

A STUDY OF THE CUTANEOUS BACTERIAL FLORA, pH AND TEWL OF INFANT DETERGENT SOLUTION.

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Synopsis

Over the last few years there has been a growing tendency to use detergent products specifically designed for infant skin when diapers are changed.

These products consist of non-woven wipes moistened with detergent solution.

The purpose of this study was to establish whether the intensive use of the product over a period of at least fifteen days influences the cutaneous flora, pH and TEWL values and general skin conditions.

Riassunto

Negli ultimi anni si è verificato un aumento nell'uso di prodotti detergenti formulati appositamente per la pulizia della cute dei bambini durante il cambio dei pannolini.

Questi prodotti consistono in fazzoletti di cellulosa imbevuta con una soluzione detergente.

Con questo studio si è voluto stabilire se l'uso intensivo del prodotto, prolungato per almeno quindici giorni, possa influenzare la flora cutanea, il pH, la TEWL e le condizioni generali della cute.

Introduction

Current lifestyles have led to an increased use of detergent products.

The formulation of detergent and personal hygiene products is towards the use of solutions which are less irritating on the skin.

The aim of all producers and researchers in the field is to produce a detergent which cleanses the skin without altering its physiology.

Traditional detergents such as soap bars and liquid soap can be somewhat irritating on the skin, especially with repeated and frequent use.

The study of the mechanism of skin cleansing has revealed that, although superficial dirt is removed, this is accompanied by a thinning of the horny layer and of the hydrolipid film and also an alteration in skin penetration power and skin bacterial population.

It has been observed that alterations in skin pH value are a consequence both of the removal of the hydrolipid film and of the use of detergent products with a different pH value to that of the skin (1).

Alterations in the horny layer lead to a decreased water-binding capacity and therefore to increased transepidermal water loss (TEWL) (2,3). Furthermore, an alteration of the pH values is one of the main mechanisms involved

in the alteration of the cutaneous flora (4).

The above-mentioned phenomena may give rise to desquamation and irritative processes manifested as dry, erythematous skin. These effects are more common in infancy and early childhood than in adult life, due to the greater delicacy and sensitivity of the child's skin (5,6).

Recent years have seen the introduction of specific products for the cleansing of infants and young children, particularly of products for use during diaper-changing. These products are generally in the form of wipes, made of inert nonwoven material, wetted with a detergent solution containing a mixture of surfactants and emollient agents which cleanse while being very careful with the skin.

The aim of this study was to assess alterations in the cutaneous flora, skin pH values and TEWL values occurring after use of a product of this type. (LINES LINDO by FATER - Italy)

Furthermore, at the beginning and at the end of the trial, the presence or absence of irritative skin phenomena was recorded.

Materials and Methods

The trial was carried out on a group of 36 subjects (15 males and 21 females) aged between 4

Table I

pH AND TEWL VALUES

	BEFORE USE		AFTER USE	
	Value	ds	value	ds
pH	5.45	0.50	5.54	0.39
TEWL	15.08	5.97	13.02	4.0

and 30 month. All were wearing diapers continuously. At recruitment, subjects were examined by a dermatologist who ascertained that there were no apparent skin lesions, and took a microbiological sample. Skin pH and TEWL values were instrumentally recorded.

During the trial stage, lasting 15 days, the wipes were used continually, at each diaper change. At the end of this period, the subjects were examined once more by a dermatologist who recorded the presence or absence of irritative phenomena, the skin pH and TEWL values, and took another bacteriological sample. Instrumental recordings were taken from exactly the same site. At the end of the trial it emerged that 1-2 wipes had been used at each change.

Microbiological samples were taken by applying a sterile swab to the skin of the buttocks, at a site 2 cm. from the intergluteal furrow, on a surface measuring approximately 2 cm. X 2 cm.. The total microbe count was performed. A qualitative and quantitative investigation was made of micro-organisms, including saprophytes and potential pathogens, likely to be present in the diapered area:

- enterobacteria (E. coli; Proteus; S. faecalis)
- staphylococci (S. aureus, S. epidermidis)
- Pseudomonas aeruginosa
- Candida albicans.

Microorganisms were identified by the A.P.I. microbiological identification system (Suppliers: Bio Merieux Italiana).

The following galleries were used:

- A.P.I. 20 E for Enterobacteria
- A.P.I. 20 STREP for Streptococci
- A.P.I. AUX for Fungi.

