Potential use of soy milk by-product as a wheat substitute for producing high fibre white bread

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ROSEWOOD RESEARCH Innovation in cereal & grain foods

Background and Aims

Soy milk by-product (SMB) is the insoluble fraction of the soybean cotyledon after the production of soy milk and is generally considered as waste material. From every 1 kg of soybean, 1.2kg of SMB is generated from soy milk production. With increased production of this alternative milk, a large quantity of SMB is generated, and this has caused environmental and financial issues for manufacturers globally. This by-product is a rich source of nutrients and bioactive components, such as dietary fibre, proteins and isoflavones, thus has great potential for use as a food ingredient. However, SMB has high moisture content (>85%), which limits its applications due to spoilage[1, 2]. Our previous study identified the optimal fan forced drying at 100 °C to dry SMB[3], then mill to a flour (SMB100) for further applications. This flour has a fibre content of 50%, showing high potential as a functional ingredient[4].

This study aimed to demonstrate the use of SMB100 as wheat flour substitute for producing a white wheat bread from a commercial pre-mix, with a high fibre content, valorising a food industry by-product.

Methodology

SMB was dried as described in our previous study[3] and then milled through a 0.8 mm screen to produce a SMB100 flour with a moisture content of 9%. Ciabatta bread mix was used to produce a small loaf (control) with fermentation time of 1.5 h, scaled to 650 g and baked at 200 °C. SMB100 was substituted for the flour mix at a rate of 5%, 7.5%, 10% and 10% + 5% extra water (10%+). After cooling, loaves (n=3/treatment) were measured for weight (g), raising volume (mL) by seed displacement, with the data used to determine specific density (g/mL). Textural profile analysis (TPA) of the crumb was determined, and the fibre content of each treatment was calculated from nutrition information.

Results

For a serve of bread (5/loaf), fibre increased from 2.7 g for control to 5.2 g/serve for 10% and 10%+ (Figure 1). Fibre content of 4 g /serve is classed as a high or good source of fibre by standard 1.2.7., which is possible at a substitution rate of 7.5% with SMB100 and above.

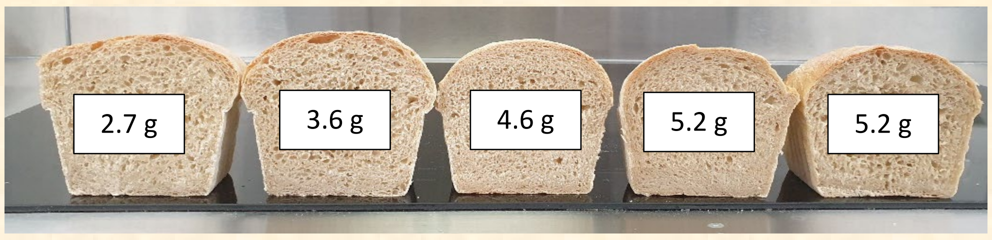

Figure 1. Fibre content per serve for ciabatta loaves substituted with SMB100 (left to right), control, 5%, 7.5%, 10% and 10%+.

