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Nourishing the Future: The crucial importance of complementary feeding in childhood nutrition

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Abstract
Diets for children during the period of complementary feeding, spanning from 6 to 23 months, play a crucial role in their survival, growth, development and overall well-being. This period presents a unique challenge as young children's nutrient needs reach a peak while their stomach capacity remains limited. Adequate complementary foods and feeding practices are essential to decrease the prevalence of all types of childhood malnutrition, such as micronutrient deficiencies, non-communicable diseases linked to diet, wasting, obesity, stunting and overweight.
The nutritional quality of children's diets during the period of complementary feeding significantly impacts their future health. Nutrient-rich, diverse and age-appropriate foods are crucial for meeting their growing nutritional demands. A diet consisting of various food groups, including animal-source foods, vegetables, fruits and fortified foods, ensures a sufficient intake of essential nutrients. It is vital to avoid low-nutrient foods, sugary beverages and added sugars to promote healthy eating habits and prevent childhood obesity.
Breastfeeding should continue alongside the introduction of complementary foods, promoting child health and development and providing essential nutrients. Enhancing children's diets during this crucial stage is essential for attaining the Sustainable Development Goals, which include the objective of ending all types of malnutrition and enhancing nutrition. By prioritizing young children's nutrition, we can build sustainable and prosperous societies and secure a healthier future for generations to come.

Keywords: Complementary feeding, malnutrition, dietary diversity, breastfeeding, complementary foods, nutrient density

Introduction
Every child has a fundamental entitlement to receive sufficient and appropriate nutrition. When children are provided with the correct types of food, in appropriate quantities, and at the right developmental stages, their chances of survival, growth, development and learning are significantly improved. This enhanced nourishment equips them to flourish, even in the face of challenges such as diseases, disasters or crises.
During the period between 6 and 23 months, known as the complementary feeding phase, a combination of access to a diverse range of nutritious foods and breastfeeding plays a vital role in providing children with the necessary nutrients, vitamins and minerals for their full cognitive and physical development. These benefits extend throughout adulthood [1, 2]. Moreover, the period of complementary feeding presents a crucial opportunity to avoid various forms of childhood malnutrition, comprising micronutrient deficiencies, wasting and stunting, as well as issues related to overweight, obesity and non-communicable diseases linked to diet. Additionally, it is during this phase when lifelong food preferences, habits and tastes are frequently established.
In almost every region across the globe, families encounter various obstacles such as political, social, economical, market or cultural barriers, hindering their ability to provide sustainable, safe, nutritious and affordable diets to young children. These challenges become even more pronounced in humanitarian crises, where there is limited availability of quality healthcare, nutritious food and clean water and caregivers are already facing significant strain on their resources and capabilities. Consequently, young children and their caregivers increasingly encounter low-nutrient foods, like commercial complementary products and processed items containing high levels of added unhealthy fats, salt and sugar. These widely available and inexpensive options are easy to feed to young children [3]. Given these circumstances, it becomes imperative to expedite efforts aimed at promoting better feeding practices for young children and enhancing the quality of complementary foods [4].

1. Why children's diets matter during the complementary feeding period
The period before age 2 is crucial for the nutritional quality of children's diets, surpassing the significance of any other life stage [4, 5]. Following good feeding practices and providing suitable complementary foods during this time greatly contribute to a child's development, growth and survival. Furthermore, it helps prevent deficiencies in essential micronutrients, reduces the risk of illnesses and even mitigates the chances of obesity in later life.
The phase of complementary feeding, covering the period between the ages of 6 and 23 months presents a considerable challenge in meeting the nutritional requirements of children. Although their stomachs can hold only limited amounts of food, their nutrient needs peak during this period, [6] making them susceptible to growth impairment. In many countries, the decline in length-for-age or height-for-age occurs predominantly during the complementary feeding period [1, 7] mainly due to insufficient quantity and quality of initial foods, heightened rates of infections and inadequate feeding practices [8, 9].
Initial foods provided to young children should ideally be rich in nutrients. However, it is common for young children

to be given meals that primarily consist of staple grains and cereals, which lack sufficient iron, energy, zinc, protein and many vital nutrients [10-13]. Additionally, unhygienic habits of feeding also raise the likelihood of diarrhea and infections in children of young age [4, 5], and when coupled with inadequate diets, it can result in failure of growth [14].

Recent worldwide assessments of practices of complementary feeding, as per WHO-established indicators, reveal a concerning condition. Half of all children in low and middle income countries lack access to the minimum meal frequency (the minimum number of daily meals required to fulfill their nutritional requirements). Moreover, more than two-thirds of children in low and middle income countries do not receive the required dietary diversity (meals from only a few food groups). Shockingly, five out of six children are not being provided with a minimum acceptable diet, which includes both the minimum dietary diversity and the minimum meal frequency required to mitigate the malnutrition risk [15]. Studies have shown that the quality of diet is closely linked to the nutritional status of children, as those who are provided with at least a minimum acceptable diet have less chances of being underweight or experiencing stunting [16-18].

