

## Whole Grain Products in (Southern) Europe: Consumer Trends and Technological Implications

SILVIA FOLLONI<sup>1</sup> AND ROBERTO RANIERI<sup>1,2</sup>

### Whole Grain Definitions in Europe

When addressing whole grain food products, trends, and consumers, Europe cannot be regarded as a whole. This is mainly due to the absence of a common and agreed official definition of whole grain in the different European countries. What is labeled or advertised as whole grain in Italy may not be considered whole grain in Germany, the United Kingdom, or Austria (as well as the United States). The requirements in the whole grain definitions of some European countries are listed in Table I: in Italy for example, the whole grain definition concerns wheat flour and semolina only and relies on the level of proteins and ashes and on the flour/semolina origin (i.e., obtained at the mill). A similar definition of whole grain based only upon ashes level is given in the French legislation while the German and Spanish definitions hold the idea of wholeness, for which the whole grain product must contain all the constituents of the grain before processing. The 6th EU Framework Programme HEALTHGRAIN project (2005–2010) worked on a harmonized and comprehensive definition of whole grain for Europe. In the proposed definition, “whole grains shall consist of the intact, ground, cracked, or flaked kernel after the removal of inedible parts such as the hull and husk. The principal anatomical components—the starchy endosperm, germ, and bran—are present in the same relative proportions as they exist in the intact kernel. Small losses of components—i.e., less than 2% of the grain, 10% of the bran—that occur through processing methods consistent with safety and quality are allowed” ([http://www.healthgrain.org/webfm\\_send/44](http://www.healthgrain.org/webfm_send/44)). The HEALTHGRAIN forum, founded soon after the finalization of the HEALTHGRAIN project in 2010 with 13 food companies and many European public institutions actually joining (<http://www.healthgrain.org/>), is now promoting the approval of this definition at the EU level.

### Whole Grain Consumption

Although a comprehensive picture of whole grain consumption in Europe is missing, the situation is considered not too different from the American one. Usual whole grain intakes are around 15% of the recommended value while refined grains are 100% above the limit (23). For bread, white bread is domi-

nant throughout Europe. In the United Kingdom and in Southern Europe, whole grain bread has a low market share (<3%) while in countries with traditions of whole grain products, like Germany, the share is stable at 10% (16). Even in the Nordic countries, where whole grain breads have a larger share of the market, white bread is dominant and whole grain intake is still below recommended levels (13). In the Netherlands, whole grain, brown (50% whole grain), and white bread have about 25% of the market each, with white bread dominating the luxury and small bread market. The remainder is multi-grain (white flour with some added grains) popular in Germany and Austria too (Van der Kamp JW, personal communication).

**Table I. Whole grain definitions of some EU countries.**

Country	Law/Standard	Definition/Features
Germany	DIN Standard 10355 of 1992 and adjournments	Whole grain flour and whole grain meal must contain the entire constituents of the cleaned grain, including the germ. It is permissible for the outer pericarp (grain shell) to be removed from the grain before processing
Spain	Decree n. 2484 of 1967 (last adjournment published on 26/04/2012) Point 3.20.10.	Whole grain flour; The product resulting from cereal grinding, subject to cleaning and conditioning, without removing any part of the cereal. The packaging should be labeled as “wholegrain flour” followed by the name of the cereal from which it is produced
France	Decree of 20 July 1963	Ashes >1.4% for all whole grain flours except rye (type T150); >1.50% for whole rye flour (type T170)
Italy	Dpr n. 187 of 2001	Minimum level of proteins (12.0% for whole grain flour from common wheat; 11.5% for whole grain semolina from durum wheat); Ashes (1.30–1.70% for common wheat; 1.4–1.8% for durum wheat); Whole grain flour/semolina obtained at the mill
Greece	Food Code Index 106, section 12	Whole grain semolina; Ashes (1.60 d.m. max) Acidity (0.15% max) Level of bran (18.0% max) Impurities (0.03% max) Granulation size

<sup>1</sup> Open Fields srl. Strada Consortile 2, 43044, Collecchio (PR), Italy.

