



# A Retrospective Study on Infectious Diseases Occurrence in Undernourished and Well-Nourished Children in Rural Sub-Saharan Africa Primary Care Center-Gambia

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## Abstract

The interrelated nature of the occurrence of infectious diseases amongst malnourished and well-nourished children is still among the topics that need a thorough research. Severe acute malnutrition (SAM) and moderate acute malnutrition (MAM) are associated with increased severity of common infectious diseases. Death amongst children with SAM is almost always as a result of infection. Malnutrition is common in Kiang West District particularly during the "hunger" season from the month of August to October every year. This study aimed to compare pattern of infectious diseases registered in malnourished children with the well-nourished children in a free rural primary care clinic in Kiang West District, The Gambia. We retrospectively analyzed data from the Keneba Electronic Medical Records System looking for records of all children 5 years and below seen with ICD-10 codes for various prevalent of infectious diseases between January 2010 and December 2017. Data of children with normal anthropometry characteristics was compared against those with moderate acute malnutrition (WHO z score 2-3) and severe acute malnutrition (WHO z score > 3).

Both MAM and SAM were compared against each other and in reference to the well-nourished children. Common colds were the most prevalent infectious diseases in all groups followed by pneumonia. Overall, all infectious diseases diagnosed apart from common colds, intestinal helminthiasis and acute otitis media were more common among malnourished children compared to well-nourished children. There was an increasing gradient in relative frequency of pneumonia, HIV, septicemia, UTIs, malaria, giardiasis and tuberculosis from well-nourished through moderate acute malnutrition to severe acute malnutrition. The relative frequency of prevalent infectious diseases among children of age 5 years and below in this study differed by their state of nutrition. More severe forms of infectious diseases occurred more frequently with worsening malnutrition in children 5 years and below in Kiang West District.

**Keywords:** Malnutrition; Infectious Diseases; children; Pneumonia; septicemia, Tuberculosis; HIV; Malaria; UTIs

## Introduction

Infectious diseases until today continues to claim the lives of many and out of these, the burdens lies in the developing and under developed nations. By the definition, according to WHO, as any pathogenic microorganism that can be spread directly or indirectly from one person to another can be term an infectious agent and if this impaired the immunity then disease stages are developed [1]. The data that represent the stunted growth children, moderate acute malnourished (MAM) and severe acute moderate (SAM) are

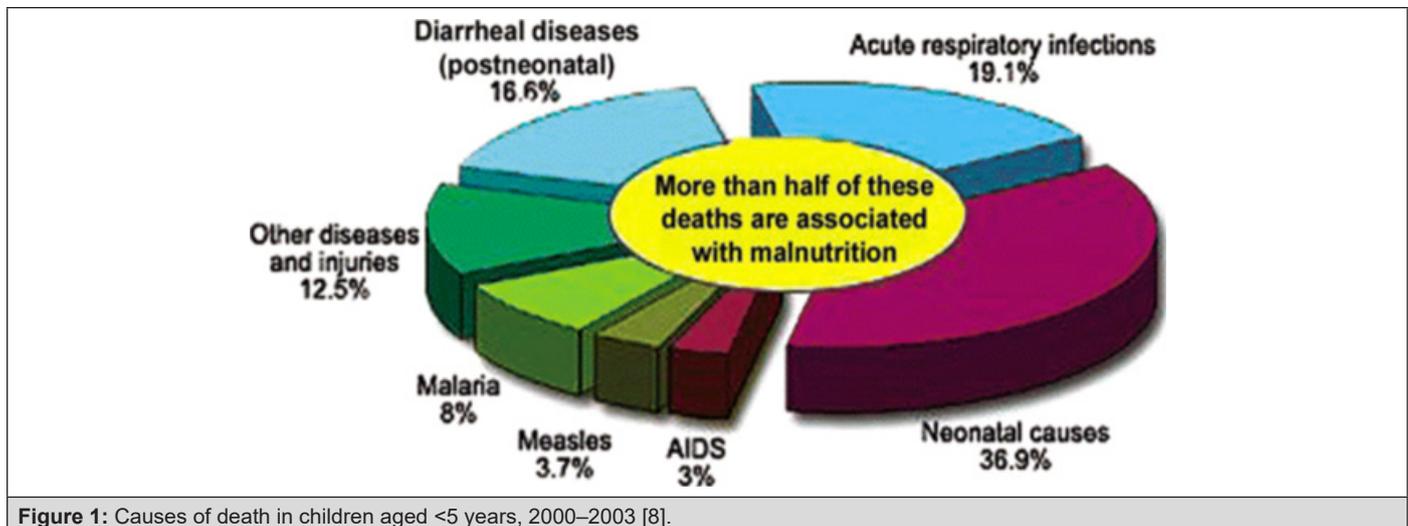
derived by United Nation (UN) and also Millennium Development Goal (MDG) [2]. In the pre-antibiotics, food and diet are the treatment methods and thus scientifically proven as protection to the occurrence of malnutrition. In fact until today, diet alongside with antibiotics is used to improve children response to diseases [3]. Globally, an estimate amount of 20 million children under five are living with SAM. This is the lowest rate weight for height (below-3 z scores of the median WHO growth standards) and most of these

