



INFECTIOUS DISEASES AND MALNUTRITION IN PRESCHOOL CHILDREN

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ABSTRACT:-

Quality and quantity of food determines physical, psychological, cognitive, social and economic growth of children. However, poor nutrition and infectious diseases largely instigate impaired growth and poor development of children. They constitute immediate cause of poor health of children. Infectious diseases and malnutrition are comorbidity among children. Infectious diseases undermine immunity of children which sequentially manifests as malnutrition in children. Furthermore, children who suffer from wasting and stunting in early period of life are extremely predisposed to recurring episodes of infectious disease.

KEYWORDS: Malnutrition, Infectious Disease, Communicable Disease, Poor Health

INTRODUCTION:

Good nutrition provides necessary energy and nutrients in formative period of childhood. Nutrition ensures proper growth of child body, balanced immune system, adequate cognitive development and

good academic performance (Young, 2012).

MALNUTRITION

Malnutrition is a clinical condition characterized by consumption of either surplus or deficient nutrients. Macronutrients provide calories to sustain physiological and metabolic functions of body. Micronutrients furnish essential vitamins and minerals to catalyzed biochemical reactions in body tissues (UNCF, 2010). Malnutrition stems from intake of poor quality and or inadequate quantity of nutrients. Prolonged intake of surplus nutrients results into imbalanced nutritional status and called as overnutrition. Obesity is a common form of malnutrition among children, especially in developed and industrialized countries. Overnutrition or obesity is the prime factor for pathogenesis of metabolic syndrome among younger generation throughout the world. Diabetes mellitus, hypertension, coronary artery disease are the non-communicable diseases which are closely associated with overnutrition (Young, 2012).

Conversely, dietary inadequacy during the growing period in children results into a form of malnutrition, called as Undernutrition. Good quality and sufficient quantity of macronutrients and micronutrients augment requisite calories and minerals necessary for proper growth and development of children (WHO, 2016). Undernutrition can originate owing to deficit intake of calories and or minerals and it is called as Protein-energy malnutrition. This clinical can manifest into two forms depending on type of nutrient deficiency in body. An insufficient intake of protein coupled with sufficient intake of calories is characterized by Kwashiorkor, whereas, inadequate intake of all nutrients is exhibited by marasmus (UNICEF, 2006). Other form of undernutrition is characterized by deficiency of minerals and or vitamins in body of children. Moreover, undernutrition is expressed as malnutrition in present paper. Depending upon severity, malnutrition manifests into three clinical conditions. Acute form of malnutrition is called as WASTING. Child has abnormally low weight for height. Chronic form of malnutrition is termed as STUNTING. Child has low

height for age. Another form is acute-chronic form of malnutrition, called as UNDERWEIGHT. Child is poorly low in weight for age.

Malnutrition can be measured in terms of Z-score. It is described in terms of weight for height, weight for age and height for age of children below -2 Z-score of the National Center for Health Statistics (WHO, 1995). It constitutes a major public health problem in developing world and serves as the most important risk factor for the burden of disease especially among preschool children.

According to a report by (UNICEF-WHO-The World Bank report, 2011) nearly 165 million children below age of five years were stunted worldwide. Additionally, a report by (UNICEF-WHO-The World Bank, 2011) described that approximately 101 million under five children were Underweight worldwide. Furthermore, a report by (UNICEF-WHO-The World Bank, 2011) stated the prevalence of nearly 52 million children below five were aggrieved by stunting worldwide.

In developing countries, according to an estimate by (Muller and Krawinkel, 2005), nearly 35.8% of preschool aged children are underweight, another 42.7% children are stunted and 9.2% children with wasting. Obesity is another growing health hazard among children below age of five years. It has been reported by (UNICEF-WHO-The World Bank, 2011) that around 43 million children below five were overweight.

There is a rising trend in obesity among children worldwide. A report by (UNICEF-WHO-The World Bank, 2011) showed an increase in prevalence of obesity from 28 million children in 1990 to 43 million children in 2011.

DISEASE

Disease is a state altered structure and/or malfunctioning of a part or whole body. Disease is characterized by its signs and symptoms. Balanced diet is insufficient to achieve good nutritional status in presence of disease. However, body should be free of any disease that might impair digestion, absorption or assimilation of food. In children below five year age group, diseases are associated with malnutrition.

INFECTIOUS DISEASES

Infectious disease is contagious and is the manifestation of invasion of pathogens like viruses, bacteria, parasites or fungi in body. Infectious diseases are communicable directly or indirectly from infected person to healthy person.

