

Review

Reducing the stress of infants by skin care

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Abstract

The horny layer of the skin of infants is thin and their barrier functions are weak due to a lack of skin surface lipids. Also, compared with adults, infants possess fewer amino acids as natural moisturizing factors. They also have more sweat glands per body surface area compared with adults. Infant skin is prone to drying and the high level of perspiration while they sleep attracts ticks to attach to the skin, which are causes of bacterial infection and allergies, leading to itchy skin. The skin becomes sensitive by being scratched, leading to a vicious cycle of increasing risks of infection and allergies.

Skincare using Sugar Scrub causes an increase in the amount of sebum, and a previous study reported improvements in scratching due to dry skin (Yamaguchi M et al., 2009). This study was aimed to show whether skincare using Sugar Scrub when bathing helped prevent itching and was effective to reduce stress. Infants aged 0-2 years old were the subjects of the study, and a comparison study was conducted with a group of 10 infants receiving no intervention, a group of 10 infants who only bathed, and a group of 10 infants who bathed with Sugar Scrub. As a result, there was no change in the salivary amylase, pulse, or SpO₂ value in the control or bath group. The Sugar Scrub group showed a significant reduction in salivary amylase ($p < 0.05$), which suggested that Sugar Scrub was effective to reduce stress.

Key words: skincare, infants, Sugar Scrub, stress, massage

I. Introduction

The skin of infants and toddlers has a thin keratinous layer and its barrier function is immature. Compared with the skin of adults, it contains less skin surface sebum and fewer natural amino acid moisturizers (Simojyo, et al., 2001). Accordingly, their dry skin is subject to infection due to invasion by various bacteria via scratches caused by itching the skin (Yamamoto, 2001; Kuwabara, et al., 1992). Skin problems of children are mostly eczema or diaper rash

because the number of perspiration glands per body surface area is higher than those of adults. The prevalence of atopic dermatitis among children is 10 to 15% (Furuie, 2008). Because of such skin problems, children are subject to itchiness or sleeping disorder, which is quite stressful.

To improve the situation, researchers have attempted skincare for infants and toddlers utilizing Sugar Scrub, a product by Abyssal Japan, since 2007. In 2007, a comparison was conducted between a group treated with a Sugar Scrub bath

(experimental group) and one with a bath but no Sugar Scrub (control group). Both groups consisted of 14 children. Skin moisture levels were measured before 30 minutes after the bath. The increase in moisture was significant in the experimental group. It was revealed that Sugar Scrub helps increase skin moisture (Yamaguchi, Imamura et al., 2009). Scratches observed before starting the use of Sugar Scrub were alleviated a month after starting it. In 2008, children with skin problems were treated with Sugar Scrub. Sebum content changes after the care and skin condition changes induced by the long-term use of Sugar Scrub were observed. The skin of children aged three months to four years became almost rash-free after the application of Sugar, and skin problems such as scratches were alleviated. It has already been reported that Sugar is effective to heal wounds (Kou, Taahashi, et al., 2004; Fuse, Ohsaga, 2004; Ruike T, et al., 2006). It is expected that Sugar will also be effective to reduce itching or pain caused by scratching. The skin surface sebum content after the care increased, and improvement of the barrier function was confirmed (Imamura, Yamaguchi, et al., 2009).

In 2010, 30 children with skin problems aged two or younger, whose keratinous layers were particularly thin, received skincare. The water content, skin elasticity, and sebum content before and after the care were examined. All values increased significantly after the care. It was revealed that Sugar was effective for the skincare of infants and toddlers (Yamaguchi, Takeuchi, et al., 2014).

