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THE USE OF IN SITU FORTIFICATION TO IMPROVE THE NUTRITIONAL QUALITY OF TRADITIONAL FERMENTED FOODS

Youna Hemery, Fabien Saubade, Insaf Berrazega, Ziad Almousa Almaksour, Christian Picq, Jean-Pierre Guyot and Christèle Humblot

Institut de recherche pour le développement, UMR 204 «Nutrition et Alimentation des Populations Aux Suds» (IRD, UM, Supagro), 34394 Montpellier, France; Christele.Humblot@ird.fr

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Introduction. Malnutrition is responsible for millions of death among vulnerable populations, and in the less advanced countries, monotonous diet leads to micronutrient deficiencies (iron, zinc, vitamin A, folate).
In many countries, cereal-based foods are the primary staple foods. Wholegrain cereals are known to contain non-negligible amounts of B-vitamins, located within the aleurone layer and the germ. Among the preservation processes applied to cereal-based foods, fermentation is among the most common. It is an ancestral way to conserve food products all around the world. It improves the sanitary quality of the food products, their organoleptic characteristics, but also their nutritional quality.
Fermentation is a sustainable process, since it produces few effluents and requires little energy consumption.
Folate (*i.e*. vitamin B9) is involved in vital functions of cell metabolism. Inadequate dietary intakes lead to deficiencies, which induce important health problems such as neural tube defects. Folate deficiency is commonly observed in developing countries, but also in many industrialized contexts. Some countries have established mandatory food fortification with synthetic folic acid, but despite the observed beneficial effects, concerns exist over the possible adverse effects in some subpopulations in case of large-scale fortification.
Another solution to improve the folate content of cereal-based staple foods would be to use *in situ* fortification by fermentation. The production of folate by lactic acid bacteria (LAB) during food fermentation has been validated in dairy products but the data on cereal based fermented foods (CBFF) are scarce.

The objective of this work is to evaluate the possibility of improving folate intakes, by increasing the folate contents of traditional cereal staple foods through fermentation. It is included in the project entitled "Contribution of cereal-based fermented foods to Folate intake in European and African countries" (FolEA).

Methods. We first measured by microbiological assay the folate content of 50 samples of a model of CBFF made from pearl millet (bensaalga), collected in 10 production units in Ouagadougou (Burkina Faso). Then, to monitor the folate content evolution, the total folate content was measured at each step of the process reproduced under controlled conditions. This traditional processing of pearl millet involves these steps: washing, soaking, grinding, kneading, sieving, fermentation and cooking. Finally, we estimated the potential of folate production by the microorganisms involved in its fermentation.

Results. The folate content of bensaalga was comprised between 0 to 3µg/100g fresh matter (FM), which is very low. There is a production of folate during the soaking step of pearl-millet (31% increase). Folate content decreased by 32% after sieving, due to removal of the outer layers of the kernels. The final folate content of the porridge made in the laboratory was 2µg/100g FM, which is in the range of measurements made in traditional production units, but lower than the expected theoretical value (2.7µg/100g FM) calculated from the folate content of the whole grain.
In order to increase this content, we looked for the best folate producing strains among the 150 LAB (*Lactobacillus acidophilus*, *L. fermentum*, *L. plantarum*, *Pediococcus acidilactici* and *P. pentosaceus*) previously isolated from bensaalga. In rich culture broth (MRS), 62% of the strains are able to produce folate (up to 120µg/L), 28% consume it and 10% do not modify folate content. The production of 6 strains has been thoroughly investigated and at least 3 of them have an interesting extracellular production of folate. We are now using those folate-producing strains to increase folate content of CBFF through fermentation.

Conclusions. Despite the high potential of LAB responsible for the fermentation of bensaalga, the folate content of this food is very low. This work is the basis to establish strategies to implement an improved process in order to increase the folate content of bensaalga through fermentation with selected strains. It will make use of the diversity of microorganisms naturally present in those food products.

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