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Improvement of chocolate flavor by yeast during cocoa fermentation

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Cocoa research performed during the last century has elucidated the basic physiology and ecology of cocoa fermentation and the biochemical changes that occur during cocoa fermentation, drying and roasting that lead to the development of the chocolate flavour. Biotechnological manipulation of the steps of microbial fermentation (microorganisms, amount of pulp, selected strains) can result in understandable and reasonably predictable effects on chocolate quality. Many different species of microorganisms have been isolated from cocoa fermentation and have been characterised and the microbial succession has been defined. Yeast are essential to the fermentation process and development of chocolate flavour. The concept of using starter cultures to conduct cocoa bean fermentations is not new. Initially, around 1960-1980, the aim was to induce a faster, more consistent fermentation, without adverse impact on chocolate quality. More specific investigations on the use of starter cultures have now been conducted where the main goals have been to develop a faster, more consistent fermentation process that yields cocoa beans with predictable qualities. The dynamic of *Saccharomyces cerevisiae*, *Pichia kluyveri* and *Hanseniaspora uvarum* during spontaneous and inoculated

cocoa fermentations and their effect on sensory characteristics of chocolate were investigated. Yeast populations were assessed by qPCR. *S. cerevisiae* was predominant during spontaneous (average 5.4 log cell/g) and inoculated (average 7.2 log cell/g) fermentations. The *H. uvarum* seemed to be suppressed by the other two yeasts, as it showed similar population (approximately 4.0 log cell/g) even in the inoculated assay. Carbohydrates were consumed quickly at inoculated fermentation (68% and 42% were consumed in the inoculated and control assays respectively, at 24 h). Ethanol content was higher in the inoculated (8.3 g/kg at 48 h) than in the control (4.6 g/kg at 96 h) fermentation. Chocolate produced from the spontaneous fermentative process presented dominance of the bitter flavour, while obtained through inoculated fermentation process presented bitter, astringent, coffee and acid as dominant flavours. The inoculation accelerated the fermentative process in 48 h. The inoculation of yeast influenced the microbial profile, which affected the volatile compounds that affect sensory characteristics, resulting in chocolate with dominant bitter, cocoa, and fruity attributes.

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