Comparative analysis of the physicochemical characteristics of kafirin proteins extracted from various grain sorghums and their distillers' grains

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Introduction



Sorghum is a globally significant cereal crop and it can also be a potential source of innovative plant proteins.

The protein content of sorghum varies around 6-18%, with an average of 11%. The primary storage protein in grain sorghum is kafirin.

Sorghum is mainly used for animal feed, biofuel, and alcohol production. Distillers' grains (DGs) are the major co-product after ethanol fermentation. There is a need for value-added uses of the DGs.

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Introduction

Materials:

| Varieties | Color |
|--------------|-------|
| Red-NLM-20 | Red |
| Red-Waxy | Red |
| Red-NLM-SB | Red |
| White-F1000 | White |
| White-32020 | White |
| White-4525 | White |
| Black-NLM-16 | Black |



> Physicochemical properties

- Protein content
- FTIR and secondary structure
- Surface hydrophobicity
- Protein in vitro digestibility
- SDS-PAGE
- Total tannin content (TTC)
- > Functional properties
- Oil/water holding capacity (OHC&WHC)
- Solubility
- Emulsion capacity and stability (EAI&ESI)

Objectives

- Extract kafirin proteins from different types of sorghums, as well as their distillers' grains (DGs).
- Analyze the physicochemical and functional properties of kafirin proteins in comparison with commercial plant proteins (SPI, PPI, gluten).
- Evaluate effect of sorghum type and fermentation on protein properties.



Results

✓ The extracted kafirins had protein content ranging between 75-85%.





1: Red-NLM-20 2: Red-Waxy 3: White-32020 4: White-F1000 5: Black-NLM-16 6: Red-NLM-5B 7: White-4525 8: Red-NLM-20 (Flour) 9: White-4525 (Flour)

✓ SDS-PAGE results showed that the kafirins from different types of sorghums DGs had similar band profiles, while new bands in the range of 15-20 kDa, and 25-37 kDa were observed for the kafirins from the flours.

Results







 ✓ Black sorghum DGs protein had the highest emulsification capacity among all the kafirins, similar to the commercial SPI (9 m²/g).

Results



✓ The OHC values of the extracted protein ranged from 1.97-3.24 g oil/ g protein and the WHC values ranged from 2.08-3.42 g water/ g protein.



✓ The kafirin from black sorghum (DG & flour) had slightly lower in vitro protein digestibility compared to that from other sorghum DGs and flours (75-79%), which may be due to the much higher total tannin content.

Conclusions

- The protein composition (SDS-PAGE) and secondary structure (FTIR) generally remain similar for the kafirins extracted from different types of sorghum or their DGs.
- The protein functional properties varied to some extent among different sorghum types and with fermentation.
- The protein in vitro digestibility was negatively correlated with the total tannin content of the protein (r = -0.42).
- Research is ongoing to extract the entire sorghum storage proteins (kafirin + glutelin) and explore their food applications.



Thank you!



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