children are found to be living in South Asia and Sub-Saharan Africa [4,5]. While the children of developed nations are properly fed and well nourished, those underdeveloped nations are still struggling with the battle of malnutrition and this has brought in the major public health problems in the mentioned regions.

One study conducted in Democratic Republic of Congo on the frequency of malnourished children while considering the geographical distribution. It is vehemently clear that, the burdens occur in the rural areas that are associated with scarcity of food and social amenities [6]. Should these imply to Gambia? A thorough research is requested as to the infectious patterns among the well-nourished in comparison of under nourished for children in both industrial regions and rural provinces. Another study claims that apart from poor socioeconomic factors and poor nutrition, lack of mother's knowledge and feeding practices are phenomenon that leads to an increase in the rate of malnutrition [7,8]. Demographic and socioeconomic are some of the factors catalyzing this malnutrition. And the calculation of weight-for-age Z score (WAZ) enables appropriate estimates to determine a malnourished child [8].

This study aimed to compare pattern of infectious diseases registered in malnourished children compared to well-nourished children in a free rural primary care clinic in Kiang West District, Gambia. The scientific assumptions on the extent at, which

infection and malnutrition confers, are interesting discipline of studies that required an immediate attention. While malnutrition is proved to cause immune impairment worldwide, the pattern of disease in relation to the age groups and other possible factors needed to be look onto [9]. Apart from the susceptibilities to infections, malnutrition can also cause poor growth and impaired intellect. Apparently, infections can lead to malnutrition and a typical example is parasitic infection among children however, this interrelationship of parasitic infection and malnutrition is still virgin. Based on the reports by World Health Organization (WHO), in a given year; billions are infected by infectious diseases and millions of lives are claimed. Among these are those whose immune systems are impaired and children form a greater percentage. Among the children in particular the poorly nourished have been seen and diagnosed with the most common infectious diseases. In 2011 alone, 12,420 different diseases and health-related ailments were registered worldwide. These data is well recognized by Center for Diseases Control (CDC) [2,3]. Common cold that is considered as mild through the dreadful HIV/AIDS viral infections that estimating kills 14 million since 1980s are in the lieu. Malaria and Tuberculosis still stand distinct among the diseases and registered even an increasing mortality rate [19]. The causes of death among children aged fewer than 5 between 2000 and 2003 can be seen as (Figure 1).



Based on this chart, more than half of these deaths are associated with malnutrition, then the interdependent nature of infectious diseases and poorly nourished children won a scientific ground. According to Child Health Epidemiology Reference Group (CHERG) pneumonia, diarrhea, malaria, measles, are the major causes of death in the first 28 days of life and also among aged 5 and below [10]. While major consideration are on the macro nutrients, Micro nutrient deficiencies have may bring in effects like; poor growth, impaired intellect, and increased mortality and susceptibility to infection [11].

