

Review

Effects of sugar scrub skin care on low birth weight infants in NICU

— Enhanced barrier function —

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Abstract

The skin of low birth weight infants (LBWIs) admitted to the neonatal infant care unit (NICU) has a very thin keratinous layer and is vulnerable to external irritation due to sparse connective tissues, which causes skin disorder easily. A bath using sugar scrub (formulation made of beet sugar and essential oil) has the mildest impact on babies, keeps the skin clean, increases the sebum content, and is expected to enhance the barrier function. The purposes of this study were to clarify the effectiveness of sugar scrub skin care on newborns by comparing a baby soap group and sugar scrub group, and to consider better skin care methods.

The subjects were newborns who are born lighter than 2,500 g in NICU & GCU, having a conceptual age of 36 weeks or older. Baby soap was used for control group of six and sugar scrub for experimental group of eight. All were given a bath in the same manner. Data on the sebum content of the chest was collected by a Sebumeter (Sebumeter® SM 815; Courage+Khazaka) before and ten minutes after the bath for comparison.

The sebum content of the soap group was 3.27 ± 3.18 (mean \pm SD) before the care and 2.30 ± 2.75 after the care. That of the sugar group was 7.37 ± 10.77 before the care and 61.60 ± 15.83 after the care. A significant increase was identified. The difference in sebum content before and after the care was -0.97 ± 0.49 for the soap group and 54.23 ± 21.75 for the sugar group. The sugar group showed a significant increase.

The sugar scrub skin care will contribute to an enhanced barrier function by increasing the sebum content.

Key words: sugar scrub, skin care, newborn, sebum content, barrier function

Introduction

The skin of infants, with a thin keratinous layer and little sebum on its surface, has a poor barrier function. Naturally, their skin surface is vulnerable to damage. It is also easily contaminated by bacteria (Baba, 2004; Kuwabara et al.,

1992). It has been reported that repeated infections can be a cause of skin allergy (Shimojo, 2001; Yamamoto, 2004). It usually takes 40 weeks for the five layers, from basal to keratinous, of the skin to become fully formed (Nishida, 2012). Babies born prematurely, therefore, are particularly vulnerable to skin disorder.

Most babies who are born lighter than 2,500 g and admitted to the Neonatal Infant Care Unit (NICU) have a younger gestational age (GA) at birth and their immature skin surface is exposed to the environment. Their keratinous layer is very thin. Connective tissues are sparse and vulnerable to external irritation. Their skin can be damaged easily by irritation. Their barrier function is underdeveloped, easily allowing bacteria to infect the body. When the skin pH becomes alkaline, the risk of skin infection increases. Therefore, the barrier function of skin has to be improved to prevent skin injuries and infections of low birth weight infants (LBWIs).

The transdermal water transpiration rate, keratinous layer water content, pH, and sebum content are regarded as useful to evaluate the skin barrier function, (Chiou et al., 2004; Garcia Bartels, 2009, 2011). Some researchers including the author of this study (Yamaguchi et al., 2009, 2010, 2011) applied sugar scrub skin care (formulation made of beet sugar and essential oil) to infants aged three months or older and younger than four years, and suggested that this skin care potentially enhanced the barrier function by increasing moisture and sebum of the skin. At the same time, much remains unclear about newborns' sebum and barrier function. Further research, therefore, is required (Kanti et al., 2014).

The bed-bath technique to prevent newborns from getting infections involves wiping the entire body gently with soft material such as cotton. A bath with baby soap is commonly performed to prevent the infections and low body temperatures. The use of baby soap, however, tends to increase alkalinity of the skin, and so increase the risk of infection. An appropriate technique to dry the skin is also required to prevent damage. The simple sugar scrub bath has the mildest impact on babies, keeps the skin clean, increases the sebum content, and is expected to enhance the barrier function.

The purposes of this study were to clarify the effectiveness of sugar scrub skin care on newborns by comparing a baby soap group and sugar scrub group, and to consider better skin care methods.