Despite the prevailing agreement regarding the significance of proper nutrition during the early stages of life, a considerable number of young children are experiencing the adverse effects of inadequate diets. According to the State of the World's Children 2019, approximately one in three children under the age of 5 is either overweight or malnourished. Stunting affects around 149 million children globally under the age of 5 [4, 19], hindering their cognitive and physical development [19]. Children who experience stunting during their early years often develops into adults with stunted growth as well [20] and mothers who have experienced stunting are more prone to having children who also suffer from stunting. Wasting, which impacts over 49 million children aged under 5 years worldwide, exposes them to a higher risk of mortality and infection [19, 21]. Undernutrition accounts for as much as 45 percent of deaths in this age group, significantly contributing to morbidity [21]. Additionally, At least 40 million children under the age of 5 are impacted by childhood overweight and It is anticipated that childhood overweight will continue to increase in low and middle income countries, leading to an increased risk of non-communicable diseases in adulthood [19, 22, 23].

The inadequate growth of children during the initial 1,000 days from the time of conception to the age of 2 is linked to reduced chances of survival [21, 24] and an increased susceptibility to non-communicable diseases linked to diet and obesity during adulthood. Additionally, it negatively affects cognitive and educational achievements [25] and results in lower income levels in the later stages of life [21, 26]. Children who experience stunting may have a 20 percent lower income compared to their non-stunted peers when they become adults [27, 28] and stunting can also have a negative impact on a country's gross domestic product, lowering it by as much as 3 percent [28]. Reversing child growth deficiencies and stunting is challenging, after the age of two, cognitive deficits may become permanent [6].

Enhancing the dietary intake of children is crucial for building sustainable and prosperous societies and plays a pivotal role in attaining the Sustainable Development Goals (SDGs) for the year 2030. These goals include Goal 2, which aims to eliminate all types of malnutrition and enhance nutrition. Furthermore, enhancing children's nutrition also contributes to achieving SDG targets related to reducing preventable childhood deaths and eradicating poverty. Additionally, prioritizing the improvement of child's diets is essential in tackling three of the six targets set by the World Health Assembly (WHA) in efforts to decrease childhood overweight, stunting and wasting by the year 2025.

2. Dimensions of children's diets during the complementary feeding period

2.1 What children eat

The World Health Organization (WHO) and UNICEF advocate exclusive breastfeeding for infants from birth to 6 months. After 6 months, children should begin consuming suitable, nutritious and safe complementary foods, while still continuing breastfeeding. During this complementary feeding period, a proper diet should be rich in nutrients and should avoid excessive energy, trans fat or saturated fats, salt and sugar.

Adequate diets for young children during the complementary feeding period are characterized by

2.1.1 Dietary diversity

To fulfill their nutrient requirements and experience various tastes and textures, young children should have a varied diet that includes foods from different food groups each day. A diverse diet for children should consist of (1) breast milk, (2) dairy products (cheese, yoghurt, milk), (3) vitamin A rich fruits and vegetables such as dark green leafy vegetables, sweet potatoes, pumpkin, mangoes, orange and carrots, (4) tubers, roots and grains, (5) eggs, (6) flesh foods (fish, liver, meat, poultry and organ meats), (7) legumes, nuts and seeds, (8) other vegetables and fruits. Providing children with a diverse range of foods helps ensure they meet their micronutrient requirements, including essential vitamins and minerals like vitamins B6 and B12, calcium, iron, zinc, vitamin A, folate and thiamine [29-32].

2.1.2 Nutrient density

Young children's small stomach capacity necessitates consuming small, nutrient-dense meals to make the most of each bite's nutrition. Locally available nutrient-dense foods are legumes like groundnuts and eggs, meat and other animal-source foods are excellent examples. While plant-based porridges or cereals may satisfy hunger, but they alone cannot offer enough micronutrients, energy and protein to bridge the gap between children's nutrient needs and breast milk [33]. The high quality healthy fats in the diets of children hold significance [34]. Long-chain-polyunsaturated fatty acids, particularly the omega-3 fatty acids present in fish (like mackerel, sardines and trout), soybean, nuts, plant oils, seeds and seafood, enhances motor and cognitive development in children [35]. To avoid chronic diseases in adults and potential inflammation in children, it's crucial to avoid trans fats, commonly present in processed foods [36]. Energy-rich and nutrient-rich foods should be provided in portions suitable for the child's age, without excessive quantities.

