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Effects of Intervention on Home-Based Environmental Counselling for Children with Severe Allergic Diseases

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Abstract

Background/Objectives: Home-based environmental management is the key to managing allergic diseases. This study identified the effects of environmental counseling intervention in children with atopic dermatitis and respiratory diseases.

Methods/Statistical analysis: The participants were 198 children with allergic diseases who participated in the study in 2016. In 2017, 66 children with severe allergic diseases in a follow-up study were selected. We ultimately analyzed the effect of environmental counseling in 26 children. To assess the effect of the intervention, the research team conducted a pre-test (baseline) and post-test (follow-up) twice. Trans-epidermal water loss (TEWL) and scoring atopic dermatitis (SCORAD) index were used to assess atopic dermatitis (AD) and forced expiratory volume in 1 second (FEV_1), forced vital capacity (FVC), immunoglobulin E (IgE), and eosinophil counts were used to assess respiratory diseases.

Findings: In children with AD, the baseline and follow-up SCORAD index values were 40.33 and 31.15 points, respectively. In children with respiratory diseases, the baseline and follow-up FEV_1 values were 77.77 and 87.53 points, respectively; baseline and follow-up FVC values were 81.38 and 95.54 points, respectively; baseline and follow-up IgE values were 520.86 and 481.37 points, respectively; and baseline and follow-up eosinophil values were 4.97 and 4.42 points, respectively. Thus, home-based environmental counseling decreased FEV_1 and FVC values.

Improvements/Applications: Patients with respiratory diseases treated with home-based environmental counseling exhibited positive changes in FEV_1 and FVC values. Home-based indoor environmental counseling is regularly needed to manage respiratory diseases. The parents of children with respiratory diseases must try to minimize their exposure to harmful substances indoors.

Keywords: *respiratory diseases, counseling, children, home-based, indoor environmental*

Introduction

Allergies are known chronic diseases with a high prevalence in infants and children[1]. A literature review of studies published between 1995 and 2013 reported that allergic disease symptoms have decreased or stopped in children and adolescents[2]. However, allergic diseases are increasing as lifestyles become Westernized and the environment becomes more polluted[3]. This evidence suggests that environmental management is very important in allergic diseases. Although the Asthma Control Guideline emphasized the need for environmental control[4], insufficient studies have examined the effects of disease improvement due to environmental control. A study reported in *The New England Journal of Medicine* found that environmental intervention in allergen sensitization and environmental risk factors improved asthma conditions[5]. Children with allergies are generally sensitive to many indoor allergen factors, but counseling or education on comprehensive indoor allergens is commonly lacking. Preventive education and teaching interventions for

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asthma patients reportedly improved symptoms[7-8] One study showed the effects of asthma by environmental interventions in the home[5], but this study focused on the effects of atopic dermatitis and respiratory diseases in socioeconomically disadvantaged children. Among the reported Korean studies, there was insufficient evidence of the environmental risk factors and allergic diseases for socioeconomically disadvantaged groups[6]. Previous studies focused on reducing exposure to only one allergy-causing substance found indoors rather than trying to improve the indoor environment as a whole[5,9-10]. Therefore, here we aimed to assess the effectiveness of a home-based comprehensive environmental counseling intervention in children with allergic diseases to provide evidence of the ability of voluntary management of the indoor home environment through environmental counseling to help improve allergic diseases.

Method

1. Study Design

This study was conducted in 2016 as part of the Korea Environmental Industry & Technology Institute (KEITI) for the Environmental Diseases Prevention Project (EDPP) for socioeconomically disadvantaged people. The purpose of the EDPP is to identify indoor hazardous environment factors for home based the living space and provide socioeconomically disadvantaged children the environmental management service through counseling. This study aimed to identify changes in the symptoms of children with atopic dermatitis and respiratory diseases before and after intervention using environmental counseling.

