www.ThePharmaJournal.com

The Pharma Innovation

ISSN (E): 2277-7695
ISSN (P): 2349-8242
NAAS Rating: 5.23
TPI 2023; SP-12(8): 1466-1469

www.thepharmajournal.com
Received: 15-06-2023
Accepted: 19-07-2023

Harleen Kaur
Student, Department of Food and Nutrition, LPU Lovely Professional University, Phagwara, Punjab, India

Corresponding Author:
Harleen Kaur
Student, Department of Food and Nutrition, LPU Lovely Professional University, Phagwara, Punjab, India

Possible applications of certain pseudocereals within the food manufacturing sector

Harleen Kaur

DOI: https://doi.org/10.22271/tpi.2023.v12.i8Ss.22405

Abstract
Modern consumers exhibit a heightened interest in adopting healthier lifestyles and sound nutritional practices. While a plethora of plant species hold potential for human consumption, the prevailing risk of health-related concerns has led to a decline in the diversity of species incorporated in diets. Recent studies underscore the imperative of enhancing the nutritional quality of gluten-free cereal-based products. As global populations increase, researchers continuously explore novel food sources to enhance diets and promote improved health. Current research is notably concentrated on the exploration of alternative crops and underutilized species with versatile applications. Pseudocereals have attracted interest because of their outstanding nutritional, phenolic, and phytochemical profiles, which place them as essential components for the development of gluten-free products. Additionally, the amino acid composition and nutritional attributes, including essential amino acid index, biological value, protein efficiency ratio, and nutritional index, of pseudocereals outshine those of traditional cereals like wheat, rice, and maize. Recent investigations highlight the various health benefits offered by phenolic compounds present in pseudocereals, such as combating oxidative stress, anti-cancer, anti-diabetic, anti-inflammatory, anti-hypertensive effects, and cardiovascular disease prevention. Commercializing pseudocereals holds potential to address diverse health-related concerns, while the availability of appealing gluten-free products made from pseudocereals contributes to meeting nutritional requirements for individuals with celiac disease. This advancement signifies a step towards ensuring adequate nutrient intake.

Keywords: Amaranth, quinoa, buckwheat, bakery products, health benefits

Introduction

People who want to change their diet in order to improve and maintain their health are increasingly interested in the option to supplement or replace common cereal grains (corn, rice or wheat) with a cereal with higher nutritional value (Stamatovska *et al*., 2017) [1]. In recent times, pseudocereals have garnered renewed attention, emerging as focal points of exploration. They have risen in significance as substitute cultivars vis-à-vis conventional and extensively employed cereal grains like wheat, corn, and rice. Moreover, they have surfaced as viable options in the realm of human nourishment. Notably, the International AACC has incorporated them into the roster of acknowledged grains, thereby eliciting escalating curiosity across diverse global regions (Haros *et al*., 2017) [6]. Pseudocereals exhibit superior nutritional excellence compared to the majority of conventional cereal grains. This enhanced nutritional profile can be attributed to their elevated protein content, notable for a harmonious distribution of essential amino acids. Furthermore, their mineral content, encompassing minerals such as calcium, magnesium, iron, potassium, and zinc, stands at elevated levels. Noteworthy is also their lipid composition, characterized by a significant concentration of unsaturated fatty acids (Schoenlechner *et al*., 2010) [15]. In tandem with the rising prevalence of gluten-free dietary regimens, pseudocereals have garnered heightened attention. These botanical entities, distinct from grasses yet possessing seed-based starch abundance, have witnessed escalating prominence. Prominent examples include buckwheat, amaranth, quinoa, and canihua (Schoenlechner *et al*., 2010) [15]. Integral pseudocereal grains, such as buckwheat, amaranth, and quinoa, manifest a diverse array of compounds encompassing flavonoids, phenolic acids, trace elements, fatty acids, and vitamins. These constituents are recognized for their established impacts on human well-being, including the prevention and mitigation of numerous degenerative ailments (Kalinova & Dadakova, 2009) [7]. Notwithstanding their commendable attributes including premium protein content, amino acids, phytochemicals and minerals,the widespread introduction of these products remains constrained due to researchgap concerning their nutritional composition and the absence of contemporary processing and application techniques. Consequently, it is imperative to persist and broaden the technology portfolio to capitalize on insights into processing methodologies, thereby attaining desirable functional attributes and nutritional worth (Riar *et al*., 2018) [4].

