EFFECTS OF NUTRITION, FOOD RESTRICTION, AND PROBIOTIC SUPPLEMENTATION ON CHILDREN WITH ATOPIC DERMATITIS

Hester Chang

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California State University, Los Angeles
Introduction

Atopic dermatitis (AD) is a chronic disease that affects the skin of nine to 30 percent of the population in the United States (Cono et al., 2013). It is an inflammation of the skin and common symptoms include chronic itchiness, inflammation, dryness, and rashes; it typically develops during early childhood (Finch, Munhutu, & Whitaker-Worth, 2010). It is not yet fully understood why children develop atopic dermatitis, but there has been much research on the interaction between genetics and the afflicted’s surrounding environment being contributing factors to the development of atopic dermatitis (Finch, Munhutu, & Whitaker-Worth, 2010). More and more so, the surrounding environment seems to play a key role on AD and this has led researchers to consider that diet and nutrition might have a profound impact on AD. Finch, Munhutu, & Whitaker-Worth (2010) assumed that dietary manipulation could be useful in controlling and maintaining AD, but the mechanisms behind this manipulation in the treatment of AD are still inconclusive.

Over the past couple of decades, there has been a growing interest in how the consumption of probiotics can help prevent and treat atopic dermatitis, especially in children (Meneghin, Fabiano, Mameli, & Zuccotti, 2012). Probiotics can be defined as “ingested live microorganisms that . . . confer a health benefit to the host” (Meneghin, Fabiano, Mameli, & Zuccotti, 2012). Unfortunately, data is not conclusive about the effects of probiotic supplementation on prevention strategies. There are many dependent factors for clinical benefits to be seen, such as type of administration, dosage delivery, and the type of bacteria, as well as other factors such as age and diet (Meneghin, Fabiano, Mameli & Zuccotti, 2012).
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There has also been a growing interest in how nutrition and food restriction can affect those with atopic dermatitis. This review article will look at different studies that looked at the effects of nutrition, food restriction, and probiotic supplementation on children with atopic dermatitis.

Method

PubMed, Science Direct, and MedLine were used for the searches and the keywords used were “nutrition”, “diet”, “atopic dermatitis”, “probiotics”, “eczema”, “children”, and “childhood”. The search parameters were for articles that were recently published up to 2009. Papers cited in the articles found that contained relevant information to the topic were also included, even if they were beyond the time frame set, i.e., published in 2007. All articles were to be written in English as well as include a free full-text or PDF and include trials that were conducted on the human species. The chosen articles had to pertain to children with atopic dermatitis and supplementation with probiotics and they had to be clinical trials. Other than the aforementioned, there were no restrictions on the length of time of the study, the number of patients in the trials, the mode of delivery of the probiotics, the country where the trial was performed, the type of study conducted, or even the strain of probiotics used.

Results

A total of six studies were chosen for this review. Table 1 provides a summary of these studies. The first article chosen was written 2007 in the Journal of Allergy and Clinical Immunology by Taylor, Dunstan, and Prescott. Entitled “Probiotic supplementation for the first 6 months of life fails to reduce the risk of atopic dermatitis and increases the risk of allergen sensitization in high risk children: A randomized
controlled trial”, the randomized, double-blind, placebo-controlled study was conducted amongst 178 infants from 178 mothers in Perth, Western Australia (Taylor, Dunstan, & Prescott, 2007). Eighty-eight infants received the placebo and 89 received the probiotic. The length of the study was two years and eight months.

It was found that after six months of supplementation (with the probiotic and the placebo), atopic dermatitis rates were similar in both groups of infants: 25.8% in the probiotic group and 22.7% in the placebo group (Taylor, Dunstan, & Prescott, 2007). The probiotic group had significantly (p=0.045) more children with AD and sensitization (a positive skin prick test) (Taylor, Dunstan, & Prescott, 2007).

The researchers concluded that although there was a higher *Lactobacillus* colonization after six months of age, the infants who had the probiotic supplementation from birth to six months did not reduce their risk of early allergic diseases such as atopic dermatitis and food allergies (Taylor, Dunstan, & Prescott, 2007). Taylor, Dunstan, and Prescott also found that the findings failed to demonstrate any type of protective effect of supplementation on infection (2007). They also found that children in the probiotic group were more significantly more susceptible (p=0.024) to develop wheezing. One limitation to this study might have been due to antibiotic usage affecting colonization (Taylor, Dunstan, & Prescott, 2007).

