Prevalence of Contact Allergens in Baby and Children's Products in Bangkok

Sittichoke Tangkitchote* and Pawit Phadungsaksawasdi

Division of Dermatology, Chulabhorn International College of Medicine, Thammasat University, Pathum Thani, Thailand
*Corresponding author, E-mail: sittichoke.tan@dome.tu.ac.th

Abstract

Allergic contact dermatitis (ACD) poses a risk for children due to their underdeveloped skin barriers. Studies indicate a rising prevalence of allergic reactions among children. While Brazil and the UK report high allergen rates in children's products, Thailand lacks clear regulations. For children with allergic contact dermatitis, the diagnostic method is a patch test, which can be quite complex. Therefore, avoiding allergens is considered the best prevention method for this disease. This study is a cross-sectional study that collected 305 products labeled for children from various department stores. The stores were categorized based on customer purchasing power, and the data were analyzed accordingly. The data collected were used to determine which types of allergens are mostly found in products for children and identify the relationship between allergens and the types of products. This information could serve as a guideline for selecting products for children. The results showed that the most frequently encountered allergens are those in the surfactant group, primarily Cocamidopropyl betaine, followed by substances in the preservative group, including methyldibromoglutaronitrile (MDBGN)/phenoxyethanol (PE), methylisothiazolinone (MI), methylchloroisothiazolinone (MCI), and propylene glycol accounting for 31.8%, 20.3%, 20%, and 18.7%, respectively. These substances contribute to the development of allergic contact dermatitis. Therefore, it can be concluded that products specified for newborns, babies, children, and kids are still not safe for use due to the presence of allergens that can trigger allergic contact dermatitis. However, many other chemicals currently in use can also trigger reactions. Despite limitations, this study highlights the need for well-defined regulations to reduce children's exposure to allergens and prevent allergic contact dermatitis.

Keywords**:** *Children's Skincare, Contact Allergens, Contact Dermatitis, Kid Products, Baby Products, Children's Products*

1. Introduction

Contact dermatitis is one kind of the inflammatory dermatoses caused by substances that come into contact with the skin. It can be categorized into two types: allergic contact dermatitis (ACD) and irritant contact dermatitis (ICD). Allergic contact dermatitis is a delayed-type hypersensitivity response that is mediated by the hapten-specific T cells in lymph nodes. Early studies have shown that the skin barrier is not yet fully developed in children. Recent research has raised concerns that children with atopic dermatitis are more prone to developing sensitization to contact allergens (Simonsen et al., 2018). The skin barrier's function is still not fully developed in children. Studies have revealed that babies are more likely to absorb external substances due to their thin skin and the dysfunction of the skin barrier (Dumycz, Kunkiel, & Feleszko, 2019). Although allergic contact dermatitis was once considered a rare condition in children, the prevalence of this condition has increased significantly over the years. It is known to affect 15%-71% of children with suspected ACD. Some studies have suggested that ACD is more common in those between the ages of 0 and 4 (Lubbes et al., 2017; Seidenari, Giusti, Pepe, & Mantovani, 2015).

A study carried out by the Pediatric Contact Dermatitis Registry (PCDR) revealed that 48% of children were sensitive to contact. Pre-emptive avoidance strategy (P.E.A.S.) is a data compilation in America referencing 5 studies that collected data from patch tests conducted on 2,025 children. The focus was on

identifying common allergens to which children exhibited sensitivity. Finally, the studies summarized a list of 25 allergens (Brankov, & Jacob, 2017). Therefore, this research is suitable for referencing allergens. There are many concerns about the safety of children's skincare products, and these products are generally considered to be safe. There are numerous products claiming to be for newborns, babies, children, and kids. The credibility and reliability of such a claim can be significant to parents. However, children with ACD can be sensitive to various allergens in products meant for them.

Today, there is an extensive range of products for children that can potentially cause the allergens present in them to vary. The process of patch testing can make it hard for parents and children to feel comfortable, and ACD can be easily misdiagnosed in those with existing atopic dermatitis.

Research conducted in Thailand on common allergens in children with eczema has found that the top three contact allergens are lanolin alcohol (8.9%), Cocamidopropyl betaine (8.1%), and nickel sulfate (7.3%). These allergens have also been found in children's products in Thailand (Puangpet et al., 2023).

From previous research conducted in Brazil (Lazzarini et al., 2018), the top 5 most frequently detected allergens were Citronellol, Methylparaben, Propylparaben, Cocamidopropyl betaine, and Methylisothiazolinone. These substances are primarily components of preservatives and surfactants found in industrial and personal care products.

