The Effects of Processed Foods on Infants and Toddlers

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Introduction

The first two years of life are a crucial timeframe for humans as many biological processes are developing and taking place. For this reason, the nutrition of a child plays a vital role in warranting proper growth, and its effects can be traced back as early as gestation. These formative years are required to build a foundation to grow physiologically and cognitively, but there are many factors that can disrupt this growing process. It is of vital importance that parents are adept at feeding recommendations and guidelines to ensure optimal growth. General health markers to consider include adequate energy intake, more specifically macro- and micronutrient levels, limited intake of added sugars, saturated fats, and sodium, and the establishment of healthy dietary habits.

The term "ultra-processed food" has been a buzzword among the health community for some time. There is often a negative connotation associated with this term for many reasons – personal beliefs, scientific findings from studies and reports, and anecdotal claims from individuals. Processed foods refer to foods that have undergone some form of processing – the types of processing and the classifications of these foods will be further discussed in detail later. The health effects of these processed foods have been studied in many fields regarding biochemical, physiological, and clinical outcomes across various populations. This research paper provides a comprehensive overview of processed food and its various effects on human health from birth through early childhood.

Classification of Processed Foods and Common Sources

A great number of foods are considered processed to some degree, and the extent to which these foods are processed dictates their classification. Scientists created a classification system known as NOVA in which foods can be sorted into one of four categories: unprocessed or minimally processed, processed culinary ingredients, processed foods, and ultra-processed foods.[1,2] Unprocessed or minimally processed foods include whole, natural foods that have no added ingredients such as fresh meats, fish, eggs, milk, fruits and vegetables, and nuts. Next, minimal processing methods include washing/cleaning, drying, freezing, and packaging. Processed culinary ingredients are extractions from these natural foods such as salt, sugar, oil, and fats that typically undergo a form of pressing, grinding, milling, or refining. The combination of these culinary ingredients with whole foods creates processed foods such as breads, cured meats, and canned or pickled products. One of the biggest issues with processed and ultra-processed foods is the added sugar content.[3] Diets high in added sugars have been linked to a wide array of health issues such as childhood obesity, type 2 diabetes, cardiovascular disease, nonalcoholic fatty liver disease, and tooth decay.[4] The addition of industry-grade ingredients such as emulsifiers, sweeteners, and gums lead to the production of ultra-processed foods such as frozen meals, sweetened beverages, chips, and desserts. Common baby foods that fall into the processed categories include fruit pouches, deli meats and sausages, candies, cereals, sweetened beverages, yogurts, and notably, infant formula. Infant formulas are produced with processed ingredients and additives to provide specific, desired nutrients.[5] While there are some infant formulas deemed "natural," many contain preservatives, additives, added sugars such as corn-syrup solids, thickeners, emulsifiers, and synthetic nutrients.[4,6]

The Prevalence of Processed Foods

The prevalence of ultra-processed foods in infants and young children's diets has significantly increased. For instance, in Brazil, a study found that 79% of foods for children aged 0-36 months were classified as ultra-processed, including breast milk substitutes and cereals introduced as early as six months, despite the recommendations for exclusive breastfeeding.[7] This early introduction of infant formula often replaces breastfeeding, influenced by marketing that promotes formula as a convenient option. Additionally, many infants are exposed to ultra-processed foods, including snacks filled with added sugars before reaching one year of age.[8] For example, in Brazil, infant formula was introduced before six months to a significant number of infants, with almost 60% of children also receiving cow's milk at an early age; this practice has been largely discouraged by health experts because of its potential harm to infant health.[7] The consumption of ultra-processed foods is widespread across socioeconomic groups, raising concerns about long-term health risks, such as obesity, diabetes, and cardiovascular issues. These trends highlight the need for increased awareness and policy interventions to promote healthier eating habits during early childhood.[8]

