

Intervention to Address Childhood Undernutrition: A Systematic Review

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Abstract

Introduction: Childhood undernutrition while being a preventable condition remains a major public health issue because it contributes to the mortality and morbidity of children globally. Intervention strategies to improve the nutritional status of children include therapeutic food, cash transfers, antibiotics and nutritional education. The objective is to review the effects of various nutritional interventions in addressing undernutrition in children.

Methods: Comprehensive search of literature in electronic databases were conducted in PubMed, Science Direct, and Scopus containing the Medical Subject Headings (MeSH) and the title terms 'Undernutrition' OR 'Malnutrition AND 'Intervention' OR 'Management' AND 'Children' OR 'Childhood' between January 2000 and August 2019. Of the 4358 studies that were identified, 17 studies matched the inclusion criteria and were reviewed.

Results: Therapeutic food is an integral part of nutritional interventions in majority of the studies along with cash transfers and nutritional education. The most consistent outcome in most of the studies was improvement in the nutritional status which subsequently reduces the undernutrition in children.

Conclusion: Therapeutic food, conditional cash transfer and nutritional education yielded the best outcome in alleviating undernutrition in developing countries.

Keywords: Undernutrition, Malnutrition, Intervention, Children, Systematic review

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Introduction

Despite the global transition to overnutrition, undernutrition while being a preventable condition remains a major public health issue among children in the developing countries because of their contribution to mortality in children and may have lasting impact to the development and growth of the child. In 2016, World Health Organization (WHO) estimated that 22.9% or 154.8 million children under-5 globally was stunted whereas 7.7% or 52 million children under-5 globally was wasted ([UNICEF Data, 2017](#)).

A malnourished child has a 9-fold increase risk of death as compared to the non-malnourished children ([Bhutta, Z.A. et al., 2008](#)). Undernutrition has contributed to 45% mortality in children under-5 years which amounted to 3 million deaths out of 6.9 million each year ([Horton, R. 2013](#)). Undernutrition is prevalent in Asia and Africa regions which accounts to almost 50% mortality of children under the age of 5 either directly or indirectly which equivalent to approximately 3 million mortality each year ([UNICEF Data, 2017](#)).

Based on Lancet review on maternal and child nutrition, intervention strategies to address undernutrition can be broadly divided into nutrition-specific interventions, nutrition-sensitive interventions and creating a conducive environment ([Horton, R. 2013](#)). These various intervention strategies include therapeutic food, cash transfers, nutritional behavioural interventions and nutritional education. Examples of therapeutic food are ready to use therapeutic food (RUTF), Lipid-based nutrient supplements (LNS), Micronutrient powder (MNF) and Liquid oral nutritional supplements (ONS). Therefore, the objective is to review the effects of various intervention strategies in addressing undernutrition in children.

Materials & Methods

Literature Search Strategy

Extensive search of literature regarding the interventions to reduce undernutrition in children were identified through electronic search of papers published between January 2000 and August 2019. The electronic databases that were searched are ScienceDirect Scopus and PubMed containing the Medical Subject Headings (MeSH) and the title terms 'Undernutrition' OR 'Malnutrition AND 'Intervention' OR 'Management' AND 'Children' OR 'Childhood'.

We used similar literature search strategy with the other electronic databases as well. Two investigators conducted systematic review of the literature independently by assessing the study eligibility from the extracted data and consulted the third investigator in case of disagreements or discrepancies so that final decision can be made with mutual consensus.

Study Selection and Eligibility Criteria

Titles and abstracts were identified by the extensive research of the electronic databases. Duplicate research papers were then removed, and the relevant papers were screened based on the titles and abstracts. Research papers that were irrelevant were excluded. The research papers full text was then retrieved to be assessed its eligibility.

Inclusion criteria for the eligible studies were studies conducted on children aged up to 18 years old that involves either community, school or clinic interventions or a combination of them. The studies selected must be in the English and Malay language that were conducted among undernutrition children and adolescents. Systematic reviews, meta-analysis, and editorials were excluded.

Data Extraction and Abstraction

The required information was extracted from all eligible papers was as follows;

- i. General information regarding the study such as the first author's name, country of publication, year of publication, study design
- ii. Characteristics of the study population such as age of studied participants
- iii. Type and duration of the intervention
- iv. Result of the study

Results

Study Selection and Characteristics of the Published Studies

Figure 1 demonstrates the flowchart for the conducted systematic review following the PRISMA-P guidelines. A total of 4358 titles were identified through our search. 17 articles were deemed appropriate for inclusion.

This systematic review showed that the quality of the studies reviewed were good as large majority of the studies (n= 13, 76 %) conducted were randomized controlled trial. An overwhelming majority of the study participants were aged less than 5 years old (94 %) with the majority of the studies' duration of intervention lasted less than 1 year (59 %). Majority of the interventions in the studies were in the form of therapeutic food (53 %) followed by cash transfers (24%), nutritional education (18%) and antibiotics (5%) (**Table 1**).