Methods

1. Study period: October 25, 2012 to March 31, 2013
2. Subjects: Newborns in NICU & GCU (36 weeks or older; moved to cot)
The subjects had a conceptual age of 36

weeks or older, considering that breathing, the body temperature, and skin condition become stable in this stage. The newborns had to show stable breathing and body temperature, normal sucking (compatible sucking and swallowing reflexes), wakefulness while being breastfed and dormancy after the feed, healthy crying, and active behavior.

3. Procedures:

Before giving their consent, parents and guardians of the subjects were given an explanation about the study using graphs and shown brochures on the sugar scrub to be used, and told that that they must cooperate based on their own free will and could terminate their involvement at any time without detriment. They were allowed to choose whether their child received sugar scrub or soap. We assigned subjects to the sugar scrub or soap group based on the choices.

- 1) Bath water at 38°C was prepared and the soap group (6 subjects) and sugar scrub group (8 subjects) were given a bath.
- 2) The babies were dried with a large towel. The skin condition of their entire body was examined before they were clothed.
- 3) Data on the sebum content of the chest was collected by a Sebumeter (Sebumeter® SM815; Courage+Khazaka) before and ten minutes after the bath.
- 4) Before the sugar scrub bath was given, a skin test was conducted for the sugar group. Sugar scrub was dissolved in water and applied to the inner part of the forearm. Then a doctor examined it after 15 minutes. If the absence of an adverse reaction was confirmed, the bath was given to the subjects.
- 5) The experiment was stopped immediately if a newborn showed rejecting behavior, such as uncontrollable crying or grimacing).
- 6) Water was applied to the skin of the newborns after measurement of the sebum content.

4. Analysis method

The attributes and sebum distribution were confirmed. Sebum contents before and after the care were compared. Differences in the sebum content before and after the care were compared between the two groups. A t-test was used to compare the means of differences between the two groups. The significance level was set 0.05 and a statistical

test was conducted (statistical software: windows SPSS20.0J).

5. Ethical and social consideration
 - 1) Protection of human rights & privacy
 - (1) The objective and method of the study were explained to the parents and guardians both orally and in writing. It was clearly communicated that participation in the study was on a voluntary basis and that terminating cooperation would always be accepted without any detriment.
 - (2) The subjects were identified by code and the data were protected.
 - 2) Consideration of any possible detriment and risk to the subjects caused by the study
 - (1) The newborns were treated in the most cautious and careful manner to avoid any possible negative impact on them.
 - 3) This study was approved by the ethics committee of the university before initiation.

Results

The GA of the soap group at birth was 29 to 38 weeks. That of the sugar group was 29 to 37 weeks. The birth weight of the soap group was 1,076 to 2,444 g. That of the sugar group was 1,076 to 2,454 g. The age during the study period of the soap group was 36 to 40 weeks. That of the sugar group was 37 to 42 weeks. The weight of the soap group during the study period was 2,021 to 2,407 g. That of the sugar group was 2,120 to 2,545 g. Fig. 1 shows the association between the respective attributes and sebum content before the care.

Fig. 2 shows the sebum content of individuals in the two groups before and after the care. The sebum content of the soap group was 3.27 ± 3.18 (mean \pm SD) before the care and 2.30 ± 2.75 after the care. There was no significant difference. That of the sugar group was 7.37 ± 10.77 before the care and 61.60 ± 15.83 after the care. A significant increase was identified ($p < .0001$).

The difference in sebum content before and after the care was -0.97 ± 0.49 for the soap group and 54.23 ± 21.75 for the sugar group. The sugar group showed a significant increase ($p < .0001$) (Fig. 3).

The newborns with a younger GA at birth did not necessarily show a lower sebum content according to the individual differences in the sebum content of the sugar group. A newborn whose GA at birth was 37 weeks showed an

increase in the sebum content from 22.5 to 54. A newborn whose GA at birth was 31 weeks and who weighed 1.540 g showed a marked rise in the sebum content from 0.5 to 70.67. In the case of newborns whose GA at birth was 37 weeks or younger, their sebum content before the care was low but their overall sebum content rose sharply after the care. This suggested the effectiveness of the sugar scrub skin care.