2.2. Study Sample

We obtained the EDPP data from the KEITI between 2016 and 2017. The EDPP participation criteria were chosen by low-income households as children with allergic diseases. The study target were 198 children with allergic diseases who participated in the study in 2016. We excluded those who did not meet our inclusion criteria as shown in Figure 1. Of the 198 children with allergic diseases who participated in the EDPP in 2016, 66 with severe allergic diseases were screened. The inclusion criteria were as follows: 1) age over 6 months, 2) sensitivity to food allergens, 3) sensitivity to inhalant allergens, 4) positive for skin test findings, and 5) agreement to participate in the study. The final sample included 26 children with severe allergic diseases; 21 who participated in the EDPP in 2017 but did not participate in the clinical intervention trials were omitted. Among the final 26 patients, 13 had atopic dermatitis, while the other 13 had respiratory diseases[Figure 1].

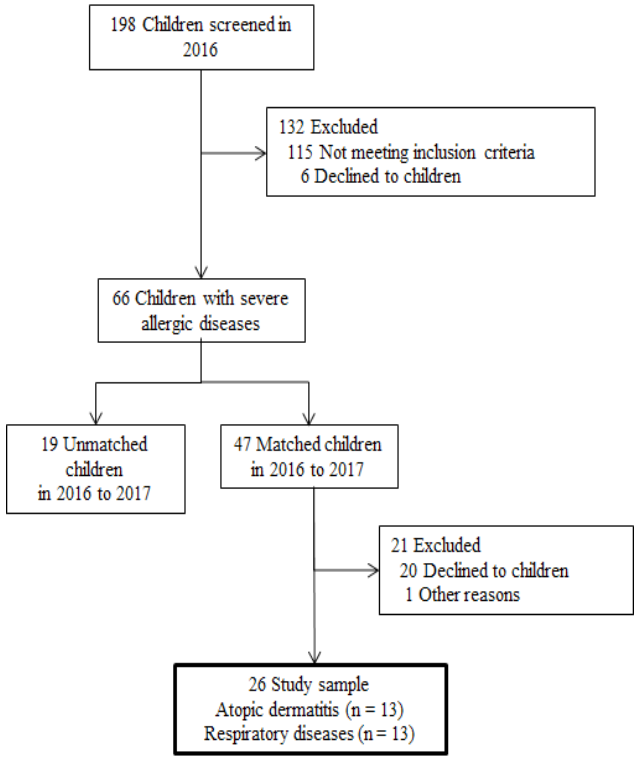

Figure 1. Selection process for study participants

3. Outcome Measures

To check the intervention effect of the environmental counseling at the Environmental Health Center for Childhood Asthma, Korea University conducted the same clinical tests two times. Demographic characteristics, disease duration, and diagnosis were investigated. Outcome measurements included skin, blood, and pulmonary function tests. The effects of the intervention in patients with atopic dermatitis were tested using the trans-epidermal water loss (TEWL) test and SCORing Atopic Dermatitis (SCORAD) index. Patients with respiratory diseases were subjected to tests of immunoglobulin E (IgE), eosinophils, forced expiratory volume in 1 second (FEV_1), and forced vital capacity (FVC). We measured TEWL using a "Tewameter" TM300 (Courage and Khazaka Eletronics, Cologne, Germany). The SCORAD index was evaluated for overall surface and visually distinct symptoms and two subjective variables[11]. The IgE concentration was measured by Coat-A-Count Total IgE IRMA (Diagnostic Products Co., Los Angeles, CA, USA)[12]. The pulmonary function test was measured in accordance with the guidelines of the American Association for Respiratory Care[13]. The FEV_1 and FVC

tests were conducted in accordance with the guidelines of American Thoracic Society and European Respiratory Society[14]. We selected the highest of three FEV_1 and FVC values collected using the pulmonary function test instrument (1022 digital spirometer; VIASYS, Palm Springs, CA, USA). In addition, food and inhalation allergen sensitization was confirmed using the multiple allergen simultaneous test (MAST).

2.4. Intervention and follow up

The intervention provided counseling for environment management for patients through home visits by an environmental counselor. Environmental counselors are trained professionals who completed professional training on the Eco-Mom-Korea. One family's counseling time (for parents and patients) was a total of 6 hours. The environmental counselors visited the home three times and called the family by mobile phone 10 times. The first home visit included indoor environmental monitoring and a pre-survey, the second visit included home indoor environment management, and the third visit included health behavior management counseling and other topics. Children with serve allergic diseases visited the hospital twice before and after the intervention. The first test (baseline) was administered on November 9, 2017, while the second (follow-up) was administered on November 30, 2017. No participant dropped out from the study.