DIARRHOEA

Diarrhea is clinical condition characterized by passing of more than three loose, watery stools per day.

However, frequent passing of formed stools in adults and poorly formed loose stools in breastfed babies are excluded from the definition of diarrhea (WHO, 2013).

Based upon clinical manifestations, diarrhea can be grouped into three categories as:

- Acute watery diarrhea: It can continue for hours or days.
- Acute bloody diarrhea: It is characterized by blood stained stools and mucus
- Persistent diarrhea: It continues for 14 days or longer (WHO, 2013).

Infections of gastro-intestinal tract are caused by bacteria, viruses or protozoans. These organisms invade the alimentary canal through fecal-oral route. Unhygienic food preparation, food serving and consumption of contaminated food prior to hand washing substantially, disseminate pathogenic organisms from one person to another. Diarrhea in developing countries is basically the result of taking contaminated food, water and other edibles. In rural population, ignorance, poor sanitation, poor hygiene, and poverty are main factors that predispose to diarrhoea. In infants, Rotavirus, is the most frequent & common cause of severe diarrhea. Rotavirus is a double stranded RNA virus. It has 8 species. However, Rotavirus A is responsible for more than 80% of the human infections. Salmonella, Shigella, E. coli, Campylobacter species are pathogens responsible for bacterial diarrhea. E. histolytica and Giardia are protozoans posing to diarrhoea episodes among millions of children.

It has been observed & substantiated by research studies that physically weak, malnourished children

face more episodes of diarrhea during early life, wherein, each successive diarrhoea episode drains away essential minerals and fluid from body. In developing countries, medical facilities are not availed by parents for treatment and prevention of different diseases including diarrhoea. It is probably due to lack of motivation & education regarding severity and ill impact of diarrhea on body. Poverty, meager earnings, particularly, in slum dwellers & nomadic tribes tilt the conditions towards disease and poor nutritional status of children. Body of children become frail due to loss water & minerals like sodium, potassium, chloride and bicarbonates, owing to persistent attacks of diarrhea every month and every year.

Chronicity of diarrhea impair appetite and weaken gut immunity. Therefore, decreased food intake along with low absorption & assimilation thwart nutritional status of children. Malnourished children become further weak and immunity compromised that predispose them to viral, bacterial diseases affecting their health and supplementary, suffer more diarrhoea episodes in future. Hence, it is a vicious cycle.

Diarrhea is the second leading cause of child mortality in developing countries. It has been found that persistent diarrhea in children under five is generally related to inadequate breast feeding, improper supplementary foods, GIT infections due to contaminated food and water, parasitic infestation (Ochoa et al., 2004). Apart from infections of GIT that cause diarrhea in under five children, we must focus on few other factors that are the cause of diarrhea in children.

It has been a common practice in India to feed children with diluted or undiluted cow milk. However, it can never replace mother milk in terms of digestion and absorption. Again, if it is given after dilution with water, the nutritive value of milk is decreased. Other conditions that can cause poor absorption of food are Coeliac disease, Intolerance to lactose of milk and Allergic colitis.

Persistent diarrhea in children is mainly due to bacterial infections of gastrointestinal tract that is not timely treated & resolved. GIT infection persists for indefinite period. According to World Health Organization estimate, prevalence of persistent diarrhea is only 10% of total diarrhoea episodes in children, however, it is responsible for 35% of child mortality under five year of age. Further, about 50% of persistent diarrhea cases are seen during weaning period (Bhan et al. 1989).

ACUTE RESPIRATORY INFECTION

Acute respiratory infections can be grouped into upper respiratory tract or lower respiratory tract infections. Acute respiratory infections are common cause of child morbidity and mortality under age of five year among children. Prevalence of lower respiratory tract infections among children is higher in developing countries in comparison to that in developed countries owing to wide variations in the cause of infections.

UPPER RESPIRATORY TRACT INFECTIONS

Infections of upper respiratory tract include allergic rhinitis, sinusitis, acute pharyngitis, tonsillitis and laryngitis. These constitute the commonest infectious diseases of children under five. Deafness and acute rheumatic fever are a few other complications that arise from untreated infections. Viruses are mainly implicated in the pathogenesis of respiratory infections. Rhino virus, Respiratory syncytial virus, Parainfluenza and Influenza viruses, Human meta pneumovirus, Adenovirus are frequently involved in infections. Mostly viral infections are self-limiting. However, recurrence, non-responsive cases, poor immunity might provoke spread of infections from upper respiratory tract to lower respiratory tract and lungs.

