

Microbiological quality of spices from Small & Medium-Scale Enterprises (SMEs) in Sri Lanka

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This study evaluated the microbiological quality of spices from Small and Medium-scale Enterprises (SMEs) in Sri Lanka to assess potential microbial risks. Samples submitted to the Industrial Technology Institute (ITI) by the SMEs for routine analysis were used in the study. Eighty-four spice samples, including curry powder, chili powder, chili pieces, turmeric powder, pepper powder and cinnamon powder were analyzed for moisture content, yeast and mold counts, *Escherichia coli* counts, and the presence of *Salmonella* using the standard ISO methods; ISO 927:2009, ISO 21527-1:2008, ISO 4831:2006, and ISO 6579-1:2017, respectively. Results showed notable variation in microbial contamination among spice types. Yeast and mold counts ranged from 3.8×10^2 to 3.4×10^5 CFU/g, with the highest contamination in chili powder (3.4×10^5 CFU/g), followed by curry powder (2.9×10^5 CFU/g), chili pieces (2.6×10^5 CFU/g), turmeric powder (1.8×10^5 CFU/g), and cinnamon powder (1.2×10^5 CFU/g). Only pepper powder ($3.8 \times 10^2 - 7.1 \times 10^4$ CFU/g) complied with the ISO 21527-1:2008 limit of 3×10^4 CFU/g. *E. coli* was detected in 28.6% of curry powder, 50.0% of chili powder, and 14.3% of chili pieces, with counts ranging from 3 to 43 MPN/g, exceeding the zero-tolerance limit set by ISO 4831:2006. Turmeric, pepper, and cinnamon powder showed no *E. coli* contamination. All samples tested were negative for *Salmonella*, in compliance with ISO 6579-1:2017. Moisture content across all spice types ranged from 6.2% to 11.8%, with the highest in curry powder (11.8%) and the lowest in pepper powder (6.2%), remaining within ISO 927:2009 limits. Correlation analysis revealed no statistically significant relationships between moisture content and yeast/mold counts ($r = -0.35$, $p=0.499$) or *E. coli* counts ($r = -0.45$, $p=0.368$), indicating that moisture content alone is not the determining factor for microbial contamination. The findings highlight the need for Good Agricultural Practices (GAPs) and Good Manufacturing Practices (GMPs) to improve hygiene and sanitation throughout production. Recommendations include enhancing storage and transport conditions, regular food safety training for producers and workers, and stronger regulatory oversight. This study provides important insights into the microbiological quality of spices from Sri Lankan SMEs and emphasizes measures to ensure food safety and consumer protection.

Keywords: *Microbiological quality, Spices, Small and Medium-scale Enterprises, Sri Lanka*