Health potential of grape and wine phenolic compounds

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Phenolic compounds or polyphenols are the most abundant and ubiquitous secondary metabolites present in the plant kingdom with more than 8000 phenolic structures currently known. These compounds play an important role in plant growth and reproduction, providing protection against biotic and abiotic stress such as pathogen and insect attack, UV radiation and wounding [1,2]. (Poly)phenols are widely distributed in the human diet mainly in plant-derived food and beverages (fruits, vegetables, nuts, seeds, herbs, spices, tea and red wine) and can influence multiple sensorial properties such as flavour and colour, and contribute to the aroma and taste e.g., astringency and bitterness [3].
Phenolic compounds are also known to have some health benefits such as a chemopreventive role toward cardiovascular, cancer, and degenerative diseases. Various epidemiological studies have shown that a regular and moderate consumption of red wine is correlated with a decreased relative risk for developing coronary heart disease. These health benefits are commonly attributed to high content of polyphenols. Many diseases and pathologies are linked, directly or indirectly, to inflammation. These include: infections, injuries, atherosclerosis, diabetes mellitus, obesity, cancer, osteo-arthritis, aged-related macular degenerescence, demyelination and the most prominent neurodegenerative diseases. Indeed, dietary intake of (poly)phenols has been estimated to be about 1g/day [4]. Their intake is 10 times greater than that of vitamin C and 100 times that of vitamin E or the carotenoids [5]. As a result, phenolic compounds are currently receiving much attention because of their favourable health effect related to their antioxidant. To date, grape and wine polyphenols have showed to exert beneficial effects on health [6,7]. For instance, polyphenolic compounds in grapes are known to lower oxidative stress, to modulate the inflammatory cascade, to reduce the oxidation of LDL-c and to induce protection against atherothrombotic episodes including myocardial ischemia and inhibition of platelet aggregation. Most of these health effects have been ascribed to polyphenolic compounds serving as reducing agents in many biological systems by donating hydrogen, quenching singlet oxygen, acting as chelators and by trapping free radicals. Moreover, these antioxidant activities help to limit oxidation of nucleic acids, proteins, lipids, which may initiate degenerative diseases such as cancer, heart disease, dermal disorders and aging. Epidemiological studies have shown an inverse correlation between the consumption of polyphenols enriched diet and reduced risks of cardio vascular diseases (CVDs). The potential mechanisms of preventing CVDs and other chronic diseases could be related to the antioxidant activity. Actually, hypertension is also an important cardiovascular risk factors worldwide due to stroke. The importance of oxidative stress, vascular inflammation and endothelial dysfunction has to be highlighted in the development of CVDs. The knowledge of the process has provided new perspectives to elaborate dietary strategies to control the development of vascular diseases or novel "healthy" foods. Grapes composition in polyphenols and their extractability which is far from complete and typically reaching only 30–40%, depend on grape varieties, vineyard location and the technological parameters during wine making process including destemming, crushing, maceration and pressing. Therefore, grape pomace potentially constitutes a very abundant and relatively inexpensive source of a wide range of polyphenols including monomeric and oligomeric flavan-3-ols (proanthocyanidins/tannins) as well as anthocyanins (glucosides, acetylated glucosides and coumaroyl glucosides), stilbenes as well as phenolics acids and cinnamates. Moreover, it has been evaluated as a potential source of antioxidants polyphenols which could be used as nutraceuticals or food additives.

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Protein Design and Discovery to Build the Future of our Food System: A Journey into the Technological Advancements Transforming our Nutritional Landscape

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The global food system is currently experiencing a remarkable transformation, thanks to groundbreaking innovations in the fields of biotechnology, analytical chemistry, genomics, and data science. These emerging technologies hold the promise to revolutionize the way we produce, consume, and think about food, empowering us to not only enjoy the foods we love but also to ensure optimal health outcomes for ourselves and our planet. This talk will delve into the advancements that are shaping the future of our food system, from the creation of novel natural colors to the treatment of food-related diseases and the unlocking of the hidden potential within our food resources.

Central to this transformation is the development and application of novel protein design and discovery techniques. By harnessing the power of synthetic biology, computational methods, and genomics, researchers are unlocking new possibilities in food science, such as creating sustainable protein sources, enhancing the nutritional content of crops, and designing tailor-made proteins to cater to individual dietary needs. This talk will discuss how these innovations are offering sustainable alternatives to traditional food sources and enabling consumers to make more informed and healthier choices.

Furthermore, the synergistic advancements in data science and analytical chemistry are fostering the development of innovative solutions to some of the most pressing challenges facing our food system. This includes generating natural food colors through metabolic engineering, combatting food-driven diseases with targeted treatments, and tapping into the potential of underutilized crops to improve food security and reduce environmental impacts. By providing an in-depth exploration of these cutting-edge advancements, this talk aims to inspire and inform scientists, policymakers, and industry stakeholders as they work together to build a more sustainable, efficient, and health-focused food system for the future.