Benefits of mobile messenger application in caregivers of food allergy children

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Abstract

Background: Unintentional exposure is common in children with food allergies.

Objective: To assess the benefits of newly developed food allergy application.

Methods: Caregivers of children with confirmed immediate reactions to food were enrolled to use the "Kinchew" application for one month. Kinchew provides the detail of food allergens after typing the name of specific food in the chat box. Then, the app provides the product image and detail of food allergens. Kinchew also has a menu for recording food diaries and videos on managing food allergies. Kinchew users were asked to assess their confidence in dealing with food allergies assessed by the questionnaire using 5 points Likert scale. The number of patients who experienced allergic reactions from unintentional food exposure was recorded after using Kinchew.

Results: Seventy caregivers were enrolled. Wheat was the most common causative food in 67% of the participants. All participants used Kinchew with a total use of 1,754 times, classified as food items searching 1080 times (62%), and recorded their food diary 674 times (38%). The number of patients who experienced allergic reactions from unintentional exposure significantly decreased from 61 (87%) to 31 (44%), $p < 0.001$. The user's confidence in choosing food improved significantly compared to the baseline score. In the subgroup analysis of the type of causative food, a significant improvement in confidence in food choosing was demonstrated in wheat and multiple food allergy groups.

Conclusions: Well-designed food allergy mobile applications could improve caregivers' confidence in dealing with food allergies and reduce unintentional food exposure.

Key word: Mobile health, food labeling, food allergen, adverse reaction to food, caregiver confidence

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Introduction

The prevalence of food allergy in children has been rising throughout the world.[1-3] Treatment for food allergy consists of causative food avoidance and appropriate food substitute.[4] Major food allergens including wheat, egg, milk, peanut, fish, crustaceans, soy, and tree nuts are required to disclose on food labels on commercial food according to the Food Labeling and Consumer Protection Act, USA, and an announcement from the Ministry of Public Health, Thailand.[5,6]

However, food allergen labelings in commercially available food are occasionally difficult to understand, resulting in accidental exposure to offending foods.[7] As a result, unintentional exposure to causative food causing allergic symptoms can occur from unclear food labels or food allergens not listed on the food label.[8,9] In addition, food allergy was the most common cause of hospitalized children with anaphylaxis[4,10] and contribute to an overall

severe burden for children and their caregivers.[11] The World Health Organization (WHO) recently established the "Be Healthy, Be Mobile" initiative and encourages mobile health technology (mHealth) to provide health care to communities. The WHO defines mobile health (mHealth) as the field of public and medical practice related to mobile devices (mobile phones, tablets, and other wireless devices).[12] Mobile applications regarding food allergens in food should have a beneficial effect on food allergy patients. However, most available mobile applications for people dealing with food allergies in application stores lack relevant information and are developed without the contribution of healthcare specialists.[13] Nowadays, the number of ownership for mobile devices increased significantly. Messaging applications such as Facebook Messenger, Telegram, and Line have been used increasingly in Southeast Asian countries including Thailand. Several messaging applications such as Line official account are used for health education services by providing reliable sources of information from health care personnel.[14] The current study aimed to assess the benefits of a newly developed food allergy mobile messaging application in caregivers of food allergy children.

Methods

This prospective cohort study was conducted at the Pediatric Allergy and Immunology Unit, Faculty of Medicine Ramathibodi Hospital, Bangkok, Thailand, from February 2021 to January 2022. Ethical approval was approved by the Human Rights and Ethics Committee of the Faculty of Medicine, Ramathibodi Hospital, Mahidol University, Bangkok, Thailand (ID 2256, COA MURA2021/75). All participants received written informed consent. The Clinical Trial Registration number is TCTR20210224003.

Participants

Caregivers of children under the age of 10 who had a diagnosed food allergy were included in the study. Food allergy was defined based on the fulfillment of all the following criteria: 1) the presence of signs and symptoms indicative of IgE-mediated food allergy, 2) positive results on skin prick tests and/or specific IgE tests for the suspected food allergen, 3) improvement of symptoms upon avoiding the culprit food or positive results on oral food challenge, and 4) occurrence of the most recent allergic reaction within the past six months. The baseline characteristics of children with food allergies were recorded, including age, sex, and comorbidities associated with allergies. The food allergy profiles included details about the specific food allergens responsible for the allergic reactions, presenting symptoms, age at the time of food allergy diagnosis, duration of the food allergy, and the number of self-reported allergic reactions resulting from unintentional exposure before the enrollment. In addition, the study also recorded information about the caregivers' educational background and the sources of online information they utilized regarding food allergies.

