Bringing Wellness to the Table: The Potential of Bread and Bakery Foods in Supporting Healthy Aging

Cristina M. Rosell[1,2*]

Abstract

Bread has been a staple food in human diets across cultures since ancient times. Traditionally, wheat has been the primary grain used in breadmaking due to its unique technological properties, which have enabled the development of a wide variety of breads through diverse production methods. In recent years, factors such as climate change, geopolitical shifts, and evolving lifestyles have prompted the exploration of alternative ingredients for bread formulation. As a result, countless types of bread—often adapted to local preferences and ingredients—can be found worldwide, reinforcing its role as a fundamental component of the human diet.

Wheat bread is a key source of macronutrients and micronutrients. By incorporating various flour types, its nutritional profile can be tailored to meet consumer demands for fortified, health-promoting, or sensory-enhanced foods. These considerations are especially important for older adults, whose nutritional needs evolve with age. While overall energy requirements may decline, the need for specific nutrients—such as protein, calcium, and certain vitamins—often increases. Additionally, age-related changes in digestion and nutrient absorption necessitate the consumption of nutrient-dense foods.

1. Department of Food and Human Nutritional Sciences University of Manitoba. Winnipeg, Canada
2. Instituto de Agroquímica y Tecnología de Alimentos (IATA-CSIC). Valencia, Spain
*Corresponding author (Cristina.rosell@umanitoba.ca)

Designing bread for older adults therefore requires special attention to factors such as nutritional enrichment, ease of chewing and swallowing, adapted digestibility, and appealing texture and flavor. This manuscript reviews the strategies and innovations that have been proposed or implemented to develop breads that meet the specific dietary needs of the aging population.

Keyword: Breadmaking, Non-conventional flours, Starch digestibility, Enrichment, Fortification

Introduction

Bread is a global staple food characterized by its affordability, accessibility, and nutritional value. It transcends cultural and seasonal boundaries and plays a fundamental role in daily diets worldwide. Among cereals, wheat has historically been—and continues to be—the primary source of flour for breadmaking. Wheat-based bread is rich in carbohydrates, particularly starch, but it also provides proteins, dietary fiber, minerals, and B-group vitamins. However, what truly distinguishes wheat in breadmaking is the functional role of its proteins, especially gluten (Gasparre & Rosell, 2023). Gluten's viscoelastic properties enable the production of a wide range of bread types, from highly aerated fermented loaves to flat, rollable breads. This versatility has led to the development of thousands of different breads around the world, with wheat as the cornerstone ingredient.

Despite its long-standing tradition, bread remains an evolving food. Innovations in processing technologies and ingredient use have vastly expanded the diversity of breads, resulting in products that vary in appearance, sensory qualities, nutritional profiles, and health-promoting attributes. This adaptability is particularly relevant when addressing the changing nutritional needs throughout life, from infancy to old age, as well as specific life stages or health conditions, such as pregnancy.

One of the most pressing demographic trends today is global population aging, driven by declining fertility rates and increased life expectancy. This shift is especially evident in Europe and Eastern Asia. According to the World Health Organization (2025), the global population aged 60 years and older is projected to increase from 1.1 billion in 2023 to 1.4 billion by 2030. This demographic transformation presents significant public health challenges and has prompted numerous initiatives aimed at addressing age-related issues, including ageism.

Nutrition plays a pivotal role in supporting healthy aging. Older adults face distinct metabolic changes and are more susceptible to chronic diseases, requiring nutrient-dense, palatable foods to maintain health and quality of life. A well-designed diet not only promotes longevity and independence but also reduces the burden on healthcare systems. In this context, bread can serve as a strategic vehicle for delivering essential nutrients to the aging population. Using diverse ingredients and processing techniques, it is possible to design breads that are tailored to the nutritional and functional needs of older adults—focusing on aspects such as enriched nutrient content, ease of chewing and swallowing, digestibility, and sensory appeal.

This review aims to explore the various strategies that have been proposed or implemented to adapt bread formulations and processing for the specific requirements of older adults, highlighting their potential to contribute to healthier aging.

Traditional and innovative breads and its nutritional profile

Wheat has traditionally been the primary cereal used in breadmaking, largely due to the unique properties of its proteins—particularly gluten-forming proteins. Upon hydration and mechanical stress, these proteins form gluten, a viscoelastic network that imparts essential functional properties to the dough. This gluten network allows wheat flour to blend into a cohesive mass, capable of undergoing proofing through yeast or lactic acid bacteria fermentation. During this stage, gas production leads to dough expansion and volume increase. Subsequent baking or cooking stabilizes the structure of the bread through several physico-chemical transformations, including microbial inactivation, protein denaturation, starch gelatinization, water loss (dehydration), and gas expansion. These changes result in a porous, aerated crumb that is both cohesive and extensible, often surrounded by a crisp crust. However, some breadmaking processes omit fermentation, producing flatbreads with different structural characteristics.

Regardless of the breadmaking method, wheat breads are considered nutrient-dense foods, providing approximately 240–284 kcal per 100 g, depending on the type. On average, wheat breads contain around 50 g of carbohydrates per 100 g, with protein content ranging from 7–9 g/100 g, and fat content varying between 3–18 g/100 g, depending on the formulation.

