

A REVIEW OF EMPIRICAL LITERATURE ON ECONOMIC AND NON-ECONOMIC DETERMINANTS OF CHILD MALNUTRITION

Rathnayake R.M.L.¹, Semasinghe W.M.² and Gunathilake M.M.³

Abstract

Malnutrition is a burning issue badly affecting the goal of economic development of any country due to inefficient labor supply through an unhealthy nation. Malnutrition among children is a significant point in the malnutrition circle and reducing child malnutrition is a foremost requirement to achieve a healthier nation. Identification of various types of determinants affecting child malnutrition has come forward since it is the initial step in the process of reducing child malnutrition. The objective of this study was to make a review of the past empirical literature on economic and non-economic determinants affecting child malnutrition. The study was based on the historical approach. The sample size for the study was 40 research papers. The sample was selected from the papers published in different kinds of journals from 2005 to 2020 using judgment sampling techniques. Descriptive statistics and content analysis were applied in the data analysis. The results found that 65% of journal articles discussed economic determinants while 75% investigated noneconomic determinants. Family income, wealth index, and employability were found to be the leading economic determinants while gender, age, family size, health services, child illnesses, maternal health, and education were the most important noneconomic determinants as found by the literature. The results may be a guidance for those who are interested in the issue. They may inform the health sector and other authorities where effective future intervention should be improved, to overcome incidences of child malnutrition.

Keywords: Determinants, Economic, Empirical Literature, Logistic Regression, Malnutrition

¹ Department of Economics and Statistics, Sabaragamuwa University of Sri Lanka.

*Corresponding author. Email: rathna@ssl.sab.ac.lk

² Department of Economics, University of Kelaniya, Sri Lanka.

³ Department of Economics, University of Kelaniya, Sri Lanka.

1. Introduction

Adequate nutrition is an essential requirement for a healthy life and better functioning of the human body, and it causes the upward socio-economic development of any country. Malnutrition creates many health and socio-economic complications being a major public health problem in the developmental process, and childhood malnutrition has remained a big challenge in the developing countries. According to WHO (2020), malnutrition is defined as the deficiencies, excesses, or imbalances in a person's intake of energy and/or nutrients. Childhood malnutrition is continuing as a major public health challenge in the developing countries (Fagbamigbe et al., 2020). According to WHO (2020), in the world, 144.0 million of children under 5 years are affected by stunting, 47.0 million and 14.3 million of children under 5 are suffering from wasting and severe wasting respectively while 38.3 million are overweight. Annually, Child undernutrition has caused more than 3 million preventable child deaths. (Cunningham et al., 2015). Combatting child malnutrition breaking the malnutrition cycle is essential for achieving an efficient labor supply for any country for its economic development.

The problem of identifying the determinants affecting child malnutrition has come forward since the identification of determinants is the initial step in the process of reducing child malnutrition. However, the key problem in studying various economic and noneconomic determinants that affect child malnutrition is the absence of a constant theoretic framework or logic to direct identifying any relationship. It is generally believed that lack of money, poverty, and inequality are the major phenomena linked to child malnutrition. However, many researchers have investigated different types of determinants affecting child malnutrition, and a number of research articles have been published on this in the past by many countries in the world. (e.g.: Igbokwe et al., 2017; Khan and Mohanty, 2018; Ghimire et al., 2020). The large volume of publications has provided a strong evidence of the importance of this current issue. This has achieved enormous recognition as an area of investigation among researchers.

However, studies on different kinds of economic and noneconomic determinants of child malnutrition by reviewing previous empirical literature is limited. This study attempted to identify economic and non-economic determinants of child malnutrition by investigating past empirical literature. Besides, the studies on reviewing those past researches were rare to find. A review of empirical literature of what had been studied in the past on determinants of malnutrition may guide those who are interested in the area. The purpose of this study was to accomplish a review of the empirical literature on determinants that effect malnutrition among children by analyzing past empirical literature from 2005 to 2020 to inform them to the health sector and improve the effectiveness of future interventions in the area.

2. Methodology

This study was based on the historical approach of reviewing past empirical literature on the economic and non-economic determinants of child malnutrition. The sampling unit of analysis in this study was the research paper and a sample of 40 research papers published from 2005 to 2020 was selected for the process of reviewing. Judgment sampling technique was employed to select the sample of research papers

for this study due to the absence of the sampling frame and the entire population inaccessible. The electronic search was utilized to search published research papers for this review study by searching the internet resources. The key terms used for filtering published research papers were child malnutrition, economic determinants, demographic, health, social and geographical determinants. Different kinds of journals were the sources for the selected articles of this study. Researchers had investigated many countries. For this study, research articles of case studies were not considered.

3. Results and Discussion

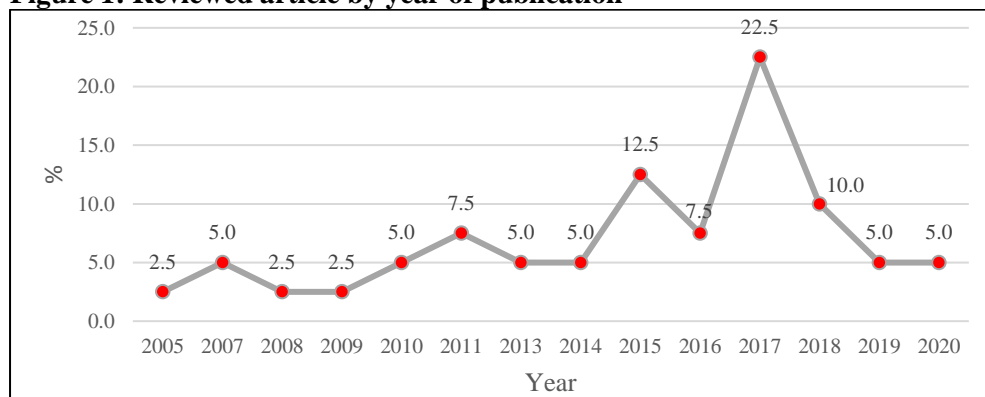
There were numerous studies published on determinants of malnutrition among children. Reviewing them enabled to summarize economic and noneconomic determinants investigated by the previous researchers. The results of this review study were sequenced under three main headings as key characteristics of the reviewed research papers, dependent variable, and independent variables.