Discussion

This review evaluates different approaches in its intervention to reduce childhood undernutrition and malnutrition. One approach involves cash transfers that were reported in Brazil (Morris, S.S. *et al.*, 2004), Congo (Grellety, E. *et al.*, 2017), Niger (Prudhon, C. *et al.*, 2017) and Indonesia (Kusuma, D. *et al.*, 2017) which revolves around the government providing cash directly to poor mothers with an undernourished child.

Cash transfers which may be conditional or non-conditional cash transfer has been one of the strategies to address the inequality in children's food consumption among the poor. This targeted cash transfer can be considered a form social safety net programme intended to avert starvation and reduce undernutrition among the most vulnerable populations. A study in Indonesia explores the impact of conditional cash transfers by a government led initiative known as *Program Keluarga Harapan* which was found to reduce the probability of wasting by 33% and severe wasting by 41% (Kusuma, D. *et al.*, 2017). These findings corroborate similar study in Congo (Grellety, E. *et al.*, 2017).

However, a study in Brazil discovers that there was poor weight gain in children who their parents receive unconditional cash transfer due to the perception of the parent that the benefit will be discontinued if the child started to grow well (Morris, S.S. *et al.*, 2004). Thus, the researchers suggest for conditional cash transfer as a better stimulus to reduce undernutrition as compared to unconditional cash transfer (Morris, S.S. *et al.*, 2004) Furthermore, cash transfers elicit less stigma to the beneficiaries in contrast to other forms of near-cash transfer namely food stamps and food vouchers which aim to increase the purchasing power of the targeted household.

Undernutrition has also been inextricably linked with inadequate food intake; therefore many various governments have taken the initiative to provide therapeutic food to those food insecure families with undernourished child. Previous study conducted in Pakistan to evaluate the impact of RUTF which consists of energy dense paste against liquid oral nutritional supplements in underweight healthy children, the researchers reported that both RUTF and liquid oral nutritional supplements are equivalently effective in improving the nutritional results in undernutrition children (Fatima, S. *et al.*, 2018). This result corroborates with other very similar studies at Malawi (Gelli, A. *et al.*, 2018), Burkina Faso (Nikièma, L. *et al.*, 2014), Palestine (Magoni, M. *et al.*, 2008) and Mali (Tranchant, J.P. *et al.*, 2019) on the effectiveness of therapeutic food as a form of intervention against childhood undernutrition.

The effect of therapeutic food is even more apparent in vulnerable populations that are exposed to conflict and political instability. Invariably, the rates of undernutrition are high in countries involve in conflict because one of strategy in war is to deprive the populations from access to food. Previous study in in Mali attributed food assistance and transfers as a protective effect against food insecure population in conflict (Tranchant, J.P. *et al.*, 2019). However, a qualitative study was conducted in Southern Ethiopia managed to unravel some unintended consequences of provision of RUTF in which a severe malnourished child may consume inadequate amount of RUTF provided due to sharing and/or selling of the RUTF (Tadesse, E. *et al.*, 2015).

