



Ontario Society of Nutrition
Professionals in Public Health

La société ontarienne des professionnel(le)s
de la nutrition en santé publique

Discussion Paper of the Family Health Nutrition Advisory Group of the Ontario Society of Nutrition Professionals in Public Health (OSNPPH)

Food Allergy Risk Reduction in Infants and Young Children

December 2010

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Introduction

The effectiveness of diet related strategies to prevent or delay food allergy in young children has been a topic of conversation and controversy during the past several years. This is due, in part, to the lack of directional or consensus type statements from Canadian health professional organizations. However, American and European consensus papers do exist. Public health professionals in Ontario need evidence informed practice advice for food allergy prevention during pregnancy and infant feeding.

The purpose of this discussion paper is to provide evidence-informed food allergy prevention key messages to public health professionals.

The scope of this paper focuses on four topics:

- 1) Pregnancy
- 2) Lactation
- 3) Human milk substitutes (e.g. infant formula)
- 4) Introducing complementary foods

The key focus of this paper is the reduction of risk of food allergy in infants and children. However, there is also mention of other types of allergic conditions such as atopic dermatitis, asthma and eczema when no specific information on food allergy was available. It is beyond the scope of this paper to examine issues associated with the treatment of infants and children already displaying allergic symptoms. For infants or children displaying allergic symptoms, a consult and an individual assessment with an allergist is recommended.

As this paper is a “discussion paper”, it represents a synthesis of the current research. The role of the health professional in communicating these guidelines should focus on informed decision making with parents and families. Any liability incurred by implementing the key messages is assumed by the health professionals and agencies who put this research into action.

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Summary of key messages

Dietary restriction during pregnancy

1. There is no evidence that restricting maternal diet by avoiding highly allergenic foods during pregnancy plays a role in preventing food allergies in offspring, regardless of family history of allergy.
2. Pregnant women should avoid foods they are allergic to. For example, they should avoid peanut products if they are allergic to peanuts and they should replace those foods with nutritionally equivalent substitutes.
3. Pregnant women do not have to avoid the allergenic foods of the biological father.
4. Refer to Health Canada's Prenatal Nutrition Guidelines for Health Professionals 2009 for key messages about overall healthy eating and nutrients of concern during pregnancy.

Dietary restriction during lactation

1. Exclusively breastfeed the infant for the first six months of life.
2. There is no consensus or convincing evidence that maternal dietary restriction during lactation prevents food allergies in children, regardless of their infant's risk of developing food allergy.
3. The mother should avoid foods to which she is allergic.
4. The mother does not have to avoid the allergenic foods of the biological father.

Human milk substitutes (e.g. infant formula)

1. For infants **without** family history of allergy, the use of cow's milk-based infant formula does not increase the risk for food allergy.
2. For infants **without** family history of allergy, there is insufficient evidence to suggest feeding partially or extensively hydrolysed formula instead of cow's-milk based infant formula decreases the risk of developing food allergy.
3. For infants **with** a family history of allergy, there is moderate evidence partially hydrolysed formulas have an advantage over formulas made with intact cow's milk protein in delaying allergic response.
4. For infants **with** a family history of allergy, feeding extensively hydrolyzed infant formula, as compared to cow's milk-based formula, in the first six months of life, may reduce the risk of allergy. However, the practicality of using extensively hydrolyzed formulas is limited because they are expensive and have low palatability.
5. For breastfed infants **with** a family history of allergy, brief exposure to cow's milk-based infant formula (i.e., the occasional bottle of infant formula) does not increase the risk for cow's milk allergy.
6. For **all** infants, the use of soy-based infant formulas should be limited to those infants with galactosemia, or those who cannot consume dairy-based products for health, cultural or religious reasons, regardless of risk of developing food allergy.

