



**EVALUATION OF SCHOOL FEEDING PROGRAMS ACROSS  
COUNTRIES: A REVIEW OF LITERATURE**

Final report

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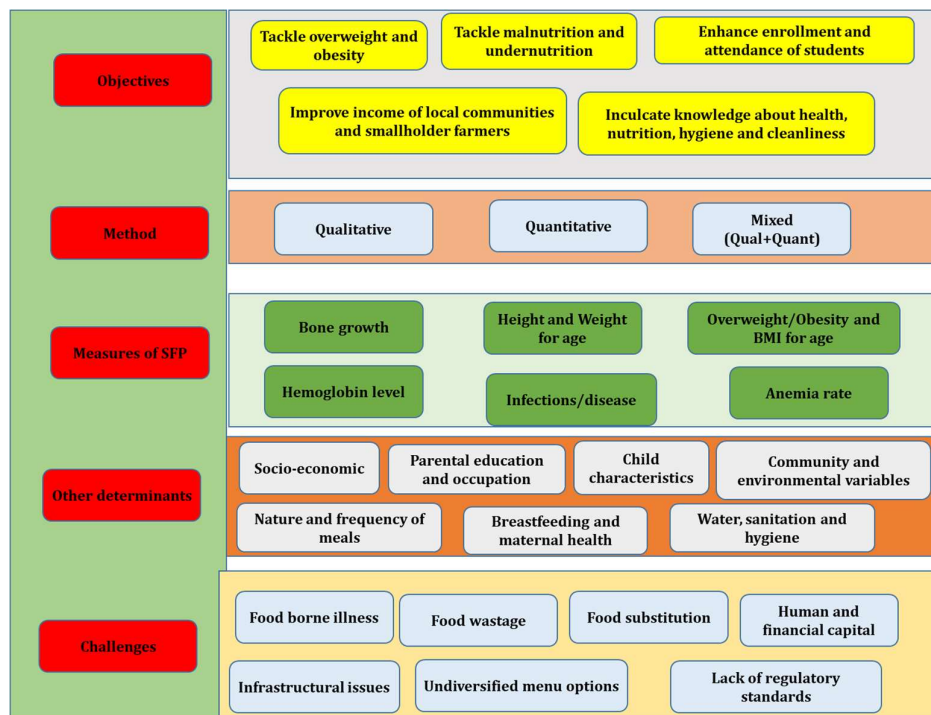
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## Abstract

The paper evaluates the objectives, outcomes and challenges of School Feeding Programme (SFP) across different countries. Following the literature review approach, the current paper conducts a thorough and comprehensive understanding of school feeding programs across different countries. The analysis is based on 63 peer reviewed articles, research and review papers published during last 30 years. Analysis shows that while most studies consider height and weight as the measures to evaluate these programs, however, other measures such as anemia, hemoglobin and iron content, bone mass, infections and disease of children are the other variables used for measuring the effectiveness of SFP. Additionally, the white paper also lists down the operational and implementation challenges of these SFP which will help in identifying the scope of improvement for running the SFP across different countries.

## Summary

Current study is summarized in Fig. 5 which enlists the objectives, methodology, outcome measures, potential confounders and challenges in school feeding program across countries.



**Fig. 1: Summary of the reviewed studies**



## 1. Introduction

Globally, 821 million people are undernourished with 80% contribution from Africa and Asia (Webb et al., 2018). 150 million children under the age of five are stunted and 55% of them belong to Asia and 39% to Africa (WHO, 2018). 697 million people are severely food insecure and 40% of this food insecure population lives in Africa, more than half reside in Asia and 10% live in Europe, America and Oceania (Roser and Ritchie, 2013). Food insecurity is strongly linked to undernourishment, malnutrition and hunger which severely impacts the child social, physical, psychological and cognitive abilities in the long run. Undernutrition, malnutrition and short term hunger leads to impaired immunity, poor cognitive abilities (Worobey and Worobey, 1999), shorter attention span, reduces interests in any activity, and increases mortality rate which adversely affects the productivity, wages and economy in long run (Broca and Stamoulis, 2003).

To address this problem, policy makers, national governments and international organizations such as World Food Program of United Nations introduced food for education programs (FFE) in most of the countries across globe. Take-home ration (THR) and school feeding programs (SFP) are the main variants of FFE programs. Cooked meals are provided in schools during SFP while dry ration is given to the children for their consumption at home during THR (Lawson, 2012). Student attends classes every day to get benefits from SFP while presence on only a certain number of days is required for obtaining THR which results in additional benefits in form of increased educational enrolment and academic achievements during SFP. Another advantage is that SFP are nutritionally rich and contain additional nutrients such as vitamins, calcium, iron and other micronutrients which may not be available in the home food (Aurino et al., 2018). SFP is preferred over THR owing to its larger benefits in improving educational enrolment and nutritional status of a child.

**Thereby, focus of the current study is on evaluating the objectives, outcomes and challenges of SFP across different countries.** SFP were first introduced in developed countries like US, UK and further in developing countries of Africa, Asia and Latin America (Lawson, 2012). SFP aim to relieve short-term hunger, enhance enrollment and attendance, improve growth, cognition, nutritional status and academic performance of children in developing, developed and undeveloped countries (Allen and Gillespie, 2001; Greenhalgh et



al., 2007). They have proved to be highly beneficial in the area of education, nutrition, health, poverty reduction, food security, gender equality, agriculture and development. These programs are mainly targeted for food insecure households who have poor socio-economic status or for schools having poor attendance and enrolment of students. They have also resulted in reducing gender and social inequalities by increasing the number of school going children, specially girl child. Approximately, 368 million children are fed on daily basis via School Feeding Program (SFP) running across 169 countries where they have helped immensely in tackling hidden hunger, malnutrition and undernutrition (World Food Programme, 2013). Despite the existence and widespread benefits of SFP in most of the countries across globe, prevalence of hunger, undernourishment and malnutrition rate has still not come down to the remarkable level. Infact, number of cases will increase in the near future due to increasing economic crisis and unemployment caused by COVID-19. For instance, SFP exists in almost every country of the world, still 340 million children are suffering from micronutrient deficiency and 0.8 billion are lacking from accessibility to food highlighting the gaps and problems with the existing SFP of these countries. These gaps and issues need to be addressed in order to improve the health and nutritional status of children which requires rigorous understanding and evaluation of SFP across these countries. The evaluation of their effectiveness, challenges, issues and priorities with the existing SFP across countries will further help in the improvement of these programs which will lead to better child health and nutrition across world.

