Fermentation and Addition of Malt to Improve Physicochemical and Sensory Properties of Complementary Foods Prepared from Starchy Grains

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Introduction

Complementary foods in the Eastern and Southern African region are characterised by low nutrient density (Badau et al., 2005).The high rates of child malnutrition reported in cereal-consuming areas of Africa are partly associated with the bulkiness and high viscosity of the cereal-based diets. As a result, mothers commonly dilute the porridge with water to reduce its viscosity (Bukusuba et al., 2008). Since young children have small gastric capacities, they are unable to consume enough of such foods to meet their nutrient and energy requirements and consequently become malnourished. Several techniques are available to reduce dietary bulk and increase nutrient density. Natural fermentation which is applied in traditional African food preparations is an effective method of improving the protein and complex carbohydrate digestibility of cooked cereals (Chavan et al., 1988).The addition of malt (amylase rich flour) also dramatically reduces the viscosity and bulk density of complementary foods, changing it to nutrient dense liquefied food that is convenient for a young child to consume (Afoakwa et al., 2010).

Figure 1: Experimental materials

Objectives

➢To evaluate effect of fermentation and addition of malt on proximate composition and anti-nutritional factors of oat, barley and teff flours.

➢To assess effect of fermentation and addition of malt on functional properties of oat, barley and teff flours and gruel.

➢To study effect of fermentation and malt on acceptability of gruel prepared from oat, barley and teff flours.

Materials and methods

➢ Experimental materials (Fig. 1)

➢Sample preparation (Fig 2)

➢3x3x3 factorial design (cereal type: Oats, Barley and Teff; fermentation time: 0, 24 and 48 h; malt concentration: 0, 2 and 5%)

➢Proximate composition and antinutritional factors were analyzed.

➢Bulk density, water absorption capacity and viscosity were measured

➢Sensory acceptability of the gruel was evaluated.

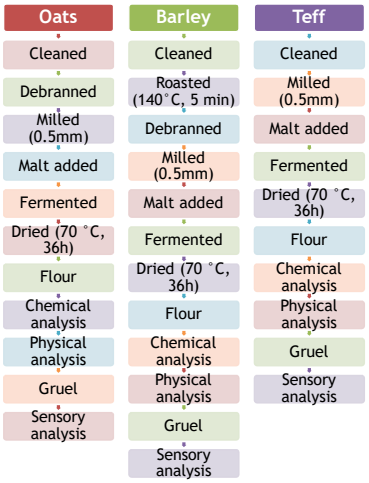

Figure 2: Flow diagram of sample preparation and analysis

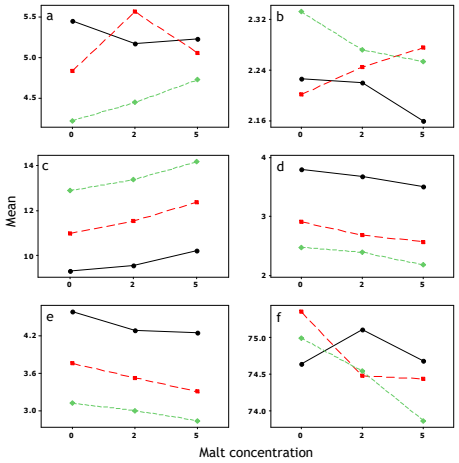

Figure 3: Two way Interaction plots for (a) moisture (%), (b) ash (%), (c) protein (%), (d) fat (%), (e) fiber (%) and (f) carbohydrate content (%). Fermentation*Malt Interaction. (●, 0h fermentation; ■, 24h fermentation; ◆, 48h fermentation)

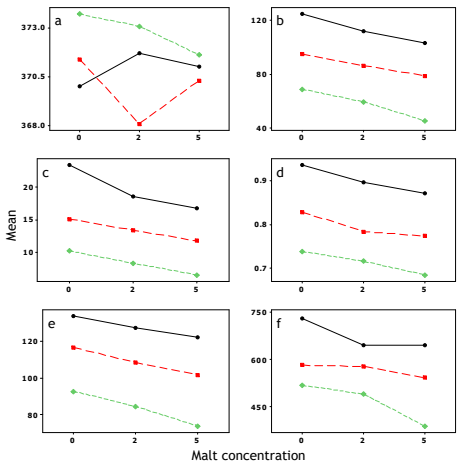

Figure 4: Two way Interaction plots for (a) calorie (cal/100g), (b) phytate (mg/100g), (c) tannin (mg/100g), (d) bulk density (g/ml), (e) water absorption capacity (%) and (f) viscosity (cP). Fermentation*Malt Interaction. (●, 0h fermentation; ■, 24h fermentation; ◆, 48h fermentation)

Results

➢Significant three-way interaction effects were observed between cereal type, fermentation time and malt concentration for the proximate composition and physical variables.

➢Interaction of fermentation duration and malt concentration resulted in a significant ($p<0.01$) reduction in crude fibre, crude fat, total carbohydrate (Fig 3), phytate, tannin, bulk density and viscosity (Fig 4) of the cereals under investigation.

➢On the contrary, crude protein content was significantly ($p<0.01$) increased. The trend of change in moisture, ash and energy contents was inconsistent.

➢Gruels made from 24 hour fermented and unfermented cereals were ranked favorably for appearance, aroma, taste, mouth feel and overall acceptability (Fig 5).

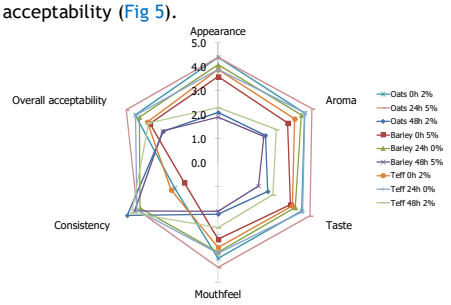

Figure 5: Spider plots for sensory attributes from gruel samples

Conclusions

➢ Addition of 5% malt and fermentation for 24 hours appear to have a promising synergistic effect in improving chemical, physical and sensory qualities of fermented starchy staples commonly used making CFs.

➢The increase in energy density and reduction in dietary bulkiness and viscosity is desirable as it will increase food intake by infants.

➢This can have an important implication in parts of Africa where both fermentation and malt addition are not are not commonly practised for baby food applications.

Future work

➢ Further research on storability of these products is recommended.

References

1. Afoakwa, E. O., Aidoo, P. R., & Adjonu, R. (2010). Int. J. Food Sci. Nutr., 61(3), 256-71.
2. Badau, M. H., Jideani, I. A., & Nkama, I. (2005). J. Trop. Pediatr., 52(3), 166-172.
3. Bukusuba, J., Muranga, F. I., & Nampala, P. (2008). Int. J. Food Sci. Tech., 43(8), 1424-1429.
4. Chavan, U. D., Chavan, J. K., & Kadam, S. S. (1988). J. Food Sci. 53(5), 1574-1575.

Acknowledgements

This research was funded by German Federal Ministry of Education and Research (BMBF) through the Reduction of Post Harvest Losses and Value Addition in East African Food Value Chains (RELOAD) project.

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