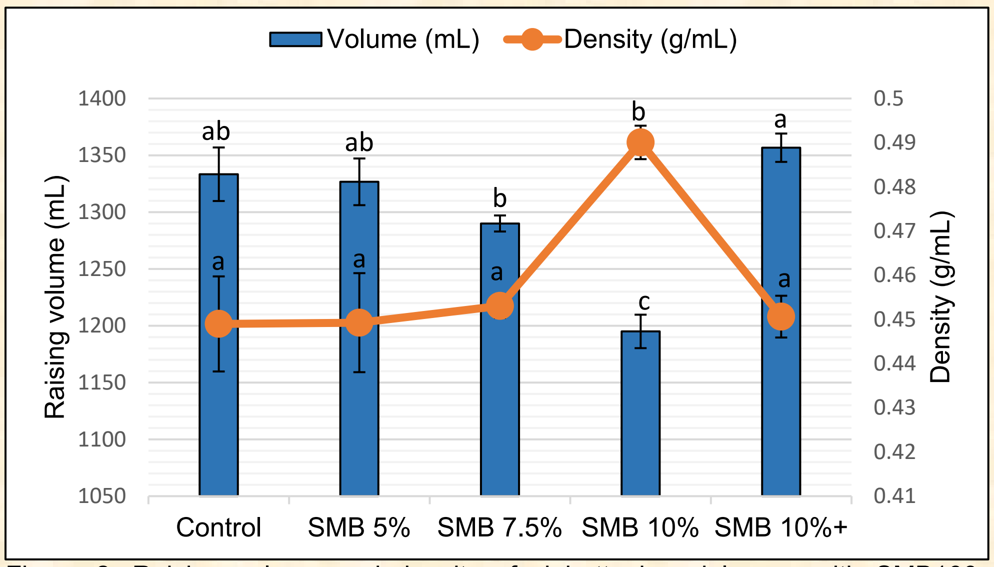

Figure 2. Raising volume and density of ciabatta bread loaves with SMB100. Different letters for same test as significantly different (p<0.05).

Substitution for wheat flour changed both the raising volume and relative density (Figure 2). Raising volume decreased with addition of SMB100 above 7.5% substitution, while the density was increased. The addition of extra water in SMB 10%+ was able to improve these factors, leading to results similar to control. Increasing dough hydration when using high fibre flour can improve volume and density of composite bread[5].

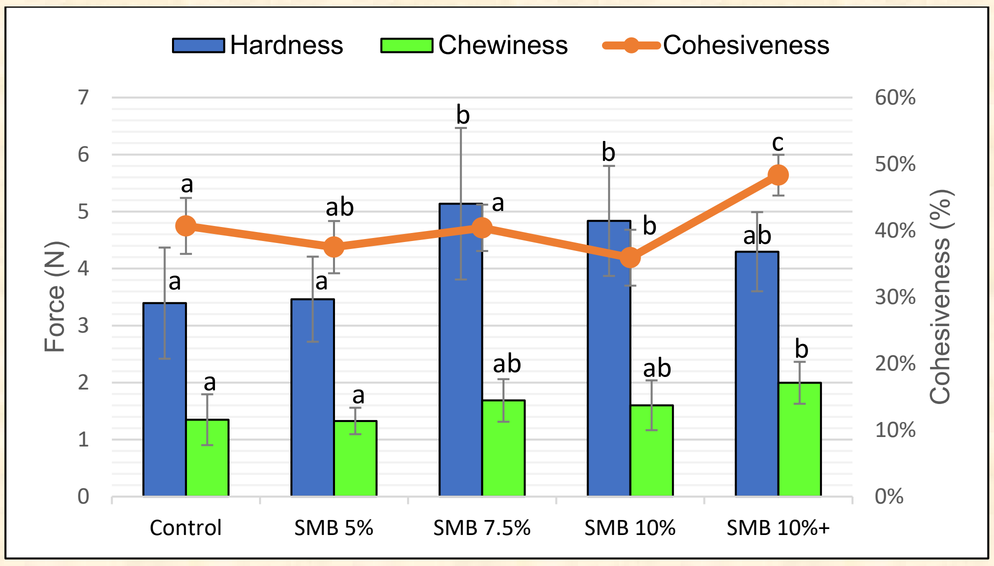

Figure 3. TPA of ciabatta bread with SMB100 for hardness, chewiness and cohesiveness. Different letters for same test as significantly different (p<0.05).

Textural properties (Figure 4) of substituted bread were affected with the addition of SMB100 for hardness (max force, N), cohesiveness (internal crumb adhesion, %) and chewiness (N). Both SMB 5% and 10%+ had hardness similar to control. Chewiness index increased with addition of extra water from control and was similar for all other treatments. The cohesiveness of the crumb was affected at 10% substitution and increased with the addition of water.

Conclusion

SMB100 flour can be substituted into commercial bread mix to produce a high fibre bread at 7.5% and above. Addition can affect the volume, density and texture, however, simple modifications such as water addition, can improve these factors. Future studies should focus on optimising the formulations further and consumer acceptability tests.

Acknowledgements

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