This study focused on stress alleviation induced by improving skin conditions of children. The stress of both mothers and children will be mitigated by proper skincare for children. Rashes caused by perspiration and insect bites in summer and interactions among children at nursery are stressful for children. In addition, stress such as that caused by sleep deprivation and fatigue may increase for mothers (Tanaka, Iwamoto, 2005). In other words, by applying Sugar Scrub skincare to an infant who is stressed because of perspiration-induced itching, diaper rash, sleep disorder, etc., the symptoms of the skin are improved, the stress of the infant is alleviated, and sufficient sleep is obtained. A child's ability to obtain sufficient sleep may reduce the mental burden on the mother (Iijima, Inoue, 2015). This study may also help reduce the problems of 'child abuse deaths' and 'unstable parent-child relationships' which are modern social problems (Nakano, Tsuchiya, 1999).

Sugar particles are coated with essential or

plant oils to avoid stimulating the skin. The skincare also involves cleansing and massage to allow sugar to smoothly permeate the keratinous layer and speed up the healing process. In this manner, Sugar not only heals the skin but also aids in developing attachment — the bond between mothers and children. This will promote a favorable parent-child relationship (Syouji, et al., 2013).

Hand massaging of the skincare will alleviate stress (Field, 2005; Okada, Hirata, 2012) and baths are relaxing (Kudou, et al., 2006). The moisturizing action of the skincare will prevent scratches and children will feel less stressed. However, there has been no research on skincare using sugar and the stress-relieving effect of bathing without sugar. 3 groups, a control group, bath group, and Sugar Care group, were compared and analyzed to discuss stress alleviation mediated by Sugar Scrub skincare. Changes in the pulse, SpO₂, and salivary amylase activity (sAA) were used as indicators of psychological stress-mitigating effects. Since the measurement of cortisol is not a suitable measurement index for stress evaluation in infants, salivary amylase, which can be easily measured, was used.

II. Method

1. Research Subjects :

Infants who are 2 years old or younger have a thin stratum corneum on the skin surface and easily develop dry skin due to a lower secretion of sebum, and this tends to cause stress due to itching and scratches caused by drying (Yamamoto, 2004). For this reason, the subjects were 30 children under the age of 3, who attended a nursery in O City.

Sugar Scrub (ABYSSAL Japan Co., Ltd.) characteristics :

- 1) Sugar Scrub consists of highly absorbable sugar. The sugar easily permeates the skin keratinous layer on massage and prevents the skin from drying due to its moisturizing action.
- 2) Sugar granules are coated with plant oil (80% sugar beet and 20% food oil). They reduce stimulation of the skin and have a cleansing effect.
- 3) Itchiness and pain of the skin are alleviated because sugar promotes the healing process.

2. Experiment :

Grouping : Thirty subjects were classified into three groups (n=10): 1) Skincare

group (control group), 2) bathing group (bath group), and 3) Skincare group using Sugar Scrub (Sugar Scrub group). In order to minimize bias age group assignment involved stratified randomization by age.

Skin test before the experiment: Sugar was dissolved in several drops of water, and then applied to the inner forearm of the three groups. The skin was examined 15 minutes later to assess the medical safety of the application. Any child showing symptoms including slight reddening of the skin was excluded.

Care and data collection: The pulse, SpO₂, and salivary amylase were measured before and after skincare. SpO₂ was measured by wrapping a pulse oximeter probe for children around their toes. The salivary amylase activity was measured within 1 minute after collection using a salivary amylase monitor (CM-3.1 manufactured by NIPRO Co., Ltd.). A drop of saliva was placed on a measurement chip and its amylase content was measured within a minute. Measurement was conducted twice, 10 minutes before and after the bath. Cortisol contained in saliva was initially planned to be used for stress measurement, but it would be difficult to obtain a sufficient saliva sample from children for measurement in a short period of time. Instead, salivary amylase was collected. Salivary amylase is secreted within one to a few minutes by direct nerve action. The response is much more rapid than hormone action. The salivary amylase activity also changes sAA, which is one of the digestive enzymes contained in saliva, when the activity of the sympathetic nervous system fluctuates (Murakami, 2009).