Introduction to solids

1. From an allergy prevention perspective, evidence suggests introducing complementary foods after the age of four months may prevent the occurrence of allergy.
2. For all healthy term infants there is no evidence delaying solids past six months of age prevents allergies, and it may increase the risk of nutritional deficiencies (especially iron) and inadequate energy intake.
3. There is no evidence to suggest different recommendations are necessary for the introduction of complementary foods based on an infant's risk of allergy.
4. For all healthy, full-term infants, there is no clear evidence that delaying the introduction of 'high-risk' foods will prevent food allergy. Parents and caregivers can introduce wheat, fish, shellfish, eggs (including egg white), soy, milk products, peanut products and tree nut products after six months of age. Fluid milk can be introduced at 9-12 months of age, and when the child is eating a variety of solid foods.
5. Current evidence suggests parents/caregivers:
 - Offer iron rich foods first; over time, gradually introduce vegetables, fruit and dairy products in no particular order
 - Offer one new food at a time
 - Allow 3-5 days between offering additional new foods until tolerance is assessed
 - Avoid the use of honey in the first year since it is related to the risk of botulism poisoning, not food allergy
6. Regardless of a child's risk of developing allergy, parents and caregivers should watch for signs and symptoms of an allergic reaction when introducing complementary foods.

Methodology

A working group of the Ontario Society for Nutrition Professionals in Public Health (OSNPPH) Family Health Nutrition Advisory Group (FHNAG) reviewed the evidence in the areas of **food allergy** and immunology related to maternal and infant health. A PubMed search identified systematic reviews, meta-analyses, review papers, primary source cohort studies, and policy and/or consensus papers. These source types were chosen, as they are considered the strongest source of public health evidence (1). A search of the evidence portals healthevidence.ca and the Dietitians of Canada Practice Evidence Based Nutrition (PEN) was also conducted.

The group reviewed sources that provided context to position/policy statements (e.g., editorials and expert opinion papers), and consensus was reached among authors that this was an acceptable process.

Background

Who is at risk of food allergy?

The prevalence of food **allergy** is thought to be increasing (2, 3, 4). In 2008, the Center for Disease Control and Prevention (CDC) (5) reported an 18% increase in childhood food allergy from 1997-2007. It has also been reported that 6-8% of children under the age of 3 years have a clinically diagnosed food allergyⁱ (6, 7, 8, 9). For adults, the prevalence rate ranges between 3.7% (9) to 3.9% (5). It remains unknown if the rising estimates are due to an increase in clinical disease or to a greater awareness by health care providers and parents (5).

Until recently there has been no Canadian prevalence data for food allergies. However, a 2010 Canadian population-based study recently estimated the childhood prevalence of probable food allergy to five of the most common foods^j associated with anaphylaxis ranged between 0.18% (fish) to 1.77% (peanut) (7). Overall, North American studies examining the incidence, prevalence and epidemiology of food allergy are limited (3).

Food allergy is thought to be genetically influenced (4). Therefore, in the past, infants considered to be “at high risk” of developing any allergy, were defined as infants with a family history of allergy [at least one first-degree relative (parent or sibling)] with documented **atopic disease** (10). This definition has been commonly used in research studies over the past 20 years. In 2010, the National Institute of Allergy and Infectious Disease (NIAID) modified the definition of “at risk” to include those with a biological parent or sibling with existing or history of allergic rhinitis, asthma, atopic dermatitis, or food allergy. Food allergy and atopic dermatitis frequently occur in the same child and the early presentation of severe atopic

ⁱ The most common food allergens are egg, cow's milk, peanut, tree nuts, wheat and seafood (NIH)

^j The most common food allergens causing anaphylactic reactions are peanut, tree nut, shellfish, fish and sesame.

dermatitis is associated with risk of sensitization to food. The mechanism of early sensitization to foods is unclear (3).

One theory related to the early sensitization to foods is a premature gastrointestinal tract in the first few months after birth. The gastrointestinal mucosal barrier in infants and young children may not be optimal because various components of the gut barrier and immune system are developmentally immature. For instance, some enzymes are not fully activated in the neonatal period and the secretory IgA system is not fully mature until four years of age. It is hypothesized; this gut immaturity may explain the increased prevalence of both gastrointestinal tract infections and food allergies seen in the first several years of life (11).

