

Infant Skin Care Products

What Are the Issues?

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ABSTRACT

Background: Infant skin is susceptible to dryness and irritation from external factors, including topical skin care products not formulated for the infant's skin. This may increase the risk of contact dermatitis. Parents frequently express concern regarding potential harm from ingredients in skin care products and seek information. This is complicated by several skin care myths.

Purpose: The purpose of this literature review was to provide evidence-based information to educate parents on the use of products for preterm and term infants.

Search Strategy: Multiple searches using PubMed were conducted including the search terms "infant skin care," "infant products," "infant bath," "emollients," "diaper skin care," and "diaper wipes." Reference lists of comprehensive reviews were also scanned. Google searches were used to assess consumer information, product information, and regulatory guidelines.

Findings: There is little scientific evidence to support safety of natural/organic products on infant skin. Raw materials originate from different sources, complicating testing and comparisons of ingredients. Research shows that cleansers formulated for infant skin do not weaken the skin barrier the way harsher soaps and detergents can. Oils with the lowest oleic acid content provide a lower risk of irritant contact dermatitis.

Implications for Practice: Nurses must be informed about natural and organic products, preservatives, and fragrances and know the definition of commonly used marketing terms.

Implications for Research: Decisions regarding the use of infant products in preterm and term infants should be evidence based. More research is needed to support claims regarding the safety of products used on infant skin.

Key Words: bathing, emollient use, infant skin care, natural baby products, product use

Infant care products have been one of the best performers in recent years for product sales, and the number of new products continues to increase rapidly. In 2014, the most frequently used product in the United States was infant wipes followed by infant oil, lotion, and powder, and bath and shampoo products are used on infants an average of 5 times per week.¹ Infants with their large body surface area in relation to their weight and their thin stratum corneum are particularly susceptible to skin barrier disruption and percutaneous absorption of chemicals. Therefore, evaluation of topically applied products is very important for infants.

Both the lay and scientific literature have shared concerns about infant skin products. Some of the concerns center on the move toward "green"

products, both environmentally and in terms of more natural ingredients. These products are perceived as less harmful to the infant's skin and some consumers like that there is no animal testing.² There is also an assumption among many consumers that infant and adult skin are the same, so that products tested on adults are safe for infants. Researchers have found that common chemicals in products such as formaldehyde, quaternium-15, sodium lauryl sulfate, some fragrances, parabens, phthalates, and polyethylene glycol may cause a variety of problems including endocrine disruption, asthma, skin irritation, allergies, reproductive disorders, and carcinogenic effects.³

Therefore, parents more than ever are faced with an abundance of information on what is best for their infant. Because of the endless amount of non-scientific information on social media, sorting out the truth can be extremely difficult and parents often seek information and advice from nurses and other neonatal providers. Therefore, to aid our understanding of skin care products used in full-term and preterm infants, this article describes a variety of controversial issues and differentiates among product terms including fragrance free and unscented products, addresses natural, herbal, and organic products, and presents an overview of cleanser, emollient, and preservative use (Table 1). Some of the common infant skin care myths discussed

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TABLE 1. Common Myths About and Terms Used to Describe Products

Myth	
<ul style="list-style-type: none"> • Water alone is enough to clean an infant's skin • Fragrance-free and unscented products are better choices • All vegetable oils are better for an infant skin because they are natural • Products with chemicals you cannot pronounce are bad for an infant's skin • Preservatives are unnecessary 	
Term	Definition
Essential oils	Complex blend of natural chemicals extracted from plants (leaves, flowers, stems, roots, or bark). There is no regulatory FDA definition for essential oils
Unscented	Products formulated to have no scent but can contain fragrance ingredients added to mask rather than impart scent
Fragrance-free	Products with no ingredients added for sole purpose of imparting scent but can contain fragrance ingredients added for some other purpose (ie, preservative)
Natural	Products composed of molecular entities derived from natural sources. May be structurally identical to synthetic chemicals. Natural products can include ingredients construed as being unsafe. Natural "can mean anything or nothing" (FDA, 2000) about safety
Organic	Grown without the use of synthetic pesticides or fertilizers
Hypoallergenic	Products that avoid the most obvious sensitizers such as lanolin, formaldehyde-releasing preservatives, and fragrance components like cinnamic alcohol, geraniol, limonene, or linalool ¹⁴
Phthalates	Synthetic, man-made chemicals used as a plasticizer and found in personal care products, food, and other plastic products ⁴²
Surfactants	Surface-active agents that lower the surface tension between a liquid and water or a liquid and a solid

throughout the article are listed in Table 1. This information will assist the nurse in education and discussions with parents.