Salivary amylase stress monitor: The salivary amylase stress monitor used in this study consists of a disposable tip and body. Because of the following advantages, this meter was adopted;

- 1) Sampling is easy and stress-free for children both psychologically and physically.
- 2) Sampling of 100 μ l can be done within a

minute (using monitor chips).

- 3) Analysis can be done within a minute.

Based on these merits, we decided to measure sAA using a salivary amylase monitor as an index of stress.

3. Each group's skincare :

- (1) Control group: They played freely for 10 minutes. Measurements were conducted twice, before and after, at the same timing as the in other two groups.
- (2) Bath group: 38°C water was prepared, a bath was given for 2 minutes, and children were massaged to wash the whole body with bare hands. Data were collected 10 minutes before and after bathing.
- (3) Sugar Scrub group: 38°C water was prepared, a bath was given for 2 minutes, the water was drained, and gentle massage with Sugar Scrub was applied, followed by a light shower. Data were collected 10 minutes before and after bathing and showering (shower).
- (4) Notes: Children's mood and activeness were observed before and after the care for the Bath and Skincare groups.

4. Statistical analysis :

Mean values of the data before and after the care were calculated. A multiple comparison test by Tukey HSD method was carried out in order to compare mean values of 3 independent variable among groups (pulse, SpO₂, and salivary amylase) before and after skincare. Also, in order to eliminate the influence of individual differences, the percentage after skincare, with 100% before skincare, was taken as the rate of change by skincare. The t-test was conducted to compare before-and-after values. The statistical software used was SPSS 21.0 J for Windows.

5. Ethical consideration :

The guardians were informed of the objective of the research and that their human rights would be respected. They consented to the study. They were also informed that the study would be discontinued at any time if the children did not wish to continue. The university's ethical committee approved this study.

This study was performed by ABYSSAL Japan Co., Ltd., under contract.

III. Results

1. Subjects age :

The age of the subjects ranged from 10 to 33 months (average : 18.87 ± 4.95 months) (Table 1).

2. Results of analysis :

1) Changes in pulse, SpO₂, and sAA

The results are shown in Table 2. Before-and-after measurements of pulse, SpO₂, and sAA were conducted of the control group, bath group, and Sugar Scrub group, all consisting of ten children. For the change in pulse and SpO₂ before and after skincare, a multiple comparison test among the 3 groups was conducted. As a result, there was no significant difference among the 3 groups. However, in sAA before and after skincare, as a result of the multiple comparison test among the 3 groups, the change of sAA in the sugar care group was lower than that in the control group ($p < 0.05$).

2) Change rate of pulse, SpO₂, and sAA

The results are shown in Table 3. As a result of

multiple comparison tests among the 3 groups, no significant difference was observed in pulse or SpO₂. Only sAA showed a tendency to decrease in the sugar care group compared with the control group ($p < 0.1$).

3) Statistical analysis of group comparison of before-and-after mean value difference

The results are shown in Table 4. For each variable, a corresponding t-test was performed before and after skincare, and as a result, no significant difference was observed between pulse and SpO₂ in the 3 groups. However, sAA after skincare was significantly lower than that before skincare ($p < 0.05$).

IV. Discussion

When measuring cortisol as an indicator of stress, it is considered that the reliability of data will be impaired due to the stress on infants caused by saliva collection (Oohira et al., 2005). In this study, we used a pulse oximeter that does not stress the child during measurement of the pulse, so we were able to obtain reliable data. The measurement of sAA using a salivary amylase monitor is useful because it is only necessary to collect saliva with a tip, and so we can evaluate stress without causing pain, which is considered to be a useful method.

