

Exploring the nutritional and technological potential of sorghum in wheat-based breads

Eleonora Charlotte Pichler^{1*}, Benjamin Illmer¹, and Regine Schönlechner¹

¹University of Natural Resources and Life Sciences Vienna, Department of Food Science and Technology, Institute of Food Technology, Muthgasse 18, 1190 Wien

*eleonora.pichler@boku.ac.at



Overview

The **nutritional and technological properties of eight sorghum cultivars grown in Austria** and their impact on the quality of composite wheat-sorghum breads were evaluated.

Total phenolic content (TPC), antioxidative potential (AOP) and ***in vitro*** digestibility of sorghum flours and breads were determined.

- Sorghum flours had **higher TPC and AOP** compared to wheat flour.
- Incorporation of sorghum **decreased the specific volume and increased crumb firmness**, darkened the crust and crumb color in breads.
- No significant impact on *in vitro* starch digestibility was determined, but a **decreased *in vitro* protein digestibility of breads**.
- Pericarp color did not influence TPC and *in vitro* digestibility

Sorghum cultivars grown in Austria have promising nutritional properties, with high TPC and AOP, and incorporating sorghum into wheat breads can enhance their antioxidant content while maintaining acceptable technological quality.

Introduction

Sorghum is a versatile, climate-smart cereal and rich in macro- and micronutrients, including proteins, polyphenols and antioxidants [1].

However, the information **about the nutritional quality of sorghum varieties grown in Austria and the suitability in composite bread is limited**.