Skin pH and TEWL values

Skin pH and TEWL values were measured at the same site. Recordings were taken ap-

proximately 2 minutes after removal of the diaper. Skin pH values were measured by a Beckman 31 pH-meter with a flat-membrane electrode (91-35 Orion). Recordings were taken when the values become stable on the display. The electrode was washed in distilled water and dried between each recording.

TEWL values were recorded at the same site after pH recordings with the sensing head of an evaporimeter Servomed EP-1.

The evaporimeter measures cutaneous hydrotension indirectly by determining the quantity of water which evaporates from the skin (7).

Statistical analysis

Student's two-tailed "t" test was used to compare the data collected before and after the use of the product. The number of bacterial populations was calculated as a logarithm in order to adapt to the normal distribution.

Values of $p < 0.05$ were considered statistically significant.

Results

The clinical examinations showed that the use of cleaning wipes produced no local irritation.

Furthermore, two cases in which mild irritative processes were recorded at the first examination showed complete disappearance of irritation after use of the product.

There were no variations in the microbe population, as shown by swabs taken before and after continual use of the product.

The total microbe population tended to normalize towards classes with lower numbers of colonies (Fig. 1).

Indeed all the micro-organisms examined showed this tendency.

We observed that E. Coli, which had very low populations before the test, showed no variation (Fig. 2); while S. Aureus showed more cases

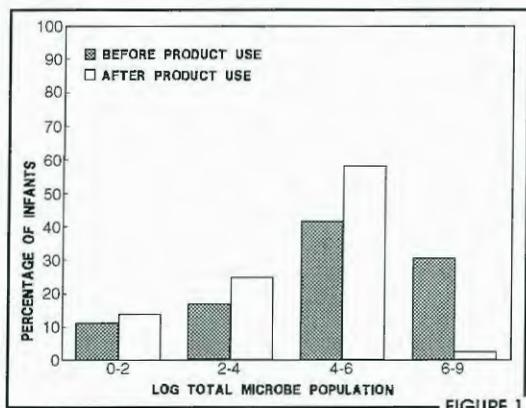


FIGURE 1

Distribution of the total microbe population in the sample examined before and after use of the product.

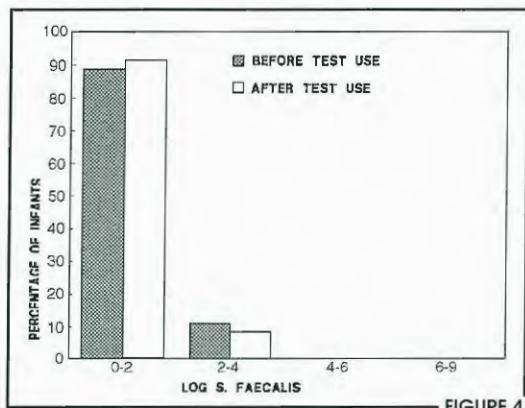


FIGURE 4

Distribution of the number of colonies of *S. faecalis* before and after use of the product.

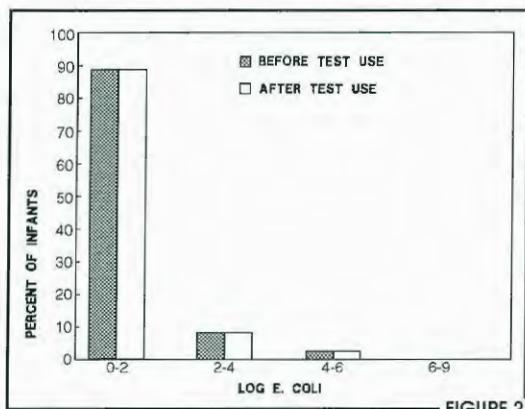


FIGURE 2

Distribution of the number of colonies of *Escherichia coli* before and after use of the product.

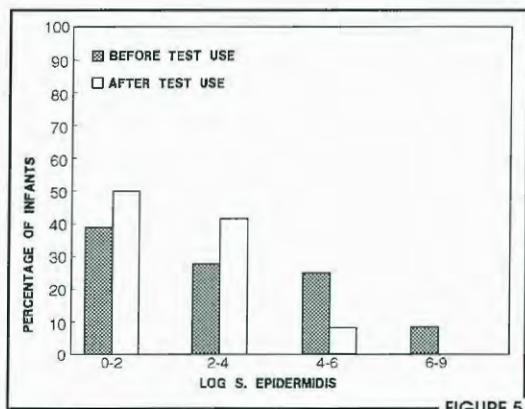


FIGURE 5

Distribution of the number of colonies of *Staphylococcus epidermidis* before and after use of the product.

