

Effect of egg avoidance diet by nursing mothers on the incidence of atopic dermatitis in infants

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ABSTRACT

Background The prevalence of allergic and atopic diseases has increased rapidly and remains a social as well as an economic problem for the patients on account of its chronic nature. In order to decrease the atopic diseases, especially atopic dermatitis in infants, nursing mothers should avoid allergenic foods as a preventive sensitization. Egg allergy is the most common cause of food allergy, and is closely related to atopic dermatitis in children.

Objective To determine whether egg avoidance diet by nursing mothers could decrease the incidence of atopic dermatitis in infants.

Method We conducted a parallel randomized-controlled trial. Seventy-nine subjects eligible for the study were divided into two groups: egg avoidance and non-egg avoidance group. Block randomization is used for random allocation. Intervention started since mothers had had delivery until their children were 4 months old. The primary outcomes were clinical atopic dermatitis.

Result Atopic dermatitis incidence in maternal egg avoidance group was significantly lower than non-avoidance group. Non-avoidance, family history of asthma, and maternal allergy are the factors significantly influencing atopic dermatitis incidence (OR 6.17; OR 4.73; OR 0.14), respectively.

Conclusion Egg avoidance by nursing mothers could decrease the incidence of atopic dermatitis in infants. Non-egg avoidance and asthma in the families are factors significantly inducing the incidence of atopic dermatitis. [Paediatr Indones 2008;48:71-5].

Keyword: atopic dermatitis, allergy, maternal avoidance diet, clinical trial, sensitization

Allergic disease is the most common cause of morbidity in children. The prevalence of allergic diseases has increased over the past two decades in many countries.¹ However, in developed countries, it affects 15% and 30% of the population.² Atopic dermatitis is an atopic disease which occurs most frequently during the first years of life. It is an inflammatory disease of the skin which appears to be erythematous and xerotic skin abnormality with severe pruritus, unclear margin, predilection on the skin folds, and is associated with cutaneous hyperactivity against environmental stimulation.³ Many studies suggest atopic dermatitis is frequently associated with food allergy.^{4,5} Egg and fish allergens are the most common causes of allergic reaction and ovalbumin, a kind of protein, plays an important role in egg white allergy.^{6,7}

Sensitization against food allergy may happen through breast milk, occurring in 6% of babies with high risk of allergy and receiving exclusive breast milk. This is due to a strong immunologic interaction of the mothers and their babies during gestational and

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breastfeeding period, in which the immune system of new born is affected by maternal immunity through both placenta and breast milk.¹ Exposure to food allergens found in breast milk, which are originated from maternal diet, is thought to be an important factor in the hidden sensitization.^{8,9} A number of food antigens existing in breast milk can be controlled by managing the diet modified for mothers during breast feeding period.¹⁰ Food antigen diet by nursing mothers with high risks of allergy may substantially decrease risk of atopic eczema in their children. The objective of the study was to identify the effect of egg diet in the nursing mothers on the risk of atopic dermatitis in their babies.

Methods

Sample and experimental design

We conducted a randomized controlled clinical trial, single blinded by comparing the mothers with and without egg diet and the incidence of atopic dermatitis in their infants. We collected subjects respectively from three health facilities in Yogyakarta Municipality: Bhakti Ibu Hospital, Dr. Sardjito Hospital, and Mergangsan Primary Health Center from January 1, 2004 until January 31, 2005. We calculated the samples size using hypothetical test formula in two proportions, with $\alpha=5\%$ and $\beta=20\%$, therefore 79 pairs of mothers and infants were included in the study.

Subjects were mothers and their babies with atopic risks (one or both parents or sibling with the atopic disease such as asthma, rhinitis allergy, and atopic dermatitis). The inclusion criteria of the babies were those with risk of atopy/ allergy and healthy babies. The inclusion criteria of the mothers were living in Yogyakarta, signing the informed consent, and willing as well as being able to breastfeed their babies for at least four months. The babies were excluded from the study when they had defects or congenital anomalies which made them unable to breastfeed, for example cleft lips (labiopalatoschisis) and asphyxia requiring mechanical ventilator. Mothers with severe diseases and a pathological disorder such as depression were excluded.