## Methods

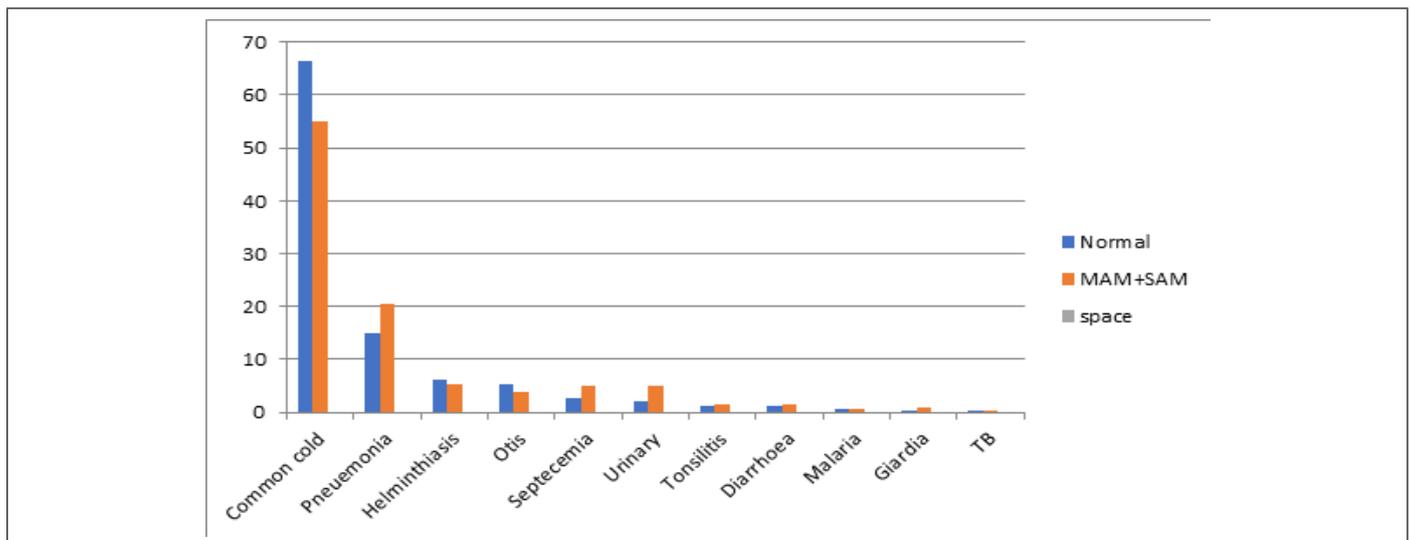
A retrospectively analysis was conducted on the data tapped from Keneba Electronic Medical Records System. These provide all the records of 1 children aged 5 and below seen with ICD-10 codes for various prevalent of infectious diseases between January 2010 and December 2017. Data of children with normal anthropometry characteristics was compared against those with moderate acute malnutrition (WHO z score 2-3) and severe acute malnutrition (WHO z score > 3). These data were thoroughly looking into as to

the frequencies of infectious disease occurrence and on the state of nutrition they occur while making analysis among the well-nourished and under nourished children.

## Results

An interesting outcome was seen in the pattern of diseases during this period of years. Upon contrasting both NAM and SAM, small deviations whose percentages are not significantly enough to represent a scientific fact were observed. However, there are distinct variances in the number of disease occurrence when SEM was compared to well-nourished children. Among all the nutrition conditions, common colds still emerge the most prevalent

infectious diseases, then pneumonia. There need a scientific and epidemiological explanation as these respiratory infections being the most prevalence. Overall, all infectious diseases diagnosed apart from common colds, intestinal helminthiasis and acute otitis media were more common among malnourished children compared to well-nourished children. There was an increasing gradient in relative frequency of pneumonia, HIV, septicemia, UTIs, malaria, giardiasis and tuberculosis from well-nourished through moderate acute malnutrition to severe acute malnutrition. This characteristic pattern of changes is in line with similar studies (Table 1 & 2) (Figure 2).



**Figure 2:** A chart showing Normal versus Malnourished Children aged 5 and under, West Kiang Gambia.

**Table 1:** Infectious diseases pattern among children aged 5 and below, West Kiang Gambia

Diagnosis	Normal		MAM		SAM	
	Number Diagnosed	%	Number Diagnosed	%	Number Diagnosed	%
Common cold	15116	66.31%	1695	59.31%	341	40.07%
Pneumonia	3213	14.09%	543	19.00%	213	25.03%
Helminthiasis	1409	6.18%	156	5.46%	40	4.70%
Otitis	1194	5.24%	109	3.81%	39	4.58%
Septicaemia	584	2.56%	99	3.46%	88	10.34%
Urinary	466	2.04%	108	3.78%	75	8.81%
Tonsillitis	292	1.28%	46	1.61%	6	0.71%
Diarrhoea	266	1.17%	52	1.82%	9	1.06%
Malaria	172	0.75%	18	0.63%	10	1.18%
Giardia	60	0.26%	22	0.77%	8	0.94%
TB	8	0.04%	3	0.10%	13	1.53%
Amoebiasis	7	0.03%	2	0.07%	0	0.00%
Rheumatic Heart Disease	4	0.02%	2	0.07%	0	0.00%
Hepatitis	3	0.01%	0	0.00%	2	0.24%
HIV	2	0.01%	2	0.07%	7	0.82%
Pyelonephritis	1	0.00%	1	0.03%	0	0.00%
Total	22797		2858		851	