Over the last decade, non-conventional flours have been increasingly explored as alternatives to wheat flour in breadmaking, largely in response to sustainability challenges. To that end, ingredients such as pseudocereals, legumes, tubers, seaweeds, leafy plants, and even insects have been incorporated into bread formulations, resulting in notable improvements in their nutritional profiles. One of the primary goals of this approach has been to increase protein content, along with enhancing the levels of antioxidant compounds such as polyphenols—both of which contribute to a reduction in glycemic index. This combination of higher protein and lower starch digestibility is particularly important for addressing the specific dietary needs of older adults.

Improving Nutritional Value and Functionality of Bread through Flour Processing

The replacement of wheat flour with non-conventional flours often compromises the sensory qualities of bread, including texture, volume, and flavor. To mitigate these drawbacks, various physical and bioprocessing techniques have been applied to modify the techno-functional properties of alternative flours, making them more suitable for breadmaking. Both conventional methods—such as boiling, roasting, germination, and fermentation—and emerging technologies—including high hydrostatic pressure, microwave treatment, ultraviolet (UV) radiation, and ultrasound—have been explored to enhance the nutritional profile of breads while maintaining consumer acceptability (*Maçãs et al.*, 2024).

Among these strategies, germination stands out as an effective means of improving the nutritional quality of flour. This process activates endogenous enzymes, leading to increased levels of resistant starch, β-glucan, antioxidants, and other bioactive compounds in the grains (Garofalo *et al.*, 2025). However, the nutritional benefits obtained from germinated grains are strongly influenced by variables such as grain type, germination duration, and the proportion of germinated flour used in bread formulations. These effects tend to be more pronounced in cereals compared to legumes and pseudocereals.

In the case of legumes, both germinated and fermented flours have gained attention for their potential in developing nutrient-dense and functional bakery products (Chinma *et al*., 2025). The changes in macronutrient composition and the enzymatic activity generated during germination or fermentation influence dough performance and final bread quality. While fermented legume flours can be incorporated into wheat-based breads at levels of up to 20%, the inclusion of germinated legume flours is generally limited to 15% to preserve optimal dough characteristics.

Despite these limitations, the use of germinated or fermented legume flours significantly enhances the nutritional value of bread, contributing higher protein, dietary fiber, micronutrients, phytochemicals, and bioactive compounds, as well as a lower glycemic index compared to 100% wheat bread. With aging, gastrointestinal changes often impair protein digestion, whereas starch digestibility is generally less affected. However, given the high prevalence of type 2 diabetes among older adults, strategies aimed at reducing the glycemic index of bread are particularly important when formulating products tailored to the nutritional needs of the elderly. Therefore, germinated or fermented flours may serve as promising alternatives for formulating breads tailored to the needs of older adults.

Conclusion

Bread, a global dietary staple, holds great potential as a vehicle for promoting healthy aging. By integrating nutrient-dense flours and innovative processing techniques, it is possible to create tailored bread products that meet the evolving nutritional needs of the elderly—supporting both health and quality of life.

Acknowledgements

The financial support of the Sustainable Canadian Agricultural Partnership, a federal-provincial-territorial initiative (T01023), the NSERC Discovery Grant Program (RGPIN-2023-04289), and funding from the Canada Foundation for Innovation and Research Manitoba if fully acknowledged.

Declaration of AI and AI-assisted technologies in the writing process

The author used Scholar-GPT during the preparation of this work to enhance language and readability. All content was subsequently reviewed and edited by the author, who takes full responsibility for the final version of the manuscript.

References

Boukid, F., Rosell, C. M. 2022. The nutritional quality of wholegrain and multigrain breads is not necessarily better than white breads: the case of gluten-free and gluten-containing breads. Int. J. Food Sci. Nutr. 73(7), 902-914.

Chinma, C. E., Ezeocha, V. C., Adedeji, O. E., Jolayemi, O. S., Onwuka, Q. I., Ilowefah, M. A., Adebo, J. A., Rosell, C. M., Bamidele, O. P. and Adebo, O. A., 2025. Germinated/fermented legume flours as functional ingredients in wheat‐based bread: A review. J. Food Sci., 90(2), p.e70022.

Garofalo, M. A., Espinales, C., Yagual, D., Rosell, C. M., Cornejo, F. 2025. Germinated Flours from Different Botanical Sources: A Comprehensive Exploration of Their Influence on Dough Performance and Bread Quality. Food Rev. Int. 1-19.

Gasparre, N., Rosell, C. M. 2023. Wheat gluten: A functional protein still challenging to replace in gluten−free cereal−based foods. Cereal Chem., 100(2), 243-255. doi.org/10.1002/cche.10624

Maçãs, M., Biduski, B., Ferragina, A., Santos, A. A. D., Huet, M., Arendt, E. K., Gallagher, E. 2024. Impact of conventional and emerging processing methods on alternative breads–a comprehensive review and meta-analysis. Critical Rev Food Sci. Nutr. pp.1-21.