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Malnutrition in Children of Growing Age and the Associated Health Concerns

AUTHORS DETAIL

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INTRODUCTION

Malnutrition is characterized as the insufficient or exclusive consumption of a dietary nutrient by children in particular. Adolescence under-nutrition (wasting, hindering, and underweight), micronutrient deficiencies, as well as overweight and stoutness, constitute a triple weight of illness, especially for low- and middle-income countries, and it is one of the main causes of chronic insecurity and a significant barrier to self-awareness and the achievement of full human potential globally (Kalu and Etim 2018). The malnutrition of children (under-nutrition) and the prevalence of non-communicable diseases (NCDs) in adults are major public health issues in the world today. Despite convincing evidence connecting prenatal malnutrition with NCDs, little is known about long-term health outcomes (Grey et al. 2021). From 10–11 million children under the age of five, over 50% dies each year from preventable causes as a result of malnutrition, which is a significant public health issue in the developing world (Collins et al. 2006). Children's deaths are primarily caused by malnutrition worldwide. Community-based interventions for malnutrition require the use of universally validated screening tools and the implementation of appropriate interventions depending on the severity of malnutrition (Khan et al. 2016). Malnutrition is more prevalent in rural areas in India because of inadequate diets, recurrent infections, lack of proper care, and unequal distribution of food within the family. A child's rapid growth and development require optimal nutrition during his or her infancy and early childhood. Deficiencies in nutrients lead to lower immune defenses against diseases and recurrent infections result in nutrient deficiencies. This adversely affects the mental and physical development of children as well as their learning capacity in the future (De and Chattopadhyay 2019).

Epidemiology of Childhood Malnutrition

Of all the developing nations, Pakistan has one of the highest rates of child malnutrition. Around 165 million children under the age of five are malnourished worldwide. At least half of all child fatalities are caused by malnutrition. Developing and underdeveloped nations are typically the only places where this issue is prevalent causing high morbidity and mortality in children's. The cause of about half of all child deaths worldwide is under-nutrition. According to the National Nutrition Survey, 50% of children were anemic, 33% of children were underweight, approximately 44% were stunted and 15% were wasted (iron deficiency). Comparing Pakistan to other emerging nations, there has been a slight decline in the prevalence of child malnutrition during the past two decades (Asim and Nawaz 2018). Children who are malnourished suffer from a host of factors including poverty, poor sanitation, crowding, infectious diseases, depression, and abuse (Awoyemi et al. 2012). Many nations in the era of the Millennium Development Goals succeeded in reducing the rate of childhood under nourish, but there was uneven improvement. The majority of Asian countries saw dramatic reductions, but progress in Africa was less encouraging, and the overall number of stunted children increased as a result of population expansion. Globally, this improvement hit a wall about 2014 and is currently regressing, as noted in the latest study by the State of Food Security and Nutrition in the World 2019. Around 51 million children under the age of 5 were wasted (too light for their height) and 151 million were stunted in the world in 2017, with poor nutrition being the primary proximal cause. However, it was stated that 38 million people were fat (Mwangome and Prentice 2019).

Prevalence

Globally and particularly in Nigeria malnutrition is measured by three anthropometric factors for stunting, wasting, and underweight and it is a serious health issue for newborns, toddlers, and preschool-aged children. Nigeria is one of the top 10 nations for children under five that are malnourished. The frequency of stunting, wasting, underweight, and obesity in children is 37%, 7%, 22%, and 2%, respectively, in Nigeria (Folayan et al. 2020).

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The number of stunted and wasted children in the world is around 155 million, indicating a high incidence of malnutrition. According to estimates, under-nutrition accounts for 45% of all fatalities in children under the age of five around the world. The frequency of underweight children worldwide was reported to have decreased from 25% in 1990 to 15% in 2015 around the end of the millennium development goals (MDGs) era. Because 90% of the underweight infants were discovered in Africa, notably in the Sub-Saharan region, this drop was regretfully not uniformly distributed. Between 1990 and 2013, the proportion of stunted children in Sub-Saharan Africa actually grew to over one-third (Adebisi et al. 2019). The Democratic Republic of the Congo (DRC) is one of five nations in the world with a high mortality rate for children under five (India, China Nigeria and Pakistan) and malnutrition is one of the main causes of death in these nations, along with other illness like diarrhea, pneumonia, and malaria, which are more prevalent in young children (Mukuku et al. 2019).