**Table 2:** Normal nourished against the malnourished children aged 5 and below, West Kiang Gambia.

Diagnosis	Normal		MAM + SAM	
	Number Diagnosed	%	Number Diagnosed	%
Common cold	15116	66.31%	2036	54.89%
Pneumonia	3213	14.09%	756	20.38%
Helminthiasis	1409	6.18%	196	5.28%
Otitis	1194	5.24%	148	3.99%
Septicaemia	584	2.56%	187	5.04%
Urinary	466	2.04%	183	4.93%
Tonsillitis	292	1.28%	52	1.40%
Diarrhoea	266	1.17%	61	1.64%
Malaria	172	0.75%	28	0.75%
Giardia	60	0.26%	30	0.81%
TB	8	0.04%	16	0.43%
Amoebiasis	7	0.03%	2	0.05%
Rheumatic Heart Disease	4	0.02%	2	0.05%
Hepatitis	3	0.01%	2	0.05%
HIV	2	0.01%	9	0.24%
Pyelonephritis	1	0.00%	1	0.03%
Total	22797		3709	

## Discussion

The relative frequency of prevalent infectious diseases among children of age 5 years and below in this study differed by their state of nutrition. More severe forms of infectious diseases occurred more frequently with worsening malnutrition in children 5 years and below in Kiang West District. The pattern of these diseases among the diagnosis is influenced by the climate type as well. The region lays the burden of tropical climatic and with an average temperature that supports the life cycle of the prevailing pathogen types causing these infections. In line with WHO estimates on the causes of children death, the pattern of diseases registered in this study has evidently put it forward that poorly malnourished children are more susceptible to infectious diseases and the common occurring infections are chiefly the most common infectious diseases.

The increase rate of malaria cannot be addressed by nutrition supplements since despite the interaction between parasitic infections and malnutrition, improved living conditions that will enable less mosquitoes biting is the best approach to eradicating malaria [12]. Since one of the symptoms of chronic malaria is weaken immunity, the impairment of children's immunity confers their vulnerability and hence infectious diseases [13]. The extent to which chronic diarrhea is relating to malnutrition cannot be explain due to the similarities in both the frequencies and the types of bacteria causing gastroenteritis [14,15].

In sub-Saharan-Africa, the rate of HIV has drastically increased since the 80s [16] found out that there is no concrete scientific

connection between HIV and disease pattern among malnourished children in their study to the rate at which HIV infection predisposes children with malnutrition to infectious disease [16,17]. Although there are no significant details at the iron deficiency and infectious diseases however, a study was conducted in Indonesia and a reduced infectious outcome upon receiving the iron supplementation was seen [18]. A similar trend was observed in a vitamin supplement study in malaria's region where no significance was seen based on the malaria occurrence [19,20].

## Conclusion

It can be understood that infections are prominent when the immune response to foreign bodies are undermined. The people at the most vulnerable states are pregnant women and children. While children will depend on the breast-milk of their nursing mother in order to benefit from micro-nutrients, these supplements ought to be made ready for women from gestation through lactating period. The factors that catalyst the speed of vulnerability to infectious diseases among the weaken immunities are imbalance taking of food, poorly nutrient absorption and intermediary metabolism. It came to light that infections are not only related to under nutrition but also over nutrition, to this end hormonal factors as well as cytokine effects should be comparatively studied with malnutrition among the under ages.

With the improving science and technology and the therapeutic diets for example fortified, ready-to-use therapeutic foods (RUTF) that children receive in hospitals that goes with proper medical care, there is a promising intervention that will improve the overall

nutritive level of those under nourished. The pattern of these diseases among the diagnosis is influence by the climate type as well. The region lays the burden of tropical climatic and with an average temperature that supports the life cycle of the prevailing pathogen types causing these infections. International bodies are introducing community-based approaches to decrease the rate of SAM [21].

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