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Oral Microbial Flora in Malnourished Children: Implications for Health and Disease

Abiodun Jacob Osatogbe[1]*, Shafiu Isah A[2] and Adamu Aliero A[1]

[1]*Microbiology Department, Kebbi State University of Science and Technology, Aliero, Kebbi State, Nigeria*

[2]*NOMA Children Hospital, Sokoto, Ministry of Health, Sokoto State*

***Corresponding Author**
Abiodun Jacob Osatogbe, Microbiology Department, Kebbi State University of Science and Technology, Aliero, Kebbi State, Nigeria, Tel: +2348077730479

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Abstract

Malnutrition is a global issue affecting children's well-being, growth, and resilience. Protein-calorie malnutrition (PCM) is the most common form, affecting pregnant women, the elderly, and young children, leading to obesity in emerging countries. Vitamin A, iron, iodine, zinc, and folate are essential for a balanced diet and healthy nutrition. One-third of sub-Saharan Africans lack these nutrients, affecting mental and physical health, vitality, and economic growth. Oral microbial populations like Streptococcus and Enterococcus also affect human health and disease development. Malnutrition increases infection risk and mortality, with diarrhoea and respiratory illnesses being the most common causes of mortality in infants under five. A deeper understanding of the oral microbiota can help develop better management options. Severe malnutrition in children with comorbidities increases mortality risk by four times. Medical personnel must prioritise diagnosing and treating severe acute malnutrition in children, as comorbidities increase the risk of death for extremely malnourished children by four times.

Keywords: Malnutrition, Oral Microbial Flora, Streptococcus, Bacterial Infection, Child Health, Public Health

1. Background

The dietary requirements of an infant or kid have an essential effect on numerous aspects of his or her health, including normal growth and development, participation in vigorous physical activity, and the capacity to withstand severe ailments [1]. Malnutrition can result from a deficiency or absence of particular nutrients. Malnutrition's manifestation and severity are determined by its aetiology, severity, and duration [2]. Protein-calorie malnutrition (PCM) may result from an insufficiency of macronutrients, such as protein, carbohydrates, and lipids. Combined with micronutrient deficiencies, these imbalances pose substantial nutritional challenges, especially for expectant women, the elderly, and young children. According to Rodrguez, et al. (2011), this problem impacts a substantial number of people. Malnutrition and developmental deficiency are significant problems affecting children, resulting in roughly half of all child deaths in developing countries [3]. The nutrition transition in Sokoto is progressing rapidly, resulting in an increasing prevalence of obesity as an urgent issue, especially in regions that are semi-urban and rural. Accompanying the recurrent occurrence of dietary shortages, the global prevalence of obesity is rising. Malnutrition is an alarming worldwide problem. Undernutrition is a form of malnutrition characterised by stunting, atrophy, and deficits in essential vitamins and minerals. The additional manifestation of malnutrition entails obesity, which results from excessive ingestion of specific nutrients. The prevalence of underweight, stunting, and waste in children, which are regarded as the most accurate indicators of malnutrition, is primarily observed in a few South Asian and Eastern African nations. According to a 2011 report by Gupta et al., approximately 33% and 28% of children under the age of 5 are classified as underweight in these regions [4]. Numerous studies have demonstrated that malnutrition is associated with a higher vulnerability to infection and mortality. Micronutrients play an essential role in sustaining proper nutrition, and their deficiency in the human diet is responsible for a variety of health problems. Vitamin A, iron, iodine, zinc, and folate are the micronutrients that have attracted the most academic interest in recent years. A significant portion of the world's population suffers from a deficiency in micronutrients that are vital, posing an ongoing problem in numerous African countries. In accordance with Kuku-Shittu, et al. (2016), approximately one-third of the population south of the Sahara in Africa suffers from vitamin and mineral deficiencies. These deficiencies have substantial effects on the cognitive and physical health of individuals, as well as their energy levels. Moreover, these deficiencies