Compared to adults, children are more likely to be allergic to milk, eggs and peanuts. Adults are more likely to be allergic to peanut, tree nuts, fish and shellfish (9). Milk, egg and wheat allergies are more likely to be outgrown during childhood compared to peanut and tree nut allergies, which are more likely to last into adulthood (3). When examining the incidence of different types of food allergy, milk allergy is the most frequent in the pediatric population (12). It has been reported almost all infants (2.5%), who develop milk allergy do so in the first year of life (3, 6). It has also been reported that 19% of milk allergic children outgrow their allergy by age four but 80% will outgrow their allergies by age 16 (11). The chance of a child outgrowing their food allergy is related to the immunological response to the allergy (3, 11).

Current Canadian guidelines

In Canada, *Nutrition for Healthy Term Infants (2005)* (NHTI) (13) is the only national statement^k on infant feeding containing guidance related to food allergy prevention. NHTI (13)^l advises exclusive breastfeeding for six months and the introduction of complementary foods around six months of age starting with iron rich foods. Parents have also been encouraged to avoid introducing egg white until after one year of age to minimize any possible allergic reactions (13). The table in *Appendix A* summarizes the current Canadian guidelines and compares them to other international guidance documents.

Dietary recommendations to reduce risk of food allergy

Dietary restriction during pregnancy

In North America, recommendations regarding food allergy risk reduction in pregnancy have been quite conservative until recent years. In an effort to offer clinical practice guidelines to health professionals on this topic, the American Academy of Pediatrics (AAP), Committee on Nutrition published a statement in 2000 called *Hypoallergenic Infant Formulas*. This statement outlined dietary strategies that might prevent or delay allergies and included recommendations for pregnant women. This statement recommended pregnant women, at

^k NHTI is a joint statement of the Canadian Pediatric Society, Dietitians of Canada and Health Canada.

^l NHTI is under review in 2010, beginning with the 0-6 month feeding recommendations.

“high risk” of having an atopic infant, need to avoid peanuts to decrease the risk of the infants developing an atopic disease (14).

In a 2003 landmark study, published as part of the *Avon Longitudinal Study of Parents and Children*, researchers found no association between maternal consumption of peanuts during pregnancy and childhood peanut allergy. The authors noted that the lack of this association, and the lack of detection of IgE to peanut in cord blood, were evidence against the role of peanut sensitization in utero (15). A Cochrane meta-analysis in 2006 later concluded antigen avoidance during pregnancy is unlikely to reduce the risk of developing atopic disease, and dietary restrictions could adversely affect maternal or fetal nutrition (16).

In 2008, the AAP released a clinical report suggesting there is not enough evidence indicating maternal dietary restrictions during pregnancy impacts the development of atopic disease in infants (10). Others have endorsed this recommendation (2, 3). American experts (17) note, “it should be appreciated that studies have not been undertaken specifically to evaluate exclusion of peanut in atopic “high risk” pregnancies” (17, p.29). Recent studies reveal that very few women in the United Kingdom, for example, followed dietary peanut exclusion advice, and no effect, either positive or negative was detectable (178).

In contrast to the earlier more conservative American position statement, European groups have taken a different approach to food allergy prevention. Historically, they have agreed, since 2004, there is a lack of evidence to recommend any dietary restriction during pregnancy to prevent food allergy development in infants (18, 19, 20, 21, 22). Respected European publications commonly cite, the widely quoted, *Cochrane Review* published in 2006 (16) and the 2003 study by Lack et al. (15). In 2008, the European Academy of Allergy and Clinical Immunology (EAACI) re-affirmed their statement that, “there is no conclusive evidence that dietary restrictions during pregnancy have a protective effect.” (21).

Implications for public health practice

1. There is no evidence that restricting maternal diet by avoiding highly allergenic foods during pregnancy plays a role in preventing food allergies in offspring, regardless of family history of allergy.
2. Pregnant women should avoid foods that they are allergic to. For example, they should avoid peanut products if they are allergic to peanuts, and they should replace those foods with nutritionally equivalent substitutes.
3. Pregnant women do not have to avoid the allergenic foods of the biological father.
4. Refer to Health Canada’s *Prenatal Nutrition Guidelines for Health Professionals 2009* (23) for key messages about overall healthy eating and nutrients of concern during pregnancy.

