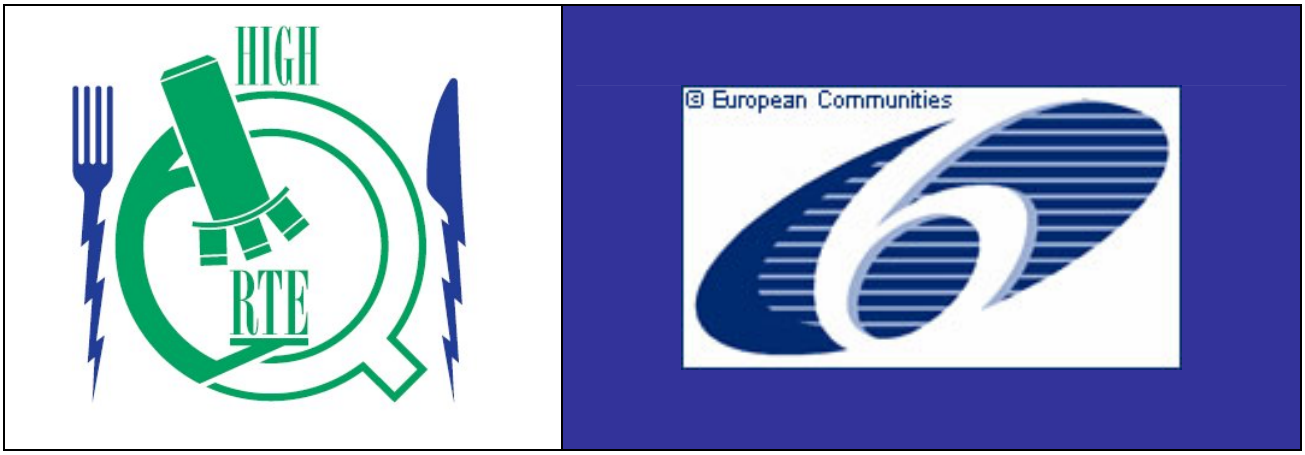

Project No. ***023140***
Project acronym: ***HighQ RTE***
Project full name: ***INNOVATIVE NON THERMAL PROCESSING TECHNOLOGIES TO IMPROVE THE QUALITY AND SAFETY OF READY-TO-EAT (RTE) MEALS***

Instrument type: Specific Targeted Research Projects

Priority name: Food Quality and Safety

☒ **Publishable Executive Summary**

☐ **Periodic Management Report**

☐ **Periodic Funding Distribution Report**

☐ **Publishable Final Activity Report**

☐ **Final plan for using and disseminating the technology**

☐ **Final Management Report**

☐ **Final Funding Distribution Report**

Period covered: *01/10/2006* to *30/09/2007* **Date of preparation**: *14/11/2007*

Start date of project: *01/10/2006* **Duration**: *36 months*

Project coordinator organisation name: *University of Bologna – Dipartimento di Scienze degli Alimenti*

.

Project coordinator name: Prof. Elisabetta Guerzoni

Publishable Executive Summary

HighQ RTE
"INNOVATIVE NON THERMAL PROCESSING TECHNOLOGIES TO IMPROVE THE QUALITY AND SAFETY OF READY-TO-EAT (RTE) MEALS"

Project objectives

The project **HighQ RTE** aims to improve the safety and quality of three representative categories of European ready-to-eat foods: ready-to-eat salads, fluid foods, and ready-to-eat vegetable based meals.
In fact several papers reported that European ready-to-eat foods, and particularly Refrigerated Processed Foods of Extended Durability (REPFEDs), are frequently contaminated with pathogenic species. In order to enhance the safety of the three categories of foods, and at the same time prevent the heat-induced physicochemical and nutritional changes, non-thermal novel processes will be developed and applied.
For **ready-to-eat vegetable and fruit salads**, procedures based on Photosensitization (PHOTO) will be set up in order to drastically reduce the contamination level of naturally occurring and inoculated pathogenic species in vegetable raw materials and packaging.
For **fluid foods,** Pulsed Electric Fields technologies (PEF) and semi-continuous High Pressure Homogenization (HPH) will be compared both in terms of pathogenic species inactivation, microbiological quality and changes of the properties of proteins as well as food microstructure and rheology. The ability of the latter technology to activate naturally occurring or exogenous enzymes will be exploited in order to generate new bioactive natural food components.
For **ready-to-eat meals** of vegetable origin High Hydrostatic Pressure will be applied to meals packaged under CO_2 atmosphere (HHPCO) in comparison and in addition to traditional mild heat processes.

The optimisation of the formulation of the fluid or solid food systems to be subjected to the various technologies will be performed taking into consideration nutritional aspects (salt, lipid contents), the possible physicochemical and structural changes induced by the processes and the specific requirements of the various process technologies (PHOTO, PEF, HPH, HHPCO) in terms of physical state and rheology (appropriate viscosity, particles presence and size etc). For the various combinations products-processes also the optimisation of the formulation of the meals will be performed in relation to chemical, nutritional, microstructural and functional changes induced by the exposure to the various processes.

For each technology, (i) inactivation due to the different treatments; (ii) re-growth of inoculated pathogens during storage; and (iii) growth of indigenous flora will be modelled. The developed deterministic and probabilistic models will be integrated into quantitative risk assessment

procedures in order to determine the parameters of the different treatments necessary to obtain the desired shelf-life and quality level of food with the various technologies.

