

Epidemiologic Study of Kwashiorkor : The Impact of Chronic Malnutrition on Child Development

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Abstract

Nutritional science is the study of how organisms consume and process food and drink for nutrition and life. It examines the relationship between diet, health and disease and involves the study of nutrients, including carbohydrates, lipids, proteins and other bioactive compounds. Nutrition science also examines the impact of food on human health, including the prevention and treatment of disease, and the improvement of overall well-being. One of the many health problems that occur in the world is the problem of malnutrition, one of which is kwashiorkor. The purpose of this study was to determine the epidemiology of chronic malnutrition in child growth and development. The research method used a literature study. Kwashiorkor is a form of acute malnutrition caused by long-term protein deficiency. The condition is characterized by abdominal swelling, weight loss, and changes in the skin and hair. Kwashiorkor often occurs in children in developing countries due to limited access to healthy and nutritious food. Further research is recommended to broaden the sample scope and consider other factors that may affect nutritional status in populations with similar profiles

Article History:

Keywords:

*Kwashiorkor,
Malnutrition,
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1. Introduction

Malnutrition remains one of the most common disorders among children in the world, especially among low- and middle-income countries. This includes any condition caused by too much or too little intake of dietary nutrients-dietary calories, proteins, and micronutrients impairs the body's form, function, tissue growth, and clinical outcome. Bavurhe et al. reiterated that acute malnutrition among under-five children is still an important health problem in rural settings, having also been evidenced in the children of the same age group in the Democratic Republic of Congo, where it keeps driving high morbidity and mortality.

Acute malnutrition, especially in children younger than five years, can be categorized into two forms: primary and secondary malnutrition. While primary malnutrition primarily stems from socio-economic factors such as scarcity and poverty that hinder access to nutritious food, secondary malnutrition is typically linked to underlying health issues or chronic diseases that disrupt nutrient absorption and utilization. According to Singh & Shaida, children experiencing malnutrition frequently face stunted physical, cognitive, and psychological development, which consequently diminishes their potential productivity in the future.

Kwashiorkor is an extreme form of protein malnutrition that arises when the intake of dietary protein is drastically reduced, even though carbohydrate consumption remains relatively sufficient. The symptoms of kwashiorkor include edema, particularly in the legs, altered mental status, compromised immunity, and impaired growth. Other symptoms may involve changes in hair color, dry

skin, muscle wasting, and a heightened risk of infections due to the weakened immune system. This situation frequently requires prompt action to prevent serious health issues and avoid death.

Nutritional and medical interventions that are needed for overcoming kwashiorkor include adequate protein and calorie intake and the treatment of co-occurring infections. May et al. (2023) have quoted that addressing kwashiorkor not only requires health attention but also social and economic needs to improve food security so that the children can have access to good nutrition without interruption. This would, again, show that health outcomes might be tied in with other social determinants, such as economic stability and access to resources.

The relationship between malnutrition and child-related poverty is well-documented. Most studies point out that the degree of malnutrition is often a sure indicator of the country's socio economic problems. In this respect, Setboonsarng (2005) pointed out that, in Indonesia, child malnutrition rates indicate increasing poverty and thus there is a great need for selected interventions to help attain better health status. Public education, government support, and an improvement of health services are all part of the comprehensive strategy to reduce future generations' use of malnutrition.

2. Methods

The approach applied in this study is a literature review, primarily known as a systematic literature review (SLR). This SLR method is used to locate, assess, analyze and interpret all existing research related to the topic of interest and relevant research questions. By utilizing this method, researchers systematically conduct the review and follow a predetermined procedure to identify journals.

Tables

Based on literature studies from reference for the last 5 years, namely 2024-2019. A systematic literature search was conducted to identify articles relevant to the theme of kwashiorkor, a form of severe malnutrition due to protein deficiency. This literature search was conducted through databases such as Scopus, PubMed, and Google Scholar using the keywords Kwashiorkor, Malnutrition, and Protein Deficiency.

