

Is maternal diet worthwhile?

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K. Fälth-Magnusson

Department of Pediatrics, University of Linköping,
Sweden

Karin Fälth-Magnusson, Department of Pediatrics,
Faculty of Health Sciences, University of
Linköping, S-581 85 Linköping, Sweden

Intervention in the maternal diet during pregnancy and/or lactation has been suggested as one way to prevent the development of allergic disease in the child. The word “worthwhile” in the title of this presentation urges a critical analysis whether these interventions have proved to reach the goal, i.e. to prevent allergic disease. Also, an analysis must be made whether the benefit of this prevention outweighs the disadvantages of the maternal dietary change.

Intrauterine sensitization

The theoretical basis for advocating dietary changes for the mother during pregnancy is the concept of intrauterine sensitization. Placenta is a membrane which makes possible not only the transfer of nutrients, but of antigens and possibly anti-idiotypic antibodies as well. Since it has been shown that fetal cells have the capacity to produce IgE from the 11 week of gestation (1) the theoretical basis for the immunological process of sensitization seems to exist. Specific IgE in cord sera has been reported towards penicillin and microfilaria (2) and occasionally to such foods as milk (3–5) or egg (6). However, other studies searching for specific antibodies to food (7–11) have failed to show specific IgE in the newborn. All these studies have used the RAST technique, modified to achieve extra sensitivity. Recently, a high proportion (76%) of babies who developed cow's milk protein allergy was reported to have specific IgE-antibodies in cord blood to bovine milk protein, analysed with a CRIE method (12). So far, this report contrasts with the previous opinion that intrauterine sensitization to food, although theoretically possible, seems to be a rare phenomenon.

Sensitization via breast milk

The passage of antigens through human milk was documented already in 1921 (13). The occurrence of sensitization to common foods such as egg and cow's milk in exclusively breast fed babies in everyday clinical practice makes sensitization via breast milk to a both theoretically possible and practically reasonable occurrence. Still, the relation between the level of antigen in breast milk and the sensitization in the child has been shown to be poor (14).

Maternal diets during pregnancy

With the aim to prevent allergic disease in the child, the expected design of a study would be non-exposure of the fetus to food antigens via placenta by a maternal elimination diet (9, 15–17). If, however, we also consider the information obtained from animal studies (18, 19) stressing the importance of the maternal immune system for the development of tolerance in the off-spring, another theoretical design is relevant, namely the excess intake of food antigens by the mother. This model has also been tested in mothers of allergy-prone families (20–22).

The Linköping study

A total of 212 Swedish women from allergy-prone families participated in a prospective, randomized study. The study group (n=104) were allocated to totally avoid intake of cow's milk, dairy products and egg, from gestational week 28 to delivery, while the control group (n=108) were allowed to take normal amounts of these foods throughout pregnancy; 79 mothers endured the diet period, but drop-outs were informed that they were allowed to partic-

ipate in the study in spite of the maternal dietary drop-out. The follow-up was performed with questionnaires to the families when the children were 6 weeks, 3 months, 6 months, 12 months, 18 months, 3.5 and 5 years. Skin prick test and assessment of total IgE was performed when the children were 6 months, 18 months and 5 years. An examination of a pediatric allergist, unaware of the maternal diet allocation, was performed when the children were 18 months. The numbers of mothers/babies "lost" to follow-up was 3/212 at birth, 4/212 at 18 months and 14/212 at 5 years.

The outcome for the children did not differ significantly in any of the studied parameters, i.e. the diet period in late pregnancy for the mother did not serve to prevent allergic disease in the child.

The size of the study group was decided after considering the risk for allergy development with a certain family history (7). The aim of the intervention was to reduce this risk with at least 25%.

