RELAZIONE FINALE RELATIVA AL PROGRAMMA DI RICERCA STM 2013

SHORT TERM MOBILITY PROGRAM 2013 - FINAL REPORT

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Title:
Utilizzazione di biomassa marina costituta da meduse per l'estrazione e la valutazione di composti bioattivi

Extraction and analysis of bioactive compounds from jellyfish

Background

The marine environment is recognized as a rich source of bioactive metabolites with various biological and pharmacological activities. Cnidarians and sponges are among the most promising invertebrate taxa for the search of bioactive molecules because of their high taxonomic diversity and their high abundance in most coastal habitats. Since the last decades, cnidarian jellyfish exhibit worldwide recurrent proliferations, becoming a crucial ecological and social issue, but available evidence shows that they can represent a key source of physiologically active compounds.

Jellyfish outbreaks are increasingly common also in the Mediterranean Sea coastal zones where, due to the high human population density, a number of economical and recreational activities, as well as public health, can be severely affected. Nevertheless, jellyfish biomasses could be also considered for their potential positive effects and exploitation of jellyfish populations (e.g. in Mar Menor, Spain) is now in agreement with the *Blue Economy* strategy, looking at the oceans as sustainable source of food and energy to meet environmental targets with innovation and growth at the same time.

Indeed, jellyfish outbreaks may reach several hundreds thousands of tons of exploitable biomasses which can be regarded as a valuable source of natural compounds including bioactive peptides, collagen and gelatin, oligosaccharides, fatty acids, enzymes, water-soluble minerals, and biopolymers. The identified various biological activities including antioxidant and anticancer activities, make them a potentially valuable source for food, feed, cosmetic, and biomedical industries, such as has been proposed for seafood processing by-products.

Several jellyfish species with large biomasses occurring in the European seas (e.g. *Rhizostoma pulmo*, *Cotylorhiza tuberculata*) can be considered for their nutraceutical features, although they are not yet considered as usual seafood in Western markets. The biochemical and nutraceutical characteristics of gelatinous biomasses are poorly studied, but the first scientific data evidenced peculiar antioxidant properties of protein and non-protein components, providing the rationale for their use as healthy food and long-standing adoption in the Eastern countries pharmacopoeia.

The extracellular matrix of jellyfish contains high collagen content, a protein rich in hydrophobic amino acids, with a high affinity for oils and remarkable emulsifier ability. In addition hydrolyzed collagen shows high antioxidant activity, therefore, it is expected that peptides with interesting properties could be obtained by hydrolysis of this protein. Overall the jellyfish biomasses may be a potential ingredient for fish feed in aquaculture.

Activity

In the framework of the FP7 EU-funded Project VECTORS, I performed analyses on bioactive compounds from *C. tuberculata* and on protein content of some Mediterranean jellyfish. The results encouraged further investigations on the possibility to exploit marine biomasses for extraction of bioactive compounds with chemo-preventive and/or nutritional properties. Based on ongoing collaborations, with experts on jellyfish biology at ICM-CSIC in Barcelona, the Short Term Mobility Program offered the opportunity to develop a new collaborative framework based on the integration of competences.

The evaluation of the nutritional/ biochemical/ pharmacological properties of some Mediterranean species, performed at CNR-ISPA-Lecce, was a starting point enabling us to consider this biomass for direct or indirect human uses. Based on pilot experiments on the most common jellyfish species undergoing massive proliferations along South Italian and Spanish coastlines, a positive evaluation of their nutritional and pharmacological properties has been evidenced. Based on our recently publication on the biochemical characterization of *C. tuberculata* jellyfish biomasses and the bioactivity of its hydro-alcoholic extract (Leone et al., 2013), a closer collaboration with ICM-CSIC has been established. We demonstrated the presence of considerable amounts of valuable compounds such as collagen and pepsin digestible proteins, phenol compounds, ω-3 and ω-6 fatty acids, and photosynthetic pigments with antioxidant properties due to the presence of symbiotic zooxanthellae. In addition the *Cotylorhiza* extract showed a specific antiproliferative activity on cancer cells (MCF-7) but not in non-cancer cells (Leone et al., 2013). This jellyfish-algal consortium represents a highly abundant biomass in Mar Menor lagoon, in the

Mediterranan coast of Spain, where large blooms of this jellyfish occur each year (> 5000 tons). however, in summer 2013, *C. tuberculata* bloom was greatly reduced due to thermal anomalies previously recorded only in the summer 2005, which altered the normal life cycle of this species.

Our studies included the analysis of the protein composition and bioactivity of two more jellyfish species: *Aurelia sp*. and *Rhizostoma pulmo*. The radical scavenging activity of hydrolyzed peptides has been demonstrated for pepsin digestible proteins and collagen extracted from both species (Leone et al, in preparation). This work benefited from the collaboration with experts on jellyfish life cycles, reproduction, biology and ecology, at the ICM-CSIC in Barcelona, where excellent facilities for jellyfish investigations are available (boats, laboratory, aquaria and lab facilities). Jellyfish samples were collected at Castelldefels (Barcelona, Spain) and lyophilized for further analyses on nutraceutical or other biological activities. A collaborative work has been set up which will lead to joint publications. Another achievement of the Short Term Mobility Program was the establishment of an Agreement of International Scientific Cooperation among the following Spanish and Italian Institutions: 1) Consiglio Nazionale delle Ricerche, Istituto di Scienze delle Produzioni Alimentari – Lecce, 2) Consorzio Nazionale Interuniversitario per le Scienze del Mare – Roma, 3) Consejo Superior de Investigaciones Scientificas, Institut de Ciències del Mar – Barcelona, and 4) Instituto Español de Oceanografia, Centro Oceanografico de Murcia.

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