Thailand currently has no equivalent regulations for baby cosmetics, thus presenting a risk for the baby to contact allergens. There is currently no consensus regarding which allergens should be included in the patch tests for children. The goal of this study was to determine the prevalence of allergens in cosmetic products for children. This information can be used by consumers and providers to guide them in choosing products that are free of sensitizing chemicals. Furthermore, the information obtained could also be valuable for pediatricians and dermatologists to recommend products suitable for patients with allergic contact dermatitis.

2. Objectives

1) To examine the prevalence of contact allergens based on the Pre-emptive avoidance strategy 2016 in products labeled for newborns, babies, children, and kids which were sold in Bangkok, Thailand in 2023.

2) To find the relationship between allergens and types of products

3. Materials and Methods

3.1 Study design

This cross-sectional study was conducted from May to December 2023. The information on baby and children's products was collected from various stores in Bangkok based on purchasing power, which included department stores, supermarkets, convenience stores, drug stores, cosmetic stores, and specific baby product stores. The selected stores were chosen based on those with the highest market share in each segment to reduce bias (Krungsri Research, 2022). All products for children that met the inclusion criteria were collected and analyzed for interpretation. The inclusion criteria for samples were the products labeled for newborns, babies, children, and kids that had Thai FDA registration numbers. Exclusion criteria included products that were withdrawn from the market during the study period and those that lacked specificity or labeling for use with babies.

3.2 Study protocol

The types of products for newborns, babies, children, and kids that were collected included soap and shampoo, conditioner, moisturizing cream/lotion, oil, powder, moist wipes, laundry detergent, softener, toothpaste, mouthwash, sunscreen, and cleanser. The authors recorded the names, product brands, and types of products, as well as indications, ingredients, and country of the manufacturer in Google Sheets. The

allergens data collected included 25 allergens, referenced from P.E.A.S. that involved a relatively large group of children and referenced 5 previous studies, leading the faculty to compile a list of 25 common allergens. If any allergens were not detected in any products, they were not listed.

3.3 Outcome assessment

The primary objective was to examine the demographic data and determine the frequency of baby product information, including product types, brands, countries of origin, indications for use, and allergens identified.

The secondary objective was to examine the relationship between product indications and allergens to determine if any association existed.

3.4 Statistical analysis

The data were analyzed using descriptive analyses. Statistical analysis was performed with SPSS. This information was compared to the top 25 allergens referred from the P.E.A.S. study.

Pearson's chi-square test was performed for the comparison of 25 allergens to products labeled for newborns, babies, kids, and children. The different p-values indicate different types of hypothesis interpretations. A p-value < 0.05 was considered statistically significant.

4. Results and Discussion

4.1 Results

From all the products collected, totaling 303 products, it was found that there were a total of 84 different brands. The products were sourced from 13 countries, with Thailand, Malaysia, and Korea being the top three producers of children's products accounting for 71.8%, 12.1%, and 3.6%, respectively. The types of products, categorized by indication of use, can be divided into 4 groups: Baby, Newborn, Kids, and Children, with percentages of 56.7%, 15.7%, 19.7%, and 7.2%, respectively.

The types of products can be categorized into four groups based on their usage characteristics and contact with substances. The wash-off group, which includes baby soap, shampoo, conditioner, and cleanser, accounts for 31.8% of the products. The leave-on group, comprising moisturizing cream/lotion, baby oil, baby powder, and lotion powder, constitutes 28.5% of the products. The toileting group, consisting of toothpaste, mouthwash, and baby wipes, accounts for 26.9%. Lastly, the detergent group, comprising laundry detergent and softener, represents 12.8% of the products.

Products labeled for use on newborns, babies, children, or kids were found to contain at least one allergen in 62% of products, with the detection ranging from 1 to 5 allergens referencing 25 allergens from P.E.A.S. When searching for allergens in products and comparing them to the 25 allergens identified by P.E.A.S., it was found that only 13 allergens were present in all products, as indicated in Table 1. Therefore, the following conclusion and discussion focuses solely on these 13 identified allergens.

The top three most frequently encountered allergens were Cocamidopropyl betaine, methyldibromoglutaronitrile (MDBGN)/phenoxyethanol (PE), and methylisothiazolinone (MI), accounting for 31.8%, 20.3%, and 20%, respectively. In a study of children's products in Brazil, the top three allergens found were methylparaben (22.4%), citronellol (22.3%), and propylparaben (22.0%). Cocamidopropyl betaine, phenoxyethanol, and methylisothiazolinone were found at 21.6%, 21.2%, and 21.2%, respectively. (Lazzarini, Hafner, & Rangel, 2018)

Table 1 reveals that the top three most frequently detected allergens are Cocamidopropyl betaine, Methyldibromoglutaronitrile (MDBGN)/phenoxyethanol (PE), and Methylisothiazolinone (MI), with Cocamidopropyl betaine being detected in 31.8% of cases.