The Stockholm-Uppsala study

In this randomized, prospective study 162 women with respiratory allergy were allocated to a diet with either a reduced intake of cow's milk and egg ($n=79$) or an excessive intake (one hen's egg a day and 1 litre of milk per day ($n=83$)). The follow-up of the babies to 18 months of age revealed no difference between the groups in the development of allergic disease (21, 22).

Maternal diets during the lactation period

The Newfoundland study

A total of 97 Canadian mothers who planned to breastfeed, were allocated to either a restricted diet (no milk, egg, soy, peanuts) or a normal diet. They were all from allergy-prone families. Eczema was found less often, and was less severe up to 18 months in breast-fed babies whose mothers were on the restricted diet (23).

The Skövde-Borås study

In a prospective Swedish study enrolling mothers from families with at least two allergic family members or one member and a high cord blood IgE in the baby, the mothers ($n=65$) in one town avoided cow's milk, egg and fish during the first three months of lactation, while the mothers in an adjacent town ($n=50$) took normal foods (24, 25). The four-year follow-up of the children has shown a significantly lower cumulative incidence and current prevalence of atopic dermatitis in the diet-group children, while other manifestations of allergic disease were similar in the groups (26).

The Isle of Wight study

In this prospective, prenatally randomized study with blinded assessment of the outcome performed on the Isle of Wight (27, 28), mothers in the prophylactic group ($n=58$) among other preventive measures, such as mite reduction, also totally avoided cow's milk, egg, fish and nuts during lactation, while the 62 control mothers took normal food. All babies had a family history of allergic disease and a high cord blood IgE. At 12 months, allergic disorders had appeared in significantly more control children, i.e. the authors had succeeded to reach the goal of a 50% reduction in allergic disease. Not only eczema but also asthma was significantly less common in the intervention group.

Maternal diet during pregnancy and lactation

The Californian study

In this randomized, prospective study with blind assessment of allergic disease in the child, an "idealized strategy for allergy prevention" was instituted (2). Apart from maternal elimination diet during pregnancy and lactation in the diet group ($n=103$) compared with the control group ($n=185$) preventive measures such as avoidance of pets, reduction of house dust and late introduction of solid foods were recommended. At 12 months, atopic dermatitis, urticaria and gastro-intestinal allergic disease was significantly less common in the diet group, while the prevalence of rhinitis and asthma was unaffected (29, 30). At 2 years, the preventive effect of the interventions had diminished further (30).

The Newfoundland study

Of 121 mothers who previously had an allergic child and entered this study, 109 completed the study with almost complete exclusion of milk, egg, fish, beef and peanut throughout pregnancy and lactation; 55 in the diet group and 54 in the control group. Atopic eczema was seen less often, and it was less severe in the diet babies (31).

In the last two studies, it is impossible to evaluate how much of the preventive effect was achieved during pregnancy or lactation, respectively.

Adverse effects of intervention in the maternal diet

To be on any diet means that you have to think whenever you eat – does this food contain any item I am not supposed to eat? For most people in the Western world cow's milk, dairy products and eggs are major nutrients. The loss of protein, fat and calcium due to diet must be compensated. In the Linköping study, the pregnant women took extra

calcium tablets and a casein hydrolysate (accepted by half of the women). The women were guided by an experienced and devoted dietician throughout the study. In spite of this, mothers on the exclusion diet put on weight significantly less during the last trimester than the control mothers (9). The birth weight for the babies did not differ significantly between the diet/non-diet group, but when information about maternal smoking habits was added, it was noted that daughters of smoking, diet mothers were significantly smaller than daughters of non-smoking, diet mothers (7). Also, the mothers experienced considerable restrictions in their daily life social activities like eating in restaurants, going to parties. Most mothers felt that this sacrifice was worthwhile in the hope of protecting the child from allergic disease, and all mothers claimed that the diet period had given them a more profound knowledge about good eating habits.