The second study was written in 2010 and conducted by Miyake, Sasaki, Tanaka, and Hirota and published in the *European Respiratory Journal*. Entitled “Dairy food, calcium and vitamin D intake in pregnancy, and wheeze and eczema in infants”, they conducted an observational cohort study with a population of 763 all over the country of Japan (Miyake, Sasaki, Tanaka, & Hirota, 2010). They chose children between 16 and
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24 months of age. They wanted to study “the association between maternal consumption of dairy products, calcium, and vitamin D during pregnancy and the risk of wheeze and eczema in Japanese children at 16-24 months old, using data from the Osaka Maternal and Child Health Study (OMCHS)” (Miyake, Sasaki, Tanaka, & Hirota, 2007).

They found that among the 763 infants, within 12 months, 18.6% developed eczema. They also found that the maternal intake of dairy products during pregnancy was not measurably related to the development of eczema in the offspring (Miyake, Sasaki, Tanaka, & Hirota, 2007). They concluded that there was no association between maternal intake of dairy during pregnancy and the development of eczema in the offspring. However, they did find that mothers who consumed more than 4.309 micrograms of vitamin D during pregnancy had children who had a significantly reduced risk of wheeze and eczema (Miyake, Sasaki, Tanaka, & Hirota, 2007). A major significance of this study was that it was “the first study in a non-Western population to examine the relationship of maternal vitamin D intake to allergic disorders in the offspring” (Miyake, Sasaki, Tanaka, & Hirota, 2007).

The next study was published in 2012 in the Annals of Dermatology and conducted by Yeşilova, Çalka, Akdeniz, and Berktaş. It was a randomized, double-blind, placebo-controlled study of seven months with an intervention of eight weeks that was called “Effect of probiotics on the treatment of children with atopic dermatitis” (Yeşilova, Çalka, Akdeniz, & Berktaş, 2012). The sample included 23 boys and 16 girls and the study was conducted in the nation of Turkey. The children had to be between the ages of 1 and 13 and have a moderate to severe SCORAD index (SCORAD means scoring atopic dermatitis). They could not have been using antihistamines and/or
The researchers wanted to find out how probiotic supplementation would affect children with AD as well as its anti-inflammatory effects. They found that the SCORAD index decreased for both the probiotics group and the placebo group and the decrease in SCORAD for the probiotics groups was significantly greater (p=0.0015) than the decrease for the placebo group (Yeşilova, Çalka, Akdeniz, & Berktaş, 2012). Yeşilova, Çalka, Akdeniz, and Berktaş also tested for serum cytokine level changes and found that the probiotics group had statistically significant decreases in cytokines IL-5, IL-6, and IFN-γ with p=0.0012, p=0.0016, and p=0.0011, respectively, when compared to the post-treatment cytokine levels of the placebo group (2012).

Yeşilova, Çalka, Akdeniz, and Berktaş concluded that although the SCORAD indices improved for both groups, there was a much greater difference between the beginning and the end for the probiotics group (2012). The probiotics also showed to be effective in decreasing serum levels of cytokines IL-5, IL-6, and IFN-γ.

In 2013, Lim et al. conducted an analytic, observational cross-sectional study of four months with 33 boys and 20 girls in South Korea. The children were aged 12 months to 13 years and presented with atopic dermatitis; they had to have a SCORAD index of 20 to 50.

Lim et al. assessed the children’s dietary intake for three months using a food frequency questionnaire; they were split into three groups: no food restriction, one to three foods restricted, and more than three foods restricted (2013). It was found that there was significant improvement in the group without any food restriction (p=0.036)
and the one to three restricted group (p=0.003) (Lim et al., 2013). They concluded that further studies are needed on the correlation between nutrition and the severity of AD and that it is necessary to provide proper nutrition management and correct information to children with moderate to severe AD (Lim et al., 2013).

In 2014, Forsey published his research study on the “Prevalence of childhood eczema and food sensitization in the first Nations reserve of Natuashish, Labrador, Canada.” It was an analytic, observational cross-sectional study that included 102 girls and 80 boys, ages 2 to 12, who were of Innu descent and lived in Natuashish, Labrador, Canada (Forsey, 2014). With the children having more access to modern, Western foods, Forsey wanted to observe how this affected these children of the Innu, who in years past ate a more traditional Innu diet and did not have a prevalent population of AD-affected people.