So far, number of studies such as Aliyar et al. (2015), Badri (2014), Bundy et al. (2009), Gelli and Daryanani (2013) and Jomaa et al.(2011) have reviewed the SFP across different countries of globe. Aliyar et al., (2015) focused on understanding the nutritional standards and objectives of SFP across different countries of the globe. Badri, (2014) reviewed implications of school meals on educational outcome of students along with identifying the challenges of school meals in these countries. Gelli and Daryanani, (2013) reviewed the sustainability of school lunch in low-income countries. Bundy et al., (2009) reviewed the effect of SFP in increasing enrolment in schools and providing health and nutritional benefits to children. Jomaa et al., (2011) identified the impact of SFP on nutrition, energy, school enrollment and attendance of children consuming school lunches on daily basis vs. non-participants to these school lunches introduced by government. Kristjansson et al., (2006) assessed the effectiveness of SFP for improving the health of socio-economically disadvantaged and advantaged children. Beaton,



(1993) reviewed the impact of these programs on psychological health; (Pollitt, 1995) reviewed the impacts of undernourishment on sensitivity of brain and (Grantham-McGregor, 2005) reviewed how school meals helped in developing cognitive abilities and improving classroom behaviour of children. All these reviews are limited by scope, some are limited to only a few countries, few to only specific outcomes. Heterogeneity existing in priorities, objectives, challenges and focus areas of these programs has not been highlighted by any review studies so far. Alongside, comprehensive information about priorities, objectives, methods, measured outcomes, potential confounders and the challenges of these programs was found to be missing in earlier such reviews.

**Considering this, current review is an attempt to fill the gap in existing literature by a thorough and comprehensive understanding of school feeding programs including their objectives, priorities, framework and challenges across different countries.** It is also noteworthy that most of the researchers consider height and weight as the only measures to evaluate these programs, however, other measures such as anemia, hemoglobin and iron content, bone mass, infections and disease of children are the rarely considered variables for measuring the effectiveness of SFP. Thereby, the current study is an advancement over earlier such studies by reviewing the impacts of SFP over all the measures including anemia rate, hemoglobin etc. rather than focusing only on height and weight of children. Additionally, the review also lists down the operational and implementation challenges of these SFP which will help in identifying the scope of improvement for running the SFP across different countries. The current study can be refereed by policy makers in devising the structured policies for improving the health and nutritional standards of children along with formulating an entirely new school feeding program for the countries that have not introduced these meals so far in their countries. Current review is based on 63 peer reviewed articles, research and review papers published during last 30 years.

## **2. Methodology**

Relevant literature including research articles, review papers, newspaper and magazine articles, reports of United Nations, World Bank, World Health Organization were considered for evaluating the measures of school feeding programs across countries. The information on school feeding programs of different countries was retrieved using Google scholar, Science



direct, PubMed, United Nations Children’s Fund, World Health Organization, World Bank and World Food Program of United Nations. Keywords for the search included “School feeding program”, “school meal”, “impact of school feeding programs’, “nutrition of children”, “health status of children” and “food for education”.

The criteria for selecting the studies is explained below:

**Sample population:** Studies involving children in the age group of 2-16 years who obtained lunch via school feeding programs were considered for review.

**Types of meal:** Review mainly incorporates breakfast or lunch provided by schools as part of their school feeding program. Studies that focussed on fortification of food products, food stamps, feeding hubs, obesity prevention and maternal breastfeeding interventions were excluded from the analysis.

**Outcome:** Outcome of school feeding programs can be measured in terms of physical and psychological health. Physical measures include effect on height, weight, bone density, haemoglobin content, anaemia etc. among children. Psychological measures include academic achievement, educational outcome, cognitive and intelligence, mental development, reasoning, attention span and concentration, school enrolment and attendance. Psychological outcomes are kept outside the scope of study as the main objective is to analyze the outcome of SFP in terms of child health and nutrition.

**Timeframe:** The peer reviewed articles, book chapters, newspaper and magazine articles published during last 30 years were screened and analyzed further for the review.

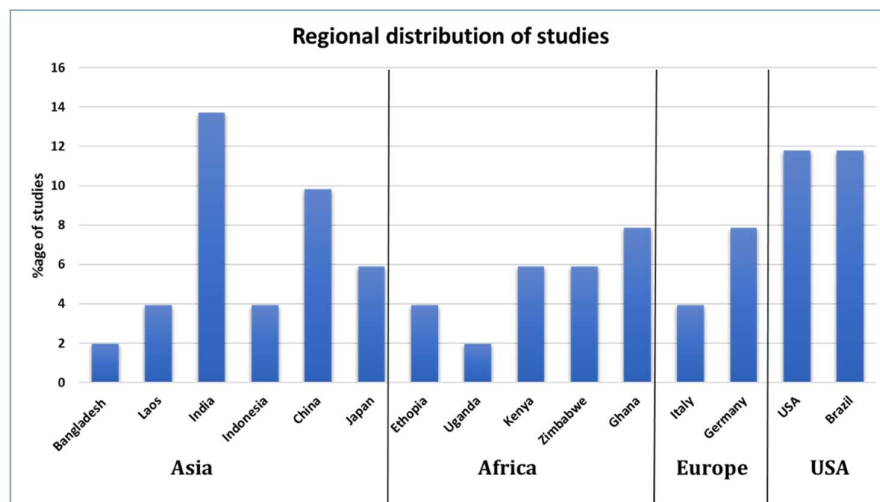
Final screening: Initially, title of around 231 studies matched with our criteria following which we read the abstract of these 231 studies and shortlisted around 105 research and review articles. These 105 articles were further screened on the basis of their objectives, method and outcome measures and finally 63 studies were tabulated for the review paper.