Dietary restriction during lactation

Breastfeeding is identified as the optimal source of infant nutrition, and exclusive breastfeeding for the first six months of life continues to be promoted internationally (3, 18, 24). For a review of the role exclusive breastfeeding plays in allergy prevention in the neonate, refer to Grimshaw et al., 2009 (22).

Allergy prevention messages differed significantly between American and European experts in the 1990's. In North America, there has been conflicting evidence over the years with respect to the avoidance of allergic foods during lactation. As with pregnancy, the AAP made strict dietary recommendations in the *Hypoallergenic Infant Formulas* (14) statement for lactating mothers considered to be "at high risk" of having an infant with an allergic disease. This breastfeeding recommendation referenced one randomized, prospectively controlled study of preterm infants (25) and another prospective non-randomized and uncontrolled study of full-term infants (26). Two smaller studies conducted in the 1980s and 1990s (27, 28) were also available for review.

At the time, the available evidence suggested a preventative effect on atopic dermatitis, after excluding allergenic foods in the diets of lactating mothers. Later, a study by Zeiger & Heller (29) also found a reduced prevalence of allergic disease, after the exclusion of allergic foods in the maternal diet at the one-year follow-up, but not at year seven. Perhaps due to the results of this study and others, the AAP was motivated to make the following recommendations:

- infants at high risk of developing allergy be breastfed for over one year
- mothers eliminate peanuts, tree nuts
- mothers consider eliminating eggs, cow's milk, fish and possibly other foods from their own diet during the time they are lactating (14, 30).

The study findings cited above, plus the knowledge that dietary food allergens have been found in breastmilk (15), may have lead the previous AAP committee to believe dietary food antigen avoidance during breastfeeding may be beneficial in reducing atopic symptoms in the breastfed infant^m (14).

Currently, it is acknowledged that maternal dietary antigens cross the placenta and pass into breastmilk (15). However, as with pregnancy, research has found no difference in the incidence of peanut allergy among children whose mothers ate or avoided peanuts during lactation (10, 16). Therefore, antigen avoidance during lactation does not appear to prevent atopic disease in infants. More data is clearly needed in this topic area (2, 3).

In contrast to the AAP recommendations in 2000, European allergy experts had an alternate perspective. A joint statement by the European Society of Paediatric Allergology and Clinical Immunology (ESPACI) and the European Society of Pediatric Gastroenterology, Hepatology, and Nutrition (ESPGHAN) Committee on Nutrition (31) also acknowledged the controversial role that breastfeeding has on allergy prevention. They cited the Saarinen & Kajosaari study (26) as well as others (32, 33). This joint statement stated, "although sensitization of infants to food proteins has been reported during exclusive breastfeeding, it is not entirely clear whether the small amounts of foreign proteins found in human milk are responsible for this, or whether other sources of allergens, such as inhaled food proteins or contaminated hands may play a role" (31, p.81). They also continued to note that, "a minority of studies has demonstrated a preventative effect of maternal avoidance of potential food allergens (i.e.,

^m Greer (10) recently stated that perhaps this recommendation was made knowing some of the studies cited above had methodological flaws as discussed in Kramer (16) Greer also stated that other larger studies found no association between consumption of allergic foods during lactation and prevalence of allergic disease in infants (10).

milk, egg, fish) during breastfeeding on the development of atopic dermatitis. However, other studies do not confirm this finding (31, p.81).

Other major European papers published since 1999 came to similar conclusions (19, 20). In 2008, the European Academy of Allergy and Clinical Immunology (EAACI) (21) and ESPHGAN (18) agreed there is no evidence that maternal diet during lactation, has an effect on allergy prevalence. As a result, they jointly recommended exclusive breastfeeding for 4-6 months (21) with a, “desired goal of 6 months” (18) for allergy prevention. Complementary foods should be introduced before 27 weeks postpartum (18).

Also in 2008, the AAP changed their position statement, which is now more consistent with their European counterparts. They concluded, “Antigen avoidance during lactation does not prevent atopic disease, with the possible exception of atopic eczema, although more data is needed to substantiate this conclusion” (10).