LOWER RESPIRATORY TRACT INFECTIONS

Pneumonia and Bronchitis are frequent infections of lower respiratory tract. Influenza virus is the most common cause of lower respiratory tract infection. It is highly seasonal infection. Para-influenza virus is another frequent pathogen for LRI. These viral infections exacerbate the probability of pneumonia and bronchitis in children those who suffer frequent attacks of influenza. Today, in developing countries, safe and effective vaccines are available for influenza. Management of influenza & para-influenza viral infections can help control the pneumonia, which is a major cause of morbidity & mortality in children in developing countries.

PNEUMONIA

It is an inflammatory disorder of lungs that affect the alveoli, basic structural & functional units of lungs. Bacteria are the commonest pathogens for pneumonia. *Streptococcus pneumoniae*, *Haemophilus influenza* and frequently, *Staphylococcus aureus* are responsible for pathogenesis of pneumonia. Organisms like *Mycoplasma pneumonia* and *Chlamydia pneumonia* cause severe atypical pneumonia in children under five. Furthermore, exact pathogenesis is uncertain.

Influenza, para-influenza and respiratory syncytial viruses increase the susceptibility of bacterial infections like *Haemophilus influenza* and *Streptococcus pneumonia*. Poor nutrition, compromised immunity and frequent viral infections of upper respiratory tract prompt bacterial pneumonia in children under five (Hemant et al., 2004).

Pathogenic microbes and viruses proliferate and colonize in upper respiratory tract. These pathogens along with secretions are aspirated by children. This sequel is implicated in the pathology of bacterial pneumonia in children. It had been assessed by authors (Chisti et al., 2009) that pneumonia and malnutrition are associated in high rate of child mortality. This mortality rate increases as the severity of malnutrition increases.

Another study was conducted by authors (Schlaudecker et al., 2011) that explained multiple & complex role of diarrhea and pneumonia in the etiology of malnutrition in children. This study explored that diarrhea and pneumonia, both weaken immunity and impair growth of children under five. Frequent episodes of diarrhea, predispose children to repeated attacks of acute respiratory infections. Micronutrient supplements and breast feeding, together, can reduce the frequency of diarrhea and pneumonia, therefore, better nutritional status can be achieved. Pneumonia is the leading cause for childhood mortality and morbidity in world. It is easily controllable and preventable with timely and suitable measures (Graham et al., 2004).

Globally, more than 9 million child mortality rate, in children below age of five has been predicted. Prevalence of about 3 million deaths due to pneumonia is noteworthy (Bryce et al., 2005).

Huge childhood mortality rate due to acute respiratory infection, pneumonia should be managed. Otherwise, it would be difficult to achieve the United Nations Millennium Development Goal-4 by 2015. Effective measures that are needed are education, motivation about importance of breast feeding, proper food supplementation, improving housing conditions, access to medical facility (WHO and UNICEF, 2004).

HIV AND OPPORTUNISTIC INFECTIONS

HIV is a deadly, retro virus, responsible for infection of about 3 million children worldwide. About 90% of childhood HIV infections occurs in Africa, that is associated with 7% of all deaths in children aged under five (WHO, 2006).

Childhood HIV infections result in growth impairment and malnutrition. Anti-retro viral treatment is the choice to combat big load of HIV infections, globally. In African countries, HIV infected children with severe malnutrition were provided micronutrient supplements, however, anti-retroviral drugs were not started. It was observed that these children recovered nutritional status slower in comparison to HIV non-infected children. In developing countries, severity of malnutrition in HIV infected children is higher than in uninfected children.

Anti-retroviral therapy and therapeutic food can improve the nutritional status of the children, especially, in Sub-Saharan Africa, where the mortality rate of malnourished and HIV infected children is three times the un-infected children.

Authors (Bachou et al., 2006) studied a group of 315 malnourished Children who had high prevalence (26%) of infections and persistent diarrhea. They were admitted to hospitals for diarrhea. Prognosis was poor and mortality rate were high.

Poor food intake, illiteracy, poor hygiene, frequent diarrhea are the common features in households having HIV infected, malnourished children.

HIV infected infants show low weight gain in first year of life. It can be due to poor feeding, infections. Tuberculosis, pneumonia, oral candidiasis and diarrhea, that are the common consequences of HIV infections, which together are implicated in compromised immunity. These result into wasting and stunting.

In HIV infected children, increased calorie need, more catabolic metabolism, opportunistic bacterial

fungal infections, lack of medical facility are additional limitations for development of low weight for height and low weight for age. These consequences on prolongation, might terminate into low height for age.