### **3. Results**

#### **3.1. Regional distribution of studies**

Our study incorporates analysis of 63 studies from 15 countries where 2 countries belong to low income group, 6 belong to lower middle-income group, 3 from upper middle income

group and 4 from high income group. World Bank classification was followed to categorize the countries into high, middle, and low income countries (World Bank, 2020). Regional distribution of countries is shown in Fig. 1 which shows that 40% of the studies belong to Asia, 33% to Africa and 13% each to Europe and America depicting the predominance of countries from Asian region. Following section describes the objectives, methodology and outcome measures of these studies.



*Fig. 1: Regional distribution of studies*

### 3.2. Objectives of SFP

Different countries have listed their objectives for running the SFP programme. SFP of Japan focuses on improving the health and nutrition related knowledge of children, addresses the socio-economic disparities by asking them to serve each other alongside inculcating hygiene and cleanliness habits among them (Kirk, 2017). School menu is designed by nutritionists with minimal interference from bureaucrats (Harlan, 2013). SFP in Italy also focuses on learning about food traditions, culture, health promotion and disease prevention of children. Italy has strict provisions regarding nutrient based standards in lunch and snacks, their presentation, dining space and facilities. Normal food based standards in Italy include provision of fresh drinking water, frequency of serving red meat, non-meat and protein, percentage of energy, fat, protein, fibre, calcium, iron and fat in food (Italian Ministry of Health, 2010).



Federal assisted National School Lunch Program (NSLP) in USA provides low cost or free lunches to more than thirty one million students across 100,000 schools (Byker et al., 2014). Main objective of NSLP is betterment of health and well-being of children, promoting local agriculture and farmers alongside improving educational outcome of students. School meal is provided on the individual basis i.e., free of cost to poor and vulnerable children whose household income is less than or equal to 130% of poverty level while at subsidized rates to the students from middle income families who have household income between 130-185% of poverty level (Ralston et al., 2008). School lunch program in China aims to improve the health and physique, combating malnutrition and anaemia among Chinese children and adolescents (Liu et al., 2016). India's school feeding program, referred to as Mid-Day Meal scheme was launched with the objective of universalisation of elementary education by enhancing retention, enrolment, and attendance of students besides focus on improving the students' nutrition or eliminating classroom hunger (Afridi, 2005). SFP in low income countries such as Kenya, Zimbabwe and Bangladesh mainly targets malnutrition and undernutrition (Oganga, 2013). In few of the low income countries, SFP aims to improve the income of local communities and smallholder farmers by buying their products to use for school meal (USDA Foreign Agricultural Service, 2009). SFP in these countries is majorly funded by World Food Program of United Nations and to some extent by their respective national government. Due to lack of sufficient funds, the coverage of program is limited to only a few geographies which are food insecure and have low level of agricultural productivity. These countries lack the food security and safety guidelines including handling, cooking, product quality and storage (USDA Foreign Agricultural Service, 2009). This section states the objectives and priorities of SFP in the countries selected for the current analysis. It depicts that income, living status of people and government policies govern the state of child feeding and nutrition in each country. Following this, we reviewed the methodology and outcomes of these programs reported by different researchers in these countries.

### **3.3. Method used**

Quantitative method: Maximum number of articles characterize the school feeding programs using quantitative methods. 20% of articles used linear regression based estimation method, 18% focussed on logistic/poisson regression, 16% focussed on Randomized

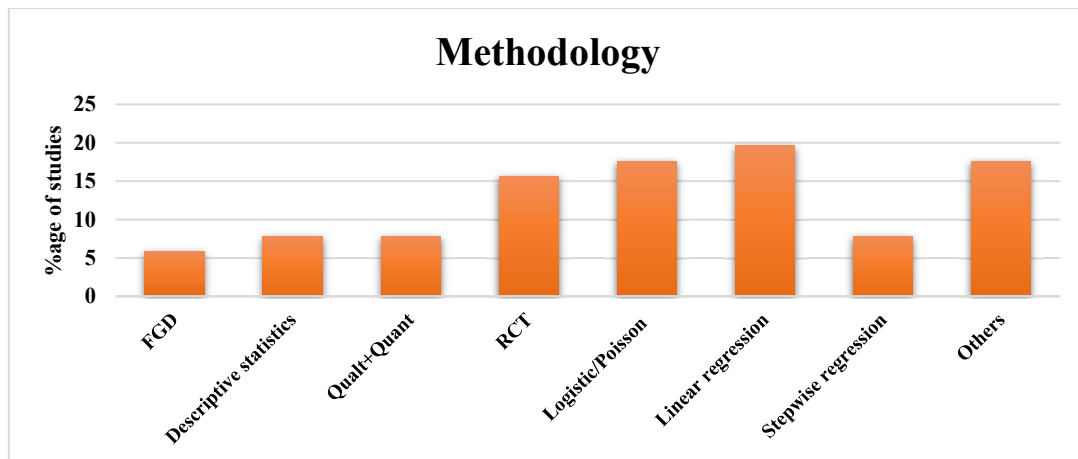


Controlled Trial (RCT), 8% used stepwise regression and other 18% used partial identification bounding method and least square switching regression model to evaluate the outcome of SFP (Fig. 2).

Qualitative method: Out of 63 peer reviewed articles, 14% used qualitative analysis (Fig. 2) comprising stakeholder-based method, focussed group discussion and semi-structured interview with teachers, principals, staff members and parents. Discussion revolved around perception of stakeholders about school feeding programs, the benefits and challenges of these programs, implementation and necessary interventions needed for improving these programs.

Mixed method: 8% of the studies used both qualitative and quantitative data (Fig. 2) for providing the comprehensive insights about the impacts of school feeding programs. Mixed method integrates both semi-structured interview and regression technique to analyse how SFP is impacting the health and nutrition of child.