INFANT SKIN CONSIDERATIONS

Over the last 5 decades, the prevalence of atopic dermatitis (AD) has increased dramatically. If one parent is affected, there is a 20% risk of a child developing the disease. If both parents have AD, there is up to a 50% chance of a child developing it. Close to 60% of people diagnosed with eczema are diagnosed between 3 and 6 months of age.⁴ Along with genetic factors, this rise in cases seems to be related to environmental exposure of infants to agents that break down the skin barrier, such as washing with soaps and detergents, dust mites, and hard water.⁵ When the skin barrier is disturbed, it permits the penetration of irritants or allergens, and triggers the development of eczematous lesions. For some infants, this is the first step along the atopic march—a progression of allergic diseases that begin early in life. The development of AD in infancy often leads to the development of allergic rhinitis, food allergies, or asthma later in childhood.

The unique aspects of infant skin are important to consider to prevent and avoid risks associated with topically applied products, including detergents, some topical oils, and irritant chemicals. Some of

these agents can compromise the skin barrier and lead to the development of AD or eczema. Infant skin is susceptible to dryness and irritation from external factors, as well as harsh topical skin care products, and has a greater tendency to develop irritant and allergic contact dermatitis.⁶ Therefore, the goal of any topical skin treatment should be to maintain the stratum corneum skin barrier.⁷

NATURAL, ORGANIC, AND HERBAL

"Natural" personal care products (Table 1) are now the fastest-growing segment of the personal care industry. However, labels such as "green" and "natural" are marketing labels that are not defined or regulated by the government.⁸ Chemophobia, or the increasing fear from chemicals, has contributed to the explosive growth of the green movement. About 50% of consumers believe natural products are free from harmful ingredients and unnecessary chemicals.⁹ However, there is no difference between a chemical extracted from a plant or synthesized in a laboratory, as long as the chemical structure is the same. Synthetic ingredients may actually be safer than natural ones because the concentration of active ingredients in plants varies by the part of the plant harvested, the time of year of harvest, the maturity of the plant at harvest, geography, and soil condition.¹⁰

All matter is made of chemicals and all food (even organic food) consists entirely of chemicals.¹¹ An all-natural pineapple is actually a combination of chemicals including octadecadienoic acid and ethyl 3-methylthiopropionate. Also, it should be pointed out that the length of a chemical's name is not indicative of the degree of toxicity. For example, methoxy-3-hydroxybenzaldehyde is vanillin found in vanilla beans and in many skin care products.

The Natural Products Association (NPA) is the largest nonprofit organization representing the interests of manufacturers and retailers of the natural product industry. In 2008, the NPA issued its certification program for personal care products. To display the NPA seal, a product must contain at least 95% truly natural ingredients derived from natural sources and 100% natural fragrance. The NPA has published a list of 839 ingredients that meet these requirements. Of note, the NPA's list of permitted safe ingredients includes 15 of the European Union's 26 listed fragrance allergens.¹²

"Organic" refers to materials grown without synthetic fertilizers or pesticides (Table 1). Their production is felt to be more environmentally conscious and ecologically sound.¹³ However, products made with "organic" ingredients are not safer for consumers because an ingredient's source does not determine its safety.⁸ For example, many plants including herbs may contain substances that are toxic or allergenic whether or not they are organically grown. "Herbal" therapies are one of the most common products leading to allergic contact dermatitis or eczema. Some of the herbs known for causing this reaction are aloe, arnica, calendula, chamomile, goldenseal, and yarrow.¹⁴

There is very little scientific evidence about the safety of natural and organic products on infant and toddler skin because the raw materials come from different sources, which makes testing and comparisons difficult.¹⁵ In addition, there is a lack of standardization of the terms *organic* and *natural*. Because of this, the AWHONN Science team could not make an evidence-based recommendation in its 2013 Neonatal Skin Evidence-Based Practice Guideline.¹⁶

OVERSIGHT ORGANIZATIONS

There has been increasing concern over the last decade about the lack of adequate testing of cosmetic ingredients that may cause harm to the consumer.¹⁷ Most over-the-counter topical infant products fall under the cosmetic category for regulatory purposes. Therefore, a review of the related oversight organizations follows. The US Food and Drug Administration (FDA) is responsible for regulatory oversight of the cosmetic industry. This oversight includes cosmetic products and ingredients, labeling requirements and label claims, guidance on recall policies, and ban on

ingredients. The Federal Food, Drug and Cosmetic Act is an important law pertaining to cosmetic products marketed in the United States. Regulations from the act require the tracking of violations involving ingredients, contaminants, processing, packaging or shipping, and handling and prohibits marketing of misbranded or adulterated products.

