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# Characterization of Citric Acid – Iron Interactions to be Used as Food Fortifiers

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## Abstract

Food insecurity is increasing worldwide despite the continuous efforts of organizations to combat it. A non-covid19 scenario was assumed in the projection of undernourishment in 2030, in which the number of undernourished was 841.4 million whereas when taking covid-19 pandemic into consideration, the optimistic scenario will be 860.3 million undernourished and 909 million in the case of the pessimistic scenario (FAO et al., 2020, 2021). Iron deficiency remains the most common widespread nutritional disorder, and the only one prevailing both developing and developed countries with variation in the average blood hemoglobin concentration between regions (Blanco-Rojo & Vaquero, 2019). By the year 2011, it was estimated by the World Health Organization that about 800 million children and women suffer from anemia mainly due to iron deficiency and in 2014 it recommended a daily oral iron supplementation as anemia being one of the most significant current illnesses in the world (Bagla, 2014; Blanco-Rojo & Vaquero, 2019). Food fortification has been extensively used as a successful tool to combat micronutrient deficiencies, but still facing some limitations especially in finding the “ideal” fortifier. The main challenge with food fortification is the combination of a bioavailable and affordable fortificant with the best (food) vehicle as a carrier to reach at-risk populations and be feasible with industrial processing techniques. New studies aim to fortify food by the optimum form of micronutrients especially minerals without compromising organoleptic properties, and shelf-life stability since the attitude of people towards fortified food is very important and the main concern is their acceptability (Jahn et al., 2019; Talbot-Walsh et al., 2018). Some of the new concepts are the production of nano-fortificants, encapsulation of micronutrients and chelation. Chelation is the promising trend in producing optimum fortificant overcoming the instability of encapsulation and the unproven safety of nanoparticles (Hurrell, 2002; Knijnenburg et al., 2019). But with some challenges especially the cost. These complexes are capable of preventing the interaction of the mineral with the food medium avoiding organoleptic changes as well as their ability in releasing the cation to the digestive tract (stomach, intestine, etc.) or to keep the chelates’ structures at the different pH values that can be found in the different gastric apparatus parts (Henare et al., 2019).

Our research aims to produce chelates of iron having the above properties to be used as food fortificants after characterizing them qualitatively and quantitatively. Famous for its sequestering ability, citric acid was chosen to produce citric-iron chelates. It is a weak organic acid present naturally in citrus fruits and it plays the role of an intermediate in citric acid cycle; it has the structure of carboxylic acids with three carboxyl groups. Its use in everyday life is very often and it is a valuable tool for food processors [5], [6], since its use in this field is extensive as a food additive it could be also used as a fortifier in combination with iron.

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