School of Food Science and Nutrition

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Impact of food processing on metabolic profile and nutritional value of Sorghum



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Sorghum

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- *Sorghum biolor (L. Moench)*
- One of the worlds oldest cultivated crops
- Worldwide cultivation
- 5th most cultivated cereal after maize, rice, wheat and barley (FAO 2013)
- Adapted to low input agricultural systems
- Drought and heat resistant
- Feed and food purpose
- Important staple food, especially in food insecure regions such as some sub-Sahara countries





Sorghum in human nutrition

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- Sorghum provides significant quantities of energy, protein, minerals and phytochemicals to the human diet
- Water and labour-intensive pre-processing required to make nutrients available for human organism
  - germination, soaking, boiling & fermentation

Different varieties of Sorghum



Morris *et al.* (2013) PNAS

The genetic basis of pericarp colour and other flavonoid pigmentation traits in sorghum.

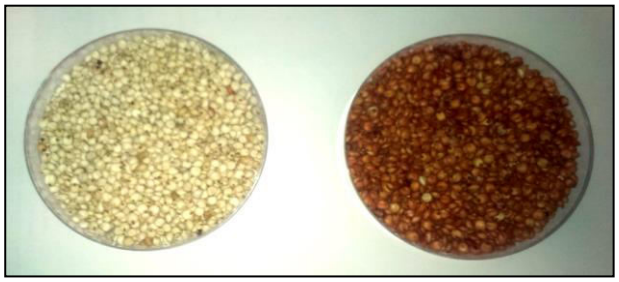
Aims and objectives

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- **Impact of modern food processing technologies on nutritional quality and metabolite profile in Sorghum**
  - How does **microwave** assisted preparation affect the **bioactive content** in comparison to traditional techniques (**boiling, fermentation**)
  - How is **starch digestibility** affected by processing?
  - How is **trace element bioavailability** affected?
- **Relationship between impact of processing and Sorghum pigmentation**

Experimental design

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Different white and red cultivars from Uganda and Nigeria

