Reducing diarrhoea in Guatemalan children: randomized controlled trial of flocculant–disinfectant for drinking-water

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Objective To examine the effect of a new point-of-use treatment for drinking-water, a commercially developed flocculant–disinfectant, on the prevalence of diarrhoea in children.

Methods We conducted a randomized controlled trial among 514 rural Guatemalan households, divided into 42 neighbourhood clusters, for 13 weeks, from 4 November 2002 through 31 January 2003. Clusters assigned to water treatment with the flocculant–disinfectant were compared with those using their usual water-handling practices. The longitudinal prevalence of diarrhoea was calculated as the proportion of total days with diarrhoea divided by the total number of days of observation. The prevalence of diarrhoea was compared using the Wilcoxon rank–sum test.

Findings The 1702 people in households receiving the disinfectant had a prevalence of diarrhoea that was 40% lower than that among the 1699 people using standard water-handling practices (0.9% versus 1.5%; $P = 0.001$). In households using the flocculant–disinfectant, children < 1 year of age had a 39% lower prevalence of diarrhoea than those in households using their standard practices (3.7% versus 6.0%; $P = 0.005$).

Conclusion In settings where families rarely treat drinking-water, we introduced a novel flocculant–disinfectant that reduced the longitudinal prevalence of diarrhoea, especially among children aged < 1 year, among whom diarrhoea has been strongly associated with mortality. Successful introduction and use of this product could contribute to preventing diarrhoeal disease globally.

Keywords Diarrhea/epidemiology/prevention and control; Potable water/microbiology; Disinfectants; Water purification/methods; Child; Randomized controlled trials; Longitudinal studies; Guatemala (*source: MeSH, NLM*).

Mots clés Diarrhée/épidémiologie/prévention et contrôle; Eau potable/microbiologie; Désinfectants; Purification eau/méthodes; Enfant; Essai clinique randomisé; Etude longitudinale; Guatemala (*source: MeSH, INSERM*).

Palabras clave Diarrea/epidemiología/prevención y control; Agua potable/microbiología; Desinfectantes; Purificación del agua/métodos; Niño; Ensayos controlados aleatorios; Estudios longitudinales; Guatemala (*fuente: DeCS, BIREME*).

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Voir page 34 le résumé en français. En la página 34 figura un resumen en español.

يمكن الاطلاع على الملخص بالعربية في صفحة 34.

Introduction

An estimated 2 million children die each year from diarrhoeal disease. Almost all of them are living in developing countries and are aged < 5 years.[1] Infants younger than 1 year account for more than half of these deaths, and the risk can be 2–3 times higher among infants who are not exclusively breastfed.[2, 3] Many of these deaths are attributed to the use of unsafe drinking-water.[1] The *World health report 2002* emphasized the need to identify simple interventions to treat unsafe water in order to have an impact on the associated high mortality among children.[1] The report recommended a policy shift toward cost effective point-of-use water disinfection.

Strategies for point-of-use disinfection were reviewed in 1995[4], and subsequent experience has been summarized.[5] Point-of-use disinfection of drinking-water with chlorine and filtration, and recently with a new flocculant–disinfectant, has been proven to reduce the incidence of diarrhoea in children in several studies in developing countries.[6–10] Although chlorine is readily available and highly successful in treating unsafe drinking-water, it has not been widely adopted by at-risk households without substantial efforts being made by local field staff to change behaviour. One reason may be that adding chlorine to drinking-water often adversely affects its taste and odour and does not make the water appear cleaner. An in-home water treatment product has been developed to address these issues.[11] The technology consists of

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a flocculant–disinfectant powder that is added to drinking-water to remove microorganisms, organic matter and heavy metals. After decanting, the water looks markedly clearer and is left with a free chlorine residual that produces microbiologically safer water without pronounced chlorine taste or odour.[11]

The initial intervention trial of this technology in Guatemala demonstrated a significant overall reduction in the incidence of diarrhoea but not among children < 1 year of age.[9] High concentrations of free chlorine residuals and a suboptimal approach to encouraging its use led to households using the flocculant–disinfectant only intermittently. A new formulation of the flocculant–disinfectant has been developed, which includes a lower concentration of calcium hypochlorite, and a new programme to change behaviour has been developed, which uses local women to encourage others to use the disinfectant.