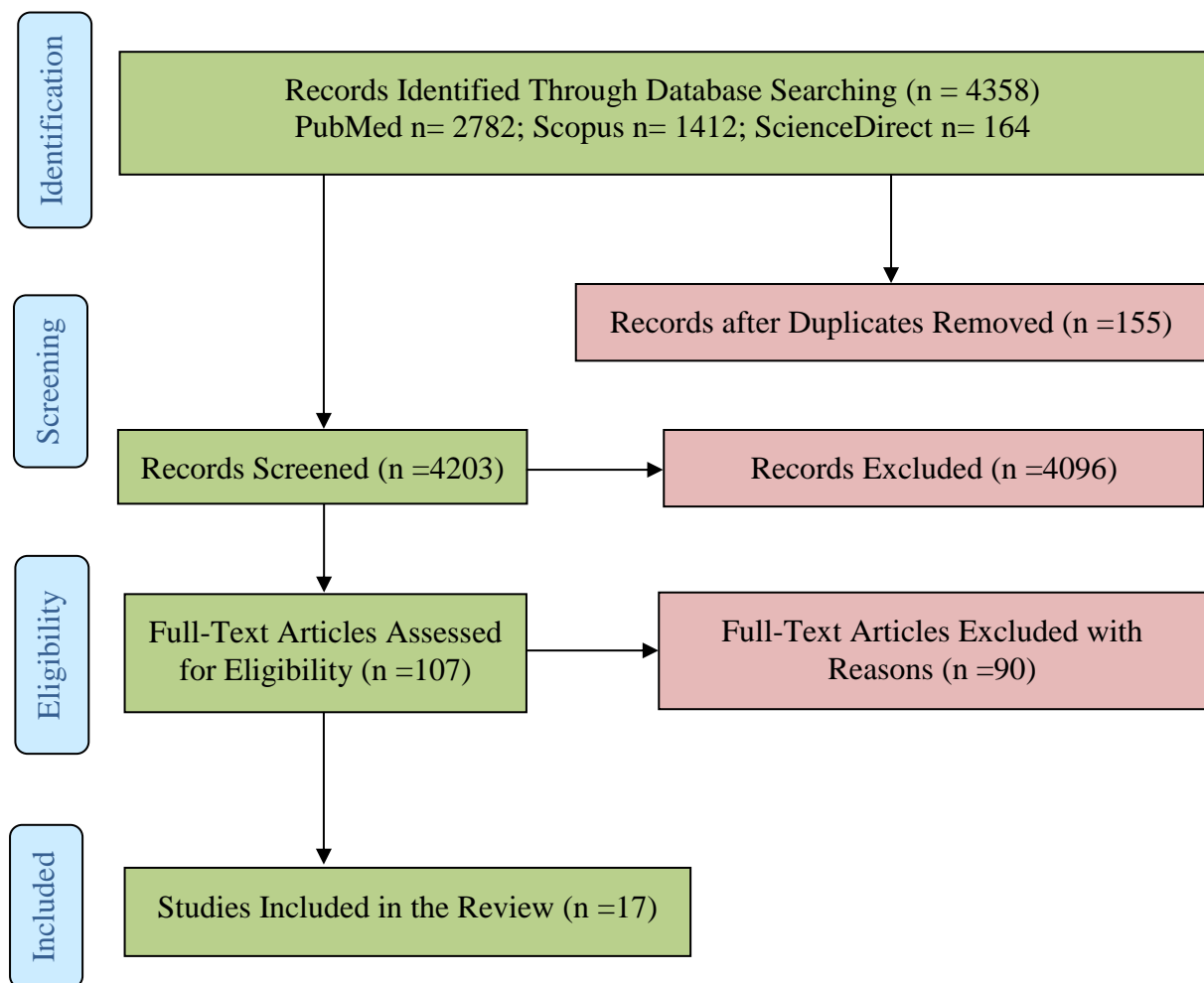


Figure 1: Flowchart of Study Selection *p*

Table 1: Effects of intervention to reduce childhood undernutrition

Author, Year, Country & Study Design	Participants Age & Intervention Duration (In Months)	Type of Intervention	Results
Gelli, A. <i>et al.</i> , 2018, Malawi, Randomized Trial	< 12 & 6	Childhood Development Centre based Agriculture & Nutrition Intervention	Greater reductions in the prevalence of stunting (17% points)
Galasso, E. <i>et al.</i> , 2018, Madagascar, Randomized Trial	6-30 & 24	Lipid based Nutrient Supplements	Reduction in stunting in children aged 6-18 months exposed to LNS
Grellety, E. <i>et al.</i> , 2017 & Bhutta, Z.A. <i>et al.</i> , 2008, Congo Randomized Trial	6-59 & 6	Cash Transfers	Increase recovery from SAM and reduce default, non-response rates
Sibson, V.L. <i>et al.</i> , 2018, Niger, Randomized Trial	6-59 & 9	Unconditional Cash Transfers	No reduction in prevalence of undernutrition
Manary. M.J. <i>et al.</i> , 2004, Malawi, Randomized Trial	> 12 & 9	3 Groups: RUTF, RUTF Supplements with Maize/ Soy Flour	Significant improvement in severe malnutrition with RUTF
Tranchant, J.P. <i>et al.</i> , 2017, Mali, Quasi-Experimental Study	60-180 & 9	Targeted Food Assistance & Supplementary Feeding	Food transfers exerted protective effect among food insecure population in conflict context
Penny, M.E. <i>et al.</i> , 2005, Peru, Randomized trial	0-18 & 18	Nutritional Education	Nutritional education reduces the rate of stunting by two-thirds
Fatima, S. <i>et al.</i> , 2018, Pakistan, Randomized trial	60-120 & 7	2 Groups: RUTF & ONS	RUTF and ONS are equally effective in improving nutritional outcome
Yousafzai, A.K. <i>et al.</i> , 2014, Pakistan, Randomized trial	5-24 & 12	Nutritional Intervention with Lady Health Worker	Growth and development of the child significantly improved
Kusuma, D. <i>et al.</i> , 2017 & Bhutta, Z.A. <i>et al.</i> , 2008, Indonesia, Randomized trial	< 60 & 24	Cash Transfers	Significantly reduce severe malnutrition
Ruel, M.T. <i>et al.</i> , 2008, Haiti, Randomized trial	< 60 & 36	Nutritional Behavioural Intervention	Preventive program more effective than recuperative treatment

