

Effect of physicochemical properties, pre-processing, and extraction on the functionality of wheat bran arabinoxylans in breadmaking – a review

AIM

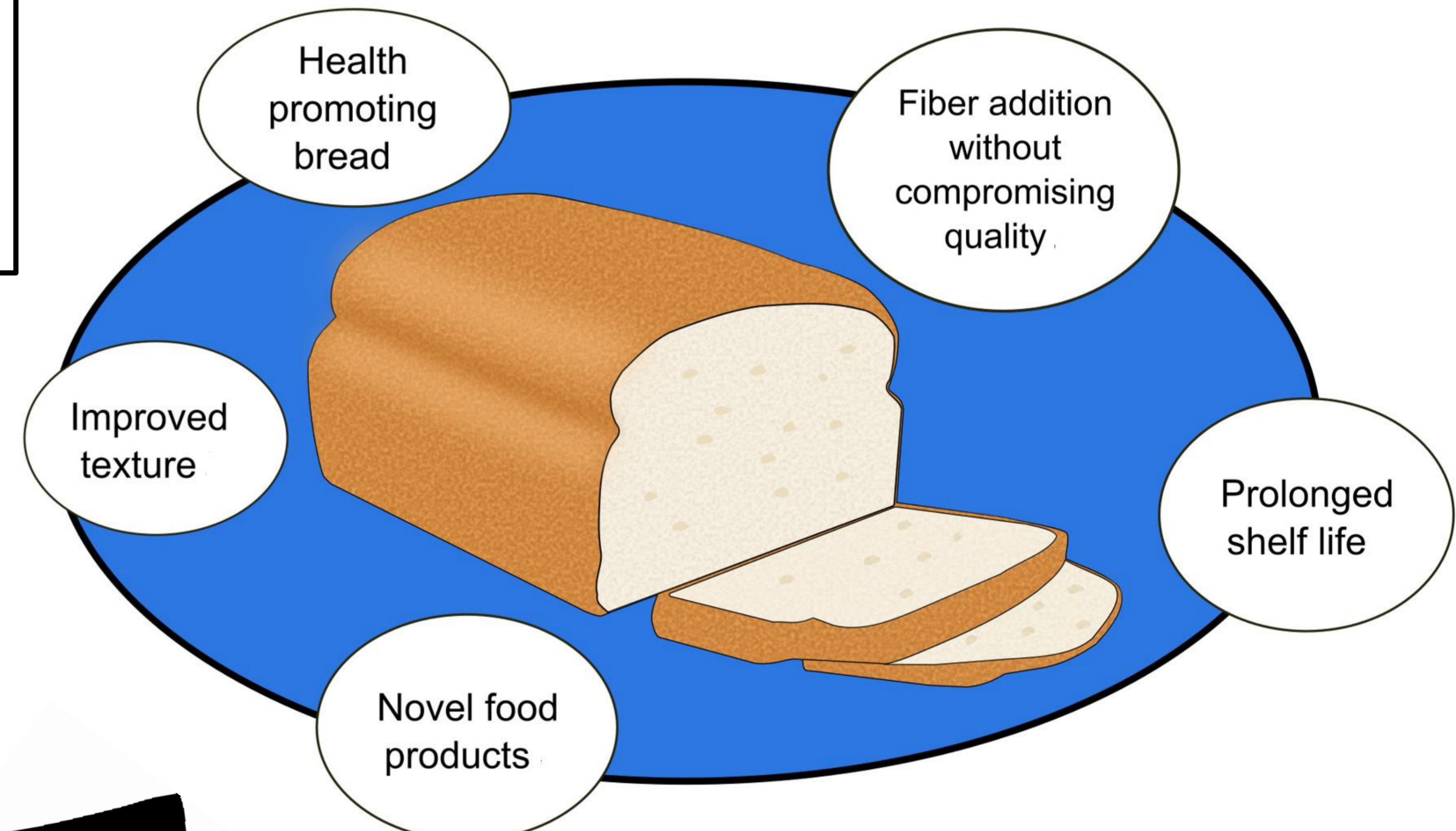
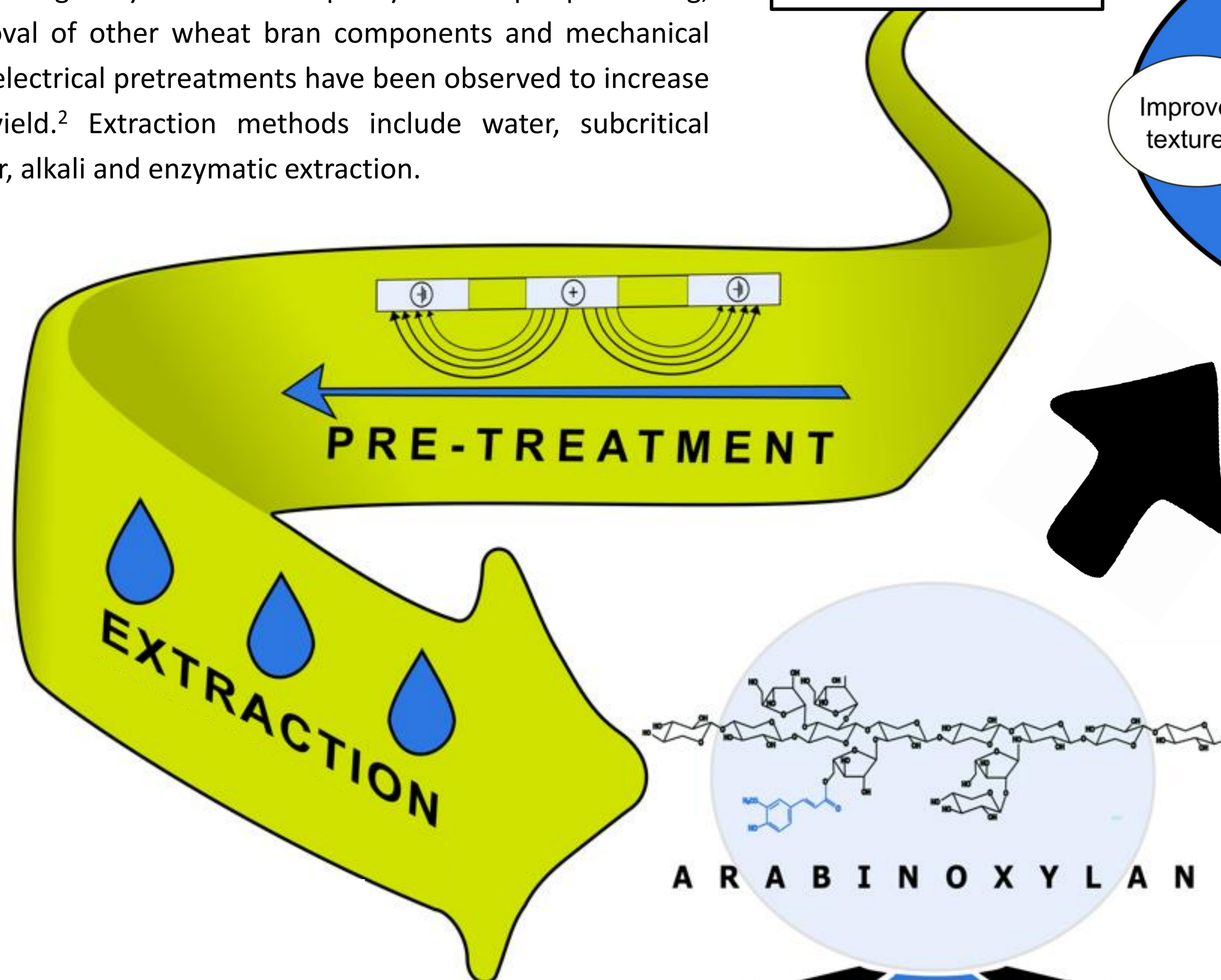
- To investigate the effect of pre-processing and extraction methods and processing parameters on AX properties.
- To provide a comprehensive understanding of connection between physicochemical properties of AX and its functionality as a bread ingredient.