Grains: Purified and milled

Fermentation **Microwaving** **Boiling**

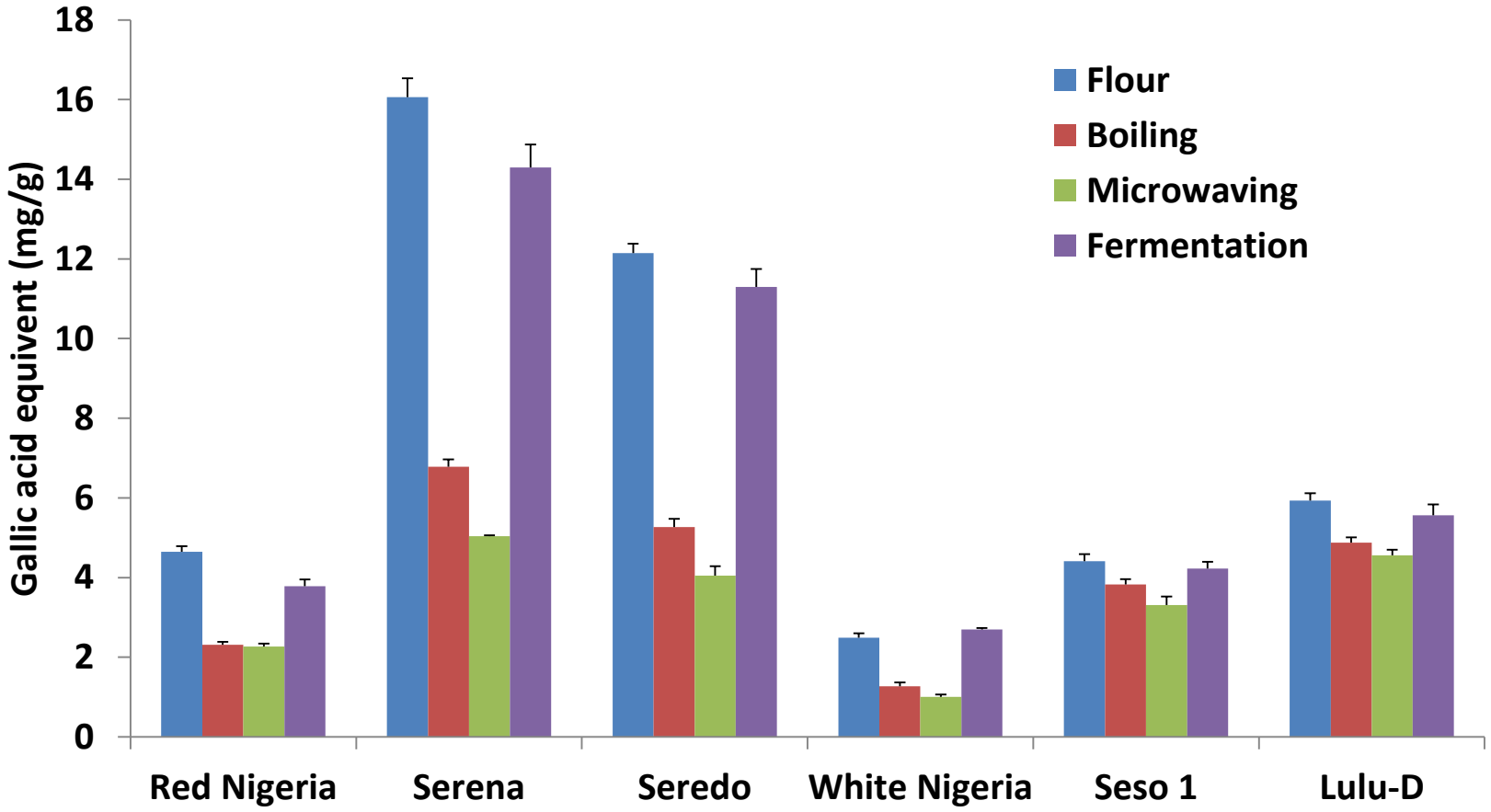
Porridge: Dried and grinded

Bioactives **Starch digestibility** **Trace elements**

Total polyphenol content in Sorghum

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Folin assay in 1%HCl/Methanol extracts



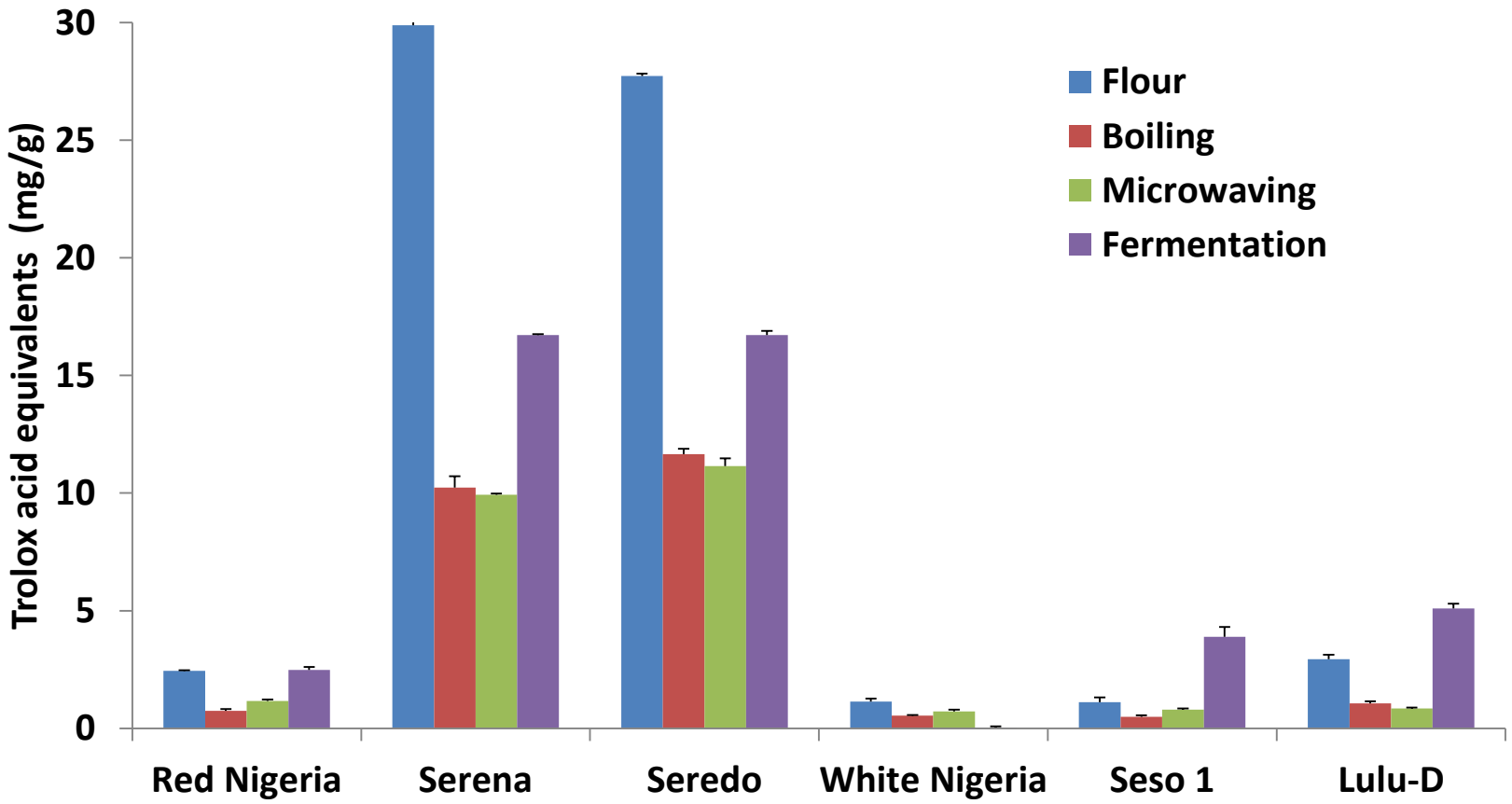
Large differences depending on country of origin and pigmentation