Previous evaluations of water-treatment strategies have used the incidence of diarrhoea as the measured outcome.[6–9] Recent studies suggest that the longitudinal prevalence of diarrhoea (the total number of days a person has diarrhoea divided by the total number of days of observation) is a better predictor of children's growth and mortality than diarrhoea incidence.[12]

We conducted a randomized controlled intervention trial to examine the effect of the new formulation of the flocculant–disinfectant on the longitudinal prevalence of diarrhoea in a setting where drinking-water is heavily contaminated and diarrhoea is common. We designed this trial to examine the effect of a point-of-use disinfection strategy on reducing diarrhoea, looking specifically at children < 5 years of age and infants (< 1 year), both groups who are the most vulnerable to death from diarrhoeal illness.

Methods

Study population

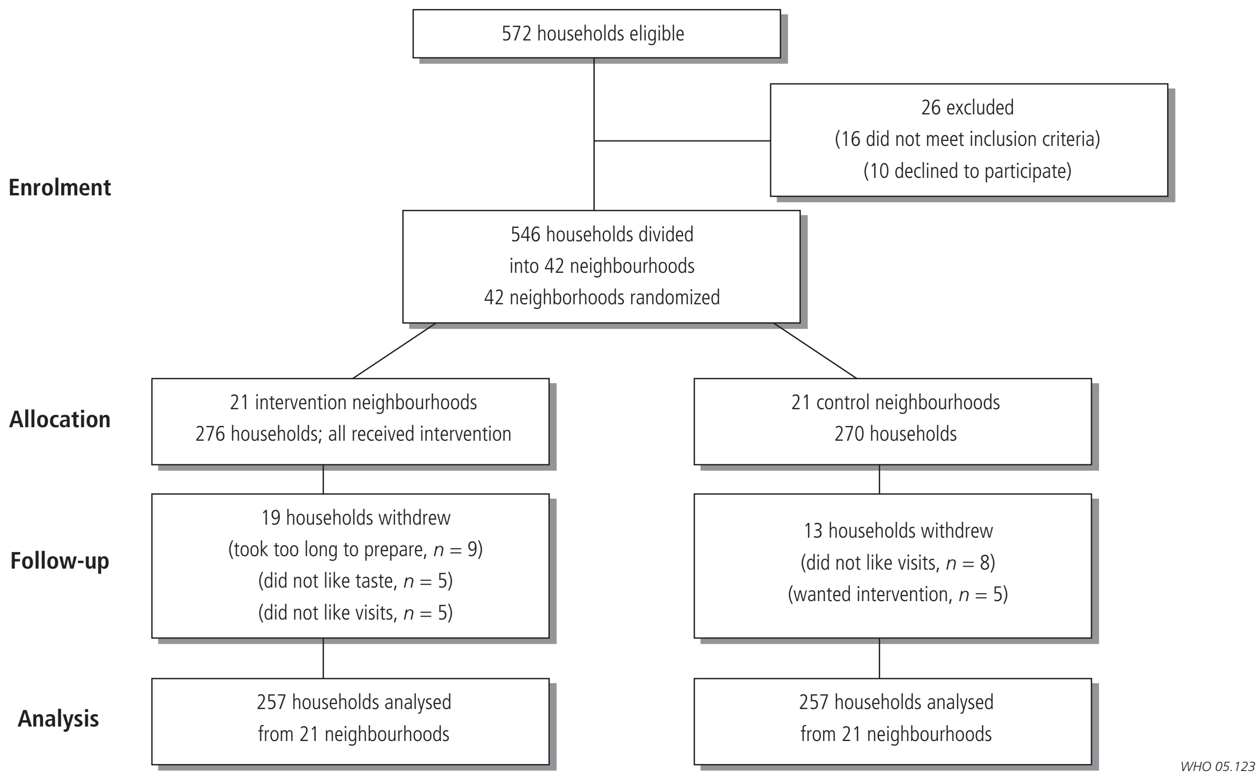
This study was conducted in rural Guatemala in the municipality of San Juan Sacatepéquez, in the highlands 30 km north of Guatemala City. In Guatemala, diarrhoea is a leading cause of death among children, and mortality among children who are younger than 5 years is 74 per 1 000 inhabitants.[13]

We chose 12 Kachiquel Mayan villages and divided them into 42 neighbourhoods, or clusters. Many villages previously had been study sites, but only households that had not participated in prior studies were eligible to participate in this one. Households had to have at least one child younger than 1 year of age. We grouped participating households into either 2 or 4 neighbourhoods within each village. Neighbourhoods had an average of 12 (range = 5–22) eligible households. We used a spreadsheet with a random number generator to assign half of the neighbourhoods in each village to the intervention group. The remaining neighbourhoods were assigned to the control group. Thus, the treatment and control groups were balanced within each village.

