Exploring drivers and barriers to the consumption of new plant-based foods in different population targets

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This PhD project is part of the ON Foods project (PNRR M4C2 – PE10: Models for sustainable nutrition) and aims to explore sensory quality of and consumer responses to new plant-based substitutes for animal products (e.g., meat, dairy and fish analogues), in order to provide a better understanding of drivers and barriers to their consumption and foster the transition toward a healthy and sustainable diet also considering the needs of vulnerable population targets, such as children and elderly people.

**Indagine dei fattori che promuovono e ostacolano il consumo di nuovi alimenti a base vegetale in diversi target di popolazione**

Questo progetto di dottorato si inserisce nell’ambito del progetto “ON Foods” (PNRR M4C2 – PE10: Modelli per una alimentazione sostenibile) e intende indagare la qualità sensoriale e la percezione dei consumatori verso nuovi alimenti a base vegetale, sviluppati come prodotti alternativi a quelli di origine animale (e.g. carne, prodotti lattiero-caseari e pesce vegetali), al fine di fornire una migliore comprensione dei fattori che ne promuovono o ostacolano il consumo favorendo la transizione verso una dieta sana e sostenibile, prendendo in considerazione anche le esigenze di gruppi vulnerabili della popolazione, come bambini e anziani.

# **1. State-of-the-Art**

Nowadays, the food system is facing an ever-increasing demand for food due to population growth (Gibbs and Cappuccio, 2022). At the same time, the natural resources of land, water and energy are limited. Moreover, current food diets, rich in meat and energy-rich foods and poor in whole grains, fruit and vegetables, are no longer sustainable and have serious consequences for human health (Gibbs and Cappuccio, 2022). All these challenges can be addressed and overcome not only by applying more sustainable food production techniques, but also by the transition toward sustainable diets. For this reason, a major global need is to find alternative food sources with low environmental impact to meet the growing demand for food.

Promising solutions that have been receiving increasing attention in recent years are plant-based substitutes for animal food. These products attempt to mimic the appearance, smell, taste and texture of their conventional animal counterparts, such as meat, fish, milk and eggs (Alcorta *et al.*, 2021). This food sector includes plant-based meat analogues (i.e., sausages, chicken, burger, nuggets, tenders and cutlets), dairy alternatives (i.e., yoghurt, cheese, milk), egg substitutes (mayonnaise) and plant-based seafood (slices, fillets, fish sticks and fish burgers) (Alcorta *et al*., 2021). Being derived from botanical sources, such as legumes, seeds and nuts, pseudocereals, cereals and/or mushrooms (Tachie *et al.*, 2023), these foods are environmentally sustainable in terms of greenhouse gas emissions, land, water and energy use (Bryant, 2022). In addition, even if their long-term impact on health is still uncertain (Tso and Forde, 2021), they are lower in fat and cholesterol and higher in fibre than animal origin products, contributing to lowering the risk of cardiovascular disease (Bryant, 2022).

In Europe, the plant-based sector has grown of 22% compared to 2020 (GFI, 2022), showing consumers’ growing interest in alternative protein sources. However, this sector remains a niche market since their consumption is still hampered by several obstacles. In general, drivers and barriers to healthy and sustainable food can be classified into person-related factors such as socio-demographic, dietary status, psychological and physiological variables, as well as product-related factors, including food convenience (e.g., price, preparation time, food availability), credence attributes (e.g., healthiness, naturalness, sustainability and animal welfare) and sensory properties (Giacalone *et al.*, 2022). Indeed, the exploitation of plant-based proteins pose several challenges about the sensory characteristics of the products, being very difficult to replicate the appearance, taste, flavour and texture of animal origin food. For example, these products are often characterised by beany flavour and bitter taste or astringency (Fiorentini *et al.*, 2020) and have textural properties that differ significantly from those of animal origin, disregarding consumers’ expectations (Alcorta *et al.*, 2021). Since food consumption is mainly driven by preferences, to foster the development of new plant-based foods, it is necessary to optimize their sensory characteristics to mimic those of the original animal version. In this context, sensory studies and consumer science provide valuable support in understanding how consumers perceive food and which sensory attributes should be modulated to increase their acceptance. Developing new food products that are not only healthy and sustainable, but also acceptable to the consumer is crucial to drive the transition towards sustainable food chains.

# **2. PhD Thesis Objectives and Milestones**

Within the overall objective mentioned above this PhD thesis project can be subdivided into the following activities according to the Gantt diagram given in Table 2:

This PhD project is part of the PNRR project “ON Foods - Research and innovation network on food and nutrition Sustainability, Safety and Security - Working ON Foods”, aimed at improving the future of the community and the supply chain through a new sustainable food model (www.onfoods.it).

The overall aim of this PhD project is to explore sensory quality of and consumer responses to new plant-based food alternatives to conventional animal counterparts (e.g., meat, dairy, eggs and fish). In particular, the perceptive and behavioural determinants that can positively or negatively influence consumer liking of plant-based food alternatives will be investigated also in vulnerable population targets (children and elderly people).

The main activities of these three years will be organized according to the Gantt diagram given in Figure 1:

First, a literature review on plant-based food alternatives will be performed in order to formulate the research strategy and develop the overall research design. Literature review will be conducted in parallel with an online Italian market inventory to create a database of animal-origin analogues. For each food, easily available information from the packaging will be collected (e.g., composition, price, specific slogans). Based on literature gaps and according to criteria such as nutritional composition and representativeness of the Italian market, specific plant-based food categories and products will be selected for sensory and consumer testing with different population targets. The participant's acceptance of selected food products will be investigated using hedonic methods, while their sensory attributes will be measured through consumer-friendly descriptive approaches (e.g. Check-All-That-Apply, CATA). Information about participants’ socio-demographics, food consumption behaviour, and personality traits (e.g., food neophobia) will be collected together with emotions while consuming such products. In order to assess the cross-national differences in the determinants of plant-based analogues acceptance, a part of the PhD project will be performed abroad.

***Figure 1*** Gantt diagram for this PhD thesis project.



# **3. Selected References**

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