Food intake is decreased in HIV infected children. This condition might arise due to many reasons. It can be due to ART medications, nausea, vomiting, depression, secondary infections or diarrhea.

In HIV infected children, opportunistic fungal infections by candida albicans is common sequela. It may manifest in mouth and esophagus resulting in dysphagia, pain and reduced intake of food (Winter,1996)

HIV infected children enter in a myriad of health problems, which are the consequence of many factors. Already discussed, reduced food intake, deliberately decreases energy level in body, low serum retinol, low serum iron, folic acid level become detrimental to health of children. Deficiency of more micronutrients raise the likelihood of secondary infections by virulent pathogens and ends in severe compromised nutritional status (Hendricks et al., 2006)

In HIV infected children, opportunistic infections in mouth and lower part of GIT, result into dysphagia, malabsorption, diarrhea and increased intolerance to lactose and gluten. Hence, under nutrition in these children have a defunct role biosynthesis of proteins, enzymes, hormones, therefore, adverse impact on structural and functional integrity of cells, tissues and organs of body.

HIV infection of the parents have direct negative impact on their physical work and livelihood which in turn deter food security and care of children, hence, increases the vulnerability of children to diseases and malnutrition.

DISCUSSION

Repeated and persistent infection of GIT, bring about structural and functional changes in mucosa of intestine. Pathogens, either, adhere or invade mucosa, release endotoxins, which trigger the release of pro-inflammatory substances called as Cytokines, initially, followed by synthesis of inflammatory compounds, like Prostaglandins, Prostacyclin, Histamine in mucosal cells of intestine. These compounds modulate gut immunity. These immunomodulatory compounds alter length of intestinal villi. Lymphocytic infiltrations within villous epithelium have been postulated by various authors. Crypts of Lieberkuhn undergo hypertrophy (Sullivan et al.1991).

Histological alterations in intestinal mucosa impair its absorptive function. Therefore, nutrients are not absorbed from diet. Body suffer from ill effects of nutrient deficiency either macronutrients or micronutrients which is divulged as malnutrition.

Malnutrition predisposes to infectious diseases, which in turn contribute to malnutrition. Hence, an interplay of malnutrition and infectious disease initiate a vicious cycle.

Wasting among children is a predictor of duration and severity of diarrhoea. Prolonged illness might aggravate nutritional disturbance, thereby render children to risk of morbidity and mortality as shown in diagram 1.

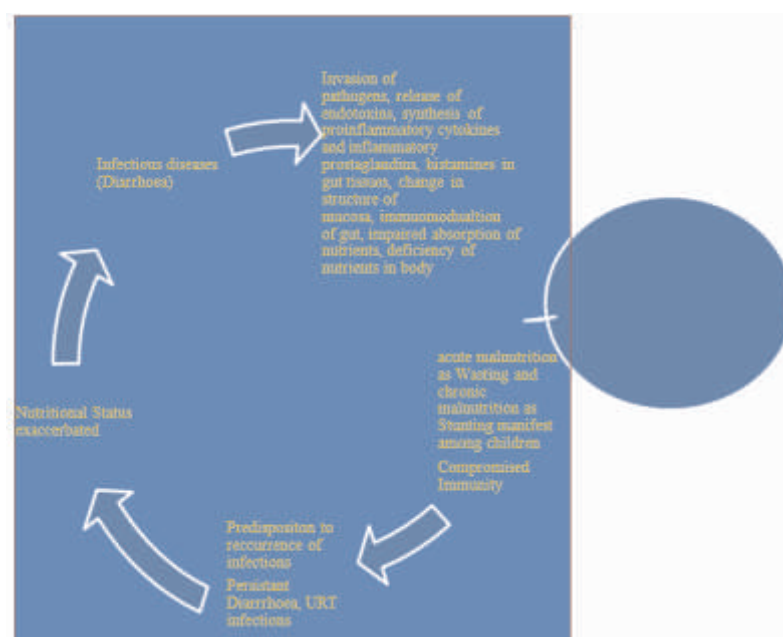


Diagram 1 depicting interrelation between infectious diseases and malnutrition

CONCLUSION

Infectious disease and malnutrition are intimately associated predisposing factors to health of children. Availability of clean drinking water is most essential to combat most of the communicable diseases. Additionally, periodic hand wash, good hygiene and proper disposal of human excreta are another safeguards to prevent from infectious diseases. Government policy to regulate adequate food supply at subsidized prices to poor population would definitely ensure availability and distribution of quality food.

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