

INNOVATIVE ON-SITE MILD PROCESSING OF FRUIT AND VEGETABLES FOR INCREASING LOCAL PRODUCTION OF FOODS WITH HIGH NUTRITIONAL QUALITY

KEYWORDS: Nutrient quality, health impact assessment, innovative technologies, FOX project, Food Processing.

ABSTRACT

Food processing in a box (FOX) is a research project, funded by the European Commission as part of the Horizon 2020 Research and Innovation programme. FOX is focused into mildly processed fruits and vegetables through innovative, small-scale technologies in flexible processing units, which can be moved between production regions. This innovative approach simultaneously meets consumers' expectations for a wider range of regionally produced foods, supports sustainable and healthier diets and provide business opportunities for food supply actors. Part of the project is focused into evaluation of nutritional quality of the newly produced foods, enabling health-impact assessment.

INTRODUCTION

Food systems have the potential to nurture human health and support environmental sustainability; however, which are both threatened (1-3). In fact, while in the EU average intakes of energy, red meat, sugars, salt, and fats continue to exceed recommendations, consumption of fruit and vegetables, legumes, whole-grain cereals and nuts is insufficient (3). Moving to a more plant-based diet with less red and processed meat and with more fruits and vegetables will reduce not only risks of life-threatening diseases, but also the environmental impact of the food system (4). It was estimated that in the EU in 2017 over 950,000 deaths (one out of five) and over 16 million lost healthy life years were attributable to unhealthy diets - mainly due to cardiovascular diseases and cancers (1). With this awareness, one of the most important objectives of the European commission's Farm to fork (F2F) Strategy is 'to increase the availability of healthy and sustainable food options' (5), and this is also addressed in the *FOod Processing in a bOX* – FOX project (6), funded within the Horizon 2020 Research and Innovation programme.

FOX PROJECT AND FOUR FOOD CIRCLES

The future of food and farming requires research and innovation, that also brings the knowledge out of the labs

and onto the fields and markets, and thereby fosters new rural value chains (5). Mild processing technologies can be used on fruit and vegetables to produce innovative food. The European Union's Horizon 2020 research project "Food processing in a box" (FOX) is focused into bringing such technologies directly very close to farms, supporting short food supply chains. Such technologies enable production of more sustainable and healthier food products. The FOX project focuses on research and development of four innovative small-scale food processing units, which are being demonstrated in relevant environments ("food circles") (6). It aims to go beyond that by implementing these technologies in mobile units to facilitate easy and affordable access for "inexperienced" farmers and SMEs. The innovative processing solutions are flexible, resource-efficient, and based on seasonality and demand. It considers the expectations of farmers and small food businesses, looks at the technical and economic feasibility, and considers the needs of the food chain and consumers. Consumers are actively involved both in the development of new products, and in development of new business opportunities. The core activity of FOX is to develop the four prototype-processing units which are making use of different technologies, demonstrate their use in real-life environments, and assess the properties of produced foods:

1. low oxygen juice extraction and mild preservation for fruits and vegetables (extraction in an oxygen-reduced environment, pulsed electric field (PEF), filling unit) – Mobile Unit;
2. sustainable, low temperature drying technologies in combination with innovative, non-thermal pre-treatment techniques (ultrasound, high hydrostatic pressure, PEF) and conventional or unconventional drying methods (infrared, microwave-assisted or hybrid drying) for soft fruits, vegetables and mushrooms – Mobile Unit;
3. innovative quality analyses as well as conditioning and packaging of fresh fruit and vegetable mixes – Mobile Unit;
4. upcycling of plant-based food side streams by using mild processing (high pressure, PEF, advanced heating technologies) – Modular Unit.

