

Case Report

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Case Report

Malnutrition in Nepal: A Comprehensive Analysis of Micronutrient Deficiencies, Health Impacts, and Intervention Strategies

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Abstract: Malnutrition, particularly micronutrient deficiencies, remains a significant public health challenge in Nepal, affecting vulnerable populations such as children under five, pregnant women, and lactating mothers. This thesis examines the complex landscape of malnutrition in Nepal, focusing on the causes, health impacts, and socio-economic consequences of nutrient deficiencies. The research highlights the severe effects of malnutrition, including stunting, anemia, and developmental delays, which contribute to broader social and economic disparities. A detailed analysis of the most affected populations and regions, based on national surveys and studies, underscores the critical need for targeted interventions. This study also evaluates existing nutrition programs in Nepal, assessing their effectiveness and identifying gaps in coverage, particularly in remote and rural areas. The findings emphasize the importance of a multi-sectoral approach that integrates nutrition-specific interventions with broader efforts to improve food security, healthcare access, and economic opportunities.

Keywords: Micronutrient

Introduction

Malnutrition remains a critical public health challenge in Nepal, with micronutrient deficiencies being a significant component of this issue. The general landscape of malnutrition in the country is shaped by various socio-economic, cultural, and environmental factors that contribute to widespread nutritional inadequacies. Despite progress in some areas, Nepal continues to grapple with high rates of undernutrition, particularly in vulnerable populations such as children under five, pregnant women, and lactating mothers.

Micronutrient deficiencies—often termed “hidden hunger”—are a major concern in Nepal. The most prevalent deficiencies include iron, vitamin A, iodine, and zinc, which are crucial for immune function, cognitive development, and overall health. Iron deficiency, which leads to anemia, is especially common among women of reproductive age and young children. Anemia in pregnant women increases the risk of preterm births, low birth weight, and maternal mortality, thereby posing a serious public health threat. Similarly, vitamin A deficiency, which can lead to impaired vision and increase the risk of severe infections, particularly affects children and can result in blindness if left untreated.

The geographic and demographic distribution of malnutrition and micronutrient deficiencies is not uniform across Nepal. Certain regions and communities are more affected due to a combination of poverty, limited access to healthcare and nutritious food, and lack of awareness. The Terai region and remote mountainous areas, for example, are among the most affected. In these regions, food insecurity is exacerbated by poor infrastructure and frequent natural disasters, which disrupt food production and access to markets. Within these areas, children under five years of age, pregnant women, and lactating mothers are the most vulnerable groups. Malnutrition in these populations can lead to stunted growth, developmental delays, and increased susceptibility to infections.

The socio-cultural practices in Nepal also contribute to the persistence of micronutrient deficiencies. Traditional diets in many parts of the country are primarily plant-based, with limited

consumption of animal products that are rich in essential nutrients like iron and vitamin A. Moreover, taboos and food restrictions during pregnancy and lactation can further exacerbate nutritional deficits. For example, the avoidance of certain nutrient-rich foods during pregnancy due to cultural beliefs can lead to inadequate intake of essential vitamins and minerals, affecting both the mother and the developing fetus.

Efforts to address these challenges have been spearheaded by various stakeholders, including the Nepalese government, UNICEF, and other international organizations. The Nepal Health Ministry, in collaboration with partners, has implemented several programs aimed at improving nutrition, such as the distribution of micronutrient supplements (e.g., iron-folic acid tablets for pregnant women), fortification of staple foods, and promotion of dietary diversification. Additionally, public health campaigns focused on educating communities about the importance of proper nutrition and breastfeeding practices have been rolled out, particularly targeting mothers and caregivers.

Despite these interventions, challenges remain, including ensuring the sustainability and coverage of these programs, especially in hard-to-reach areas. The COVID-19 pandemic has also disrupted nutritional services, further exacerbating the issue. Moving forward, a multi-sectoral approach that involves health, agriculture, education, and social protection sectors will be critical in addressing the underlying causes of malnutrition and micronutrient deficiencies in Nepal. Continued research and surveillance are also essential to monitor the impact of ongoing interventions and to adapt strategies as needed to ensure that all populations, particularly the most vulnerable, have access to the nutrition they need for healthy development.