Intervention group

The intervention was to have households use the flocculant–disinfectant. The flocculant–disinfectant includes many chemicals used in commercial water treatment but has been specially formulated to work quickly on small volumes of water.[11] All ingredients in the flocculant–disinfectant are used in commercial water treatment or in food products and are generally recognized as safe. The flocculant–disinfectant combines precipitation, coagulation and flocculation with chlorination. It facilitates the removal

Fig. 1. **Flow of households through the study of flocculant–disinfectant for treating drinking-water, Guatemala 2002–03**



of suspended organic matter, bacteria, viruses, parasites and heavy metals from treated water. The formulation yields approximately 2 ppm free residual chlorine in treated water.[10]

Field workers provided participating households with a large spoon and a wide-mouthed bucket for mixing; they also provided a common locally available narrow-topped vessel with a lid for storing treated water. They taught participants to add a sachet of flocculant–disinfectant to a bucket containing 10 litres of water, to stir it vigorously for 5 minutes, and then let it stand for 5 minutes. Field workers instructed participants to decant the water through a flannel cloth into the storage vessel and to discard the residue remaining in the preparation vessel somewhere out of reach of animals and children. Since most families do not have access to latrines, the refuse site was often a hillside or several metres away from the living area. Field workers instructed participants to wash the cloth with detergent to prepare it for reuse. They instructed households to wait 20 minutes (for a total of 30 minutes) before drinking the treated water.

Control group

In the control group, participants continued their usual water collection, treatment and storage practices. Each week they received small items that would not be expected to affect diarrhoea (for example, a kitchen utensil) as an incentive to continue participating.

Field workers, training and observations

A team at the Medical Entomology Research and Training Unit (MERTU) implemented and supervised the field activities. Two groups of field personnel were used in this study. The first group consisted of 13 local women who were trained as field educators and who used the flocculant–disinfectant in their homes. They visited households 1–2 times per week. They explained how to prepare the water; emphasized the importance of providing only treated water, especially to young children; answered questions; and helped mothers integrate regular water treatment into their daily lives.

The second group consisted of field technicians who visited households weekly. They conducted a baseline survey of each household using a questionnaire; this questionnaire collected data on water use. Weekly diarrhoea surveillance began after the intervention households had been using the flocculant–disinfectant for one week. The technicians collected information using a standardized questionnaire and recorded whether each household member had had diarrhoea since the last visit. Diarrhoea was defined by the respondent, usually the mother. The technicians recorded the start date and stop date for each episode of diarrhoea. If an episode of diarrhoea was ongoing, information on the stop date was collected at a subsequent visit. Information on breastfeeding and the consumption of food and water during the preceding week were recorded for children who were aged < 2 years. Field technicians provided households in the intervention group with sachets of the flocculant–disinfectant during their weekly visits. Households retained the empty sachets, and technicians collected and counted both empty and unused sachets each week and provided new supplies. They conducted visits for 13 weeks, from 4 November 2002 through 31 January 2003.

Medical care

Field technicians provided packets of oral rehydration solution and instructions regarding use to all participating families, including those in the control group. They urged mothers to seek care at a community health post for any family member with persistent diarrhoeal symptoms. If field technicians judged that a family member needed urgent medical attention, they arranged for rapid assessment by one of the two field physicians or transport to the hospital.

Collection of water samples

Field technicians collected samples of drinking-water stored by the household at baseline to determine chlorine concentration. During the intervention, they collected samples from stored drinking-water at each household at their weekly visits so that the total chlorine concentration and free chlorine concentration could be determined. During unannounced visits, in weeks 3, 6 and 10 after the intervention, they collected additional water samples to determine chlorine concentration. At baseline and during an unannounced visit in week 3 after the intervention, they collected samples from household water sources and water storage containers to measure *Escherichia coli* and total coliform counts.

