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Fortifying Fermenting Enset (*Ensete ventricosum*) with *Moringa* Leave and Garden Cress: Physicochemical and Microbial Profiling

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Abstract

Enset (*Ensete ventricosum*) is an important food security crop for over 20 million Ethiopian people after fermentation into kocho. The fermented food product is a good source of starch (65 %) and soluble sugars (9 %), but it is low in protein (< 4 %) and fat (< 1 %). The aim of this study was to assess the physicochemical and microbial dynamics during fortified-enset fermentation. To this end, six enset plants were processed using enset processing machines and fortified each with 3 % shed-dried *Moringa Stenopetala* leave powder (MS), *Moringa Oleifera* (MO) leave powder, *Lepidium sativum* (LS) seed powder and the fourth treatments left as a Control (C). The fortified and control enset samples were allowed to ferment for two months in a Sauerkraut jars. Samples were taken on days 1, 7, 15, 30 and 60. The pH and moisture content were measured. Also, microbial dynamics were determined using the plate count method as described by Dijk et al. (2015). The pH of the enset sample fortified with MS, MO, LS and C samples on day 0 were 5.99, 6.15, 5.83 and 6.63, respectively. On day 60 the pH reduced to 4.25, 4.00, 4.28 and 3.92 for MS, MO, LS and C samples, respectively. The total aerobic count attained a maximum of 9.23, 9.40, 9.29 and 9.28 log cfu/g at day 0 for MS, MO, LS and C, respectively. Lactic acid bacteria count (LAB) were 8.10, 8.13, 8.10 and 8.10 log cfu/g on day 1. On day 60 the LAB count reduced to 7.34, 7.05, 7.73 and 6.70 for MS, MO, LS and C, respectively. Moreover, enset fortified with MS and MO leave powder inhibited the growth of undesirable microorganisms (*Clostridium* sp, Enterobacteriaceae and molds) from enset samples on day 15 and onwards. Addition of *moringa* leaves powders (MS and MO) to fermenting enset showed a significant improvement in the protein, calcium, iron, phosphorus and magnesium contents of kocho. In conclusion, addition of *moringa* leave powder to fermenting enset significantly decreased *Clostridium*, yeast and mold counts and Enterobacteriaceae) abundance, whereas it increased *Lactobacillus* abundance as compared with the untreated enset samples.

Keywords: Enset, fermentation, fortification, *Moringa*, lactic acid bacteria