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The Success of Elimination Diet in Indonesian Children with Food Allergy: The Role of Caregiver's Stress, Family Activities, and Coping

Azwin Mengindra Putera*[1], Irwanto[1], Margarita Maria Maramis[2]

[1]Department of Child Health, Faculty of Medicine, Universitas Airlangga – Dr. Soetomo General Academic Hospital, Surabaya, Indonesia
[2]Department of Psychiatry, Faculty of Medicine, Universitas Airlangga – Dr. Soetomo General Academic Hospital, Surabaya, Indonesia

Corresponding Author: Azwin Mengindra Putera **Email**: azwinmengindraputera@gmail.com

ABSTRACT

Background: Elimination diet is the most effective treatment in treating children with food allergy. However, in its implementation, the success of elimination diet depends on a variety of factors, especially their caregiver.
Objectives: This study analyzed the correlation between caregiver's stress, coping strategy, and family's daily activities on the success of elimination diet in Indonesian children with food allergy.
Methods: Participants in this study were caregiver of Indonesian children with food allergy who received elimination diet for 4 weeks. Participants were measured for caregiver's stress, family's daily activities, and family's coping strategy after elimination diet. Caregiver's stress was measured using PSS, family's daily activities used FAIS, and while family's coping strategy used F-COPES. The data were analyzed using multiple linear regression, with p <0.05.
Results: The success rate of elimination diet in Indonesian children with food allergy was 43.64%. There was no significant correlation between caregiver's stress and elimination diet in Indonesian children with food allergy (t = -0.145; 95% CI -0.014 – 0.012; p = 0.886). A significant correlation was found between FAIS and elimination diet in Indonesian children with food allergy (t = -2,297; 95% CI -0.179 – -0.012; p = 0.026). Moreover, caregiver's coping strategy significantly correlated with elimination diet in Indonesian children with food allergy (t = 16,154; 95% CI 0.034 – 0.043; p <0.001).
Conclusion: The success of elimination diet in Indonesian children with food allergy is influenced by family's daily activities and coping strategy, while caregiver's stress has no significant influence.

Keywords: Caregiver's stress, family's coping strategy, family's daily activities, food allergy, elimination diet

Correspondence:
Azwin Mengindra Putera
Department of Child Health, Faculty of Medicine, Universitas Airlangga – Dr. Soetomo General Academic Hospital, Surabaya, Indonesia
Email: azwinmengindraputera@gmail.com

INTRODUCTION

Food allergy is the main cause of early atopic disease manifestation that can cause various other allergic manifestations [1]. The incidence of allergy in the world, particularly food allergy continues to increase, especially in children [2]. It was reported that in 2016, 2-10% of patients experienced food allergy, while as much as 5.9% of patients in Europe experienced food allergy. Moreover, 7.1% children in Canada had food allergy [3]. There is still no detailed data on the prevalence of food allergy patients in Indonesia in all age groups [4], but data on children with food allergy in Indonesia is reported to be 3-60% [5]. Food allergy disease is commonly found in children [3,6,7]. The prevalence of food allergy continues to increase by around 4-8% in children annually [8].

Elimination diet is the most effective treatment in handling patients with adverse reactions due to food allergy [1,9]. The method detects and removes specific antagonistic foods by formulating a nutritious hypoallergenic diet to ensure optimal health of people who are sensitive to food. However, this process is often tedious, time-consuming, and requires extraordinary knowledge, skills, and commitment [8]. In the case of children with food allergy, the success of food elimination diet depends on parents and children, how serious they are to follow and understand the elimination diet recommendation as much as possible. There are still many parents and children with food allergy who do not follow elimination diet properly due to various factors, both from parents and children [1,10].

Food allergy in children cannot be predicted and life threatening, thus increases caregiver's stress [11]. It was reported that 41% of caregivers experienced increased stress when their children were diagnosed with food allergy [11,12]. This condition causes the caregiver to limit children's activities in party and snacking at school. Daily activities such as shopping and eating out are frightening for children with food allergies and are even considered life threatening [12,13]. Adaptive coping is needed to solve these problems [14,15], so that the elimination diet given to children with food allergies can be successful [6,7].

Elimination diet is the best way to help patients cutting ties from foods that cause their daily allergic symptoms [1,9,16,17]. Data related to the success of elimination diet in Indonesian children with food allergy is very limited. Dr. Soetomo General Academic Hospital, Surabaya, as the main referral hospital in East Java, Indonesia, reported the number of Indonesian children with food allergy has increased annualy, with 127 patients in 2017 and 143 patients in 2018. Based on the explanation above, it is necessary to conduct a analysis to examine correlation between caregiver's stress, coping strategy, and family's daily activities on the success of elimination diet in Indonesian children with food allergy.