Conclusions

No study has proved a beneficial effect of maternal intervention diet during pregnancy. Some beneficial effect on the development of atopic eczema and food allergy has been shown after maternal elimination diet during lactation in high-allergy-risk families, but the exact impact of the diet period is hard to evaluate since often other preventive measures have been instituted as well. Maternal diet interventions have not proved to prevent rhinitis, wheezing or asthma, unless combined with other preventive measures (27, 28). The disadvantages of a diet period should not be overlooked, and it should never be continued longer than necessary. Advice by a dietician is urgently needed if interventions in the maternal diet are recommended.

References

- MILLER DL, HIRVONEN T, GITLIN D. Synthesis of IgE by the human conceptus. *J Allergy Clin Immunol* 1973; 52: 182-8.
- ZEIGER RS, HELLER S, MELLON MH et al. Effectiveness of dietary manipulation in the prevention of food allergy in infants. *J Allergy Clin Immunol* 1986; 78: 224-38.
- MICHEL FB, BOUSQUET J, GREILLIER P, ROBINET-LEVY M, COULOMB Y. Comparison of cord blood immunoglobulin E concentrations and maternal allergy for the prediction of atopic diseases in infancy. *J Allergy Clin Immunol* 1980; 65: 422-30.
- DELESPESE G, SARFATI M, LANG G, SEHON AH. Prenatal and neonatal synthesis of IgE. *Monogr Allergy* 1983; 18: 83-95.
- CHANDRA RK, SINGH G, SHRIDHARA B. Effect of feeding whey hydrolysate, soy and conventional cow milk formulas on incidence of atopic disease in high risk infants. *Allergy* 1989; 63: 102-6.
- BUSINCO L, MARCHETTI F, PELLEGRINI G, PERLINI R. Predictive value of cord blood IgE levels in 'at-risk' newborn babies and influence of type of feeding. *Clin Allergy* 1983; 13: 503-8.
- KJELLMAN NIM, JOHANSSON SGO. IgE and atopic allergy in newborn and infants with a family history of atopic disease. *Acta Paediatr Scand* 1976; 65: 601-7.
- CRONER S, KJELLMAN NIM, ROTH A. IgE screening in 1701 newborn infants and the development of atopic disease during infancy. *Arch Dis Child* 1982; 57: 364-8.
- FÄLTH-MAGNUSSON K, ÖMAN H, KJELLMAN NIM. Maternal abstinence from cow milk and egg in allergy risk pregnancies. Effect of antibody production in the mother and the newborn. *Allergy* 1987; 42: 64-73.
- ZEIGER RS, HELLER S, MELLON M et al. Effects of combined maternal and infant food-allergen avoidance on development of atopy in early infancy: a randomized study. *J Allergy Clin Immunol* 1989; 84: 72-89.
- HATTEVIG G, KJELLMAN B, SIGURS N, BJÖRKSTÉN B, KJELLMAN NIM. Effect of maternal avoidance of eggs, cow's milk and fish during lactation upon allergic manifestations in infants. *Clin Exp Allergy* 1989; 19: 27-32.
- HØST A, HUSBY S, GJESING B, LARSEN JN, LØWENSTEIN H. Prospective estimation of IgG, IgG subclass and IgE antibodies to dietary proteins in infants with cow milk allergy. Levels of antibodies to whole milk protein, BLG and ovalbumin in relation to repeated milk challenge and clinical course of cow milk allergy. *Allergy* 1992; 47: 218-29.
- SHANNON WR. Demonstration of food proteins in human breast milk by anaphylactic experiments on guinea pigs. *Am J Dis Child* 1921; 22: 223-231.
- CANT A, MARSDEN RA, KILSHAW PJ. Egg and cow's milk hypersensitivity in exclusively breast fed infants with eczema, and detection of egg protein in breast milk. *Br Med J* 1985; 291: 932-5.
- FÄLTH-MAGNUSSON K, KJELLMAN NIM. Development of atopic disease in babies whose mothers were receiving exclusion diet during pregnancy: a randomized study. *J Allergy Clin Immunol* 1987; 80: 868-75.
- FÄLTH-MAGNUSSON K, KJELLMAN NIM, MAGNUSSON KEM. Effects of various types of diets on food allergy in the infant. *Acta Paediatr Scand* 1989; 351 (suppl): 53-6.
- FÄLTH-MAGNUSSON K, KJELLMAN NIM. Allergy prevention by maternal elimination diet during late pregnancy: a 5-year follow-up of a randomized study. *J Allergy Clin Immunol* 1992; 89: 709-13.
- JARRETT EE, HALL E. The development of IgE-suppressive immunocompetence in young animals: influence of exposure to antigen in the presence or absence of maternal immunity. *Immunology* 1984; 53: 365-73.
- TELEMO E, JAKOBSSON I, WESTRÖM BR et al. Maternal dietary antigens and the immune response in the offspring of the guinea pig. *Immunology* 1987; 62: 35-8.
- LILJA G, DANNAEUS A, FÄLTH-MAGNUSSON K, GRAFF-LONNEVIG V, JOHANSSON SGO, KJELLMAN NIM. Immune response of the atopic woman and fetus: effects of high- and low-dose food allergen intake during late pregnancy. *Clin Allergy* 1988; 18: 131-42.
- LILJA G, DANNAEUS A, FOUCARD T et al. Effects of maternal diets during late pregnancy and lactation on the development of atopic diseases in infants up to 18 months of age: *in vivo* results. *Clin Exp Allergy* 1989; 19: 473-9.
- LILJA G, ÖMAN H. Prediction of atopic disease in infancy by determination of immunological parameters: IgE, IgE- and IgG-antibodies to food allergens, skin prick tests and T lymphocyte subsets. *Pediatr Allergy Immunol* 1991; 2: 6-13.
- CHANDRA RK, PURI S, HAMED A. Influence of maternal diet during lactation and use of formula feeds on devel-