In addition to FDA oversight, each company is legally responsible for ensuring the safety of its formulations before it goes on the market. Dermal sensitization, dermal irritation, and the ability of the product to move through the skin (transdermal penetration) are key pieces of data that should be studied. Created in 1976, the US-based Cosmetic Ingredient Review (CIR) is an independent, scientific review board that critically evaluates chemical ingredients used in cosmetics and publishes the results of its findings in peer-reviewed literature.¹⁸ The CIR process provides an important mechanism for evaluating the safety of the ingredients in personal care products.¹⁹

The Safe Cosmetics Modernization Act is currently gaining momentum since its introduction in the House of Representatives in November 2015. If passed, this bill would modernize and improve the FDA's ability to ensure the safety of cosmetic products by examining ingredient safety, establishing manufacturing processes, and tracking and quickly addressing adverse health impacts from potentially unsafe products. It would require all manufacturers to be registered with the FDA.²⁰ Another current bill moving through the legislature is the Cosmetics and Personal Care Products Safety Act or Feinstein Bill, which would require the FDA to review chemicals used in personal care products and provide clear guidance on their safety.

Health Canada regulates all cosmetics sold in Canada under the Cosmetic Regulations and the Food and Drugs Act. Health Canada also publishes a Cosmetic Ingredient Hotlist, which keeps the industry and consumer aware of restricted or prohibited substances. The Canadian Cosmetic, Toiletry and Fragrance Association (CCTFA) is regarded as the leading voice of the personal care industry in Canada (<http://www.cctfa.ca/site/consumerinfo>).

The European Union Cosmetics Regulation protects consumers of the 27 member states and makes sure that all cosmetic products on the European market are safe. The Cosmetic Toiletry and Fragrance Association of New Zealand Inc has adopted the European Union's Cosmetic and Cosmetic Ingredients regulations. The Japanese government regulates the cosmetics industry through its Ministry of Health, Labor and Welfare according to its Pharmaceutical Affairs Law. The 10 member countries of the Association of Southeast Asian Nations follow the ASEAN Cosmetic Directive. Established in 2007, the International Cooperation on Cosmetics Regulation is a voluntary international group of cosmetics

regulatory authorities from Brazil, Canada, the European Union, Japan, and the United States. This group meets on an annual basis to discuss common issues on cosmetic safety and regulation (<http://www.iccrnet.org>).

Fragrances are regulated under the Federal Food, Drug and Cosmetics Act in the United States. Safety data on fragrance ingredients are generated and evaluated by independent scientific experts for The International Fragrance Association, a nonprofit industry system. It is an internationally accepted risk management system for the safe use of fragrance ingredients and compounds.

CONSUMER INFORMATION GROUPS

The Personal Care Product Council (<http://www.PCPCouncil.org>), Cosmetic Ingredient Review (<http://cir-safety.org/ingredients>), and Cosmetics Info (<http://www.cosmeticsinfo.org>) are online resources for the consumer to learn about the science behind ingredients. The Environmental Working Group is an American nonprofit organization that provides research and education about a variety of environmental issues that can potentially affect public health. Their mission is “to empower people to live healthier lives in a healthier environment.” They have developed a hazard scale, which rates the potential risks of ingredients in commonly used products, and stores the information in a database. This Skin Deep Database rates popular cosmetics and personal care products with hazard scores on a scale of 0 to 10, depending on their toxicity.²¹ The flaw to this database is that products are rated very high even if there is no data available, which is the opposite of an evidence-based approach. Other ingredients, rated as a potential health hazard, lack scientific support or specific reference.¹⁸ There have been many criticisms of this site for its questionable validity and reliability. *Activist Facts* states that “the Environmental Working Group preys on the public’s distrust of polysyllabic scientific jargon to make it sound as if everyday items with complicated names are, in fact, deadly dangerous.”²²

SELECT INFANT SKIN CARE PRODUCT TYPES

Cleansers

Good skin hygiene is essential to the maintenance of barrier function and overall health.²³ Although the benefits of cleansing are agreed upon, the use of cleansers and soaps in neonates remains controversial.

