In conclusion, the results of this study indicated that mechanical bowel preparation did not reduce microbial contamination of the peritoneal cavity or the subcutis during surgery. Furthermore, mechanical bowel preparation did not alter the correlation between bacteria cultured from the colonic anastomosis and those cultured from the subcutis after closure of the abdomen. Finally, mechanical bowel preparation did not alter the correlation between microorganisms isolated from subsequent wound infections and those isolated during the surgical procedure.

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RESEARCH NOTE

Clinical and mycological benefits of topical application of honey, olive oil and beeswax in diaper dermatitis

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ABSTRACT

Twelve infants suffering from diaper dermatitis were treated four times daily for 7 days with a mixture containing honey, olive oil and beeswax. The severity of erythema was evaluated on a five-point scale. Three infants had severe erythema and ulceration, four had moderate erythema, and five had moderate erythema with maceration. The initial mean lesion score of 2.91 ± 0.79 declined significantly ($p < 0.05$) to 2.0 ± 0.98 (day 3), 1.25 ± 0.96 (day 5) and 0.66 ± 0.98 (day 7). *Candida albicans* was isolated initially from four patients, but from only two patients after treatment. This topical treatment was safe and

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well-tolerated, and demonstrated clinical and mycological benefits in the treatment of diaper dermatitis.

Keywords Beeswax, *Candida albicans*, dermatitis, diapers, honey, olive oil

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Diaper dermatitis is the most common dermatological problem of infancy [1], occurring in 25–65% of children [2], and is caused by the combined irritant effects of wearing a diaper, urine and faeces [3]. Colonisation by *Candida* spp. is significantly more frequent in children with diaper dermatitis than in those with healthy skin, whereas colonisation by *Staphylococcus aureus* does not differ between these two groups [4]. Corticosteroids, zinc paste and eosin are well-known topical agents for the treatment of diaper dermatitis. It has been suggested that topical antifungal agents are not indicated for diaper dermatitis; indeed, their safety and effectiveness have not been established in infants [5].

Olive oil, beeswax and honey are natural products, containing flavonoids, and antioxidant, antibacterial and antifungal compounds, that affect the production of cytokines by skin cells when applied topically [6–11]. Previous studies have demonstrated the efficacy of a mixture containing honey, olive oil and beeswax (in a ratio of 1:1:1 v/v) for the treatment of dermatitis, psoriasis and skin fungal infections [12,13]. In the present pilot study, the effect of using this honey mixture to treat infants with diaper dermatitis was investigated.

Eight boys and four girls, aged 3–18 months and suffering from diaper dermatitis, were selected randomly for a pilot study. The infants developed dermatitis despite immediate bathing with warm water and replacement of a diaper following urination or defaecation. Informed consent was obtained from parents. At baseline, a thorough medical history was obtained and a complete physical examination was conducted. A moistened swab was used to sample the rash, erosion or ulceration, for mycological culture on Sabouraud glucose agar and subsequent testing for *Candida albicans*. Sampling was performed immediately before and at the end of treatment. Rash severity was assessed on a five-point scale (none = 0; mild erythema = 1; moderate erythema = 2; moderate erythema plus maceration = 3; and severe erythema plus pustules or ulceration = 4) at baseline and at days 3, 5 and 7 during treatment. Any new sign or symptom that appeared during therapy was recorded as an adverse effect. A positive therapeutic effect was recorded when a severe or moderate rash became mild or disappeared.

The topical treatment was prepared by thoroughly mixing natural honey, olive oil and beeswax (1:1:1 v/v; equivalent to (w/v) honey 50%, olive oil 29%, beeswax 21%). The honey was dark yellow in colour, and of multifloral origin; it contained (/100 g); 38 g fructose, 28 g glucose, water 20% v/v, 2.3 g vitamin C, 0.098 mg copper, 0.6 mg zinc, < 0.5 g sucrose, and 0.51 mg glutathione reductase. Natural olive oil prepared with the cold press method was used. The mixture was stored in the dark at room temperature until use.

The parents were asked to apply the topical treatment four times daily with gentle rubbing for a maximum of 7 days, and to bathe the infant with warm water and change the diaper following urination or defaecation. All parents used the same brand of diapers before and during the study. Infants who did not respond within 7 days were given conventional therapy, and the failure of the topical treatment was recorded. No other topical product was used during the study. The study was open, and it was deemed unethical to use a placebo on infants. Furthermore, any comparison with the use of standard therapy was postponed until the results of this pilot study were evaluated. Lesion scores were expressed as means ± standard deviations. ANOVA tests were used for the comparison of mean scores before, during and after treatment, with $p < 0.05$ deemed to be significant.

Culture of specimens collected from the lesions showed that *C. albicans* was present in four patients at baseline. *C. albicans* was associated with increased severity of rash. Of three infants who had severe erythema and ulceration, two were positive for *C. albicans*. Nine infants had moderate erythema, including five with maceration. The mean total rash score was 2.91 ± 0.79 at baseline (Table 1), decreasing to 2.0 ± 0.96