- opment of atopic eczema in high risk infants. *Br Med J* 1989; 299: 228–30.
24. HATTEVIG G, KJELLMAN B, SIGURS N et al. Effect of maternal avoidance of eggs, cow's milk and fish during lactation upon allergic manifestations in infants. *Clin Exp Allergy* 1989; 19: 27–32.
25. HATTEVIG G, KJELLMAN B, SIGURS N, GRODZINSKY E, HED J, BJÖRKSTÉN B. The effect of maternal avoidance of eggs, cow's milk, and fish during lactation on the development of IgE, IgG and IgA antibodies in infants. *J Allergy Clin Immunol* 1990; 85: 108–15.
26. SIGURS N, HATTEVIG G, KJELLMAN B. The effect of maternal avoidance of eggs, cow's milk and fish during lactation upon allergic manifestations, skin prick tests and specific IgE antibodies in children at age four. *Pediatrics* 1992; 89: 735–9.
27. ARSHAD SH, MATTHEWS S, GANT C, HIDE DW. Effect of allergen avoidance on development of allergic disorders in infancy. *Lancet* 1992; 339: 1493–7.
28. ARSHAD SH, HIDE DW. Effect of environmental factors on the development of allergic disorders in infancy. *J Allergy Clin Immunol* 1992; 90: 235–241.
29. ZEIGER RS. Prevention of food allergy in infancy. *Ann Allergy* 1990; 65: 430–9.
30. ZEIGER RS, HELLER S, MELLON MH, HELSEY JF, HAMBURGER RN, SAMPSON HA. Genetic and environmental factors affecting the development of atopy through age 4 in children of atopic parents: a prospective randomized study of food allergen avoidance. *Pediatr Allergy Immunol* 1992; 3: 110–27.
31. CHANDRA RK, PURI S, SURAYIA C, CHEEMA PS. Influence of maternal antigen avoidance during pregnancy and lactation on incidence of atopic eczema in infants. *Clin Allergy* 1986; 16: 563–9.