Laboratory analysis

Chlorine

Residual free chlorine and total chlorine concentrations were measured using the DPD colorimetric method within 4 hours of collection (Hach Company, Loveland, CO, USA).

Water bacteriology

Field workers collected household water samples in sterile 100-ml Colilert plastic bottles containing 1% sodium thiosulfate solution to neutralize any bleach present. Samples were transported on ice packs (at 6 °C) to the laboratory at MERTU for culture within 4–6 hours of collection. Samples were processed with the Colilert Quantitray 2000 kit (IDEXX Laboratories, Westbrook, ME, USA). A most-probable number table was used for quantification of total coliform bacteria and *E. coli*. Water samples were collected in 500-ml sterile wide-mouth polypropylene bottles. They were transported and processed under similar conditions.

Sample size

We calculated that if 250 households per group were followed for 13 weeks there would be sufficient power to detect a difference in the longitudinal prevalence of diarrhoea of ≥ 24% between intervention and control children aged < 1 year. This was based on results from the previous study where residents of households receiving the flocculant–disinfectant had 24% fewer diarrhoeal episodes than controls.[9] We assumed a prevalence of diarrhoea of 24% among children < 1 year in the control group (based on the prior study); we also assumed a weekly follow-up of 95%, a 10% drop-out rate, 95% confidence intervals and a design effect of 1.5 from clustering.

Statistical methods

The field team continued weekly surveillance of diarrhoea in all households that permitted it, even if they discontinued treating their water. We used an intention-to-treat analysis — that is, all participants were analysed in the group to which they had been randomized. The primary outcome specified in the protocol was the longitudinal prevalence of diarrhoea. We calculated longitudinal prevalence as the number of person–days of diarrhoea divided by the total number of person–days of observation. To account for multiple individuals within each household, we calculated the longitudinal prevalence of diarrhoea for each cluster and then compared the mean values of the longitudinal prevalence in intervention clusters with the longitudinal prevalence in control clusters. We calculated 95% confidence intervals for these means. We evaluated chance in explaining observed differences between groups using the Wilcoxon rank–sum test.

Another outcome measured was the incidence of episodes of persistent diarrhoea, defined as > 13 consecutive days of diarrhoea. We calculated the incidence of persistent diarrhoea as the number of new episodes divided by the total number of person–weeks at risk. A new episode was defined only if the participant reported no diarrhoea in the preceding week.

Ethical approval and informed consent

The purpose of the study was explained in Spanish or Kachiquel to each female head of household who was a prospective participant. The field technicians emphasized that participation was voluntary and that participants could withdraw at any time; they obtained written informed consent from all mothers who were literate. Verbal consent was obtained from those who were not. An institutional review board at the Centers for Disease Control and Prevention and the Ethics Committee Review Board at the Universidad del Valle de Guatemala reviewed and approved the protocol.

Findings

Participant flow

A total of 572 eligible households were assessed for the study and 546 enrolled (Fig. 1). A total of 514 households (257 in each group) completed the entire 13-week study and data from these households were analysed.

Baseline characteristics

The three main sources of drinking-water for study households consisted of rivers or springs, taps and wells. Households in intervention and control groups were similar demographically, in economic indicators, and had similar water sources at baseline (Table 1).

A total of 111/113 (98%) drinking-water sources were contaminated with *E. coli* when tested at the beginning of the study. All households in the study got their drinking-water from these sources.

Table 1. **Baseline characteristics of households in control and intervention groups of trial of flocculant–disinfectant, Guatemala 2002–03**

Characteristic	Control group (*n* = 270)	Intervention group (*n* = 268)
Mean No. (SD[a]) people per household	6.3 (2.3)	6.2 (2.5)
Mean No. (SD) children aged < 5 years per household	2.0 (0.7)	2.0 (0.7)
Mean No. (SD) children aged < 2 years per household	1.0 (0.2)	1.0 (0.2)
% females	50	51
% households with children aged < 1 year	11	11
% with children aged 1 to < 2 years	5	5
% with children aged 2 to < 5 years	16	16
% with children aged 5 to < 15 years	30	29
% with members aged > 15 years	38	39
% with literate mothers	26	24
Economic indicators		
Own land	26	28
Have electricity	79	84
Have a television	44	43
Have a bicycle	40	45
Have a radio	68	76
Primary water source		
Tap (private and public)	31	35
River or spring	40	39
Well	25	22
Familiarity with flocculent–disinfectant		
Knowledge of prior studies	10	10
Tried flocculent–disinfectant previously	1	1

[a] SD = standard deviation.