HEALTH IMPACT ASSESSMENT APPROACHES

As new food items are considered for market integration, the production-side interventions present a key in developing optimal food systems inclusive of sustainable diets (7). In the assessment of the sustainability, nutritional quality and health dimension should be also considered. The FOX project is focused to improve the quality of products produced locally with innovative food technologies. Two approaches are being used in respect to health impact assessment:

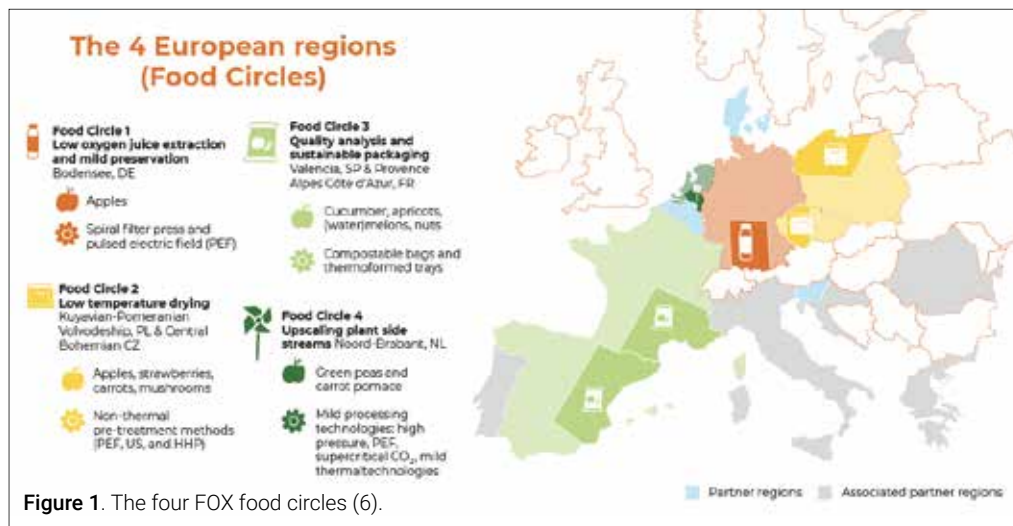


Figure 1. The four FOX food circles (6).

- **Nutrient density approach.** Food nutrient density indicators are intended to measure nutrient quality of individual foods (8). Some of those are based on nutrients to encourage (NR), others on nutrients to limit (LIM), or on combination of both. The Nutrient Rich Foods (NRF) models are typically based on two subs cores: NR and LIM. NR is based on a variable number of nutrients to encourage (protein, fibre, vitamins A, C and E, calcium, iron, magnesium, potassium,...), whereas LIM is typically focused to saturated fat, added sugars and sodium (8, 9). Nutrients are assessed with consideration of the daily reference intakes, which represent guidelines about the approximate amount of particular nutrients and energy required for a healthy diet. The goal of such quantitative method is to identify nutrient-rich foods and separate them from foods of lower nutritional value (8).
- **Health impact approach.** Health Nutritional Index (HENI) has been suggested as an innovative method that enables a systematic, comparative, and holistic assessment of the marginal health effects of food products on human

health (10). This approach enables the association of foods, meals or diets with health damages based on epidemiological evidence. Global Burden of Disease (GBD) studies are a good source of such data, since they represent systematically quantifying multiple risk factors in a comparative and comprehensive manner (1). GBD studies focus on population-level estimates of health burden associated with dietary risks at national, regional, and global levels. HENI provides a single-score quantification, expressed in minutes of healthy life (calculated from disability-adjusted life years) per functional unit of food, based on GBD dietary risks factors. The method is suitable for looking at small changes in food intake, when evaluating and comparing food items and substitutions.

CONCLUSION

Optimizing innovative food technologies within the framework of a sustainability concept in agri-food systems requires the use of new approaches, where health dimensions should be also considered. Different methodological approaches are available for assessment of the

health impact, enabling meaningful comparison of foods produced with the use of different technologies. Indirect approach is to consider nutritional quality of the foods, for example with the Nutrient Rich Foods models. Alternatively, Health Nutritional Index method can be used to estimate the effect of consumption of such foods to disability-adjusted life-time, with consideration of dieted related health risks.

FUNDING

This project has received funding from the European Union's Horizon 2020 Research and Innovation Program Project "Innovative down-scaled FOod processing in a boX - FOX" under grant agreement No 817683.

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