MATERIALS AND METHODS

Participants

Participants in this study were caregiver of Indonesian children with food allergy, which consisted of biological

mother or father. The participant's inclusion criteria were caregiver with children aged 1 month to 18 years, children diagnosed with food allergy [4,18,19], and children receiving elimination diet. The exclusion criteria were caregiver or children who did not want to participate in the study and children aged <1 month. Participants first received explanation of their rights, obligations, and filled out an informed consent sheet.

Design

This study used a case control study design [20,21], by observing the administration of elimination diet in Indonesian children with food allergy. This research was conducted in Dr. Soetomo General Academic Hospital, Surabaya, Indonesia, from May to August 2019. The participants were chosen using consecutive sampling, with a total of 55 participants (figure 1). Participants were not assessed prior to elimination diet. Assessment of allergy symptoms of Indonesian children with food allergy was carried out based on the response of emerging diseases such as allergic rhinitis [22], asthma [23], and atopic dermatitis [24]. The elimination diet was given for 4 weeks based on the Guideline for Diagnosis and Management of Food Allergy [18,25,26]. The participants were then evaluated for allergy symptoms and measured for characteristics, caregiver's stress, family's daily activities, and family's coping strategy.

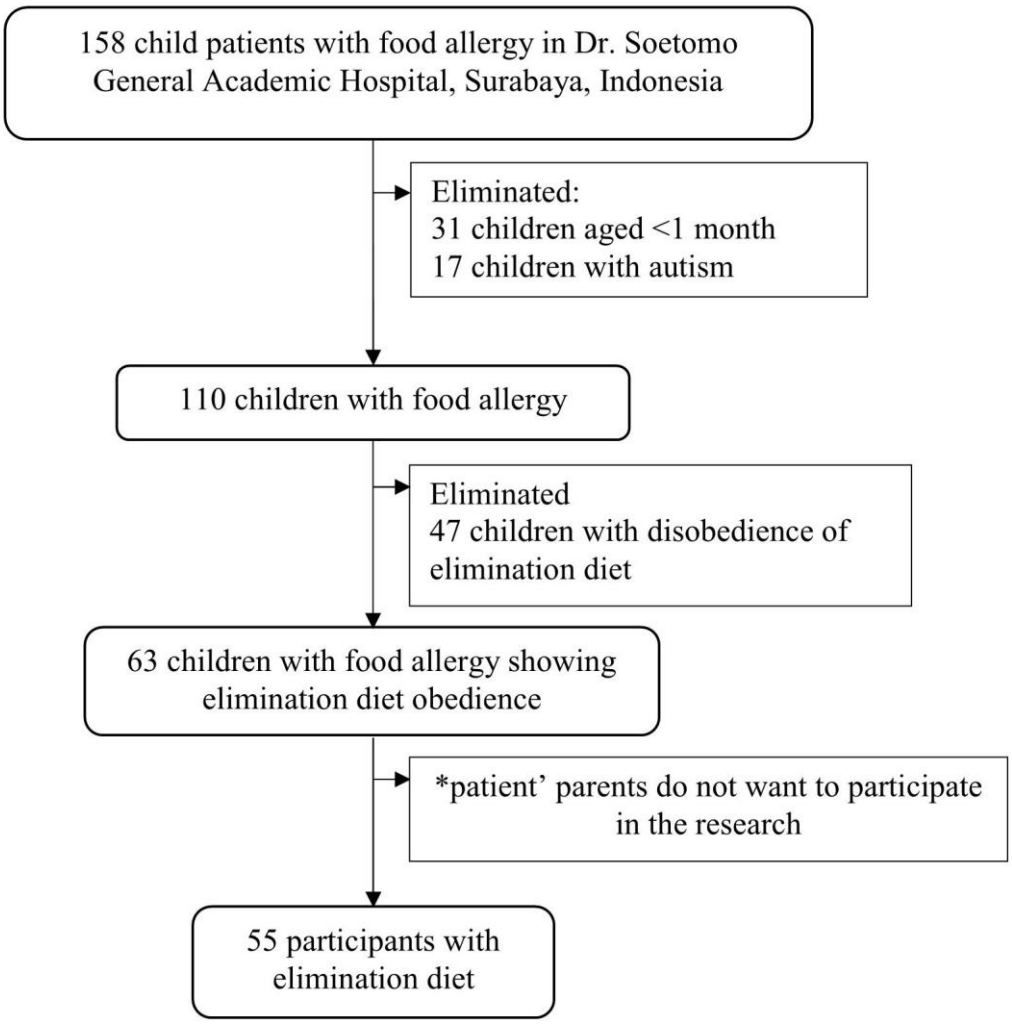

Figure 1. Identification Flowchart of Number of Participants

Ethical Approval

This study has obtained a certificate of ethical clearance according to Declaration of Helsinki from ethical committee team in Dr. Soetomo General Academic Hospital and Faculty of Medicine Universitas Airlangga ethics Committee (1165/KEPK/V/2019).

Elimination Diet

Elimination diet was provided based on a history of response to food allergies and skin prick tests [16]. The consumption of allergy-causing food was stopped and replaced the nutritional intake of these foods in consultation with a nutritionist. Nutrients obtained from these foods should be replaced with foods containing similar nutrients [18,25,26]. The use of books in elimination diet really helped caregivers and nutritionists make a diet plan for 4 weeks. Diet elimination was declared unsuccessful if the elimination diet was carried out >4 weeks and persistent signs of symptoms of food allergy.

Measurement of Caregiver's Stress

Caregiver's stress was measured using parental stress scale (PSS) with 18 questions. The scale is developed to measure stress level as parents [27]. The PSS used Likert scale of 1-5 (1 = strongly disagree, 2 = disagree, 3 = neutral, 4 = agree, 5 = strongly agree), with a minimum value of 18 and a maximum value of 90 [28]. This assessment tool was categorized into 3, namely mild (18 – 42), moderate (43 – 66), and severe (67-90) [29]. The