Discussion

In previous studies, moisture, elasticity, and sebum of infants aged three months to four years were measured before and thirty minutes after care. All parameters significantly increased after the care ($p < .05-.001$) and sugar scrub skin care (80% sugar coated with 20% essential or edible oil) was reported to be useful for the skin care of infants.

Here, our focus was on LBWIs. It will take 40 weeks for the five layers, from basal to keratinous, of the skin of LBWIs (2500 g or lighter at birth) to be completely formed. This is particularly true of babies with a preterm birth. Their gestation periods are short and their keratinous layer is very thin. Their skin is vulnerable to external irritation due to sparse connective tissues. Their skin can be damaged easily and lead to serious infection.

The impact on newborns was minimized and the study was conducted to discuss the effectiveness of barrier functions of the skin by comparing the difference in sebum content of the soap group and sugar group before and ten minutes after the bath. The sebum content of the soap group, which was already low, tended to decline (Fig. 2). Baby soap will be effective to prevent infection but not to increase the barrier function. On the contrary, the sugar group showed an increase (Fig. 2); the sebum content of a newborn (GA at birth of 37 weeks) was doubled from 22.3 to 50. The other six infants also showed a high sebum content ranging from 45 to 87. This clarified that the sugar scrub contributed to the increase. Fig. 3 shows how the sebum content rose: the sugar group showed a significant rise of the sebum content compared with the soap group ($p < .0001$). Barrier functions will be enhanced by an increased sebum content.

The newborns with a short gestational period did not necessarily have a lower sebum content; however, a newborn, one of the eight subjects, whose GA at birth was 37 weeks, showed an increase in sebum content from 22.5 to 54, while