2.5. Statistical Analysis

The statistical analysis was performed with basic statistics and a paired sample t-test. The probability of significance was interpreted as being statistically significant when less than 0.05.

Result and Discussion

The average age was 10.69 years; 53.8% (n = 14) of the participants were girls. Those with a family history comprised 84.6% (n = 22) of the sample, while those delivered by cesarean section comprised 46.2% (n = 12). Those who had been breastfed accounted for 65.4% (n = 17), while those with secondhand smoke exposure accounted for 57.7% (n = 15). The prevalence over 6.73 years of age was 50.0% (n = 13) for atopic dermatitis and 50.0% (n = 13) for respiratory diseases. In baseline atopic dermatitis function, mean TEWL was 36.33 (range, 18.80–76.90), while mean SCORAD index was 40.33 (range, 20.00–76.00). Regarding baseline respiratory disease function, mean FEV_1 was 77.77% (range, 60.00–114.00%), mean FVC was 81.38% (range, 60.00–113.00%), mean IgE was 520.86 IU/mL (10.00–1131.00 IU/mL), and mean eosinophil proportion was 4.97% (range, 1.30–10.10%). Regarding environmental exposure, secondhand smoke affected a mean 57.70% (n = 15) of patients. The allergen sensitization prevalence was 30.8% (n = 8) for food and 80.8% (n = 80.8) for inhalants [Table 1].

Table 1. Baseline characteristics of the 26 children

Characteristic	**n/N**	**% or 95% CI**
Demographic Characteristic		
Girls (%)	14/26	53.8
Age (yr)	10.69	2.93 (5.00-16.00)
Family history (%)	22/26	84.6
Cesarean section (%)	12/26	46.2
Breastfeeding (%)	17/26	65.4
Duration of allergic diseases (yr)	6.73	3.21 (2.00-15.00)
Allergy symptoms within 1 week before (%)		
Atopic dermatitis	13/26	50.0

Cont... **Table 1. Baseline characteristics of the 26 children**

Respiratory diseases	13/26	50.0
Baseline atopic dermatitis function (% of predicted value)		
Trans-epidermal water loss (n = 10)	36.33	19.58 (18.80-76.90)
Scoring atopic dermatitis (n = 12)	40.33	15.23 (20.00-76.00)
Baseline respiratory diseases function (% of predicted value or IU/mL)		
Forced expiratory volume in one second (n = 13)	77.77	14.54 (60.00 – 114.00)
Force vital capacity (n = 13)	81.38	15.38 (60.00 – 113.00)
Immunoglobulin E (n = 13)	520.86	439.88 (10.00 – 1131.00)
Eosinophil (n = 13)	4.97	3.07 (1.30 – 10.10)
Environmental exposure (%)		
Secondhand smoke exposure	15/26	57.7
Allergen (%)		
Food allergen	8/26	30.8
Inhalant allergen	21/26	80.8

The final 26 children selected had a 30.8% food allergen sensitization prevalence in 2016 that increased to 46.2% in 2017, while the inhalation allergen sensitization prevalence was 80.8% in 2016 and decreased slightly to 76.9% in 2017 for inhalants [Table 1-2].

Table 2. Changes in food allergen and inhalant allergen sensitization rate

Examination item	**Baseline (n, %)**	**Follow-up (n, %)**	**Difference***
Food allergen	8 (30.8)	12 (46.2)	-8(-15.4)
Inhalant allergen	21(80.8)	20(76.9)	1(3.9)

*Differences were used to determine the difference between 2016 and 2017

In children with atopic dermatitis, the baseline TEWL index was 36.33 (range, 18.80–76.90), while the follow-up TEWL was 48.64 (range, 17.60–101.50), an increase of 12.31. The baseline SCORAD index was 40.33 (range, 20.00–76.00), while the follow-up SCORAD was 31.15 (range, 13.00–71.00), a decrease of 9.18. In children with respiratory diseases, the baseline FEV_1 was 77.77% (range, 60.00–114.00) and the follow-up FEV_1 was 87.53% (range, 73.00–122.00%), an increase of 9.76% (p = 0.023). In addition, the baseline FVC was 81.38% (range, 60.00–113.00%), while the follow-up FVC was 95.54% (range, 85.00–123.00%), an increase of 14.16% (p = 0.004). Also, the baseline IgE was 520.86 IU/mL (range, 10.00–1131.00 IU/mL), while the follow-up IgE was 481.37 IU/mL (range, 14.30–1253.00 IU/mL), a decrease of 39.49 IU/mL. The baseline eosinophil proportion was 4.97% (range, 1.30–10.10%), while the follow-up eosinophil proportion was 4.42% (range, 1.00–8.20%), a decrease of 0.55% for inhalants [Table 3].