PSS was considered valid and reliable with Cronbach's alpha = 0.83 [27,28].

Measurement of Family's Daily Activities

Family's daily activities were measured using the food allergy impact scale (FAIS) to evaluate parents' perceptions about the impact of food allergy on eight aspects of family's daily activities, with the higher score indicating a greater impact. The scale consists of 32 questionnaire items, consisting of 8 activity aspects namely meal preparation (six items), family social activities (five items), caregiver-supervised child social activities (two items), family relations (three items), caregiver's stress and free time (three items), school or structured activities (six items), autonomous child social activities (three items), and employment and finances (three items). The FAIS reliability value was ≥ 0.70 [15,30].

Measurement of Family's Coping Strategy

The measurement of family coping was conducted using family crisis oriented personal evaluation scales (F-COPES) questionnaire, with a 5-point Likert's scale. This instrument displays 30 items of coping behavior designed to record problem solving, attitudes and behaviors developed by families to respond to problems or difficulties. This scale is divided into 5 subscales: obtaining social support, reframing, seeking spiritual support, mobilizing family support, and passive assessment [31]. The Indonesian F-COPES was considered valid and reliable with Cronbach's alpha = 0.89 [32,33].

Statistical Analysis

The measured data were analyzed univariate and bivariate, where univariate data were displayed in the form of a frequency distribution or mean ± standard deviation (SD). Meanwhile, the bivariate analysis used multiple linear regression tests. Statistical tests were significant if p <0.05. Measurement data were analyzed using IBM SPSS Statistic software version 21.0 (IBM Corp., Armonk, NY, USA).

RESULTS

Characteristics of Participants

Most participants were male 40 (72.73; p = 0.349), with the mean age of 68.1 ± 37.46 years (p = 0.159). Most participants came from low-income family (65.46%; p = 0.009). Parents' income affects the process of treating children with food allergy. Most parents' education level was non-bachelor as much as 72.73% (p = 0.782; Table 1). Most elimination diet was unsuccessful (56.36%). The mean age of participants who succeeded in implementing elimination diet was 60.0 ± 39.23 years, and those who were unsuccessful were 74.4 ± 35.38 (p = 0.692).

Table 1. Characteristics of Participants

Characteristics of Participants	N (%)	*p*
Sex		
Male	40 (72.7)	0.349
Female	15 (27.3)	
Income		
Low	36 (65.5)	0.009*
High	19 (34.5)	
Educational Level		
Non-bachelor	40 (72.7)	0.782
Bachelor	15 (27.3)	
Elimination diet in Children		
Unsuccessful	31 (56.4)	-
Successful	24 (43.6)	

Abbreviations: * significant p <0.05; **significant p <0.001.