Quantitative method, especially linear and logistic regression are the most widely used model to estimate the impact of SFP. Following this, we further reviewed the measures and outcomes of the school feeding programs via analyzing these 63 studies.



*Fig. 2: Methodology used for analyzing school feeding program across countries*

### 3.4. Measures of SFP



Outcome of school feeding programs can be measured in form of height for age, weight for age, anaemia, bone growth, haemoglobin levels, BMI for age, dietary diversity, food insecurity, overweight and obesity which are explained as following:

**Bone growth:** 10% of the reviewed studies (Fig. 3) have used bone growth as an indicator to measure the effectiveness of SFP. Bone growth needs to be given very high importance due to the increasing concern about osteoporosis in developing as well as developed countries (Kohri et al., 2012). 10% increase in bone mass delays the frequency of fracture after menopause by 50% and osteoporosis by 13 years (Hernandez et al., 2003). Milk is enforced with school meal in 98% of the elementary schools in Japan for stronger bone growth (Ministry of Education Japan, 2009). Toshiyuki et al., (2016) found that nutritional content of meal in form of calcium, vitamin, zinc and magnesium resulted in increased bone density in Japanese children. Apart from provision of meal in school lunch, other factors attributed to bone growth include environmental factors (Kohri et al., 2012), genetic factors (Rizzoli, 2008), sex hormones and gender (Pettinato et al., 2006), nutritional intake, Body Mass Index and time spent on sleeping (Toshiyuki et al., 2016). Rizzoli, (2008) recommended consumption of at least 1000 mg/d for calcium, 800 IU/d for vitamin D, and 1 g/kg body weight of protein for optimal bone development.

**Height for age:** 30% of the reviewed studies (Fig. 3) have used height for age to analyse the impact of SFP. This indicator is used in all developing, developed and underdeveloped countries. Hall et al., (2007) examined the effect of school lunch and frequency of meals on height of 1080 children in Vietnam. Children were given 90 kcal/day over 17 months on regular basis via school meals which increased the height of children increased from 7.88 cm to 8.15 cm. Zenebe et al., (2018) evaluated the impacts of Ethiopian school feeding program on height for age of Ethiopian children where other potential confounders were socio-demographic and economic factors including age of child, educational status and occupation of mother and father, household wealth index, food insecurity at household level and size of agricultural land. Here, household wealth index refers to the ownership of household assets (radio, television, bicycle, chair, table, mobile phone and horse/donkey cart), materials used to construct the house, numbers of livestock owned, ownership of improved drinking water source and latrine. The study witnessed the positive impact of SFP on height for age for children receiving the



meals on regular basis in comparison to the non-recipients. Wang et al., (2020) examined the impacts of school feeding program on height for age of students in China using ordinary least square regression and propensity score where other independent variables were age and sex of children, educational and migration status of parents, and household socio economic status. The study reported increase in height for age in children from 0.72 to 0.82 after consumption of school meal. Fenske et al., (2013) after analyzing the cross-sectional data of National Family Health Survey in India using quantile regression identified that increased food diversity and school meal frequency result in positive growth in height for age among children. Horta et al., (2013) reported increase in height for age of children after assessing the impacts of school feeding program PNAE, socio-economic condition of household, sanitation and hygiene on 6050 children surveyed in Brazil.

**Weight for age:** 26% of the reviewed studies (Fig. 3) have used weight for age for assessing the impacts of SFP. Zhang et al., (2009) assessed the impacts of Chinese SFP on weight for age in China's children where other independent variables included breast feeding practices, child age and sex, maternal age and education level, number of children in the household, the occurrence of diarrhoea, fever, cough/runny nose in the past 2 weeks, and household ownership of assets. The study found that dietary diversity of school meals and breast feeding increased the weight of children by 0.29 and 0.54 units respectively indicating the more positive impact due to breastfeeding practices. Lindsay et al., (2017) identified that regular intake of school meals, change in dietary practices, physical activity and socio-economic factors are the governing factors for weight for age of children in Brazil. Getaneh et al., (2019) through cross-sectional study in Northwest Ethiopia analyzed that school meals, child age, maternal education, poverty, water and sanitation are the major problems associated with child wasting in Ethiopia. The study reported significant increase in weight for age of children after consumption of regular school meals. Devi and Geervani, (1994) during their study of 197 children from low-income households in Andhra Pradesh identified that calorie adequacy of mid-day meal and socio-economic factors i.e., type of family, caste, family size, per capita income, land availability, income from land, per capita food expenditure, type of roofing, floor space per person, source of drinking water, and number of children in the family attending school or college are the main factors for determining the weight for age among children in low-income households of Andhra Pradesh. The study reported increase in weight for age by 0.18 units by one-unit increase in calorie adequacy of school lunch.



***Overweight/obesity and BMI for age:*** Outcome of SFP was measured in terms of overweight and obesity by 10% of the studies (Fig. 3). Obesity occurs when a child's Body Mass Index (BMI) is above 95<sup>th</sup> percentile with respect to the age and gender of child (Gundersen et al., 2012). Childhood obesity leads to negative effect on physical, social and psychological health that results in reduced life expectancy among children (Fontaine et al., 2003). Gundersen et al., (2012) used partial bound identification method for evaluating the impact of US National school lunch program on child obesity where age and ratio of income to poverty line were used as other independent variables. The study reported that the prevalence of obesity reduced by 17% due to regular consumption of NSLP by children. Wojcicki and Heyman, (2006) examined how change in menu items of school lunch program affects overweight among children. A child is considered as overweight when BMI lies between 85<sup>th</sup> and 95<sup>th</sup> percentile with respect to age and gender of child. Overweight is mainly due to increased soda consumption, improper eating behaviour, more number of television hours and declining level of physical activities (Hanson and Austin, 2003). Overweight leads to poor academic achievements (Davy et al., 2004). Von Kries et al., (1999) evaluated the impact of SFP and breastfeeding practices i.e., frequency and duration of breastfeeding on child obesity level by conducting a survey of 9357 children in Germany. The study found that the prevalence of obesity was lower in the breast fed children in comparison to the children who were not breastfed on regular basis. Zenebe et al., (2018) evaluated the impacts of school feeding program on BMI for age of Ethiopian children where other independent variables were socio-demographic and economic factors i.e., age of child, educational status and occupation of mother and father, household wealth index, food insecurity at household level and size of agricultural land. The study reported increase in BMI for beneficiary children in comparison to non-beneficiary children. Wurbach et al., (2009) used linear regression to estimate how meal patterns i.e., school lunch participation rate, meal frequencies, breakfast consumption and frequency of family meals and parental information i.e., parental education, employment and weight status of parents affected the deviation of BMI by surveying 2504 children in Germany. The study identified inverse relationship between BMI for age and frequency of school meals. Toschke et al., (2009) surveyed 4642 children in Germany and identified that having regular breakfast and increased frequency of meals is associated with lowering of obesity rate in children.