European authorities continue to support their original recommendations. They state there are no specific breastfeeding recommendations for allergy prevention beyond recommending exclusive breastfeeding (19, 21, 22). Grimshaw et. al. in 2009 concluded that the most effective dietary measure for the prevention of allergenic diseases, even in high risk patients is exclusive breastfeeding for 4-6 months (22).

Recently, in the 2010 NIAID *Guidelines for the Prevention and Management of Food Allergy*, the expert panel recommended that all infants be exclusively breastfed until 4-6 months of age. They acknowledge the lack of strong evidence that demonstrates breastfeeding has an exclusive role in preventing allergy. Despite the apparent consensus of allergy experts on the influence of diet during breastfeeding on allergy prevention in the infant, the topic remains controversial and in need of further study (3).

Implications for public health practice

1. Exclusively breastfeed the infant for the first six months of life.
2. There is no consensus or convincing evidence that maternal dietary restriction during lactation prevents food allergies in children, regardless of their infant’s risk of developing food allergy.
3. The mother should avoid foods to which she is allergic.
4. The mother does not have to avoid the allergenic foods of the biological father.

Human milk substitutes (e.g., infant formula)

High-risk infants: with family history of allergy

For infants at high risk of allergy, who are not exclusively breastfed, hydrolyzed formula feeding, as compared to cow’s milk-based formula, when fed for the first six months of life, has been shown to reduce the risk of allergy up to early childhood (3, 10, 14, 19, 20, 21, 34-40). There is limited evidence to demonstrate hydrolyzed formulas have a greater protective effect than partially hydrolyzed formulas. However, completely hydrolyzed formulas are often limited in the practicality of their use because of their higher cost and lower palatability.

Therefore, partially hydrolyzed formulas can be recommended as an alternative (3, 19, 36, 38, 41, 42, 43). Further prospective, well designed studies are needed to confirm the role of hydrolyzed formulas in the prevention and treatment of food allergy in those not being breastfed (2, 19, 22, 44-46).

Soy infant formula is not recommended as a strategy for preventing the development of food allergy, or modifying its clinical course, in high-risk infants (3, 47-50). Based on the limited available data, there appears to be neither long-term harm nor significant benefit in using soy infant formula as the sole source of nutrition for infants (3, 50). The use of soy-based infant formulas should be limited to those infants with galactosemia or those who cannot consume dairy-based products for health, cultural or religious reasons (50).

Low-risk infants: without family history of allergy

Brief exposure to cow's milk-based infant formula does not increase the risk for cow's milk allergy among healthy term infants. This is based on research that examined the infant's risk of exhibiting cow's milk allergy at age 18 months and up to five years of age (51-53).

There is no clear evidence to suggest brief early feedings of infant formula offered to predominantly breastfed infants, changes the risk of developing allergy, regardless if the formula is extensively hydrolyzed or cow's milk based (26, 35, 53-55). There are no studies looking at the outcome of prolonged feeding with extensively hydrolysed protein formula among infants with no parental history of allergy.

Feeding soy protein-based formula instead of cow's milk-based formula or breastmilk does not reduce the risk for allergy among healthy term infants (or in children up to seven years of age), and therefore has no proven benefit in preventing allergy (47, 48). The use of soy-based infant formulas should be limited to those infants with galactosemia or those who cannot consume dairy-based products for health, cultural or religious reasons (50).

Implications for public health practice

1. For infants **without** family history of allergy, the use of cow's milk-based infant formula does not increase the risk for food allergy.
2. For infants **without** family history of allergy, there is insufficient evidence to suggest feeding partially or extensively hydrolysed formula instead of cow's-milk based infant formula decreases the risk of developing food allergy.
3. For infants **with** a family history of allergy, there is moderate evidence partially hydrolysed formulas have an advantage over formulas made with intact cow's milk protein in delaying allergic response.
4. For infants **with** a family history of allergy, feeding extensively hydrolyzed infant formula, as compared to cow's milk-based formula, in the first six months of life, may reduce the risk of allergy. However, the practicality of using extensively hydrolyzed formulas is limited because they are expensive and have low palatability.
5. For breastfed infants **with** a family history of allergy, brief exposure to cow's milk-based infant formula (i.e., the occasional bottle of infant formula) does not increase the risk for cow's milk allergy.