Author, Year, Country & Study Design	Participants Age & Intervention Duration (In Months)	Type of Intervention	Results
Trehan, I. <i>et al.</i> , 2016, Malawi, Randomized trial	6-59 & 24	3 Groups: Amoxicillin, Cefdinir & Placebo	Improvement in recovery SAM from antibiotics and reduction in mortality
Van der, K.S. <i>et al.</i> , 2012, Nigeria, Randomized trial	6-59 & 7	RUTF and MNF	RUTF and MNF given for 2 weeks did not reduce the incidence of malnutrition
Morris, S.S. <i>et al.</i> , 2004, Brazil, Quasi-experimental Study	< 84 & 6	2 Groups: Cash Transfers & Control	Poor weight gain to children that receive cash transfer due to perception that the benefit will be discontinued if the child started to grow well
Prudhon <i>et al.</i> , 2017 & Bhutta, Z.A. <i>et al.</i> , 2008, Niger, Prospective intervention	6-23 & 15	2 Groups: LNS-LQ/ LNS-MQ	Provision of LNS-LQ more appropriate when food insecurity is high while when food security is better LNS-MQ more appropriate
Nikièma, L. <i>et al.</i> , 2014, Burkina Faso, Randomized trial	6-24 & 3	Nutritional Education & Supplement	Effective in treating moderate acute malnutrition
Magoni, M. <i>et al.</i> , 2008, Palestine, Random survey	6-59 & 2	Nutrition Education & Supplementation	70% reduction in acute malnutrition

RUTF: Ready-to-Use Therapeutic Food; ONS: Liquid Oral Nutritional Supplements; LNS: Lipid Based Nutrient Supplements; LNS-LQ: Large Quantity Lipid Based Nutrient Supplements; LNS-MQ: Medium Quantity Lipid Based Nutrient Supplements; SAM: Severe Acute Malnutrition; MNF: Micronutrient Powder.

On the contrary, a previous study in Nigeria regarding the effect of short term supplementation RUTF and micronutrient powder for 2 weeks failed to reduce the incidence malnutrition (Van der, K.S. *et al.*, 2016). The lack of effect can be explained by the short duration of RUTF and micronutrient powder given which is insufficient to overcome the effects of high morbidity and pre-existing malnutrition (Van der, K.S. *et al.*, 2016). Thus, it is recommended for supplementation such as RUTF and micronutrient powder to be consumed for a longer duration of more than 2 weeks.

Another intervention strategy in reducing child undernutrition is nutritional education as evidence in a previous study in Peru that concludes that nutrition education intervention reduces the rate of stunting in children by two-thirds (Penny, M.E. *et al.*, 2005). Nutritional

education involves health care worker imparting knowledge and information to the parents or caretaker to instil the importance of exclusive breastfeeding for the first 6 months followed by complementary feeding, promote preventive health care seeking behaviour, proper methods of feeding practices and dietary intake. A study by (Fawzi, W.W. *et al*, 1998) points out those women with low education level or no education level is usually less exposed to the information regarding on how to prepare food with sufficient nutrients and may also delay the introduction of complementary feeding after 6 months of exclusive breastfeeding.

A previous study was conducted in Malawi to ascertain the role of providing antibiotic by the outpatient department for severe acute malnourished children (Trehan, I. *et al.*, 2016). The researchers concluded that there were improvement in the recovery of severe acute malnutrition and reduction in mortality after antibiotics were given (Trehan, I. *et al.*, 2016). This finding parallels another study conducted in Kenya (Maitland *et al.*, 2006). As recurrent childhood infections have been identified as the immediate cause of malnutrition, hence it is warranted for antibiotic treatment for uncomplicated severe acute malnourished child in the outpatient setting. However, further studies are required to evaluate the need antibiotic in mild and moderate acute malnutrition as unrestricted use of antibiotics may give rise to antibiotic resistance.

There are some certain limitations that need to be considered in interpreting the findings of this review because several of the studies were conducted at different regions with different socio-demographics population and service providers which makes comparison difficult and biased. In addition, the improvement in the nutritional status of children in several of the studies reviewed cannot be entirely attributed to the interventions alone as other factors such as improvement in the hygiene, water quality and sanitation may also contribute to the improvement of the nutritional status of children. Since only studies in English and Malay are included in this review, hence there may be studies not included in this review and this has contributed to bias.

Conclusion

Undernutrition is still rampant many developing countries as compared to the developed countries and unfortunately children are the most vulnerable group to undernutrition. This review has demonstrated that therapeutic food, conditional cash transfer and nutritional education yielded the best outcome in alleviating undernutrition in developing countries.

Conflicts of Interest

There are no financial and non-financial conflicts of interest in this review.

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