Table 1. Summary of Research Results on the Epidemiologic Study of Kwashiorkor: The Impact of Chronic Malnutrition on Child Development

No	Citations	Title	Methods	Sample/Site	Result
1.	Bavurhe, R. F., Ahmad, B., Naaz, F., Oduoye, M. O., Rugendabanga, E., Nkundakozero, M., ... & Birindwa, A. M. (2024).	Epidemiology and clinical characteristics of acute malnutrition among under-5 children attending a rural hospital in the Democratic Republic of Congo: a cross-sectional study	retrospective and descriptive cross-sectional study	Children under 5 years old with acute malnutrition from April 2022-April 2023. A total of 287 malnourished children were consulted. Measures were conducted at a hospital in rural Democratic Republic of Congo.	As many as 25% of children are acutely malnourished. The age group of 13 to 24 months is the most affected, reaching 30%. The sex ratio among them was 1.17 (M/F). Kwashiorkor dominated the malnutrition cases with a high percentage of 59.6%. Common symptoms include abdominal distension, weight loss, diarrhea and vomiting. Serious complications such as shock were common, but the use of therapeutic milk (F75 and F100) proved effective in the treatment process. Of the total cases, 10.1% lost their lives, while 89.9% fully recovered.

2.	SINGH, P., & SHAIDA, B	Primary and Moderate Acute Malnutrition and Rehabilitation Measures in Children Under the Age of Five:	The methods used included physical measurements, clinical evaluation, and nutritional interventions	Children under the age of 5 years with severe acute malnutrition (SAM) or moderate acute malnutrition	Children with SAM had more severe symptoms such as significant weight loss, edema and weakness, while children with MAM had slower growth
		Clinical Effects and Treatment.	based on the child's health condition.	(MAM). Held at various clinical sites, but specific locations were not specified.	and were more susceptible to infections.
3.	Alou, M. T., Golden, M. H., Million, M., & Raoult, D. (2021)	Difference between kwashiorkor and marasmus: Comparative meta-analysis of pathogenic characteristics and implications for treatment	Conduct a literature review by searching journals through PubMed and Google Scholar based on PRISMA (The Preferred Reporting Items for Systematic Reviews and Meta-Analyses) guidelines.	Conducted a detailed analysis comparing the literature on kwashiorkor and marasmus, taking into account their pathogenic characteristics. And located in a village located in the highlands of Guatemala.	The journal found that vitamin and mineral deficiencies are often found in varying degrees, but are often not detected clinically. This review aims to adopt a systematic organization of the available information to present a descriptive picture, not to highlight pathogenetic factors of malnutrition.
4.	May, T., Babirekere-Iriso, E., Traoré, M., Berbain, E., Ahmed, M., Amadi, B., ... & Sabo, H. S. (2023).	The neglect of kwashiorkor. The Lancet Child & Adolescent Health	Used qualitative methods to gather insights on kwashiorkor awareness and management among health workers, and conducted interviews and focus groups to explore perceptions and experiences related to the condition.	The sample consisted of various professionals, such as pediatricians, nutritionists, and general practitioners, ensuring a comprehensive understanding of the issue from different perspectives. It was conducted in health facilities, including hospitals and community health centers.	There is a widespread lack of understanding of kwashiorkor among health care providers. Many were concerned that the condition may be difficult to diagnose due to its similarity to various other nutritional deficiencies. Better training and adequate resources are needed to improve the practice of recognizing and managing kwashiorkor in clinical settings.
5.	Soriano, J. M., Rubini, A., Morales-Suarez-Varela, M.,	Aflatoxins in organs and biological samples from	Apply the method of scoping observation or	The study did not select a specific sample as it focused on	The presence of aflatoxin tended to be higher in children with kwashiorkor

	Merino-Torres, J. F., & Silvestre, D. (2020).	children affected by kwashiorkor, marasmus and marasmic-kwashiorkor: A scoping review	systematic analysis on scientific articles relevant to the topic.	a literature review. However, we focused on children with kwashiorkor, marasmus and marasmic-kwashiorkor.	than those with only marasmus or marasmic-kwashiorkor.
6.	Hsieh, P. P., Wijaya, P. D., Aziana, P., Purnomo, P. W., & Radhiah, S. (2022).	Malnutrisi Energi Protein Berat: Laporan Kasus	We used the case report method, which emphasizes the collection of clinical data and laboratory examination results to provide a comprehensive picture of the child's health condition.	A 12-month-old girl was hospitalized for malnutrition. The report indicated that the child had weight loss, decreased appetite, and symptoms of respiratory infection.	Physical and laboratory examinations showed that the child had iron deficiency anemia and infiltrates in the lungs. After two weeks of treatment with fluid therapy, antibiotics, and dietary intervention, the child's condition progressed quite well.
7.	Perdana, H. M., Darmawansyah, D., & Faradilla, A. (2020).	Gambaran Faktor Risiko Malnutrisi pada Anak Balita di Wilayah Kecamatan Tamalanrea Kota Makassar Tahun 2019.	Using a cross-sectional design to observe variables simultaneously at one specific time.	There were approximately 100 children under five living in Tamalanrea Sub-district, Makassar City, Indonesia.	Children from economically disadvantaged families are more likely to experience malnutrition. Parents' education also affects their nutrition knowledge and eating habits. Children who do not have adequate access to health services also tend to show higher levels of malnutrition.
8.	Ahmed, T., Hossain, M. I., Islam, M., Ahmed, A. S., Afroze, F., & Chisti, M. J. (2020).	Protein energy malnutrition in children. In Hunter's tropical medicine and emerging infectious diseases	Although details of the methods are not specifically described, the authors tend to utilize a broad research design in	Protein Energy Malnutrition (PEM) affects children, but details about the sample size and characteristics of the target population were	Health risks in children are sometimes related to poor family economic conditions, limited access to medical care, and an unbalanced diet.