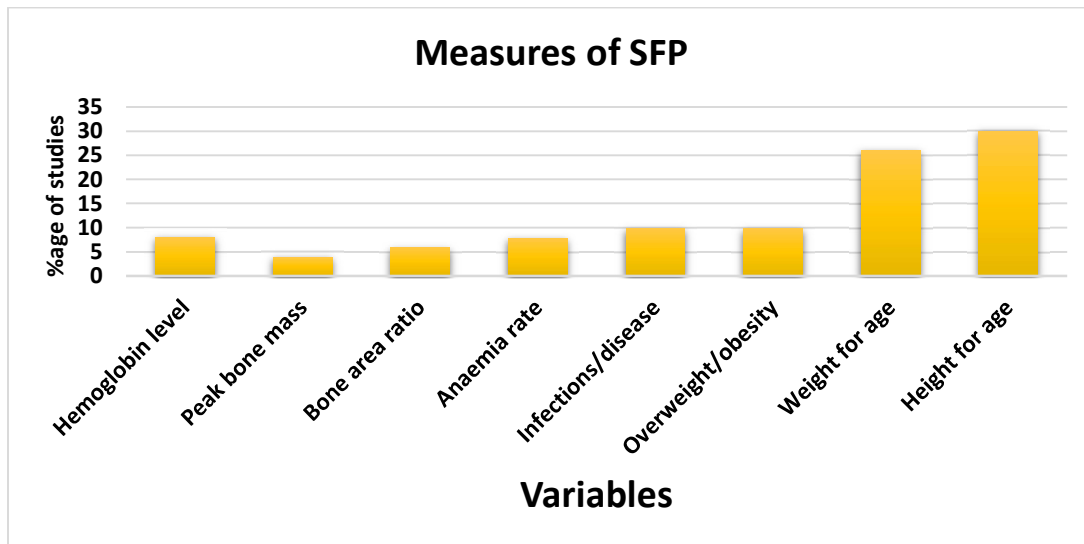
**Anaemia rate:** 8% of the reviewed studies (Fig. 3) measured the impacts of SFP on anaemia rate of children. Prevalence of anaemia is highest in the developing countries specially among infants (McLean et al., 2009). It is caused by multitude of factors including genetics, nutrition, diet, infectious disease and iron deficiency (Hasanbegović and Sabanović, 2004). Anaemia in infants lead to cognitive, social and emotional disruptions which negatively affects the academic achievements, performance and behaviour of child. Anaemia can be cured by regular intake of iron supplements (Pasricha et al., 2013). Different studies have evaluated how SFP impacts anaemia. Wang et al., (2020) evaluated the impacts of school feeding program on anaemia rate of children in China using ordinary least square regression and propensity score. Other potential cofounders in the analysis included age, sex of children, father and mother educational status, father and mother migration status and household socio economic status. The study did not identify any effect of SFP on reduction of anaemia rate in students. Luo et al., (2014) used both linear and logistic regression to analyse the effects of potential confounders including school meals, gender, age, birth weight, birth order, whether child suffered from fever or diarrhoea, maternal educational level and social security support received by the family on prevalence of anaemia among children. The findings revealed that the breastfeeding practices i.e., breastfeeding up to 6 months of child birth reduced anaemia level by 0.81 g/L among children and on increasing the duration of child breastfeeding more than 6 months, anaemia level reduced by 5.13 g/L. Introduction of solid, semi-solid and soft food in diet of child after 6 months also resulted in declining levels of anaemia in children. Adelman et al., (2019) evaluated the impacts of school feeding program on anaemia prevalence in adolescent girls aged 10-13 years in Uganda. Other independent variables which determined the anaemia prevalence in the study were age, household size, number of children in household and educational status of mother. The study identified that SFP led to reduction of anaemia by 20% in girls who were consuming school meals on regular basis in comparison to the control group where girls were not consuming this nutrient fortified meal. Results indicate that breastfeeding rate and introduction of nutrients in school meals resulted in positive impacts on decreasing anaemia rate among children.

**Haemoglobin levels:** 8% of the reviewed studies (Fig. 3) identified impact of school meals on haemoglobin level of children. SichertHellert and Kersting, (2003) identified that intake of iron helps in growth and developing cognitive abilities in children. Consumption of iron helps in



maintaining healthy cells, skin, nails and hair. Wang et al., (2020) evaluated the impacts of school feeding program on haemoglobin levels of students in China using ordinary least square regression and propensity score. Other independent variables in the analysis included age and sex of children, educational and migration status of parents, and household socio economic status. The study reported decrease in haemoglobin level of students even after consumption of SFP for continuously three years.

