Novel grain flours blended with chickpea for quality improvement of pasta

THU MCCANN*[1], RANGIKA WEERAKKODY[1], JENNY FAVARO[1], ROMAN BUCKOW[2] AND REGINE STOCKMANN*[1]

[1] CSIRO, Agriculture and Food, Werribee, VIC 3030, Australia

[2] The University of Sydney, School of Chemical and Biomolecular Engineering, Darlington, NSW 2008, Australia

Novel cereal grains (elite grains) have been developed by CSIRO to improve the levels of health-active components. Cereal grains are limited in lysine, threonine, and tryptophan which can be overcome by blending with pulse flours, rich in these amino acids. Exploring the potential of blending chickpea with elite grains may provide complete nutrient profiles, however, understanding how the incorporation of chickpea flour with functional grains impacts on a food quality including processing is important.

Methodology

High amylose wheat (HAW), Kebari® Barley (KB) or BARLEYmax® (BM) and chickpea (CP) flours at different ratios (100:0, 80:20, 50:50, 20:80 and 0:100) were used to prepare fresh pasta, which was then dried (85°C for 3 h). The pasta was evaluated by boiling in water for 15 min. The hardness of cooked pasta was measured using an Instron (5564, UK) equipped with a cutting knife plate (60 mm/min). Water absorption (WA) of cooked pasta was defined as percentage of water in cooked pasta. Total phenolic content of the flour mixtures, dried uncooked pasta and cooked pasta was determined according to Singleton et al (1999). Antioxidant activity (AA) was determined according to Ragee et al (2006), expressed as Trolox equivalent (TE, mg/100 g dry sample).

Results and discussion

Physical properties of cooked pasta

Cooking performance: (Figure 1A)

- BM-CP and HAW-CP maintained its shape during through cooking.
- The 100:0 and 80:20 KB-CP pasta were deformed. Only 50:50 and 20:80 KB-CP pasta maintained their shape through cooking.

Textural properties: (Figure 1B and 1C)

- Both 100% BM and 100% KB formed very soft pasta whilst 100% HAW pasta was too firm.
- Increasing amount of CP flour in BM-CP and KB-CP pastas resulted in firmer texture.
- Mixing CP with HAW did not significantly improve texture.
- Texture of cooked pasta was correlated with WA during cooking. Higher WA for cooked BM and KB pasta would explain its softer texture compared to HAW pasta.

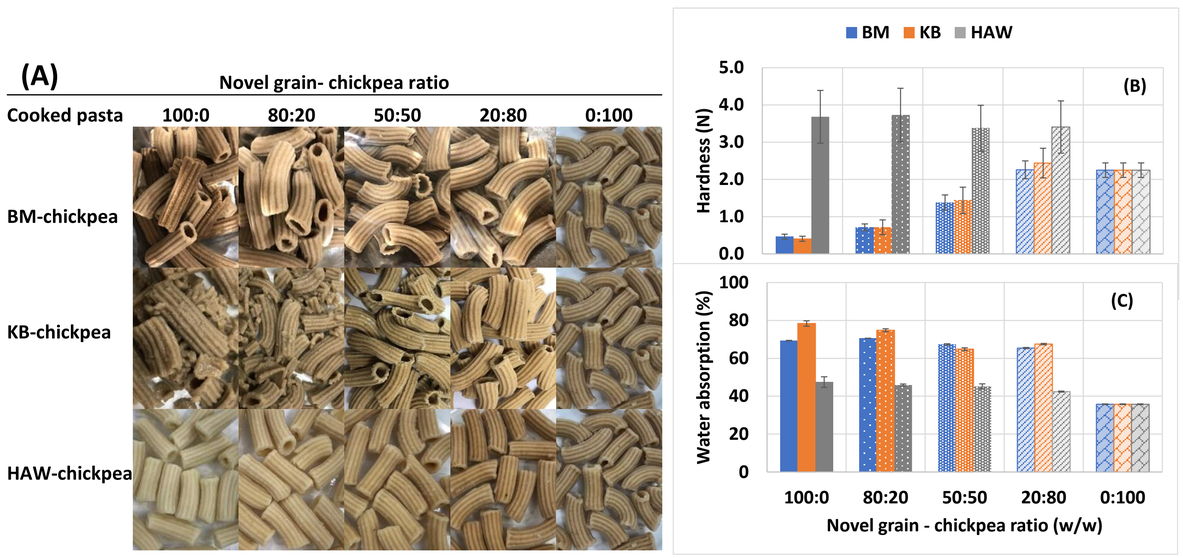

Figure 1: Cooking performance (A), textural properties (B) and water absorption properties (C) of novel grain-CP pasta

Phenolics content and antioxidant activity

Phenolics content:

- The 100% BM pasta had the highest phenolic content which decreased with increasing CP in BM-CP pasta.
- Mixing CP with KB or HAW improved phenolic levels in pasta (Figure 2A).