The average daily consumption of drinking-water did not differ between control or intervention households.

Children < 1 year of age were reported to be breastfed during 95% of all observed person–weeks and to be have been fed supplementary liquids during 93% of person–weeks. Thus, almost all infants were routinely given drinking-water, even if they were being breastfed.

Longitudinal prevalence

Weekly data on the prevalence of diarrhoea were collected from 1702 people in households using the flocculant–disinfectant and 1699 people in control households, giving a total of 41 877 person–weeks of observation. The longitudinal prevalence of diarrhoea was reduced among people in all age groups in households using the flocculant–disinfectant (Table 2). A similar significant magnitude of reduction was also seen in the incidence of diarrhoea among all age groups (data not shown). In total, there was a 40% reduction in the longitudinal prevalence of diarrhoea among people living in households receiving flocculant–disinfectant compared with people from control households (0.9% versus 1.5%; $P < 0.001$). A total of 253 children aged < 1 year in intervention households and 246 children aged < 1 year in control households were observed for 5 454 person–weeks. In this age group, there was a 39% reduction in the longitudinal prevalence of diarrhoea in intervention households compared with control households (3.7% versus 6.0%; $P = 0.005$). There was also a 39% reduction in diarrhoea among infants from intervention households who were reported to have been breastfed (3.7% versus 6.1%; $P = 0.002$) compared with breastfed infants in control households. Similarly, children < 5 years of age in intervention households also had significant reductions in the longitudinal prevalence of diarrhoea (2.4% versus 3.9%; $P = 0.002$). Participants ⩾ 15 years of age in intervention households had the greatest reduction in prevalence: 72% lower than controls (0.1% versus 0.4%; $P = 0.006$).

Children in the intervention households who were < 1 year had 46% fewer episodes of persistent diarrhoea (lasting > 13 days) compared with controls (0.7 episodes/100 person–weeks versus

Table 2. **Prevalence of diarrhoea by age group in trial of flocculant–disinfectant, Guatemala 2002–03**

Age group	Longitudinal prevalence of diarrhoea[a]		Reduction from control (%)	Wilcoxon (2-sided) *P*-value
	Intervention group[b]	Control group[b]		
< 1 year	3.68 (2.63–4.73)	6.03 (4.87–7.18)	39	0.005
1 to < 2 years	4.17 (3.04–5.29)	7.33 (5.54–9.11)	43	0.002
2 to < 5 years	0.76 (0.47–1.06)	1.30 (0.82–1.77)	42	0.100
5 to < 15 years	0.21 (0.12–0.31)	0.38 (0.23–0.53)	45	0.050
⩾ 15 years	0.10 (0.04–0.16)	0.35 (0.13–0.57)	72	0.006
All participants	0.90 (0.68–1.10)	1.50 (1.19–1.81)	40	0.002
Children < 5 years	2.42 (1.91–2.92)	3.95 (3.23–4.67)	39	0.002

[a] Longitudinal prevalence is the number of person–days of diarrhoea/the total number of person–days of observation.
[b] Values are mean (95% confidence interval). Values were calculated from the means of the longitudinal prevalence of each cluster within the group.

1.3/100 person–weeks; $P < 0.03$). Similarly, children in intervention households who were < 5 years of age had 50% fewer episodes of persistent diarrhoea than did controls (0.4 episodes/100 person–weeks versus 0.8/100 person–weeks; $P < 0.002$).

Flocculant–disinfectant use

The number of sachets of flocculant–disinfectant used rose to > 10 sachets per household per week by week 5, and this level was maintained throughout the study (Fig. 2). During weekly scheduled visits, an average of 85% of intervention households had concentrations of free chlorine in their drinking-water > 0.1 ppm throughout the study. Unannounced visits conducted at periodic intervals (weeks 3, 6 and 10 of the study period) to measure free chlorine concentrations supported the finding that intervention households were using the flocculant–disinfectant (Table 3). The effect of adequate chlorination in intervention households was supported by measurements of *E. coli* contamination in the household's drinking-water. At week 3, 28% (74) of intervention households tested had *E. coli* in stored drinking-water compared with 76% (195) of control households (data not shown).

