THE INFLUENCE OF SOME MONOVALENT CATIONS, AT VARIOUS CONCENTRATIONS UPON THE ACTIVITY OF CHLORHEXIDINE DIACETATE AND $(ETHOXY)_5$ OCTYL PHENOL

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Chlorhexidine diacetate and $(Ethoxy)_5$ octyl phenol (Triton X45) are surface-active agents possessing antimicrobial activity (Hugo & Longworth, 1964; Lamikanra & Allwood, 1976). This action has been attributed to perturbation of the cytoplasmic membrane, leading to loss of essential intracellular small molecular weight metabolites, such as potassium (Lambert & Hammond, 1973). The presence of salts, especially those of potassium, at concentrations isotonic with the intracellular environment might be expected to reduce the rate of potassium-ion leakage and perhaps decrease the activity of these agents.

Chlorhexidine (0.5-0.65 μM) and Triton X45 (30-40 μM) added to exponential-phase Bacillus megaterium KM cultures, growing at 30°C in Tryptone Soya broth gave between 0 and 100% growth rate inhibition. The presence of KCl (0.05-0.35M) in the medium did not significantly affect growth rate in the absence of drug, yet reduced the growth inhibitory action of the chlorhexidine and enhanced that of the Triton X45. These effects were maximal at KCl concentrations of 0.2M and above, when complete protection towards chlorhexidine and lysis of the cultures in presence of the Triton X45 were observed. This concentration of potassium approximates to that of the intracellular environment. Similar results were obtained when testing was repeated in the presence of NaCl, NH_4Cl or $(NH_4)_2SO_4$ (0.35M). Time-survivor curves in the presence of chlorhexidine (0.7-1.0 μM) gave LT_{90} values of 1.5-2.0 h in the absence of salts. Inclusion of NH_4Cl and $(NH_4)_2SO_4$ (0.35M) did not significantly influence survival, whereas both NaCl and KCl (0.35M) totally inhibited this low level bactericidal activity.

Isotherms of drug absorption by B. megaterium cells were determined at 30°C. Chlorhexidine uptake was reduced by approximately 50% in the presence of KCl (0.35M), whereas that of Triton X45 was increased by a similar amount.

Triton X45 is a non-ionic surfactant. Increasing salt concentration reduces water solubility, increases surface activity, and might be expected to lead to increased adsorption of drug at the cell surface. No correlation however could be demonstrated between isotoxic concentrations of Triton X45 for different salt systems and surface activity.

The influence of salts upon the antimicrobial activities of chlorhexidine and Triton X45 are more probably consequences of ionic interaction at the cell wall, leading to competition for drug binding sites, and contraction of the peptidoglycan matrix. The consequences of such interaction will be complex, and likely to influence the action of any antimicrobial agent active at a site beneath the cell wall (Brown & others, 1979). These findings may have important consequences in the preservation of pharmaceuticals and in vitro testing.

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