Baby Wipes versus Water and Cloth: A Comparative Review

Josh Gregorio PhD,
Kimberly-Clark Corp., 2015
<table>
<thead>
<tr>
<th>Did you know...</th>
<th>Better Skin Health Outcomes</th>
<th>Multiple Benefits with Wipes</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Overwhelmingly, infant skin's response to disposable baby wipes has been</td>
<td>• Clinical researchers have demonstrated that relative to water and cloth/cotton,</td>
<td>• <strong>Balanced skin pH</strong> - Within a few days of birth, the pH of infant skin is slightly acidic</td>
</tr>
<tr>
<td>positive.</td>
<td>disposable baby wipe use leads to:</td>
<td>around 5, which protects skin from pathogens. Most disposable baby wipes are 90% water and</td>
</tr>
<tr>
<td></td>
<td>• less skin redness and irritation</td>
<td>are specifically formulated to have a final pH of 4.5-5.5 to help maintain healthy skin pH. Tap</td>
</tr>
<tr>
<td></td>
<td>• a better skin barrier</td>
<td>water can have a pH up to 8.5 and distilled water can range from 6.5-7, which can disrupt natural</td>
</tr>
<tr>
<td></td>
<td>• balanced skin pH</td>
<td>skin pH.</td>
</tr>
<tr>
<td></td>
<td>• Clinical studies have repeatedly demonstrated the gentleness and safety of disposable</td>
<td>• <strong>Effective removal of feces</strong> - Baby wipes contain gentle surfactants that are more effective</td>
</tr>
<tr>
<td></td>
<td>baby wipes in both healthy infants as well as infants in the NICU.</td>
<td>at removing fecal residues due to their ability to remove both water and fat soluble materials</td>
</tr>
<tr>
<td></td>
<td>•</td>
<td>unlike water and cotton/cloth.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• <strong>Enhanced glide</strong> – Baby wipes contain emollients that reduce friction between the wipe and</td>
</tr>
<tr>
<td></td>
<td></td>
<td>the skin, leading to less mechanical skin irritation.</td>
</tr>
</tbody>
</table>
Premature infant skin is very delicate and lacks efficient barrier protection as the stratum corneum, the outermost layer of the skin, has not fully developed. Consequently, premature infants have an extremely high transepidermal water loss (TEWL) through their skin and are more vulnerable to exogenous insults and stresses (Andersen, 1994; Visscher M., 2009). Coupled with weak resilience and structural integrity, the diapered environment can create even more impediments to skin health. For example, it has been extensively shown that occluded or diapered skin leads to over-hydration, compromising skin strength and barrier function (Garcia Bartels, 2012). Moreover, skin irritants present in feces and urine can induce skin rash through a variety of mechanisms including increased skin pH, proteolytic breakdown of stratum corneum proteins and membrane integrity and, permeation of bile salts and other contact irritants into the epidermis (Visscher M. M., 2009b; Chew, 2006).

Regularly cleaning diapered skin without causing mechanical abrasion or chemical-induced stress is essential to maintaining skin health. The concern for the latter has led many skilled practitioners and mothers alike to adopt a skin cleaning regimen consisting of a cotton cloth/ball and water. It is the view of many that disposable baby wipes might cause more harm than water and cotton alone, especially in infants with sensitive skin or in infants experiencing diaper rash (Frieden, 2011). This concern, although well intended, is misplaced. Many clinical studies have evaluated the use of disposable baby wipes and compared them to water and cloth or water and cloth and soap. Overwhelmingly, the skin’s response to disposable baby wipes has been positive. Using various methods to analyze skin health, clinical researchers have demonstrated that disposable baby wipe use leads to lower erythema, less water loss across the skin (TEWL), maintaining skin pH, and less irritation compared to water and cotton or water, cotton and soap (Ehretsman, 2001; Visscher M. T., 2007; Odio, 2001).