6. For **all** infants, the use of soy-based infant formulas should be limited to those infants with galactosemia, or those who cannot consume dairy-based products for health, cultural or religious reasons, regardless of risk of developing food allergy.

Introduction to solids

The AAP recommended in both 2000 and 2004, that infants at high risk for developing allergic conditions not be exposed to solid foods before six months of age, with dairy products delayed until one year, eggs until two years, and peanuts, nuts and fish until three years of age (14, 30). This advice (as well as the advice during lactation), was based only on two randomized control trials of high-risk infants (56, 57). A prospective, randomized control trial by Zeiger and Heller (56) was also considered, as was the work by Fergusson, Horwood and Shannon (58, 59). Since the publication of these studies, recent authors have highlighted their limitations (60, 61).

European guidelines have taken a different perspective. European groups such as ESPHGAN (18) and the EAACI (21) have always questioned whether there was enough evidence for the strict dietary avoidance recommendation for “high-risk” infants that American groups have proposed. Researchers from these European groups (18-20) have made statements such as, “avoidance or delayed introduction of potentially allergenic foods, such as fish and eggs, has not been convincingly shown to reduce allergies, either in infants considered at risk for the development of allergy or those not considered to be at risk” (18, p.105), citing insufficient data (21).

Since the release of the original American (14) and European statements (31), key studies have been published examining the role, timing and type of complementary foods have on allergy development. In 2004, Zutavern, von Mutius & Harris et al. (62) showed no protective effect for high-risk families of introducing solid foods to infants past 4-6 months for the development of asthma or eczema by age two years. Later in 2008, the same research group published another major cohort study, which found that for families with a history of allergy, there was a statistically significant increase in food allergen sensitization when solids were introduced before four months and after six months of age (63). Specifically, there was a statistically significant association between late introduction of solids and a specific immunological allergic response against peanut.

The authors concluded that the positive association found between the timing of the introduction of solids and food sensitization, should be considered with caution (63). American experts (2), have recently noted, that it cannot be ruled out that delaying the introduction of solids for the first four months of life might offer some protection against the development of food allergy, as demonstrated in other studies (64, 65).

These findings are similar to the findings of Snijders, Thijs, van Ree and van den Brandt (61). Their results indicated the late introduction of cow’s milk based products (older than nine months), and the late introduction of other foods (other than cow’s milk- based), were significantly related to the incidence of eczema at age two. Interestingly, the incidence of any allergic sensitization was also significantly related to the late introduction of other foods (after age seven months) (61). Allergic sensitization due to the delayed introduction (> 4 months of

age) of solids has also been recently noted (66) in sample of infants at risk for type 1 diabetes. However, "studies that attempt to separate the effects of breastfeeding duration and the age of introduction of cow's milk or food products face problems of high correlation between variables; therefore, "the possibility it may be breastfeeding itself that may confer protection, cannot be rejected" (61, p.e120). Overall, recent cohort studies (as described above), as well as a systematic review (67), generally agree, delaying the introduction of allergenic foods past 4-6 months of age has no effect on the development of allergic outcomes in either infants considered to be "at risk" or not "at risk" (63, 68).

In 2008, the AAP updated their recommendations based on available studies. There was no difference in the recommendations made for high vs. low risk infants and the development of food allergy. Specifically, the 2008 AAP report states:

"There is no current convincing evidence that delaying the introduction of solid foods beyond 4-6 months has a significant protective effect on the development of atopic disease regardless of whether the infants are fed cow milk protein formula or human milk. This includes delaying the introduction of foods that are considered to be highly allergenic, such as fish, eggs, and foods containing peanut protein. For infants after 4-6 months of age, there are insufficient data to support a protective effect of any dietary intervention for the development of atopic disease." (10, p.188-189).

Most recently, in 2010, the National Institute of Health (3) assembled 33 different American health professional organizations, including the AAP and the American Academy of Allergy, Asthma and Immunology (AAAAI) to create a consensus type document called *Guidelines for the Diagnosis and Management of Food Allergy*. This document is currently in draft form (final guidelines to be released December 2010). It 'suggests' the introduction of solid foods should not be delayed beyond 4-6 months and that potentially allergenic foods can be introduced at this timeⁿ (3). Overall, the expert panel was careful to note the overall evidence for this topic is limited, even for infants at risk for developing an atopic disease (3).

