**Development of a platform to evaluate plant bioactive intake in the population and predictive models for dietary assessment using intake biomarkers.**

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This PhD thesis research project aims to evaluate the intake of dietary plant bioactives in the population through the development of a new comprehensive food composition database. It will take into consideration different types of phytochemicals, belonging to major compound families that may have relevant effects on our health, like (poly)phenols, terpenoids, *N*-containing compounds and miscellaneous phytochemicals. Then, predictive models for dietary assessment using intake biomarkers will be created.

**Sviluppo di una piattaforma analitica per determinare il consumo di composti bioattivi vegetali nella popolazione e metodi predittivi per la valutazione dietetica utilizzando biomarcatori di consumo alimentare.**

Questo progetto di tesi di dottorato ha lo scopo di valutare il consumo di composti bioattivi vegetali provenienti dalla dieta nella popolazione, attraverso lo sviluppo di un nuovo e comprensivo database di composizione alimentare. Verranno presi in considerazione diversi tipi di molecole bioattive, appartenenti alle principali famiglie di composti che possono avere effetti rilevanti sulla nostra salute, come (poli)fenoli, terpenoidi, composti contenenti azoto e fitocomposti misti. Successivamente, verranno creati modelli predittivi per la valutazione dietetica, utilizzando biomarcatori di consumo.

1. **State of the art**

Healthy dietary habits are one of the most important factors to reduce chronic non-communicable diseases (NCDs) and all-cause mortality (Afshin *et al*., 2019). The consumption of fruit and vegetables is related to a decrease of several pathologies, like cardiovascular diseases and some types of cancer (Willett and Stampfer, 2013). This is mainly due to the presence in these foods of different components like fibres, micronutrients and many bioactive compounds that can help in the prevention of chronic diseases (Liu, 2013). (Poly)phenols and carotenoids are the most studied compounds (Liu, 2013) while there is a lack of information about many others, like phytosterols, glucosinolates, alkaloids, thiosulfinates, and alkylresorcinols. These phytochemicals are showing increasing evidence in the promotion and maintenance of a good health status, even if only results from *in vitro* studies have been published for some of them (Fraga *et al*. 2019; Landberg *et al*., 2014). It is also important to consider that there could be some factors that can drive inter-individual variability and thus health effects after consumption of these compounds, like age, sex, and genetic polymorphisms (Gibney *et al*., 2019, Milenkovic *et al*. 2017).

For some classes of bioactive compounds, missing data on their content in foods makes it difficult to determine the amount consumed everyday through the diet by the population. Also, food composition databases usually report only data regarding macro- and micro-nutrients and the most consumed compounds. This means that a lot of information about a considerable number of compounds we eat every day is missing. Considering this, more efforts are needed to understand the effects of these bioactives on our health and how they may be used as preventing tools against non-communicable diseases. Starting from the assessment of the intake of these plant bioactive compounds in our diet can represent a turning point. New methodologies for the evaluation of dietary intake are thus essential to have a complete view on our diet and consequently on the health status. In this sense, biomarkers of intake may also help to create more objective methods for dietary assessment, limiting bias related to traditional methods (Garcia-Aloy *et al*., 2017).

1. **PhD Thesis Objectives and Milestones**

Taking into account all issues discussed above, this PhD project can be divided into major points:

1. **Development of a food composition database about dietary plant bioactives.** This part of the PhD project is the most complex and time consuming. It lasted the first year and will be part of the second yeat too. It consists in the creation of interconnected food composition databases on the most important plant bioactives, like (poly)phenols, terpenoids, *N*-containing compounds and miscellaneous phytochemicals.
2. **Determination of the dietary plant bioactive intake in different populations.** Using the developed database, it will be possible to assess the intake of several phytochemicals in many populations, using data both coming from studies conducted by the University of Parma or their collaborators and publicly available. Finally, comparisons among different cohorts will be done to provide a global picture of the intake of plant bioactives.
3. **Development of predictive models for dietary assessment using data on the intake of plant bioactives and intake biomarkers**. Results coming from the intake of dietary plant bioactives in different populations and data regarding intake biomarkers will allow us to demonstrate the relationship between them and to develop new predictive models for an objective dietary assessment.
4. **Writing and editing** of the PhD thesis, scientific papers and oral and/or poster communications.

***Table 2*** Gantt diagram for this PhD thesis project.

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| Activity Months | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** | **9** | **10** | **11** | **12** | **13** | **14** | **15** | **16** | **17** | **18** | **19** | **20** | **21** | **22** | **23** | **24** |
| 1) | ***Development of a food composition database about dietary plant bioactives*** |   |   |   |  |  |  |  |   |   |  |  |  |  |   |  |  |  |  |   |   |  |  |  |  |
| 2) | ***Determination of the dietary plant bioactive intake in different populations*** |   |   |   |  |  |  |  |   |   |  |  |  |  |   |   |   |  |   |   |   |  |  |  |  |
|  | 1) Intake assessment in different population settings |   |   |   |  |  |  |   |   |   |  |  |  |  |   |   |  |  |  |   |   |  |  |  |  |
|  | 2) Comparison between different populations |   |  |   |  |  |  |  |   |   |  |  |  |  |   |  |   |  |   |   |   |  |  |  |  |
| 3) | ***Development of predictive models for dietary assessment using data on the intake of plant bioactives and intake biomarkers*** |   |  |   |   |   |   |  |   |   |   |   |   |  |   |  |  |  |  |   |   |   |   |   |  |
| 4) | ***Thesis and Paper Preparation*** |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |  |   |   |   |   |   |   |   |

1. **Selected references**

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