3.1 Key characteristics of reviewed research papers

The year of publication, size of the sample, unit of analysis, data collection method, analytical approach, type of journal, country investigated, and statistical tests were the key characteristics of the selected research papers.

3.1.1 Year of publication

Figure 1: Reviewed article by year of publication



Source: Based on literature survey

Research papers published from 2005 to 2020 were selected for the reviewing process in this study. Figure 1 shows that the highest percentage of research papers (22.5%) in the sample have been published in 2017. More than 75% of reviewed papers have been published during the previous ten years, from 2011 to 2020. Due to these recent publications, updated findings on this issue could be reviewed in this study.

3.1.2 Types of journal

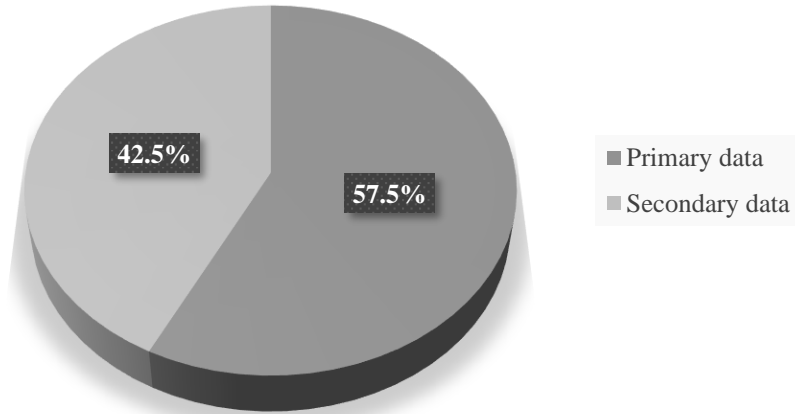
The selected research papers were published in some of the most popular journals including, Global Health, American Journal of Public Health Research, BioMed Research International, BMC Nutrition, Science Journal of Public Health, Annual Nutrition Metab, Maternal and child nutrition, Rural and Remote Health, Journal of Tropical Pediatrics, International Journal of Social Economics and Tropical Agricultural Research.

3.1.3 Country of investigation

Many countries in the world had conducted research on economic and non-economic determinants of child malnutrition. A majority, 60% of the sample of 40 reviewed research papers here, had been conducted in Asian countries. Therefore, the reviewed determinants were more relevant to examine the malnutrition in the Asian countries. The second place was received by African countries showing 35%. In addition, European countries and American countries too had been studied by the researchers. This is an evidence to show that the research on determinants of child malnutrition received a recognition in the world.

3.1.4 Type of data and sample size

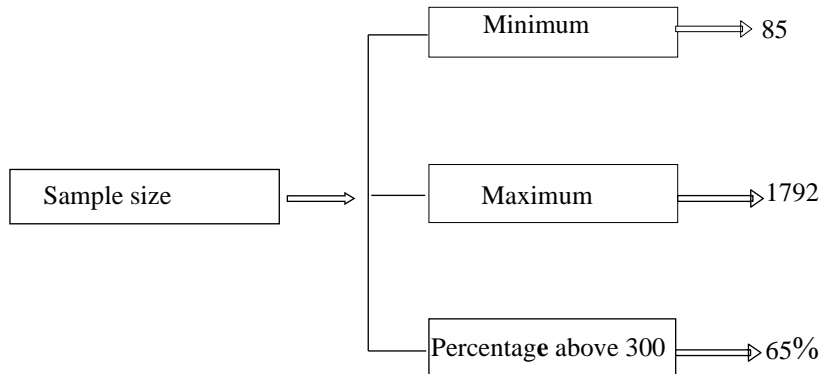
Figure 2: Distribution of the sample by data source



Source: Based on literature survey

Both primary and secondary data sources were employed by the reviewed studies. According to figure 2, the majority of the researchers (57.5%) used primary data while 42.5% used secondary data for their research. This indicates that the source of primary data is most suitable in research related to the determinants of malnutrition among children. The ability to collect only relevant and reliable and data by themselves directly targeting their own research and to overcome the difficulties in handling too many unnecessary data in secondary sources may direct to engagement with primary sources to a great extent.

Figure 3: Range of Sample size



Source: Based on literature survey

As given in figure 3, the size of the sample of primary data-based studies ranged from 85 to 1792. The majority of these studies (65%) employed more than 300 of sample size. An adequate sample size is important in conducting researches depending on the number of independent variables utilized and the analytical method. The reliability of the results and the interpretation may not be satisfied with inadequate size of the sample.

3.1.5 Sampling unit

All reviewed research papers ad considered the child as the sampling unit. The majority of the researchers (80%) had studied under five years children while only 20% was on children in the school age. Sri Lanka had been studied by only 12.5% of studies. The school age children had been investigated by only one study in Sri Lanka. It is clear that the school-age children had received less attention by the researches. School children are at the door of the adolescent group and will play an important role in future labor force that leads to the economic development of a country.

3.1.6 Method of analysis

Considering the analytical methods, binary or multivariate logistic regression techniques were the most popular approaches and 58% of the research studies had been analyzed using these two approaches. The binary nature, suffering or not suffering from malnutrition for the response variable, may be the key reason for this. Besides, different types of approaches such as the discriminant analysis, structural equation model, log linear model, t-test, chi-square test and ANOVA also had been applied.

3.2. Dependent variable- Malnutrition

The dependent variable or the response variables for this study was the child malnutrition. It played the main role in the discussion made through this reviewed study. Different malnutrition indices used to indicate nutritional status were applied to measure the dependent variable.

According to Setboonsarng (2005), nutritional level of a child is usually assessed in three ways: using anthropometric indicators (measurement of growth and body composition); using biochemical indicators (analysis of the biochemical content of blood and urine); and using clinical indicators (clinical examination of external physical signs of nutrient deficiencies). Anthropometric measurement is the most popular and easy method to measure child's health and nutritional status. With international consistency, popular malnutrition indices under anthropometric measurements are Birth Weight (malnutrition at birth), WFA (Weight for Age): underweight, HFA (Height for Age): stunting, WFH (Weight for Height): wasting, and Body Mass Index (BMI). Research papers in this review had utilized one or more of these indices for the assessment of child malnutrition.