have a negative impact on the economic growth of societies in this region [5]. The human body contains a wide variety of autochthonous bacteria, with distinct communities located at different anatomical sites. There are microbial populations in the oral cavity that have significant effects on human well-being and disease. Individual dental health is dependent on the presence of healthy endogenous bacteria on the surfaces of the gums, teeth, and oral cavity linings [6]. Understanding the composition of oral flora and its components, microbes, has been the subject of limited study to date. Bacteria are typically present in the surface tissues of all individuals, such as the buccal cavity. The composition and abundance of microorganisms can vary depending on a person's age, dietary habits, and personal hygiene practices [7]. The oral bacteria mentioned in the study by Bik, et al. (2010) have been identified as the primary agents responsible for numerous systemic diseases, such as endocarditis caused by bacteria, pulmonary pneumonia, osteomyelitis in infants, preterm low birth weight, and cardiovascular disease. The human buccal cavity is an extremely active ecosystem that supports a wide variety of bacterial species. Within this environment, these bacteria engage in fierce competition, resulting in the formation of biofilm structures comprised of numerous species. Bacteria like Streptococcus, Lactobacillus, Lactococcus, Enterococcus, Staphylococcus, Corynebacterium, Veillonella, and Bacteroids are often found in the mouth [8, 9]. Oral microbial-plaque colonies are bacterial biofilms composed of a variety of genetically distinct bacterial types that coexist on surfaces inside the microbial host. Multiple mechanisms, which include coaggregation and coadhesion, as well as additional physiological and metabolic interactions, facilitate bacterial communication [10]. Multiple research investigations have presented evidence demonstrating that malnutrition is associated with increased susceptibility to infection and mortality [2]. Abrupt diarrhoea and severe respiratory infections are the most prevalent causes of morbidity among infants under the age of five. Multiple studies have established a causal link between malnutrition and these fatalities. Due to its rare inclusion as a direct cause of death on official death certificates, however, the true impact of malnutrition is frequently understated [11]. This review aims to explore the relationship between malnutrition and oral microbial flora in children, with a focus on the prevalence of protein-calorie malnutrition (PCM). The objective are 1. Investigate the prevalence and severity of malnutrition, particularly protein-calorie malnutrition, in children. 2. Explore the composition and diversity of oral microbial flora in malnourished children, focusing on Streptococcus and Enterococcus. 3. Examine the association between malnutrition, oral microbial flora, and the increased susceptibility to infectious diseases in children.The study investigates the impact of malnutrition on the composition of oral bacterial populations, particularly Streptococcus and Enterococcus, and their potential role in affecting children's health and disease development [12-15].

2. Methodology

This investigation seeks to clarify the relationship between malnutrition and bacterial infections. In addition, we investigate the increased prevalence of infectious diseases among malnourished children. To determine the extent to which studies have investigated the association between malnutrition and microbes, an in-depth review of existing research articles was conducted. To identify original articles, an inquiry was carried out on MEDLINE, which is maintained by the National Library of Medicine in Bethesda, Maryland. This was accomplished by using the PUBMED query programme. In addition, our analysis utilised electronic databases such as the EMBASE database and Scopus. The databases were queried systematically for articles published between 2010 and 2022, with a focus on English-language publications with an English abstract. The research made use of several combinations of the following keyword groups: malnourished children, malnutrition, bacteria, Nigeria, and global scope. Subsequently, an independent investigation was conducted to determine the literature regarding the presence of microorganisms in malnourished children. Bacteria and malnutrition are discussed separately in distinct sections of this review. The exclusion criteria, are the studies does not focus on other pathogenic agents or malnourished adults as well the investigation did not include studies that examined the association between malnutrition and other pathogenic agents, such as HIV-related or other viral diseases. In addition, research on emaciated adults was eliminated from the analysis.

3. Discussion

In the discipline of public health nutrition in this issue region, malnutrition and micronutrient deficiencies continue to be the primary concerns. Multiple genotypes of oral bacteria classified as Streptococcus and Enterococcus and presenting diverse patterns of susceptibility to antibiotics were successfully identified in the present study, which was also proved by Alghamdi (2022). In accordance with Karajibani et al. (2013), the conclusions of the research study revealed the presence of varying degrees of malnutrition, ranging from mild to severe, but found that overweight and obesity were not significant issues among children.According to Jain (2011), the results show that the ability of bacterial biofilm cells to keep their intracellular pH level stable is what makes them more physiologically stable and resistant to acidity.

4. Conclusion

The findings reveal insights into the association between malnutrition, bacterial infections, and increased susceptibility to infectious diseases in malnourished children. A greater understanding of the significance of oral microflora, which functions as a colony comprised of several different microbes exhibiting synchronised behaviour, will lead to the development of more efficient management methods. There was a significant correlation between comorbidity prevalence and mortality. On admission, the probability of death for severely emaciated children with complications was discovered to be four times that of children who were severely malnourished without comorbidities. Medical professionals and healthcare professionals must prioritise the prompt identification and effective management of complications in paediatric patients with severe acute malnutrition.

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