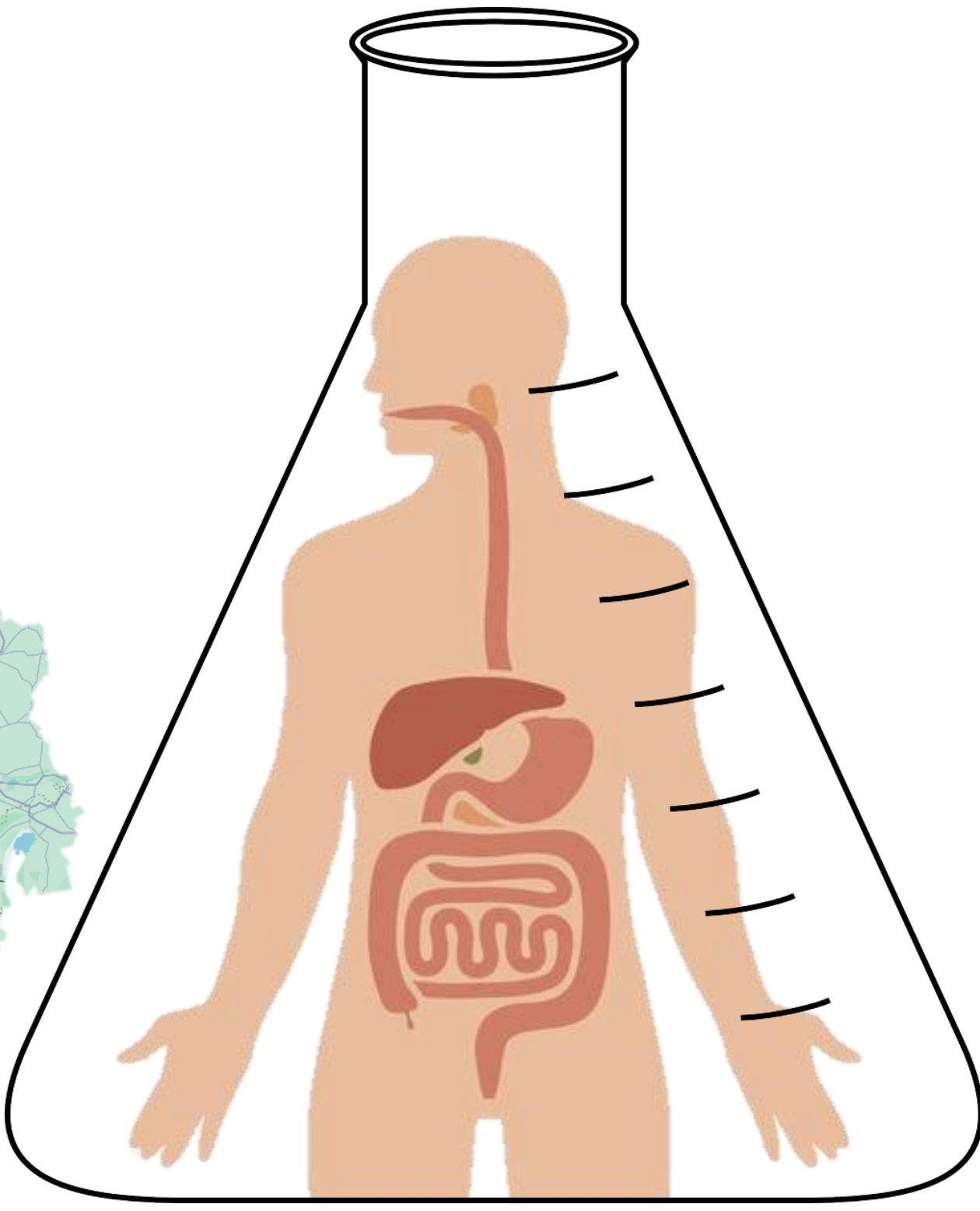
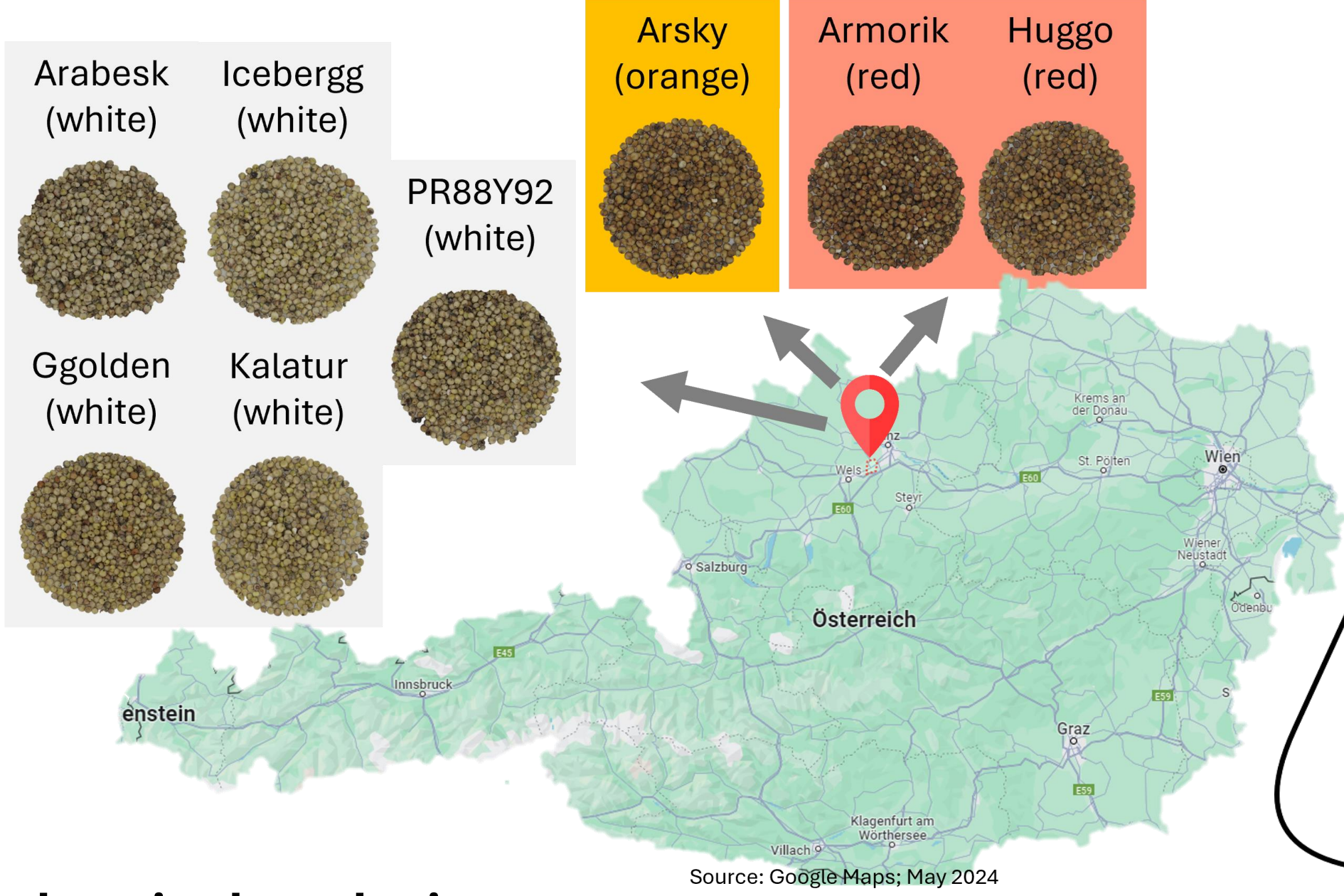
Polyphenols in sorghum can decrease its digestibility, which is often correlated to the pericarp color of the grains [2].

