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Undernutrition in Children of Resource-poor Settings: Predictors, Treatment and Prevention

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Abstract

Undernutrition is a condition in which food and nutrient intakes are not adequate to meet physiological needs and maintain good health. Undernutrition remains a major public health problem, especially in children. An estimated 149 million children are stunted, 45 million are wasted and 45% of deaths in children under 5 are linked to undernutrition. The developmental, economic, social, and medical consequences of undernutrition are serious and lasting, for individuals and their families, communities, and countries, especially in resource-poor settings.

The objective of this review was to describe the predictors and to outline the best treatment and prevention strategies to combat undernutrition in children of resource-poor settings.

There is evidence of an association between birth weight, birth order, breastfeeding status, frequent illness, immunization, family size, family income, household food expenditure, sanitation, education level of parents, maternal decision-making, and undernutrition.

Treatment options include therapeutic foods and the use of antibiotics depending on the underlying cause and severity of the undernutrition. Prevention strategies must never exclude cash transfers and nutrition education.

This review has demonstrated that in resource-poor settings, access to nutritious food to combat undernutrition can be improved through interventions like cash transfers, food assistance, improved agricultural techniques, and educational programs to improve the knowledge, attitude, and practice of carers on undernutrition.

Keywords: Undernutrition, children, predictors, treatment, prevention, resource-poor settings

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Introduction

Undernutrition refers to stunting, wasting, underweight and micronutrient deficiency which remains a global public health challenge, especially in children from resource-poor settings (WHO 2005). The prevalence of undernourishment climbed from 8.4% in 2019 to 9.9% in 2020 (FAO 2022). Around 45% of deaths among children under 5 years of age are linked to undernutrition These mostly occur in low- and middle-income countries (Müller and Krawinkel 2015). In 2020, 149 million and 45 million children under 5 were stunted and wasted respectively at the global level. Also, 17 percent of preschool children are underweight and 33 percent suffer from iodine deficiency (Dukhi 2020).

Nutritional insults such as low birth weight, underweight, and stunting during critical periods of fetal and young child development produce lifelong developmental, economic, social, and medical consequences (Victoria, et al. 2008). Another serious and problematic outcome of undernutrition in resource-poor settings is the impact of early undernutrition on metabolic programming or fetal Origin of Adult Disease (FOAD). Metabolic programming is the phenomenon whereby the unborn fetus adapts to a nutrition-deficient environment because of the mother's undernourishment (Barker and David 2008). This may become problematic when the child grows up in a food-abundant or obesogenic environment as this mismatch can lead to obesity and non-communicable diseases, which already account for most of the mortality in resource-poor settings (Obiageli 2015).

In the short-term, maternal and child undernutrition are estimated to be associated with between a half and a third of global child deaths (Ezatti, et al. 2004). The contribution of undernutrition to child mortality varies by disease, being highest for diarrheal diseases (73%), and close to half for pneumonia, measles, and severe neonatal infections (Black , et al. 2008).

In 2015, the United Nations adopted a set of 17 SDGs as a universal call to action to ensure by 2030, a world free from all forms of malnutrition. Efforts to meet this target have resulted in a global decline in the burden of malnutrition but undernutrition is still on the rise. Overcoming undernutrition in resource-poor settings needs an understanding of risk factors and a scale-up of treatment and prevention strategies that have worked in similar settings (Krawinkel 2012). This write-up is thus relevant in that it describes predictors of undernutrition and the best treatment and prevention strategies in resource-poor settings.

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The objectives of this review were: to describe the predictors, outline the best treatment options and prevention strategies for undernutrition in children of resource-poor settings.

I. Predictors of undernutrition among children of resource-poor settings

Undernutrition has been associated with predictors at the individual, household, and community levels. **Table 1** below provides a list of major risk factors and a description of their association with undernutrition in children of resource-poor settings.

Table 1. Description of predictors of undernutrition in resource-poor settings

Predictor	Description
Age of the child	Undernutrition is common between the ages of 6 – 24 months because, by 6 months, breast milk alone cannot cover a baby's nutrient needs, especially iron. Complementary foods started late or unsuitable for young infants may not cover the increased nutrient needs if they are not 'nutrient dense', too watery, or fed infrequently leading to undernutrition (Burgess and Louis 2008). Childhood infections at this age last longer and are more frequent and serious (WHO 2005). Children undernourished at this age are at high risk of permanently stunted growth and development (Burgess and Louis 2008).
Higher birth order	Higher birth orders (from the third, fourth, and fifth) are more likely to be stunted than lower birth orders (first and second). A parent's feelings towards a later born might hurt the child's health when these feelings contribute to conscious or unconscious neglect of the index child, resulting in inadequate nutrition, lack of parental bonding, and inattention to healthcare needs (Rahman, et al. 2015).
Low birth weight	The risk of being stunted, wasted and underweight is higher in children with low birth weight (LBW) than in those with normal birth weight due to growth failure (Peter and Morton 2019). Children with low birth weight have increased vulnerability to infections such as diarrheal and lower respiratory infections and increased risk of complications including jaundice, anemia, fatigue, and loss of appetite (Rahman, et al. 2015). This leads to poor physical growth and development.