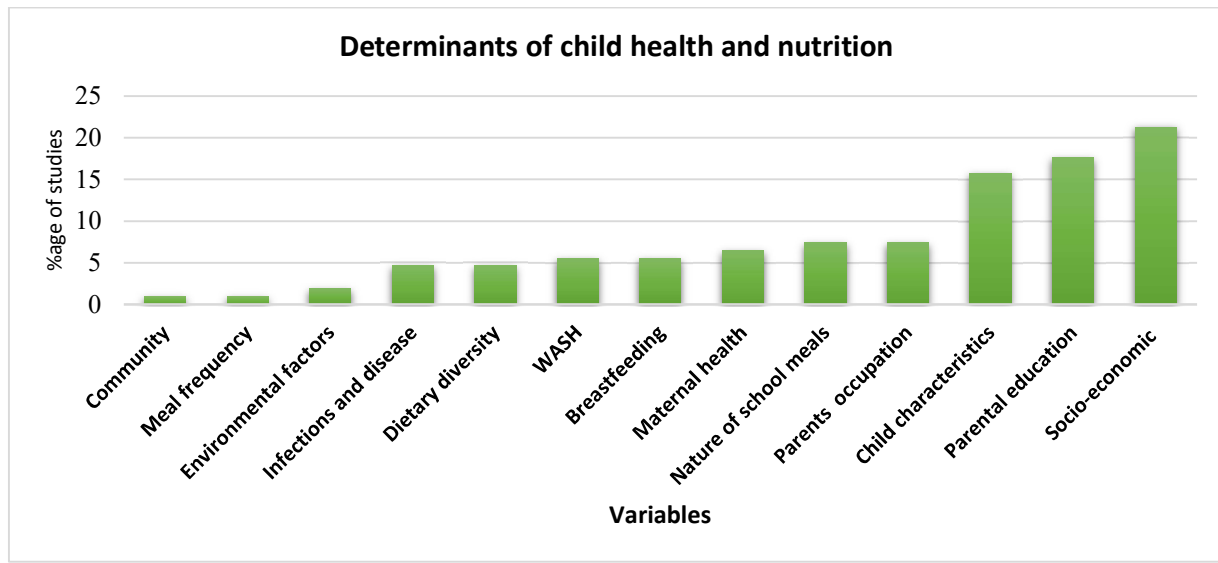
***Infections/diseases:*** 10% of the reviewed studies (Fig. 3) reported impact of SFP on infections and disease pattern in children. Globally, infections and diseases such as pneumonia are the leading causes of child's death (Schwartz et al., 1994). Marzano and Balzaretto, (2013) conducted a study in 26 Italian schools to identify the impact of ready to eat school lunch, safety, sanitation and hygiene practices i.e., use of tap water vs. drinking water for food, food contact surfaces and food handlers on child health. Presence of bacteria in raw vegetables, cheese and food contact surfaces led to high level of contamination in food, utensils and kitchen area. These factors caused growth of food borne pathogen and microbial contamination in food which resulted in lowering of child immunity and rapid spread of infections in body. Duijster et al., (2017) evaluated the factors leading to prevalence of helminth and odontogenic infection by conducting survey of 1847 children in Indonesia using non-randomized clustered controlled trial and logistic regression. The study identified that water, sanitation and hygiene practices i.e., daily group handwashing with soap and tooth brushing with fluoride toothpaste, biannual school-based deworming and construction of group handwashing facilities are the major causes in spreading infection. The study reported that appropriate sanitation and hygienic facilities contributed towards prevention of infections and disease among children.



*Fig. 3: Measures of School feeding program across countries*

### 3.5. Determinants of child health and nutrition

Household characteristics, weak governance and accountability, maternal health, breastfeeding practices, socio-economic factors, reproductive health, infections and disease, community, water, sanitation and hygiene, environmental factors and micronutrients are the main determinants of child health and nutrition. Among all these factors, socio-economic factors are considered by 21%, parental education by 18%, child characteristics by 16%, nature of school meal by 7%, parental occupation by 7%, breastfeeding by 6% and maternal health by 6% of the studies. These are most widely considered factors across countries. Other variables that are rarely used to evaluate the SFP include dietary diversity which are considered by 5%, infections/disease by 5%, environmental factors by 2% and community oriented factors by 1% of the studies (Fig. 4).



*Fig. 4: Other determinants of child health and nutrition*

### 3.6. Outcome of school feeding program

82% of the reviewed studies showed positive impact on child health and nutrition by targeting micronutrient deficiencies that reduced the susceptibility of a child to infection. 5% identified negative impact while 13% reported non-significant impact on health of child. School meals provide sufficient calories and energy that help in dealing with iron deficiency resulting in reduced anaemia prevalence in child (World Food Programme, 2020). School lunches contribute towards increased calcium and vitamin intake in the students who regularly take up the meals (Nozue et al., 2010). Japanese school meals have led to significant improvement in physical strength, health promotion alongside inculcating healthy dietary habits in school children (Toshiyuki et al., 2016). Indian Mid-Day Meal has been quite effective in multiple other dimensions including inter-caste socialization, better school participation, enrolment of dalits and girl child in school, better learning outcome in students, providing employment along with increasing knowledge and awareness about hygiene among children (Drèze and Khera, 2017; Kaye and Lhungdim, 2018). While SFP resulted in positive impacts in most of the cases, still negative and insignificant impact was observed by few studies. For instance, (Wang et al., 2020) observed no significant change in anaemia rate before and after implementation of China's national SFP while the anaemia rate increased upto 25% from 19%





in few provinces of China depicting the negative impact due to SFP. The study also reported a significant reduction in haemoglobin concentration among children in China depicting insignificant improvement in child even after implementation of SFP for three consecutive years. 13% of the studies did not find any significant impact on height and weight of children. For instance, (Buttenheim et al., 2011) conducted a study in Laos where they identified non-significant impact on stunting and underweight. Insignificant impact on stunting, wasting and underweight was found by (Kazianga et al., 2009) on children in Burkina Faso. Muthayya, (2009) also identified non-significant impact on underweight by his study in Bangalore, India. Van Stuijvenberg et al., (1999) also reported non-significant impact on stunting and underweight among children in South Africa. Wang et al., (2020) via their study in China reported insignificant effect of school meals on weight for age of children.

#### 4. Challenges

Challenges in school feeding programs across countries are mentioned as following:

**Food-borne illness:** Imai, (2005) and Michino and Otsuki, (2000) reported the problem of food-borne illness i.e., presence of *Escherichia coli* O157:H7 infection in the school lunch of Japan which caused severe infection to 9845 students at elementary and nursery level. In Japan, same lunch menu is prepared in all the schools of one region which increase the chances of spreading infections simultaneously across all the schools. Approximately 344,471 confirmed cases of food-borne allergy and infection were reported in Japan from 1987-1996 showing the severity of the problem.