The Marketing of Processed Foods to Children

The marketing of food products to young children is pervasive, and often relies on techniques specifically designed to attract their attention. In many countries, products aimed at toddlers and children feature bright packaging, cartoon characters, and popular mascots. These methods are highly effective because young children are drawn to these images. As a result, their food preferences and consumption patterns early in life are influenced. Children are more likely to consume foods that are heavily marketed to them, even when these products lack nutritional value.[9,10] Studies have shown that a significant portion of these products are ultra-processed foods (UPFs), which are low in essential nutrients and high in added sugars, unhealthy fats, and

additives.[10] These UPFs, such as sugary cereals, snack foods, and sweetened beverages, have continued to dominate the market for children's food. The overconsumption of such foods contributes to unhealthy diets in young children and can have life-long lasting health consequences. Since children are naturally drawn to what is most accessible and appealing, the prevalence of unhealthy food marketing is problematic for their long-term health.[9] Excessive intake of sugary and processed foods increases the risk of obesity, type 2 diabetes, and cardiovascular issues later in life. Additionally, poor nutrition at an early age can impair cognitive development and set the stage for lifelong unhealthy eating habits.[9] Since children are particularly vulnerable to marketing influences, they are less likely to make healthier food choices without intervention, whether through parental guidance or regulatory policies that limit exposure to unhealthy food marketing.[10] Exploitive marketing is not only targeted towards infants and children, but at parents as well. A study investigating various nutritional and marketing qualities of squeeze pouches found that 26% of 276 products claimed to be suitable for infants as early as 4 months of age, contradictive with the WHO complementary feeding guidelines set at 6 months.[11] The introduction of processed foods, nonetheless any complementary food, before 6 months interferes with breastfeeding, which can limit its many benefits. Additionally, these pouches contained various claims, regulated and not, leading parents to believe these products healthier/better than they were.[11]

Another factor that exacerbates this issue is the regulatory gap in many countries when it comes to marketing practices aimed at children. While there are some guidelines and recommendations in place, many food products that do not meet health standards are still widely advertised to children, especially in the form of appealing packaging and promotional tactics.[9] These loopholes allow companies to continue promoting unhealthy foods, even though they

contribute to the poor dietary habits seen in many young populations. Stricter regulations are needed to ensure that healthier foods are marketed to children, which could help reduce their consumption of ultra-processed foods. Marketing tactics aimed at children significantly contribute to the prevalence of processed foods, particularly ultra-processed products, in their diets. The UPFs that are marketed to infants and children are often nutritionally inadequate, containing excessive sugar, salt, and unhealthy fats.[11] A regular analysis of the market and policy adjustments are essential to ensure that marketing practices and the nutritional quality of foods improve over time, with a focus on protecting children's health through better food labeling and reduced exposure to unhealthy processed foods.

Health Effects of Processed Foods

Ultra-processed foods are often deficient in essential vitamins and minerals, leading to nutritional deficiencies that can hinder optimal growth and development. These foods typically have an imbalance of macronutrients since they are usually high in added sugars, saturated, and trans-fat, while being low in dietary fiber and protein.

Early exposure to UPFs correlates with an increased risk of childhood obesity and type 2 diabetes; Additionally, children with high UPF consumption often exhibit higher body mass indices, which contribute to metabolic disorders.[12] Emerging research indicates a potential link between processed food consumption and cognitive development, suggesting that diets high in sugar and low in nutrients may negatively impact children’s cognitive function and learning abilities.[12] Additionally, UPFs can disrupt normal eating behaviors, leading to overeating and poor appetite regulation. This pattern often results in a preference for sweet and salty flavors, shaping future eating habits toward less nutritious options. Given these health effects, promoting

healthier eating practices by encouraging the consumption of minimally processed foods is vital for establishing a strong foundation for long-term health and wellness.[13]

To add, new research examining the association between oral health and ultra-processed foods has found a positive relationship between daily consumption of processed foods and cavitated caries in children.[14] Fluoride is an important nutrient in a child's diet that protects against the accumulation of cavities, and those who do not receive adequate fluoride are at higher risk of cavitated caries. Untreated cavities can lead to further problems such as mouth pain, poor oral health, tooth loss, malnutrition, and poor quality of life.[15]