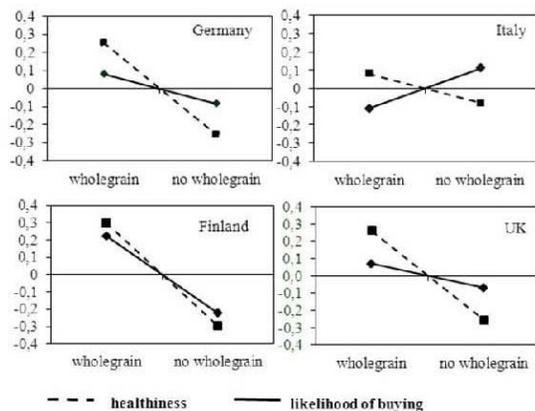
<sup>2</sup> Corresponding author. E-mail: [r.ranieri@openfields.it](mailto:r.ranieri@openfields.it).

## Consumer Trends

European consumers are aware of whole grains having a positive health effect but this does not always translate into a higher likelihood of buying them, as was recently shown for Italian consumers (21). In the study, consumers from Finland (n = 679), Germany (n = 504), the United Kingdom (n = 547), and Italy (n = 662) were asked to rate whole grain labeled products in terms of healthiness and likelihood of buying. In Finland, Germany, and the United Kingdom, whole grain labels increased perceived healthiness but had a less positive impact on likelihood of buying. In Italy whole grain labels even decreased the likelihood of buying (Figure 1). In a previous study (2), data on whole grain appraisal were collected with self-completion questionnaires in the United Kingdom (n = 552), Italy (n = 504), and Finland (n = 513). In the United Kingdom and Italy respondents were less likely to differentiate between whole grain and refined grain products than the Finnish respondents. In general however, whole grain products were rated as more nutritionally balanced, healthier, more natural, more filling, slower to release energy, slightly more digestible than the refined product category. In terms of price, whole and refined grains were equally rated in the United Kingdom while in Finland and Italy refined grains were better. Sensory features of whole grains were rated slightly better in Finland and the United Kingdom while Italians rated refined grains better than whole grains. Results suggested that providing information about the benefit of whole grains may not be a successful strategy in promoting the consumption of whole grains. Instead, it seems essential to provide new whole grain options with attractive sensory features relying on the overall positive health image of cereal-based products. In southern Europe an additional obstacle in adapting consumer habits may be the strong culinary tradition and the belief that the traditional Mediterranean diet is healthy enough. The awareness of the health benefits given by whole grains is not enough if good whole grain products cannot be found on the shelves and tailor-made recipes are not suggested.

## Emerging Technologies

Indeed, the technological advances in food processing are



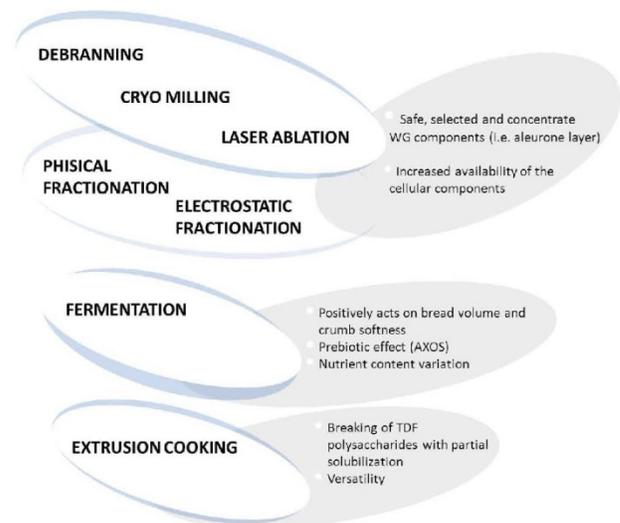
**Fig. 1.** Whole grain healthiness and likelihood of buying in some European countries (Germany, Italy, Finland, and the United Kingdom). Adapted from Shepherd et al. 2012 (21).

