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A comparison of local handwashing agents in Bangladesh

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Summary

The efficacy of handwashing using ash, soap, mud or plain water was tested in a group of 20 women living in a slum of Dhaka in Bangladesh. Each woman was asked to wash her hands using each of the washing agents and the efficacy of handwashing was assessed by comparing estimated faecal coliform counts from post-washing hand samples. Mud and ash were found to be as efficient as soap. Research on appropriate handwashing techniques in the light of the existing practices is suggested.

Introduction

In spite of wide variability in handwashing behaviour (Aziz *et al.* 1989; Zeitlyn & Islam 1988) several studies from different parts of the world suggest that handwashing-related hygiene education programmes may have a 14–40% impact on diarrhoea incidence (Khan *et al.* 1982; Black *et al.* 1981; Stanton *et al.* 1988). A strong association has been found between the *faecal* coliform count on fingertips of hands and possession of in-house water (Pinfold *et al.* 1988). Hence, the promotion of handwashing has often been proposed to control diarrhoeal diseases (Feachem 1984).

In rural Bangladesh, soap is rarely used for handwashing purposes: it is costly and it is perceived more as a beautifying agent (Zeitlyn & Islam 1989). In general, hands are washed with water except following defaecation when the majority of rural people rub their left hands on the ground and rinse with water (Aziz *et al.* 1983). Although washing with ash is not common in the Indian subcontinent, it is often promoted in health education programmes (Aziz *et al.* 1989; APHA 1985; I. Bhusan, personal communication). To our knowledge, however, there are no study data describing the efficacy of handwashing at the household level using these different local handwashing agents.

Clinical or hospital studies suggest that acquired organisms are removed from the hands by the mechanical action of rubbing and rinsing rather than killed by a special handwashing preparation (Sprunt *et al.* 1973; Mortimer *et al.* 1965; Lowbury *et al.* 1964). Washing agents are in contact with hands for only a few seconds and even rapidly bactericidal substances require time to act (Sprunt *et al.* 1973).

In this study, the efficacy of the three widely used local washing agents, soap, mud and ash, was compared to that of plain water to investigate whether local washing agents could be promoted for handwashing at the community level. Since change of behavioural practices is complex, it is important that promoted handwashing methods relate to the existing methods.

Subjects and methods

This study was conducted in Agargaon, a Dhaka slum less than a mile from the National Assembly building. The community comprised about 300 people who lived in 59 temporary houses made of bamboo roofs and walls with earthen floors. The men were daily workers, mostly rickshaw pullers and street hawkers. Most women were housewives and about 20% of them were divorced and worked as housemaids.

The local leader of the slum was approached with the plan of the study, without mentioning

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Table 1. Experimental design

Groups	Days 1	2	3	4	5
1	water	ash	mud	soap	control
2	control	water	ash	mud	soap
3	soap	control	water	ash	mud
4	mud	soap	control	water	ash
5	ash	mud	soap	control	water

the benefits of handwashing, but was informed of our objective to measure (finding) the efficacy of local washing agents. Twenty women aged 18–35 years volunteered to wash their hands through 5 consecutive days.

To avoid any confounding effect, these women were randomly divided into five groups of four women, each of whom, at every session, washed their hands either with water, mud, ash or soap or did not wash their hands and were considered a control. At every session the groups were rotated so that at the end of the study each woman had washed her hands with each of the three washing agents, with plain water, or had been a control (Table 1).

To standardize faecal coliform counts for the different washing agents, ash and mud were sterilized by heating for 3 h at 110°C before handwashing. The pH values of the mud and ash were 6.5 and 9.2 respectively. The mud was orange-yellow coloured clay, collected in the slum. When wetted with water, mud was smoother on the hand than ash. One of the cheapest kinds of soap was used for the soap washing. The water used for handwashing was collected from a deep tubewell in a properly washed plastic container with a tap outlet.

