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RESEARCH

Research and Practice Innovations

A Medical Nutrition Therapy Primer for Childhood Asthma: Current and Emerging Perspectives

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ABSTRACT

Asthma is the most common chronic disease in children. Prevalence has increased in the past 2 decades and has reached a plateau of approximately 9% of children in the United States, affecting about 6.7 million children. The increased prevalence of childhood asthma has paralleled the increased prevalence in childhood obesity. Changes in diet have also been implicated in the increased prevalence of asthma, among other risk factors. The main symptoms of asthma (ie, wheezing, coughing, and chest tightness) require medical evaluation and monitoring. The cornerstone of asthma management is medication therapy, frequently consisting of inhaled bronchodilators and corticosteroids and, when needed, therapy of corticosteroids by mouth. As part of the multidisciplinary management of this chronic disease, nutrition assessment and follow-up in childhood asthma is necessary to identify and address relevant nutrition-related problems. These problems can involve food–medication interactions, obesity, gastroesophageal reflux disease, food allergies, and other issues; therefore, individualized medical nutrition therapy is warranted. Finally, counseling to achieve a healthy balanced diet is recommended for overall health and weight management. A recent but small number of descriptive investigations agree that adherence to a Mediterranean dietary pattern can be associated with a decreased risk of current asthma symptoms in children. Although this evidence is promising, food interventions are required to substantiate an evidence-based foundation for medical nutrition therapy in childhood asthma. At this time, there is no known health risk if a Mediterranean diet is adopted.

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Asthma is a major public health problem and the most common chronic disease in children, according to the World Health Organization (1). Prevalence, especially in children, has increased in the past 2 decades, but reached a plateau in most industrialized countries toward the end of the last decade. During this plateau, prevalence escalated to historically high levels. In the United States, 6.7 million children (9.1%) had asthma in 2007 (2).

The increased prevalence of pediatric asthma has been mirrored by an increased prevalence of pediatric obesity (3). Also, it has been postulated that changes in diet might be responsible, in part, for the increased prevalence and severity of asthma. It is of clinical interest to identify dietary characteristics that have the potential to modulate asthma risk and/or decrease asthma symptoms in diagnosed cases.

As in many chronic diseases, ongoing multidisciplinary management of children with asthma supports better patient monitoring and overall progress. A multidisciplinary team should include a registered dietitian (RD) as the expert most qualified to conduct a comprehensive nutrition assessment, nutrition diagnosis, intervention, monitoring, and evaluation, where the main goal is to effectively identify and address nutrition-related problems.

This article aims to provide a clinical foundation of the basics of asthma in terms of screening issues and practices, risk factors, medical diagnosis, and treatment, with an emphasis on common nutritional issues and respective practices in the field. Also, this article describes those dietary modifications that have been shown, primarily through the findings of recent descriptive research, to have the potential to decrease asthma symptoms. Future studies must include interventional investigations in children in order to build the knowledge necessary to develop evidence-based asthma medical nutrition therapy (MNT) guidelines for children. Evidence-based MNT for asthma could improve quality of life for children with asthma and is the necessary justification for reimbursement of services.

SCREENING

Should All Children Be Screened for Asthma?

Pediatric cases of undiagnosed asthma range from 3% to 20% (4-7). Despite the high prevalence of asthma (9.1%) (2) and the fact that asthma is the most common chronic disease in childhood, experts have questioned, for a variety of reasons, whether a universal pediatric screening is

warranted. The first reason is cost, because funds dedicated to a population-wide screening could detract sizeable financial resources that could go to other higher-priority health issues. Another reason is that early intervention has not been shown to alter the natural history of the disease (8). Furthermore, it is unclear whether detection offers actual benefit to undiagnosed asthma cases. This unorthodox rationale against screening is posed because case detection does not necessarily translate to access and/or use of appropriate care (9). Finally, recent research supports that, despite similar physician-rated severity, children with undiagnosed disease report significantly less frequent respiratory symptoms and health care use than already diagnosed children (10). On the other end of the spectrum, there is some evidence to suggest that case detection can be beneficial, particularly in those settings with a high prevalence of undiagnosed asthma (11). In weighing the available information, the American Thoracic Society (9) concluded that there is not enough evidence to recommend population-wide screening unless there is a sufficiently great probability for undiagnosed or undertreated asthma in the target population to justify allocation of funds. It is important to note that despite the lack of evidence for universal screening, several national organizations (12) have actively advocated for screening to help raise awareness and improve the quality of life for individuals with asthma.