Micronutrient deficiencies and malnutrition can lead to a vast array of severe health complications, some of which are life-threatening, while others have long-term consequences that affect physical, cognitive, and social development. The human body requires a variety of vitamins and minerals to function properly, and when these are lacking, a cascade of health issues can arise. Below is a detailed exploration of the potential health consequences of malnutrition and specific micronutrient deficiencies:

1. Iron Deficiency

Iron deficiency is one of the most common nutrient deficiencies worldwide and can lead to several severe conditions:

- **Anemia:** This is the most well-known consequence of iron deficiency, characterized by reduced hemoglobin levels in the blood. Symptoms include fatigue, weakness, shortness of breath, and pale skin. Severe anemia can lead to heart complications such as an enlarged heart or heart failure because the heart has to work harder to pump oxygenated blood through the body.
- **Increased Susceptibility to Infections:** Iron plays a crucial role in immune function. A deficiency can impair the body's ability to fight infections, making individuals more prone to illnesses, which in turn can exacerbate nutritional deficits due to decreased appetite and nutrient absorption.
- **Impaired Cognitive Development:** In children, iron deficiency can lead to cognitive and developmental delays. It is associated with poor attention span, difficulty in learning, and behavioral issues. These deficits can have long-lasting effects, leading to lower educational attainment and reduced economic opportunities later in life.
- **Complications During Pregnancy:** Pregnant women with iron deficiency are at higher risk for preterm delivery, low birth weight, and perinatal mortality. Severe anemia during pregnancy can also lead to maternal death during childbirth.

2. Vitamin A Deficiency

Vitamin A is critical for vision, immune function, and cell growth. Deficiency in this vitamin can result in:

- Night Blindness: One of the earliest signs of vitamin A deficiency is difficulty seeing in low light conditions, known as night blindness. Without intervention, this can progress to more severe eye disorders.
- Xerophthalmia: This condition includes a spectrum of eye disorders starting with dryness of the conjunctiva and cornea and progressing to keratomalacia, where the cornea becomes soft and may lead to complete blindness if untreated.
- Increased Mortality: Vitamin A is essential for immune function. A deficiency can increase the risk of death from infections like measles and diarrhea, particularly in children. It also exacerbates the severity of these diseases.
- Skin and Mucosal Disorders: Vitamin A deficiency can lead to hyperkeratosis, a condition where the skin becomes dry, thick, and scaly. The mucous membranes, which line the respiratory, digestive, and urinary tracts, may also become dry, increasing susceptibility to infections.

3. Iodine Deficiency

Iodine is crucial for the production of thyroid hormones, which regulate metabolism and are vital for growth and development. Deficiency can lead to:

- Goiter: An enlarged thyroid gland, or goiter, is the most visible sign of iodine deficiency. While often painless, goiter can cause difficulty in swallowing or breathing if it becomes large enough.
- Hypothyroidism: Low thyroid hormone levels can result in symptoms such as fatigue, weight gain, cold intolerance, constipation, and depression. In severe cases, it can lead to myxedema coma, a life-threatening condition.
- Cretinism: In developing fetuses and young children, severe iodine deficiency can cause cretinism, characterized by stunted physical and mental growth. Affected individuals may suffer from profound intellectual disabilities, speech difficulties, and deafness.
- Developmental Delays: Even moderate iodine deficiency during pregnancy and early childhood can result in lower IQ levels and impaired cognitive function.