Objectives

This study aimed to determine the **TPC, AOP, and *in vitro* digestibility of sorghum** (8 varieties) grown in Austria, evaluate the quality of **composite wheat-sorghum breads** (40% sorghum; 60% wheat), and investigate the impact of the baking process on the **nutritional properties** of sorghum.

Material & Methods

- 8 sorghum cultivars
- cultivated 2020 in Austria (Hörsching)
- Different pericarp colors (white, orange, red)



chemical analysis

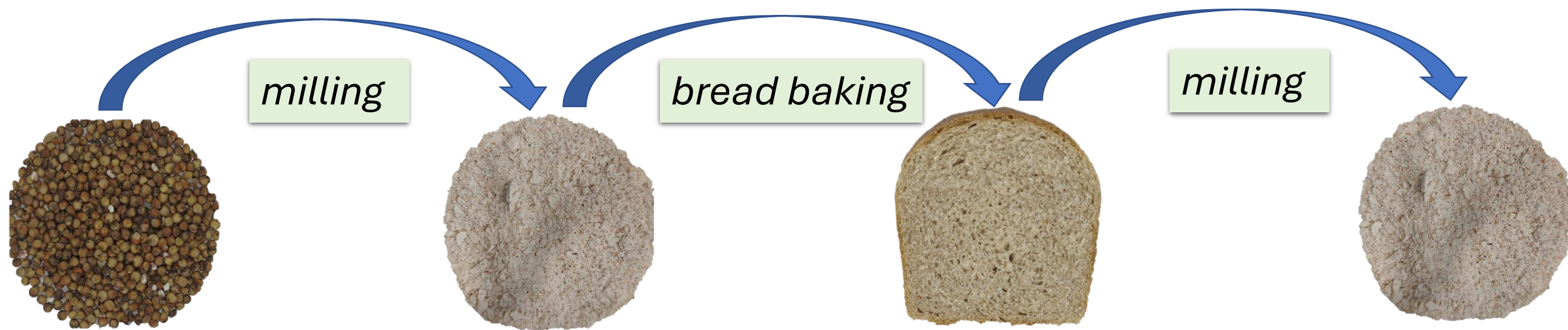
- Dry matter (ICC Nr. 110/1)
- Total Phenolic Content (TPC, Folin-Ciocalteu assay)
- Antioxidative potential: ABTS, DPPH, FRAP assays
- In vitro* digestibility of starch (Megazyme) and protein (static INFOGEST method).