Contractors involved

HighQ RTE is managed by a Consortium of 15 Partners 7 of which have strong experience in academic and industrial research with specific multi-disciplinary expertises on food microbiology, quality, safety, processing, packaging as well as analytical techniques and data processing. It also comprises an organization devoted to the management of research projects in food safety and quality, 6 Enterprises working the area of food/meal processing and catering, and a Centre whose activities are focused on consumers' education to food consumption and adequate nutrition, food safety.

Organisation name	**Short name**	**Country**	**Person in charge**
University of Bologna - Dipartimento di Scienze degli Alimenti	UNIBO	Italy	M.Elisabetta Guerzoni
Orma S.r.l.	ORMA	Italy	Pasquale Saracino
Vilnius University - Institute of Material Sciences and Applied Research	VU	Lithuania	ZivileLuksiene
Universitat Politècnica de València	UPV	Spain	Isabel Pérez Munuera
SIK - Institutet for Livsmedel och Bioteknik AB	SIK	Sweden	Elisabeth Borch
Institute of Food Research	IFR	United Kingdom	Jozsef Baranyi
Laboratoire National de Métrologie et d'Essais	LNE	France	Catherine Loriot
Consejo Superior de Investigaciones Científicas	CSIC	Spain	M. Pilar Cano
UAB "Palink"	UAB	Lithuania	Modestas Keblys
Tecnoalimenti S.C.p.A.	TCA	Italy	Marco Gerevini
Ortoreale S.r.l.	ORT	Italy	Paola Massari
Cooperativa Sociale "Il Bettolino" S.C	CSB	Italy	Katia Verzellesi
Rubinetteria Webert S.r.l.	WEB	Italy	Emanuele Zanetta
Acetum s.r.l.	ACE	Italy	Cesare Mazzetti
Centro Tecnico Regionale di Ricerca sul Consumo Europeo	CTRRCE	Italy	Marino Melissano

Work performed and results achieved so far

During the **first year of the project** the research activities were successfully initiated and carried out from month 1 on. Major scientific achievements of the project's 6 Workpackages (WPs) are:

WP1 – A LED-based portable pilot scale prototype with variable irradiation parameters for photosensitization treatmens to decontaminate food and packaging material has been constructed. Experiments performed by using both chlorophyll sodium salt and γ-aminolevulinic acid as precurs of endogenous photosensitizers showed that three food pathogens, i.e. L*isteria monocytogenes, Bacillus cereus* and *Salmonella Typhymurium*, can be inactivated *in vitro* by 4-6 Log units.

WP 2 - A first and a second generation of a PEF treatment chamber have been developed: in particular, the latter one can be used on milk, egg and buffer without any technical problem. The bacterial reduction varied between the bacterial species used for inoculation and with the product matrix, but it was was substantially increased by applying repeated treatment in buffer and milk. Experiments on PEF-treated whole egg sampls showed that viscosity, colour and textural profiles values were unaffected by the treatment, but the foam stability was higher than that of the control, i.e. pasteurized samples.

WP 3 - Some significant new data have been collected on the inactivation dynamics of 3 food pathogens (*Listeria monocytogenes, Salmonella enteritidis* and *Escherichia coli*) and spoilage species (*Saccharomyces cerevisiae* and *Zygosaccharomyces bailii*) when inoculated in fluid foods (vegetable soups, egg/dairy derived products, fruit juices) and subjected to high pressure homogenization treatments. The maximal bacterial reduction due to HPH treatments varied among the bacterial species used and increased by applying subsequent repeated HPH treatments at 100 MPa. In general a linear relationship between the number of repeated treatments and cell load was observed for *Listeria monocytogenes, Salmonella enteritidis* and *Z. baili*, while a tail was observed in the deactivation curve of *S. cerevisiae*. HPH treatments prevented also the proliferation of the target pathogens as well as of the indigenous microflora during the subsequent refrigerated storage. Another interesting aspect of this research is the enhancement of the antmicrobial activity of the enzymes lysozyme and lactoferrin as a consequence of HPH treatments in model a system.

WP 4 - Decisions about the vegetable-base dishes and the most appropriate type of packaging materials to be used in HHPCO processing of foods have been taken. Moreover, the effect of different HHPCO treatments, obtained according to Surface Methodology Response design, on endogenous and inoculated (*Listeria innocua*) microbial counts were evaluated. The results obtained represent a useful tool to select the best processing parameters to obtain the maximum microbial inactivation. For examples, experiments with HHPCO resulted in a reduction of about 4.0 and 6 log CFU/g of *Listeria innocua* in raw carrot slices and red pepper, respectively.

WP 5 - The work performed has been aimed at the optimization and comparison of different molecular methods for the detection of pathogens from model and real systems. In particular, the protocols based on polymerase chain reaction (PCR) to be used with the molecular mehods PCR-DGGE, quantitative-PCR and reverse transcription quantitative PCR have been developed. Moreover, the expression of three genes under different environmental stresses and following technological treatments has been evaluated for *Listeria monocytiogenes*.

WP 6 - This workpackage consists of cross-package activities aiding all the four studied technology, mainly using Predictive Microbiology and Quantitative Microbial Risk Assessment (PM and QMRA) methods. In the first year, the structure of the database to be created by those partners who produce microbial survival and growth data has been defined. Also the experimental designs were provided for the different technologies studied. For each technology, inactivation raw data were modelled to provide preliminary inactivation models that are useful to identify data gaps and planning further experiments.

Co-ordinator details

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