In this study, it was suggested that skincare for Sugar Scrub significantly reduces sAA and relieves stress. No difference was observed in the pulse or SpO₂ as an index of the autonomic nervous system among the 3 groups. However, the change in sAA, an index of stress, showed a

Table 1 Age in months among the 3 different groups ($n=30$)

	Mean \pm SD (in months)	Min (in months)	Max (in months)
Control ($n=10$)	21.70 ± 6.02	10	29
Bath ($n=10$)	15.90 ± 2.56	13	20
Sugar Scrub ($n=10$)	19.00 ± 4.24	13	26
Total	18.87 ± 4.95	10	29

Mean \pm SD, minimum, and maximum ($n=10$ for 3 groups) are shown. Control group : They played freely for 10 minutes. Bath group : 38°C water was prepared, a bath was given for 2 minutes, and children were massaged to wash the whole body with bare hands. Sugar care group : 38°C water was prepared, a bath was given for about 2 minutes, the water was drained, and gentle massage with Sugar was applied, followed by a light shower.

Table 2 Changes in pulse, SpO₂, and sAA

	Control	Bath	Sugar Scrub	Total	<i>F</i>
	mean \pm SD	mean \pm SD	mean \pm SD	mean \pm SD	
Pulse (beats/min)	1.10 ± 9.74	1.90 ± 8.90	-1.90 ± 13.64	0.37 ± 10.70	0.33
SpO ₂ (%)	0.70 ± 1.06	-0.10 ± 0.74	0.50 ± 0.97	0.37 ± 0.96	1.99
sAA (kU/l)	$7.80 \pm 40.50^*$	-13.70 ± 32.18	$-32.80 \pm 37.84^*$	-12.90 ± 38.62	3.18

*= $p < 0.05$

Changes in pulse, SpO₂, and sAA. Pulse showed no significant difference among the 3 groups. SpO₂ showed no significant difference among the 3 groups. sAA in the sugar care group was lower than that in the control group ($p < 0.05$).

Table 3 Change rate of pulse, SpO₂, and sAA

	Control	Bath	Sugar Scrub	Total	<i>F</i>
	Mean \pm SD	Mean \pm SD	Mean \pm SD	Mean \pm SD	
Pulse (%)	101.47 ± 9.18	101.99 ± 7.67	98.95 ± 11.43	100.80 ± 9.31	0.29
SpO ₂ (%)	100.71 ± 1.08	99.90 ± 0.75	100.51 ± 1.00	100.38 ± 0.98	1.97
sAA (%)	$206.56 \pm 232.85 \dagger$	87.05 ± 52.57	$60.06 \pm 36.47 \dagger$	117.89 ± 149.30	3.13

$\dagger = p < 0.1$

Change rate in pulse, SpO₂, and sAA. Pulse showed no significant difference among the 3 groups. SpO₂ showed no significant difference among the 3 groups. sAA in the sugar care group was lower than that in the control group ($p < 0.1$).

Table 4 Pulse, SpO₂, and sAA among the 3 groups (n=30)

		pre	post	<i>t</i>	df	<i>p</i>
		Mean±SD	Mean±SD			
Control (n=10)	Pulse (beats/min)	106.0±7.30	107.1±6.56	0.36		0.73
	SpO ₂ (%)	98.7±0.67	99.4±0.69	2.09	9	0.07
	sAA (kU/l)	21.1±15.59	28.9±37.05	0.61		0.56
Bath (n=10)	Pulse (beats/min)	116.3±13.42	114.4±13.75	0.44		0.67
	SpO ₂ (%)	98.9±0.99	99.4±0.69	1.63	9	0.14
	sAA (kU/l)	74.6±53.16*	41.8±40.27*	2.30		0.02
Sugar Scrub(n=10)	Pulse (beats/min)	116.3±13.42	114.4±13.75	0.44		0.67
	SpO ₂ (%)	98.9±0.99	99.4±0.69	1.63	9	0.14
	sAA (sU/l)	74.6±53.16*	41.8±40.27*	2.30		0.02
Total	Pulse (beats/min)	113.70±11.91	114.07±11.35			
	SpO ₂ (%)	98.83±0.79	99.20±0.71	—	—	—
	sAA (sU/l)	43.50±41.58	30.60±32.38			

* =*p*<0.05

Mean±SD in pulse, SpO₂, and sAA. Pulse showed no significant difference between pre and post skincare. SpO₂ showed no significant difference between pre and post skincare. sAA after skincare was significant lower than before skincare (*p*<0.05).

significant decrease (*p*<0.05) in the skincare compared with other groups. In addition, the rate of change of sAA also showed a tendency to be lower in the skincare compared with other groups (*p*<0.1). From these results, we suggest that skincare using Sugar Scrub has the effect of reducing stress.

