Cow's milk protein hydrolysates

Using technology to improve allergy management

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First choice of nutrition for infants:
Breast milk

Nutrients in breast milk
- Proteins: whey > casein
- Fats: Essential fatty acids, polyunsaturated fatty acids
- Carbohydrates: mainly lactose
- Minerals, vitamins, trace elements

Immune-related components and growth factors
- Antibodies
- Bioactive cytokines (TGF-β, IL-10)
- Oligosaccharides
- Hormones

If breast milk is not available:
Infant formula

Types of infant formula

- Intact protein: casein > whey
- Hydrolysed protein: casein or whey
  - Partial hydrolysate: no size-filtration
  - Extensive hydrolysate: peptides (e.g. <1500 Da)
- Amino acids

Why applying protein hydrolysis?

Process

Protein + process conditions

endopeptidase

exopeptidase

Benefit

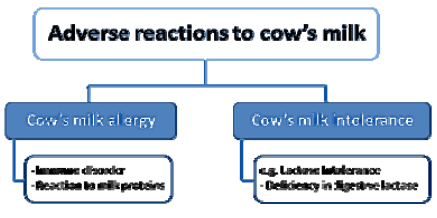
Amino acid production
Improving protein extraction
Increasing protein solubility

Debittering
Improve flavour

Reducing allergenicity
Bioactive peptides production

Tailoring texture

Hydrolysed formula in cow's milk allergy (CMA)



Hydrolysed formula in CMA
Reduction of symptoms

American Academy of Pediatrics - Committee on Nutrition

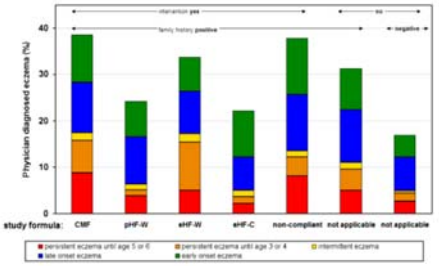
Hypoallergenic:

- Tested in infants with hypersensitivity to cow's milk
- Properly conducted elimination-challenge tests
- No reaction in ≥90% of infants

→ Extensive hydrolysates or amino acid-based formula are effective

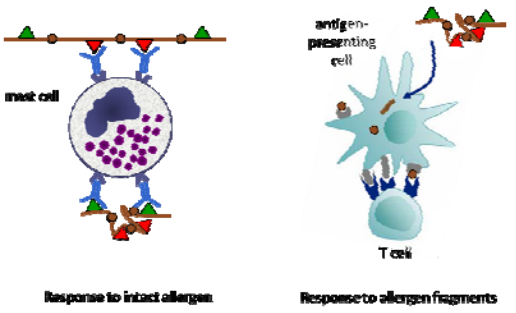
Hydrolysed formula in CMA
Prevention of allergy

Development of tolerance to food requires exposure
GINI study: prevention of eczema in children at risk



Von Berg et al. Clin Exp Allergy 2010;40:627-36

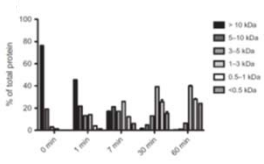
Allergic response



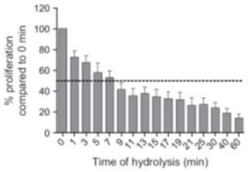
Hydrolysed formula in CMA
Prevention of allergy

Effect of hydrolysis on T cell response
T cells from CMA patients

Distribution of fragment lengths



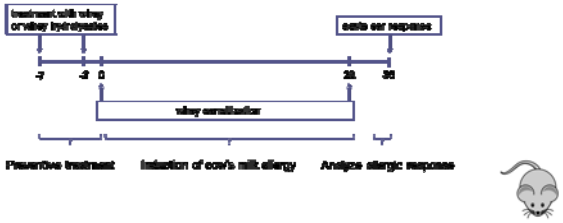
Impact on T cell response



Meulenbroek et al. Clin Exp Allergy 2014;44:529–39

Hydrolysed formula in CMA
Prevention of allergy

Preventive treatment with partial whey hydrolysate
Prevention of CMA in a mouse model



Van Esch et al. Pediatr Allergy Immunol 2011;22:820–26

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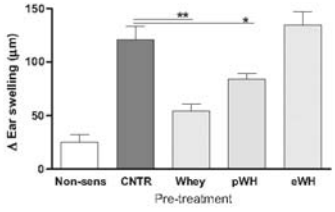