			describing cases of protein-energy malnutrition (PEM) in children, which includes in-depth analysis of epidemiological, clinical, and nutritional aspects.	not mentioned. The authors did not provide specific details about the location of the study, but emphasized that the study was conducted in a tropical region or an area prone to malnutrition.	Early signs of Patient Empowerment Model (PEM) are weight loss or stunted growth, fatigue, lack of energy, and irritability when disturbances occur. In the treatment of PEM, the first step is to replace the required fluids and electrolytes, followed by the slow restoration of macro and micro nutrients, which should be done with the guidance of a nutritionist.
9.	Bunker, S., & Pandey, J. (2021).	Understanding Kwashiorkor and Marasmus: Disease Mechanisms and Pathologic Consequences.	A narrative review approach was used to understand the disease mechanisms and pathological consequences of kwashiorkor and marasmus.	In this journal, there is no specific description of the sample and research location due to the literature analysis method used. However, data and information from previous studies on kwashiorkor and marasmus were analyzed.	In terms of pathological mechanisms, both situations affect the immune system, increasing susceptibility to infection. Kwashiorkor disease occurs when serum albumin levels drop, leading to edema due to osmotic pressure imbalance. Marasmus, on the other hand, can result in significant weight loss as the body burns fat and muscle for energy.
10.	Michael, H., Amimo, J. O., Rajashekara, G., Saif, L. J., & Vlasova, A. N. (2022).	Mechanisms of Kwashiorkor-Associated Immune Suppression: Insights From Human, Mouse, and Pig Studies.	Utilizing a multi-dimensional approach to understand the effects of protein deficiency on children's	Children suffering from kwashiorkor and marasmus and used in specialized immunological clinical studies.	Kwashiorkor can cause a significant reduction in the immune system, such as a decrease in the ability of dendritic cells, macrophages, and

			immune systems. In addition, the laboratory study also used mice and pigs to mimic the kwashiorkor condition.	In addition, rats and pigs were also used as animal models to simulate kwashiorkor conditions. The location of the research in the journal was not described in detail.	adaptive immune responses. Recent research has shown that experiments using pig animal models that have been transplanted with the fecal microbiota of human infants have been successful in mimicking kwashiorkor conditions accompanied by both innate and adaptive immune disorders. Providing adequate nutrition can help improve some of the immune functions impaired by protein deficiency.
11.	Sato Y, Yoshihisa A, Sugawara Y, Misaka T, Sato T, Kaneshiro T, Oikawa M, Kobayashi A, Yamaki T, Nakazato K, Takeishi Y (2024)	Malnutrition stratified by marasmus and kwashiorkor in adult patients with heart failure.	In this journal, the method used is study population and statistical analysis.	The sample taken consists of 2308 patients divided into four groups.	Group marasmic-kwashiorkor (MK) had the oldest age and lowest proportion of male sex. In laboratory data, the levels of B-type natriuretic peptide (BNP) increased in groups C, M, K and MK. According to right heart catheterization, group K showed a higher average pulmonary artery wedge pressure.
12.	Thompson, D. S., Francis-Emmanuel, P. M., Barnett, A. T., Osmond, C., Hanson, M. A., Byrne, C. D., ...	The effect of wasting and stunting during severe acute malnutrition in infancy on insulin sensitivity and	Study design, Procedures, HEC, Assays, Calculations and data analysis and Statistical analysis	Gathered a group of 1,336 Afro-Caribbean adult men and women who were treated between the ages of 6 and 18	Data were analyzed for 40 survivors of SAM and 10 controls (since 2 controls had no detectable basal insulin in the assays and 1 had fasting
	& Boyne, M. S. (2022).	insulin clearance in adult life		months in the metabolism research unit, Jamaica, from 1963 to 1993 with severe malnutrition.	hyperglycemia). The 40 participants were of similar age and BMI as the other study participants that did not undergo HEC. The participants mean age in each group was not statistically significantly different from each other, approximately 27 years, as were their BMIs.