When categorized by usage groups, it is notable that in the kids/children group, this allergen can be found in up to 53.7% of products, which differs significantly from the baby/newborn group with 23.5% (p-value < 0.05).

Methyldibromoglutaronitrile (MDBGN)/phenoxyethanol (PE), ranked second, can be found in both the baby/newborn and kids/children product groups, at 22.2% and 15.9%, respectively, with no statistically significant difference.

Methylisothiazolinone (MI), comprising 20% of all allergens, can be found in the baby/newborn group at 14.5% and in the kids/children group at 34.1%, showing statistical significance (p-value < 0.05).

From the table, it can be concluded that there is a statistically significant correlation between allergens and age groups, specifically regarding compositae mix, Cocamidopropyl betaine, decyl glucoside, methylchloroisothiazolinone (MCI), and methylisothiazolinone (MI) (p-value < 0.05).

Table 1 Comparison between age groups (baby/newborn and kids/children) and 13 allergens

Reference allergens	All (%)	Baby/Newborn	Kids/Children	Number of allergens in children's products in other studies (%) (Dumycz et al., 2019; Brankov & Jacob, 2017; Lazzarini et al., 2018)	Number of allergens in other studies (%) (Young et al., 2022; Tran et al., 2022)	P-value
	N = 303 (100 %)	N = 221 (72.9 %)	N = 82 (27.1 %)			
Compositae mix	11.8	34 (15.4 %)	3 (3.7%)	1.7-2.2	12.2	0.002
Cocamidopropyl betaine	31.8	52 (23.5%)	44 (53.7%)	3.2-30.7	7.8-17.6	0.000
Formaldehyde	0.3	1 (0.5%)	0 (-)	4.4	3.4	0.546
Decyl glucoside	6.2	8 (3.6%)	11 (13.4%)	2.7-9.3	5.9	0.001
Cinnamic aldehyde	0.3	1 (0.5%)	0 (-)	0.9-1.6	0.1	0.546
Propylene glycol	16.7	32 (14.5%)	19 (23.2%)	3.8-16.5	9.8-25.1	0.061
Bronopol (2-bromo-2-nitropropane-1,3-diol)	1.0	3 (1.4%)	0 (-)	1.9-3.8	N/A	0.294
Methyldibromoglutaronitrile (MDBGN)/phenoxyethanol (PE)	20.3	49 (22.2%)	13 (15.9%)	1.6-25.9	11.4-40.2	0.255
Wool (Wax)/Lanolin	0.7	1 (0.5%)	1 (1.2%)	4.7-9.0	1.7-2.6	0.454
Propolis	0.7	1 (0.5%)	1 (1.2%)	2.6-3.8	0.4	0.454
Methylchloroisothiazolinone (MCI)	18.7	29 (13.1%)	27 (32.9%)	2.4-18.2	1.4-3.3	0.000
Methylisothiazolinone (MI)	20.0	32 (14.5%)	28 (34.1%)	4.3-21.2	3.3	0.000
Fragrance mix II	1.6	4 (1.8%)	1 (1.2%)	2.5-7.5	N/A	0.734

It can be concluded that there was a statistically significant association between 6 allergens, including Cocamidopropyl betaine, Decyl glucoside, Propylene glycol, Methyldibromoglutaronitrile (MDBGN)/phenoxyethanol (PE), Methylchloroisothiazolinone (MCI), and Methylisothiazolinone (MI) and the types of usage. Although the compositae mix has a relationship with age groups, no statistically significant correlation was found when examining the relationship between compositae mix and types of usage.

As an example, Cocamidopropyl betaine was detected in wash-off products for babies/newborns at 82.1% and in products for kids/children at 92.5%. Similarly, Decyl glucoside was also found in wash-off product groups (Table 2).

Table 2 Relationship between allergens and product groups of leave-on, wash-off, toileting, and detergent