Which Factors Increase Risk of Children Developing Asthma?

Asthma is the result of complex interactions between genetics and environmental exposures. In genetically susceptible people, such interactions can accelerate the development of airway inflammation, atopy (the tendency to develop allergic diseases), airway hyperresponsiveness, or even the initiation of unknown pathways that consequently lead to asthma (13). There is still much to be learned about the causation of asthma. Nevertheless, the incidence of asthma in childhood is commonly associated with a family history of atopy. Eczema, also associated with atopy, frequently precedes development of asthma. In children 3 to 14 years old, a positive skin test for allergies and elevated immunoglobulin E increase the risk of developing asthma (14). Other predisposing inherent factors are ethnicity (non-Hispanic blacks have a higher risk) and sex. In younger children, asthma develops twice as frequently in boys as in girls, but after puberty new asthma onset is more common in girls. Other environmental causal factors linked to childhood asthma include exposure to indoor allergens (eg, domestic mites, animal allergens, cockroach allergens, fungi) and outdoor allergens (eg, pollens and fungi) (15). Also, tobacco-smoke exposure, air pollution (outdoor and indoor pollutants), respiratory infections, receipt of broad-spectrum antibiotics during the first 2 years of life, small size at birth, attendance at day care, having few siblings, and lower socioeconomic status have been associated with increased risk of asthma development (15).

Obesity and diet have been implicated in influencing asthma risk (13). Although the strength of the link with obesity is rather low, a recent meta-analysis concluded that a high body mass index (BMI; calculated as kg/m^2) during childhood is associated with a statistically significant increase in relative risk for subsequent asthma (16). The association has been found to be independent of socioeconomic factors (17) and ethnicity (18). In contrast, lifestyle factors such as increased television viewing (19,20) and frequent fast-food consumption (21,22) appear to increase asthma risk. One potential mechanism linking asthma and obesity is low-grade systemic inflammation characterizing both diseases (23). Serum C-reactive protein is an inflammation marker and recent research has shown increased levels of C-reactive protein in nonatopic children with asthma (24). Other proinflammatory molecules have been proposed as important mediators in the obesity-asthma relationship. These are tumor necrosis factor-α, leptin, interleukin-4, interleukin-5, and interleukin-6 (23,25). Genetics can also play a role in asthma and obesity. A pediatric case-controlled study identified polymorphisms in the leptin gene that can contribute to both asthma development and overweight status (26), while other research (23) has pointed to encoding receptors relevant to asthma, inflammation, and metabolic disorders, including the beta(2)-adrenergic receptor gene ADRB2 and the glucocorticoid receptor gene NR3C1. In addition, obesity itself can alter airway mechanics and exacerbate airway inflammation, leading to respiratory symptoms associated with asthma (23). Insulin resistance, metabolic syndrome, and common comorbidities, such as gastroesophageal reflux disease (GERD) and sleep-disordered breathing are other areas that are being actively explored as possible links (27). There are still many open questions as to how obesity might cause or worsen asthma. Overall, obesity might be related to pediatric asthma, either directly or through complex interactions involving genetic profile and environmental exposures, including diet.

Multiple studies have examined specific nutrients and asthma, such as antioxidant and/or anti-inflammatory dietary components (vitamins, n-3 fatty acids, various minerals), and/or nutrients affecting immunity status, such as vitamin D. A recent comprehensive meta-analysis of descriptive research supports an influential protective role of antioxidant vitamins A and C (28) in decreasing asthma risk. Observational and clinical evidence on fish oil and fish consumption has not been consistent in demonstrating protection against asthma and/or allergy (29). Lower dietary intake of vitamin D during pregnancy has repeatedly been associated with increased asthma and wheezing outcomes in children up to the age of 5 years old (30). Other diet and asthma studies have focused on food groups and/or dietary patterns. Several but not all cross-sectional and longitudinal studies have correlated reduced fruit and vegetable intakes with reduced lung function (29). Finally, a small number of recent investigations agree that a high level of adherence to the Mediterranean diet early in life protects against development of asthma and atopy in children (31).

There are some encouraging signals from observational research but there is a distinct lack of nutrition intervention studies, especially during early life (30). Such studies are necessary to support definitive recommendations for