**Food wastage:** Food wastage has also been identified as one of the main challenges. Byker et al., (2014) identified that around 45% of the food served via NSLP is thrown away by the children. Cohen et al., (2013) estimated that food wastage at lunch during one school year is approximately 432,349 kg indicating the severity of issue. Food wastage (Byker et al., 2014), inadequate nutrition (Byker et al., 2013) and limited menu options (Bhatia et al., 2011) are few of the prominent challenges that require immediate attention by policy makers. Food loss and wastage negatively impacts the environmental resources and social development. The process of food wastage from producer to consumer leads to emission of greenhouse gases in environment which further deepens global food shortage and malnourishment (Liu et al., 2016).



**Food substitution:** One important concern of SFP is related to substitution of food. A survey in Malawi reported that 77% of the children received less food at home on the days when they receive lunch from school (Galloway et al., 2009). Despite having huge benefit of SFP, it cannot act as replacement for home food, instead, they are meant to be complementary to child's diet along with home food. The fine line of difference between substitution and complementary needs to be properly understood.

**Human and financial capital:** Zenebe et al., (2018) identified that financial constraints, delays in the delivery of supplies, food hygiene problems and wastage are the main challenges in implementation of SFP in Ethiopia. Lack of human and financial capital is the major challenge in successful implementation of SFP in China, India, Kenya and Ghana (Drèze and Khera, 2017; Wang et al., 2020).

**Lack of infrastructural facilities and awareness:** SFP in low income countries has faced numerous challenges including lack of infrastructure like kitchen, dining, cooking facilities, cooks; lack of funds and donor organizations; no budget for school feeding; clean and safe water; lack of participation from government leaders; and limited awareness of local population about SFP.

**Lower back pain:** Nagasu et al., (2007) identified the prevalence of low-back pain among cooks preparing school lunches in Japan. Most of the cooks were also undergoing psychological stress such as unsatisfied with the job, financial constraints, health related problems and stress about future.

**Lack of diversity in menu:** Unsubsidized meals, lack of variety in menu options and diverse preference of students are few of the major challenges for reducing the participation rate of students for NSLP (Bhatia et al., 2011).

**Lack of regulatory standards and design of school menu:** Most of the high income countries have SFP from middle of twentieth century and thereby, they possess strong regulatory framework, strong institutionalization, well- established nutritional guidelines and thereby, targeting only education. Menu is designed by nutritionists in developing countries. However, low and middle income countries lack the proper guidelines on nutrition and menu designs (USDA Foreign Agricultural Service, 2009). Reduced subsidies and insufficient local nutrition expertise are the major challenges in China's SFP.



Addressing these challenges will help in successful and effective outcome of SFP in these countries. Alongside, these challenges can be effectively dealt while formulating the new school feeding program for any country.

## 5. Outcomes

***Income defines the priority of SFP:*** SFP in high income countries such as USA, Italy, Germany and Brazil was introduced for betterment of health and well-being of children, promoting local agriculture and farmers along with improving the educational outcome of students. These programs focus on learning about food traditions, culture, health promotion and disease prevention of children. In most of the high income countries, free school meals are provided for the children from vulnerable background while offered at subsidized cost to the children who are not that socio-economically vulnerable (Bundy et al., 2009). Middle income countries such as India, Brazil and China have immediate and long term objectives. In short term, they aim to eliminate hunger, increase enrollment in schools, act as a social safety net by providing employment opportunities to the local public, farmers and women. In long-run, they aim to improve the cognitive ability, attendance and nutrition status of children (Jomaa et al., 2011). They mostly emphasize on extending the coverage of SFP to maximum number of children along with acquiring funding from different sources. Low income countries such as Ghana, Ethiopia, Uganda, Kenya and Zimbabwe focus on addressing the hunger, illness, malnutrition, undernutrition and increased dropout rate from school. However, the objectives of SFP in these countries revolve around school enrolment and improving nutritional status of children, still the discrepancies in outcomes are so different that it acts as a source of health and nutritional knowledge in few of the countries (especially high income countries) while deals with hidden hunger, undernutrition and malnutrition in others (middle and low income countries). Low-income countries mainly target undernutrition and malnutrition; middle income countries target hidden hunger while high income countries target overweight and obesity.

***Transition in priorities of SFP:*** Initially, the program was introduced in USA to overcome malnutrition and poverty but now the rationale for NSLP has shifted more towards meeting the calorie target and controlling obesity which resulted in inclusion of more fruits, vegetables and whole grains in diet. NSLP menu has provisions of vitamin A, calcium, magnesium, iron,



sodium and phosphorus (Smith and Cunningham, 2014). SFP named Programa Nacional de Alimentacao Escolar (PNAE) of Brazil was initially introduced for reducing undernutrition and increasing enrolment of children in school. But, now the rationale of PNAE is more on bio psychological development of students along with increasing the knowledge of children about food, health and nutrition (Sidaner et al., 2013).

***Predominance of height and weight:*** The results of the reviewed studies indicate that height and weight for age are the most widely used measures for assessing outcome of school feeding programs. Patel et al., (2015) have considered stunting and underweight as proxy for children's health across India. Stunting and child mortality were used as proxy for children health and nutrition by Victora et al., (2011) in their study over Brazil. Kamiya, (2011) used undernutrition as proxy for children health over their study in Laos. Devi and Geervani, (1994) used weight for age, height for age and weight for height as proxy for nutritional status of children during their study of 197 children of age less than 4 years from schools of Andhra Pradesh, India. Fenske et al., (2013) considered height for age, stunting and severe stunting as proxy to determine health and nutritional status of children across India. Harpham et al., (2005) used stunting and child undernutrition as the indicators of child health and nutrition in a study conducted in four developing countries namely India, Peru, Vietnam and Ethiopia. Ramakrishnan et al., (2012) in their study over eight districts in Uttar Pradesh and Tamil Nadu used stunting, wasting, underweight and anemia as the proxy for child health and nutrition. Coneus and Spiess, (2012) during their study of 1268 newborns and 775 three year old children in Germany used low birthweight of child as proxy for child health. Horta et al., (2013) conducted a study of 6075 children in North, Northeast, Central-West, and Southeast/South Brazilian regions to understand the effect of poor sanitation and school meals on underweight and stunting in children. These studies show that all countries including developing, developed and underdeveloped recognize height and weight for age i.e., stunting and wasting as the major factors to measure outcome of SFP.

