Journal of Medical Sciences

ISSN 1682-4474

science alert

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Research Paper

JMS (ISSN 1682-4474) is an International, peer-reviewed scientific journal that publishes original articles in experimental & clinical medicine and related disciplines such as molecular biology, biochemistry, genetics, biophysics, bio-and medical technology. JMS is issued four times per year on paper and in electronic format.

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J. Med. Sci., 5 (4): 320-323
October-December, 2005

Skin Lesions Induced by Sodium Lauryl Sulfate (SLS) in Rabbits

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The objective of this experimental study was to elucidate the damaging effect of sodium lauryl sulfate on the skin of rabbits. Ten adult domestic rabbits (5 males, 5 females) maintained at Animal house, were used. The animals were exposed to 5% solution of sodium lauryl sulfate, by brushing on the back region, for 8 weeks (between October and December 2004). All exposed rabbits developed wide area of allopacia (hair loss) and frequent skin erosions. The affected skin was dried and wrinkled. The animals were depressed and markedly emaciated. The clinical signs commenced with the onset of the skin lesions. It was concluded that sodium lauryl sulfate is a skin irritant and can provoke skin lesions in the form of eczyma and dermatitis.

Key words: SLS, skin lesions, rabbits, allopacia

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INTRODUCTION

Sodium Lauryl Sulfate, SLS (synonymously called Sodium dodecyl sulfate, SDS) [CH_3 $(CH_2)_{11}$ OSO_3 Na] (MW 288.38) is an anionic (negatively charged) surfactant used as a cleansing agent (detergent) in cosmetics[1,2]. It is prepared by the sulphation of commercially available lauryl alcohol from coconut oil. The molecule has a tail of 12 carbon atoms, attached to a sulfate group, giving the molecule the amphiphilic properties required of a detergent. This foaming detergent is cheap, used in personal care products and small amount generates a large amount of foam[3]. SLS is used as a detergent in most (90%) of commercial soaps and shampoos. Additionally, it is found in large number of personal care products including toothpastes, body wash, cleansers, facial cleansers, bath oils/salts/bubbles, liquid hand soap, Baby bath wash, hair removers, fragrance/perfume/cologne, sunscreen/tanning oil, conditioners, styling products and makeup removers. Unfortunately, most of data reporting, describing and discussing the probable effects of SLS was sourced from net databases[4-14]. The available data is contradicting as to the toxicity of SLS, i.e. while some reports indicate some damaging effects, others deny any harmful effects for use of SLS[15,16]. According to available information, the experimental studies on SLS used oral and intraocular routes of administration and the applied concentrations were high approaching 20% in case of intraocular administration. To the best of the author's knowledge, there is a paucity of experimental data concerned with the effect of SLS on the skin of experimental animals. Therefore, the present study was undertaken to elucidate the probable damaging effect of SLS after cutaneous application in rabbits.

MATERIALS AND METHODS

Animals: Adult domestic rabbits (4 months of age) weighing 2300-2450 g, obtained from the colony kept at King Saud University, were used. The animals were maintained under the standard experimental conditions, including temperature (25°C) at the animal house, College of Science, King Saud University. Feed and water were available *ad libitum*.

Chemical substance: Sodium Lauryl Sulfate (SLS) (Winlab Co., UK) was dissolved in distilled water and used at concentration of 5% (w/v).

Experimentation: After one week acclimatization period, animals were randomly divided into two groups, the first was the exposed one (n=10, 5 males and 5 females) and the second one served as control (n=5). Animals of the first group were exposed to daily cutaneous application of SLS by mean of a gentle brushing on the back region for 8 weeks (from October to December, 2004), during this period, the exposed animals were observed for developing skin lesions and clinical signs were also recorded.

RESULT AND DISCUSSION

Exposed rabbits (males and females) manifested wide skin areas of allopacia (hair loss), severe dermal congestion, frequent skin erosions and also developed dermal crusts (Fig. 1 and 2). The affected skin was apparently wrinkled and dried. Clinically the exposed rabbits were dull, depressed, emaciated and their feed intake was markedly decreased. Consequently, body weight of the exposed animals was progressively

Fig. 1: Rabbit exposed to SLS for 8 weeks showing wide area of allopacia (hair loss) on the back region (arrow)

Fig. 2: Close up for the skin lesions manifested by the rabbit in Fig. (1). Note the skin erosions

Fig. 3: Rabbit exposed to SLS for 8 weeks manifesting severe emaciation evidenced by the weak musculature and projection of vertebral column.

Fig. 4: Rabbit exposed to SLS for 8 weeks showing large sized coalescent skin erosions (arrows). The exposed rabbit is markedly emaciated

decreased approximating 1900 to 2100 g at end of the experimentation period compared with that of controls (3200 to 3300 g) (Fig. 3 and 4). Response of the exposed rabbits to external stimuli was much lower and slower than that of control animals. The aforementioned clinical signs commenced with the onset of the described skin lesions.

Since the skin is the body's largest organ and most of the exposure to the chemicals in cosmetics is via skin, the cutaneous route of application of SLS has been chosen in the current study.

The detergent SLS or SDS contained in most of the commercial soaps and shampoos can be retained in tissues up to 5 days even after a single drop. This finding may partially interprets the resultant skin damage demonstrated in the present study. One of the mechanisms explaining the damaging cutaneous effects of SLS is that it has the ability of stripping off the oil layer and then irritating and eroding the skin, leaving it rough and pitted. Moreover, SLS has been found a skin irritant that can penetrate and impair the skin barrier[17] and also enhance the allergic response to other toxins and allergens[18-20]. At the cellular level, SLS has a degenerative effect on the cell membranes because of its protein denaturing properties. Few studies have provided an evidence that SLS has systemic effects since it can penetrate, enter the blood stream and be retained in the eye, brain, heart and liver with potentially harmful long-term effects. Possibly the most serious sequel of using SLS (SDS) is its tendency to react with other commonly used ingredients to form NDELA (N-nitrosodiethandamine), a potent carcinogen nitrosamine[21-23]. In this respect, large amounts of nitrates may enter the blood system from just one shampooing. According to the present results, it seems that no sex-related factors interfere with the effect of SLS, since both males and females manifested skin lesions.

The present demonstrated skin lesions indicate that SLS is a skin irritant and the resultant skin lesions are strongly indicative of SLS-induced eczyma and dermatitis.

The current study presents an example of the damaging effects which could be induced by an ingredient contained in many personal care products, especially soaps, shampoos and toothpastes. The ingredient of concern, SLS (SDS) may be found in these products at higher concentrations (up to 15% in shampoos) than that employed in the present study. Supposing contained at lower concentrations and the daily use of the care products applied to the skin is taken into consideration, one might expect some harmful effects on the long-term use.

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