Protein sources alternative to gluten

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INTRODUCTION

Cereals represent a fundamental element in any healthy diet, but, day after day, the diagnosis of pathologies related to gluten increases, the most relevant one being celiac disease. This makes the development and production of food free of this increase and constitutes a large market worldwide

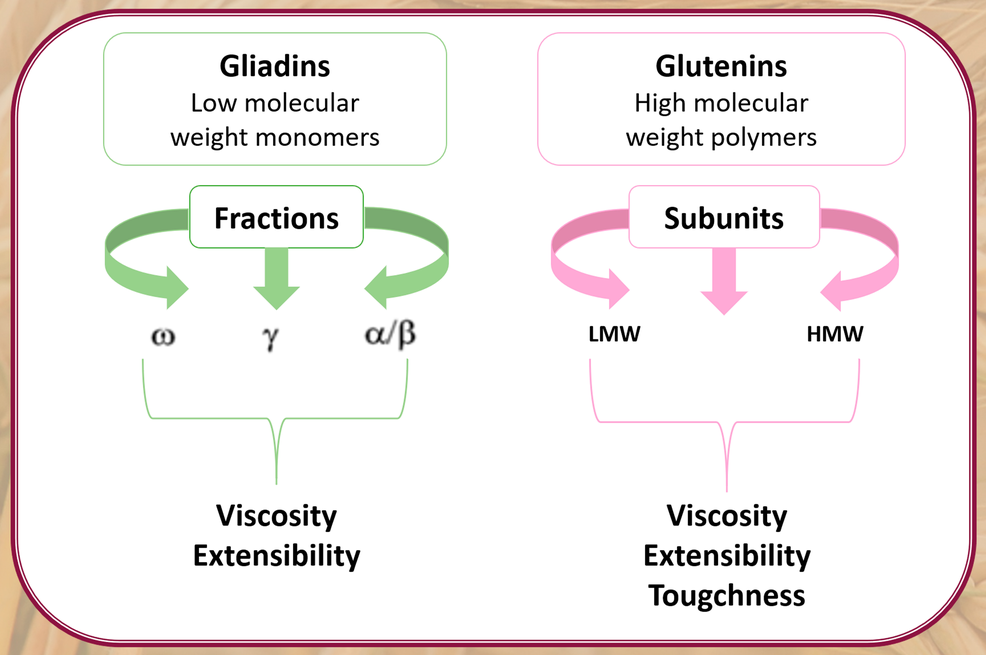
Many studies have been carried out on the improvement of gluten-free products, most of them on the incorporation of starches and hydrocolloids, but this work has focused on the review of different protein sources alternative to gluten

The products that want to be offered as "gluten-free" or "low-gluten", should benefit from Commission Regulation (EU) No. 828/2014

OBJECTIVE: Review on the use of protein sources alternative to gluten, highlighting its technological effect on bread products

GLUTEN

Gluten proteins: fractions and technological properties.
Modified from Lamacchia et al. (2014)



PROTEIN SOURCES

Most important vegetable protein sources

FAMILY	PROTEIN SOURCES STUDIED	TECHNOLOGICAL PROPERTIES
Cereals	**Rice** (*Oryza sativa*) **Corn** (*Zea mays*) **Sorghum** (*Sorgum vulgarae*)	Proteins insoluble in water and incapable of forming a viscoelastic network to retain carbon dioxide produced during fermentation (due to low prolamins content) **Final product:** bread of a very compact crumb that does not resemble the structure of conventional bread
Pseudocereals	**Amaranth** (*Amaranthus*) **Quinoa** (*Chenopodium quinoa*) **Buckwheat** (*Fagopyrum esculentum*)	In the same way as cereals, proteins insoluble in water and incapable of forming a viscoelastic network to retain carbon dioxide produced during fermentation (due to low prolamins content) **Final product:** the specific volume is improved, better appearance with a darker color in the crust and the crumb and the texture is softer with a more cohesive crumb
Legumes	**Carob** (*Ceratonia siliqua*) **Soybeans** (*Glycine max*) **Lupine** (*Lupinus luteus*)	Legumes proteins have the capacity to form the dough with rheological properties similar to gluten, also, increase water retention and act as a foam former **Final product:** the crumb of gluten-free bread was favored with a higher number of alveoli and larger diameter, a longer shelf life is obtained. In the case of soy, the specific volume is reduce

Most important animal protein sources

Protein sources studied	Technological properties
Dairy products	Highly functional ingredients due to its ability to form a network similar to that of gluten and increase the capacity of water retention **Final product: a** general improvement of the loaves is observed, they improve their specific volume, as well as a firmer crumb texture. They present a better appearance (white crumb and dark crust) and a better organoleptic quality
Egg products	They act mainly as a foaming agent, since, thanks to the thermal coagulation of these, the dispersion and stabilization of gas bubbles in gluten-free systems is facilitated **Final product:** the initial bread hardness is increased, but this defect is compensated by the increase in shelf life and the increase in the specific volume as well as the diameter of the alveoli

CONCLUSIONS

- **Proteins play a key role in the replacement of gluten to obtain gluten-free quality products**
- **The animal protein sources and the legumes show better results regarding the final product, being those of higher protein concentration**
- **In the formulation of a gluten-free bread, a single functional ingredient cannot replace all the properties it brings to the product**