The Use of Pseudocereals as a Source of lipids and Essential Fatty Acids

The lipid content within pseudocereal seeds is relatively modest, with the lowest levels recorded in buckwheat. Current knowledge regarding the fatty acid content and composition in buckwheat seeds is limited. The scant data available align with the findings acquired in the ongoing study (Gulpinar *et al*., 2012) [3]. Due to the high concentration of non-fat bioactive ingredients in this product, primarily polyphenols like rutin, orientin, vitexin, quercetin, isovitexin, and isoorientin, it is particularly alluring (Zhang *et al*., 2012) [20]. Nevertheless, lipid constituents have the potential to influence the technological characteristics of both seeds and the resultant flour, along with the oxidative stability of these products. The lipid contents and fatty acid compositions within seeds of plants belonging to the Amaranthaceae family (such as quinoa, canihua, and amaranth) exhibited considerable similarity. The fatty acid composition within this group of pseudocereal seeds closely mirrors that of cereal grains. While the variety of products derived from quinoa, canihua, and amaranth is extensive, industrial-scale oil extraction is primarily conducted using amaranth as a byproduct of the production process for high-protein amaranth flour or the isolation of protein and starch components (Berganza *et al*., 2013) [2]. Amaranth oil boasts abundant squalene content, a constituent extensively employed in pharmaceutical and cosmetic sectors (Mir *et al*., 2018) [4]. The lipids present in amaranth, quinoa, and buckwheat exhibit notable unsaturation, a desirable trait from a nutritional standpoint. Furthermore, these lipids display substantial resistance to oxidation, a pivotal attribute during the various technological procedures they undergo (Ryan *et al*., 2007) [7].

Bakery Products

Pseudocereals have been integrated into bread formulations with the intent of enhancing the nutritional composition. An examination was conducted to assess the impact of incorporating 15% and 30% of pseudocereal flours (buckwheat, amaranth, and quinoa) on the antioxidant capacity and sensory attributes of the resultant breads. Notably, the 30% dosage exhibited superior effectiveness in heightening antioxidant activity in comparison to the 15% dosage. Noteworthy is the observation that the introduction of buckwheat flour into wheat flour displayed a more pronounced enhancement in bread's antioxidant status when compared to the other pseudocereals studied, namely amaranth and quinoa (Chlopicka *et al*., 2018) [4]. Buckwheat-based bread exhibited the highest phenolic compound content. Sensory quality analysis of the bread demonstrated that the addition of pseudocereal flours, particularly buckwheat and quinoa, to wheat flour could enhance favorable quality attributes such as taste, color, and aroma. One avenue for promoting the utilization of buckwheat is its incorporation into items like biscuits, cookies, and crackers. Another investigation explored the influence of buckwheat flour and the hydrocolloid carboxymethyl cellulose (CMC) on gluten-free cookie production. The incorporation of buckwheat flour as a substitute for 10%, 20%, and 30% of rice flour led to decreased cookie hardness and fracturability, along with increased eccentricity (deviation from regular shape) and overall acceptability (Hadnađev *et al*., 2011) [14]. Furthermore, studies highlighted that buckwheat flour can be successfully integrated into biscuit formulations, yielding products with augmented nutritional and bio-functional properties, while remaining sensorially acceptable (Ahmed *et al*., 2014) [1].

Pasta Products

Pasta products in various forms are gaining global popularity due to their convenience, nutritional value, and appealing taste. Traditional Italian pasta is crafted using semolina flour derived from durum wheat. In a bid to enhance the nutritional and functional aspects of pasta, similar to the case of bakery products, pseudocereals have emerged as potential alternative sources. The fusion of various cereals or beans with pseudocereals has been explored for pasta production, yielding an array of recipes encompassing gluten-free and non-gluten-free variants like noodles, macaroni, and spaghetti, among others. It was noted that sensory evaluation of cooked noodles with amaranth yielded higher scores than the control (wheat flour), and the incorporation of amaranth up to 30% led to heightened brown coloration and distinct amaranth aroma. Texture analysis of uncooked noodles showed significantly elevated levels of traits like hardness, cohesiveness, gumminess, chewiness, and springiness in amaranth noodles relative to the control. Schoenlechner *et al*. (2010b) [15] investigated the feasibility of creating pasta incorporating amaranth, quinoa, and buckwheat with satisfactory textural attributes. When uncooked noodles were analysed for texture, amaranth noodles significantly outperformed the control in terms of attributes like hardness, cohesiveness, gumminess, chewiness, and springiness. Schoenlechner *et al*. (2010b) [15] investigated the feasibility of creating pasta incorporating amaranth, quinoa, and buckwheat with satisfactory textural attributes. The inclusion of amaranth reduced texture firmness and cooking duration, while quinoa yielded the opposite trend concerning cooking time. Buckwheat-integrated samples exhibited minor unfavorable impacts on pasta's functional properties. Through experimental design, these researchers successfully developed a formulation (20:20:60) that harmoniously combined amaranth, quinoa, and buckwheat while minimizing detrimental effects (Chlopicka *et al*., 2018) [4].