"Kinchew" mobile messenger application

"Kinchew" was developed via a mobile messenger application namely Line Official. Kinchew app provides the detail of food allergens in foods after typing the name of specific food in the chat box. Then, the app provides the product image and detail of food allergens. In addition, Kinchew also has a menu for recording food diaries and videos on managing food allergies (**Figure 1A**). The study team requested and obtained detailed information regarding the food allergens present in 670 commercial food products from 30 manufacturing companies in Thailand. These companies responded to a written request for such information, providing the necessary data for the study. If Kinchew could not match the food with the Kinchew database, Kinchew would provide instructions on how to read labels to find food allergens. Participants were instructed to log in anonymously to Kinchew and accept the agreement on terms and conditions before using the application. All participants were trained on how to use Kinchew. After using Kinchew for one month, Kinchew user assessed their confidence in dealing with food allergy by assessing the questionnaire using 5 points Likert scale (**Figure 2D**). The confidence was classified as poor if the scale was 1 or 2, average if the scale was 3, and high if the scale was 4 or 5. The confidence scale were compared before and after using the Kinchew.

Statistical analysis

Demographic data were described using descriptive statistics, which were presented as percentages, medians, and interquartile ranges. The Shapiro-Wilk Test was used to determine if continuous data was a normal distribution. Comparison of baseline and follow-up unintentional exposure data was analyzed by Wilcoxon signed rank test (non-normal distribution). Fisher's Exact test was used for analyzing the baseline and follow up confidence scoring in dealing with food allergy, and the number of patients who experienced allergic reaction from unintentional exposure. All p-values less than 0.05 were considered statistically significant. The statistical analysis was conducted using the SPSS 18.0 software package (IBM, Chicago, IL, USA).

Results

Seventy caregivers of children with food allergies were enrolled in the study. Among them, 36 caregivers (52%) had obtained a Bachelor's degree as their highest level of education followed by a postgraduate degree in 26 caregivers (37%) and 8 caregivers (11%) reported having an undergraduate degree as their highest level of education. Forty-seven patients (67%) were allergic to wheat, followed by egg white (49%) and cow's milk (37%). Thirty-seven patients (53%) had multiple food allergies (**Figure 2A**). The presenting symptom of food allergy in 35 patients (50%) was anaphylaxis. The median duration of food allergy diagnosis was 1.9 years (with an interquartile range of 0.5-4 years). Associated allergic diseases included allergic rhinitis, reported in 29% of the patients, asthma in 11%,
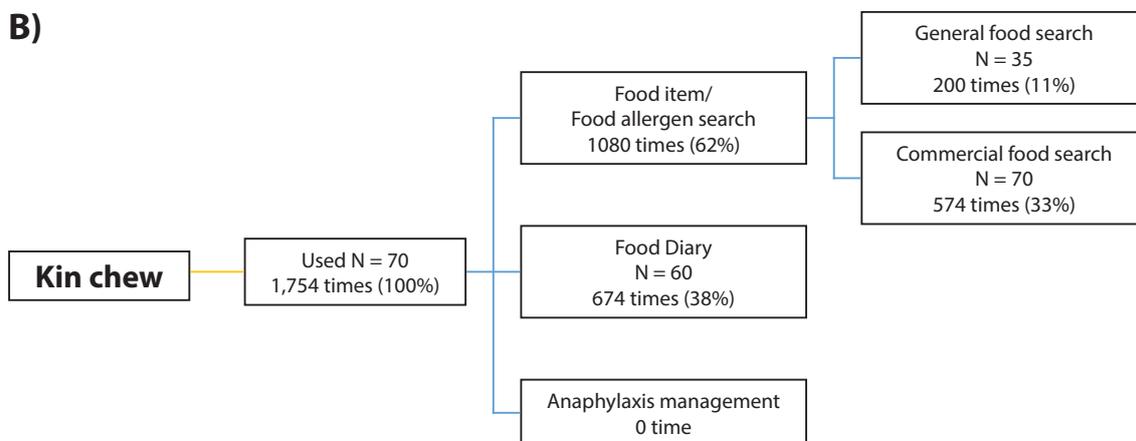
A)