4. Zinc Deficiency

Zinc is essential for immune function, wound healing, DNA synthesis, and cell division. A deficiency can result in:

- Growth Retardation: Zinc is critical for growth and development. Deficiency in children can lead to stunted growth, delayed sexual maturation, and increased risk of infections.
- Impaired Immune Function: Zinc is crucial for maintaining a healthy immune system. Its deficiency can result in frequent infections, slow wound healing, and prolonged recovery from illnesses. It also increases the risk of severe outcomes from common infections like diarrhea and pneumonia.
- Skin Disorders: Zinc deficiency can cause a condition called acrodermatitis enteropathica, characterized by dermatitis, alopecia (hair loss), and diarrhea. The skin lesions are often crusty and scaly, appearing around the mouth, anus, and extremities.
- Reproductive Health Issues: Zinc is necessary for reproductive health, and deficiency can lead to infertility in both men and women. In men, it affects sperm production and motility, while in women, it can lead to irregular menstrual cycles.

5. Vitamin D Deficiency

Vitamin D is vital for bone health, as it aids in the absorption of calcium. Deficiency can lead to:

- Rickets: In children, vitamin D deficiency causes rickets, a condition where bones become soft and weak, leading to skeletal deformities such as bowed legs, thickened wrists and ankles, and in severe cases, a deformed pelvis.
- Osteomalacia: In adults, vitamin D deficiency leads to osteomalacia, characterized by weak bones, muscle weakness, bone pain, and an increased risk of fractures.
- Osteoporosis: Long-term vitamin D deficiency contributes to osteoporosis, a condition where bones become porous and brittle, significantly increasing the risk of fractures, particularly in the elderly.

- Increased Risk of Chronic Diseases: Emerging evidence suggests that vitamin D deficiency may be associated with an increased risk of chronic diseases such as cardiovascular disease, certain cancers, and autoimmune conditions like multiple sclerosis.

6. Calcium Deficiency

Calcium is crucial for bone health, muscle function, and nerve transmission. A deficiency can result in:

- Hypocalcemia: This condition, characterized by low levels of calcium in the blood, can cause muscle cramps, spasms, and tingling in the fingers and toes. Severe hypocalcemia can lead to seizures, arrhythmias, and even life-threatening cardiac arrest.
- Osteopenia and Osteoporosis: Chronic calcium deficiency leads to the thinning of bones, known as osteopenia, which can progress to osteoporosis, increasing the risk of fractures.
- Dental Problems: Calcium is also vital for maintaining strong teeth. Deficiency can lead to dental issues such as weak tooth enamel, increased cavities, and periodontal disease.

7. Folate (Vitamin B9) Deficiency

Folate is essential for DNA synthesis and repair, and it is particularly important during periods of rapid growth such as pregnancy and infancy. Deficiency can lead to:

- Megaloblastic Anemia: This form of anemia results from the production of abnormally large red blood cells that are inefficient at transporting oxygen. Symptoms include fatigue, weakness, pale skin, and shortness of breath.
- Neural Tube Defects: Folate is critical during early pregnancy for the proper development of the fetal nervous system. Deficiency can result in neural tube defects such as spina bifida and anencephaly, which can lead to severe disability or death.
- Cardiovascular Diseases: Folate deficiency can elevate levels of homocysteine, an amino acid linked to an increased risk of cardiovascular diseases, including heart attack and stroke.

8. Vitamin B12 Deficiency

Vitamin B12 is essential for nerve function, red blood cell production, and DNA synthesis. Deficiency can cause:

- Pernicious Anemia: This type of anemia results from the body's inability to absorb vitamin B12, leading to symptoms such as fatigue, weakness, pallor, and shortness of breath. In severe cases, it can cause neurological issues.
- Neurological Complications: Vitamin B12 deficiency can lead to nerve damage, resulting in symptoms such as numbness and tingling in the hands and feet, difficulty walking, memory loss, mood changes, and in severe cases, irreversible neurological damage.
- Megaloblastic Anemia: Similar to folate deficiency, a lack of vitamin B12 can cause the production of abnormally large and dysfunctional red blood cells.

