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Editorial

High Amylose Starches and Legume Flours as Interesting Ingredients in Gluten-Free Food Formulation

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Editorial

Celiac disease is the most common food induced enteropathy caused by the ingestion of gluten containing grains in genetically susceptible individuals [1]. To date, the only efficacious treatment for celiac disease affected patients is a lifelong adherence to a Gluten-Free (GF) diet. In addition, GF food products not only cater to clinically diagnosed celiac patients, but also to healthy consumer who seek to remove gluten from their diet [2]. Although many advantages have been made in the formulation of GF products, several industrial GF cereal-based foods available on the market exhibit lower nutritional quality, lower content of Resistant Starch (RS) and higher Glycemic Index (GI) than their traditional gluten containing counterparts [2-4]. A recent survey, assessed through a voluntary nutrient profiling scheme, of several food categories available in the Australian market revealed that commercial GF plain dry pasta presented lower nutritional properties when compared to traditional non-GF counterparts [5]. Accordingly, nutritional studies on people with celiac disease on a GF diet revealed several nutrient deficiencies, as well as an increase in obesity risk [6].

As a consequence, extensive research has been conducted to investigate the preparation of a new generation of cereal-based GF products [2]. Overall, the current research goes in two different directions. On one hand gluten is modify aiming to eliminate, or reduce, the immune toxicity of gluten protein. On the other, naturally GF recipe and/or ingredients are being optimized to fit the desired nutritional ameliorations [2]. Therefore, a large number of starches and flours, in combination with enzymes, non-gluten protein sources, hydrocolloids, gums, novel ingredients and technological treatments have been tested in several GF food formulation aiming to improve the overall nutritional quality [1,2,6]. In particular, considering starch composition, it can vary from being virtually amylose-free (i.e., 0 to 5% of amylose) to being high in amylose, with values up to 70% on a total starch basis [7]. The structural difference between amylose and amylopectin polymers, along with their relative amounts in starches, contributes to substantial change both starch digestion potential and functionality. In particular, it is recognised that digestive enzymes slowly digest amylose, whereas amylopectin is rapidly digested because of its branched structure [7]. Accordingly, in vitro findings revealed that GF bakery products formulated with increasing levels of high amylose starches were characterized by overall slowly digestible starch properties when compared to control samples, being characterized by greater RS content, lower predicted GI and slower rate of starch hydrolysis [8,9]. The contribution of amylose to decreasing starch digestibility could be also linked to the compactness of the amylose molecule compared to that of amylopectin. This in turn affects the degree of starch swelling during gelatinisation and the subsequent accessibility of starch to hydrolysing enzymes [6]. Lastly, an increase in the total dietary fiber content has been reported in GF breads formulated with increasing level of HA starches [3]. Greater amount of dietary fiber of GF bakery products are considered beneficial, since a general low intake of this food component has been described for celiac population [10]. With this perspective, high amylose starches may be favourably incorporated into GF food recipes to contribute one of more of these functionalities depending on the type of GF food product and other ingredients in the formulation.

Besides high amylose starches, flours from legumes, due to their poor starch digestibility related to the inherent physical and structural properties of starch (i.e., higher RS content and lower GI when compared to common GF cereal flours) can represent a valuable alternative for GF food production [11]. Whatever the legume used, the use of GF cereal/leguminous blend may be nutritionally convenient in GF product manufacturing in order to enhance protein, dietary fiber and minerals contents [10-12]. In addition, the fortification of GF products with legume flour would improve their protein nutritional value due to the complementation of cereal and legume amino acid patterns. For instance, with respect to control GF rice pasta, the inclusion of bean flour increased dietary fiber, protein and RS contents, while decreased the in vitro GI of cooked to optimum samples [10]. Likewise, GF spaghetti made with chickpea and unripe plantain flours were characterized by higher protein and RS contents, a lower rate of starch hydrolysis and a lower in vitro GI value than the non-GF control [13]. However, even if legumes appear to be a promising ingredient for the production of a new generation of GF cereal-based foods, anti-nutritional factors, and their fate during processing, need to be rigorously investigated [11,14].

Considering the growing demand for GF products, the production of high-nutritional foods, along with the expansion of the range of GF cereal-based foods available on the market is, without any doubts, of main importance. From this perspective, high amylose starches and legume flours with high nutritional value would replace, at least in part, the low-nutritional ingredients currently used for GF food production. However, this replacement will require several technological challenges, with the aim to optimize not only the nutritional quality, but also quality, sensory and tastefulness attributes of a new generation of GF food products.

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