A COMPARISON OF SELECTED PUBLIC HEALTH CRITERIA IN MILK FROM MILK-SHOPS AND FROM A NATIONAL DISTRIBUTOR

by

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"Milk is nearly a perfect food" - Hippocrates

Dedicated to:

my husband, RORY and our son, SEBASTIAN

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SUMMARY

A COMPARISON OF SELECTED PUBLIC HEALTH CRITERIA IN MILK FROM MILK-SHOPS AND FROM A NATIONAL DISTRIBUTOR

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Selected public health criteria of pasteurised milk available to the consumer from milk-shops in a selected area of Pretoria compared with a national distributor's milk were evaluated. Pasteurised milk samples were obtained from five randomly selected milk-shops in the north-western part of Pretoria over a six-week period from June to August 1998. Milk from a well-known national distributor was also obtained from three supermarkets in the same area during the same time period to act as the control milk.

Mean total aerobic bacterial counts, coliform counts and psychrotrophic bacterial counts were determined. The presence of *Escherichia coli (E. coli), Staphylococcus aureus (S. aureus), Salmonella* species, staphylococcal enterotoxins, inhibitory substances, alkaline phosphatase and somatic cells in milk were also determined. Of the 135 milk samples purchased from milk-shops, 87% were not fit for human consumption on the basis of the minimum standards prescribed in the Foodstuffs, Cosmetics and Disinfectants Act (Act 54 of 1972). In contrast, 100% of the 79 control milk samples passed all the safety criteria laid down in the Act.

Milk-shop milk quality varied between milk-shops and between sampling days. All milk-shop milk was sold as having been pasteurised, yet 38.5% of milk samples purchased failed the alkaline phosphatase test, indicating that they had not been pasteurised correctly or were contaminated with raw milk. The total aerobic plate counts were generally high for all milk-shop milk samples ranging from 1.0×10^2 to 2.7×10^7 CFU/mℓ with a median value of 41 000 CFU/mℓ, whereas for the control milk it ranged from 7.0×10^2 to 8.7×10^3 CFU/mℓ, with a median value of 2 200 CFU/mℓ. Coliform counts varied from 0 to 3.4×10^4 per mℓ in milk-shop milk, with 68% of samples having counts lower than 20 coliforms/mℓ, which is the maximum number allowed when the Petrifilm method of counting is used. Coliforms could not be detected in 1 mℓ of control milk samples. *E. coli* was detected in 1 mℓ of 17% of milk-shop milk, 95% of which originated from milk which was alkaline phosphatase positive. *Salmonella* spp. could not be detected in 1 mℓ in any of the *E. coli*-positive milk tested.

Psychrotrophic bacterial counts done after pre-incubation of milk-shop milk were extremely high, and ranged from 3×10^5 to 2.2×10^8 CFU/mℓ, with a median value of 2.4×10^7 CFU/mℓ. In Europe the psychrotrophic count may not be greater than 100 000 CFU/mℓ. None of the milk-shop milk passed this European standard, whereas 98.7% of the milk obtained from the national distributor fell within the prescribed parameters.

S. aureus was isolated from 54 (40%) milk-shop milk samples, and four (7.8%) of 51 isolates tested produced staphylococcal enterotoxins A (SEA), B (SEB), D (SED) or a combination. Control milk did not contain any *S. aureus* and 15 milk samples tested for the enterotoxin gave a negative result.

All control milk was negative for inhibitory substances, but these were detected in 54.1% of milk-shop milk. Somatic cell counts varied between 1.2×10^4 and 1.6×10^6 cells/mℓ in the milk-shop milk, with a median count of 4.2×10^5 cells/mℓ. Only 18.7% of samples had counts above the legal limit of 500 000 cells/mℓ. The national distributor's milk always had counts less than 150 000 cells/mℓ.

The results showed that milk-shop milk differed significantly ($p < 0.05$) from the national distributor's milk, and that the quality of milk purchased from milk-shop outlets was generally of a poor bacteriological quality. The presence of inhibitory substances, and the isolation of *E. coli* and *S. aureus* (some of which were able to produce enterotoxins) indicated potentially unsafe milk and posed a serious public health risk to consumers.

SAMEVATTING

'n VERGELYKING VAN GESELEKTEERDE VOLKSGESONDHEIDSMAATSTAWWE VAN MELK VANAF MELKWINKELS EN VANAF 'n NASIONALE VERSPREIDER

deur

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Geselekteerde volksgesondheidsmaatstawwe vir gepasteuriseerde melk beskikbaar aan verbruikers vanaf melkwinkels in 'n uitgesoekte gebied van Pretoria, en vergelyk met die melk van 'n nasionale melkverspreider, is geëvalueer. Gepasteuriseerde melkmonsters vanaf vyf ewekansig geselekteerde melkwinkels in die noord-westelike deel van Pretoria, is oor 'n ses-weke periode vanaf Junie tot Augustus 1998 verkry. Melk, vanaf 'n bekende nasionale melkverspreider, is ook vanaf drie selfbedieningswinkels in dieselfde gebied en oor dieselfde tydperk verkry om as kontrolemelk te dien.