Table 1: Indices applied by reviewed studies to measure malnutrition

| Index | BMI | WFH | WFA | HFA | MUAC | Others |
|------------|-----|-----|-----|-----|------|--------|
| Count | 6 | 7 | 9 | 11 | 4 | 2 |
| Percentage | 15 | 18 | 23 | 28 | 10 | 5 |

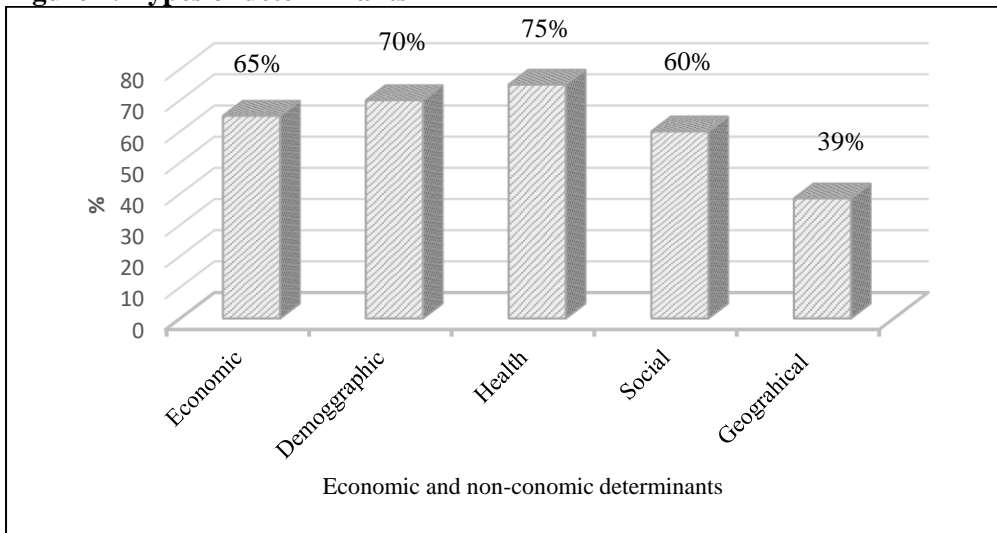
Source: Based on literature survey

The highest percentage of research studies had measured child malnutrition in terms of stunting (HFA). It is obvious that three indices, HFA, WFA and WFH were dominating in the context.

3.3 Independent variables- determinants of malnutrition

Independent variables used in the research articles considered for reviewing were determinants of malnutrition. Various economic and noneconomic factors investigated by researchers to influence child malnutrition had been paid the key attention through this discussion. According to the empirical literature, basically, the presence of two categories of determinants was evident as economic and non-economic determinants. Child malnutrition had been commonly investigated as an economic issue associated with household income. However, it was found several other factors too that were linked with child malnutrition belonged to the non-economic category. The non-economic category includes four main clusters namely, demographic factors, health factors, social factors, and geographical factors.

Figure 4: Types of determinants



Source: Based on literature survey

Figure 4 shows the distribution of reviewed articles according to the category of determinants. The majority of the researchers in the sample, 75% had paid their attention to health factors. Demographic factors and economic factors were investigated in 70% and 65% of total articles respectively while less attention has been retained by geographical factors recording 35%.

3.3.1 Economic determinants

Economic determinants had been studied by 65% of the reviewed research papers. Yadav and Dixit (2017) indicated that the socio-economic status of parents is significantly associated with the nutritional status of children. Low socioeconomic status had made a significant impact in deciding the incidence of malnutrition among children according to Hossain et al. (2020), Getaneh et al. (2019) and Pravana et al. (2017).

Family income

Income is a key factor attached to the group of economic determinants. Family income or paternal income had been investigated by 42.3% of journal articles which considered economic factors and for 91.7% of them, family income was found to be significant. According to Ayana et al. (2015), Cheah et al. (2010) and Oliveira Assis et al. (2008), malnutrition was significantly associated with household income. As observed by Kabir et al. (2018), Tette et al. (2016), Zhang et al. (2016), having lower family incomes increased the risk of having malnutrition in their children.

In the Sri Lankan context, Galgamuwa et al. (2017), Keerthiwansa et al. (2014) and Rathnayake and Weerahewa (2005) investigated that low income appeared to be an important factor associated with child malnutrition in Sri Lanka. In contrast, income had built an insignificant relationship with nutritional status according to Ubeysekara et al. (2015).

Wealth index

The wealth index had been identified as an important factor among economic determinants. According to Getaneh et al. (2019), Chowdhury et al. (2018), Das and Gulshan (2017) and Endris et al. (2017), the children in lower wealth index were more prone to be malnourished than those who were in upper socioeconomic class. Habyarimana et al. (2016) identified the wealth index of the household as the key determinant of malnutrition in the study of under five-year children in Rwanda.

Employability

Employability is another economic factor influence for child malnutrition. Das and Gulshan (2017) and Duru et al. (2015) revealed that a mother's occupation was a significant factor affecting the nutritional status of children. The paternal occupation was found as a significant in both studies of Ayana et al. (2015) and Duru et al (2015).

Other economic related factors

A few studies talked about poverty, household expenditure, child labor or home-care activity, some economic decisions and policies and housing condition such as the number of rooms, wall type, roof type and floor type of the house was made from. Cheah et al. (2010) found that total expenditure had a significant impact on malnutrition among children. Khan and Mohanty (2018) suggested that the poverty of households was a strong and significant predictor of the incidence of malnutrition. Ali Khan and Azid, (2011) examined that the chance for anthropometric failure is increased by the child's activity (child labor or home-care activity).

Considering the housing condition, a considerable investigation had not been made by the researchers of reviewed studies. For the studies that investigated housing condition too, the relationship was not significant (type of roof, type of wall). However, Cheah et al. (2010) verified the number of rooms in the house had a significant effect on malnutrition. Kandala et al. (2011) pointed out that economic decision to sell more than the population consumes may cause to increase in childhood malnutrition.

3.3.2 Non-Economic determinants

In addition to economic determinants, noneconomic determinants too are responsible for child malnutrition. Noneconomic determinants including demographic, health, social, and geographical factors had been studied by 75% of the reviewed research papers.

3.3.2.1 Demographic factors

Considering non-economic determinants, demographic factors made a significant contribution in determining child malnutrition. According to this study, 70% of researchers had investigated demographic factors. Rahman and Chowdhury (2007) pointed out that the demographic characteristics appeared to be the most significant factor for malnutrition among children.