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Breastfeeding status	Breastfeeding has an impact on infectious and noninfectious disease prevention. Non-breast-fed infants, infants whose breastfeeding is not initiated within an hour after birth, and infants who are not exclusively breastfed are at greater risk of diarrheal and other infectious diseases that either affect their appetite, micronutrient absorption or increase energy needs that puts them at greater risk of undernutrition (Chisti, et al. 2011).
Frequent illness	Many illnesses can directly affect appetite, calorie absorption, or both. Loss of appetite may prevent children from eating enough food. Other illnesses also increase calorie needs. This great increase in nutrients might not be compensated by adequate intake during illness, increasing the risk of undernutrition (John 2022).
Incomplete immunization	Basic health services such as vaccination have been shown to have a protective effect against undernutrition because they prevent morbidity. (Prendergast 2015).
Family income and household food expenditure	Households with low incomes usually spend most of their total household income on food. In these cases, even the lowest out-of-pocket healthcare service can severely diminish the remaining income to be used for food supply, further perpetuating the issue of food insecurity. These low-income families cannot afford nutritious food due to unemployment, low wages, or lack of education which are associated with inadequate diet and diseases that lead to undernutrition (Siddiqui, et al. 2020).
Family size	As the family size increases, the amount of time, energy, and money spent on each available child reduces which affects the adequacy of their dietary intake. This hinders their social and physical development. Children from small families have lower risk of undernutrition than those from medium or large families and those from medium families are at lower risk of undernutrition than those from large families (Abera, et al. 2019).
Religion of household	The religious affiliation of a child's family provides information on the likely dietary restrictions encountered by a child in his or her early growing years, on the child's exposure to fasting in utero during the Muslim holy month of

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	Ramadan, and the possible differences between religions in women's autonomy and control over household resources (Brainerd and Nidhiya 2015).
Education level of parents	Parents with low education or no education are usually less exposed to information on how to prepare food with sufficient nutrients and the introduction of complementary food after 6 months may also be delayed. A previous study revealed that higher education levels lead to a higher socioeconomic status which acts as a preventive factor for undernutrition (Khattak, et al. 2017).
Unimproved sanitation	Poor water, sanitation, and hygiene increase the risk of infections, and infections influence growth. Inadequate handwashing in children increases risks of soil-transmitted helminths, diarrhea, and pneumonia which all influence growth rates in different dimensions (Dearden, et al. 2017).
Maternal decision-making power	Women's participation in decision-making influences the feeding practices of their children, which is a key determinant for undernutrition. Women's participation in healthcare decision-making is a proxy measure for a household's overall access to healthcare which is protective against stunting prevalence. Decision-making regarding visits to her family and relatives demonstrates her mobility autonomy, which allows for greater independence and may promote access to broader resources for her children (McKenna, et al. 2019).

II. Best treatment options for undernutrition

Treatment for undernutrition depends on the underlying cause and how undernourished the child is. Antibiotics and therapeutic foods have been demonstrated to have the best treatment outcomes in resource-poor settings.

❖ Therapeutic foods

Therapeutic food is a type of nutrient-dense food used to treat acute undernutrition in children. They are lipid-based pastes, energy-dense, resist bacterial contamination, and need no cooking.

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They usually contain added minerals and vitamins and are an excellent source of protein and energy (Lancet 2007). Some of these therapeutic foods include ready-to-use therapeutic food (RUTF), liquid oral nutritional supplement (ONS), lipid-based nutrient supplement (LNS), large quantity lipid-based nutrient supplement (LNS-LQ), and micronutrient powder (MNP).

Therapeutic foods have been used to treat millions of children threatened by severe wasting, one of the most dangerous forms of undernutrition (Ellen and Manary 2014). Recovery rates have ranged from 80% (Lancet 2007) to 93.7% with an increase in weight, height, and MUAC (Rachel, Stephanie and Mark 2009). One of the most effective components of local therapeutic food is soybean. It is high in fiber and protein, low in saturated fat, cholesterol free, lactose-free, a good source of omega-3 fatty acids, a source of antioxidants, and high in phytoestrogens (Niyibituronsa, et al. 2014).