Types of Malnutrition

According to World Health Organization (WHO), malnutrition divided into three groups including; micronutrient related malnutrition, over-nutrition and under-nutrition (Khaliq et al. 2022). Under-weight, stunting and wasting are three types of under-nutrition. Obesity is mainly related to the over-nutrition. Micronutrient are further classified as micronutrient related malnutrition (MRM) deficiency and MRM overload (Khaliq et al. 2021; Khaliq et al. 2022).

A- Under-nutrition

Under-nutrition has intense effect on growth, development and survival of children. Globally 200 million children under five face stunting and wasting (Keeley et al. 2019). Under-nutrition is defined as the weakening, stunting, or micronutrient deficiencies (such as anemia, zinc, and vitamin A). Stunting and wasting both point to distinct nutritional deficit issues. Wasting (low weight for height) is a kind of acute malnutrition characterized by inadequate dietary intake to satisfy protein and energy requirements. Infectious disease makes wastage more prevalent in underdeveloped nations with long-term or short-term food insecurity (Abdullah 2015). Stunting, wasting, and underweight were all prevalent at varying degrees (10.4%, 5.3%, and 18.4%) (Boah et al. 2019).

i- Under-weight

Underweight is described as population of children whose weight is less as per their age (Asim and Nawaz 2018). Particularly in underdeveloped nations, underweight is a substantial risk factor for infection in children and teens, perhaps due to hunger and less hygiene standards. Not only underdeveloped but also in Western nations underweight children are more susceptible to illness. Underweight children were more likely to be admitted to emergency rooms in the USA than normal-weight, overweight, or obese children, according to an observational chart assessment of the data.

ii- Stunting

Stunting is described as population of children who are too short for their height (Keeley et al. 2019). Stunting in childhood increased the risk of infectious diseases, poor cognitive development, mortality rate, poor productivity and non- communicable diseases in adulthood (Kang and Kim 2019). 149 million children are globally stunted and 1 in 3 children is stunted in Asia and Sub-Saharan Africa. The cause of stunting start from the nutritional status of mother. Mothers who are stunted in childhood are at high chance to having stunted child (Keeley et al. 2019).

iii- Wasting

Wasting is defined as a child who is too thin for his or her height (Keeley et al. 2019). Wasting is due to improper dietary intake and disease. Wasted children have increased risk of death therefore they require urgent nutritional or medical help. Wasting in growing age cause delayed physical development and weakened immunity (Donkor et al. 2022). Globally 49.5 million children are wasted and in South Asia 1 in 7 children under five is wasted (Keeley et al. 2019).

B- Over-nutrition

Over-nutrition leads to over-weight and obesity in children that affect both early and later life of children (Keeley et al. 2019). Obesity is a global challenge, and the prevalence of obesity and over-weight is increasing in low and middle income countries as compared to high income countries (Adeomi et al. 2022). Globally 40.1 million children are over-weight, and in Eastern Europe and Central Asia 1 in 7 children under five is over-weight (Keeley et al. 2019). In over-weight children, the health outcomes are inferior then adults. It increase the risk of non-communicable diseases such as insulin resistance and heart diseases in early life, and 41 percent of cancer chances increased in obese children (Pant and Vaidya 2018).

C- Micronutrient Related Malnutrition

Humans who are deficient in vital vitamins and minerals, commonly referred as micronutrients, are said to have "hidden hunger." Nearly one-third of the world's population, or two billion people, suffer from micronutrient deficiencies

(Harding et al. 2018). When extended, insufficient dietary intake of macronutrients (fat, protein, and carbs) and micronutrients (vitamins and minerals) can have negative consequences on health outcomes and possibly start a cycle of poor health (Eggersdorfer et al. 2018). Globally, hidden hunger affects a sizable population and has a variety of negative consequences, such as poor health, stunted growth, low productivity, mental impairment, and untimely death (Ekholuenetale et al. 2020). Iodine deficiency (ID), the world's leading contributor to children's preventable brain damage and mental retardation, needs top priority among micronutrient deficiencies (Asfaw and Belachew 2020).