Gender

Gender had established different, significant, insignificant, positive, and negative relationships with malnutrition. Gebre et al. (2019), Dodos et al. (2018), Igbokwe et al. (2017) and Habyarimana et al. (2016) revealed that gender was significantly associated with nutritional status of children. Zhang et al. (2016), Duru et al. (2015), Demissie and Worku (2013) and Linnemayr et al. (2008) concluded that being a boy appeared to increase malnutrition compared to being a girl. In contrast, being a girl was significantly associated with increased prevalence of malnutrition of the children as found by Hossain et al. (2020), Yadav and Dixit (2017), and Ali Khan and Azid, (2011). However, according to Ahsan et al. (2017), there was no significant difference between girls and boys in the incidence of underweight.

Considering gender, regarding Sri Lanka, Galgamuwa et al. (2017), investigated that being the male children appeared to be an important factor associated with undernutrition of preschool children, but the opposite was found for the group of school children. Ubeysekara et al. (2015) revealed that the gender of the child was associated with malnutrition among children, and it was significantly higher among boys than girls. However, according to Keerthiwansa et al. (2014), sex was not associated with the degree of malnutrition.

Child's age

Age is another key determinant related to malnutrition. According to Igbokwe et al. (2017), Das and Gulshan (2017), Yadav and Dixit (2017), Habyarimana et al. (2016), and Rahman and Chowdhury (2007), age had a significant influence on the nutritional status of children. As found by Ghimire et al. (2020), Zhang et al. (2016) and Sargana and Mohyuddin (2013), decreasing in the age was more likely to increase malnourishment of children. In contrast, in the study conducted by Getaneh et al. (2019), Endris et al. (2017), Aheto et al. (2015), Ali Khan and Azid, (2011), and Oliveira Assis et al. (2007), increasing age of the child was associated with malnutrition. However, Duru et al. (2015), pointed out that variation of age with low weight for age is not statistically significant. Regarding the Sri Lankan situation, Ubeysekara et al. (2015) revealed that the age of the child was associated with malnutrition among children.

Age of mother and household head

The mothers' age too had a significant influence on child malnutrition. Pravana et al. (2017) and Habyarimana et al. (2016) revealed that the mother's age at childbirth is a key determinant of malnutrition among children. Further, Linnemayr et al. (2008) too found that children of mothers who were 20 years of age or less when giving birth had lower nutritional status. Moreover, in the bivariate analysis, Tette et al. (2016) identified that the mother's age at pregnancy and Mother's current age had a relationship with malnutrition.

According to Getaneh et al. (2019), the risk of malnutrition among children increased with the age of their mothers. Kabir et al. (2018) too examined that younger mothers were more prone to have a malnourished child than their older counterparts in the study of Adivasi children age 24 – 59 months in Bangladesh. According to

Rahman and Chowdhury (2007) age of the household's head was significantly associated with malnutrition.

Family size

Malnutrition was associated with family size as revealed by Ghimire et al. (2020), Fagbamigbe et al. (2020), Gebre et al. (2019), and Ayana et al. (2015). According to Rahman and Chowdhury (2007), the number of under-5 children was significantly associated with severe as well as moderate stunting. Moreover, Chowdhury et al. (2018) and Ahsan et al. (2017) found that increase in the number of children in a household was a risk factor of child malnutrition. Similarly, in Sri Lanka, Galgamuwa et al. (2017) investigated that living with a large number of family members appeared to be an important factor associated with undernutrition of school children in the Sri Lankan plantation community in Sri Lanka. According to Rathnayake and Weerahewa (2005), undernourished children came from relatively larger families.

Multiple birth and birth interval

Habyarimana et al. (2016) and Aheto et al. (2015) showed that the occurrence of multiple births was a key determinant of child malnutrition. According to Linnemayr et al. (2008), being a twin was associated with lower anthropometric measures while being the younger of two siblings less than 36 months exerts a positive influence on child nutritional status.

According to Pravana et al (2017), the birth interval established a significant relationship with severe acute malnutrition among children. Fagbamigbe et al. (2020) and Endreis et al. (2017) illustrated that a born with a short birth interval was related to increased malnutrition. Considering Sri Lanka, Jayawardena (2015) showed that frequent births exert a strong impact on the long-term nutritional status of children.

Birth order

According to Habyarimana et al. (2016) and Rahman and Chowdhury (2007), birth order was significantly associated with a child's nutritional status. Ali Khan and Azid (2011) finalized the probability for anthropometric failure increased by birth-order. In the unadjusted logistics regression model, Ghimire et al. (2020) reported that order of birth greater than two was a significant predictor of severe acute malnutrition among children. However, in the same study (Ghimire et al., 2020), for the adjusted model, no evidence was found to have a relationship between birth order and severe acute malnutrition among children. Considering the plantation community in Sri Lanka, Galgamuwa et al. (2017) investigated that high birth orders appeared to be an important factor associated with undernutrition of preschool children.

Ethnicity

Kabir et al. (2018) demonstrated significant disparities of malnutrition among different ethnic groups. Similarly, in the unadjusted logistics regression model, Ghimire et al. (2020) reported that Madhesi ethnicity was a significant predictor of severe acute malnutrition among children. However, in the same study (Ghimire, et al., 2020), for the adjusted model, no evidence was found to have a relationship between ethnicity and severe acute malnutrition among children. For Sri Lanka,

ethnicity was not associated with the degree of malnutrition in the study of malnutrition and anemia among hospitalized children in Vavuniya (Keerthiwansa et al., 2014).

3.3.2.2 Health factors

Health factors are another key non-economic determinant responsible for malnutrition. The highest percentage, 75% of studies reviewed in this study was recorded for health factors.

Health services and vaccination

According to Fagbamigbe et al. (2020), healthcare service was the main attribute to the nutritional status of urban children. According to Linnemayr et al. (2008), health facility presence had a positive and statistically significant impact on nutritional status. Ahsan et al (2017), explored that vaccinated children were less likely to be malnourished. According to Ahsan and et al (2017) and Rahman and Chowdhury (2007), the vaccine was significantly associated with child malnutrition. Despite this, Dodos et al. (2018) pointed out that traditional healing practices had a significant relationship with malnutrition.