Nursing mothers were randomized into two groups of study: egg diet or non-egg diet. Mothers in egg diet group avoided foods containing egg, and a

list of foods were given to the mothers as guidance. The food records were performed daily using a standard food list to collect data about food intake of the mothers in the two groups. Therefore, we could monitor the compliance of mothers to diet protocol. Mothers then were classified into fully compliant, less compliant, and non-compliant. Mothers were classified into fully compliant when they obeyed all recommended rules and noted all kinds of food they and their babies consumed. Less compliant if the mother's daily record is not complete for several days (less than two weeks) and the mother has (less than five times) broke the recommended rules. Non-compliant if the mother's daily record is not complete over than two weeks and the mother has more than five times broke the recommended rules.

There were 79 subjects in the study during the period of January 1, 2004 - January 31, 2005, 39 of whom were in the egg diet group, and 40 were in the non-egg diet group.

Outcome variables

The evaluation on the two groups was carried monthly out for four months, which included the presence or absence of atopic dermatitis, other allergic manifestations, and the mothers' compliance. The diagnosis of atopic dermatitis was established by criteria of Hanifin Rajka and was performed by a dermatologist (Table 1).¹¹

Statistical analyses

The results of the study were analyzed by chi-square test, or Fischer's exact absolute test based on the kinds of data with computer software. To measure the other independent variables which might affect the result of the study, a logistic regression analysis was performed.

Results

Basic characteristics of subjects

The characteristic of subjects in both groups were comparable (Table 2). The incidence of atopic dermatitis in the egg diet group was significantly lower,

Table 1. Hanifin & Rajka criteria

Major criteria	
• Pruritus	
• Early age of onset	
• Typical morphology and distribution; flexural lichenification and linearity in adults; facial and extensor involvement during infancy and childhood	
• Chronic or chronically relapsing dermatitis	
• Personal or family history of atopy (asthma, allergic rhinoconjunctivitis, atopic dermatitis)	
Minor criteria	
• Xerosis	
• Hand/foot non specific dermatitis	
• Pityriasis alba	
• Nipple eczema	
• White dermografism	
• Subcapsular catarac	
• Increased serum Ig E level	
• Immediate (i.e. type 1) skin response	
• Susceptibility to cutaneous infections (especially Staphylococcus aureus and Herpes simplex)	

Table 2. Characteristics of subjects

Variable	Egg avoidance group n=39(%)	Non-egg avoidance n=40(%)
Birth weight (gram)		
<2500	1 (3)	8 (20)
2500-4000	38 (97)	32 (80)
Average	2,969±556	2,932±451
Gestational age		
<37 weeks	1 (3)	1 (3)
37-39 weeks	15 (39)	15 (39)
≥40 weeks	23 (59)	24 (59)
Average	38.77±5.98	39.96±1.55
Sex (%)		
Boys	22 (56)	14 (35)
Girls	17 (44)	26 (65)
Number of brothers/ sisters		
0	20 (50)	20 (51)
1	16 (40)	15 (39)
>1	4 (10)	4 (10)
Maternal age		
<25 years	6 (15)	3 (8)
25-35 years	34 (85)	35 (90)
>35 years	0	1 (3)
Average	29.59±3.77	29.55±4.25
Mother's formal education		
Elementary/ Junior High School	1 (3)	1 (3)
Senior High School	12 (1)	7 (18)
Academy	8 (21)	4 (10)
Undergraduate/ Graduate	18 (46)	28 (58)
Allergy/ Atopy in mothers	6 (67)	31 (78)
Asthma in the families	16 (41)	19 (48)
Environmental exposure		
Cigarette smoke	28 (72)	23 (58)
Dry/ dusty environment	2 (5)	2 (5)
Pets	13 (33)	15 (38)
Social economic status		
High	13 (33)	14 (35)
Middle	24 (62)	26 (65)
Low	2 (5)	0
Early feeding in babies	3 (8)	2 (5)

affecting two babies (17%), than that in the non-egg diet group, affecting 10 babies (83%). The risk of atopic dermatitis in the non-egg diet group was 25%, whereas in the egg diet group was 5%. The risk difference in both groups was 20%.

Factors affecting atopic dermatitis

Table 3 showed three significant predictor variables towards the incidence of atopic dermatitis, among others were non-egg avoidance with OR=6.17, maternal allergy with OR=0.14, and asthma in the families with OR=4.73.

Table 4 (multiple regression) showed non egg avoidance, asthma in the families and maternal allergy increased the risk of atopic dermatitis 14.76 times.