Correlation between Caregiver's Stress on Elimination Diet in Indonesian Children with Food Allergy

The participant's stress value in this study ranged from 28 to 57, where the most participant had a stress value of 43 for 12 participants. The mean value of the participant's stress was 45.29 ± 4.67, with a median value of 45 (43 - 48). Most participants had stress in the moderate category as much as 89.09%. Participants who had mild PSS scores and successful elimination diet were as much as 83.3%, while participants who had moderate PPS scores and unsuccessful elimination diet were 61.2%. There was no significant correlation between

Table 2. Correlation between Caregiver's Stress, Family Activities, and Family Coping on the Success of Elimination Diet in Indonesian Children with Food Allergy

Caregiver's Condition	Successful Elimination Diet			Unsuccessful Elimination Diet			*p*
	Mean ± SD	Median (Q1-Q3)	Min-Max	Mean ± SD	Median (Q1-Q3)	Min-Max	
PSS	44.17 ± 5.65	45.00 (43.00 – 46.75)	28.00 – 54.00	46.16 ± 3.61	45.00 (43.00 – 49.00)	41.00 – 57.00	0.886
FAIS	5.01 ± 0.89	5.13 (4.48 – 5.47)	2.98 – 6.75	5.52 ± 0.53	5.33 (5.15 – 5.78)	4.31 – 6.52	0.026*
F-COPES	116.29 ± 3.91	116.50 (113.25 – 120.00)	109.00 – 122.00	95.45 ± 5.20	97.00 (94.00 – 99.00)	77.00 – 100.00	0.000**

Abbreviation: PSS, parental stress scale; FAIS, food allergy impact scale; F-COPES, family crisis oriented personal evaluation scales; *significant p <0.05; **significant p <0.001.

Table 3. Comparison of Each FAIS Subscale to the Caregiver of Indonesian Children with Food Allergy

FAIS	2		3		4		5		6		7		8	
	95% CI	*p*	95% CI	*p*	95% CI	*p*	95% CI	*p*	95% CI	*P*	95% CI	*p*	95% CI	*p*
1	0.12-0.43	0.001*	0.48-1.31	0.000**	0.72-1.48	0.000**	0.96-1.68	0.000**	0.96-1.77	0.000**	0.26-0.97	0.001*	0.46-1.23	0.000**
2			0.17-0.94	0.005*	0.43-1.22	0.000**	0.70-1.38	0.000**	0.65-1.44	0.000**	-0.09-0.70	0.125	0.15-1.23	0.008*
3					-0.56-0.48	0.875	-0.12-0.90	0.135	0.97-1.00	0.019*	-0.69-0.24	0.329	-0.54-0.76	0.743
4							-2.71-0.70	0.380	0.04-1.01	0.067	-0.99-0.65	0.084	-0.83-0.32	0.372
5									-0.39-0.57	0.714	-1.34--0.24	0.005*	-0.90--0.04	0.031*
6											-1.34--0.23	0.007*	-1.11-0.01	0.053
7													-0.21-0.80	0.249

Abbreviation: FAIS, food allergy impact scale; 1, meal preparation; 2, family social activities; 3, caregiver-supervised child social activities; 4, family relations; 5, caregiver stress and free time; 6, school or structured activities; 7, autonomous child social activities; 8, employment and finances; *significant p <0.05; **significant p <0.001.

Table 4. Comparison of Each F-COPES Subscale to the Caregiver of Indonesian Children with Food Allergy

F-COPES	Reframing		Spiritual Support		Mobilizing Family Support		Passive Appraisal	
	95% CI	*p*	95% CI	*p*	95% CI	*p*	95% CI	*p*
Social Support	-6.14 – -0.52	0.021*	11.81 – 16.95	0.000**	14.62 – 20.03	0.000**	16.76 – 22.01	0.000**
Reframing			16.57 – 18.85	0.000**	19.36 – 21.95	0.000**	21.24 – 24.18	0.000**
Spiritual Support					2.04 – 3.85	0.000**	3.87 – 6.13	0.000**
Mobilizing Family Support							0.96 – 3.15	0.000**

Abbreviation: F-COPES, family crisis oriented personal evaluation scales; *significant p <0.05; **significant p <0.001.

Caregiver's stress and elimination diet in Indonesian children with food allergy, where the PSS value of the participant with the successful elimination diet was 44.17 ± 5.65, while the PSS value of unsuccessful diet was 46.16 ± 3.61 (t = -0.145; 95 % CI -0.014 – 0.012; p = 0.886; Table 2).