Child illnesses and morbidity

Getaneh et al. (2019) and Gebre et al. (2019) had built a significant relationship between child illness and malnutrition. According to Dodos et al. (2018), recent morbidity was found to be associated with severe acute malnutrition and moreover, the presence of diarrhea, fever and vomiting were identified as significant factors for severe acute malnutrition. Episodes of diarrhea and child anemia were associated with malnutrition of the children as experienced by Hossain et al. (2020) and Getaneh et al. (2019) respectively. Habyarimana et al. (2016) pointed out that the incidence of fever and incidence of anemia are key determinants of malnutrition of children under age five in Rwanda. Respiratory sickness was strongly related to the wasting of children according to Rahman et al. (2009). Ayana et al. (2015) found that wasting was significantly associated with the presence of diarrhea and febrile illness. Hannah et al. (2017) investigated the prevalence of malnutrition and its association with hypertension and microalbuminuria of school-age children. Moreover, Ahsan et al. (2017) explored that the mortality of a child in the last 6 months in the family was more likely to be malnourished.

Maternal health

Debnath and Bhattacharjee (2014) found that maternal health as a variable that interrelates with wealth index to determine child malnutrition and receiving antenatal care by mothers from a health professional caused to reduce the incidence of malnutrition. It further showed that having low maternal malnutrition demonstrated a low incidence of child malnutrition. Dodos et al. (2018) showed that maternal undernutrition seemed to have a high risk of getting malnutrition for their children.

According to Rahman et al. (2009), poor maternal nutrition level was associated with a higher risk of wasting. Das and Gulshan (2017) found that underweight mothers as a key factor for malnutrition in all three terms of stunting,

wasting, and underweight. However, in both the bivariate and multivariate analyses, there was no evidence of an association between complications during pregnancy and malnutrition (Tette et al., 2016).

Mother's Body Mass Index

Khan and Mohanty (2018), Habyarimana et al. (2016), Rahman and Chowdhury (2007) illustrated that the BMI of the mother is a key determinant of malnutrition among children. Aheto et al. (2015) concluded that an increase in a mother's body mass index is associated with decreased childhood malnutrition. Rahman and Chowdhury (2007) showed that a mother's height was strongly related to child malnutrition. However, in both the bivariate and multivariate analyses, there was no evidence of an association between mother's BMI and malnutrition (Tette et al., 2016).

Breastfeeding

As found by Debnath and Bhattacharjee (2014), breastfeeding practice was the most important factor that affects child malnutrition. Cheah et al. (2010) and Rahman and Chowdhury (2007) indicated that breastfeeding had significant effects on childhood malnutrition. Ayana et al. (2015) found that nutritional status as measured by wasting was significantly associated with time breastfeeding initiated and duration the child exclusively breastfed. According to Hossain et al. (2020), breastfeeding practices for more than 6 months reduced the likelihood of severe acute malnutrition of the children. Ghimire et al. (2020) and Dodos et al. (2018) established a significant relationship between no exclusive breastfeeding practices and malnutrition among children. Ahsan et al. (2017) explored that absence of breastfeeding as a significant factor influenced stunting and breastfed children were less likely to be malnourished. However, according to Pravana et al. (2017), initiation of breastfeeding, colostrum feeding, and exclusive breastfeeding were not significantly associated with severe acute malnutrition among children. Similarly, in the adjusted model, no evidence was found to have a relationship between exclusive breastfeeding practices and severe acute malnutrition among children by Ghimire et al. (2020).

Food security

Household food insecurity built a significant relationship with malnutrition among children as established by Ghimire et al. (2020), Getaneh et al. (2019), and Mustari et al. (2017). According to Fagbamigbe et al. (2020), a balanced meal was the main attribute to the nutritional status of urban children. According to Dodos et al. (2018), food insecurity showed an association with severe acute malnutrition in bivariate analysis, and low household food diversity increased the severe acute malnutrition among children in the multivariate analysis. In the same study, the type of complementary meal introduced and age when the first complimentary meal was introduced (≤ 6 months) was found to be associated with severe acute malnutrition. Hossain et al. (2020) and Pravana et al. (2017) revealed that complementary or dietary feeding were linked to child malnutrition. Rahman and Chowdhury (2007) concluded that malnutrition in children was significantly associated with supplementation of the diet with liquids. Dietary caloric availability was associated

with the underweight of children (Oliveira Assis et al., 2008). According to Chowdhury et al. (2018), consumption of non-iodized salt caused high risk of severe underweight among children. Cheah et al. (2010) indicated that calorie intake had significant effects on malnutrition in a rural area, Kelantan, Malaysia. BMI of children was normal whose eating was regular was found by Sargana and Mohyuddin (2013).

Drinking water

Considering water sources and drinking water, Getaneh et al. (2019), Mustari et al. (2017), Habyarimana et al. (2016), Ayana et al. (2015) and Ali Khan and Azid, (2011) demonstrated that water sources appeared to be linked with child malnutrition. According to Fagbamigbe et al. (2020), portable water was the main attribute to the nutritional status of urban children. However, according to Dodos et al. (2018), water quality was not significant to be associated with severe acute malnutrition.

3.3.2.3 Social factors

Social factors had received substantial importance among non-economic determinants of child malnutrition. According to this study, 60% of researches investigated social factors.

Education

Education was the key social factors related to malnutrition as found by this study. Sargana and Mohyuddin (2013) and Rahman and Chowdhury (2007) showed that parents' education or family education was strongly related to child malnutrition. Ghimire et al. (2020), Getaneh et al. (2019), Gebre et al. (2019), Chowdhury et al. (2018), Igbokwe et al. (2017), Das, and Gulshan (2017), Endris et al. (2017), Tette et al. (2016), Habyarimana et al. (2016), Duru et al. (2015). Ayana et al. (2015), Aheto et al. (2015), Ali Khan and Azid, (2011) identified that a mother's education level had a relationship with malnutrition. Ahsan et al. (2017) explored that illiteracy of mother as a significant factor influenced the prevalence of stunting and child of an illiterate mother was more likely to be malnourished than a child of literate mothers. Dodos et al. (2018) and Mustari et al. (2017) demonstrated that the education of caretakers was linked to child malnutrition. Zhang et al. (2016) and Linnemayr et al. (2008) found evidence of a positive impact of female education on nutrition.