one of the main tools to boost whole grain consumption, through the possibility of improving sensory appeal (i.e., taste and color) and food safety (14,18) (Figure 2). Grain milling technologies already available at an industrial level like de-branning (6,7), physical fractionation (10), and the possible further developments as cryo milling (9), laser ablation (15,17), and electrostatic fractionation (11) enable a selection and concentration of whole grain fractions (i.e., the aleurone layer) allowing for a lighter appearance as well as a nutrient availability increase (1,3,4). Fermentation is being exploited to reduce the impact of whole grain flour on food-making processes as well as to enhance the bioavailability of the whole grain components (5,8,12). For breadmaking, innovative milling and fermentation technologies are going to be studied for commercial applications in an EU project called HealthBread (www.healthbread.eu). The project—coordinated by TNO (The Netherlands) and involving 17 partners from five European countries, including eight SME bakeries from four European countries (The Netherlands, Austria, Germany, and Italy)—aims at releasing commercially viable bread products rich in wheat-based dietary fiber and micronutrients which have beneficial effects that go beyond common white bread and/or common whole grain bread. Improvements in extrusion cooking are leading to an array of whole grain products (snacks, breakfast cereals, crispy expanded products, filled snacks, etc.) with lighter texture and mouthfeel (19,20,22).

Moreover, exploiting genetics and breeding by choosing tailor-made varieties (i.e., white wheat) can help technology to release attractive whole grain foods.

## Whole Grain Product Launches

Advances in whole grain food technologies translate into an increase in whole grain food launches both in countries with a well-established tradition such as Denmark and Germany and in countries like the United Kingdom and France where whole grains were little known until a few years ago. Whole grain launches across southern European food sectors continue to grow (Mintel/GNPD 2011). In the Mediterranean area including France, Italy, Spain, Portugal, and Greece, new launches



**Fig. 2.** Technological tools for the improvement of whole grain products. Abbreviations: whole grain (WG), arabinoxylan-oligosaccharides (AXOS), total dietary fiber (TDF).

with whole grain claims have increased by 92% since 2005 (Figure 3). Next to whole grain bread and breakfast cereals, which remain market leaders, whole grain and multigrain snacks are appearing on the market more and more (by brands like Lorenz Bahlsen, DE; Warbutons, GB; Walkers, GB; World Gourmet, FR; and Cipster and Mulino Bianco-Barilla, IT).

## Conclusion

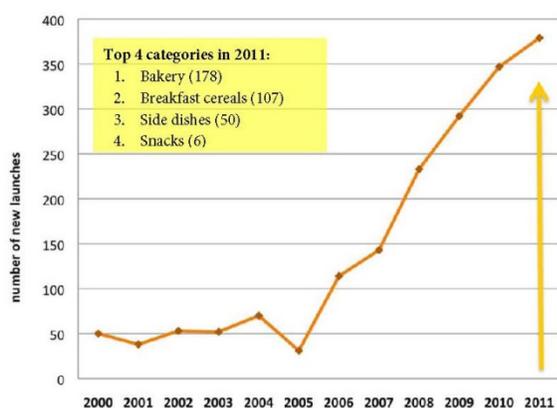
In order to set up a robust whole grain business strategy it is necessary to release a common definition of whole grain in Europe and to establish reliable statistics on whole grain consumption in each European country. The HEALTHGRAIN Forum has taken an action in this respect. A strategy for promoting whole grain consumption in Europe could be to provide a wide range of whole grain end product options and to make them widely available, relying on the overall positive health image of cereal products. This can be achieved using suitable raw materials and processes that make the whole grain product sensory features (taste, texture, and appearance) more similar to those of the refined ones. Convincing consumers to adopt whole grain food seems to be still a precompetitive sector where companies and research institutions can share common strategies.

## Acknowledgments

The authors wish to acknowledge Bettina Zeuch and Carola Funk from Kampffmeyer Food Innovation GmbH and Enrico Cademartiri from Barilla G. e R. Flli SpA for providing some market data.

