



شبكة المعلومات الجامعية
التوثيق الإلكتروني والميكروفيلم

بسم الله الرحمن الرحيم



MONA MAGHRABY



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شبكة المعلومات الجامعية التوثيق الإلكتروني والميكروفيلم



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جامعة عين شمس التوثيق الإلكتروني والميكروفيلم

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SAFETY AND QUALITY ASPECTS OF DRIED MILK PRODUCTS

A thesis submitted by

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(B.V.Sc, Cairo University, 2013; M.V.Sc, Cairo University, 2017)

**For the degree of philosophy Doctor of Veterinary Medical Sciences
(Hygiene and Control of Milk and its products)**

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Abstract

"Safety and quality aspects of dried milk products" Aml Elsayed Ibrahim, Cairo Univ. Fac. Vet. Med. Thesis; Ph.D., Food Hygiene and Control, 2021.

Samples of fifty whole milk powder and thirty of each skim milk powder, powdered infant milk formula and milk-cereal based infant formula were collected from various shops, supermarkets and pharmacies in Giza and Cairo Governates, Egypt. Whole and skim milk powder samples were graded according to their sensory parameters and its evaluation were revealed that 60.00% and 56.67% of excellent quality, respectively. By analysis of their chemical compositions (moisture%, total solids%, fat%, protein%, and titratable acidity %); all samples were within range established by Egyptian standards. Lead and mercury were measured in a mean value of 0.243 ± 0.069 and 0.261 ± 0.052 mg/kg for whole milk powder samples in a percentage of (68.00 & 34.00%), while 0.150 ± 0.037 and 0.347 ± 0.110 mg/kg in a percentage of (66.67 & 40.00%) for skim milk powder, respectively. In addition, lead, cadmium, aluminum, arsenic and mercury were measured in a range concentration of 0.384-0.480, 0.014-0.015, 0.296-0.761, 0.174-0.233 and 0.236-0.345 mg/kg of the examined powdered infant milk formula. All dried samples were investigated to the presence of melamine and cyanuric acid, melamine could be detected in 30.00% of whole milk powder, 73.33% of skim milk powder, 66.67% of powdered infant milk formula and 83.33% milk-cereal based infant formula samples, but cyanuric acid was not detected in all samples. Total aerobic bacteria were present in mean values of $4.97 \times 10^2 \pm 1.21 \times 10^2$, $2.25 \times 10^2 \pm 0.40 \times 10^2$, $0.23 \times 10^2 \pm 0.02 \times 10^2$ and $3.47 \times 10^2 \pm 0.50 \times 10^2$ CFU/g for whole milk powder, skim milk powder, powdered infant milk formula and milk-cereal based baby formula, respectively. While mean values of aerobic spore formers were as follows: $4.33 \times 10^2 \pm 1.625 \times 10^2$, $0.36 \times 10^2 \pm 0.064 \times 10^2$, $0.25 \times 10^2 \pm 0.026 \times 10^2$ and $2.39 \times 10^2 \pm 0.322 \times 10^2$ CFU/g of 50 samples of whole milk powder, 23/30 of skim milk powder, 30 of powdered infant milk formula and 30 milk-cereal based infant formula, respectively. Yeasts were only found in two whole milk powder samples with a mean value of $0.65 \times 10^2 \pm 0.05 \times 10^2$ CFU/g. Coagulase Positive *S. aureus* was isolated from whole, skim milk powder, powdered infant milk and milk-cereal based baby formula samples in a percentage of 36.00 (23 isolates), 6.67 (2 isolates), 10.00 (4 isolates), and 13.33 (6 isolates), respectively. These *Staphylococcus aureus* isolates were resistant to oxacillin, methicillin, and penicillin. *Bacillus cereus* was existing in 64.00, 43.33, 26.67 and 36.67% with a mean of $0.57 \times 10^2 \pm 0.182 \times 10^2$, $0.07 \times 10^2 \pm 0.018 \times 10^2$, $0.06 \times 10^2 \pm 0.019 \times 10^2$ and $0.12 \times 10^2 \pm 0.038 \times 10^2$ CFU/g of whole, skim milk powder, powdered infant milk and milk-cereal based baby formula, respectively. *Bacillus cereus* was identified biochemically as follows; in a percentage of 53.4, 80.0, 56.3 and 66.7 of total isolates identified in whole, skim milk powder, powdered infant milk and milk-cereal based baby formula, respectively. The PCR results revealed that *Bacillus cereus* isolates found to harbor toxigenic genes in the following percentages: 77.8, 2.0, 72.7, 16.2 and 67.7 for *nhe*, *hbl*, *cytK*, *Ces* and *bceT*, respectively, in all examined powder samples. *Bacillus cereus* strains were able to grow in presence of cefoxitin, colistin sulphate, neomycin, trimethoprim-sulfamethoxazole, oxacillin, and penicillin. By using traditional biochemical tests and the vitek2 system a total of forty-three Enterobacteriaceae spp. have been identified from dried samples as follows: 11 (8 *Enterobacter cloacae* ssp. *cloacae* and 3 *Pantoea* spp.) were contaminated ten samples of whole milk powder, 1 (*Enterobacter cloacae* ssp. *cloacae*) from one skim milk powder sample, 10 (6 *Enterobacter* spp. {3 *Enterobacter cloacae* ssp. *cloacae* and 3 *Enterobacter hormaechei*} and 4 *Pantoea* spp.) have been isolated from 6 samples of powdered infant milk formula and twenty-one (7 *Enterobacter cloacae* ssp. *cloacae*, 2 *Enterobacter hormaechei*, 11 *Pantoea* spp. and 1 *Raoultella ornithinolytica*) from 13 samples of milk-cereal based baby formula. By evaluation of antimicrobial resistance degree of Enterobacteriaceae species, the most of distinguished species were susceptible to chloramphenicol, gentamycin, and nalidixic acid antimicrobials. A cross section sample of 554 mothers in Giza, Egypt, mothers accepted to complete a questionnaire for assess their knowledge, attitudes, practices & hygienic awareness during using of powder infant milk formula for feeding their infants. One-hundred and fifty-five mothers correctly followed procedures for efficient cleaning and sterilization of feeding bottles, about eighty mothers were hygienically aware, they believed in the lack of sanitary cleaning and sterilization may cause food poisoning. Egyptian mothers found necessity to more advice and information on adequate procedures in feeding infants.

Keywords: milk powder, powdered infant milk formula, melamine, *Staphylococcus aureus*, *Bacillus cereus*, toxigenic genes, Enterobacteriaceae, antimicrobial resistance, toxic elements, questionnaire.



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Dedication

To

My Mother and Father

My Husband

My Daughter

My Sister

&

My friends

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