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Study of the functional properties of the corn flour proteins (*Zea mays*), barley (*Hordeum vulgare*), quinoa (*Chenopodium quinoa*), potato (*Solanum tuberosum*), and wheat (*Triticum aestivum*) national and imported intended for use in baking and noodles

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Abstract: Proteins are not only sources of amino acids, but because of their polymeric nature, their presence directly influences the rheological characteristics of the food, which makes it more acceptable to the consumer. A protein can have a high nutritional quality and yet not possess functional properties suitable for incorporation in a particular food system or process. The functionality of proteins is therefore of great technological importance, and there is a great interest to gain insight into the mechanisms involved in the functionality itself, in order to be able to modify them and extend their range of applicability. Several physical chemical analyzes of each sample demonstrated that the product presents the most adequate protein characteristics to obtain a flour that is better adapted to the technology of baking and noodles. It was proposed the use of five flours from different cereals and tubercle (wheat, maize, barley, quinoa and potato), where a randomized single factor design was applied . The parameters that were used as indicators of the adaptation of the flour for baking technology and noodles were the solvent retention capacity and the determination of disulfide and sulfhydryl groups. The main objective of the present research is to study the functional properties of flour proteins of different products in order to intend their use for baking and noodles.

Keywords: functional properties, cereals, tubercle, solvent retention capacity

1. Introduction

The proteins are not only sources of amino acids, but because of its polymeric nature. Its presence strongly influences the rheological characteristics of the food, which makes it more acceptable to the consumer [1].

The protein maybe have a high nutritional quality and not possess functional properties that are unique to obtain a viscoelastic and cohesive mass capable of retaining gas and suitable for incorporation into a given food system or process. The functionality of the proteins is accordingly of great technological importance, being of great interest to know the mechanisms involved in the functionality of the same, in order to be able to modify them and extend its applicability range [2].

One of the functional properties of proteins is due to their ionizable carboxyl groups, amino, disulfide and others. The amino acids are able to change from one charge to another according to the pH in which they are. In other words, their amphoteric character confers the ability to receive and donate electrons, this situation induce a chemical condition known as an isoelectric or double ion point [2].

The wheat is used primarily in the manufacture of various bakery derivatives, since it presents the peculiarity that during its fermentation a swelling occurs. This capacity of swelling is mainly due to proteins, wheat flour contains 10 to 12 percent proteins that as the corn, are basically glutelins and prolamins [2].

The glutelins of the wheat receive the name of glutenins, while prolamins with name of gliadins, both account for 85 percent of the protein fraction, this along with lipids and water form the so-called gluten, who is the responsible for the properties of cohesiveness and viscoelasticity of the bread bulk [3].

[4] mentions that the functional role of wheat proteins, especially of gluten in bread quality is well defined. The specific viscoelastic properties of the bread mass are usually explained by the presence and interaction of the thiol and disulfide groups.

[5] mentions that wheat flour is the only one that has proteins that when mixed with water or water containing liquids form a firm, gummy and elastic substance called gluten. This protein is a determining factor in the technological characteristics of wheat, both in quantity and in quality in bread manufacturing. In quality, reserve proteins, especially gliadins and glutenins, play a relevant role, since during the mixing thank by the action of water form gluten. Both contribute to the viscoelastic properties necessary for a good mass behavior during baking, by the formation of a continuous three-dimensional network called gluten.

The objective of the present work is search for a substitute of the wheat in the elaboration of bread and noodles

2. Results and Discussion

Determination of the percentage of gluten

[2] mentions that the gluten have an amino acid composition of about 6% ionizable, 45% polar and 49% non-polar, the same which is characterized by its high content of proline and glutamine.