Pravana et al. (2017) found that a mother's educational level was not significantly associated with severe acute malnutrition among children. Similarly, in the adjusted model, no evidence was found to have a relationship between mother's education level and severe acute malnutrition among children by Ghimire et al. (2020). Fathers' education was significantly associated with malnutrition (Getaneh et al., 2019, Chowdhury et al., 2018, Igbokwe et al., 2017, Pravana et al. 2017, Das and Gulshan, 2017 and Ayana et al., 2015).

Considering Sri Lanka, Rathnayake and Weerahewa (2005) found that mothers of undernourished children were not well educated. Keerthiwansa et al. (2014) examined that having malnutrition was associated with both lower maternal and paternal education. Galgamuwa et al. (2017) and Jayawardena (2015) suggested

that educated and knowledgeable mothers might have better practices to reduce the malnutrition of their children.

Marital status

Marital status was one of the significant social factors related to malnutrition. According to Dodos et al. (2018), the marriage status of not married/ lives alone of caretakers or mothers was more likely to be acutely malnourished compared to their counterparts. Dodos et al. (2018) and Tette et al. (2016) observed that being unmarried increased the prevalence of malnutrition of their children. Oliveira Assis et al. (2008) found that a family headed by a woman was the main determinant of child malnutrition.

Housing condition

According to Fagbamigbe et al. (2020), improved housing schemes were the main attributes to the nutritional status of urban children. Malnutrition was positively related to congestion in the household (number of household members per room). (Ali Khan & Azid, 2011). According to Ali Khan and Azid (2011) provision of electricity and underground drainage turned out to be negatively affecting children's malnutrition.

Other social factors

Considering the different habits, Getaneh et al. (2019) indicated that alcohol drinking habits at home appeared to have more risk of increasing child wasting than their counterparts. Getaneh et al. (2019) further found that tea taking habits of the children decreased the probability of stunting. Mass media exposure was strongly related to the wasting of children and children whose mothers were not exposed to any mass media had a higher risk of becoming acutely malnourished (Rahman & Chowdhury, 2007 and Rahman et al., 2009). Tette et al. (2016) declared that mothers not having heard of social services were more likely to have malnutrition in children than those who heard of such services according to the bivariate analysis. In the Sri Lankan context, Keerthiwansa et al. (2014) concluded that being in a socially deprived group increased the degree of malnutrition.

3.3.2.4 Geographical factors

Considering geographical factors accountable for the noneconomic group, Regional disparities were observed by Endris et al. (2017) and Rahman and Chowdhury (2007) and regional disparities established a significant association with child malnutrition. Kandala et al. (2011) identified that the geographical location was affecting the nutritional status of the children among the age of five in the Democratic Republic of Congo.

Ayana et al. (2015) and Debnath and Bhattacharjee (2014) found that the place of residence was an important variable to determine child malnutrition. According to Fagbamigbe et al. (2020), Das and Gulshan (2017), and Kandala et al. (2011), the living sector was found as a key factor for malnutrition. Zhang et al. (2016) and Ali Khan and Azid (2011) found that being least urbanized was more likely to suffer from malnutrition. According to Habyarimana et al. (2016) and

Kandala et al. (2011), the province was a key determinant of malnutrition among children. Chowdhury, et al. (2018) found that living in the Sylhet division in Bangladesh was a risk factor for a child severely underweight indicating the significance of the geographical factor. Khan and Mohanty (2018) suggested a spatial heterogeneity, spatial dependence, and clustering of child malnutrition in districts of India.

Considering geographical characteristics and malnutrition in Sri Lanka, significant disparities of malnutrition among the provinces were identified by Jayawardena (2015) and Rathnayake and Weerahewa (2005). Further, Jayawardena (2015) showed that the highest number of babies with low birth weight were recorded for the estate sector

4. Conclusion

Many research articles had investigated determinants on child malnutrition and a large volume of publications were available on this. More than 75% of reviewed papers belonged to the immediate last ten years, from 2011 to 2020. Bivariate or multivariate logistic regression technique had been adopted by most of the studies as a popular approach to fit a model on malnutrition determinants where the dependent variable is with categorical nominal scale, like suffering or not suffering from malnutrition. The sample size was over 300 for 65% of reviewed studies suggesting a justifiable sample size for reliable interpretation. Less attention had been paid to school children and motivating the researchers is suggested to study the determinants of malnutrition focusing school children since they are the immediate group critical for the future labor force that contributes to country development.

Basically, the presence of two categories of determinants of child malnutrition is evident as economic and non-economic determinants. Considering economic determinants, family income, wealth index, and employability are the leading factors associated with child malnutrition and having lower family incomes increases the risk of having malnutrition in their children according to the previous literature. Furthermore, it was found that there were several other issues too that were linked with child malnutrition related to determinants which belonged to the non-economic category. The non-economic category includes four main types of determinants namely, demographic factors, health factors, social factors, and geographical factors. Gender, age, and family size are the most important demographic factors, and being a boy was more prone to malnutrition than being a girl. In contrast, being a girl was significantly associated with an increased prevalence of malnutrition in children in a few studies. Health services, child illnesses, and maternal health are some of the key health factors associated with child malnutrition. The most important social factor is the education. Especially, mother's education is strongly related to the malnutrition of their children while housing condition had not been significant in many of the reviewed research papers. Many studies found a relationship between malnutrition and geographical factors such as region, sector, province, and district. It was evident that being least urbanized was more likely to suffer from malnutrition than their urban counterpart.

These findings inform the health sector and relevant authorities of what kind of determinants should be addressed and where the effective future intervention

should be to reduce the incidences of child malnutrition. These finding may direct future researchers too who are interested in the area. Also, the findings identified that the less attention was paid by the reviewed studies to the different determinants related to the school children. Motivating the future researchers is suggested to study the economic and non-economic determinants and malnutrition focusing school age children since they are the immediate group critical for the future labor force that contributes to country development.

