

# CHARACTERIZATION OF DOMINANT LAB ASSOCIATED WITH TRADITIONAL MALTING OF SORGHUM GRAINS FOR THE SELECTION OF STARTER CULTURES TO IMPROVE THE QUALITY OF FERMENTED SORGHUM MALT PRODUCTS

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## INTRODUCTION

In Africa, sorghum is malted and used to produce food products mainly fermented food (gowé) and beverages like traditional beers (*dolo*, *pito*, *chibuku*, *bili-bili*, *choukoutou*...), no alcoholic beverages (*ranoodo*, *otika*) or as ingredient in the preparation of weaning food. Microorganisms proliferated during malting process (Agu and Palmer, 1997) among of those some are essential for the brewing process but some are spoilage microorganisms or could be harmful to humans (Priest and Campbell, 1996). Moulds (*Aspergillus* spp., *Fusarium* spp., *Alternaria* spp., *Penicillium* spp.) and bacteria (*Bacillus cereus*, *E. Coli*, *Staph. aureus*, *Sarsina* spp., *Enterobacter* spp., *Kelbsiella* spp., *Lactobacillus* spp.) have been identified in sorghum grains and malt (Ilori et al., 1991; Ogundiwin et al., 1991; Lefyedi, 2006). Chemical treatments (formaldehyde, sorbic acid, sodium benzoate, sodium chlorite) have been investigated to inhibit microorganisms growth during malting of sorghum grains (Ogundiwin et al., 1991; Lefyedi, 2006). Biological methods including the inoculation with LAB and yeast starter cultures in the steeping water have shown promise for the control of undesirable bacteria and moulds during barley and sorghum malting (Boivin and Malanda, 1997; Lefyedi, 2006). *Lact. fermentum* has been found the dominant species involved in the processing of *dolo* and *pito* and responsible for the spontaneous fermentation of *dolo* and *pito* wort (Sawadogo-Lingani et al. 2007). So, spoilage and pathogen microorganisms can affect the quality of the final sorghum malt and the derived products.

## OBJECTIVE OF THE STUDY

To identify the dominant LAB associated with the traditional malting of sorghum and to examine the antimicrobial activity and the ability to produce amylase and exopolysaccharides (EPSs) of the dominant isolates for the selection of starter cultures.

## MATERIAL & METHODS

Malting process was studied at four production sites at Tamale (North Ghana) and Ouagadougou (Central Burkina Faso). Sampling was done from the raw sorghum grains to the final sorghum malt for microbial counts and isolation of dominant LAB. LAB isolates were identified by phenotyping (basic phenotypic characteristics, API 50 CHL analysis) and genotyping (ITS-PCR/RFLP, partial sequencing of the 16S r RNA gene). The LAB isolates were screened for their antimicrobial activity against pathogen indicator strains using agar spot test with MRS-0.2% glucose under anaerobic conditions (Schillinger and Lucke, 1989), their ability to produce amylase (Sanni et al, 2002) and exocellular polysaccharides (EPSs) (Pidou et al., 1990; Guiraud, 1998).

## RESULTS

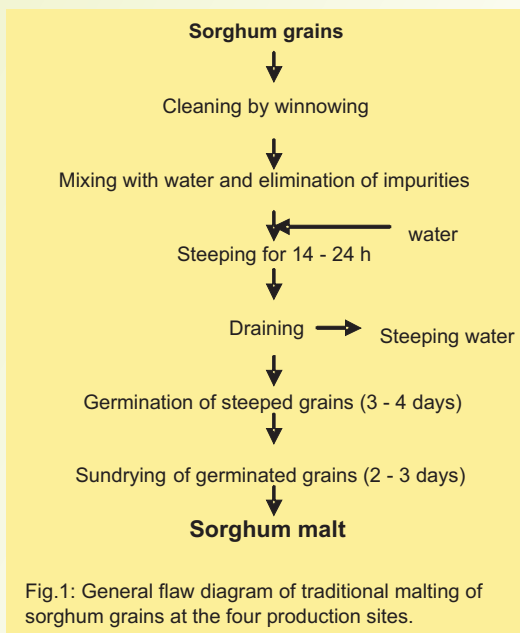


Fig. 1: General flow diagram of traditional malting of sorghum grains at the four production sites.