Changes and developments in skin cleansing products over the last 150 years have reflected the improvements in skin compatibility. Before the 1900s, cleansing products were primarily made in

small batches with lye soap. Alkaline soaps (pH >7.0) made with lye increase skin pH, interfere with development and function of the acid mantle, alter skin lipids, and are generally more irritating to the skin. In the late 1800s, *Ivory* was marketed as “pure” soap for infants. Although traditional bar soaps have good detergency and produce a lot of lather, they have an irritant action and an alkalotic pH.²³ The use of soaps or detergents can affect the lipid film on the skin, can interact with proteins that trigger skin irritation, and can increase the pH of the skin surface. All of these changes can ultimately result in skin roughness, flakiness, skin dryness, and a tightening effect.²⁴

During World War II, synthetic detergents, or syndets, emerged due to the scarcity of plant oil–derived surfactants. Syndets allowed for the production of a lower more skin-neutral pH product (pH 5.5-7) that was milder and less irritating than soap. The neutral or slightly acidic pH of these cleansers has the advantage of not altering the pH of the skin or the cutaneous commensal bacteria.^{18,26} Synthetic surfactants also allowed for the development of liquid skin cleansers, and in 1953, Johnson & Johnson introduced the first liquid infant shampoo. Liquid skin cleansers are the mildest formulation for infants with a pH of 4.0 to 7.0.

Modern cleansers are primarily made up of surfactants, which act by decreasing the surface tension between water and air, and create lather, allowing the fat-soluble impurities to be removed from the skin surface. Several classes of surfactants are used in cleansing formulations, including anionic surfactants (sodium lauryl sulfate or sodium laureth sulfate), nonionic surfactants (eg, polyethylene glycol), and amphoteric surfactants (cocamidopropyl betaine).²⁷ The type of surfactant used in the product determines foaming action and mildness.

Surfactants in cleansers can potentially weaken the skin barrier, increase transepidermal water loss (TEWL), and lower hydration, leading to skin dryness, irritation, and redness when the product is not designed to be mild and infant skin compatible.^{25,26} In addition, cleansers and soaps, with harsh detergents, reduce stratum corneum hydration and increase skin surface pH.²¹ By skin testing, relative skin irritancy has been determined for surfactants. The rankings for common surfactants are listed in Table 2.⁷

In addition to skin issues, ocular safety is an important consideration in infant wash or shampoo products because newborn infants do not readily protect their eyes by closing their eyelids when a visual object approaches as well as adults. An infant’s blink rate at birth is 23 to 60 seconds versus 11 seconds in adults.²⁹ This defensive blinking, which is necessary to protect against eye injury, is not a fully reliable response until about 4 months of age. Therefore, infant shampoos should have a low

TABLE 2. Irritancy Potential of Common Surfactants⁵

Relative Irritancy	Surfactant
High	Benzalkonium chloride Bromide
	Dodecyl trimethyl ammonium
	Linear alkyl benzene sulfate
	Sodium lauryl sulfate
	Sodium dodecyl sulfate
	Sodium alkyl sulfate
	Sodium or potassium cocoate
	Sodium or potassium tallowate
	Sodium palmitate
	Sodium or potassium stearate
	Sodium olefin sulfonate
	Triethanolamine laurate
	Moderate
Sodium laureth sulfate	
Ammonium laureth sulfate	
Low	Sodium cocoyl isethionate
	Sodium alkyl glycerol ether sulfonate
	Sodium cocoyl sulfosuccinate
	Disodium stearyl sulfosuccinate

ocular irritation index and a pH and saline concentration similar to tears.

In summary, an ideal cleansing agent should be a mild liquid, should remove unwanted material, interact minimally with the skin, have a skin-compatible pH value below 7.0, have minimal dyes and fragrance, and have been tested on infants so that the infant’s acid mantle and skin barrier are not disrupted.