Table 3. Allergy symptom changes after intervention

	Examination items	Baseline (M, 95% CI)	Follow-up (M, 95% CI)	Difference*	t(p)**
Atopic dermatitis	TEWL n = 10	36.33 (18.80-76.90)	48.64 (17.60-101.50)	-12.31	-4.816 (0.001)
	SCORAD n = 12	40.33 (20.00-76.00)	31.15 (13.00-71.00)	9.18	1.584 (0.142)
Respiratory diseases	FEV1 (%) n = 13	77.77 (60.00-114.00)	87.53 (73.00-122.00)	-9.76	-2.604 (0.023)
	FVC (%) n = 13	81.38 (60.00-113.00)	95.54 (85.00-123.00)	-14.16	-3.498 (0.004)
	IgE (IU/mL) n = 13	520.86 (10.00-1131.00)	481.37 (14.30-1253.00)	39.49	0.562 (0.584)
	Eosinophil (%) n = 13	4.97 (1.30-10.10)	4.42 (1.00-8.20)	0.55	1.254 (0.234)

abbreviation: M, mean; CI, confidence interval; TEWL, trans-epidermal water loss; SCORAD, scoring atopic dermatitis; FEV1,forced expiratory volume in one second; FVC, forced vital capacity; IgE, immunoglobulin E: *Difference values were used to determine the difference between 1 week (baseline) and 3 weeks; **P values were determined using the paired sample t-test.

The symptoms of allergy-stricken children can be decreased even slightly with focus on environmental management at home. Environmental counseling aims to continuously manage the home indoor environment by identifying allergens and linking them to health behaviors to reduce allergies. One study reported the importance of developing self-care plans, patient education and counseling, and regular checkups to effectively manage asthma[15]. Therefore, the families of severely allergic children require much attention and practice. In previous studies, the effects of home-based environmental intervention were assessed for children with asthma, but in our study, health changes for home-based environmental counseling intervention were evaluated for children with atopic dermatitis and respiratory diseases. In this study, the levels of FEV1 and FVC were lower after the intervention. While not significant, IgE and eosinophil levels decreased. Since we did not investigate the participants' medication use or disease treatment during the intervention period, environmental counseling had limited ability to explain the reduction in these factors. That is why our findings may have been accidental. However, it is clear that reducing exposure to allergens in the home can decrease children's respiratory and allergy symptoms. We provided information on bedding management, ventilation (air circulation), and vacuum cleaner use, cleaning water dusters, and maintaining proper temperature and humidity through three home visits and 10 telephone consultations. In particular, a recent meta-analysis[16] study reported that air filtration improved asthma symptoms. While previous studies showed no change in waste capacity in a home-based environmental intervention[5], our study showed the opposite result. Seo et al. suggested that long-term and systematic environmental monitoring is necessary since socioeconomically disadvantaged children are exposed to indoor environmental risk factors[6]. Therefore, environmental management education through continuous counseling will be needed, as more frequent environmental counseling may effectively reduce the symptoms of atopic dermatitis and respiratory disease.

We confirmed that ongoing counseling by environmental counselors is effective at preventing allergies. However, subsequent studies are needed since our study intervention methods were not sophisticated, the methods of arbitration were not evaluated, and few samples were obtained. Having a particularly small sample was the largest study limitation.

Conclusion

In summary, TEWL in atopic dermatitis patients was not improved through this intervention of environmental counseling. However, The symptoms of FEV_1 and FVC in children with respiratory diseases were improved after the intervention. Therefore, environmental counseling in the home positive affected respiratory disease symptoms. The parents of children of respiratory diseases will need to try to reduce their exposure to harmful substances indoors and clean up the in-home environment.

Ethical Clearance: Not required

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Conflict of Interest: No other author has reported a potential conflict of interest relevant to this article.

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