baking trials

addition of **40% wholegrain sorghum flour** to **refined wheat flour (W700)** in Western-style wheat bread formulation

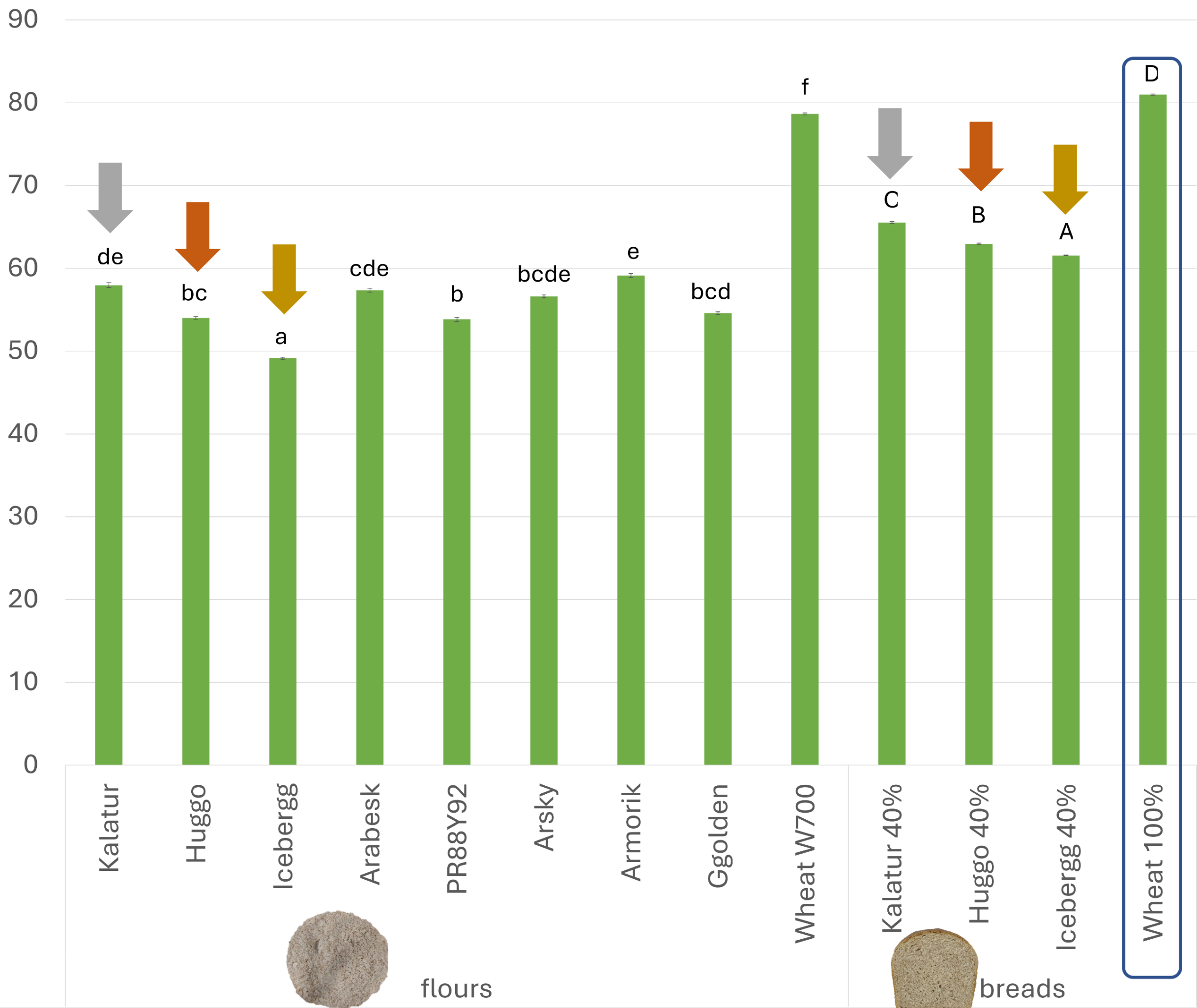
Quality parameters of the baked goods:

- Baking loss, volume, crust and crumb color (CIE L*a*b*), pore analysis (ImageJ), crumb texture (Texture Analyzer)



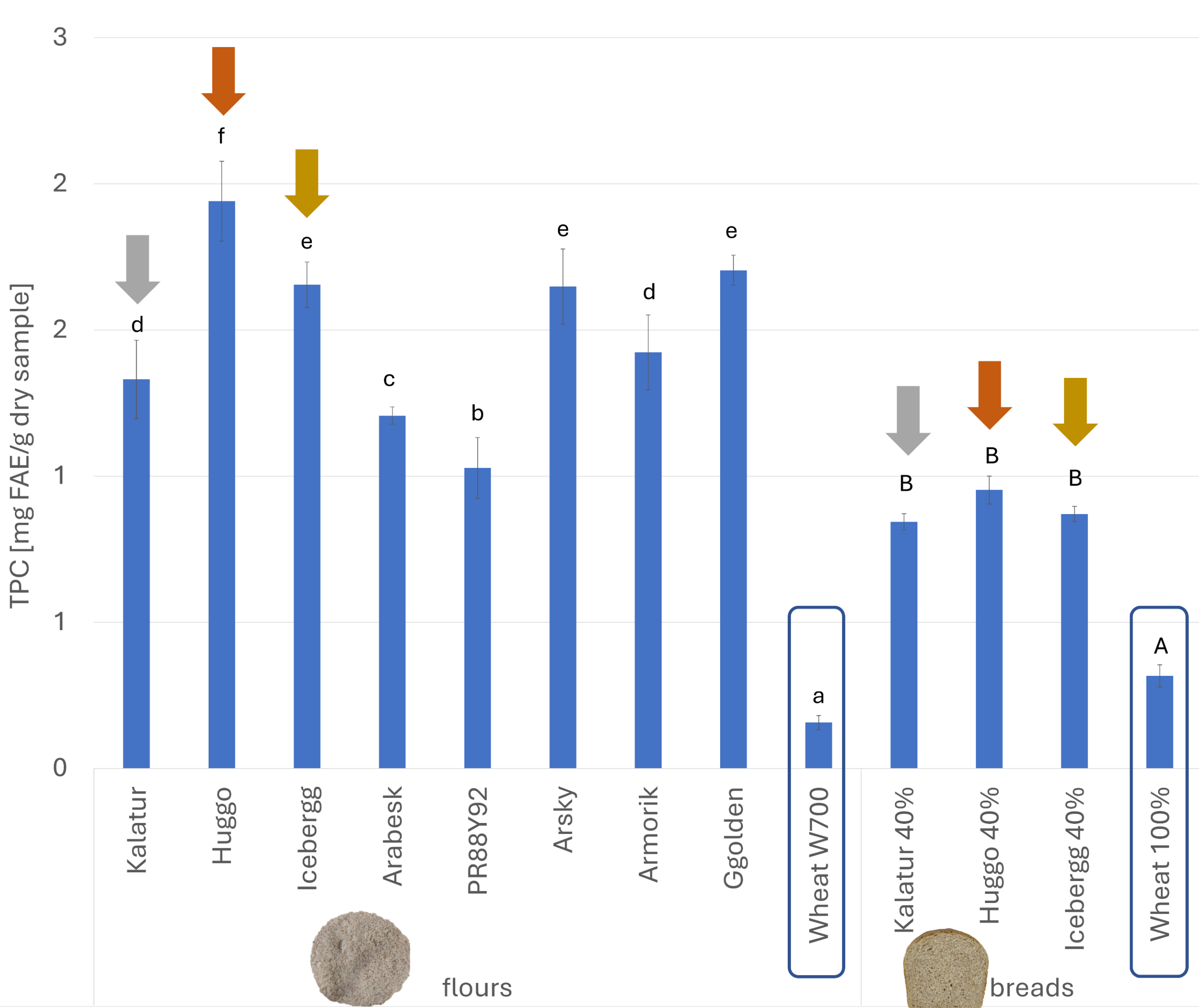
Results

Digested protein [%]