Correlation between Family's Daily Activities on Elimination Diet in Indonesian Children with Food Allergy

The FAIS value ranged from 2.98 – 6.75, where the mean value was 5.30 ± 0.75 with a median value of 5.26 (5.08 – 5.66). The mean value of each FAIS subscale in the successful elimination diet group was as follows: meal preparation (5.86 ± 0.85), family social activities (5.58 ± 1.05), caregiver-supervised child social activities (3.64 ± 2.77), family relations (4.82 ± 1.40), caregiver's stress and free time (4.82 ± 1.15), school or structured activities (3.33 ± 2.35), autonomous child social activities (4.14 ± 2.52), and employment and finances (4.91 ± 1.49). Meanwhile, the FAIS value in the unsuccessful diet elimination group was as follows: meal preparation (6.37 ± 0.76), family social activities (6.10 ± 0.82), caregiver-supervised child social activities (4.92 ± 2.12), family relations (5.22 ± 1.61), caregiver's stress and free time (4.84 ± 1.33), school or structured activities (3.79 ± 2.30), autonomous child social activities (5.83 ± 1.30), and employment and finances (5.61 ± 1.10). There was a significant correlation between FAIS and elimination diet in Indonesian children with food allergy, where the caregiver's average FAIS value in the successful elimination diet group was 5.01 ± 0.89, while the value in the unsuccessful group was 5.52 ± 0.53 (t = -2.297; 95% CI -0.179 – -0.012; p = 0.026; Table 2).

There was a significant correlation of each FAIS subscale value in caregiver of Indonesian children with food allergy. The correlation was as follows: meal preparation versus (vs) family social activities (0.28 ± 0.57; p = 0.001); meal preparation vs caregiver-supervised child social activities (0.90 ± 1.40; p <0.001); meal preparation vs family relations (1.10 ± 0.90; p <0.001); meal preparation vs caregiver's stress and free time (1.32 ± 1.33; p <0.001); meal preparation vs school or structured activities (1.37 ± 1.30; p <0.001); meal preparation vs autonomous child social activities (0.62 ± 1.25; p = 0.001); meal preparation vs employment and finances (0.84 ± 1.43; p <0.001); family social activities vs caregiver-supervised child social activities (0.56 ± 1.26; p = 0.005); family social activities vs family relations (0.82 ± 1.45; p <0.001); family social activities vs caregiver's

stress and free time (1.04 ± 1.28; p <0.001); caregiver-supervised child social activities vs school or structured activities (0.55 ± 1.38; p = 0.019); caregiver's stress and free time vs autonomous child social activities (-0.79 ± 1.93; p = 0.005); caregiver's stress and free time vs employment and finances (-0.47 ± 1.58; p = 0.031); and school or structured activities vs autonomous child social activities (-0.80 ± 1.93; p = 0.007). The highest correlation value was obtained by meal preparation vs school or structured activities of 1.37 ± 1.30 (95% CI 0.96 – 1.77; p <0.001). Meanwhile, the lowest comparison value was obtained in subscale school or structured activities vs autonomous child social activities of -0.80 ± 1.93 (95% CI -1.34 – -0.23; p = 0.007; Table 3).

Family's Coping Strategy on the Success of Elimination Diet in Indonesian Children with Food Allergy

The participant's F-COPES value ranged from 77 to 122, where the mean F-COPES value was 104.54 ± 11.42 with a median value of 100 (96 – 115). The mean value of each F-COPES subscale was as follows: social support of 39.08 ± 6.77 (successful elimination diet) and 23.29 ± 5.22 (unsuccessful diet elimination); reframing of 34.08 ± 3.34 (successful elimination diet) and 33.06 ± 3.46 (unsuccessful elimination diet); spiritual support of 16.46 ± 1.56 (successful elimination diet) and 15.29 ± 2.22 (unsuccessful elimination diet); mobilizing family support of 13.38 ± 2.75 (successful elimination diet) and 12.45 ± 2.69 (unsuccessful elimination diet); and passive assessment of 11.54 ± 3.58 (successful elimination diet) and 10.23 ± 2.79 (unsuccessful elimination diet). There was a significant correlation between caregiver's coping strategy and elimination diet in Indonesian children with food allergy, where the mean value of family coping with successful diet elimination was 116.29 ± 3.91, and 95.45 ± 5.20 for unsuccessful group (t = 16.154; 95% CI 0.034 - 0.043; p <0.001; Table 2).

