



H.F.R.I.
Hellenic Foundation for
Research & Innovation

Description of the funded research project
1st Call for H.F.R.I. Research Projects to Support Faculty Members &
Researchers and Procure High-Value Research Equipment

Title of the research project:

Goat milk from Greek autochthonous breeds_ A metagenomics approach

Principal Investigator:

Prof. Effie Tsakalidou

Reader-friendly title:

Mapping of the Greek goat milk microbiota

Scientific Area:

Agricultural Sciences – Food Science and Technology

Institution and Country:

Agricultural University of Athens, Athens, Greece

Host Institution:

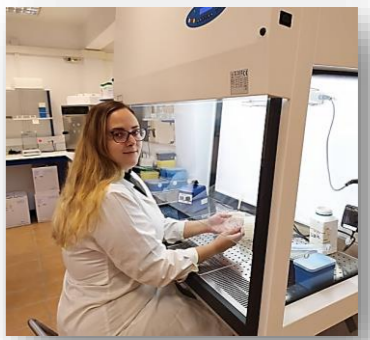
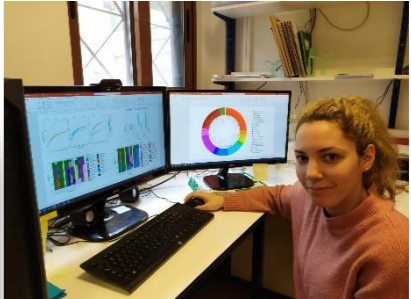
Agricultural University of Athens, Athens, Greece

Collaborating Institution:

Max Rubner Institut - Federal Research Institute of Nutrition and Food,
Department of Microbiology and Biotechnology, Kiel, Germany

Project webpage

(if applicable): -



Budget: 170.000,00 €

Duration: 36 months

Research Project Synopsis

The core objective of our proposal is to employ state-of-the-art approaches in order to perform, for the first time in our country, an in-depth exploration of the microbiome of raw goat milk produced by Greek autochthonous goat breeds. The specific objectives are:

1. To shed, for the first time, light to the indigenous microbiota of raw goat milk produced by Greek autochthonous breeds using as the major tool the metagenomics approach. The conventional microbiological analysis will be also used as a valuable complementary analytical tool
2. To shed, for the first time, light to the bacteriophage diversity of raw goat milk produced by Greek autochthonous breeds, using approaches at both phenotype and genome level
3. To elucidate the technological potential of strains as well as whole microbial consortia deriving from raw goat milk produced by Greek autochthonous breeds, using technological as well as *in silico* (genome sequencing) assessment
4. To validate the performance of selected strains and whole microbial consortia in small-scale cheese making trials using goat (raw and pasteurized) milk produced by Greek autochthonous breeds

Project originality

We consider as the most robust and novel tool of our research approach the state-of-the-art methodology of metagenomics, which we are going to employ in order to shed light on the indigenous microbiota of raw goat milk. In particular, phylogeny metagenomics along with shotgun metagenomics will be applied. In parallel, the classical microbiological approach, i.e. culture-dependent techniques, accompanied by molecular techniques, such as 16S rRNA and ITS gene sequencing, and rep-PCR, will be also included as a complementary tool, which will allow us to isolate and identify strains, so as to be able to investigate their technological potential. This holistic approach will allow, for the first time, the full and systematic description of the microbiota of raw goat milk in Greece.

A further novel task of our project, in the sense that it has not been investigated so far, is the elucidation of bacteriophage diversity of raw goat milk. This will be based on a phenotypic approach along with whole genome analysis. The phages will be isolated using a wide spectrum of laboratory reference strains of lactic acid bacteria (LAB), as well as LAB strains isolated in the course of the present project. Isolated phages will be characterized according to their host spectrum and identified by Transmission Electron Microscopy (TEM) as well as whole genome sequencing. This work will be performed in collaboration with the group of Dr. Charles Franz [Max Rubner Institut (MRI), Federal Research Institute of Nutrition and Food, Department of Microbiology and Biotechnology, Kiel, Germany], which is considered among the top groups worldwide in dairy bacteriophages.

Expected results & Research Project Impact

- Fingerprinting of the indigenous raw goat milk microbiota by including milk samples deriving from autochthonous Greek breeds and by targeting pro-technological microorganisms, e.g. LAB and yeasts, along with spoilage and pathogenic ones
- Characterization of the phages that occur in Greek raw goat milk in order to test whether these have lytic activity against potential starter strains that could be selected for processing of typical Greek dairy products
- Elucidation of the pro-technological potential of the raw goat milk microbiome, so as to be able to select strains as well as whole microbial consortia in order to be used as starters in the production of novel goat milk products. The safety of strains will be also considered. In particular, the characterization of whole microbial consortia we expect to allow us to prepare cheese from non-pasteurized goat milk, with the fermentation relying only on the indigenous milk microbiota.
- Production of two novel goat milk cheeses, namely (a) a soft, fresh cheese from pasteurized goat milk using selected strains isolated and characterized during the course of the present project, and (b) a hard, ripened cheese from raw goat milk with no use of starters but relying on the indigenous microbiota of the milk.

Our round trip, which starts from the raw goat milk and its microbiome and goes back to this valuable material by transforming it into novel dairy products using as starters members of its own microbiota, is a journey that goat milk produced by Greek autochthonous breeds deserves many decades now. We expect that this journey will disclose technological treasures, and, why not, limitations as well that are hidden within goat milk. The knowledge to be accumulated can act as keystone for the rational and creative exploitation of goat milk in the benefit of the scientific and industrial community in Greece

The importance of this funding

We consider funding research and innovation as the keystone for both the reinforcement of the Greek research community and the development of the Greek economy. This is particularly true for the so called applied sciences, as in our case.

It is expected that the successful implementation of the present project will reinforce the position of our group, and in particular the young scientists involved, in the field of Food Science and Technology. This, in turn, will strengthen our position in pursuing (a) research funding at the National, European and International level, and (b) collaborations with the Greek Dairy sector.

It will also fortify our position in the field of non-cow milk, which is constantly gaining attention around the globe due to its economic and social significance, in particular for less favored areas, where rural economy is poorly diversified and employment opportunities are limited.



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COMMUNICATION

185 Syggrou Ave. & 2 Sardeon St. 2
171 21, N. Smyrni, Greece
+30 210 64 12 410, 420
communication@elidek.gr
www.elidek.gr