There is insufficient evidence to support restricting the introduction of allergenic foods beyond six months of age in order to prevent food allergy development among infants. Although there is a small body of research that considers the negative impact of offering commonly allergenic foods beyond six months of age; and that the late introduction of foods can result in the increased sensitization to food and inhalant allergens in older children (8), more research is needed.

Implications for public health practice

1. From an allergy prevention perspective, evidence suggests introducing complementary foods after the age of four months may prevent the occurrence of allergy.
2. For all healthy term infants there is no evidence delaying solids past six months of age prevents allergies, and it may increase the risk of nutritional deficiencies (especially iron) and inadequate energy intake.

ⁿ It should be noted that the term "suggests" is used when the expert panel weakly recommends for or against a course of action. This is compared to the term "recommends" which is used when the expert panel strongly recommended for or against a particular course of action.

3. There is no evidence to suggest different recommendations are necessary for the introduction of complementary foods based on an infant's risk of allergy.
4. For all healthy, full-term infants, there is no clear evidence that delaying the introduction of 'high-risk' foods will prevent food allergy. Parents and caregivers can introduce wheat, fish, shellfish, eggs (including egg white), soy, milk products, peanut products and tree nut products after six months of age. Fluid milk can be introduced at 9-12 months of age, and when the child is eating a variety of solid foods.
5. Current evidence suggests parents/caregivers:
 - Offer iron rich foods first; over time, gradually introduce vegetables, fruit and dairy products in no particular order
 - Offer one new food at a time
 - Allow 3-5 days between offering additional new foods until tolerance is assessed
 - Avoid the use of honey in the first year since it is related to the risk of botulism poisoning, not food allergy
6. Regardless of a child's risk of developing allergy, parents and caregivers should watch for signs and symptoms of an allergic reaction when introducing complementary foods.

Conclusion

This discussion paper presents evidence there is no proven benefit in avoiding highly allergic foods during pregnancy or lactation for women with or without a family history of allergy. There is no proven benefit in delaying the introduction of allergenic foods beyond the age of six months for either low or high allergy risk infants. These findings; however, remain controversial. There are many limitations to the conclusions and suggestions drawn in this paper. Inadequate study design and a general lack of data limits the ability of experts to draw 'firm' conclusions. Therefore, a "lack of proven efficacy does not equate to an approach being disproven" (17, p.29).

More research is needed to determine if dietary food allergen avoidance delays prevent or mask allergy symptoms. The fundamental cause of food and other types of allergy is not completely understood; additional, longer-term prospective research will continue to strengthen or change dietary practice.

Glossary of Terms

Allergy	A hypersensitivity reaction initiated by immunological mechanisms
Atopic disease	Clinical disease characterized by atopy, typically refers to atopic dermatitis, asthma, allergic rhinitis, food allergy (10), eczema, conjunctivitis (hay fever) and urticaria (hives) (16)
Food allergy	An immunologically mediated hypersensitivity reaction to any food, including IgE-mediated and/or non-IgE mediated allergic reactions (10)

Appendix A Dietary prevention recommendations/comments from several professional organizations