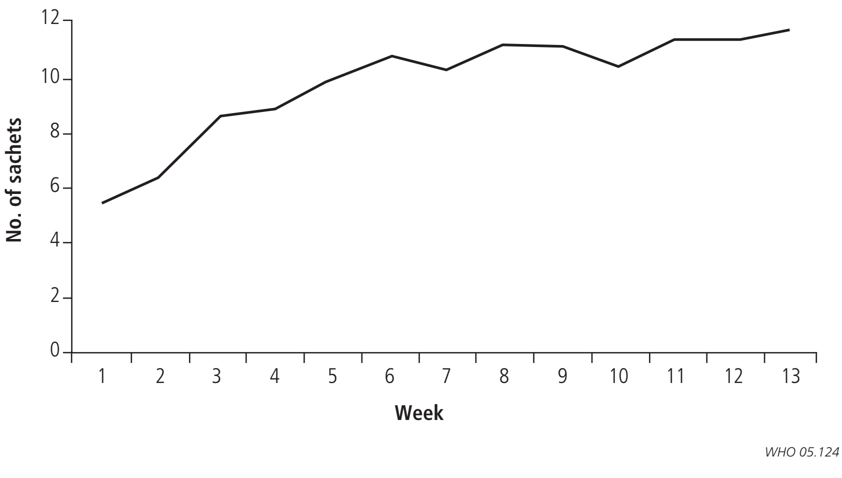
Discussion

The treatment of unsafe drinking-water with a new formulation of a flocculant–disinfectant markedly reduced the longitudinal prevalence, or burden, of diarrhoeal illness among study participants in Guatemala. Importantly, a significant reduction in the longitudinal prevalence of diarrhoea was seen among children < 5 years of age and among infants, who are at the highest risk of dying from diarrhoea. A strong association has been noted between the longitudinal prevalence of diarrhoea and mortality in young children.[8] Given this association, it is likely that in-home treatment of drinking-water would contribute to a reduction in the number of deaths occurring in children that are caused by diarrhoea. Importantly, there was also a 72% reduction in diarrhoea among adults (⩾ 15 years of age). Reducing diarrhoea in this group is important because these household members make decisions about drinking-water treatment for the household; reducing their diarrhoea burden could encourage the adoption and maintenance of the in-home treatment of drinking-water. These findings are consistent with other studies that used bleach to disinfect water; however, those studies used diarrhoea incidence as an outcome rather than longitudinal prevalence.[5–8]

In our study population, almost all infants were not breastfed exclusively, with more than 93% receiving supplemental liquids regularly. Infants who are not exclusively breastfed have an increased risk of dying from diarrhoea.[2,3,14] It is not known what proportion of diarrhoeal mortality can be attributed to unsafe drinking-water. In this study, breastfed children in the control group regularly received unsafe drinking-water, and the prevalence of diarrhoea among breastfed children who received treated water was significantly lower. Since non-exclusive breastfeeding is prevalent in settings where drinking-water is unsafe, providing safe water in these settings may save lives.

In the previous study in Guatemala, people living in households that received a formula of the flocculant–disinfectant with a higher dose of chlorine than was used in the present study had a 24–29% reduction in the incidence of diarrhoea when compared with the control group. People who received bleach to treat their

Fig. 2. **Mean number of sachets of flocculant–disinfectant used per household, by week, Guatemala 2002–03**



water had a 12–25% reduction in diarrhoea. However, no significant reduction was found among children who were < 1 year of age.[9] On unannounced visits only 27% of households had residual chlorine in their drinking-water, and the authors concluded that this low use contributed to the lower than expected reduction in diarrhoea.

In the current study, a high proportion of households consistently had adequate residual chlorine in their drinking-water as measured at both unannounced and regular visits; this suggests that they used the flocculant regularly, and consequently there was a larger health benefit. Reducing the concentration of calcium hypochlorite produced equivalent microbiological efficacy while reducing the objectionable chlorine taste associated with treatment; this contributed to higher use of the treatment. The percentage of households with adequate concentrations of chlorine in their drinking-water declined slightly during the study period, despite high levels of flocculant use. Thus households may have used the flocculant–disinfectant less often than daily, so daily use may not have been necessary to provide the sustained reduction in diarrhoea prevalence observed. Furthermore, using local women as field educators improved the acceptability and use of the flocculant-disinfectant. In most households, women prepare the drinking-water for the family, so frequent regular visits by an educator who was a well-known woman from the community seems to be an effective method of motivating regular use.