There was a significant comparison of each F-COPES subscale value of caregiver of Indonesian children with food allergy. The highest comparison value was obtained in subcale reframing vs passive appraisal of 22.71 ± 5.44 (95% CI 21.24 – 24.18; p <0.001). Meanwhile, the lowest comparison value was found on subscale social support vs spiritual support of -3.33 ± 10.40 (95% CI -6.14 – -0.52; p = 0.021; Table 4).

DISCUSSION

The main treatment of allergy is eliminating the allergen causing the problem, so the main management of food allergy is elimination diet [34]. Some literatures stated that elimination diet is an effective treatment for patients with food allergies [6,7,16]. The success of elimination diet in children with food allergy can increase the nutritional intake of children in the stages of development and growth and eliminate the signs of food allergy symptoms [16,17]. The success of elimination diet is expected to prevent the occurrence of food allergy reactions, most of which are anaphylactic reactions [35]. The success of elimination diet in children is strongly influenced by the role of caregiver, as they are the closest people to the child. Any condition experienced by the caregiver greatly affects the child's condition, including the success of elimination diet in children with food allergy [11,36].

In this study, there was no significant correlation between caregiver's stress and the success of elimination diet in Indonesian children with food allergy. Previous research pointed out that parents or caregivers of children with food allergy experienced increased stress [11] that eventually had negative effect on the knowledge, attitudes and behavior of the caregiver in assisting children in carrying out the elimination diet [37]. Caregivers with high stress level have difficulty to adapt to changes in lifestyle of elimination diet for children with food allergy, because the allergy-causing food must be stopped and replaced with those that have similar nutritional content but are hypoallergenic. These conditions result in increased costs and the need for dietary consultation with a nutritionist for the selection of foods that are good for consumption during elimination diet [11,38]. In addition, excessive stress leads to incorrect treatment chosen by caregivers [39]. Thus, caregiver's stress directly and indirectly affects the success of elimination diet in children with food allergy [11,37,38].

This study found that family's activities had a significant relationship with the success of elimination diet in Indonesian children with food allergy. Previous studies mentioned that food allergies greatly affect daily activities, in which the caregiver must pay attention to the labels of food items that children will consume [12]. In addition, caregivers of children with food allergy are forced to limit children's activities, especially in public activities (attending parties, eating together outside) [12,13,40]. Caregivers should pay extra attention to children at school because their risk of eating food allergens is very high [12,30]. Activities such as sleepovers and camps are also limited by the caregiver to minimize the risk of exposure to food allergens [15]. Daycare, birthday parties, field trips, and going to restaurants are also reported to be limited by the caregiver to prevent children with food allergies from consuming food allergens [12,41]. Activity limitation by the caregiver can increase the success of elimination diet by 70% [12,13].

Moreover, this study found a significant correlation between family's coping strategy and the success of elimination diet in Indonesian children with food allergy. Family's coping is important in overcoming the problem of food allergy in children, because family coping can determine the coping strategies used to seek treatment for children with food allergy [42]. The use of family coping in elimination diet in children with food allergy is very complex, which requires an effective strategy in its implementation. On the other hand, prolonged elimination diet causes psychological problems. Elimination diet in adults is effective to reduce food allergy load, but it requires further research in children patients regarding adaptive coping strategies [43]. Family coping affects the success of elimination diet in children with food allergies because family support is needed to play a crucial role in eliminating children's diets [6,7,11], because adapting children to eat hypoallergen foods to avoid allergic foods requires a long process [44,45].

However, some limitations should be noted. First, is it is hoped that further research will investigate elimination diet in Indonesian children with food allergy by using a quasy / true experimental research design. Second, it is hoped the number of participants in future studies will be greater and use a randomized control trail technique so that the composition between the intervention group and control group is more balanced and minimizes bias. Third, it is hoped that further research classifies the ages

of children with food allergy in order to identify the most effective elimination diet given to which age group.

CONCLUSION

Elimination diet is an effective treatment for children with food allergy, and the role of caregiver greatly affects its success. Family activities greatly affect the success of elimination diet in children with food allergy because limiting social activity greatly supports its success. Likewise, family coping greatly affects elimination diet in Indonesian children with food allergy because the coping used by families in responding to food allergies is critical to success because children cannot make decisions. While caregiver's stress greatly influences the success of elimination diet in Indonesian children with food allergy, this study found no significant correlation between caregiver's stress and elimination diet in Indonesian children with food allergy.

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CONFLICT OF INTEREST

None.

Author's Contribution

All authors contributed toward data analysis, drafting and revising the paper, gave final approval of the version to be published and agree to be accountable for all aspects of the work.

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