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Sustainable transformation of the West African soft cheese value chain via milk substitution and whey valorisation

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Abstract

West African soft cheese (WASC) is predominantly produced by Fulani women through traditional practices, generating a meaningful source of household income. Despite its nutritional, economic and cultural significance, the WASC value chain faces recurring challenges. Seasonal fluctuations in cow milk supply drive up production costs and retail prices during the dry season, pushing some processors toward adulteration, which compromises quality, fuels food fraud, and erodes consumer trust. Additionally, whey, a nutrient-dense by-product of WASC production, remains largely wasted throughout the value chain.

This study investigated the potential of partially substituting cow milk with soya-based drink (referred to as soya milk) at rates of 0, 5, 10, 15, and 20 % in WASC production, and the incorporation of whey as an ingredient in Tuo zaafi (TZ), a cereal-based staple widely consumed in Ghana. Cheese yield was assessed across six independent replicates, and its sensory evaluation involved 30 semi-trained panellists in a non-replicated full cross-over design, where each panellist assessed all products once using a Check-All-That-Apply (CATA) questionnaire with 23 descriptors. Nutritional evaluation of whey-based TZ was conducted in two independent replicates. ANOVA was used for comparisons, while Cochran Q test, correspondence analysis, and penalty-lift analysis were applied for CATA data.

Results showed that soya milk can replace up to 20 % of cow milk in WASC production without compromising sensory properties or consumer acceptability, though yield was significantly reduced compared to the control (23.2 % vs. 27.8%; $p < 0.001$). As for TZ, partially replacing water with whey utilisation at up to 40 % in TZ preparation significantly improved its nutritional profile, with notable increases in protein (+42 %), calcium (+149 %), magnesium (+33 %), and iron (+311 %) ($p < 0.001$).

These findings highlight the potential of these solutions to strengthen the WASC value chain by improving supply stability and reducing waste. Future research should examine consumer acceptance of whey-enriched TZ. WASC incorporated with soya milk should be clearly labelled to prevent food fraud, allergic risks to protect consumers. The economic implications should also be studied for both processors and consumers, particularly during the dry season when cow milk is scarce, and WASC retail prices rise.

Keywords: by-product utilisation, dairy value chain, milk, Wagashi

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