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"Competing pathways for equitable food systems transformation: Trade-offs and synergies"

Assessing the impact of urbanisation on milk quality and safety: A study in Bengaluru's metropolitan dairy farming systems

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Abstract

The complex interplay of rapid urbanisation with a rising demand for quality food in India adversely impacts on the production of fresh milk in urbanising areas; in particular, sourcing dairy cattle feed is increasingly challenging. This leads farmers to incorporate alternative feedstuffs, such as roadside vegetation or food waste, in their cows' rations. This may affect milk safety and composition, including its fatty acid (FA) profile and heavy metal (HM) content. However, these variables are also influenced by cattle breed and season. An investigation was carried out in southern India to explore the effects of urbanisation on the quality and safety of milk, with a focus on FA profile and HM concentration. The study included 39 farmers situated in urban and peri-urban regions of the Bengaluru metropolitan area. During three visits in winter 2021 (n=74 records), monsoon 2021 (n=61), and summer 2022 (n=104), information on farm management was collected along with feed and milk samples. Selected FA and HM analyses for milk were performed by gas chromatography and inductively coupled plasma, respectively, and a mixed model approach for statistical analysis was implemented in R. Milk yield was significantly affected by location and season, with cows in urban locations and in winter season exhibiting highest milk yield. Milk from urban cows contained more unsaturated FAs than milk from peri-urban cows (11 %). Similarly, summer season milk contained more unsaturated FAs than milk collected during winter and monsoon (5 %). There was no difference in milk yield and FA profile between cattle breeds (Jersey, HF, native zebus and their crossbreeds). None of the milk samples contained arsenic and cadmium, whereas chromium and lead were detected in 60 % and 28 % of the milk samples. Thereby, the average concentrations of chromium ($0.011 \pm 0.014\,mg\,kg^{-1}$) and lead ($0.019 \pm 0.053\,mg\,kg^{-1}$) were within permissible limits as recommended by WHO. In conclusion, the high concentration of unsaturated FAs in milk from urban cows suggests that land-constrained farmers manage to supply a high-quality product to urban consumers by using alternative feedstuffs. Since its HM content is not of concern, fresh cow milk is safe for consumers, even in a highly urbanized setting.

Keywords: Alternative feedstuffs, dairy cattle feeding, megacity, milk quality, milk safety, urbanisation

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