Emollients

Emollients are topical agents made of fat or oil that soften and smooth the skin. They provide a layer of oil over the surface of the skin that supplies the stratum corneum with water and lipids, and traps water underneath to inhibit water loss.³⁰ They are also referred to as moisturizers and lubricants. Emollients can be applied after a bath if the skin shows any signs of dryness or cracking. Because emollients provide a temporary artificial repair of the stratum corneum, they must be applied frequently. They are beneficial for infants with a family history of eczema or AD.²³ A recent pilot study in the United States investigated the application of an emollient beginning in the first week of life in newborns at high risk of developing AD. The results were encouraging as only 3 of the 20 infants developed AD in the first 2 years of life.³¹

One of the safest and most effective emollients available for newborns is white petrolatum ointment (Aquaphor ointment).³² However, in a multicenter trial the use of a twice-daily petrolatum-based emollient for 14 days on 1191 extremely premature infants (<1000 g) increased their risk of coagulase-negative staphylococcal infections, but did not have

an effect on neonatal mortality.³³ Skin damage was, however, significantly lower for the emollient group. The authors speculated that contamination may have occurred during application of the preservative-free petrolatum ointment. Emollients also have different formulations and, therefore, will have different effects on the skin. There are no other studies looking at the long-term use of emollients in healthy infants.

Oils and Massage

Studies in premature and full-term infants have shown positive effects of infant massage with natural oils. Infants who received routine touch and massage were 50% more likely to make eye contact, 3 times more likely to have an overall positive expression, and had improved sleep quality and quantity when part of a bedtime routine.³⁴ Certain natural oils have been shown to possess antimicrobial activity, display anti-inflammatory properties, reduce skin irritation, and provide moisturization, reduce TEWL, conserve heat, and improve growth.^{28,35-37}

Fourteen natural oils were compared for their ability to prevent irritant contact dermatitis. Positive effects were noted with the oils with the lowest oleic acid content and the highest linoleic acid content.³⁸ For a list of oils and their respective percentages of oleic and linoleic acids, refer to Table 3. Linoleic acid activates protein factors that increase the rate of stratum corneum barrier formation. Olive oil contains 55% to 83% oleic acid, compared with sunflower seed oil that is high in linoleic acid. Oleic acid is a skin penetration enhancer that increased TEWL, indicative of barrier disruption. Sunflower, safflower, sesame, and apricot oil have high amounts of linoleic acid that has anti-inflammatory properties.³⁸ The International Association of Infant Massage now discourages the use of olive oil and instead recommends organic, cold pressed vegetable oil low in oleic acid.⁴

Several massage studies have evaluated the use of different emollients in developing countries where the use of oils and massage is common. In rural Nepal, infant massage with mustard oil 2 to 3 times a day occurs in almost all households (99.8%). In India, coconut oil is preferred for infant massage and for dry skin.²⁴ One randomized controlled study comparing massage with coconut oil versus mineral oil versus placebo (powder) infants found that coconut oil massage resulted in significantly greater weight gain velocity as compared with mineral oil and placebo in preterm infants and term infants compared with placebo.³⁹

In Bangladesh, the application of sunflower seed oil and a petrolatum-based emollient (Aquaphor) 3 times daily for 14 days, and then twice daily until day 28, reduced nosocomial bloodstream infection and mortality rates in preterm infants born at 33 weeks’ or less gestation.⁴⁰ The incidence of hospital-acquired infections was lower in the sunflower seed

TABLE 3. Comparison of Unsaturated Fatty Acid Composition in Various Oils⁴⁰

Oil	Oleic Acid, %	Linoleic Acid, %
Castor seed	7	5
Wild apricot seed	72-75	18-22
Coconut	5-8	0-1
Corn	19-49	34-62
Cotton seed	35	42
Joboba seed	1	—
Flaxseed	12-34	17-24
Mustard seed	22	14
Olive	65-80	4-10
Palm kernel	11-19	0.5-2
Palm	38-52	5-11
Poppy seed	11	72
Rice bran	40-50	29-42
Safflower	13-21	73-79
Sesame	40-50	35-45
Soya bean	22-34	43-56
Sunflower seed	14-35	44-75
Tea seed	—	7-14
Wheat germ	8-30	44-65

Adapted from Visscher and Geiss³⁸, with permission from Elsevier.

oil group than in the Aquaphor group, but both preparations were felt to be a cost-effective way to decrease nosocomial infections. In another study the acceptability of sunflower seed oil, Aquaphor Original Emollient Ointment, or usual care (mustard oil) was assessed in preterm neonates born at less than 33 weeks' gestation. Topical therapy with sunflower seed oil or Aquaphor was perceived by many families to be superior to mustard oil and more cost-effective.^{41,42} Mustard oil has been shown to delay skin barrier maturation and is capable of causing contact dermatitis.

In the Philippines, a study found that extra virgin coconut oil and mineral oil both improved skin hydration.⁴³ Mineral oil penetrates the upper layers of the stratum corneum, has a long record of safe use, and is unlikely to go rancid even in hot, humid climates.²⁷ All vegetable oils should be used cautiously in warm weather because of their occlusive properties and the likelihood of degradation, spoilage, and microbial growth.