There are limitations to this study. We did not collect baseline data on episodes of diarrhoea occurring among the study population before introducing the intervention, so it is possible that groups had different rates of diarrhoea at baseline. However, equal numbers of intervention and control clusters were present in each village to account for possible differences in diarrhoea incidence between groups. A previous study in the same area of Guatemala did not reveal significant differences in baseline rates between groups.[9] In addition, our study was not blinded. It is possible that the intervention group or the control group could have given biased answers. Furthermore, the field technicians who collected the data were also used to provide the intervention, possibly introducing some courtesy bias. However, all data collection instruments were standardized, and all study workers were thoroughly trained.

This study demonstrates that in-home use of a flocculant–disinfectant to treat contaminated drinking-water successfully reduced diarrhoea among all age groups but most importantly it reduced it in the most vulnerable children, those < 1 year of age. In contrast to previous studies, behavioural change techniques were used throughout the study period: local women, who also used the intervention, acted as motivators by visiting households. Furthermore, the formulation of the flocculant–disinfectant had been changed to a newer one with less chlorine taste. Both of these basic changes to the intervention could be implemented in other settings where point-of-use strategies are needed. The flocculant–disinfectant costs approximately US$ 0.035 per sachet, so if the intervention were to be broadly implemented, it will be important that people are willing to purchase it. Additionally, efforts to explore any marketing challenges that arise should be pursued Given the reduction in the longitudinal prevalence of diarrhoea and in the number of episodes of persistent diarrhoea in this high-risk age group, we expect that this strategy, if broadly implemented, would also reduce mortality. Therefore, it is important to further study its effectiveness under various conditions and in different populations. ■

Table 3. **Percentage of households with free chlorine concentrations > 0.1 ppm in stored drinking-water as measured during periodic unannounced visits in trial of flocculant–disinfectant, Guatemala 2002–03**

Week of study	Intervention group[a] (*n* = 252)	Control group (*n* = 247)
3	66 (166)	5 (12)
6	38 (96)	2 (5)
10	44 (110)	5 (12)

[a] Values are percentage (number of households).

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Competing interests: The funding organization, represented by Bruce Keswick, contributed to the design of the study and the preparation and critical review of the manuscript. BK did not take part in the conduct of the study, or in data collection, analysis, or interpretation, nor did he approve the manuscript.

Résumé

Essai contrôlé et randomisé d'un traitement par un produit floculant/désinfectant pour l'eau de boisson visant à réduire la fréquence des diarrhées chez les enfants du Guatemala

Objectif Étudier les effets sur la prévalence de la diarrhée d'un nouveau traitement de l'eau de boisson par un produit floculant/désinfectant, appliqué au point d'utilisation et développé à l'échelle industrielle.

Méthodes Un essai contrôlé et randomisé a été mené pendant 13 semaines, du 4 novembre 2002 au 31 janvier 2003, chez 514 ménages ruraux du Guatemala, répartis en 42 agrégats définis par le voisinage. Les agrégats ayant reçu la consigne de traiter leur eau de boisson par le produit floculant/désinfectant ont fait l'objet d'une comparaison avec ceux manipulant l'eau selon des pratiques usuelles. La prévalence longitudinale de la diarrhée a été calculée comme le rapport du nombre total de jours où un ou plusieurs membres du ménage souffraient de diarrhée au nombre total de jours d'observation. Les prévalences ont été comparées au moyen du test de Wilcoxon.

Résultats Parmi les 1702 membres des ménages recevant le désinfectant, la prévalence de la diarrhée était inférieure de 40 % à celle observée chez les 1699 personnes manipulant l'eau de manière classique (0,9 % contre 1,5 %, p = 0,001). Les nourrissons membres des ménages utilisant le produit floculant/désinfectant présentaient une prévalence de la diarrhée moindre que les nourrissons des ménages ayant des pratiques classiques en matière de manipulation de l'eau (3,7 % contre 6,0 %, p = 0,005).