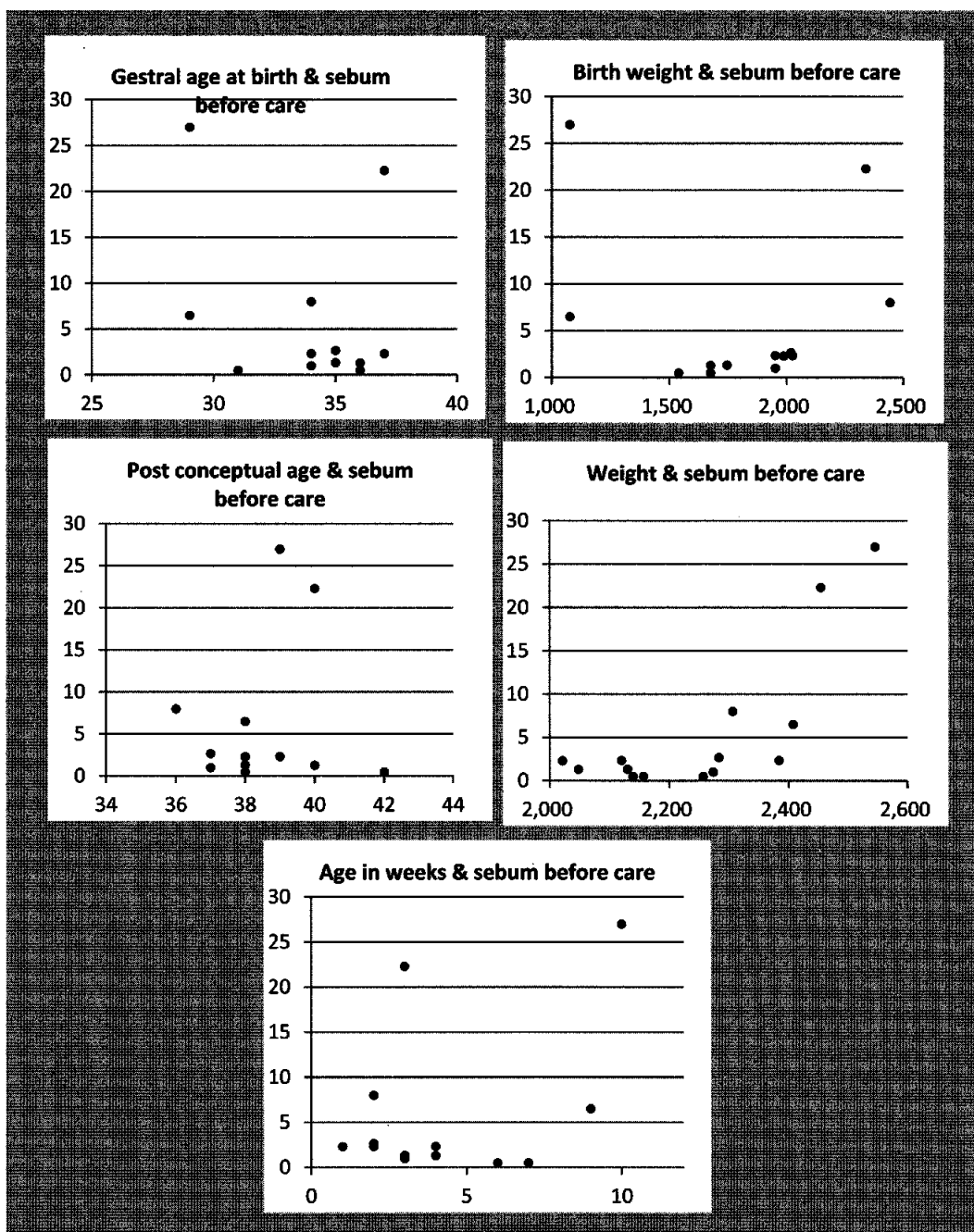


Fig. 1 Association between attributes and sebum content before care

another newborn with a birth weight of 1,540 g (GA at birth of 31 weeks) showed a significant increase from 0.5 (before care) to 70.67 (10 minutes after care). The newborns whose GA at birth was younger than 37 weeks had a low sebum content before the care but it generally increased after the care. This shows the effectiveness of sugar scrub skin care.

LBWIs have a lower sebum content on the skin surface, which can easily cause dry skin. Their skin is susceptible to the high temperature and

moisture in an incubator. However, body temperature control is one of the most important elements in nursing LBWIs in the NICU, and heat loss is a major concern. Their temperature control is immature, their body surface is large, their subcutaneous fat is limited, and their skin is thin. Heat is lost via radiation, convection, conduction, and transpiration. Thin skin, skin moisture, and the sebum content of the skin are considered to affect transpiration. One method to increase the skin's sebum content is to apply some