Others

As a promising candidate crop for NASA's Controlled Ecological Life Support System (CELSS), quinoa has drawn attention. In order to create food, oxygen, and water for prolonged human space missions, the CELSS concept uses plants to remove carbon dioxide from the atmosphere. Quinoa was specifically chosen because of its excellent nutritional qualities and high productivity. Quinoa appears to achieve the proper amino acid balance independently, whereas the CELSS has traditionally needed to combine the nutritional qualities of different crops to achieve this balance (Haros *et al*., 2017) [6]. NASA incorporates quinoa into the diets of crews on prolonged space missions due to its nutritive value, health benefits, and ease of cultivation. Another intriguing application of pseudocereals is their utilization in the production of biopolymers to formulate edible and/or biodegradable films. This avenue presents an alternative means of expanding their utility, creating new markets, and potentially replacing non-degradable synthetic plastics in pharmaceutical and food sectors (Tapia-Blácido *et al*., 2007) [18]. These edible films are crafted using a combination of polysaccharides, proteins, and lipids. In this context, films made from amaranth protein-lipid combinations were compared with films produced from amaranth flour to assess the impact of interactions between biopolymers (starch and protein) and lipids on film properties (Tapia-Blácido *et al*., 2007) [18]. The cohesive integration of the lipid phase within the flour film matrix contributed to effective plasticization and excellent barrier characteristics in amaranth flour films (Haros *et al*., 2017) [6].

Conclusion

Pseudocereals, aside from their commendable nutritional profiles, often possess abundant phenolic phytochemicals that hold potential health-promoting properties. This attribute underscores the significance of incorporating these lesser-known grains into dietary routines, fostering dietary diversity and upholding food plant biodiversity. To realize this objective, substantial research efforts are indispensable for crafting food items that resonate with the preferences of Western diet consumers. Heightened endeavours are warranted to raise awareness about these plants among the populace.

Unravelling the molecular structure of the storage proteins within these minor grains is crucial to extending the use of pseudocereals in staple dough-based foods like bread, both for the expanding urban population in developing countries and in gluten-free applications. In order to manipulate these structures, a thorough understanding of their genomes is necessary, which is a prerequisite for achieving the challenging task of converting non-wheat proteins into bakery goods that resemble wheat. Consequently, numerous gluten-free products featuring pseudocereals have emerged, including gluten-free bread, biscuits, pasta, and crackers. Diverse studies have highlighted successful formulations of pseudocereal-containing gluten-free cereal-based items like bread, pasta, and confectionery products. However, the market availability of these products remains relatively restricted. Furthermore, pseudocereals hold potential as nutritional resources in the battle against global hunger due to their undemanding agronomic requirements and straightforward cultivation methods. Their capacity to serve as viable nutritional sources in addressing food scarcity is significant.