13.	Khan, S., Arshad, R., Sultan, M. T., Tabasum, S., Batool, N., & Ikram, T. (2023)	Treatment Outcome of Kwashiorkor in Children as Per World Health Organization Guideline at Nutrition Stabilization Center Multan, Pakistan.	In this journal, the method used is Retrospective Descriptive research	Within the period of 2012-2020 a total of 2393 children were admitted with severe acute malnutrition and 222 kwashiorkor patients.	During the year 2012-2020, a total of 2393 children were admitted with severe acute malnutrition out of which 222 were edematous SAM. 222 kwashiorkor patients 25 were less than 6 months while 197 were more than 6 months old. 120 were males and 102 were females. Out of total kwashiorkor patients, 40% presented with diarrhea, about 30% had pneumonia, hypoglycemia was recorded in 10% children, Urinary Tract Infection 15% and other diseases like celiac disease nephrotic syndrome and complication
14.	Dipasquale, V., Cucinotta, U., & Romano, C. (2020)	Acute malnutrition in children: pathophysiology, clinical effects and treatment.	In studies using various methods of documenting the significant prevalence of malnutrition	children who are treated in hospitals in developed countries like Germany or Indonesia.	In 2008, 24.1% of pediatric patients in tertiary hospitals in Germany experienced malnutrition, with 17.9% having mild
			even in developed countries.		malnutrition, 4.4% moderate, and 1.7% severe malnutrition. The prevalence of malnutrition varies depending on the underlying medical conditions, ranging from 40% in cases of neurological diseases, to 34.5% for infectious diseases, 33.3% for cystic fibrosis, 28.6% for cardiovascular diseases, and 23.6% in cases of gastrointestinal diseases. Most children with primary acute malnutrition can be managed at home, whereas those with severe acute malnutrition and complications require hospital care.

15.	May, T., de la Haye, B., Nord, G., Klatt, K., Stephenson, K., Adams, S., ... & Jahoor, F. (2022).	One-carbon metabolism in children with marasmus and kwashiorkor.	The method used is cross-sectional study	422 Children aged 12-60 months before nutritional rehabilitation	Serum was collected from 422 children. Of these, sufficient quantities of non-hemolyzed serum for metabolic analyses were available from 357 (43 marasmic-kwashiorkor, 94 kwashiorkor, 118 marasmus, 56 MAM and 46 controls). All participants lived in rural communities where household food security is linked to subsistence patterns of agriculture.
16.	Arcieri ST, Cheung S, Belkin A, Pillai A, Gupta R. (2021)	Kwashiorkor on the south shore.	Qualitative method	A 38 year old caucasian male with a history of schizophrenia and noncompliance with medications presented to the emergency department with abdominal swelling and altered mental status.	Kwashiorkor is caused by low protein consumption patients with kwashiorkor are more likely to experience lower extremity edema, a distended abdomen, and history of poor dietary habits consisting only of vegetables without significant protein intake. Normal liver enzyme levels, an INR of 1.2, and the absence of alcohol intake make differential diagnosis of decompensated liver disease with secondary thrombosis less accurate. Another complicating factor in the course of this patients disease that needs to be considered is the beginning and the bilateral DVT found on lower extremity ultrasound
17.	Kamaruzaman NA, Jamani NA, Said AH	An infant with kwashiorkor: The forgotten disease	Qualitative method	The case of a 5 month old boy with kwashiorkor	He was born full term with a birth weight of 2.42 kg. His weight continued to rise through the second month but began to fall below the -2SD in the third month and below the -3SD in the fifth month. Nutritional deficiencies are non uncommon in primary care.

3. Result and Discussion

3.1 Results



Figure 1.1

According to Bavurhe et al. (2024), kwashiorkor is the most common form of acute malnutrition in developing countries, especially in children within the age group of 13-24 months. Indeed, these authors showed that 59.6% of acute malnutrition cases in the Democratic Republic of Congo were due to kwashiorkor. Khan et al. (2023) reported a prevalence of kwashiorkor as high as 9.3% in severely malnourished children of Pakistan, with complications including, but not limited to, diarrhea and pneumonia. According to Perdana et al. (2020), factors contributing to this anomaly in Indonesia include low levels of parental education, access to health care, and low family incomes. It is also worsened by environmental factors such as the ingestion of aflatoxins, according to Soriano et al. (2020).