- **Antibiotics**

Diseases have been identified as one of the underlying causes of undernutrition. Epidemiological studies have generated evidence of a high prevalence of pneumonia, bacteremia, and urinary tract infections in children with undernutrition (Burgess and Louis 2008). This supports WHO's recommendations of broad-spectrum antibiotics for these children (WHO 2005). Recommended antibiotics include but are not limited to cotrimoxazole, ampicillin, oral amoxicillin, gentamycin, and chloramphenicol depending on the level of complication of the undernutrition, availability of the antibiotics in the setting, the response of the child to the treatment and local resistance patterns. The provision of antibiotics to severely undernourished children has been an effective strategy in resource-poor settings (Kumar, et al. 2022). The introduction of standardized regimens has significantly reduced mortality in hospitalized children (Trehan, et al. 2016).

III. Preventive strategies for undernutrition

Preventive strategies target the risk factors. Strategies such as vitamin, mineral, and micronutrient supplementation, delayed cord clamping after birth, kangaroo mother care, early initiation of breastfeeding, promotion of dietary diversity, fortifying staple foods, cash transfer programs, community-based nutrition education, and school feeding programs have shown to be effective in several settings (Burgess and Louis 2008). Preventive strategies against the risk factors are outlined in **Table 2** below.

Table 2. Preventive strategies

Predictor	Prevention	Necessary actions

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Age of the child	Nutrition education	Smooth texture semi-liquids complementary foods should be introduced at approximately 6 months of age (Burgess and Louis 2008).
Higher birth order	Nutrition education on parents (Rahman, et al. 2016).	Family planning
Low birth weight	Kangaroo mother care for 1-3hours repeated at least three times a day (Evereklian and Bobbie 2017).	Adequate support for pregnant women to reduce incidence of low birth weight.
Breastfeeding status	Early initiation of breastfeeding, Nutrition education and promotion of dietary diversity (Syeda and Kingsley 2020).	Breastfeeding should be initiated within an hour after birth and continued exclusively until 6 months. Supplementary food should be introduced at 6 months and weaning done before 18 months
Frequent illness	Vitamin, mineral and micronutrient supplementation, Cash transfer programs and nutrition education (John 2022).	Prompt treatment of illnesses by addressing barriers that hinder access to care and adequate nutrient intake during illness
Incomplete immunization	Health promotion (Prendergast 2015).	Vaccination is crucial for healthy growth
Family income and household food expenditure	Cash transfer programs	Improve access to food
Family size (Number of	Cash transfer to large families (Abera, et al. 2019).	Reduce birth rates

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children in the household)		
Religion of household	Nutrition education (Beruk , et al. 2019).	Sensitizations to end dietary restrictions
Education level of parents	Nutrition education and school feeding programs (Khattak, et al. 2017).	The education of parents especially females be given due importance and promoted in rural and semi-urban settings
Unimproved sanitation	Education on infant and young child feeding (Dearden, et al. 2017).	Improve sanitation
Maternal decision-making power	Cash transfer to women (McKenna, et al. 2019).	Gender equality and women empowerment

From **Table 2** above, cash transfers and nutrition education can prevent many of the risk factors. The potential of cash transfer programs to improve child nutrition is because of their positive role in increasing resources for food, health, and care.

Nutritional education is any set of learning experiences designed to facilitate the voluntary adoption of eating and other nutrition-related behaviors conducive to health and well-being (Eric, et al. 2021). It provides people with correct information on the nutritional value of foods, food quality and safety, methods of preservation, processing, and handling, food preparation, and eating to help them make the best choice of foods for an adequate diet (Ayesha, et al. 2013). Nutrition education interventions with a multi-component approach that are age appropriate and of a good duration (6 months) are more likely to succeed (Murimi, et al. 2018).

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Conclusion

Undernutrition remains a major public health problem in children of resource-poor settings and children unfortunately are the most at-risk group. Main predictors have been demonstrated to be age of the child, higher birth order, low birth weight, breastfeeding status, frequent illness, incomplete immunization, family income and household food expenditure, family size, religion of household, education level of parents, unimproved sanitation and maternal decision making power. Treatment options include therapeutic foods and use of antibiotics. Preventive strategies must never exclude cash transfers and nutrition education.

Recommendations

In resource-poor settings, access to nutritious food to combat undernutrition can be improved through interventions like cash transfers, food assistance, improved agricultural techniques, and educational programs to improve the knowledge, attitude, and practice of carers on undernutrition.

Competing Interest

There are no conflicts of interest in this review

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