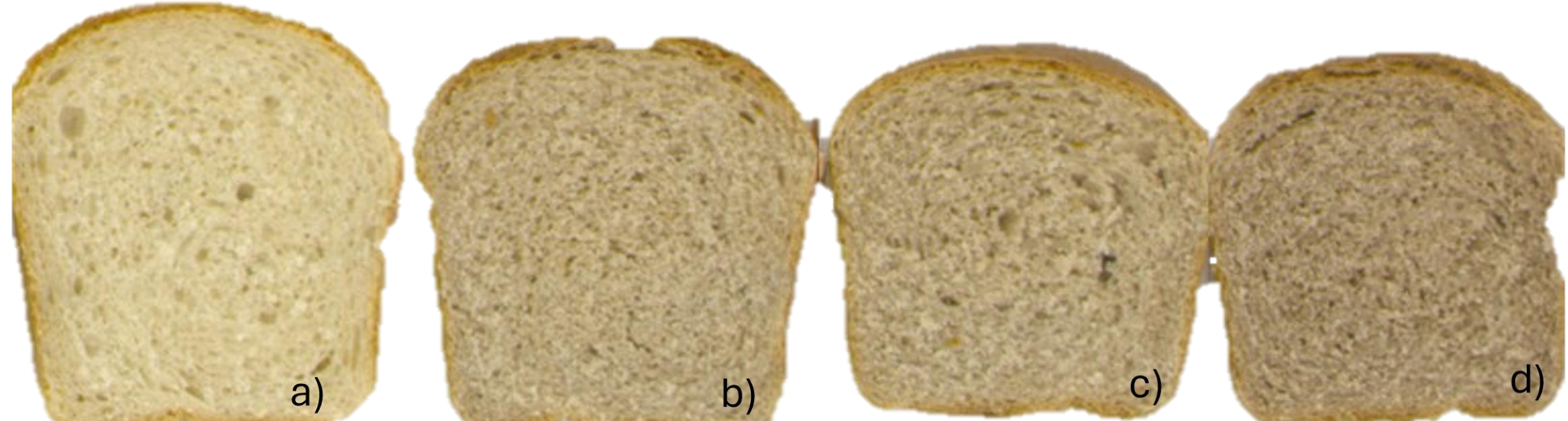


Results expressed as mean value ± standard deviation (n = 3). Differing superscript letters (uppercase letters for breads, lowercase letters for flours) indicate significant differences ($p > 0.05$; Fisher's Least Significant Difference test).

TPC sums (free + conjugated + bound) of each sample



Results expressed as mean value ± standard deviation (n = 3). Differing superscript letters (uppercase letters for breads, lowercase letters for flours) indicate significant differences ($p > 0.05$; Fisher's Least Significant Difference test).



Cross sections of the breads with 40% sorghum addition
a) Wheat 100%, b) Kalatur 40%, c) Icebergg 40%, d) Huggo 40%

Conclusion

- Sorghum cultivars grown in Austria have **promising nutritional properties**, with high TPC and AOP.
- Incorporating sorghum into wheat breads can enhance their AO content while maintaining **acceptable technological quality**.
- Plant breeders should consider **selecting and cultivating sorghum cultivars for food uses**.
- Suitable pre-processing treatments** to increase the *in vitro* protein digestibility of sorghum should be further investigated.

References

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[2] Rashwan, A.K.; Yones, H.A.; Karim, N.; Taha, E.M. (2021): Potential processing technologies for developing sorghum-based food products: An update and comprehensive review. In Trends in Food Science & Technology 110. Pp. 168-182. DOI: 10.1016/j.tifs.2021.01.087.



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