



Kinetics of heat-induced denaturation of whey proteins and characterization of protein aggregates in model infant formulas

Amira Halabi, Amélie Deglaire, Marie Hennetier, Frédéric Violleau, Said Bouhallab, Didier Dupont, Thomas Croguennec

► To cite this version:

Amira Halabi, Amélie Deglaire, Marie Hennetier, Frédéric Violleau, Said Bouhallab, et al.. Kinetics of heat-induced denaturation of whey proteins and characterization of protein aggregates in model infant formulas. 2nd Food Chemistry Conference:, Sep 2019, Séville, Spain. hal-02737469

HAL Id: hal-02737469

<https://hal.inrae.fr/hal-02737469>

Submitted on 2 Jun 2020

HAL is a multi-disciplinary open access archive for the deposit and dissemination of scientific research documents, whether they are published or not. The documents may come from teaching and research institutions in France or abroad, or from public or private research centers.

L'archive ouverte pluridisciplinaire **HAL**, est destinée au dépôt et à la diffusion de documents scientifiques de niveau recherche, publiés ou non, émanant des établissements d'enseignement et de recherche français ou étrangers, des laboratoires publics ou privés.

Important notes:

Do **NOT** write outside the grey boxes. Any text or images outside the boxes **will** be deleted.

Do **NOT** alter the structure of this form. Simply enter your information into the boxes. The form will be automatically processed – if you alter its structure your submission will not be processed correctly.

Do not include keywords – you can add them when you submit the abstract online.

Title:

Kinetics of heat-induced denaturation of whey proteins and characterization of protein aggregates in model infant formulas

Authors & affiliations:

Please do not include Personal Data (email address, postal address, etc.) in this field. Include only author names & affiliations

Amira Halabi¹, Amélie Deglaire¹, Marie Hennevier², Frédéric Violleau², Said Bouhallab¹, Didier Dupont¹, Thomas Croguennec¹

¹ UMR STLO, Agrocampus Ouest, INRA, 35000 Rennes, France

² Université de Toulouse, Ecole d'Ingénieurs de Purpan, 31076 Toulouse, France

Abstract: (Your abstract must use **Normal style** and must fit in this box. Your abstract should be no longer than 300 words. The box will 'expand' over 2 pages as you add text/diagrams into it.)

Preparation of Your Abstract

1. The title should be as brief as possible but long enough to indicate clearly the nature of the study. Capitalise the first letter of the first word ONLY (place names excluded). No full stop at the end.

2. Abstracts should state briefly and clearly the purpose, methods, results and conclusions of the work.

Introduction: Clearly state the purpose of the abstract

Methods: Describe your selection of observations or experimental subjects clearly

Results: Present your results in a logical sequence in text, tables and illustrations

Discussion: Emphasize new and important aspects of the study and conclusions that are drawn from them

Introduction: In 2018, about 60% of world's newborns received cow milk-based infant formulas (IF) instead of human milk (UNICEF). The process of manufacturing IF involves heat treatments altering the physicochemical properties of milk components, especially whey proteins (WP). The objective of the study was to investigate the impacts of thermal treatments on the denaturation of WP of IF, particularly for those mimicking the protein profile of human milk, and to characterize the heat-induced protein structures.

Methods: Three model IF were produced with a caseins:WP ratio of 40:60 at 1.3% and 5.5% of total proteins, differing in the quality of WP. The kinetic of heat-induced denaturation of each WP was investigated between 67.5°C and 80°C by quantification of the residual native proteins by RP-HPLC. The heat-induced protein structures were studied by dynamic light scattering, electrophoresis and asymmetric flow field flow fractionation coupled with MALLS.

Results: The quantification of native WP fractions revealed an enhanced denaturation of α -lactalbumin in presence of both β -lactoglobulin and lactoferrin, an increased denaturation of β -lactoglobulin in presence of lactoferrin, and an increased denaturation lactoferrin in presence of β -lactoglobulin. At similar rate of total WP denaturation at 67.5°C and 80°C, the protein composition of the heat-induced aggregates changed between formulas, protein concentrations and heating temperatures but disulfide bonds were the main intermolecular links. The aggregates were larger and of fractal shape (apparent fractal dimension $df_{app} = 2.1$) in formulas at 5.5% proteins whereas they were of spherical shape ($df_{app} = 2.9$) in formulas at 1.3% proteins.

Discussion: Effets of heat treatment on the denaturation of α -lactalbumin, β -lactoglobulin and lactoferrin and the protein structure are influenced by the WP quality of IF. These results will give to industrials reliable data on the protein structures formed during the heat treatments of IF. The impact on digestibility will be subsequently investigated.