Die gemiddelde totale aërobiese bakteriese telling, kolivormtellings en psigrotrofiese bakteriese tellings is bepaal. Die teenwoordigheid van *Escherichia coli*, *Staphylococcus aureus*, *Salmonella* spesies, stafilokokkusenterotoksiene, inhiberende middels, alkaliese fosfatase en somatiese selle in melk is ook bepaal. Uit 135 melkmonsters wat vanaf melkwinkels aangekoop is, was 87% op grond van die minimum standaarde voorgeskryf in die Wet op Voedingsmiddels, Skoonheidsmiddels en Ontsmettingsmiddels, (Wet 54 van

1972), nie geskik vir menslike verbruik nie. In vergelyking het 100% van die 79 kontrole melkmonsters in al die veiligheidsbepalings neergelê in die Wet geslaag.

Die kwaliteit van melk verskil tussen melkwinkels en ook tussen bemonsteringsdae. Alhoewel al die melkwinkels melk as gepasteuriseer verkoop het, het 38.5% van die aangekoopte melkmonsters nie die alkaliese-fosfatase toets geslaag nie, wat aandui dat dit nie doeltreffend gepasteuriseer is nie, of dit was besoedel deur ongepasteuriseerde melk. Die totale aërobiese plaattellings was oor die algemeen hoog vir al die melkwinkel melkmonsters, en het gevarieer vanaf 1.0 x 10^2 tot 2.7 x 10^7 KVE/mℓ met 'n mediaan waarde van 41 000 KVE/mℓ, terwyl dit vir die kontrolemelk tussen 7.0 x 10^2 tot 8.7 x 10^3 KVE/mℓ met 'n mediaan waarde van 2 200 KVE/mℓ was. Kolivormtellings het gewissel vanaf 0 tot 3.4 x 10^4 per mℓ in die melkwinkel melk, en 68% van die monsters het tellings laer as 20 kolivorme per mℓ getoon, wat die hoogste aantal toelaatbaar is wanneer die Petrifilm metode van telling gebruik word. Kolivorme kon nie in 1 mℓ van die kontrole melkmonsters gewaar word nie. *E. coli* is gewaar in 1 mℓ in 17% van melkwinkel melk, waarvan 95% hul oorsprong gehad het in melk wat positief vir alkaliese fosfatase was. Geen *Salmonella* spp. kon in die positiewe *E. coli* melk wat getoets is gewaar word nie.

Die psigrotrofiese bakteriese tellings na voor-inkubasie in melkwinkel melk was uiters hoog, en het gevarieer vanaf 3 x 10^5 tot 2.2 x 10^8 KVE/mℓ, met 'n mediaan waarde van 2.4 x 10^7 KVE/mℓ. In Europa mag die psigrotrofiese telling nie hoër as 100 000 KVE/mℓ wees nie. Terwyl geen melk van die melkwinkels voldoen het aan hierdie Europese standaard nie, het 98.7% van die melk aangekoop vanaf die nasionale melkverspreider binne die voorgeskrewe parameters geval.

S. aureus is in 54 (40%) van die melkwinkel melkmonsters geïsoleer, en vier (7.8%) van die 51 stamme getoets, het stafilokokkusenterotoksiene A (SEA), B (SEB), D (SED) of 'n kombinasie geproduseer. Kontrolemelk het geen *S. aureus* bevat nie, en 15 melkmonsters het negatief getoets vir die enterotoksien.

Alle kontrolemelk was negatief vir inhiberende middels, maar is in 54.1% van die melkwinkel melk gevind. Somatiese seltellings het gewissel tussen 1.2 x 10^4 en 1.6 x 10^6 selle/mℓ in die melkwinkel melk, met 'n mediaantelling van 4.2 x 10^5 selle/mℓ. Slegs 18.7% van monsters het seltellings hoër as die wettige limiet van 500 000 selle/mℓ gehad. Die melk van die nasionale verspreider het altyd tellings laer as 150 000 selle/mℓ getoon.

Die resultate toon dat die melkwinkel melk aansienlik ($p < 0.05$) verskil het van die nasionale verspreider se melk, en dat die kwaliteit van die melk aangekoop van melkwinkels in die reël van 'n swak bakteriologiese kwaliteit was. Die teenwoordigheid van die inhiberende middels en die isolasie van *E. coli* en *S. aureus* (waarvan sommiges enterotoksiene geproduseer het) is aanduidend van moontlike, ongesonde melk, en hou die gevaar in van 'n ernstige volksgesondheidsrisiko vir die verbruiker.