Except for the water group, each group was shown how to rub both hands, clockwise, using the washing agent for 10 s and then rinse them with water. The water wash groups rubbed both hands for 10 s under running water from the plastic container.

The left hands of the wash-groups and control group were then sampled by the fingertip technique (Pinfold *et al.* 1988) by dipping all five fingers up to the palm and rubbing them for 10 s in the sample collection solution. The

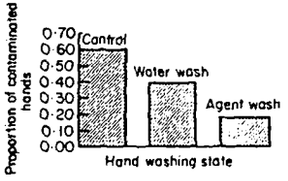

Figure 1. Distribution of hand contamination.

sample collection solution contained 100 ml of 1/4-strength Ringer solution with 0.1% Tween 20. The samples were immediately transported to the laboratory to test for the presence of faecal coliforms by the membrane filtration method (APHA 1985).

A hand was considered contaminated when one or more faecal coliform colonies were found in the sample. Handwashing and the subsequent sampling was completed every day by 1000 h. The same women were sampled all through the study. On the last day, a short questionnaire was used to record their knowledge, attitude and practices regarding hygiene.

Results

In total, 115 samples were tested for faecal coliform count; 20 for each of the four washing groups (80 samples), 20 control samples, five mud samples, five ash samples and five water blanks from rinsing water (two on each day). All the water blanks, mud and ash samples were found to have no faecal coliforms.

Out of 80 handwash samples, 24 had faecal coliform bacteria. Figure 1 shows the distribution of hand contamination (positive faecal coliform counts in samples). The proportion of

Table 2. Hand contaminations by wash groups

Groups	Number of contaminated hands (%)	*P*-values against control
Soap	4 (20)	<0.01
Ash	3 (15)	<0.01
Mud	4 (20)	<0.01
Water	8 (40)	NS
Control	12 (60)	

Differences between groups were not significant.

contamination in hands washed with washing agent was lower than in the control hands and in water-washed hands.

Table 2 shows the effect of different handwashing agents and compares the proportion of contaminated hands within the groups with the proportion of contaminated hands in the control group. Mud, ash and soap reduced hand contamination significantly whereas the reduction of hand contamination by water was not significant. The proportions of positive counts were similar for ash, mud and soap and, slightly higher for water. None of these differences was statistically significant.

The questionnaire showed that 85% of women washed their hands after defaecation with plain water and that the others used mud. They all mentioned that soap, and to some extent ash, were not easily available for them. Women who used mud explained that they used it for washing hands only after defaecation. The health risk related to hand contamination was not clearly understood by these women who explained the need for handwashing in religious terms.

Discussion

Our results suggest that under controlled conditions, all the locally available washing agents, i.e. ash, mud and soap, are more or less equally effective in reducing faecal coliform hand contamination. Washing hands with plain water was apparently less effective than washing with agents but nevertheless reduced contamination.

Our results are consistent with hospital studies which suggest that the effectiveness of handwashing is determined more by its thoroughness and by the time taken to clean the hands than by the type of soap or water used (Sprunt *et al.* 1973). It seems likely that recently acquired organisms were removed from the hands by the mechanical action of rubbing and rinsing and the difference in pH of the washing agents had no significant effect on results.

Our object was to investigate the potential of local washing agents under comparable conditions before studying complex real situations. The effect of washing hands with bacteriologically contaminated washing agents was not studied. We suggest, however, that local washing agents may have merits and that studies of handwashing in real situations are needed to develop appropriate handwashing methods for the community.

This study showed that the hands of slum mothers were contaminated with faecal coliform bacteria at a significant level (70% of control mothers). Mothers were unaware of the health benefits of handwashing. They were using washing agents for the study but hardly paid any attention to it. We suggest that until an appropriate community handwashing method is developed, the health education programmes could aim at increasing women's awareness regarding the need for handwashing rather than advocating the expensive or less available washing agents whose superiority to traditionally used mud have not been established.

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