Finally, in UK maternity and neonatal units, olive oil is recommended to parents for dry skin by nurses most often. The nurses' preference was influenced by their belief in the safety of natural oils and their desire to suggest an inexpensive intervention for parents. However, olive oil delays the development of

the skin barrier that prevents water loss and prevents against allergy and infection.⁴⁴ However, in mouse studies, mustard, olive, and soybean were detrimental to the skin barrier whereas sunflower seed oil and petrolatum accelerated skin barrier repair.³⁷

Infant case studies report that repeated topical use of products containing lavender and tea tree oil may cause gynecomastia in boys before puberty.⁴⁵ Some natural oils such as eucalyptus, sage, and tea tree oils to name a few can be toxic depending upon blood levels.²⁷ Also, allergic contact dermatitis is related to lavender, peppermint, and jasmine.⁴⁶

In the intensive care nursery, emollient use may interfere with the adherence of adhesives but has not been associated with thermal burns when used in conjunction with a radiant warmer.¹⁶ To reduce the risk of infection, use of emollients should be limited to targeted areas of dry skin preferably and should not be shared between infants. More research is needed to determine the impact on the skin barrier of the oils being used in clinical practice.

Skin Protectant Use in Diaper Dermatitis

Barrier creams and ointments protect full-term infants' skin from contact with moisture and irritants in the diaper area. One or both of these agents can be applied thickly at each diaper change for the prevention and treatment of mild-to-moderate diaper dermatitis.⁴⁷ Most barrier preparations contain zinc oxide and petrolatum as their active ingredients. There is a lack of evidence to prove the effectiveness of one skin protectant over another at this time, especially in premature infants.⁴⁸ Complete removal of the barrier cream or ointment is not necessary during the diaper change because this has the potential to disrupt healing skin. Any stool present should be gently removed, and the product that has come off should be reapplied.

In addition to topical creams, solutions that form a semipermeable barrier film when dried are another option for protecting the skin from direct contact with irritants.⁵ In infants greater than 28 days, a Cavilon No-Sting Barrier Film (Cavilon, 3M Corporation, St Paul, MN) has been used for treatment of diaper dermatitis. It provides a protective lipid film that prevents exposure of the skin to stool and urine irritancy, and allowing the skin to heal.

Sureprep No-Sting Protective Barrier Wipe (Sureprep; Medline Industries Inc, Mundelein, IL) is a water-based formula that has no age restriction noted on the package label. In 10 neonatal intensive care unit patients with severe skin breakdown, Sureprep was applied to the perineal area and, when evaluated, the skin condition had improved.⁷ The FDA has only endorsed 18 ingredients as protectants for over-the-counter (OTC) skin protectant products (Table 4).⁷ Nurses can use this information to educate parents about the best ingredients to look for in diaper dermatitis products.

Wipes and Powder

Diaper wipes use has increased over the last decade as an alternative to water and washcloths for cleaning the diaper area. Older wipe formulations included alcohol, perfumes, and harsh surfactants leading to concerns of irritation and development of allergic contact dermatitis. However, the formulation of today's diaper wipes is free of alcohol, with a mild surfactant to lower surface tension. They also include a preservative, an ingredient that enhances glide across the skin to minimize frictional damage (eg, dimethicone), and have a pH of approximately 5.5. Cloth and water versus an acidic pH diaper wipe to cleanse the perineum and buttocks in premature and term infants during diaper change improved pH, lower TEWL, and less erythema with use of diaper wipes.⁴⁹ In the United Kingdom, a study found wipes to have the same effect on skin hydration, erythema, pH, and microbial colonization as water and cotton wool.⁵⁰ However, water alone may not be as effective as a gentle cleanser at removing stool from the diaper area as the water-insoluble stool fragments may require more friction to remove the stool.⁵⁰ In addition, wipes with a pH buffering action may prevent a rise of the skin surface pH in the diaper region and help reduce fecal enzyme activity that causes diaper dermatitis.⁵¹

Pure Water Wipes manufactured in Ireland are now available in the United States. They are 99.9% water and 0.1% grapefruit seed extract. They were introduced as an alternative to cotton wool and water. Research on skin irritancy or efficacy of the product has not been conducted in infants. Because they are preservative free, they should be used within 4 weeks of package opening.