Other allergic manifestations

Other allergic manifestations found in eight subjects were respiratory manifestations (63%), gastrointestinal manifestations (25%), and other skin manifestations such as seborrheic dermatitis and urticaria (13%).

Compliance degree to the diet protocol

Twenty-eight subjects (72%) were fully compliant, seven subjects (18%) were less compliant and four subjects (10%) failed to comply.

Discussion

We found no significant difference associated with sociodemographic characteristics, risk factors of atopic dermatitis, and environment between both groups. The incidence rate of atopic dermatitis in this study was 15% with the risk difference of 19% in both groups, showing a significant incidence of atopic dermatitis. It is similar to the results of the former studies which was 14-20%.¹²⁻⁴ The length of gestational age would increase the risk of atopic dermatitis due to (1) transplacental allergen exposure or maternal factors of nutrition during late critical period of pregnancy. Early antigen exposure in premature babies post delivery may increase the tolerance or sensitization; (2) babies with heavier birth wight and post term babies are associated

Table 3. Logistic regression of factors affecting atopic dermatitis

Variable	OR	95%CI	P
Birth weight	0.67	(0.03; 6.38)	0.862
Number brother/sisters	1.28	(0.56; 10.3)	0.193
Post term gestational age	4.17	(0.76; 29.98)	0.170
Non-egg avoidance	6.17	(1.25; 30.32)	0.025*
Maternal allergy	0.14	(0.03; 0.52)	0.001*
Atopy in both parents	0.25	(0.06; 1.02)	0.060
Asthma in the families	4.73	(1.1; 19.1)	0.028*
Cigarette smoke exposure	0.32	(0.93; 1.14)	0.072
Exposure to dry and dusty environment	6.50	(0.82;51.5)	0.107
Exposure to pets	0.89	(0.24; 3.28)	1.000
Early feeding in babies	4.27	(0.43; 38.18)	0.756

Table 4. Results of multiple regression

Variable	OR	95%CI	P
Non-egg avoidance	14.76	1.76;123.39	0.010
Asthma in the families	10.4	1.47;73.79	0.021
Maternal allergy	0.03	0.03;0.25	0.001

with increased IgE total serum, meanwhile post maturity was also associated with decreased weight and thymus size, which could change the balance of Th1 and Th2. It is consistent with this study, where atopic dermatitis occurs more frequently in the babies with normal birth weight (91.7%) and in those who are post-term (≥ 42 weeks), whose result is 83.3%. It is also consistent with former studies which reported the longer the gestational age, the higher the risk of atopic dermatitis.¹⁵⁻⁷

The mothers with allergy had $OR < 1$, showing it was not the risk factor of atopic dermatitis. It was inconsistent with the results of the previous studies. It might be due invalidity of allergic diagnosis in those mothers.

Asthma in the families gave an adequate and significant influence to the incidence of atopic dermatitis. It increased the risk of atopic dermatitis by 4.73 times, which was consistent with other study.¹⁸

Respiratory manifestations are the most common other allergic manifestation (62.5%) in all subjects, which are consistent with the study by Sicherer.¹⁹ The mother's compliance on egg avoidance diet is not influenced by social-economic, level of education, and age factors.

Multiple regression analysis reveals variables significantly affecting the incidence of atopic dermatitis, which include non-egg avoidance, asthma in the families, and allergic mothers. The risk of atopic dermatitis would increase by 14.76 times if non-egg avoidance factor, familial asthmatic factor, and allergic

mothers are found. If non-egg avoidance and familial asthmatic factors are found, on the other hand, it would increase the risk of atopic dermatitis by 10.4 times.

The estimated rate of treatment effect in the study was $NNT = 5$, which means if there are five mothers on an egg diet during breastfeeding period, it would prevent the incidence of atopic dermatitis in one baby.

Some constraints of this study include short follow-up (four months), inaccurate food record of mothers, other allergic manifestations which are not confirmed by supportive laboratory examination, the possible compliance's bias, and the small number of subjects. A study with a longer and complete follow-up needs to be conducted and the diagnosis of atopic dermatitis should be confirmed by IgE examination, a supportive laboratory examination.

We conclude that egg avoidance in breastfeeding mothers may decrease the risk of atopic dermatitis in babies. Non-egg avoidance and asthma in the families are two factors significantly inducing the incidence of atopic dermatitis.

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