Boiling and microwaving lead to reduction in total polyphenols

Bioactivity: Antioxidant properties

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ABTS (TEAC) assay in 1%HCl/Methanol extracts



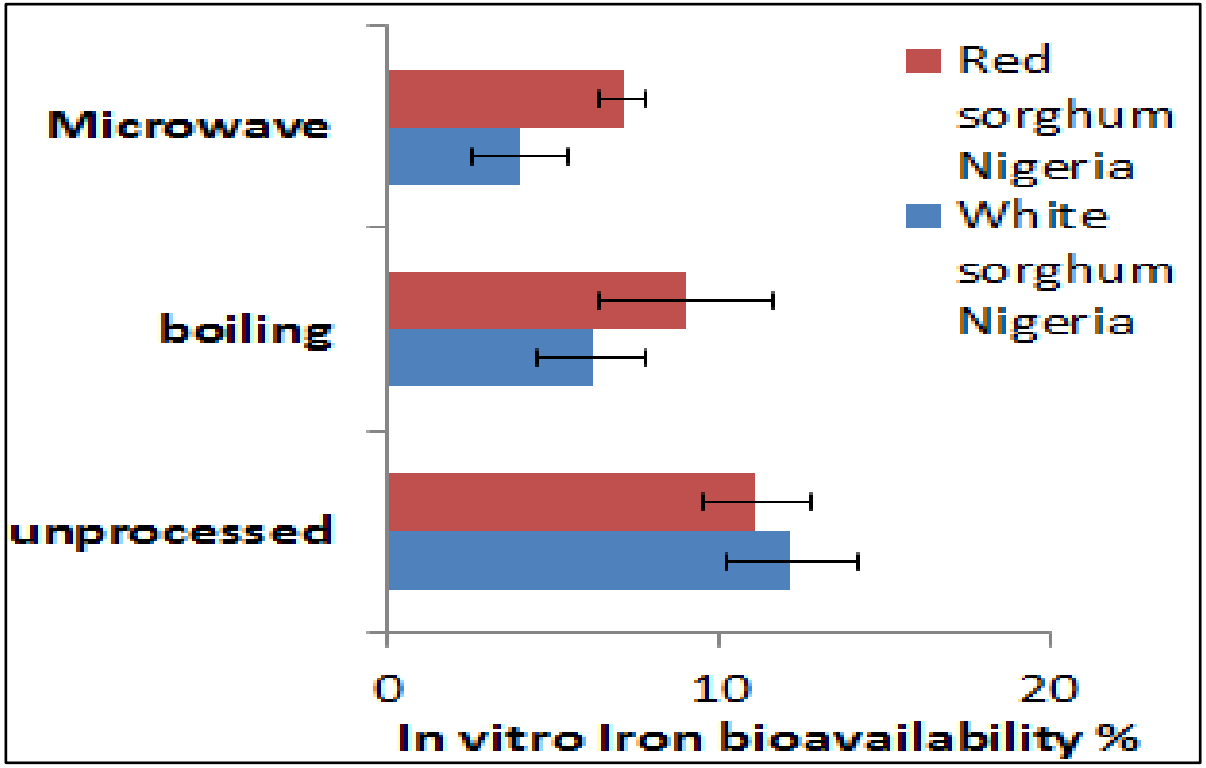
"Bioactivity" largely depends on pigmentation and country of origin

Boiling and microwaving lead to reduction

Iron bioavailability in Sorghum

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Soluble trace elements after digestion of processed/unprocessed flour preparations