Causes of Malnutrition

There is multiple causes of malnutrition in growing age including; diseases, nutritional status, inadequate dietary intake, inadequate child care, household food insecurity and insufficient health services. These all causes belong to the potential sources like economic and organization sources (Mkhize and Sibanda 2020).

Factors Related to Malnutrition in Growing Age

Malnutrition is a major problem of under-developed and developing countries. Inadequate diet cause malnutrition in growing age like undernutrition, fatigue, multivitamins deficiency and feeling of weakness that all impact on child growth (Shahid et al. 2021). There are many factors responsible for malnutrition and the basic factors are.

i- Inadequate Diet

The issue of inadequate diet usually occurs in growing children (Achakzai and Khan 2016; Shahid et al. 2021). Maternal factor like BMI of mother is also a risk factor for child malnutrition (Khan et al. 2019). Inadequate feeding habits are a major cause of the emergence of malnutrition in young infants (Eshete et al. 2018). The increased nutritional requirements of pregnancy and fetal growth place women of reproductive age who live in under-resourced environments in low- and middle-income nations at an especially high risk of receiving insufficient nutrients, especially of important micronutrients (Lander et al. 2019).

ii- Food Insecurity

Food insecurity is also a principal factor of child malnutrition in South Africa. Food insecurity effect the child nutrition because of the consumption of less or improper diet. Consumption of unhealthy and less diet also have adverse effect on child nutrition (Ntila et al. 2017; Mkhize and Sibanda 2020).

iii- Low Household Income

Low household income effects the nutritional status of children which lead to malnutrition. According to national survey in south Africa, there are estimated 2.5 billion children, under age of five year are belong to poor families or low income household (Mkhize and Sibanda 2020). Having low income possess some families to live in the house with poor substructure and unhygienic conditions which lead to different infections that effect people especially children (Guevara-Romero et al. 2021).

iv- Family Size

The increase number of family size effect the income and education of children and the lack of sanitary condition like drinking water and sewerage affect the health. Health problems are directly proportional to the malnutrition of children at growing age which causes retarded growth, negative effect on body size and growth and also effect the mental health (Cedeño et al. 2022; Calceto-Garavito et al. 2019).

v- Environmental Factor

Unimproved water, poor sanitation, and biomass fuel are the second most significant worldwide attributable burdens as causes of child stunting. A study of 137 developing nations found that unimproved sanitation was responsible for an estimated 7.2 million instances of stunting (Amare et al. 2019).

vi- Educational Status

Parental education is a significant predictor of children's nutritional status. The higher parental educational status is connected with better child parenting and wellness. Children with tertiary-educated parents are more likely to have a nutritious diet, regardless of economic level, due to their greater level of understanding on fundamental child nutrition. Parents with higher educational attainment may encourage values that are harmful to their children's health (Kalu and Etim 2018).

How Maternal Malnutrition Affect Children

The mother is a kid or infant's primary caregiver. An infant's health and wellbeing are somewhat reliant on the mother's health and wellbeing (Amaha and Woldeamanuel 2021). It has been demonstrated that infant and mother health are related to a child's birth weight, which indicates that these factors may determine maternal and infant mortality before, during and after birth (Mishu et al. 2020; Ipadeola et al. 2013). Malnutrition, which includes low birth weight, underweight, wasting, stunting, and a lack of micronutrients, affects millions of children and women worldwide (Roy

2018). More than 20% of women are undernourished in various South Asian and sub-Saharan African nations (BMI 18.5). More than 10% of women are under 145 cm in height in various South-Central Asian nations. However, anemia affects 30% of reproductive-age women globally (Ravaoarisoa et al. 2018). Women who are pregnant or breastfeeding are at danger and the newborn babies will be more susceptible to diseases in later life. In infancy and adulthood, behavioural and cognitive impairment caused by maternal and newborn malnutrition has been linked to increased susceptibility to neuropsychiatric illnesses (Sinha et al. 2018). The effects of infectious diseases on maternal, fetus, neonatal, and child health are more significant and maternal malnutrition aggravate this effect (Blakstad and Smith 2020).