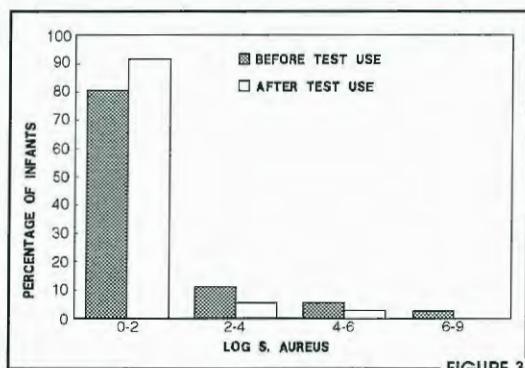


FIGURE 3

Distribution of the number of colonies of *Staphylococcus aureus* before and after use of the product.

with a lower number of potentially pathogenic colonies after use of the products (Fig. 3).

S. faecalis and *S. Epidermidis* (Fig. 4,5) also showed a lower number of colonies after use of the product.

Cases of *Proteus* and *Candida* were almost completely absent (one case of each, before and after use), while no cases of *Pseudomonas* were recorded.

pH and TEWL values are shown in table 1. pH values are similar to those recorded in other studies (8); statistical analysis does not show

significant differences between before-use and after-use values ($p > 0.05$).

TEWL values do not show statistically significant differences before and after use of the product ($p > 0.05$).

Discussion

The aim of the experiment was to assess whether use of a new cosmetic detergent on non-woven material would influence the cutaneous flora or the skin condition itself through chemical or mechanical action, leading to localised irritative phenomena.

Specific tests were therefore carried out.

Although clinical examination before and after the trial period may be influenced by a certain degree of subjectivity, no irritative phenomena were observed.

Moreover this result is confirmed by the objective parameters of skin pH and TEWL, which were not altered by use of the product.

The results of the microorganisms tests performed before and after use of the trial product are also important, in that they show a normal cutaneous bacterial flora, as regards both strains and number of colonies. The disappearance or decrease in number of potential pathogens (*S. aureus*, *Pseudomonas*, *Proteus*, *E. Coli*) was observed after use of the trial product.

This phenomenon may be related to the mechanical action of cleansing rather than to the chemical action of the detergent itself. The decrease in the number of fungal organisms (*Candida albicans*) which were initially present in some subjects may be similarly explained.

It can be concluded that use of detergent products containing substances which do not alter factors regulating skin physiology, such as a microbial flora and pH values, allows constant and long term cleansing even in subjects with sensitive skin, such as infants and young children, without giving rise to irritative phenomena.

References

1. Savermann G., Doerschner A., (1986): "Comparative study of the skin care efficacy on In-use properties of soap and surfactant bars." *J. Soc. Cosm. Chem.* **37**: 309-327
- 2.- Murahata R.I., Crowe D.M., Roheim J.R., (1986): "The use of transepidermal water loss to measure and predict the irritation response to surfactants." *Int. Journal of Cosm. Sc.* **8**: 225-231
- 3.- Leveque J.L., Garson J.C., de Rigal J., (1979): "Transepidermal water loss from dry and normal skin". *J. Soc. Cosmet. Chem.* **30**: 333-343
4. Binazzi M. (1988): "The flora cutanea (cap. 20). In: Trattato italiano di dermatologia - Serri F. - Ed. Piccin
5. Maibach H.I., Boisits E.K. (1982): Neonatal skin, vol. 1 Ed. Dekker
6. Zimmerer R.E., Lawson D., Calvert J. (1986): "The effects of wearing Diapers on Skin" *Pediatric Dermatology* Vol. 3 No 2: 95-101
7. Pinnacoda J., Tupker R.A. (1990): "Guidelines for transepidermal water loss (TEWL) Measurement." *Contact Dermatitis* **22**: 164-178
8. Bellucci R., Carlucci G., Di Girolamo R., Palumbo G., Guarracino M. (1989): "Skin pH in the diapered area." 5th International Congress of Pediatric Dermatology, Milano.