Infant talcum powder absorbs moisture and cuts down on friction. However, talcum powder is not recommended for use in an infant's diaper area because inhaled particles can lead to respiratory complications. Also, these products may promote the growth of bacteria and *Candida* sp. and can worsen diaper dermatitis.¹⁶

PRODUCT INGREDIENTS

Fragrances

At approximately 28 weeks' gestation, the olfactory system of infants seems capable of detecting chemical stimuli; by 5 to 6 days of life, infants choose the

breast pad of their mother rather than that of another mother.⁵² Smell is the number one sense linked to memory because the olfactory processing cortex is located near the emotion center (amygdala) and the memory center (hippocampus).⁵³ Enjoyable scents can improve mood and alertness and play an important role in bonding with the mother. Term infants prefer sweet smells such as lavender and vanilla, and lavender scent during bath time promotes relaxation in both the infant and parents.⁵⁴ Lightly fragranced skin care products are well tolerated in healthy term infants,⁵⁵ and bathing before sleep has been reported to enhance the quality and duration of sleep.^{34,56}

Fragrance ingredients are used in perfumed goods and perfumes to give them a specific, pleasant smell or mask an unpleasant odor and are one of the key factors that affect individual's preference for personal care products. They can be derived from chemical synthesis or natural sources. The most common health problems seen with fragrance ingredients are irritant contact dermatitis and allergic contact dermatitis. A key difference is that irritant dermatitis develops immediately after exposure and allergic reactions normally occur upon re-exposure to the allergen.⁵⁷

Most fragrant compositions on a product label are listed as "parfum," "perfume," "fragrance," or "aroma." A fragrance's ingredient list can sometimes be longer than the ingredient list for the product but because fragrance is considered a trade secret, companies are not required to list these ingredients. Since 1999 though, a list of 26 fragrance substances have to be individually identified on product labels to warn consumers due to their high potential for allergies.⁵⁸ These fragrances were identified by the European Union and adopted by the United States (Table 5)⁵ to help in the clinical management of patients with contact allergy to one or more of these chemicals.

Fragrances are typically classified into 3 groups: essential oils, derived from plants; natural fragrances, derived from a natural source; and synthetic fragrances. Essential oils are extracted and distilled from plants. If applied directly to the skin, they may cause inflammation due to their intense concentration.¹⁰ Natural fragrances are not always considered to be safer than synthetic fragrances, because some ingredients such as essential oils (eg, rosemary,

TABLE 4. Skin Protectants Endorsed by the FDA for OTC Use⁵

Allantoin	Dimethicone	Sodium bicarbonate
Aluminum hydroxide gel	Glycerin	Topical starch
Calamine	Kaolin	White petrolatum
Cocoa butter	Lanolin	Zinc acetate
Cod liver oil	Mineral oil	Zinc carbonate
Colloidal oatmeal	Petrolatum	Zinc oxide

bergamot, and peppermint) may be allergens or irritants.⁵⁹

“Fragrance-free” and “unscented” are misleading terms for consumers seeking to buy a product with no fragrance added. Products can be labeled as fragrance-free if the scent-imparting ingredient is added for another purpose (ie, preserving the product). Unscented products mean that the product has been formulated to have no scent. However, there may still be a fragrance added if it was added to mask the odor of the formulated product.⁶⁰ If you see essential oils and fruit/flower distillate waters on the ingredient list, then it is a scented product.

Preservatives

Preservatives are added to a product to prevent or retard microbial growth from either the manufacturing process or contamination of the product during use and should always be in any product that contains an aqueous (water) component.³⁰ Bacterial and fungal contaminations of personal care products can occur through regular storage and use by consumers. Products can become contaminated by hands dipping into a multiuse container, palms rubbing against a tube mouth, and hands touching a pump mouth. Unpreserved products can foster the growth of bacteria and fungi, including *Staphylococcus aureus*, *Pseudomonas aeruginosa*,^{61,62} and *Candida albicans*.⁶³ Personal care products contaminated with microorganisms can cause allergic reactions, inflammation, and potentially fatal infections. Ongoing criticisms against preservatives in recent years⁶⁴ led the European Union to remove some approved preservatives not because of safety data, but as a consumer-driven concern. However, what may be more dangerous than exposure to

preservatives is having a serious infection by omitting them.⁶¹

Parabens are widely used as preservatives in personal care products.²¹ The concern is that parabens can mimic estrogen and therefore cause estrogenic effects in humans. After reviewing scientific data including toxicology studies, the FDA and the CIR do not support claims about the risk potentially posed by parabens in products. The safest and most commonly used preservatives are methylparaben, ethylparaben, propylparaben, isopropylparaben, and isobutylparaben. Parabens do not easily penetrate the skin and are 100,000 times weaker than the endocrine disrupters found naturally in the body.⁶⁵ Typically, more than one paraben is used in a product to provide preservation against a broad range of microorganisms.⁸ Parabens are widely permitted by government agencies across the globe including the European Union, Canada, Japan, Australia, and the United States.