Clinical studies have shown benefits of the use of disposable baby wipes in pre-term and term infants from birth up to 24 months and in seriously ill neonates, as well as infants with clinically diagnosed atopic dermatitis. For instance, a study involving 53 infants, conducted over a 4 week period, evaluated the use of disposable baby wipes on infants with clinically diagnosed atopic dermatitis (sensitive skin). The mean number of wipes applied to the infants was 12 per day. Their results showed that the incidence of erythema dropped from 34% at day 1 to 14% at day 29 of the study and that baby wipes are suitable for everyday cleaning of sensitive diapered skin (Ehretsman, 2001). Similarly, in a double blinded study involving 102 infants over a 2 week period, disposable baby wipes were compared to water
plus a cleaning material (mostly cotton wool balls) in 6 to 24 month old infants. The study found that diaper rash was significantly lower in the skinfolds area of infants who were cleaned with disposable baby wipes compared to those cleaned with water and cleansing materials (Ehretsmann, 2001). Another skin care study was conducted to evaluate wipe use in a level III NICU and demonstrated the benefits of disposable baby wipes vs cloth and water towards maintaining balanced skin pH (Visscher M., 2009). This study compared disposable baby wipes at pH ranges lower than those found in water and compared them to water and cloth. Strikingly, the study showed that perineal erythema and TEWL were significantly lower in the wipe groups compared to the water and cloth groups. The authors noted that the lower pH in the disposable baby wipes led to a lower skin pH than water and cloth use (Visscher M., 2009).

The importance of maintaining a low skin pH has been evaluated in many studies, highlighting the significance for establishing the acid mantle in skin, a key defensive attribute. At birth, the pH of skin is around 6.5 – 7, but continues to drop to around 5.5 after several days, weeks, or months. (Mauro T. S.-Q., 1998). The acid mantle is important in promoting skin health and function by permitting stratum corneum maturation and preventing colonization of pathogenic microorganisms. Premature infants are even more prone to these effects as it takes much longer for acid mantle and stratum corneum development to occur (up to 8 weeks after birth). Therefore, any diapered skin cleansing strategy needs to take this into consideration. The source of water used can factor greatly in the potential to harm skin when incorporated into a skin cleansing method, as tap water can have a pH up to 8.5 and distilled water can range from pH 6.5-7 (EPA, 2015; Tsai, 1999) and offers no buffering capacity. Moreover, water has been shown to have damaging effects on skin and might not be the harmless cleaning agent one might expect (Tsai, 1999).

For instance, infant skin absorbs water within 10 seconds (Nikolovski, 2008) and it has been suggested that this attribute creates the potential for water to disrupt skin barrier function, making it more susceptible to external insults (Lavender, 2012). Contemporary disposable baby wipes, although over 90% water, are typically formulated to have a final pH in the range of 4.5-5.5 and are designed to have good buffering capacity. It has been shown that maintaining a skin pH around 5.5 helps stratum corneum development, improves barrier protection, reduces water loss, and helps protect against inappropriate microbial colonization (Stamatas, 2011; Schmid-Wendtner, 2006; Mauro T. S.-Q., 1998) (Figure 1).
Figure 1. Disposable baby wipes are formulated to complement healthy skin pH. The pH of water can be as high as 8.5.

A recent report attributes rash development to an imbalance of skin pH following exposure to urine and feces (Adam, 2009). This mixture leads to activation of digestive enzymes present in feces that can damage the stratum corneum through degradation of lipids and proteins in the skin (Adam, 2009; Andersen, 1994). Infant feces contains lipolytic and hydrophobic enzymes that are immiscible in water. Cleansing practices that only include water may not adequately remove these materials and can result in stratum corneum damage and rash development. The efficient removal of lipid soluble lipolytic enzymes requires surfactants or detergents to emulsify and trap them into droplets so that can then be effectively removed (Gelmetti, 2001). It has been shown that mild surfactants can be effectively used to remove these harmful substances without compromising skin health. Thus, many contemporary disposable baby wipes contain low concentrations of mild surfactants to accomplish this task.

In summary, modern disposable baby wipes offer benefits that cloth (mostly cotton) and water do not provide. Clinical studies have repeatedly demonstrated the gentleness and safety of disposable baby wipes in both healthy infants as well as infants in the NICU. Baby wipes are more efficient at removing fecal residues due to their ability to remove both water and fat soluble materials. Additionally, wipes are specifically designed to gently clean delicate infant skin including tough areas like skin folds without impeding acid mantle development or causing inordinate physical abrasion. It is this utility that gives disposable baby wipes an advantage over water and cloth as a diapered area cleaning method.
Figure 2. Disposable baby wipes contain surfactants that can effectively remove both hydrophobic and hydrophilic fecal material unlike water and cloth. In addition, studies conducted in pre-term and term infants have demonstrated that the use of disposable baby wipes leads to reduced skin redness and irritation, decrease water loss, and balanced skin pH relative to the use of water and cotton/cloth.

References