Diagnosis of Malnutrition in Children

The human body may be measured quantitatively without any physical contact. The Centers for Disease Control and Prevention (CDC) claim that anthropometry is a useful tool for determining both children's and adults' nutritional health (Casadei and Kiel 2019). An individual's nutritional status is now considered to be highly affected by anthropometric measures. Adverse changes in the body composition result from malnutrition, either under-nutrition or over-nutrition. Malnutrition can lead to increased morbidity or death if the body's energy reserves are severely depleted. Changes in the status of nutrition may be easily assessed using the simple and efficient approach of anthropometry. Additionally, it offers a way to assess if nutritional treatment is being utilized appropriately (Suriah et al. 1998). The fundamental measurements of anthropometry include height, weight, head circumference, body mass index (BMI), waist, hip, and thigh circumferences to measure adiposity, and skinfold thickness (Casadei and Kiel 2019).

Body Mass Index (BMI)

WHO claims that BMI is a basic measure of weight in relation to height that is often used to diagnose humans as being underweight, overweight, or obese. Its formula is kg/m^2, or weight in kilograms divided by height in meters squared (Naeem et al. 2021).

Associated Health Risks in Malnutrition

Malnutrition at any stage of childhood affects schooling and thus a child's lifetime earning potential. It impacts educational outcomes, including reduced learning capacity (either as a result of early cognitive deficits or reduced attention span) and reduced overall years of schooling. A triple burden of disease is caused by all types of childhood malnutrition, including under-nutrition (wasting, stunting, and underweight), micronutrient deficiencies, as well as overweight and obesity. Childhood malnutrition may have long-term, irreversible impacts, such as stunted physical growth and delayed cognitive development. Additionally, inadequate nutrition might impair sensory-motor development, reproductive health, and children's susceptibility to infections and hereditary illnesses like diabetes. In addition, under-nutrition increases health care expenses, lowers adult productivity, and stunts economic growth, which can lead to a protracted cycle of illness and poverty. Most cases of childhood under-nutrition occur in low- and middle-income countries, primarily as a result of poverty, which is linked to poor feeding practices, unsanitary living circumstances, and a lack of access to health care (Vassilakou 2021). The summarized health risk of malnutrition in growing children is enlisted Table 1.

Protein Energy Malnutrition (PEM)

Protein-energy malnutrition (PEM) is a common childhood disorder and it is commonly caused by deficiency of micronutrients protein and energy. PEM manifests as underweight (low body weight compared with healthy children), stunting (poor body growth), wasting (acute weight loss), or edematous malnutrition (kwashiorkor) (Ahmed et al. 2020). PEM has been named by the WHO as one of the main issues affecting children worldwide. Additionally, it has been discovered over time that PEM in children, particularly at the most critical stage of their development, is a problem in developing nations like India. Additionally, this is a problem that primarily affects rural populations and the poor and is brought on by problems with poverty, poor environmental sanitation, poor dietary practices, low socioeconomic status, maternal education, frequent infection, inadequate household food security, high rice consumption, frequent acute illness, and low birth weight of children (Satapathy et al. 2021).

Primary Acute Malnutrition

Primary acute malnutrition affects children and is particularly prevalent in low- and middle-income countries. It results from insufficient food availability brought on by socioeconomic, political, and environmental causes. The contributing causes of primary acute malnutrition include household food insecurity, poverty, inadequate prenatal nutrition, intrauterine growth restriction, low birth weight, inadequate breastfeeding, frequent infectious diseases, poor water quality and poor hygiene (Dipasquale et al. 2020).

Secondary Acute Malnutrition (SAM)

According to the United Nations Children's Fund, World Health Organization, and World Bank Group,2017, approximately 17 million children are suffering from severe acute malnutrition (SAM) worldwide, which is indicated by