2.1.3 Inclusion of fruits, vegetables and animal-source foods

Animal-source foods (e.g., dairy, poultry, eggs, fish and meat) serve as excellent sources of high-quality protein and

essential fatty acids, these nutritious foods are recommended to be introduced early in a child's diet, among the first foods they consume. These foods also provide essential nutrients like vitamin B12, zinc, calcium and iron [37, 38]. Recent evidence indicates that consumption of a minimum of five food groups, which includes animal-based foods, in a child's diet can reduce the risk of stunting [18, 39]. Additionally, fruits and vegetables play a crucial role in a nutritious diet, offering a wealth of dietary fiber, vitamins, antioxidants and minerals [40]. Encouraging the daily consumption of a diverse range of fruits and vegetables ensures the intake of many essential nutrients for healthy growth and development.

2.1.4 Inclusion of vitamins and minerals supplements or fortified foods, as needed

While it is ideal to prioritize locally available, home prepared and nutrient-rich foods [41], there are certain situations, such as humanitarian crises or food insecurity as well as predominantly vegetarian diets, where meeting the nutritional needs of young children becomes challenging. In such contexts, fortified foods containing essential vitamins and minerals, including iron, can help bridge the nutrient gap. Micronutrient powders (MNPs) can also be incorporated into homemade foods to boost their nutritional quality [42]. Additionally, commercially fortified foods designed for young children and infants, such as mineral or vitamin enriched cereals, can serve as valuable sources of micronutrients in specific circumstances. It is crucial to promote affordable fortified complementary foods while adhering to national and global standards [43].

2.1.5 Avoid beverages and foods of low nutritional value

Caregivers should refrain from offering low-nutritional-value drinks or foods, including chips, candy, sweetened beverages and foods rich in trans fats, salt and sugar. These types of "junk" foods primarily provide empty calories, replacing breast milk and reducing the appetite of child for more nourishing options. Consuming sugar beverages during early childhood is linked to elevated weight gain, higher risk of obesity and overweight and higher body mass index (BMI) [44]. It is advisable to consume fruit juices, particularly processed ones, in moderation due to their often high content of added sugars. Additionally, the regular consumption of commercial complementary foods with sweet taste and texture may diminish a child's interest in exploring various family foods and experiencing different textures and flavors.

2.1.6 Avoid the inclusion of added sugars

In various situations, caregivers include sugar in homemade foods and drinks to enhance their flavor. However, sugar intake can lead to excessive energy consumption and dental cavities. Moreover, consuming sweet foods also fosters a preference for such items, which may establish lifelong taste preferences for sugar.

2.1.7 Continued breastfeeding

It is recommended that children should continue to breastfeed frequently and on demand until the age of 2 years or beyond. During the complementary feeding period, breastfeeding offers vital nutrients like protein, fats and additional essential nutrients that are crucial for children's well-being. Studies have demonstrated that young children in the age between 6 to 23 months who are not breastfed face an increased likelihood of all-cause mortality and mortality associated to infections when compared to children who are breastfed [45]. In countries with higher income levels, continuing breastfeeding beyond the age of 4 months has been linked to a reduced risk of childhood obesity and overweight [46-48]. Moreover, breastfeeding is also linked to enhanced cognitive development [49]. In cases where children do not receive breast milk during the period of complementary feeding, children can be introduced to dairy products like yogurt, fermented milk or animal milk can be provided. The use of growing up milks or follow-up formulas is unnecessary and can often be high in sugars like added caloric sweeteners or corn syrup solids [50].

Conclusion

The period of complementary feeding, spanning from 6 to 23 months of age, plays a pivotal role in shaping a child's lifelong health and development. Adequate nutrition during this phase is crucial for child survival, growth and cognitive potential. However, in many parts of the world, barriers hinder access to nutritious and safe diets for young children, leading to alarming rates of malnutrition and childhood overweight.

To address this pressing issue, it is essential to prioritize the improvement of complementary foods and appropriate feeding practices. A diverse diet, rich in nutrient-dense foods like fruits, vegetables and animal-source foods, is key to meeting children's nutritional needs and preventing deficiencies. Avoiding foods and beverages of low nutrient value, added sugars and unhealthy fats is crucial to promote healthier eating habits.

Continued breastfeeding remains a critical component of optimal child nutrition, supporting both physical and cognitive development. Additionally, the incorporation of fortified foods or minerals and vitamins supplements can help fill nutrient gaps, especially in challenging circumstances. By recognizing the significance of children's dietary needs throughout the period of complementary feeding and taking urgent action to address the challenges, we can pave the way for healthier, thriving future generations. Ensuring children's right to adequate nutrition during this critical time is not only essential for their individual well-being but also fundamental to achieving global goals related to health, nutrition and sustainable development.

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