9. Protein-Energy Malnutrition (PEM)

PEM is a severe form of malnutrition caused by a lack of protein and calories. It manifests in two primary forms:

- Marasmus: This is a severe wasting condition where individuals appear emaciated due to extreme loss of fat and muscle mass. It primarily affects children under the age of five and can lead to stunted growth, weakened immune function, and an increased risk of infections. If untreated, marasmus can result in death.
- Kwashiorkor: This condition is characterized by edema (swelling, particularly in the belly), an enlarged liver, and skin and hair changes. Kwashiorkor is also associated with a weakened immune system, leading to high susceptibility to infections. The mental development of affected children may be severely impaired, and if untreated, it can be fatal.

10. Selenium Deficiency

Selenium is a trace element that is crucial for antioxidant defense and thyroid function. Deficiency can lead to:

- Keshan Disease: This is a cardiomyopathy (heart muscle disease) associated with selenium deficiency, leading to heart failure and sudden cardiac arrest, particularly in children.
- Kashin-Beck Disease: A form of osteoarthropathy (joint disease) that causes joint pain, stiffness, and deformities, primarily affecting the growth plates in children, leading to stunted growth and permanent physical disabilities.

11. Vitamin C Deficiency

Vitamin C is essential for collagen synthesis, wound healing, and immune function. Deficiency can lead to:

- Scurvy: Characterized by bleeding gums, bruising, joint pain,

The causes of malnutrition in Nepal are deeply interwoven with the country's socio-economic, environmental, and cultural landscape. The primary drivers of malnutrition include food insecurity, poverty, poor maternal and child health practices, limited access to healthcare, and insufficient sanitation and hygiene.

Food insecurity remains a critical issue, particularly in remote and rural areas where agricultural productivity is often low and subject to the impacts of natural disasters like floods, landslides, and droughts. The reliance on subsistence farming, coupled with poor infrastructure and limited access to markets, means that many households are unable to secure a diverse and nutrient-rich diet. Additionally, poverty exacerbates malnutrition by restricting access to nutritious food, healthcare services, and education about proper dietary practices.

Cultural practices also play a significant role in perpetuating malnutrition. Traditional beliefs and dietary taboos can lead to poor feeding practices, particularly among pregnant women and young children. For instance, the restriction of nutrient-dense foods like eggs and meat during pregnancy due to cultural beliefs can result in inadequate intake of essential nutrients, leading to deficiencies that affect both mother and child.

Most Affected Populations:

1. Children Under Five:

- Stunting: As of the NDHS 2022, about 31.6% of children under five are stunted, indicating chronic malnutrition. This represents a significant decrease from 36% in 2016, but it still shows that nearly one-third of young children suffer from long-term nutritional deficits.
- Wasting: Approximately 11.2% of children under five are wasted, meaning they are too thin for their height, a sign of acute malnutrition.
- Underweight: Around 24.3% of children under five are underweight, a composite indicator of both stunting and wasting.
- Anemia: The NDHS 2022 reports that 52.3% of children aged 6–59 months are anemic, with anemia being more prevalent in rural areas compared to urban regions.

2. Pregnant Women:

- Anemia: According to the NDHS 2022, about 36.7% of pregnant women in Nepal are anemic. Anemia during pregnancy can lead to complications such as low birth weight, preterm birth, and increased maternal mortality.
- Micronutrient Deficiencies: Pregnant women are particularly vulnerable to deficiencies in iron, iodine, and vitamin A, which are crucial for the health of both the mother and the developing fetus.

3. Lactating Mothers:

- Micronutrient Deficiencies: Lactating mothers require additional nutrients to support both their own health and that of their breastfeeding infants. However, many suffer from deficiencies, particularly in iron and vitamin A, which can affect breast milk quality and quantity.

Most Affected Regions:

1. Terai Region:

- The Terai plains, particularly in the southern belt of Nepal, have some of the highest rates of malnutrition. The NDHS 2022 highlights that stunting is more prevalent in the Terai region, with rates ranging from 35% to 40% in some districts.
- Saptari and Siraha districts in the eastern Terai are particularly affected, with stunting rates of around 38% and 39%, respectively.