Table 1: Health risks of malnutrition in growing children

Health risk	Causes	Effects	References
Protein energy malnutrition	Deficiency of micronutrients protein and energy	Stunting Wasting	(Ahmed et al. 2020; Satapathy et al. 2021)
Primary acute malnutrition	Insufficient food availability Poverty	Low birth weight Infectious diseases	(Dipasquale et al. 2020)
Kwashiorkor	Extreme protein deficiency	Swelling in both extremities	(Benjamin and Lappin 2021)
Marasmus	Insufficient energy intake	Children feels weak and lethargic Hypotension, and hypothermia bradycardia	(Pham et al. 2021; Dipasquale et al. 2020)
Iron deficiency anemia	Iron deficiency	Maternal anemia is linked to low birth weight, higher perinatal mortality	(Cusick et al. 2018; Bhadra and Deb 2020; Mantadakis et al. 2020)
Scurvy Rickets Pellagra Beriberi	Vitamin deficiencies	Periodontitis Enamel, hypoplasia Defective tooth development Oral epithelial development Osteomalacia	(Antonucci et al. 2018; Gossweiler and Martinez-Mier 2020)
Obesity	Excess energy	Hypertension Type -2 diabetes	(Oriaifo et al. 2019; Seneviratne and Rajindrajith 2022)
Congenital heart disease	Low energy intake Protein losing	Vomiting and, have trouble eating Vocal cord dysfunction Chylothorax	(Larson-Nath and Goday 2019; Herridge et al. 2021; Shahid et al. 2021)

a mid-upper arm circumference (MUAC) less than 115 mm or a weight-for-height z-score (WHZ) less than 3 SD (Stobaugh et al. 2019). A set of recommendations for treating severe malnutrition in children were released by the World Health Organization (WHO) in 1999. Mortality dropped from 30% to 5% in nutritional centers all over the world after the application of this approach. An urgent issue around the world is providing adequate care for sick and malnourished children (Bernal et al. 2008).

Kwashiorkor

It is a condition characterized by extreme protein deficiency and swelling in both extremities. Infants and toddlers are typically affected, most frequently between the ages of weaning at 5.This is a severe form of protein-energy malnutrition characterized by a lack of protein and edema in both extremities. Extremely severe cases of malnutrition and areas of extreme poverty around the world are affected by the disease (Benjamin and Lappin 2021). Edema in kwashiorkor resolves with dietary therapy before the plasma albumin concentration increases.It has also been proposed that hypoalbuminaemia is not included in the etiology of the condition (Coulthard 2015).

Marasmus

The word "marasmus" is a Greek word meaning to waste or wilted. The most typical sign of acute malnutrition is marasmus. Marasmus, also known as phthisis, dystrophy, and cachexia, has been reported for the longest as the usual type of severe malnutrition (Pham et al. 2021). It results from insufficient energy intake over several months to years. It is characterized by wasting of body tissues, especially muscles and subcutaneous fat, and typically results from extreme limits in calorie intake. It is the body's physiological adaptive reaction to hunger in response to severe loss of energy and all nutrients. The children feels weak and lethargic, and have associated, hypotension, and hypothermia bradycardia (Dipasquale et al. 2020).

Children at Risk of Iron Deficiency Anemia

Children are at risk for iron deficiency at three different ages: late prenatal and neonatal, 6 to 24 months, and adolescence. The first 1000 days, sometimes referred to as early-life iron deficiency, are when the brain grows and develops quickly, and they can have a detrimental effect on neurodevelopment. Around two billion individuals worldwide suffer from iron deficiency and iron-deficiency anemia (IDA), with the majority living in low- and middle-income nations. Malaria and parasite infections, other dietary deficiencies, chronic illnesses, hemoglobinopathies and lead poisoning are additional causes of anemia in these countries (Mantadakis et al. 2020).

Maternal iron deficiency anemia, preterm birth, and prenatal problems including intrauterine growth restriction, gestational diabetes mellitus, maternal smoking, maternal obesity, and inflammation are the most common causes of iron deficiency in the fetal and newborn period. The most frequent causes of iron deficiency in people are eating a diet low in iron and/or containing iron binders, persistent gastrointestinal blood loss brought on by an aversion to cow's milk or a hookworm infection, and anemia (Cusick et al. 2018). Maternal anemia is linked to low birth weight, higher perinatal mortality, and lower labor productivity in countries with limited resources. In these conditions, it might be difficult to maintain a healthy iron balance because animal-based meals with high iron bioavailability tend to be expensive or hard to come by. Other significant risk factors

for IDA in low-income nations include poor vitamin C intake, diets high in iron absorption inhibitors, and infrequent meat eating. Using micronutrient powders to fortify complementary foods at home with iron has been shown to significantly lower the risk of iron deficiency anemia (IDA) in infants and young children in developing nations, but it is also linked to unfavorable changes in gut flora and the induction of intestinal inflammation, which can cause diarrhoea and hospitalization. Infants older than six months of age, adolescents with excessive menstrual bleeding, women of childbearing age, and elderly persons are more likely to have IDA (Mantadakis et al. 2020).

