

Fungal fermentation improves protein quality of cereals

through increased amino acid score of deficient lysine

Background

- The global demand for protein is rising.
- Transition to more non-animal sources required
- Plant protein sources often have inferior protein quality, in particular cereals.
- These staple foods contribute to a substantial proportion of the protein intake, especially in developing countries (Manary, 2013; Schonfeldt & Hall, 2012).

Objectives

- To address the need for alternative protein sources
- To determine the effect of solid-state fungal fermentation on protein quality of cereals

Introduction

- Several food processing methods, such as cooking, soaking and extrusion can improve protein digestibility
- Solid-state fungal fermentation can be an efficient method to improve protein quality, through an improved amino acid composition.

Results

- Fermentation resulted in:
 - **IVPD:** Slightly decreased in fermented barley, constant in fermented rice
 - **IAAI:** increased, but not always significantly

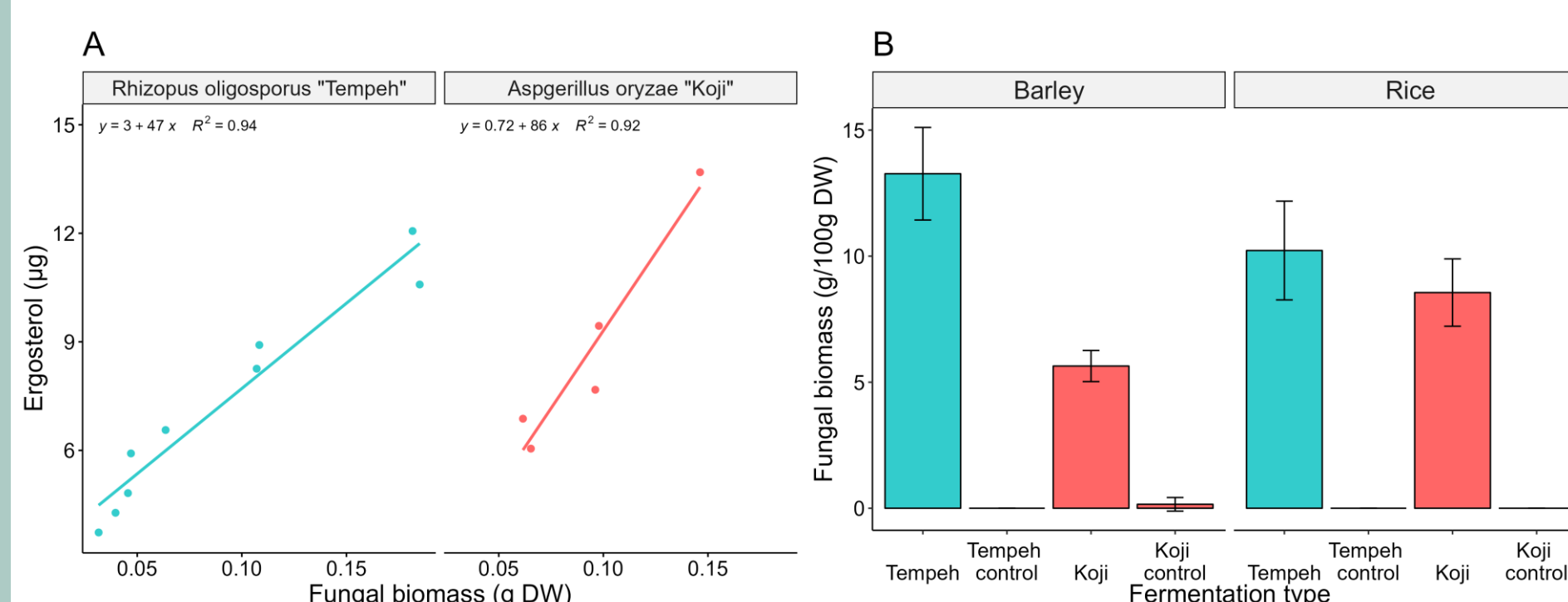


Fig. 1 A) Calibration curve plotting ergosterol (µg) on pure fungal biomass of *A. oryzae* and *R. oligosporus*. B) Fungal biomass of fermented and unfermented (control) samples calculated from linear model in (A).