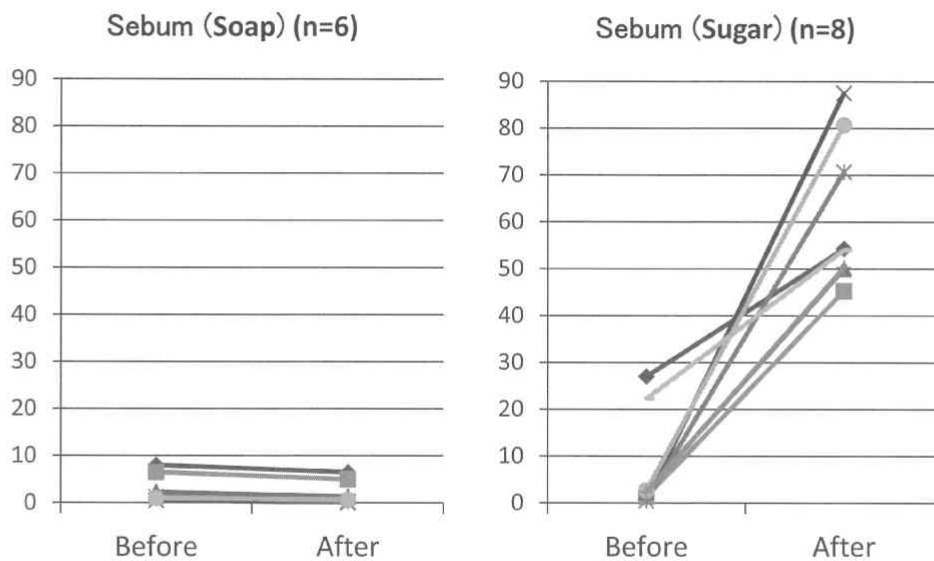


Fig. 2 Sebum content before/after care

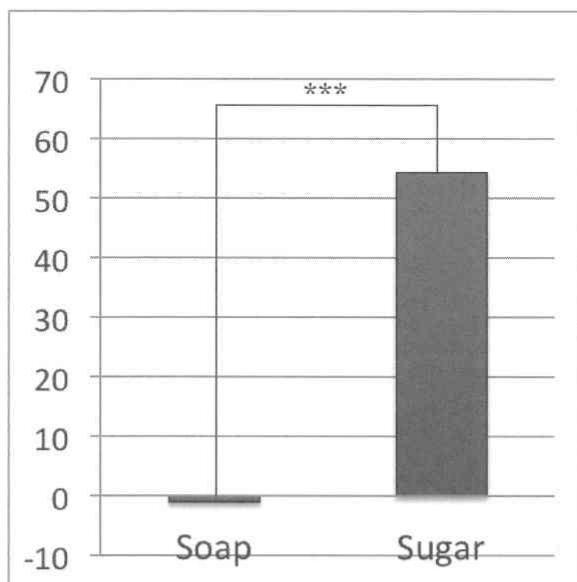


Fig. 3 Difference in sebum content between before and after care

type of oil, but the body temperature will drop when the body is exposed to air, and too much oil on the skin will cause other skin disorders. Skin disorders caused by various factors could lead to serious infection. Facilities nursing newborns administer their own type of skin care. For example, how the body temperature is controlled, what linen or baby soap is used, and how room temperature and humidity are controlled are all different depending on the facilities. They simply do their best to prevent problems.

It was already suggested in the preceding study that sugar scrub skin care was effective for infants aged three months to four years. This

study on LBWIs also identified an increase in the sebum content in the sugar group, while the soap group showed a decrease. The sugar scrub skin care will contribute to an enhanced barrier function by increasing the sebum content, particularly among LBWIs who tend to have more skin-related problems than other infants. Also, sugar scrub does not have to be rinsed, unlike soap, because it is dissolved into hot water in the tub. As a result, less time is required. This will reduce the impact on LBWIs.

Diaper rash was not noted among the subjects in this study, but it is common among newborns and LBWIs. It is caused by external irritation due to friction with the diaper or cleaning the bottom, or stimulation by urine or stool. Premature babies show immature bowel movements and hormonal control of the gastrointestinal tract, affecting the time needed, for milk to pass through the stomach. Feeding can be a stimulus, and they are inclined to defecate every time they are fed milk.

Babies who are breast-fed have loose stool, and the frequency of defecation is higher. This will be another factor leading to skin problems. LBWIs who tend to more frequently develop diaper rash will benefit from sugar scrub skin care. Their sebum content will increase and barrier function will improve. The study period was short, and how skin problems can be improved or prevented has yet to be identified. However, it is considered that the continuous use of sugar scrub will be effective for the prevention of skin-related problems among LBWIs.

The number of subjects was small and the

study period was too short this time. It was not clarified whether the increased sebum content could be maintained, or whether skin problems were lessened due to an enhanced barrier function. Further studies with larger numbers of subjects and longer study periods, such as a week before discharge, are required.

Conclusion

Comparison between the soap group and the sugar group of LBWIs indicated that newborns with a younger GA at birth tend to have a lower sebum content and that they will suffer from more skin disorders. Babies with a lower weight show the same tendencies. Newborns with a younger GA at birth and lighter birth weight had a lower sebum content and their condition improved significantly by the application of the sugar scrub bath. This suggests the effectiveness of the skin care by increasing the sebum content and barrier function.

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