References

1. Haros CM, Sanz- Penella JM. Food uses of whole pseudocereals. Pseudocereals: chemistry and technology; c2017. p. 163-192.
2. Ahmed A, Khalid N, Ahmad A, Abbasi NA, Latif MSZ, Randhawa MA. Phytochemicals and biofunctional properties of buckwheat: A review. The Journal of Agricultural Science. 2014;152(3):349-369.
3. Alvarez-Jubete L, Arendt E, Gallagher E. Nutritive value of pseudocereals and their increasing use as functional gluten-free ingredients. Trends in Food Science & Technology. 2010;21(2):10.
4. Berganza BE, Moran AW, Rodríguez GM, Coto NM, Santamaría M, Bressani R. Effect of Variety and Location on the Total Fat, Fatty Acids and Squalene Content of Amaranth. Plant Foods Hum. Nutr. 2003;58:1-6.
5. Galanty A, Chlopicka J, Kaleta M, Soltys A, Podolak I. Wpływ warunków przechowywania na aktywność antyoksydacyjną i zawartość polifenoli w owocach jarzębu szwedzkiego. Bromatologia i Chemia Toksykologiczna, 2018, 51(2).
6. Gulpinar AR, Erdogan Orhan I, Kan A, Senol FS, Celik SA, Kartal M. Estimation of *in vitro* Neuroprotective Properties and Quantification of Rutin and Fatty Acids in Buckwheat (*Fagopyrum esculentum* Moench) Cultivated in Turkey. Food Res. Int. 2012;46:536-543.
7. Kalinova J, Dadakova E. Rutin and total quercetin content in amaranth (*Amaranthus* spp.). Plant foods for human nutrition. 2009;64:68-74.
8. Mir NA, Riar CS, Singh S. Nutritional Constituents of Pseudo Cereals and Their Potential Use in Food Systems: A Review. Trends Food Sci. Technol. 2018;75:170-180.
9. Nakov G, Komlenić DK, Stamatovska V, Šušak A, Jukić M. Influence on time of baking and different role of barley flour on the colour of the biscuits. Journal of Hygienic Engineering and Design. 2017;21(1):90-95.
10. Navruz-Varli S, Sanlier N. Nutritional and health benefits of quinoa (Chenopodium quinoa Willd.). Journal of cereal science. 2016;69:371-376.
11. Nowak V, Du J, Charrondière UR. Assessment of the Nutritional Composition of Quinoa (*Chenopodium quinoa* Willd.). Food Chem. 2016;193:47-54.
12. Ogrodowska D, Zadernowski R, Czaplicki S, Derewiaka D, Wronowska B. Amaranth Seeds and Products—The Source of Bioactive Compounds. Pol. J Food Nutr. Sci. 2014;64:165-170.
13. Ryan E, Galvin K, O’Connor TP, Maguire AR, O’Brien NM. Phytosterol, Squalene, Tocopherol Content and Fatty Acid Profile of Selected Seeds, Grains, and Legumes. Plant Foods Hum. Nutr. 2007;62:85-91.
14. Sakač M, Torbica A, Sedej I, Hadnađev M. Influence of breadmaking on antioxidant capacity of gluten free breads based on rice and buckwheat flours. Food Research International. 2011;44(9):2806-2813.
15. Schoenlechner R, Drausinger J, Ottenschlaeger V, Jurackova K, Berghofer E. Functional properties of gluten-free pasta produced from amaranth, quinoa and buckwheat. Plant foods for human nutrition. 2010;65:339-349.
16. Schoenlechner R, Drausinger J, Ottenschlaeger V, Jurackova K, Berghofer E. Functional properties of gluten-free pasta produced from amaranth, quinoa and buckwheat. Plant foods for human nutrition. 2010;65:339-349.
17. Siwatch M, Yadav RB, Pseudocereals: Nutritional Quality, Processing and Potential Health Benefits S. Current Nutrition & Food Science. 2017;13(4):296-302.
18. Steadman KJ, Burgoon MS, Lewis BA, Edwardson SE, Obendorf RL. Buckwheat Seed Milling Fractions: Description, Macronutrient Composition and Dietary Fibre. J Cereal Sci. 2001;33:271-278.
19. Tapia- Blácido D, Mauri AN, Menegalli FC, Sobral PJ, Añón MC. Contribution of the starch, protein, and lipid fractions to the physical, thermal, and structural properties of amaranth (Amaranthus caudatus) flour films. Journal of Food Science. 2007;72(5):E293-E300.
20. Villa D, Russo L, Kerbab K, Landi M, Rastrelli L. Chemical and Nutritional Characterization of *Chenopodium pallidicaule* (CañIhua) and Chenopodium quinoa (Quinoa) Seeds. Emir. J Food Agric. 2014;26:609.
21. Wang S, Opassathavorn A, Zhu F. Influence of quinoa flour on quality characteristics of cookie, bread and Chinese steamed bread. Journal of Texture Studies. 2015;46:281-292.
22. Watanabe K, Kawanishi-Asaoa M, Myojin C, *et al*. Amino

acid composition, oxidative stability, and consumer acceptance of cookies made with quinoa flour. Food Science and Technology Research. 2014;20:687-691.
23. Wronkowska M, Haros M. Wet-milling of buckwheat with hull and dehulled – the properties of the obtained starch fraction. Journal of Cereal Science. 2014;60:477-483.
24. Wronkowska M, Haros M, Soral-Śmietana M. Effect of starch substitution by buckwheat flour on gluten-free bread quality. Food and Bioprocess Technologies. 2013;6:1820-1827.
25. Yamsaengsung R, Berghofer E, Schoenlechner R. Physical properties and sensory acceptability of cookies made from chickpea addition to white wheat or whole wheat flour compared to gluten-free amaranth or buckwheat flour. International Journal of Food Science and Technology. 2012;47:2221-2227.
26. Yildiz G, Bilgiçli N. Effects of whole buckwheat flour on physical, chemical, and sensory properties of flat bread, lavas. Czech Journal of Food Sciences. 2012;30:534-540.
27. Yildiz G, Bilgiçli N. Utilisation of buckwheat flour in leavened and unleavened Turkish flat breads. Quality Assurance and Safety of Crops and Foods. 2015;7:207-215.
28. Young VR. Soy protein in relation to human protein and amino acid nutrition. Journal of the American Dietetic Association. 1991;7:828-835.
29. Zanwar SR, Pawar VS. Preparation of biscuit from amaranth, sago and Echinochloa colonum (Bhagar). BIOINFOLET – A Quarterly Journal of Life Sciences. 2015;12:254-255.
30. Zhang Z-L, Zhou M-L, Tang Y, Li F-L, Tang Y-X, Shao J-R, *et al*. Bioactive Compounds in Functional Buckwheat Food. Food Res. Int. 2012;49:389-395.