References

- Ahsan, S., Mansoori, N., Mohiuddin, S., Mubeen, S., Saleem, R., & Irfanullah, M. (2017). Frequency and determinants of malnutrition in children aged between 6 to 59 months in district Tharparkar, a rural area of Sindh. *Journal of the Pakistan Medical Association*, 67(9), 1369-1373.
- Aheto, J., Keegan, T., Benjamin M., Taylor, B., & Diggle, P. (2015). Childhood malnutrition and its determinants among under-five children in Ghana. *Paediatric and Perinatal Epidemiology*, 29(6), 552-561. <https://doi.org/10.1111/ppe.12222>.
- Ali Khan, R., & Azid, T. (2011). Malnutrition in primary school-age children: A case of urban and slum areas of Bahawalpur, Pakistan. *International Journal of Social Economics*, 38(9), 748-766. <https://doi.org/10.1108/03068291111157221>.
- Ayana, A. B., Hailemariam, T.W. & Melke, A. S. (2015). Determinants of acute malnutrition among children aged 6–59 months in public hospitals, Oromia region, West Ethiopia: a case–control study. *BMC Nutrition*, 1(34), 1. <https://doi.org/10.1186/s40795-015-0031-9>.
- Cheah, W. L., Abdul Manan, W. W., & Zabidi-Hussin, Z. A. M. H. (2010). A structural equation model of the determinants of malnutrition among children in rural Kelantan, Malaysia. *Rural and Remote Health*, 10(1), 1248.
- Chowdhury, T. R., Chakrabarty, S., Rakib, M., Saltmarsh, S., & Devis, K.A. (2018). Socio-economic risk factors for early childhood underweight in Bangladesh. *Global Health*, 14(1) 54. <https://doi.org/10.1186/s12992-018-0372-7>
- Cunningham, K., Ruel, M., Ferguson, E., & Uauy, R. (2015). Women's empowerment and child nutritional status in South Asia: a synthesis of the literature. *Maternal and child nutrition*, 11(1), 1-19. <https://doi.org/10.1111/mcn.12125>
- Das, S., & Gulshan, J. (2017). Different forms of malnutrition among under five children in Bangladesh: a cross sectional study on prevalence and determinants. *BMC Nutr* 3(1), 1, <https://doi.org/10.1186/s40795-016-0122-2>.
- Dasa, J. K., Lassib, Z. S., Hoodbhoya, Z., & Salama, R. A. (2018). Nutrition for the next generation: older children and adolescents. *Ann Nutr Metab*, 72(3), 56–64, <https://doi.org/10.1159/000487385>

- Debnath, A., & Bhattacharjee, N. (2014). Factors associated with malnutrition among tribal children in India: A non-parametric approach. *Journal of Tropical Pediatrics, 60*(3), 211–215. <https://doi.org/10.1093/tropej/fmt106>.
- Demissie, S., & Worku, A. (2013). Magnitude and factors associated with malnutrition in children 6-59 months of age in pastoral community of Dollo Ado District, Somali Region, Ethiopia. *Science Journal of Public Health, 1*(4), 175-183. <https://doi.org/10.11648/j.sjph.20130104.12>
- Dodos, J., Altare, C., Bechir, M., Miyatt, M., Pedro, B., Bellet, F., Lapegue, J., Peeters, J. & Altmann, M. (2018). Individual and household risk factors of severe acute malnutrition among under-five children in Mao, Chad: a matched case-control study. *Arch Public Health, 76*(1), 35. <https://doi.org/10.1186/s13690-018-0281-5>
- Duru, C. B., Oluoha, U. R., Uwakwe, K. A., Diwe, K. C., Merenu, I. A., Chigozie, I .O., & Iwu, A.C. (2015). Prevalence and sociodemographic determinants of malnutrition among under-five children in rural communities in Imo State, Nigeria. *American Journal of Public Health Research, 3*(6), 199-206. <https://doi.org/10.12691/ajphr-3-6-1>.
- Endris, N., Asefa, H., & Dube, L. (2017). Prevalence of malnutrition and associated factors among children in rural Ethiopia. *BioMed Research International, 2017*:6 <https://doi.org/10.1155/2017/6587853>
- Fagbamigbe, A.F., Kandala, N.B., & Uthman, A.O. (2020). Demystifying the factors associated with rural–urban gaps in severe acute malnutrition among under-five children in low- and middle-income countries: a decomposition analysis. *Sci Rep, 10*, 1-15. 11172. <https://doi.org/10.1038/s41598-020-67570-w>
- Galgamuwa, L.S., Iddawela, D., Dharmaratne, S.D., & Galgamuwa, G.L.S. (2017). Nutritional status and correlated socio-economic factors among preschool and school children in plantation communities, Sri Lanka. *BMC Public Health, 17*, 377. <https://doi.org/10.1186/s12889-017-4311-y>
- Gebre, A., Reddy, P.S., Mulugeta, A.Y., & Kahssay, M., (2019). prevalence of malnutrition and associated factors among under-five children in Pastoral Communities of Afar Regional State, Northeast Ethiopia: A community-based cross-sectional study. *Journal of Nutrient and Metabolism, 2019*, Article ID 9187609. <https://doi.org/10.1155/2019/9187609>
- Getaneh, Z., Melku, M., Geta, M., Melak, T., & Hunegnaw, M. T. (2019). Prevalence and determinants of stunting and wasting among public primary school children in Gondar town, northwest, Ethiopia. *BMC Pediatr, 19*, (1), 1-11. <https://doi.org/10.1186/s12887-019-1572-x>
- Ghimire, U., Aryal, B.K., Gupta, A.K., & Sapkota, S. (2020). Severe acute malnutrition and its associated factors among children under-five years: a facility-based cross-sectional study. *BMC Pediatr, 20*(1), 1-9, <https://doi.org/10.1186/s12887-020-02154-1>