Antioxidant activity:

- AA was highest in 100% BM pasta and lowest in 100% HAW pasta. AA decreased with increasing CP flour in BM-CP pasta, and increased in HAW-CP pasta, due to CP complementary AA levels in BM and HAW.
- Mixing CP and KB did not reduce the AA for KB-chickpea pasta, indicating that KB and CP could have a synergistic effect on antioxidant levels in pasta (Figure 2B).

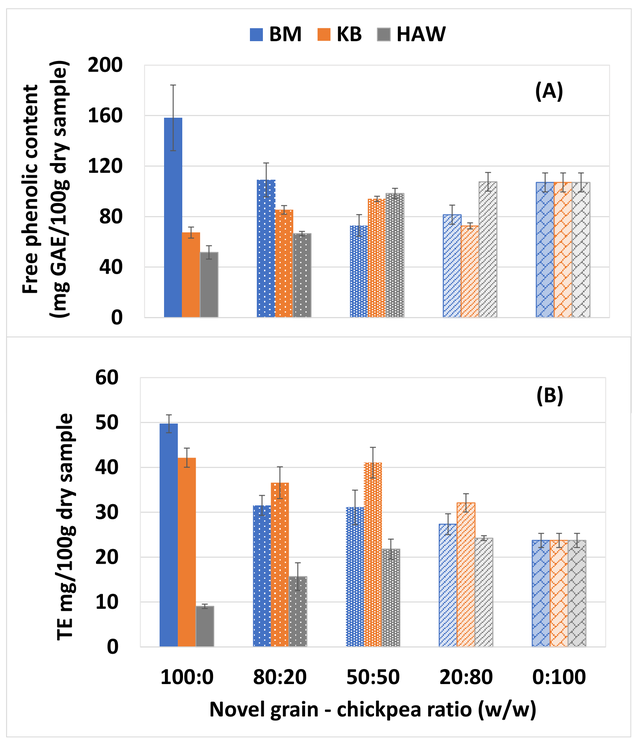

Figure 2: Phenolics content (A), antioxidant activity (B) and resistant starch levels (C) of novel grain-CP pasta

Conclusions

- Mixing CP with BM and KB improved the cooking quality of pasta, giving a firmer texture. The hardness and water absorption of cooked pasta were correlated, due to the ratio of novel grain to CP.
- Mixing CP with BM and KB decreased phenolic content but did not impact on AA.
- Mixing CP with HAW improved the AA level of the pasta.
- These results show that the functional properties of staple foods (such as pasta) can be tailored by blending of novel cereal grains and pulse flours (such as CP).
- These results inform AI approaches to predict functional performance of pulse protein ingredients within foods.

As Australia's national science agency and innovation catalyst, CSIRO is solving the greatest challenges through innovative science and technology.

CSIRO. Unlocking a better future for everyone.

FOR FURTHER INFORMATION

Thu McCann
Agriculture and Food
Thu.mccann@csiro.au
csiro.au/A&F

REFERENCES

Singleton, V. L.; Orthofer, R.; Lamuela-Raventós, R. M. (1999). Analysis of total phenols and other oxidation substrates and antioxidants by means of Folin-Ciocalteau reagent. Methods Enzymol. 299, 152-178.

Sanaa Ragaee, El-Sayed M. Abdel-Aal, Maher Noaman. (2006) Antioxidant activity and nutrient composition of selected cereals for food use. Food Chemistry 98 , 32–38

ACKNOWLEDGEMENTS

The authors gratefully acknowledge financial support from the CSIRO Precision Health Future Science Platform and from the CSIRO AI for Missions Funding Program. We are also thankful to Drs C. Howitt and P. Watkins for the constructive feedback on the poster.