Forsey found that 16.5% of the children (30/182) had eczema and that females with eczema was higher than males with eczema (22 vs 8) (2014). Twenty-three percent of the children with eczema were sensitive to milk and 67% of the children with eczema had eczema that was categorized as moderate or severe (Forsey, 2014). He concluded that the children of Natuashish Labrador had a high rate of eczema and the sensitization rates of the 30 children with eczema were comparable to results in other studies (Forsey, 2014). One limitation was the fact that some children might have been missing in the study due to them not being in the community when the study was occurring. Another limitation was the fact that the severity of the eczema was provided by the caregivers of the children through the use of a diagram (Forsey, 2014).
The final study was published in 2014 and conducted by Yang, Min, Lee, and Pyun in South Korea. They conducted a double-blind, placebo-controlled, randomized parallel trial with a two-week washout period prior to intervention; the trial lasted for six weeks (Yang, Min, Lee, & Pyun, 2014). Their sample included 71 children, ages two to nine, who had mild to moderate AD (SCORAD score ≤ 40) (Yang, Min, Lee, & Pyun, 2014). These researchers created a probiotic cocktail (L. casei, L. rhamnosus, L. plantarum, and B. lactis) and wanted to determine the effects of this mixture on serum cytokine levels of the aforementioned children (Yang, Min, Lee, & Pyun, 2014).

They had 37 children in the probiotics group and 34 in the placebo group. Fecal cell counts for all the probiotic strains were significantly higher in the probiotics group over the placebo group (all p≤0.001 for all four bacteria) (Yang, Min, Lee, & Pyun, 2014). Significant improvement was seen in both groups in the sixth and final week. Yang, Min, Lee, & Pyun found that there was no difference in serum cytokine levels in either of the two groups from between baseline and week six (2014).

The researchers concluded that adopting certain aspects of Western lifestyles, including diet and low rates of breastfeeding, were considered some important factors in the development of AD in the children (Yang, Min, Lee, & Pyun, 2014). Both groups saw modest clinical improvement in their AD regardless of whether or not they received the probiotic therapy; the researchers concluded that although up to the time of this publication probiotic therapy on the treatment and prevention of AD had inconsistent results, it is still viewed as effective for managing AD (Yang, Min, Lee, & Pyun, 2014). Limitations to this study included the possible addition and interference of consumption of fermented foods in the diet, contributing to the lack of clinical difference between the
two groups. Increased fecal counts of CFU’s might have been due to the failure of eliminating dietary fermented foods from both groups (Yang, Min, Lee, & Pyun, 2014). Neither group was instructed to avoid fermented foods.

Discussion

There were some studies that had more power than others. For example, the cohort study conducted by Miyake, Sasaki, Tanaka, and Hirota (2010) used Diet History Questionnaires which relied on the mothers’ memory of what they ate in the month before they started the study. Recall from memory is not as accurate as results and data from a study that is controlled. Although it was a cohort study that included a large sample population, there was a lot more room for error and inaccuracy.

Studies that were double-blind, placebo-controlled, and randomized have much greater power in their data. Such studies included the ones from Taylor, Dunstan, and Prescott (2007); Yeşilova, Čalka, Akdeniz, and Berktaş (2012); and Yang, Min, Lee, and Pyun (2014). However, although Yang, Min, Lee, and Pyun (2014) had a good study design, the length of their study, six weeks, was actually short and a possible limitation. However, they did make it that length on purpose for fear of an increased length of time causing more outside influences to factor into the results. Also, more time might have been unbearable for the children without using any topic treatment to manage their atopic dermatitis (Yang, Min, Lee, & Pyun, 2014).

The Forsey study on the children of Labrador, Canada would be given a medium power strength because although they ran blood tests on the children, the severity of eczema noted was subjective due to it being determined by the child’s caretaker, who decided based on a diagram.
Overall, these studies indicated that diet, nutrition, and probiotic supplementation can affect the maintenance of atopic dermatitis. None had finite data that definitively said that probiotics are an effective treatment for atopic dermatitis nor that restricted diets or foods definitively had a significant effect on treating atopic dermatitis.

Suggestions for future research

More research needs to be conducted in order to come up with better treatment methods for AD. Research and studies on the topic are still fairly young and further studies are needed to help the physicians guide the patients as well as help everyone understand the mechanisms underlying this uncomfortable disease.