B)

Figure 1. A) Example of Kinchew application B) Flow chart demonstrating Kinchew application usage.
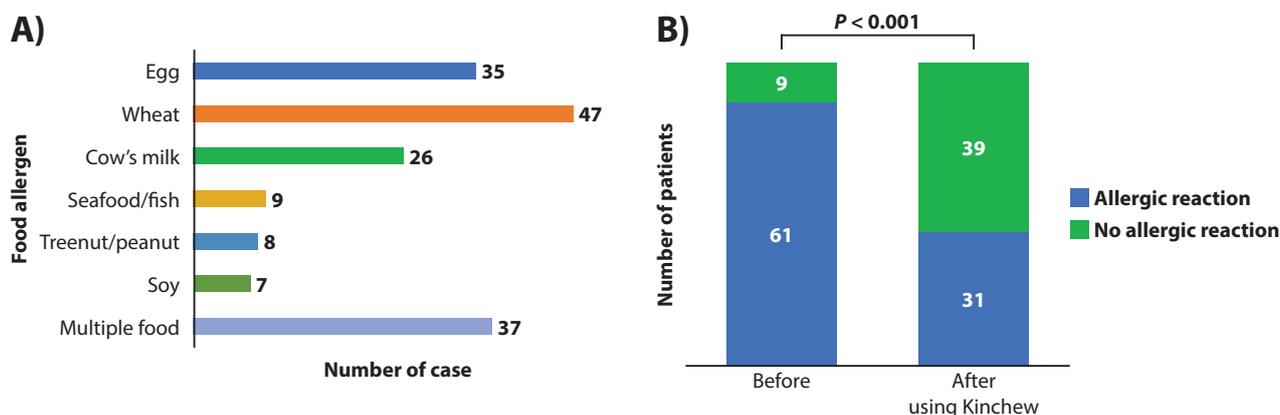
A)

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Figure 2. A) Causative food allergen of enrolled children B) Number of patients experiencing allergic reaction from unintentional causative food exposure before and after using Kinchew application.

and atopic dermatitis in 10%. When seeking information on food allergies, the majority of caregivers (87%) relied on internet search engines. Social media platforms were consulted by 39% of caregivers, while 30% referred to articles by unknown authors.

Kinchew application usage by the participant

All participants in the study utilized Kinchew, with a total usage count of 1,754 times. This usage was classified into two categories: food item/food allergen searching, which accounted for 1,080 instances (62%), and recording their food diary, which accounted for 674 instances (38%) (**Figure 1B**). After using Kinchew, the number of patients who experienced allergic reactions from unintentional exposure significantly decreased from 61 (87%) to 31 (44%), $p < 0.001$. (**Figure 2B**). All reactions were urticaria, and there were no instances of anaphylaxis reported by any of the patients during their enrollment in the study. Seventy-four percent of the users expressed high satisfaction with Kinchew, indicating a positive response to the application. Additionally,

21% of the users rated their satisfaction as neutral, implying a moderate or ambivalent viewpoint. A small proportion of users, specifically 4%, reported being unsatisfied with Kinchew.