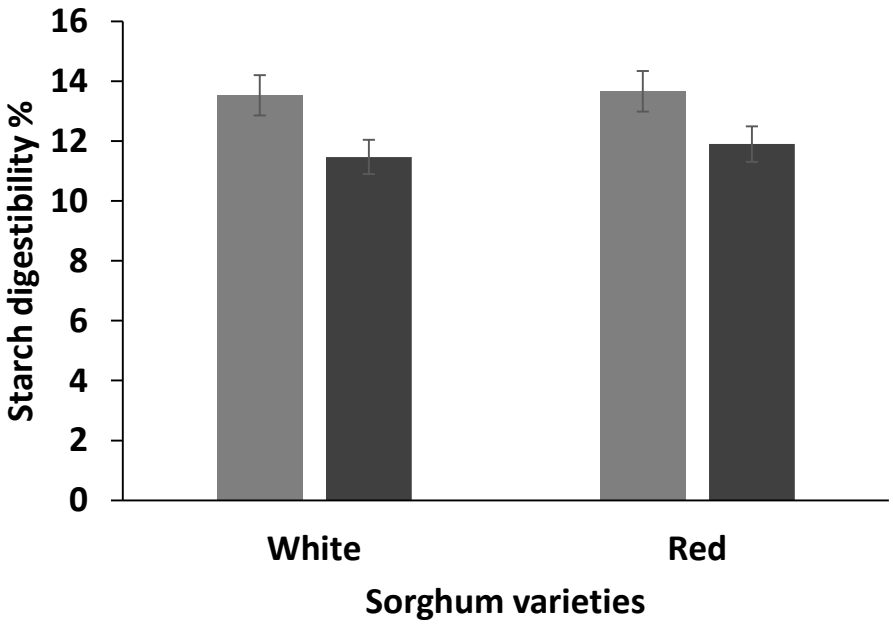
Iron bioavailability lower in processed samples

Availability of Iron higher in red Sorghum varieties

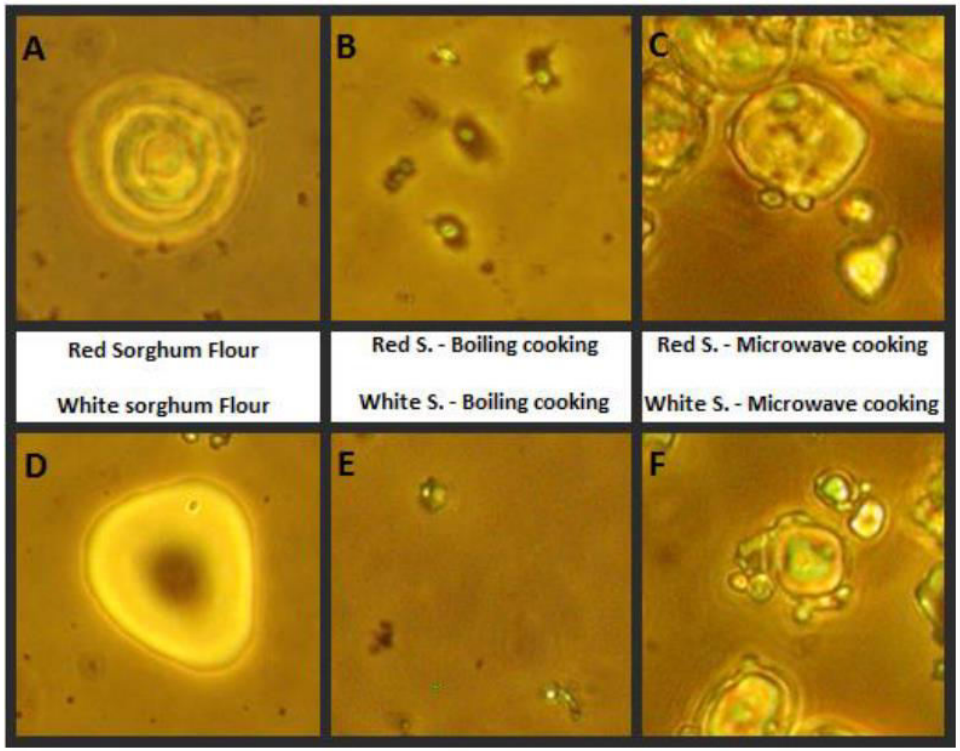
Starch digestibility in Sorghum varieties

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Starch digestibility



Starch structure



Boiling resulted in higher in vitro starch digestibility compared to microwaving

Summary

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- Total polyphenol content and bioactivity are largely depending on origin/pigmentation of Sorghum varieties
- Boiling and microwaving do reduce polyphenol content and bioactivity whereas fermentation retains higher polyphenol levels
- Microwaving does not seem to have a positive impact on parameters investigated

Present and future research activities

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- Polyphenol composition
  - Different cultivars/growth conditions might result in variations in polyphenols
  - Variations due to processing, in particular fermentation
- Fermentation: Standardisation of fermentation conditions
- Starch digestion: Particle size and fermentation
- Impact of Sorghum polyphenols on glucose metabolism
- Bioactivity of grain proteins and peptides

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