The area of probiotics has been growing in interest for much of the population as a way not to only supplement their health, but also to remedy many ailments and disorders such as food allergies, irritable bowel syndrome, atopic dermatitis, and much more. While genes are genes, the environment is something that some people can control and many of those who have AD, child or adult, would like to know the solution or solutions in order to live a more comfortable life. Finch, Munhutu, and Whitaker-Worth stated that although there has been much research done on the correlation between special diets and atopic dermatitis, there has been no firm or concrete evidence stating that the special diets have significant effects on treating AD (2010). To conclude, if more studies in the future cohesively conclude that dietary changes and probiotic supplements can help prevent, control, or maintain atopic dermatitis, then there will be many benefits to the millions of sufferers out in the world. It would be interesting to see how the different climate regions also affect children (and adults, alike): if it were a more arid climate or a more humid climate.
Table 1. Summary of nutrition, food restriction, and probiotic supplementation in the prevention and treatment of atopic dermatitis (AD) in children.

<table>
<thead>
<tr>
<th>Authors</th>
<th>Location of Study</th>
<th>Type of Study</th>
<th>Sample Size</th>
<th>Duration</th>
<th>Outcome</th>
</tr>
</thead>
<tbody>
<tr>
<td>Taylor, Dunstan, &amp; Prescott (2007)</td>
<td>Perth, Western Australia</td>
<td>Randomized, double-blind, placebo-controlled</td>
<td>n = 177</td>
<td>2 years, 8 months</td>
<td>Children who received the probiotic supplementation did not reduce their risk of early allergic diseases such as AD and food allergy even though there was a higher <em>Lactobacillus</em> colonization at age 6 months. Probiotic supplementation actually increased the child’s sensitization to allergens with more children having positive Skin Prick Tests.</td>
</tr>
<tr>
<td>Miyake, Sasaki, Tanaka, &amp; Hirota (2010)</td>
<td>Japan</td>
<td>Cohort</td>
<td>n = 763</td>
<td>18 months</td>
<td>There wasn’t an association found between maternal calcium intake during pregnancy and the risk of eczema in infants. A higher intake of vitamin D during pregnancy might have positive, protective effect infantile eczema.</td>
</tr>
<tr>
<td>Yesilova, Çalka, Akdeniz, &amp; Berktas (2012)</td>
<td>Turkey</td>
<td>Randomized, double-blind, placebo-controlled</td>
<td>n = 39</td>
<td>8 weeks</td>
<td>Probiotic intervention reduced patients SCORAD index (improving their AD) as well as serum levels of cytokines IL-5, IL-6, and IFN-γ. Researchers concluded that probiotics can be used as a supplement to treat and manage AD.</td>
</tr>
<tr>
<td>Lim et al. (2013)</td>
<td>South Korea</td>
<td>Analytic, observational, cross-sectional</td>
<td>n = 62</td>
<td>4 months</td>
<td>Children who did not have a restricted diet as well as children who had only one to three foods restricted all saw significant improvements in AD symptoms. Foods that cause food allergies should be restricted to not only treat food allergies, but also treat AD. It is important to complement the restricted foods with alternative foods in order to prevent nutritional deficiency. Food allergies and AD are correlated.</td>
</tr>
<tr>
<td>Forsey (2014)</td>
<td>Labrador, Canada</td>
<td>Analytic, observational, cross-sectional</td>
<td>n = 182</td>
<td>3 months</td>
<td>Children of Natuashish, Labrador have high rate of eczema, more than likely due to exposure to highly Westernized diet. Sensitization rates in the 30 children with eczema were comparable to results in other studies.</td>
</tr>
<tr>
<td>Yang, Min, Lee, &amp; Pyun (2014)</td>
<td>South Korea</td>
<td>Double-blind, placebo-controlled, randomized parallel trial with a 2-week washout period prior to intervention</td>
<td>n = 71</td>
<td>6 weeks</td>
<td>Fecal cell counts increased in the probiotics group. Six weeks of probiotic administration did not change serum cytokine levels of IL-4, IL-10, TNF-α. No differences in clinical improvement between the two groups suggested interference.</td>
</tr>
</tbody>
</table>
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References

http://www.niams.nih.gov/health_Info/atopic_dermatitis/default.asp


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