Fungal biomass produced:
6 to 13 % DW

PDCAAS increased 30-33% in fermented barley

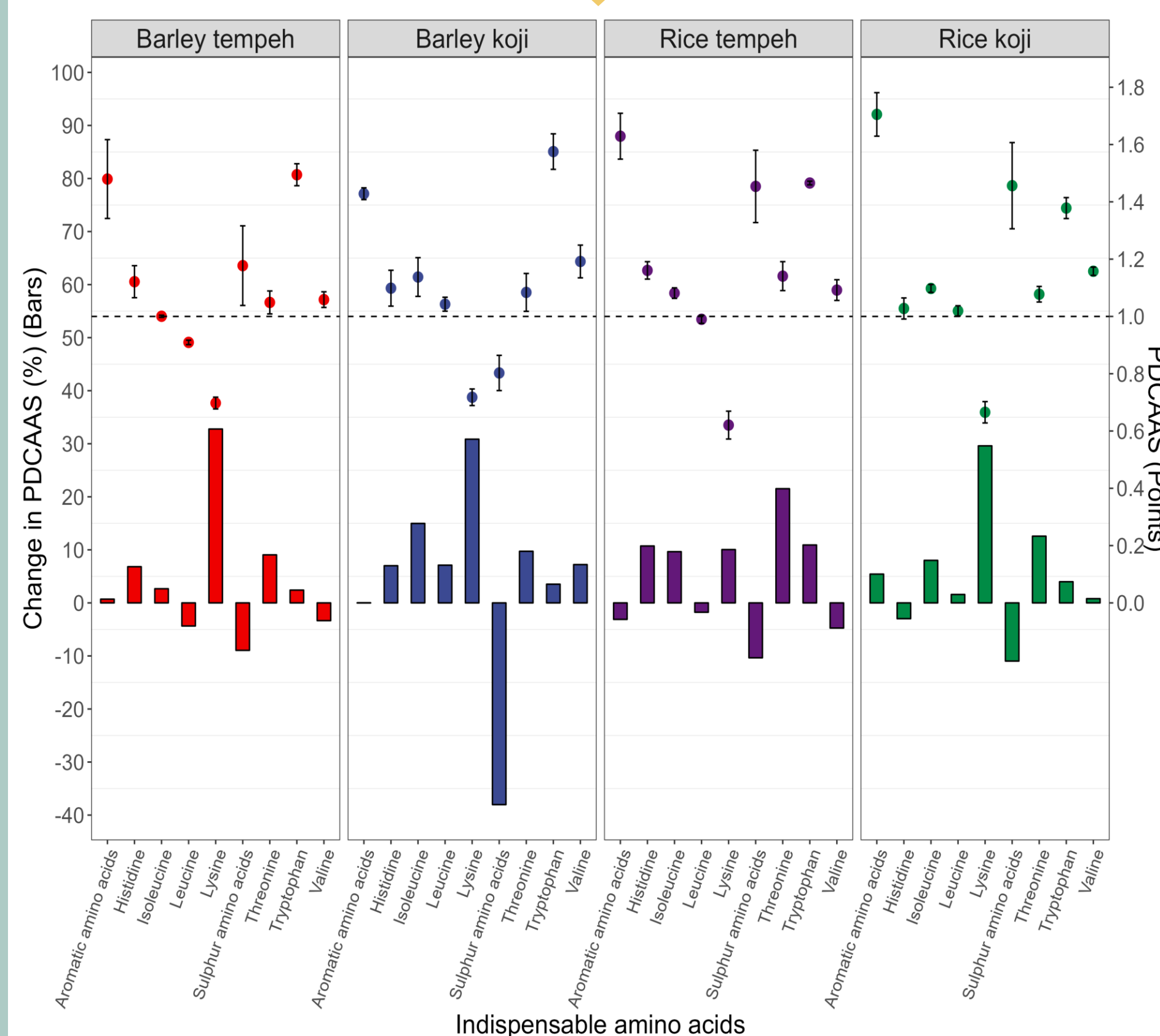


Fig 1. Protein digestibility corrected amino acid score (PDCAAS) of fermented samples barley tempeh, (red), barley koji (blue), rice tempeh (purple), rice koji (green) is indicated in points for all indispensable amino acids \pm standard deviation. Change in PDCAAS as a result of fermentation (% increase of original unfermented substrate) is indicated in bars.

Methods

Solid-state fermentation:

- Fungal strains used
 - Tempeh: *Rhizopus microsporus* var. *oligosporus*
 - Koji: *Aspergillus oryzae*
- Plant substrate used
 - Pearled barley (*Hordeum vulgare*)
 - Basmati rice (*Oryza sativa*)



PDCAAS = *in vitro* Protein digestibility *
mg of indispensable amino acid in 1 g of test protein
mg of same amino acid in 1 g of reference protein

$$IAAI = \frac{g \text{ indispensable amino acids}}{g \text{ total amino acids}}$$

Conclusions

- Solid-state fungal fermentation produces considerable amount of fungal biomass.
- Solid-state fungal fermentation can improve the protein quality of cereals.
- Protein quality is improved by increased amino acid score of limiting amino acid lysine.

