Safety evaluation of white soft cheese

By

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B.Sc. Agric. Sci. (Dairy Sci.), Fac. of Agric., Fayoum Univ., (2018)

M.Sc. Agric. Sci. (Dairy Sci.), Fac. of Agric., Fayoum Univ., (2022)

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SUPERVISION COMMITTTEE

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SUMMARY AND CONCLUSION

White soft cheese is one of the most widely consumed dairy products in many regions due to its nutritional value, affordability, and ease of production. However, its high moisture content and relatively low acidity make it a favorable medium for microbial growth, posing potential health risks if not produced and handled under strict hygienic conditions. This thesis aimed to comprehensively evaluate the safety of white soft cheese from multiple perspectives, including microbiological, chemical, and natural preservation strategies.

The study involved the detection and quantification of microbial hazards such as Escherichia coli, Bacillus subtilis, Bacillus licheniformis, and Kocuria flava, which may serve as indicators of poor hygienic practices or post-processing contamination. The chemical safety assessment included the determination of heavy metals (such as lead and cadmium), which may originate from environmental contamination or raw material sources.

Moreover, the thesis explored the potential use of natural preservatives particularly dried fruit peels such as mango and pomegranate peels as functional additives with antimicrobial and antioxidant properties. These natural ingredients were incorporated into cheese formulations to assess their effect on microbial load, shelf life, and sensory acceptability, aiming to improve cheese safety and stability without relying on synthetic additives.

Therefore, the current thesis was aimed to:

I: Microbiological evaluation and genetic identification of some bacterial species in soft cheeses: Implications for Food Safety

II: Assessment of heavy metal contamination in soft cheese: dietary exposure and health risk evaluation

III: Exploring the potential of using pomegranate and mango peel powders as natural food additives targeting safety of white soft cheese

The present study was carried out under the following parts:

Part I: **Microbiological evaluation and genetic identification of some bacterial species in soft cheeses: Implications for Food Safety**

This part of the study focused on evaluating the microbiological profile of soft cheeses in Egypt, with emphasis on the identification and characterization of specific bacterial species, namely *Kocuria flava*, *Bacillus licheniformis, Bacillus subtilis,* and *Escherichia coli.* A total of 100 cheese samples were collected and analyzed. Bacterial isolates were identified using 16S rRNA gene sequencing, and the resulting sequences were registered in GenBank.

- Phylogenetic analysis confirmed the affiliation of isolates to the genera Escherichia, Bacillus, and Kocuria, closely matching known strains. Cluster analysis revealed two main phylogenetic groups.
- Microbiological assessments showed significant variability in bacterial counts among different cheese types.
- Salmonella was found in higher concentrations in Istanbolly and Tallaga cheeses, while B. licheniformis was more prevalent in Tallaga, Feta, and Kariesh cheeses.
- E. coli was most abundant in Istanbolly cheese, with decreasing levels in Tallaga, Kariesh, and Feta cheeses.
- B. subtilis was highest in Feta cheese, and K. flava was predominantly associated with Istanbolly cheese.
- These findings underscore the presence of potentially harmful and spoilage microorganisms in soft cheeses, emphasizing the critical need for improved hygiene practices and routine microbial monitoring to ensure consumer safety and uphold food quality standards.

Part II: **Assessment of heavy metal contamination in soft cheese: dietary exposure and health risk evaluation**

This part of the study evaluated the concentrations of heavy and traces metals (Fe, Mg, Mn, Zn, Na, Cu, Se, Cr, Pb, and Cd) in four traditional Egyptian soft cheese varieties: Feta, low-salt soft cheese, Istanbolly, and Kareish. Atomic absorption spectrophotometry was used for metal quantification, while health risk assessments were conducted using estimated daily intake (EDI), target hazard quotient (THQ), hazard index (HI), and carcinogenic risk (CR) models.

- The results showed that all mean concentrations of metals were within internationally accepted safety limits. Toxic elements such as lead (Pb), cadmium (Cd), and chromium (Cr) were below detection levels in all samples.
- Among the elements, magnesium and sodium exhibited the highest dietary contributions, accounting for 17.81–22.72% and approximately 3.15% of the tolerable daily intake, respectively.
- All risk indices (THQ and HI < 1; CR < 1×10^{-6}) indicated no significant non-carcinogenic or carcinogenic health risks.
- These findings confirm that the examined cheeses are safe for consumption concerning metal contamination and comply with global food safety standards. The study reinforces the importance of continuous monitoring and risk assessment as integral components of effective food safety and public health protection systems.

Part III: Exploring the potential of using pomegranate and mango peel powders as natural food additives targeting safety of white soft cheese

This part of the study explored the incorporation of pomegranate and mango peel powders into white soft cheese to evaluate their potential as natural preservatives. The investigation focused on their antimicrobial effects, as well as their influence on the physicochemical properties and sensory quality of the cheese. The peel powders were first analyzed for their polyphenolic and flavonoid content, which are known for their bioactive and antimicrobial properties.

- Antimicrobial assessments revealed that both peel powders exhibited significant inhibitory effects against common spoilage and pathogenic microorganisms, including Escherichia coli, Salmonella spp., Bacillus subtilis, Bacillus licheniformis, and Kocuria flava, as determined by minimal inhibitory concentration (MIC) and minimal lethal concentration (MLC) assays.
- The incorporation of peel powders at concentrations up to 2% not only reduced microbial contamination but also improved the physicochemical stability and enhanced the sensory characteristics of the cheese, such as texture, flavor, and appearance.

- The findings suggest that pomegranate and mango peel powders can serve as effective, natural alternatives to synthetic preservatives in soft cheese production, contributing to both food safety and product quality. The study supports further research to optimize formulation and scalability for commercial applications in the dairy industry.

It could be concluded that:

1- **Microbiological Safety Concerns:** The presence of spoilage and pathogenic bacteria (E. coli, B. subtilis, B. licheniformis, K. flava) in white soft cheese highlights the need for strict hygiene practices during production, storage, and distribution to ensure product safety.

2- **Heavy Metal Safety Assurance:** All analyzed cheese samples contained heavy and trace metals within permissible limits, with toxic metals (Pb, Cd, Cr) below detection levels. Health risk assessments (EDI, THQ, HI, CR) confirmed that the cheeses pose no significant risk to consumers.

3- **Natural Preservation and Quality Improvement:** Incorporating pomegranate and mango peel powders (up to 2%) effectively reduced microbial contamination and improved the cheese's physicochemical and sensory properties. These natural additives offer a safe and functional alternative to synthetic preservatives.