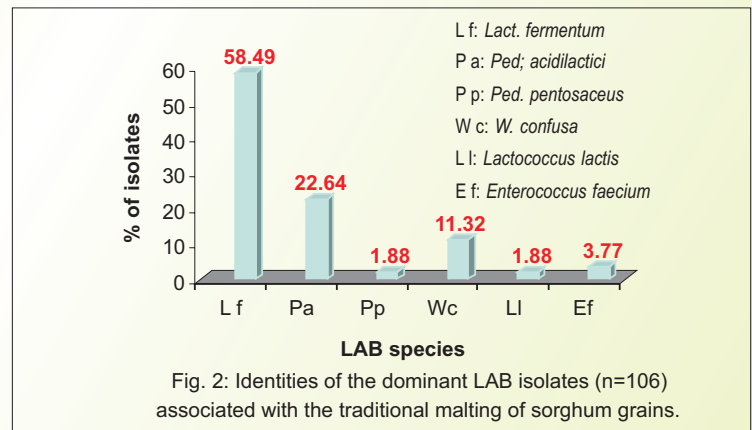


Fig. 2: Identities of the dominant LAB isolates (n=106) associated with the traditional malting of sorghum grains.

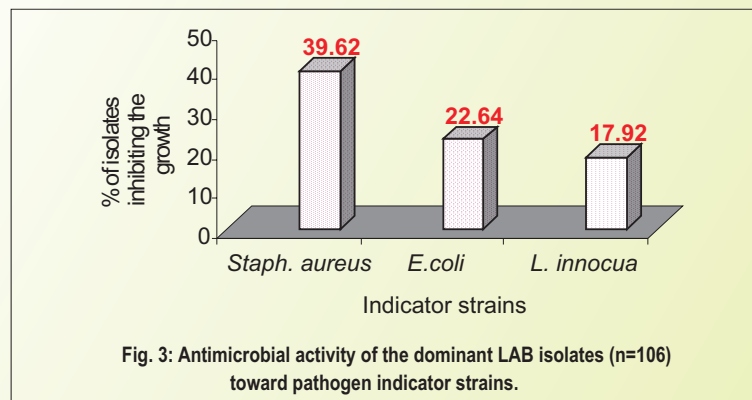


Fig. 3: Antimicrobial activity of the dominant LAB isolates (n=106) toward pathogen indicator strains.

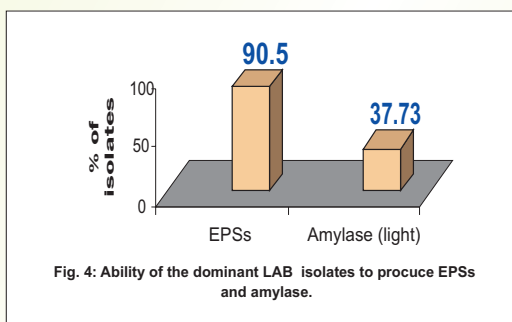


Fig. 4: Ability of the dominant LAB isolates to produce EPSs and amylase.

### During the steeping of sorghum grains

- LAB (*Lact. fermentum*, *Ped acidilactici*, *W. confusa*) counts in the steeping water increased from  $10^5$  to  $10^9$ - $10^{10}$  cfu/ml.
- pH of water decreased [ $5.08 \pm 0.22$  to  $4.20 \pm 0.52$  at Tamale;  $5.30 \pm 0.15$  to  $3.90 \pm 0.21$  at Ouagadougou].
- Growth of Gram-negative bacteria was inhibited.

## CONCLUSION

*Lact. fermentum* dominated the microbiota from the sorghum grains to the sorghum malt, including the steeping step. Suitable isolates of *Lact. fermentum* are promising candidates to be used as starter culture from the initial step of malting i.e. the steeping, and expected to improve the quality of the sorghum malt or other malted cereals by inhibiting the growth of undesirable microorganisms and expected to control the subsequent fermentation of malted cereals base products e.g. *dolo*, *pito* and infant formulations.