As an effect of massage, children's stress decreases and they are considered to grow healthily. Therefore, it has been reported that maternal child-rearing stress and mental stress are alleviated, and affection for the children increases (Iijima, et al., 2015).

In addition, it was reported that infant massage is effective for promoting attachment between mothers and infants and the alleviation of child-rearing stress (Tanaka, Iwamoto, 2004; Okuda, Hirata, 2012). Sugar skincare not only alleviates children's stress, but also promotes mental development. It may be helpful for reducing mothers' child-rearing stress and childcare burden. Additionally, skincare using sugar improves the relationship between mothers and children and helps to build trust.

The relaxing effect of a bath was previously reported (Kudou, 2006). The relaxing effect of massage on newborns was also reported (Nitta, et al., 2002; Fuse, Ohsaga, 2004; Iwazaki, Nomura, 2005; Yoshinaga, et al., 2005; Mitsumori, Yamaguchi, 2009).

Within the uterus, babies are protected in fluid but the environment becomes dry after birth and the skin becomes fragile (Marty, Ranjit, 2002). The necessity of skincare for newborns has been suggested (Yamamoto, 2004). However, insufficient research on skincare has been conducted in the field of nursing. Preceding studies provided

important data on the skincare of infants, focusing on barrier function enhancement by increased sebum (Yamaguchi, et al., 2009; Imamura, et al., 2010; Shimatani, et al., 2012). The results of this study support the stress-relieving effect of Sugar Scrub.

When infant skin problems occur, most consult a dermatologist and receive a diagnosis. After that, at home, the mother applies the medicine prescribed to the child. It has been suggested that keeping the skin clean is the first step for treating atopic dermatitis (Sasaki, 2004). However, the treatment tends to depend on the doctor's prescription.

The skin with ointment application before going to bed may be contaminated by miscellaneous bacteria, ticks that cause allergies, etc., the following morning. Therefore, the next morning is facial cleansing session is important when applying ointment (Kuwabara, et al., 1992; Sasaki, 2006). However, the importance of cleaning the child's face in the morning was only recognized by 60% of mothers. Knowledge regarding the fact that wiping the salve off is also an important skincare practice may be insufficient (Yamamoto, 2004). Eczema might be temporarily cured but may progress to skin allergy due to a lack of basic skincare. Sugar is suggested to be a useful skincare tool for children from many aspects: it is relaxing when applied in warm water and stress-relieving due to the massage effect.

It was determined that the use of salivary amylase as a stress index was easy for the children and contributed to the reliability of the data. Massage can be done safely with bare hands without damaging the skin. Such a massage is a form of physical contact between a mother and

child, and as a result, the mother's stress is alleviated. Such a physical contact will help mothers develop deep affection for their children.

V. Conclusions

In this study, we examined the effect of Sugar Scrub to relieve the stress of infants. Sugar skincare may be considered effective because of its stress-alleviating. Skincare using sugar suggested that sAA was significantly decreased, and that the effect of reducing stress was effective. Sugar has a wound-healing-promoting effect, and promotes the barrier function. This study further clarified its effect to alleviate the stress of children. Infants cannot verbally communicate the stress caused by dry, itchy skin. Their stress will be reduced by alleviating the skin damage with Sugar.

As research subjects, there was a difference among the groups in the data before the experiment, and so it is necessary to conduct a more detailed analysis in the future.

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