The current recommendation is to choose cleansers with low concentrations of preservatives that have demonstrated safety and tolerability for newborns. Preservatives may result in skin irritation or contact dermatitis.¹⁷ Consumers should note both the expiration date and period after opening of a product. A green or “Free-From” product may contain no preservative or a less robust one and therefore have a shorter shelf-life.⁶⁶

Phthalates

Phthalates are a group of man-made chemicals used as plasticizers in hundreds of products.⁶⁷ Their association with various health effects including potential reproductive or developmental effects is of increasing public concern. The American Academy of Pediatrics

TABLE 5. Twenty-Six Fragrances That Must Be Identified on the Label

Frequently Reported and Well-Recognized Allergens	Less Frequently Reported and Thus Less Information About Allergenic Potential
Amyl cinnamal	Anisyl alcohol
Amyl cinnamyl alcohol	Benzyl benzoate
Benzyl alcohol	Benzyl cinnamate
Benzyl salicylate	Citronellol
Cinnamyl alcohol	Farnesol
Cinnamal	Hexyl cinnamaldehyde
Citral	Lilial
Coumarin	d-Limonene
Eugenol	Linalool
Geraniol	Methyl heptene carbonate
Hydroxycitronellal	3-Methyl-4-(2,6,6-trimethyl-2-cyclohexen-1-yl)-3-buten-2-one
Hydroxymethylpentyl-cyclohexenecarboxaldehyde	
Isoeugenol	

Summary of Recommendations for Practice and Research

What we know:	<ul style="list-style-type: none"> • Infant skin is susceptible to dryness and irritation and has a greater tendency to develop irritant and allergic contact dermatitis. • Infant wash products should be tested on infants for irritancy and ocular safety, have a preservative and a mildly acidic pH.
What needs to be studied:	<ul style="list-style-type: none"> • All infant care products should be tested on infants for irritancy, pH, and epidermal barrier disruption. • How natural products compare to synthetic products for infant's skin.
What we can do today:	<ul style="list-style-type: none"> • Become educated about product ingredients and product labeling. • Discuss product selection with parents. • Make evidence-based decisions regarding product use in our healthcare settings.

released a statement endorsing the possibility that childhood sucking of chewing on plastic toys is associated with increased phthalate metabolite levels in urine. Phthalates are also in food and are thought to be a contaminant from processing and packaging.

In one study of infants ranging in age from 2 to 28 months, there was a strong association between several phthalates used in topically applied infant care products and increased levels of phthalate metabolites in the urine.⁶⁷ The urinary concentration was highest in the infants younger than 8 months and those exposed to the greatest number of products. Several factors affect dermal absorption rates, including duration of exposure, specific body part exposed, chemical concentration, skin surface area exposed, and absorption through the skin. Phthalates may also be inhaled from the air or ingested orally from a number of sources, including drugs, food, plastics, water, and cosmetics. This study did not establish an association between the urine metabolite findings and health effects. Since 2004, the number of infant products that contain phthalates has consistently decreased. Additional research should be done to identify routes, sources, and risks of phthalate exposure in infants.

CONCLUSION

The goal of evidence-based newborn skin care should be to preserve integrity, prevent toxicity, and avoid exposure of the skin to harmful chemical agents. Infant skin care products should not interfere with skin surface pH or disrupt the skin barrier.²⁷ Not even product labels that claim things such as *derm tested*, *balanced pH*, *natural or organic*, guarantee the safety of the ingredients in a product. We should not equate "natural" with safe, because herbs and plants can be just like drugs.¹⁰

In evaluating infant skin care products, we should ask: (1) How and on whom was it tested? (2) What concentration and frequency of the product was used? (3) Are the data valid and relevant for infant use?⁶⁸ Some of the criteria used to assess infant products are irritancy, pH, ocular safety, preservative use,

fragrance, and cost. Minimizing negative environmental exposures and maximizing the optimal development of the skin barrier during the first 2 years of life should be a priority.³²

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