Confidence in dealing with food allergies after using the application

The use of the Kinchew application resulted in a significant improvement in users' confidence in choosing food (question 1, **Figure 3B**) compared to their baseline scores (**Figure 3A**). However, there was no significant improvement observed in the question related to confidence in recognizing food allergy symptoms and treatment. Upon conducting a subgroup analysis based on the type of food allergy, it was found that the significant improvement in caregivers' confidence in food selection after using Kinchew was primarily observed in children with wheat allergy and those with multiple food allergies However, no substantial improvement was noted in children with cow's milk and egg allergy. (**Figure 3C-F**).
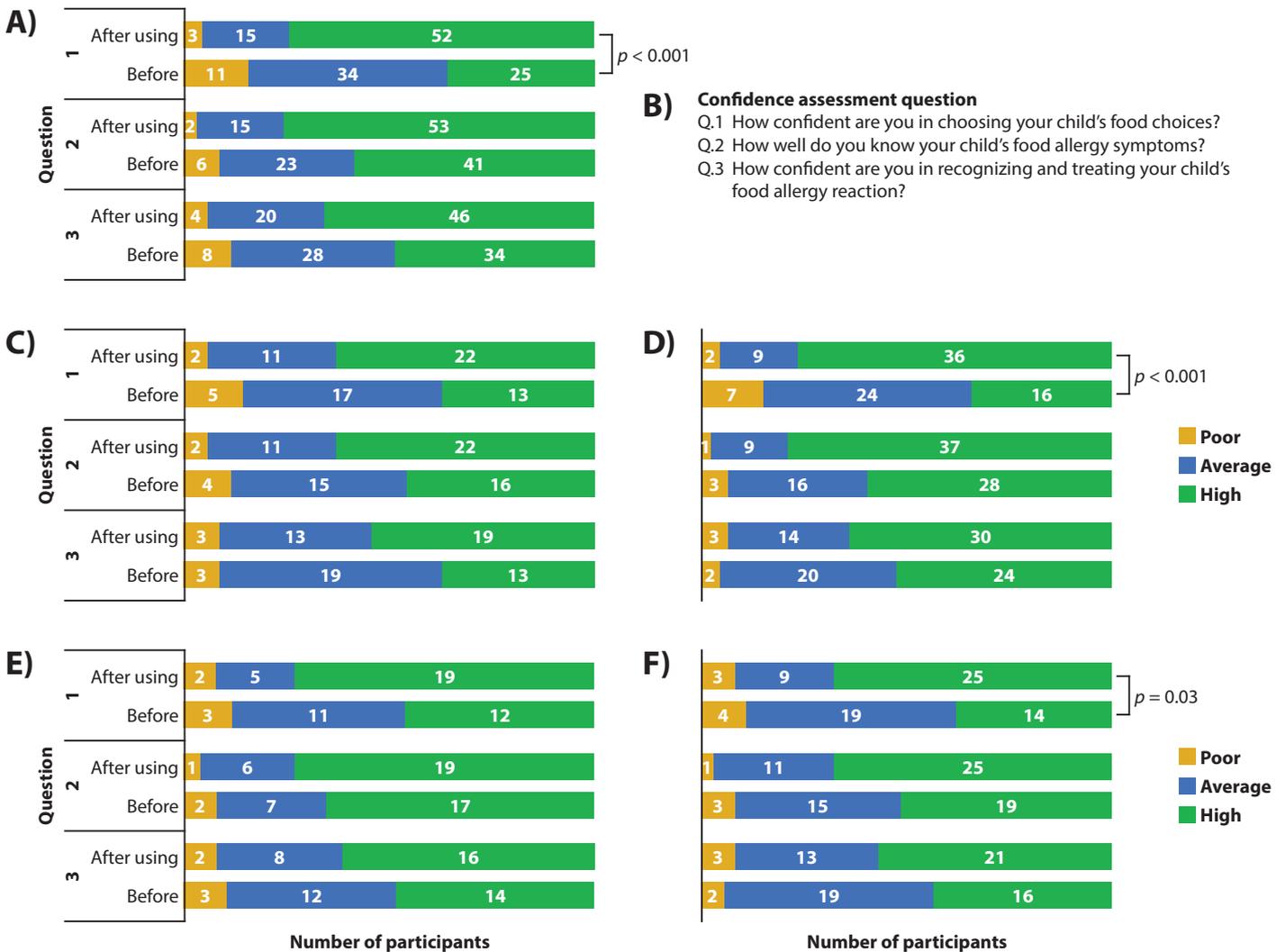
Figure 3. A) Confidence in dealing with food allergy before and after using Kinchew application B) Questions for assessment of confidence in dealing with food allergy. Confidence in dealing with food allergy before and after using the Kinchew application categorized by type of food allergen C) Egg, D) Wheat, E) Cow milk, and F) Multiple foods.

