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## Review

## How can both the health potential and sustainability of cereal products be improved? A French perspective



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## ABSTRACT

A more sustainable cereal sector would preserve the environment (environmental sustainability) and promote health (physiological sustainability) at a price that is acceptable to consumers regardless of their social status (socio-economic sustainability). The health potential of cereal products can be improved throughout the cereal sector *via* a more integrative approach based on reverse engineering. Globally, whole-grain products that contain less sugar, fat and salt must be developed. Therefore, the first main point is to fully understand the consumers' acceptance of such new cereal products of higher nutritional value. Then, levers and locks at the technological, agricultural and genetic selection levels must be identified. Recent literature reviews and Committee reports emphasised the importance of preserving the structure of cereal foods *via* less drastic hydrothermic and mechanical processes and greater use of pre-fermentation and/or germination processing. The results of more human intervention studies are required to fill the gap between those obtained from observational and mechanistic/animal studies, notably, in reaching a conclusion regarding the health-promoting antioxidant potential of whole-grain cereal products. However, genetic selection faces the constraints of preserving both high yields and high levels of protective bioactive compounds. In conventional agriculture, one important issue is the accumulation of pesticides in the outer fractions of grains, which affects the development of whole-grain products. Although organic agriculture does not seem to provide a significant improvement in nutritional value, this practice is clearly more sustainable in terms of environmental protection. In conclusion, the improvement of the nutritional value of cereal products in the framework of a sustainable development should involve the concerted contribution of different actors of the sector.

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## 1. Introduction

Certain practices affect the nutritional quality of cereal products, including the refining and fractionation processes applied to the raw material and the addition of sugar, salt and fat in product formulations. During refining, the components of high-nutritional value that are contained in the bran and germ fractions, such as fibre, micronutrients and protective phytochemicals, are stripped from the grains; whereas the addition of salt, sugar and fat causes public health problems, such as the increased prevalence of obesity, type 2 diabetes, cardiovascular diseases and cancers. A typical example is childrens' breakfast cereals, which are usually made from refined grains (with very few protective micronutrients) that are extruded under stringent conditions (causing a high glycaemic

index) and are high in sugars and fats (risk factors for the development of overweight and obesity) (Lioger et al., 2007).

In addition to addressing problems caused by the accumulation of contaminants (including mycotoxins and insecticidal residues) in the outer layers of the grain, the proponents of non-refining or less intensive refining must also address the question of the acceptability of whole-grain and partly refined flours from digestive and taste perspectives. The challenge for the cereal sector is to maintain the organoleptic properties and safety of cereal products while improving their nutritional quality.

With the objective to develop sustainable diet, several questions must be addressed at the different levels of the cereal sector, as follows: 1) at the level of agricultural production, can we select genetic varieties that are the richest in protective micronutrients or use cereal varieties that are very little cultivated currently but are rich in the nutrients of interest while maintaining a satisfactory yield? Can we use cultivation practices that are more protective of the environment and at the same time ensure the nutritional value

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