2. Hill and Mountain Regions:

- Remote and rural areas in the Hill and Mountain regions, such as Dolpa, Jumla, and Mugu, are also severely affected by malnutrition. These areas suffer from food insecurity due to poor agricultural productivity, difficult terrain, and limited market access.
- Stunting rates in these regions can be as high as 42%, particularly in the Mountain districts of the Mid-Western and Far-Western regions.

3. Urban vs. Rural Disparities:

- While urban areas generally have better nutritional outcomes, there are still significant pockets of malnutrition. For instance, Kathmandu Valley has a lower stunting rate of around 19%, but urban poor populations, particularly those living in slums, are still highly vulnerable.
- Rural areas, on the other hand, have much higher rates of stunting (over 35% in many regions) and anemia (over 55% in children).

The health impacts of malnutrition in Nepal are severe and far-reaching. Stunting, which affects nearly one-third of children under five, is a key indicator of chronic malnutrition and reflects the long-term consequences of inadequate nutrition during the early stages of life. Stunted children are shorter than their peers, but more critically, they often suffer from impaired cognitive development, which can limit educational attainment and future economic productivity. Anemia, particularly iron-deficiency anemia, is prevalent among women and children and leads to fatigue, weakened immunity, and, in severe cases, increased maternal and child mortality. Developmental issues associated with malnutrition include not only physical growth delays but also cognitive and behavioral impairments, which can have lifelong implications.

The broader social and economic outcomes of malnutrition in Nepal are profound. Malnourished children are more likely to struggle in school, leading to lower educational attainment and reduced economic opportunities in adulthood. This perpetuates the cycle of poverty, as low educational levels and poor health outcomes hinder economic productivity and growth at both the individual and national levels. Furthermore, the economic burden of malnutrition is significant, as it increases healthcare costs and reduces the overall productivity of the workforce. The intergenerational transmission of malnutrition—where malnourished mothers are more likely to give birth to underweight and malnourished babies—further entrenches poverty and inequality in Nepalese society.

In response to this critical issue, Nepal has implemented various intervention strategies aimed at combating malnutrition, with mixed results. One of the key strategies has been the distribution of micronutrient supplements, such as iron-folic acid tablets for pregnant women and vitamin A supplements for children. These programs have had some success in reducing specific micronutrient deficiencies, particularly in more accessible areas. However, challenges remain in ensuring consistent coverage and adherence, especially in remote regions.

The government has also promoted the fortification of staple foods with essential nutrients, such as the iodization of salt and the fortification of wheat flour with iron and folic acid. While these initiatives have helped to reduce the prevalence of certain deficiencies, their effectiveness is limited by the reach of fortified products, particularly in rural areas where access to markets is constrained.

Community-based nutrition programs have been another critical intervention, focusing on improving maternal and child feeding practices through education and support at the community level. These programs have shown promise in improving breastfeeding rates and complementary feeding practices, but their impact is often limited by cultural resistance and the pervasive influence of traditional beliefs.

Social protection programs such as cash transfers and food assistance have also been employed to alleviate the economic pressures that contribute to malnutrition. These interventions can provide

immediate relief to vulnerable households, but their long-term effectiveness depends on their ability to address the underlying causes of food insecurity and poverty.

Overall, while these intervention strategies have made some progress in addressing malnutrition in Nepal, significant challenges remain. The effectiveness of these programs is often hindered by issues of coverage, sustainability, and cultural acceptance. Moving forward, a more integrated and multi-sectoral approach is needed—one that combines nutrition-specific interventions with broader efforts to improve food security, healthcare access, and economic opportunities, particularly for the most vulnerable populations. Additionally, continuous monitoring and evaluation of these programs are essential to ensure they are adapted to the changing needs and contexts within Nepal.

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