Figure 1 shows the difference in the percentage of gluten from samples of imported wheat flour (CWRS # 1 and Hard Red Winter) with the national wheat flour (Cojitambo), the latter showing a value equal to half of that is reported for imported wheat flour. The percentage of gluten of the national wheat flour Cojitambo is due to the fact that it has a smaller amount of proteins, therefore a lower amount of glutamines and prolamines, which are responsible for the formation of glutenin and gliadin respectively, this proteins are responsible for the formation of gluten. The prolamins are responsible for the viscosity and extensibility. The glutenins of the elastic characteristics of gluten. In the case of national wheat Cojitambo which has an excess of gliadin (proline) relative to glutenins, gluten is weak and permeable.

Determination of Sedimentation Volume

One parameters associated with the wheat protein quality is the sedimentation volume what hydration capacity and expansion gluten protein in medium light acid.

Figure 2 shows the sedimentation volume index, consisting of measure the volume of the particles that sediment (principally swollen proteins that have absorbed water) in one acid solution of water and lactic acid. The sedimentation volume is conditioned by the quantity and quality of proteins which when is denatured by lactic acid, the flour with best quality link more water, it will float and it will precipitate slowly. The sedimentation volume of imported wheat flour is considerably high

because of its content in glutenins (glutamines) which upon contact with the solution of lactic acid and isopropyl alcohol are denatured and absorb water [4]. National wheat flour contains about half of glutamines than imported wheat shows so that is less denatured so the action of lactic acid is lower and therefore the sedimentation volume tends to fall.

The flours of barley, corn, quinoa and potato, have high sedimentation values since the absorption of water by denaturation of the proteins is measured by the acid hydrolysis to which it is subjected.

But especially in samples of potato and quinoa flour the volume of sedimentation that it presents is due to the amount of starch that they have, since the content of glutamic acid would not contribute to the volume of sedimentation.

In these flours the starch plays a very important role, since in the process of grinding it undergoes modifications, provoking a greater content of damaged starch and justifying in this way the volume of sedimentation that they have.

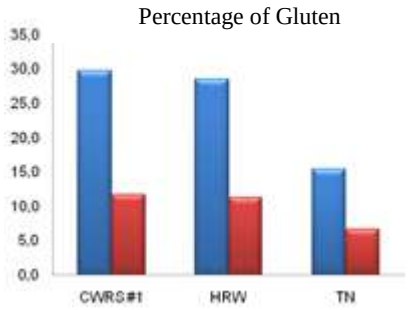

Figure 1. Percentage of gluten of wheat samples. In blue percentage of wet gluten, in red percentage of dry gluten.

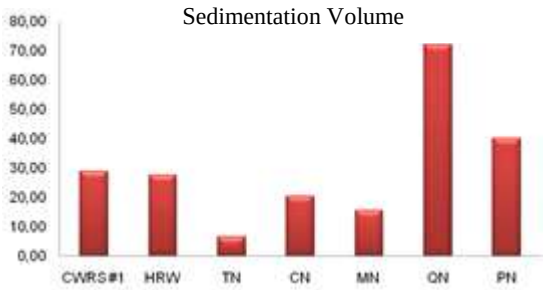

Figure 2. Sedimentation volume of cereal and potatoes flour.

3. Materials and Methods

It was used samples the imported wheat flour CWRS # 1 (control) and Hard Red Winter, samples from National Cereal Flours such as maize, barley, wheat, quinoa and variety potato Gabriela.

For the analysis in the flours, physical - chemical analyzes were taken into account, such as: Percentage of Gluten[6], Sedimentation Volume

4. Conclusions

It was possible to know the functional properties of cereal flour proteins (maize, quinoa, barley, wheat national and imported) and potatoes concluding that from the functional point of view the best flours for use in baking and noodles were barley and national wheat the same ones that, when substituted, improved the characteristics of bread and noodles.

After a study of the functional properties of proteins of cereal and tuber flours it maybe suggested that the flour suitable for partial use in baking and noodles is barley flour thanks to its pentosans content which considerably improves the masses to be formed.

The national wheat flour improves the characteristics in the noodle and derived products, such as volume, extensibility, elasticity and water absorption.

Author Contributions

Main text paragraph.

Conflicts of Interest

State any potential conflicts of interest here or "The authors declare no conflict of interest".

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