Conclusion Dans des zones où les familles traitent rarement l'eau de boisson, l'étude montre que l'on peut introduire un nouveau produit floculant/désinfectant capable de réduire la prévalence longitudinale de la diarrhée, en particulier chez les nourrissons, pour lesquels il existe une forte association entre diarrhée et mortalité. Réussir à introduire et à faire utiliser ce produit contribuerait à la prévention des maladies diarrhéiques dans le monde.

Resumen

Estudio aleatorizado controlado sobre la reducción de la diarrea en niños guatemaltecos mediante la adición de un floculante-desinfectante al agua de bebida

Objetivo Investigar el efecto que sobre la prevalencia de la diarrea infantil tiene un nuevo tratamiento del agua de bebida consistente en la adición en el lugar de consumo de un floculante-desinfectante.

Métodos Durante 13 semanas (entre el 4 de noviembre de 2002 y el 31 de enero de 2003), realizamos un estudio aleatorizado controlado en 514 hogares rurales de Guatemala, divididos en 42 vecindarios. Los vecindarios asignados al tratamiento del agua con el floculante-desinfectante se compararon con aquellos que siguieron las prácticas habituales de tratamiento del agua. La prevalencia longitudinal de la diarrea se calculó como el número de días con diarrea dividido por el número de días de observación. La prevalencia de diarrea se comparó con la prueba de la suma de rangos de Wilcoxon.

Resultados Las 1702 personas residentes en los hogares que recibieron el desinfectante presentaron una prevalencia de diarrea un 40% menor que las 1699 personas que siguieron las prácticas habituales de tratamiento del agua (0,9% frente a 1,5%; P = 0,001). Los niños menores de un año residentes en hogares donde se utilizó el floculante-desinfectante presentaron una prevalencia de diarrea un 39% menor que los residentes en hogares donde se utilizaron las prácticas habituales de tratamiento del agua (3,7% frente a 6,0%; P = 0,005).

Conclusión En zonas donde las familias raramente tratan el agua de bebida, la introducción de un nuevo floculante-desinfectante redujo la prevalencia longitudinal de diarrea, en particular en los niños menores de un año, en los que la diarrea se asocia estrechamente a la mortalidad. La introducción y uso de este producto podría contribuir a la prevención de las enfermedades diarreicas en el mundo.

ملخص

إنقاص الإسهال بين الأطفال في غواتيمالا: دراسة معشاة مضبّطة بالشواهد لاستعمال مادة مندِّفة ومعقمة لمياه الشرب

الهدف: دراسة تأثير معالجة جديدة لمياه الشرب طورت تجارياً لمندِّف معقم لمياه الشرب على معدلات انتشار الإسهال بين الأطفال.

الطريقة: أجرينا تجربة معشاة مضبطة بالشواهد شملت 514 من سكان غواتيمالا الريفيين، قسمناهم إلى 42 مجموعة متجاورة، واستغرقت الدراسة 13 أسبوعاً بدءاً من 4 تشرين الثاني/نوفمبر 2002 حتى 31 كانون الثاني/يناير 2003. وقمنا بمقارنة المجموعات التي عولجت المياه لديها بمادة مندِّفة معقمة مع المجموعات التي تستخدم المياه بالطريقة المعتادة لديهم. وحسبنا معدل الانتشار الطولي للإسهال باعتباره النسبة المئوية من مجمل أيام الإصابة بالإسهال مقسوماً على مجمل أيام الملاحظة مقارناً معدل انتشار الإسهال مستخدمين اختبار جمع المراتب لويلكوكسون.

الموجودات: كان معدل انتشار الإسهال بين من يستخدمون المعقم من السكان، وعددهم 1702، أخفض بمقدار 40% مما لدى الناس الذين يستخدمون المياه بالطريقة المعتادة لديهم وعددهم 1699 وهذا ما يعادل 3.7% مقابل 6.0% وقيمة لاحتمال 0.005 .

الاستنتاج: لقد أدخلنا مادة مندِّفة ومعقِّمة في مواقع لم تكن الأُسر تعالج فيها مياه الشرب إلا نادراً، وقد خفض ذلك معدل الانتشار الطولي للإسهال، ولاسيَّما بين الأطفال الذين تقل أعمارهم عن سنة واحدة، وهم الأطفال الذين يترافق الإسهال لديهم بمعدلات وفيات كبيرة. إن النجاح في إدخال هذه المواد المندِّفة والمعقمة قد يساهم في الوقاية من أمراض الإسهال على الصعيد العالمي.

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