

**Influence of dough porosity and rheology on the quality of chapattis made with wheat and lupin flours**

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Chapattis are a staple in the diet of people living in the sub-continent of India. They are widely made using atta flour in homes and in small scale industries. Atta is flour obtained by grinding wheat grown in the Indian sub-continent. Atta dough is made by mixing flour with only salt and water. It is rolled into circular disks and baked on open hot stoves. High quality chapattis puff during baking and remain soft and pliable over a considerable period of time. Attempts to make chapattis of the same quality have been made in countries outside of the Indian sub-continent using local flours. However, it has not been possible to produce products of a similar quality. The same issue of quality – sub-standard puffing and texture, has also hindered fortifying atta by adding nutrition-rich additives, like pulse flours. A project was carried out in our laboratory comparing quality of chapattis made with Indian atta with those made with local wholemeal flour (WW), mixes of local wholemeal flour (L+WW) and lupin flour and 100% lupin flour. Lupin is a legume, high in protein and fibre with no starch. Having no gluten, lupin dough lacks extensibility. All chapattis made from these four different flours, including those made with 100% lupin dough, puffed fully. Qualitatively, the quality of chapattis made with atta was equivalent to those made with the mix of lupin flour and WW flour. To understand these surprising results, doughs were characterized by measurement of true rheological properties and by image analyses of pore structures in doughs using a Skyscan CT scanner. Results showed that atta dough was more porous and retained more elasticity and porosity compared to other doughs. Dough extensibility was not a requirement for puffing of chapattis.

These results provide new methods for characterizing atta dough quality and methods to guide addition of additives atta to improve nutritional profiles.

**Optimising quality assessment of Indian wheat flour for Atta and Maida products**

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Atta flour represents 90% of the Indian wheat crop. It is obtained by the complete grinding of medium to hard wheat kernels. Atta flour is used to produce a wide variety of Indian flatbread such as chapatti, roti, naan, and puri. In contrast, Maida is a finely milled flour of wheat and is often used to produce buns and bakery products as well as also noodles and biscuits.

The aim of the study was to test the quality of Maida flours from the same provider but with different applications (biscuits and noodles, South Indian parottas, buns and bakery products and multipurpose) as well as samples from different areas (Bangalore, Hyderabad, Chennai, Mumbai and Chandigarh). Concerning Atta flour, we tested 5 samples from different regions (Bangalore, Hyderabad, Chennai, Mumbai and Chandigarh). All samples were analysed by a NIR device to quantify moisture, protein, ash and other components. Damaged starch was measured using a rapid amperometric method. To determine rheological properties, all samples were submitted to the double constraint of mixing and heating/cooling in the Mixolab instrument. Last, but not least, alveographic measurement was performed to measure the plastic (tenacity, elasticity, baking strength) properties of these samples. All measurements (except NIR determination) were performed according to ICC standard methods.

The work described the quality differences observed on Maida flour from the same provider but with different final applications; Maida flour from different areas; and Atta flour from different areas. It also resulted in guidelines on the most important quality parameters and the most appropriate tools to build up an efficient quality control laboratory based on the most pertinent tools.