy fluid.

Chabance *et al.* (1998) recently detected CPP in the stomach and duodenum of adult humans after ingestion of milk or yoghurt. Our studies (H Meisel, H Bernard, S Fairweather-Tait, RJ FitzGerald, R Hartmann, CN Lane, D McDonagh, B Teucher and JM Wal, unpublished results) demonstrate, for the first time, the presence of CPP in the distal small intestine (ileum). Vitamin D independent paracellular transport of Ca is known to play a major role in Ca absorption from the distal small intestine (Kitts & Yuan, 1992). However, the physiological significance of CPP, which survive intestinal passage, as potential Ca carriers to the ileum has yet to be clarified (bioavailability studies are currently taking place).

H. Meisel[1], H. Bernard[2], S. Fairweather-Tait[3], R. J. FitzGerald[4], R. Hartmann[1], C. N. Lane[5], D. McDonagh[5], B. Teucher[3] and J. M. Wal[2]
[1]*Federal Dairy Research Centre*
Institute for Chemistry and Physics
Kiel
Germany
[2]*Laboratoire d'Immuno-Allergie Alimentaire*
INRA-CEA
SPI
Gif sur Yvette
France
[3]*Institute of Food Research*
Norwich Research Park
Norwich
Norfolk
UK
[4]*University of Limerick*
Life Science Department
Limerick
Republic of Ireland
[5]*Teagasc*
Dairy Products Research Centre
Moorepark
Fermoy
Co. Cork
Republic of Ireland

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