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Design and characterization of a sustainable food for people with anaemia

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Iron deficiency is the leading cause of anaemia, which affects about 40% of children 37% of pregnant women, and 30% of adult women (WHO, 2024). The iron most assimilated by humans is heme iron, which is found exclusively in animal tissues. However, in response to the global food transition, we expect a shortage of animal-based foods in favour of plant-based foods. This perspective raises the need to better promote animal by-products, including liver, which is rich in heme iron but unattractive for the consumers and to increase the proportion of plant proteins. A multi-layered food composed of liver (pork-chicken) and red lentil was manufactured by 3D printing to produce a textured iron-rich food. Once printed the food was stored for 3 weeks at 4°C in a modified atmosphere, with or without oxygen. Whatever the packaging method, heme iron content decreased and the texture became firmer during storage, but the phenomenon was amplified when the food was stored under oxygen modified atmosphere packaging (O₂-MAP) compared to nitrogen modified atmosphere packaging (N₂-MAP). Major variations in iron distribution as a function of storage conditions (N₂-MAP and O₂-MAP) were observed in both the animal and plant parts of the food. From a synchrotron X-ray fluorescence analysis, the positive correlations between iron and other elements such as phosphorus and sulphur helped to identify compounds that may be associated with iron (ferritin, phytates, sulphur-containing amino acids...). XANES spectroscopy highlighted spectral signatures specific to the animal and plant mixtures. The results also suggested the migration of iron between animal and plant areas during storage. This food is suitable for anaemic people due to the complementarity of iron sources. However, special attention must be paid to storage conditions.

WHO, 2024. https://www.who.int/health-topics/anaemia#tab=tab_1