- Habyarimana, F., Zewotir, T., & Ramroop, S. (2016). Key determinants of malnutrition of children under five years of age in Rwanda: simultaneous measurement of three anthropometric indices. *African Population Studies*, 30(2), 2328-2340. <http://dx.doi.org/10.11564/30-2-836>
- Hannah R.A, Sekarwana, N., & Effendi, S.H. (2017). Prevalence of moderate malnutrition in school-age children and its association with hypertension and microalbuminuria. *American Journal of Clinical Medicine Research*, 5(1), 6-9 <http://pubs.sciepub.com/ajcmr/5/1/2> DOI:10.12691/ajcmr-5-1-2
- Hossain, A., Niroula, B., Duwal, S., Ahmed, S., & Kibria, M.G. (2020). Maternal profiles and social determinants of severe acute malnutrition among children under-five years of age: A case-control study in Nepal. *Heliyon*, 6(5). <https://doi.org/10.1016/j.heliyon.2020.e03849>
- Igbokwe, O., Adimorah, G., Ikofuna, A., Ibeziako, N., Ubesie, A., Ekeh, C., & Iloh, K. (2017). Socio-demographic determinants of malnutrition among primary school aged children in Enugu, Nigeria. *Pan African Medical Journal*, 28(1), 248. <https://doi.org/10.11604/pamj.2017.28.248.13171>
- Jayawardena, P. (2015). Socio-economic determinants and inequalities in childhood malnutrition in Sri Lanka. *Well-Being and Social Policy Journal*, 8(1), 1-22.
- Kabir, M. R., Rahman, M., Mamun, M. A., & Islam, H. (2018). Prevalence of malnutrition and associated factors affecting the nutritional status of Adivasi (tribal) children aged 24-59 months in Bangladesh. *Asian Journal of Medical and Biological Research*, 4(2), 178-185. <https://doi.org/10.3329/ajmbr.v4i2.38253>
- Kandala, N., Madungu, T.P., Emina, J.B., Nzita, K.P. & Cappuccio, F.P. (2011). Malnutrition among children under the age of five in the Democratic Republic of Congo (DRC): does geographic location matter?. *BMC Public Health* 11: 261. <https://doi.org/10.1186/1471-2458-11-261>
- Keerthiwansa, J., Gajealan, S., Sivaraja, S., & Subashiniv, K.Y, (2014), Malnutrition and anaemia among hospitalised children in Vavuniya. *Ceylon Medical Journal*, 59(04), 141-143.
- Khan, J., & Mohanty, S.K. (2018). Spatial heterogeneity and correlates of child malnutrition in districts of India. *BMC Public Health*, 18, 1027, 1-13. <https://doi.org/10.1186/s12889-018-5873-z>
- Kulaga, Z., Litwin, M., Tkaczyk, M., Rózdzyńska, A., Barwicka, K., Grajda, A., Świąder, A., Gurzkowska, B., Napieralska, E. & Pan, H. (2010). The height-, weight-, and BMI-for-age of polish school-aged children and adolescents relative to international and local growth references. *BMC Public Health*, 10, 109. <https://doi.org/10.1186/1471-2458-10-109>
- Linnemayr, S., Alderman H, & Ka, A. (2008). Determinants of malnutrition in Senegal: individual, household, community variables, and their interaction. *Economics & Human Biology*, 6(2), 252-263. <https://doi.org/10.1016/j.ehb.2008.04.003>

- Magalhães, R.J.S., & Clements, A.C.A. (2011). Mapping the risk of anaemia in preschool-age children: The contribution of malnutrition, malaria, and helminth infections in West Africa. *PLoS Med*, 8(6), e1000438. <https://doi.org/10.1371/journal.pmed.1000438>
- Mustari, S., Hossain, I., Khatun, K., Ali, M.S., Rahman, H., Mondal, A., Arif Iqbal, M., Neshad, N.I. & Islam, S. (2017). Prevalence and determinants of malnutrition among poor women and children in the South-West Region of Bangladesh. *IOSR Journal of Pharmacy and Biological Sciences*, 13(4), 62-69. DOI: 10.9790/3008-1304036269
- Oliveira Assis, A., Barreto, M. L., De Oliveira, L. M., De Oliveira, V., Prado, M. D. S., Gomes, G.D.S., Pinheiro, S.M.C., Santos, N.S.D, Da Silva, R.D.C.R., Sampaio, L.R. & Santos, L. P. (2008). Determinants of mild-to-moderate malnutrition in preschoolers in an urban area of Northeastern Brazil: A hierarchical approach. *Public Health Nutrition* 11(4), 387-394. doi:10.1017/S1368980007000390 <https://doi.org/10.1017/S1368980007000390>
- Pravana, N.K., Piryani, S., Chaurasiya S.P., Kawan, R., Thaoa, R.K., & Shresta, S., (2017). Determinants of severe acute malnutrition among children under 5 years of age in Nepal: a community-based case-control study, *BMJ Open*, 7(8), <http://dx.doi.org/10.1136/bmjopen-2017-0170>
- Rahman, A., & Chowdhury, S. (2007). Determinants of chronic malnutrition among pre-school children in Bangladesh. *Journal of Biosocial Science*, 39(02), 161-173 doi:10.1017/S0021932006001295
- Rahman, A., Chowdhury, S., & Hossain, D. (2009). Acute malnutrition in Bangladeshi children: levels and determinants. *Asia Pacific Journal of Public Health (APJPH)*, 21(3), 294-302. <https://doi.org/10.1177/1010539509335399>
- Rathnayake, I.M., & Weerahewa, J. (2005). Determinants of nutritional status among pre-school children in Sri Lanka. *Tropical Agricultural Research*, 17, 148-161
- Sargana, S.I., & Mohyuddin, A. (2013). Malnutrition among school going children in Pakistan. *Indian Journal of Health and Wellbeing*, 4(9), 1654-1659.
- Setboonsarng, S., (2005). Child malnutrition as a poverty indicator: An evaluation in the context of different development interventions in Indonesia1, ADB Institute Discussion Paper No. 21
- Tette, E.M.A., Sifah, E.K., Nartey, E.T., Nuro-Ameyaw, P., Tete-Donkor, P., & Biritwum, R.B. (2016). Maternal profiles and social determinants of malnutrition and the MDGs: What have we learnt?. *BMC Public Health*, 16(1), 214. <https://doi.org/10.1186/s12889-016-2853-z>
- Ubeysekara, N.H., Jayathissa, R., & Wijesinghe C.J. (2015). Nutritional status and associated feeding practices among children aged 6-24 months in a selected community in Sri Lanka: A cross sectional study. *European Journal of Preventive Medicine*, 3(2-1), 15-23. doi: 10.11648/j.ejpm.s.2015030201.14

- World Health Organization, [WHO], (2020). *Malnutrition*, Retrieved on 26.07.2020 from <https://www.who.int/news-room/fact-sheets/detail/malnutrition>
- Yadav, A., & Dixit, A. (2017). A study to assess the prevalence of malnutrition among under 5-year children at selected Anganwadi centres of Jaipur district. *Medical Science Journal*, 3(11), 78-79.
- Zhang, N., Bécaries, L., & Chandola, T. (2016). Patterns and determinants of double-burden of malnutrition among rural children: Evidence from China. *PloS one*, 11, e0158119. <https://doi.org/10.1371/journal.pone.0158119>