## References

1. Antoine, C. et al.: Intérêt nutritionnel de la couche à aleurone du gran du blé. *Industries des céréales*, 133 4-10 (2003).
2. Arvola, A. et al.: Consumers' belief about whole and refined grain products in the UK, Italy and Finland. *Journal of Cereal Science*, 46, 197-206 (2007)
3. Atwell, B. New Aleurone Definition Approved. *Cereal Foods*



**Fig. 3.** New launches with whole grain claims in southern EU countries (France, Italy, Spain, Portugal, and Greece). Data from MINTEL/GNPD; years 2000–2011.

- World 55 (5), 242 (2010).
4. Buri, R.C. et al.: Description and Characterization of Wheat Aleurone. *Cereal Foods World*, 49, (5), 274-281 (2004).
5. Delcour, J.A. et al.: Technologies for enhanced exploitation of the health-promoting potential of cereals, *Trends in Food Science & Technology* (2012) <http://dx.doi.org/10.1016/j.tifs.2012.01.007>.
6. Dexter, J.E. and Wood, P.J.: Recent applications of debranning of wheat before milling. *Trends Food Sci. Technol.*, 7, 35-41. (1996).
7. Dexter, J.E. and Marchylo, B.A.: Recent trends in durum wheat milling and pasta processing: Impact on durum wheat quality requirements. In: Proc. International workshop on durum wheat, semolina and pasta quality: Recent achievements and new trends, Montpellier, France, Feillet P. eds. INRA, Montpellier, France, p-77-101 (2000).
8. Eklund-Jonsson, C. et al.: Reduction of phytate content while preserving minerals during whole grain cereal tempe fermentation. *Journal of Cereal Science*, 44, 154-160 (2006).
9. Hemery, Y. et al.: Potential of dry fractionation of wheat bran for development of food ingredients, part 1: influence of ultra-fine grinding. *Journal of Cereal Science*, 53, 1-8 (2001).
10. Hemery, Y. et al.: Dry processes to develop wheat fractions and products with enhanced nutritional quality. *Journal of Cereal Science*, 46 (3), 327-347 (2007).
11. Hemery, Y. et al.: Potential of dry fractionation of wheat bran for development of food ingredients, part 2: electrostatic separation of particles. *Journal of Cereal Science*, 53, 9-18 (2011).
12. Katina, K. et al.: Fermentation-induced changes in the nutritional value of native or germinated rye. *Journal of Cereal Science* 46 348-355 (2007).
13. Kyro, C. et al.: Intake of whole grains in Scandinavia is associated with healthy lifestyle, socio-economic and dietary factors. *Public Health Nutrition*, 14, 1787-95 (2011).
14. Laca, A. et al.: Distribution of microbial contamination within cereal grains. *J. Food Eng.*, 72, 332-338 (2006).
15. Martelli, M.R. et al.: Pulsed laser ablation: A new approach to reveal wheat outer layer properties. *Journal of Cereal Science*, 49, 354-362 (2009).
16. Newsletter VDM presenting results of GfK, major market research agency (2011).
17. Panchev, I.N. et al.: Possibilities for application of laser ablation in food technologies. *Innovative Food and Emerging Technologies*, 12, 369-374 (2011).
18. Rios, G. et al.: Assessment of dehulling efficiency to reduce deoxynivalenol and Fusarium level in durum wheat grains. *Journal of Cereal Science*, 49 (3), 387-392 (2009).
19. Robin, F. et al.: Process, structure and texture of extruded whole wheat. *Journal of Cereal Science* (2012) <http://dx.doi.org/10.1016/j.jcs.2012.02.014>.
20. Shaw, M. Extrusion Processing: New Whole-Grain Opportunities. *Food Product design*, 19(6), 1-3 (2009).
21. Shepherd, R. et al.: Communicating the benefits of wholegrain and functional grain products to European consumers. *Trends in Food Science & Technology*, 25, 63-69 (2012).
22. Stojceska, V. et al.: The effect of extrusion cooking using different water feed rates on the quality of ready-to-eat snacks made from food by-products. *Food Chemistry*, 114, 226-232 (2009).
23. U.S. Department of Agriculture, U.S. Department of Health and Human Services. *Dietary Guidelines for Americans* (2010). Available online at <http://www.cnpp.usda.gov/publications/dietaryguidelines/2010/policydoc/policydoc.pdf>.