Lack of vitamin B12 (riboflavin) can cause anemia to develop. It has been demonstrated that riboflavin supplements given alongside iron supplements have a stronger impact on haemoglobin concentration than iron supplements alone. There have been cases of riboflavin deficiency in school children, newborns, pregnant women, and breastfeeding mothers. Vitamin C influences iron metabolism and improves non-heme iron absorption. Pregnant women, children who only consume cow's milk, the elderly and smokers are among the groups at risk for vitamin C insufficiency. Children and non-pregnant women who take vitamin C supplements had higher haemoglobin concentrations and serum ferritin levels (Bhadra and Deb 2020).

Vitamin Deficiencies in Children

Vitamins are necessary organic substances that speed up metabolic processes. Additionally, they serve as antioxidants, electron donors, or transcription effectors. They can be derived from food and supplements, or in rare situations, our bodies or gut bacteria can produce them on their own. Systemic effects from severe vitamin deficiency include the emergence of scurvy, rickets, pellagra, and beriberi. Oral problems can also be caused by some mild, moderate, and severe deficits. Vitamin A deficiency has been linked to periodontitis, enamel hypoplasia, defective tooth development, and oral epithelial development (Gossweiler and Martinez-Mier 2020).

It is well recognized that a vitamin D deficiency leads to osteomalacia in adults and rickets in youngsters. Nutritional rickets almost vanished from developed nations after vitamin D deficiency was identified and food supplements with vitamin D were introduced. However, over the past two decades, a number of circumstances have caused the disease to resurface, with non-Caucasian children accounting for an increasing number of cases. In wealthy nations, hypovitaminosis D in children is an emerging public health issue. The emergence of vitamin D insufficiency may be favoured by new lifestyle patterns, the current "epidemics" of obesity in children and adolescents around the world, and other preventable risk factors. Hypovitaminosis D has been linked to the development of major extra-skeletal health issues in children, such as atopy and autoimmune disorders, in addition to its effects on the skeleton (Antonucci et al. 2018).

Vitamin Deficiencies Linked to Childhood Obesity

The major issue occurring worldwide is childhood obesity. Overweight during infancy and adolescence is a well-known risk factor for adult obesity as well as the emergence of comorbidities. In relation to vitamin D (vit D), its role in immunological processes and lowering the risk of chronic illnesses have been taken into account in addition to its impact on bone health and calcium and phosphorus metabolism. A study with the general pediatric population of the United States of America, aged 1 to 11 years found that the prevalence of vitamin D deficiency varies by geographic region and is estimated to be 15%. In a cross-sectional survey of a representative sample of adolescents from America aged between 12 to 19, a prevalence of 14% was also discovered (Fiamenghi and Mello 2021).

Over-nutrition or Obesity in Children

The term "obesity" describes an individual who has an excessive buildup of body fat that is dangerous to their health. An imbalance between calorie consumption and expenditure is the primary driver of obesity, with excess energy being retained as fat in adipose tissue (Seneviratne and Rajindrajith 2022). Including young children, the obesity epidemic has affected every age group(Perng et al. 2019). In developing countries, a number of factors contribute to the rise of childhood obesity including reduced exercise, higher calorie consumption, high socioeconomic position, urbanization and living in large cities, socio cultural influences, age, female gender and school food programs (Arfines et al. 2020). Obesity is linked to problems that might develop in childhood and adolescence and last into adulthood. Hypertension is one of these problems, which increases the risk of long-term cardiovascular illnesses and early mortality. According to the studies in Nigeria among school-aged children, the obese children had a considerably greater proportion of children with blood pressure in the pre-hypertension and hypertension range (Oriaifo et al. 2019). One of the key factors contributing to a poor pregnancy outcome is maternal obesity or over-nutrition. Obesity during pregnancy has a severe impact on fetal and embryonic development, but it may also have long-term effects on the children's health (Sarker et al. 2019). The primary cause of type 2 diabetes is obesity (Seneviratne and Rajindrajith 2022). Maternal obesity during pregnancy and lactation affects offspring's neurodevelopment and raises the risk of behavioral and emotional issues like hyperactivity, autism spectrum disorder, anxiety, and cognitive impairment. This is supported by growing evidence from epigenetic, clinical, and preclinical studies (Hasebe et al. 2021).