Reference allergens	Leave on (N=87)		Wash-off (N=96)		Toileting (N=84)		Detergent (N=36)		P-value
	Baby/ Newborn	Kids/ Children	Baby/ Newborn	Kids/ Children	Baby/ Newborn	Kids/ Children	Baby/ Newborn	Kids/ Children	
	N = 79	N = 8	N = 56	N = 40	N = 50	N = 34	N = 36	N = 0	0.323
Compositae mix	8 (10.1%)	0 (-)	10 (17.9%)	2 (5.0%)	8 (16.0%)	1 (2.9%)	8 (22.2%)	0 (-)	0.323
Cocamidopropyl betaine	2 (2.5%)	1 (12.5%)	46 (82.1%)	37 (92.5%)	1 (2.0%)	6 (17.6%)	3 (8.3%)	0 (-)	0.000
Formaldehyde	0 (-)	0 (-)	0 (-)	0 (-)	0 (-)	0 (-)	1 (2.8%)	0 (-)	0.077
Decyl glucoside	1 (1.3%)	0 (-)	6 (10.7%)	11 (27.5%)	0 (-)	0 (-)	1 (2.8%)	0 (-)	0.000
Cinnamic aldehyde	0 (-)	0 (-)	0 (-)	0 (-)	0 (-)	0 (-)	1 (2.8%)	0 (-)	0.077
Propylene glycol	12 (15.2%)	0 (-)	4 (7.1%)	15 (37.5%)	16 (32.0%)	4 (11.8%)	0 (-)	0 (-)	0.006
Bronopol (2-bromo-2-nitropropane-1,3-diol)	0 (-)	0 (-)	0 (-)	0 (-)	3 (6.0%)	0 (-)	0 (-)	0 (-)	0.041
Methyldibromoglutaronitrile (MDBGN)/ phenoxyethanol (PE)	26 (32.9%)	3 (37.5%)	12 (21.4%)	7 (17.5%)	11 (22.0%)	3 (8.8%)	0 (-)	0 (-)	0.000
Wool (Wax)/Lanolin	0 (-)	1 (12.5%)	0 (-)	0 (-)	1 (2.0%)	0 (-)	0 (-)	0 (-)	0.654
Propolis	0 (-)	0 (-)	0 (-)	0 (-)	1 (2.0%)	1 (2.9%)	0 (-)	0 (-)	0.140
Methylchloroisothiazolinone (MCI)	1 (1.3%)	1 (12.5%)	28 (50.0%)	26 (65.0%)	0 (-)	0 (-)	0 (-)	0 (-)	0.000
Methylisothiazolinone (MI)	1 (1.3%)	1 (12.5%)	28 (50.0%)	27 (67.5%)	0 (-)	0 (-)	3 (8.3%)	0 (-)	0.000
Fragrance mix II	1 (1.3%)	0 (-)	2 (3.6%)	1 (2.5%)	1 (2.0%)	0 (-)	0 (-)	0 (-)	0.611

4.2 Discussion

Products for children in Bangkok have a lower prevalence of allergens compared to other countries. This is because other research studies have more reference allergens, resulting in a higher prevalence of allergens (Lazzarini, Hafner, & Rangel, 2018; Low, & Wallace, 2019).

In this study, the top five most commonly found allergens were Cocamidopropyl betaine, Methyldibromoglutaronitrile (MDBGN)/phenoxyethanol (PE), Methylisothiazolinone (MI), Methylchloroisothiazolinone (MCI), and Propylene glycol. The occurrence of allergens differed from other studies because, in this study, the majority of collected products comprised wash-off products, which typically contain surfactants and preservatives. The result is a relatively high prevalence of all five types of substances. Additionally, this study did not collect data on paraben substances, resulting in the absence of paraben information in this research.

The surfactant substance found most frequently in this study was cocamidopropyl betaine, which is consistent with other research that identified this substance as the most commonly used surfactant (Young, Gui, & Bae, 2022; Tran, Comstock, & Reeder, 2022).

The remaining substances are all in the preservative group. In this study, Methyldibromoglutaronitrile (MDBGN)/phenoxyethanol (PE) was found to be as high as 20.3%. In another study, however, this substance was found at a rate of 25.9%, which is considered a similar proportion (Dumycz, Kunkiel, & Feleszko, 2019). The reason for the similar prevalence is likely due to the similarity in the number and types of products collected.

A limitation of this research is that it relies on referencing different allergens compared to other studies, potentially causing variations in the prevalence of allergen detection across studies. Moreover, there presently are more than 5700 known types of allergens that can trigger allergic contact dermatitis (Low, & Wallace, 2019), including other factors not considered in this study, such as the concentration of substances, duration of substance contact, and the agonist-antagonistic effects of substances. Furthermore, this study only collected data on children's products in the Bangkok area. If researchers wish to expand the study in the future, it is recommended to gather comprehensive data covering the entire country or include products from other countries.

5. Conclusion

Currently, products designated for children still contain a relatively high quantity of allergens based on P.E.A.S 2016. Further, there are still no well-defined regulations for products labeled for babies, newborns, kids, and children in Thailand. Therefore, parents who choose to purchase products labeled for newborns, babies, children, and kids still face the risk of their offspring coming into contact with allergens and developing allergic contact dermatitis.

This research also emphasizes the importance of product composition for children among manufacturers, healthcare professionals, and parents.

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7. References

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