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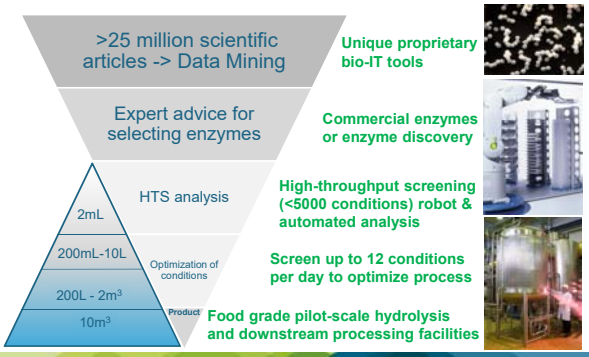
Characterization and targeted production of hydrolysates

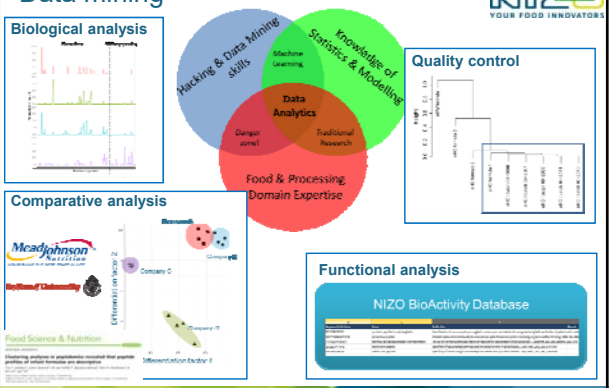
Better characterization of hydrolysates
- Size distribution
- Peptide profile
- Potential bioactivity

Targeted production
- Know which peptides are important
- Better understand the hydrolysis proces

Enzyme selection pipeline



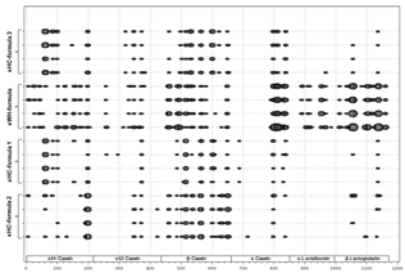
Data mining



Characterization of hydrolysates

Peptide profiling

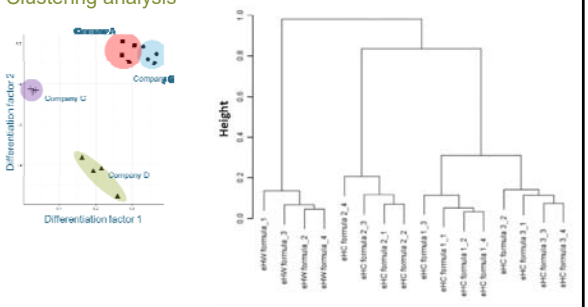
4 extensive hydrolysates



Lambers et al. Food Sci Nutr 2015;3:81-90

Characterization of hydrolysates

Clustering analysis



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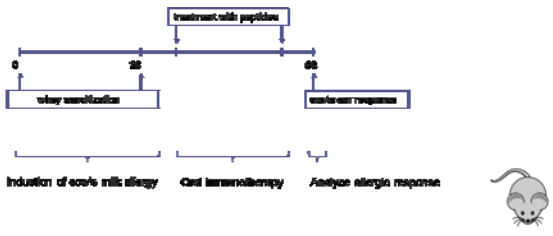
Cow's milk derived peptides

Treatment of allergy

Oral immunotherapy using whey peptides

Treatment of CMA in a mouse model



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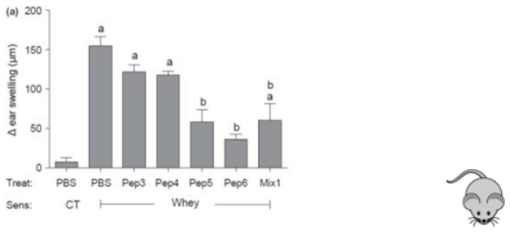

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Conclusions

Use of hydrolysates for treatment/prevention of CMA:

- Extensive hydrolysates are adequate for reduction of symptoms in CMA
- Hydrolysates may be effective in prevention of CMA or eczema

→Mechanism of action: Immune tolerance? Other bioactivity?

→Better characterization → targeted production and application of protein hydrolysates

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