CONCLUSION

- Extraction process can be adjusted to produce AX with targeted functionality.
- AX functionality in bread depends on AX properties, addition level and interactions.
- Selecting AX with suitable physicochemical properties can improve bread quality.
- Optimized baking process helps increasing the amount of added AX in bread.

Extraction and pre-processing

Arabinoxylan (AX) is embedded in a complex cell wall matrix that makes economic and sustainable extraction challenging.¹ Extraction processes combine different pretreatments, extraction methods, and purification steps to obtain higher yields and AX purity. With pre-processing, removal of other wheat bran components and mechanical and electrical pretreatments have been observed to increase AX yield.² Extraction methods include water, subcritical water, alkali and enzymatic extraction.



Bread quality

Arabinoxylan affects several important baking factors, including water-holding and binding, starch retrogradation, and rheology.² Addition of wheat bran AX interferes with gluten development, but it can also improve specific volume and crumb texture with lower addition levels between 0.5 and 5 %.³ AX structure, bread recipe and baking process need to be adjusted to facilitate use of higher fiber addition levels needed to reach levels required for health claim labelling.⁴

MOLAR MASS

- High molar mass lowers AX solubility.⁴
- High and low molar mass AX differ in their health effects.⁵

ARABINOSE/XYLOSE-RATIO

- High intrinsic viscosity is correlated with low A/X ratio.⁶

FERULOYLATION

- Ferulic acid increases dough extensibility due to cross-linking between gluten and AX.⁷
- Feruloylated AX has antioxidant activity.⁸

References

- (1) Escarnot, E., Aguedo, M., Agneessens, R., Wathelot, B., & Paquot, M. (2011). *Journal of Cereal Science*, 53(1), 45–52.
- (2) Liu, Y., Wang, S., Kang, J., Wang, N., Xiao, M., Li, Z., Wang, C., Guo, Q., & Hu, X. (2020). *Food Hydrocolloids*, 107(April), 105914.
- (3) Koegelenberg, D., & Chimphango, A. F. A. (2017). *Food Chemistry*, 221, 1606–1613.
- (4) Zhang, L., van Boven, A., Mulder, J., Grandia, J., Chen, X. D., Boom, R. M., & Schutyser, M. A. I. (2019). *Journal of Cereal Science*, 87(December 2018), 1–8.
- (5) Bhattacharya, A., Ruthes, A., Vilaplana, F., Karlsson, E. N., Adlecreutz, P., & Stålbrand, H. (2020). *Lwt*, 131(May), 109762.
- (6) Pavlovich-Abril, A., Rouzaud-Sáenz, O., Carvajal-Millán, E., Navarro, R. E., Robles-Sánchez, R. M., & Barrón-Hoyos, J. M. (2016). *LWT*(74), 484–492.
- (7) Wang, M., Zhao, Z., Niu, M., Zhao, S., Jia, C., & Wu, Y. (2020). *LWT*, 133(June), 109894.
- (8) Zhang D, Rudjito RC, Pietiäinen S, Chang SC, Idström A, Evenäs L, Vilaplana F, Jiménez-Quero A. (2023). *Food Chemistry* 414, 135660