In addition to physiological and clinical health concerns, another health implication to consider is the effect of processed foods on dietary habits. The foundation of eating habits and patterns is forged during infancy and early childhood; this is a time for children to not only adopt taste preferences, but to develop specific eating behaviors as well. There is some speculation about chemicals in ultra-processed foods that may alter cognitive effects and behaviors at a biochemical level, but the actual experience of eating processed foods also plays a big part in a child's eating experience. Two large factors that influence these eating experiences are environment and sensory criteria. Because of the convenience of processed foods, parents are likely to provide these snacks and meals on-the-go instead of taking time to sit and eat. An emerging theme within the increased convenience criteria of processed foods includes more efficient and easily transported packaging. For example, squeeze pouch products have become increasingly popular within the last decade. On top of poor nutrient profiles, these pouches take away from the hands-on experience of trying other nutritional complementary foods as they eliminate the opportunity for spoon and hand feeding.[16] This, in turn, can lead to excessive energy intake due to the ability of consuming large quantities at once.[11,17] Similar to eating on-

the-go, specific eating practices, such as eating while watching TV, has been linked to a lower-quality diet consisting of a higher intake of processed foods.[18]

Although not completely within the scope of this paper, it is important to note the importance of parenting styles and how they influence a child's eating behaviors which begin as early as infancy. Parents' practices and behaviors are the main examples in which a child should approach and behave at mealtimes. The diet of a child is directly linked to that of their caregivers, as they are the ones responsible for providing them with food. Therefore, infants of mothers who consume a higher intake of processed foods will also consume higher intakes of processed foods.[18]

Potential Benefits of Processed Foods

As previously established, the degree of processing that a food undergoes will be the biggest determinant of its health implications in vivo. Despite the detrimental effects of some processed foods, it is important to note the potential benefits they provide as well. As mentioned earlier, one of the prime benefits of processed foods is their convenience. Balancing the many responsibilities of providing for and raising a child is a challenge in and of itself; taking on the task of preparing every single meal for a child while ensuring every nutritional requirement is met adds on to the rest of the existing struggles of parenting. Although processed foods provide additional ingredients that may not be necessary or beneficial to a child's diet, they are a notably a good source of important nutrients as well. For instance, consumers of commercially prepared baby foods display higher intakes of fruits and vegetables and thus, fiber, potassium, vitamins A, C, and E, and magnesium, but lower intakes of sodium and vitamin D.[19] Adequate consumption of these nutrients ensures infants and children meet the recommended intakes to achieve optimal growth and health status.

Conclusion

With the prevalent rise of processed food intake among all ages, it is vital that parents monitor and limit their children's intake to prevent the onset of various health conditions and to promote healthy eating behaviors. The current dietary guidelines for infants recommend that healthful complementary foods be introduced at 6 months of age to ensure optimal growth. These healthful foods should meet nutrient guidelines and limit potentially harmful nutrients such as saturated fat, added sugar, and sodium. In other words, complementary foods should consist mainly of unprocessed/minimally processed foods, such as fresh meats, fish, dairy products, eggs, nuts, beans/lentils, and fruits and vegetables. The literature demonstrates the association between processed and ultra-processed food intake and various health conditions including obesity, type 2 diabetes, nutritional deficiencies, impaired cognitive function, and dietary habits and behaviors.

To lower the intake of processed food in infancy and early childhood, government policies should be set in place to improve label regulation,[20] decrease pervasive marketing techniques to both children and parents, and to instill education intervention techniques among parents to raise awareness of the problems linked to processed foods. However, certain limitations such as socioeconomic factors, lack of resources, and finances can play a major role in the foods available to provide to a child. Thus, it is of most importance to ensure a child is receiving adequate nutrition, despite the processing of the food source; fed is always best.

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