Definitions/interventions	Group/Publication				
	CPS Joint Statement 2005 (13)	NIAID 2010 (3)	AAP 2008 Clinical Report (10)	ESPACI/ESPGHAN 1999 (30), ESPGHAN 2008 (18) Recommendations	SP-EAACI 2004 (19), 2008 (21) Recommendations
Definition of risk category: "high risk"	<ul style="list-style-type: none"> Family history (one or both parents or sibling) 	<ul style="list-style-type: none"> Family history with existing allergy (biological parent or sibling) 	<ul style="list-style-type: none"> Family history (one or both parents or sibling with documented allergy) 	<ul style="list-style-type: none"> Family history (parent or sibling) (1999) 	<ul style="list-style-type: none"> Family history (parent or sibling with documented allergic disease)
Dietary avoidance during Pregnancy	<ul style="list-style-type: none"> No special diet 	<ul style="list-style-type: none"> No special diet 	<ul style="list-style-type: none"> Lack of evidence 		<ul style="list-style-type: none"> No special diet*
Breastfeed "exclusively" until	<ul style="list-style-type: none"> 6 months (2005) 	<ul style="list-style-type: none"> 4-6 months 	<ul style="list-style-type: none"> Evidence for 3-4 mo (waiting 4-6 mo tied to introducing solids*) 	4-6 mo*	<ul style="list-style-type: none"> At least 4 mo, prefer 6 mo*
Maternal lactation avoidance of allergens	<ul style="list-style-type: none"> No special diet 	<ul style="list-style-type: none"> No special diet 	<ul style="list-style-type: none"> Some evidence for reduced atopic dermatitis 		<ul style="list-style-type: none"> No special diet*
Prevention formulas	<ul style="list-style-type: none"> Recommend cow's milk based formulas for low-risk families Role of soy formulas in prevention is controversial Casein hydrolysate formulas recommended for high risk infants 	<ul style="list-style-type: none"> Extensively or partially hydrolyzed formulas for infants "at risk" Standard cow's milk formula vs. soy formulas in "at risk" infants 	<ul style="list-style-type: none"> Compared with whole cow's milk protein, evidence for certain extensive hydrolysates, partial hydrolysates, but not soy (see text) 	<ul style="list-style-type: none"> Confirmed reduced allergenicity (1999) 	<ul style="list-style-type: none"> Extensively hydrolyzed until 4 mo of age (2004); documented reduced allergenicity (2008)
Types of "solids" and complimentary foods	<ul style="list-style-type: none"> Avoid egg whites in the first year (2005) 	<ul style="list-style-type: none"> No evidence that delaying the introduction of commonly allergenic foods impacts food allergy development at low or high risk of food allergy 	<ul style="list-style-type: none"> Evidence to wait 4 (to 6) mo Lack of convincing evidence for avoiding specific allergenic foods 	<ul style="list-style-type: none"> Not before 17 wk and no later than 26 wk no convincing evidence for delaying potentially allergenic foods such as fish, egg (2008)* 	<ul style="list-style-type: none"> No evidence of diet effect after 4 – 6 mo

Table adapted from Sicherer & Burks, 2008 (17).

Appendix B Signs and symptoms of food allergic reactions^o

Target Organ	Immediate Symptoms	Delayed Symptoms
Cutaneous	<ul style="list-style-type: none"> • Redness • Itchiness • Hives • Swelling • Measles like rash 	<ul style="list-style-type: none"> • Redness • Flushing • Itchiness • Measles like rash • Eczema like rash • Swelling
Ocular	<ul style="list-style-type: none"> • Itchiness • Red eyes • Tearing • Swollen Eyes 	<ul style="list-style-type: none"> • Itchiness • Red eyes • Tearing • Swollen eyes
Upper Respiratory	<ul style="list-style-type: none"> • Nasal congestion • Itchiness • Runny nose • Sneezing 	
Lower Respiratory	<ul style="list-style-type: none"> • Cough • Chest tightness • Irregular breathing • Wheezing • Difficulty breathing 	<ul style="list-style-type: none"> • Cough, irregular breathing, wheezing
Gastrointestinal (Oral)	<ul style="list-style-type: none"> • Swelling of the lips, tongue, and/or palate • Itchy mouth • Tongue swelling • Swelling in the throat • Hoarseness • Dry staccato cough 	
Gastrointestinal (Lower)	<ul style="list-style-type: none"> • Nausea • Colicky abdominal pain • Reflux • Vomiting • Diarrhea 	<ul style="list-style-type: none"> • Nausea • Abdominal pain • Reflux • Vomiting • Diarrhea • Maroon-coloured stool • Irritability and food refusal with weight loss (young children)
Cardiovascular	<ul style="list-style-type: none"> • Fast heart beat (occasionally slow heart beat in anaphylaxis) • Hypotension • Dizziness • Fainting • Loss of consciousness 	

^o Table adapted from NIAID 2010, page 39(1257). DRAFT.

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