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Novel Characteristics of African *Streptococcus infantarius* subsp. *infantarius* Potentially Responsible for the Predominance over other Lactic Acid Bacteria in Spontaneously Fermented Camel Milk

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Abstract

Streptococcus infantarius subsp. *infantarius*, a pathogenic species of the *Streptococcus bovis* / *Streptococcus equinus* complex (SBSEC), was unexpectedly found to be predominating in spontaneously fermented East-African camel milk (suusac) over other lactic acid bacteria including *Streptococcus thermophilus*. Lactose metabolism of currently known SBSEC and the classic yoghurt bacterium *S. thermophilus* is reported to differ, not justifying the predominance observed. Bacteriocin production by SBSEC is described and might be a factor contributing to the predominance.

African *S. subsp. infantarius* predominate in suusac fermentation mediated by bacteriocin production and an adapted lactose metabolism that parallels lactose utilisation in *S. thermophilus* instead of previously reported SBSEC metabolic pathways. Presumptive *S. subsp. infantarius* isolates (213) were obtained at 10⁸ CFU ml⁻¹ from 22 out of 24 Kenyan and Somali suusac on semi-selective media and subsequently typed by pheno- and genotypic methods. Primers based on *S. thermophilus* and *S. salivarius* sequences were designed for 6 genes of the *gal-lac* operon. Genes *galE*, *galM*, *lacS* and *lacZ* were detected by PCR in African *S. subsp. infantarius* strains. Sequencing of a 6.949-kb fragment of *S. subsp. infantarius* CJ18 revealed higher homology to *galE* (94.1%), *galM* (92.1%), *lacS* (93.1%) and *lacZ* (97.4%) of *S. thermophilus* than to *galE* (83.3%) and *galM* (56.6%) of the *S. subsp. infantarius* type strain. *lacS* and *lacZ* were not detected in the available genome scaffolds and PCR assays of all 9 SBSEC type strains. Bacteriocin screening was performed using a wide spectrum of indicator strains in buffered media. Bacteriocins active against *Listeria*, lactobacilli and streptococci were detected in 33 out of 66 tested *S. subsp. infantarius* strains.

Our African *S. subsp. infantarius* strains harbour genes for a lactose metabolism homologous to those of *S. thermophilus*, which are either absent or strongly differ in SBSEC type strains. The presence of an adapted *gal-lac* operon and the production of bacteriocin possibly explain their predominance during suusac fermentation. Our investigations are continuing to better define additional metabolic characteristics, the fermentative role of CJ18 and to identify any putative virulence factors that may pose a significant human health risk.

Keywords: Bacteriocin, camel milk fermentation, galactose lactose metabolism, *Streptococcus infantarius*