According to Alou et al. (2021) and Michael et al. (2022), clinically, Kwashiorkor is manifested through swelling, distension of the abdomen, and severe impairment in immune response because of an absence of protein. Consequences not only involve physical aspects but also include cognitive and emotional underdevelopment of the child, which may affect their future productivity, states Singh & Shaida (2023). Kwashiorkor in infancy may heighten metabolic complications in later life, as discussed by Thompson et al. (2022). According to May et al. (2023), one major challenge with care for kwashiorkor is inadequate training of the healthcare professional. This form of nutritional disorder, nonetheless, could be managed to reduce its burden by embracing a wide-ranging approach entailing nutritional care, management of infections, and health education for the public.

3.2 Discussion

Epidemiological studies on kwashiorkor show the complexity of the impact of chronic malnutrition on child development. Kwashiorkor is acute malnutrition caused by chronic protein deficiency. It remains one of the major challenges in many regions of the world, especially in areas with very low socioeconomic levels. This discussion, based on the sources reviewed, will discuss important aspects of the epidemiology, clinical characteristics, and pathological implications of kwashiorkor.



Figure 1.2

3.2.1 Prevalence and Risk Factors

The research carried out by Bavurhe et al. (2024) in the Democratic Republic of Congo revealed a significant occurrence of kwashiorkor in children under five, with the highest rates seen in the 13-24-month age category. The study pinpointed several key risk factors, including impoverished socioeconomic conditions, insufficient access to nutritious food, and existing health issues that exacerbate the nutritional status of children. Similarly, in Indonesia, Perdana et al. (2020) found that parental education and the availability of health services are crucial factors in combating malnutrition.

3.2.2 Pathophysiology and Clinical Symptoms

Kwashiorkor is characterized by edema, abdominal distension, hair discoloration, and immune system weakness due to chronic protein deficiency. The study by Alou et al. (2021) illustrated that kwashiorkor presents different pathophysiological mechanisms from marasmus, including osmotic pressure imbalance because of low serum albumin levels. This also explains the child's susceptibility to infection. Bunker and Pandey (2021) added that kwashiorkor is often accompanied by serious immune disorders, which was further supported by the results of Michael et al. (2022) that protein deficiency impairs the activities of innate and adaptive immune cells.

3.2.3 Impact on Child Development

Kwashiorkor not only has ill effects on the physical health of the child but also impairs cognitive and mental development. Singh & Shaida (2023) mentioned that acute malnutrition stunts growth and reduces learning ability, thus impacting later productive potential. Thompson et al. (2022) outlined the risk of metabolic disorders, including insulin resistance, associated with malnutrition in childhood.

3.2.4 Diagnosis and Management Challenges

The study by May et al. (2023) established that a lack of understanding among health workers about kwashiorkor is commonly associated with delays in diagnosis. Furthermore, Khan et al. (2023) established that even though the guidelines provided by WHO are efficient in the management of kwashiorkor cases, most children are not afforded appropriate nutritional care.

3.2.5 Role of Environmental Factors and Toxins

Soriano et al. (2020) pointed out that aflatoxins heighten kwashiorkor. Children with aflatoxin exposure had a higher severity than those with marasmus alone.

3.2.6 Integrated Approach to Intervention

These studies support the importance of multidimensional interventions: improvements in nutrition, community education, and strengthening of health services. Similarly, Hsieh et al. 2022 and Ahmed et al. 2020 recommend a combination of macros and micro-nutrient supplementation, infection management, along proper healthy eating knowledge, to avoid any further occurrences in the future.

4. Conclusion

Kwashiorkor is a long-term nutritional condition resulting from a lack of protein, which affects the normal growth of a child's physical, cognitive, and mental. From the reviewed epidemiological studies, kwashiorkor mostly occurred among children from families with low socioeconomic conditions, limited access to nutritious food, and lack of health services. Symptoms include edema, abdominal distension, and immune disorders that make them more susceptible to serious infections.

It causes an increase in the level of severity due to environmental exposures, such as aflatoxin, whereas the principal protecting factors are the education and availability of healthcare to the parents.

Long-term features include effects on childhood and increased incidence of metabolic disorders during adulthood because of kwashiorkor.

Timely diagnosis and multidimensional interventions through improved nutrition, treatment of infections, community education, and strengthened health policies hold the key to solving the problem. Further research would be required to understand the various genetic, environmental, and cultural factors that may have a bearing on the prevalence of kwashiorkor for the development of more effective preventive strategies. A comprehensive approach to the issue will help prevent such a situation from affecting the future generation due to kwashiorkor, and it would also improve the living quality of children in vulnerable communities.

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