Table 2: Preventive measures/interventions of malnutrition

Stages of life	Interventions for infants or young children	Intervention for mother	References
Mother during pregnancy	N/A	Healthy maternal diet promotion and assistance; provision of food or micronutrients in situations when there is a lack of access to food, Supplementing with iron and folate	(Bhutta et al. 2008)
Lactating mother and child (0-4 months)	Supplementing of food or micronutrients for infants under 24 months	Promoting the best breastfeeding and supplementary feeding methods	(Hawkes et al. 2020)
Children aged ≤ 5	Monitoring and promoting growth and acute malnutrition detection and care Hygienic measures such as hand washing		(Hawkes et al. 2020;Bhutta et al. 2008)

Congenital Heart Disease in Children

One of the most prevalent birth defects is congenital heart disease (CHD) which has a significant morbidity and death rate, particularly in young children who are chronically undernourished (Shahid et al. 2021). The congenital heart disease (CHD) is a dangerous condition affecting on the health of children. According to studies, congenital cardiac problems cause more newborn mortality than the sum of all other congenital abnormalities. Congenital heart disease patients typically have early de-compensation. Heart failure strikes 20% of these kids with in the first week of life, 18% within the first and fourth weeks, and 20% within the first year (Ismail et al. 2021). Children with congenital heart disease frequently experience vomiting, have trouble eating, and can even develop an oral aversion. Regular feed interruptions, vocal cord dysfunction, and chylothorax are postoperative risk factors for malnutrition in infants with congenital heart disease. Children with single ventricle illness also run the risk of developing a protein-losing enteropathy (Larson-Nath and Goday 2019). Congenital heart disease induced a severe impairment in the circulatory system's structure or activity, which consequently had an impact on the respiratory system's performance (Rahayuningsih et al. 2021). Delayed in weight gain, length, and head circumference are indicators of growth challenges faced by CHD children. Lower weight-for-age and weight-for-length are indicators of acute malnutrition. There is reduction in growth velocity, which significantly slows down weight achievement (Herridge et al. 2021).

Prevention of Malnutrition in Children

The timely growth and maturity of physiological, physical, neurocognitive, emotional, and social functions is a sign of good health in children. The design and function of organs and tissues as well as metabolic functions can be irreversibly altered by insufficient intake of energy and nutrients throughout development (Owino et al. 2019). Nutritional status in women during pregnancy and breastfeeding, as well as in newborns and young children throughout the early years of life, has a significant impact on malnutrition in all of its forms during the course of a person's life. Infants who get insufficient amounts of nutrients early in life not only suffer from under-nutrition, but are also more likely to have a more centrally located body fat distribution and they should go on to put on weight in the future and have adverse effects on child's health (Hawkes et al. 2020).

The fundamental preventive health measures used to combat undernourishment at various stages of life that are provided by medical institutions and networks of community-based health professionals are enlisted in Table 2.

These are some interventions in the health system to support and promote nutrition for pregnant women and young children during the first 1000 days (Hawkes et al. 2020) .Children's anemia, iron-deficiency anemia, and iron deficiency can all be improved with the use of micronutrient powders for point-of-use fortification of supplemental meals (Heidkamp et al. 2021). Exercise is advised not just to help with weight reduction and maintenance while treating obesity, but also to improve whole-body insulin sensitivity and both mothers' and children's metabolic profiles (Castro-Rodríguez et al. 2020). The six essential nutrients—carbohydrates, fats, proteins, vitamins, minerals, and water—must be included in the balanced diet in the right amounts and qualities (Ahmed et al. 2019).

Conclusion

Malnutrition is a significant issue in growing children which are contributing in malfunctioning of child growth and the associated health concerns like congenital heart disease, stunting, wasting and vitamin deficiencies. Malnutrition is usually assessed by anthropometric measurements. A child's rapid growth and development require optimal nutrition during his or her infancy and early childhood.

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