Discussion

The present study has successfully demonstrated the advantages of "Kinchew," a recently developed food allergy mobile application designed for patients and caregivers. The application exhibited significant efficacy in enhancing the confidence of caregivers when selecting appropriate foods, particularly those responsible for children with wheat allergy or multiple food allergies. Half of the patients in our study presented with anaphylaxis as a symptom of their food allergy. Following the utilization of Kinchew, none of the enrolled patients experienced anaphylactic events throughout the duration of the study, and all reported symptoms were limited to urticaria. By providing comprehensive information regarding the ingredients in various food products, Kinchew empowered caregivers to make well-informed decisions concerning suitable dietary choices for their children with food allergies.

This improvement in confidence can be attributed to the fact that wheat is often present as a hidden ingredient in many commercially available food items. Consequently, the significant enhancement in caregivers' confidence in selecting appropriate foods within the wheat allergy group can be attributed to the application's ability to raise awareness and assist in identifying hidden sources of wheat in various food products. A previous study has demonstrated the advantages of utilizing a mobile application to educate and train adults with intellectual disabilities in identifying potential food allergens.[15] Due to the increased likelihood of young children experiencing unintentional exposure to causative food allergens, which may arise from unclear food labels or the presence of allergens not listed on the label, it is important to address this issue effectively.[8,9] Our study serves to emphasize the necessity of developing mobile applications that cater to specific groups of individuals who may lack awareness regarding food allergens or face difficulties in reading food labels accurately. Such applications can play a crucial role in providing support and guidance, ensuring the safety and well-being of individuals who are at a higher risk of allergen exposure due to these challenges. While there are various food allergy mobile applications accessible through app stores, it is worth noting that only a limited number of them offer comprehensive food allergy education. Furthermore, none of the existing applications currently provide personalized food allergy treatment plans generated by specialized healthcare professionals. This highlights a potential gap in the market and underscores the need for mobile applications that combine both educational resources and individualized treatment recommendations created by qualified healthcare providers. Such applications would be valuable tools in assisting individuals with food allergies in managing their condition effectively and improving their overall quality of life.[16] The fact that Kinchew solely features a video demonstrating the proper usage of prefilled epinephrine during anaphylaxis events may indeed explain why the application did not result in an improvement in users' confidence in managing food allergy symptoms beyond anaphylaxis. The absence of a dedicated education module focused on managing various food allergy symptoms, in addition to providing information on epinephrine use, could be a limitation of the application. In order to address this concern, it would be beneficial for Kinchew to enhance its food allergy education module to encompass a broader range of symptom management strategies. By providing comprehensive knowledge and guidance on dealing with various food allergy symptoms, Kinchew could help users develop the necessary skills and confidence to effectively manage their food allergies.

The present study has provided valuable insights into the benefits and limitations of the Kinchew food allergy application. Firstly, the limited number of participants may restrict the generalizability of the findings to a larger population. Secondly, the absence of a control group limits the ability to compare the outcomes of the Kinchew application to other interventions or non-intervention scenarios. Additionally, reliance on self-reporting of symptoms for unintentional exposure may introduce information bias. As a result, it is recommended that further research is conducted with a larger sample size and a more diverse population, including individuals with varied educational backgrounds. This would help to evaluate and improve the Kinchew food allergy application before advocating for its widespread use among patients and caregivers. Addressing these limitations will contribute to a more robust and comprehensive understanding of the application's effectiveness and suitability in real-world settings. However, there are several limitations to food allergy application. First, the language used in the application needs to be local. As a result, each country may need its well-developed food allergy application, especially in non-English speaking countries such as Thailand. Second, the detail of food allergens in commercial food may change depending on the manufacturers. So, the application database needs to be regularly updated. Third, patients and caregivers cannot rely solely on the food allergen information provided by the application. Since allergenic food may contaminate during food processing or cooking.[12]

In summary, this pilot study has underscored the advantages of well-designed food allergy applications that provide detailed information on food allergen components and instructions for managing food allergy events. However, there is still room for improvement in food allergy applications. In addition to providing accurate information about food allergens, it is crucial to incorporate comprehensive food allergy education and initial treatment guidance for both patients and caregivers. By addressing these areas, food allergy applications can better support individuals with food allergies and empower them to effectively manage their conditions.

Author contributions

- KC, JA, WK, and WM designed the study.
- KC and JA contributed to data collection.
- KC, JA, AS, and WM performed the statistical analysis and interpretation of the results.
- KC drafted the manuscript and WM edited the final manuscript.
- All authors read and approved the final manuscript.

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