***Regulatory standards for SFP:*** Most of the high income countries have provisions of SFP from middle of twentieth century and thereby, possess strong regulatory framework, strong institutionalization, well- established nutritional guidelines. Ministry of Education Japan, (2009) designs the guidelines for school menu in Japan where they have prescribed standards for energy, lipids, proteins, calcium, magnesium, iron, vitamin B1, vitamin B2, vitamin C and dietary fibres for school meals. Meals are designed in a way to provide one third of daily



energy/nutrients requirements, 50% of recommended dietary allowances (RDA) for calcium and magnesium, 40% of RDA for vitamin B1 and vitamin B2 (Toshiyuki et al., 2016). NSLP menu has provisions of vitamin A, calcium, magnesium, iron, sodium and phosphorus (Smith and Cunningham, 2014). In most of the countries, school menu is designed by nutritionists with minimal interference from bureaucrats i.e., they only step in when unhealthy meal is being served in the schools and so far, there are not much complaints received against it (Harlan, 2013). It depicts the better regulatory standards of health and nutrition in Japan, USA and Europe. Middle and low income countries do not follow well-prescribed food standards i.e., the amount of energy, fat, protein, vitamin needed in the diet, instead, their main priority is to eradicate hidden hunger by last mile connectivity approach.

## **6. Learnings**

Japan's school menu is designed by the nutritionists which is primarily dominated by the fruits, soup, vegetables and rice. Owing to the efforts of healthy menu designed by nutritionists, Japanese population has the lowest obesity rate and highest longevity i.e., 83 years on an average which is highest among any country of the world. It depicts the effect of better regulatory standards of health and nutrition followed by Japan. In Italy, teachers are also involved in providing knowledge to the students about school kitchen including food, health, nutrition, cooking practices, Italian diet, food culture, food quality along with informing them about the role and challenges faced by Italian framers. Owing to their efforts, Italian students prefer to host parties at their own home with home cooked meal instead of hosting at fancy restaurants. Brazil's school feeding policy of integrating local produce with school meals and nutritional education has proved to be quite successful in improving the child health and nutrition which can be adopted by other countries in their respective policies. As can be learnt from Brazil's example, government is a very important institution in shaping the school feeding programs due to its well defined procurement policies and involvement in supporting local farming and agricultural practices by doing bulk purchases. Indian school feeding program of Mid-Day Meal is one of the largest in the world and has improved the enrolment and attendance rate of children in schools. Mid-day meal (MDM) acts as a social safety net for children from low-income households and proved to be highly effective in improving the psychological, physical and social behaviour of children. Kenya school feeding program also helps in



improving the income of local farmers by buying directly from them which helps in betterment of local economy. Ghana SFP teaches about coordination between government, parents and teachers in effective implementation of SFP. Here, teachers themselves go to market to buy the raw material for cooking the food for school meals. It also helps in stimulating the income of local communities and smallholder farmers.

## **7. Conclusion**

Encouraging more number of students to consume free meals and strengthening school feeding programs can prove to be an effective tool for promoting healthy eating habits. School feeding programs in different countries aim to improve child health and nutrition by their contributing towards increasing height for age, weight for age, iron, dietary diversity, cognitive abilities and reducing anaemia, obesity, overweight, infections and disease of a child. The review intends to focus on evaluating the outcome of these school feeding programs along with identifying the potential challenges worldwide. The review basically aims to synthesize the objectives of these programs in developing, developed and undeveloped countries, methodologies and measures used by different studies to evaluate these programs along with summarizing the outcomes and challenges of these programs. So far, height for age and weight for age are the most widely used measure to evaluate the effectiveness of these programs but our work highlights other ways of measuring the outcome of these programs which will enhance the understanding of researchers and policy makers in analysing and formulating policies in this direction. The review encompasses studies from developing, developed and undeveloped countries and thereby, provides the holistic understanding of the policies and focus areas of each of these countries. For instance, developed countries focuses on overweight, obesity and dietary diversity while developing countries such as India, China and Brazil on tackling anemia, iron content, infections and disease. Majority of the studies identified positive impact of these practices in improving the child health and nutrition. The review found that socio-economic characteristics of households and breastfeeding practices should be the main focus areas to improve the child health. School lunch has proved an important meal and acts as the main source of protein, energy and nutrition for children. Intake of nutrients was higher in lunch time than other meals of the day (Musamali et al., 2007). Good quality meals also helped in increasing cognitive abilities and mental health of a child. (Musamali et al., 2007) reported



that only 5% of the students consuming school meals were stunted in comparison to the 18% stunted students who did not consume school meals. Few studies have performed cross-sectional and longitudinal analysis where they have reported how consumption of school lunch differentiates a child from the one who does not consume school meals. Dearth of such reviews and complexity of findings indicate towards the need of well-designed research in future. We could hardly find any studies that quantified the effect of socio-economic, maternal education and breastfeeding practices on child health and nutrition which is one of the limitations of earlier such studies. Evaluation of substitution is one of the important research areas which need to be considered by future researchers. Changes in lunch and breakfast menu need to be continuously evaluated to improve the health and nutritional status of children. Healthy interventions incorporate multi-faceted approach i.e., discouraging consumption of soda, fried, sugar and fatty foods to reduce obesity and overweight. Physical exercise and fitness should be part of school curriculum. Attention and love by parents, teachers and siblings along with schooling environment plays a highly significant role in improving the child health but these factors are not evaluated by any of the studies. Significant improvement is only possible if both working and living environment of children is improved.



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