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## Improving the quality of pearl millet and wheat flour composite bread by optimising process parameters

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### Abstract

Bread is traditionally made from wheat flour. However, there are challenges in using wheat for bread development, such as low yield, the inability to resist drought, and low pest resistance in developing countries. Millets, which are underutilised cereals on the other hand can overcome the above-mentioned challenges and hence be used to make bread by mixing with wheat. However, using millet for bread development has some issues due to the presence of anti-nutritional factors (phytate and tannin). The overall process includes cleaning, washing the millet, germination (malting), drying, grinding, and dough preparation for making bread. The germination effect on the anti-nutritional contents was investigated by varying the germination time (1, 2, and 3 days) and germination temperature (25, 30, and 35 °C). After the germination conditions were optimised, the effect of flour size (150, 250, and 350  $\mu\text{m}$ ) and the mixing ratio of millet flour with wheat (0, 10, 30, and, 50 %) on antinutritional components and the quality of bread were analyzed. The phytate and tannin content of raw pearl millet were 689.6 mg/100 g and 834.7 mg/100 g, respectively. The lowest phytate and tannin content for pearl millet was 95.5 mg/100g and 105.2 mg/100 g, respectively, at 30 °C for 3 days of germination. This result shows that both temperature and time during the germinating process have a significant impact on both phytate and tannin content reduction. The optimum mixing ratio (millet to wheat) and particle size were 10:90 and 150 micrometers, respectively, for pearl millet with wheat flour composite bread, which shows mixing ratio and particle size have a significant effect on the reduction of phytate, and tannin content and enhance the quality of bread from pearl millet, and wheat composite bread. Germination time, temperature, mixing ratio, and particle size appeared to be promising food processing methods for improving the nutrient and energy densities of pearl millet, and wheat composite flour bread, which enables the introduction of the utilisation of underutilised and environmentally shock-resilient cereals like pearl millet, and this could be a means to alleviate the hidden hunger in developing countries, including the global south.

**Keywords:** Bread, germination, mixing, pearl millet, phytate, tannin