

Some observations on malnutrition among Indian pre-school children

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ABSTRACT: *Childhood phase is a very crucial phase during which body growth and development occurs along with cognitive and behavioural skills. Shift from healthy habits leads to overall deterioration of the body which affects the physiological process of the body. Under-nutrition, over-nutrition, micronutrient deficiencies and diseases related to malnutrition are a common concern among children under-five years of age (pre-school children). Trends show that both low and high socio-economic conditions equally contribute to malnutrition. Incidences of overweight and obesity have increased along with underweight primarily due to unhealthy consumption of junk food and inactivity towards physical exercise among pre-school children. Overweight during childhood shows high associations with diseases like type 2 diabetes, cardiovascular diseases, neurological disorders and emotional stress, whose effects continues during later phases of life. Deficiencies in vitamins and minerals give rise to various diseases which may result in morbidity and mortality. The present paper deals with malnutrition (under-nutrition and over-nutrition), micronutrient deficiencies, diseases, programmes implemented and recommendations among pre-school children (children aged under-five years) in India.*

Keywords: *Pre-school, Under-nutrition, Over-nutrition, Micronutrients, India*

INTRODUCTION

The very word, ‘malnutrition’ is being used to refer to both excess and deficiencies in nutrition resulting in imbalances faced by both children and adolescents. This very phase of growth and development coincides with the intake of nutrients which is mostly available through food intake. The dietary nutritional intake cause changes in lifestyles which are results of the changes in socio-economic, epidemiological and demographic patterns (Popkin 2002; Subramanian et al.2007; Debnath et al.2019).

Malnutrition includes under-nutrition (stunting, wasting and underweight), micronutrient deficiencies (insufficient and overweight), overweight, obesity and diet related communicable diseases. Malnutrition among children is now recognized as a major problem worldwide in both the developed and developed countries. Sedentary lifestyles coupled with intake of high calorie foods in these countries lead to overweight which subsequently results in obesity. It is now being observed that both underweight and overweight are persisting among populations of the developing countries such as India. This is termed as a “Double Burden of Malnutrition” and is observed to occur comparatively at all levels, be it household, national and community levels (Doak et al. 2005).A major nutritionally affected group are pre-school children (children aged under-five years). Malnutrition among them affects their psychological, cognitive, physical, behavioural and thinking skills which causes a rise in morbidity and mortality.

Under-nutrition which includes stunting, wasting and micronutrient deficiencies contributes to nearly half of all deaths among pre-school children which are mainly attributed to various diseases such as anaemia and blindness (Maleta 2006). This in turn increases the severities and also results in delays in recovery (UNICEF 2020).In the recent times it has been estimated that prevalence of stunting have declined from 199.5 million to 144.0 million between 2000 to 2019 and this accounts to a global decrease from 32.4% to 21.3% per decade. However, in west and central Africa stunting have increased from 22.4% to 29.0%. Wasting and severe wasting have been reported to be 6.9% and 2.1% globally whereas highest prevalence of wasting prevails in the countries of south Asia (UNICEF 2020).

Over-nutrition which encompasses both overweight and obesity mainly results in the intake of high energy and fat rich foods with sedentary lifestyles which no doubt excludes physical exercises. The unhealthy food habits which also include consumption of excess sugar containing carbohydrates arealso principal causes of obesity (Astrup et al. 2008). Obesity outcomes lead to various chronic diseases such as certain types of cancers, hypertension, type 2 diabetes, diseases related to the cardiovascular system and arteriosclerosis (WHO 1990; Popkin et al. 2012; Mondal and Sen 2014). Overweight seems to increase significantly at alarming rates in North America during the period from 2000 to 2019. Around 38.3 million pre-school children seemed to be overweight globally compared to 30.3 million children to be overweight in the year 2000(UNICEF 2020).

The literature search in relation to the effects of malnutrition among pre-school children revealed that under-nutrition which encompasses stunting, underweight and wasting is highly

prevalent among them. This has some important ramifications as childhood malnutrition is observed to affect the overall development of the growing child including both physiological and physical development (Victoria et al. 2008, 2010). This is because this phase remains the most crucial phase just before the period of adolescence. Deficiencies in micronutrients or its excesses have the potential to lead to various health problems that can culminate in mortality and morbidity. Studies have shown the absence of micronutrients like vitamin A among pre-school children increases risks of diarrhoea and morbidity for infection in respiratory tract (Sommer et al. 1984; Dibley et al. 1992; Standsfield et al. 1993; Bhandari et al. 1994) and measles (Barclay et al. 1987). Iron deficiency which causes diseases like anemia too has the highest incidence among such children (Kotecha 2011). Zinc deficiency triggers stunting among children by harming the immune system, physical development and decreasing cognitive developmental skill (Chandra and Ray 2002; Rao et al. 2016). Interventions are being received for children with acute malnutrition in the form of change in feeding habits and “therapeutic” home-made food with high protein and calories to meet basic requirements (Schoonees et al. 2019) along with powders consisting multiple micronutrients (Rao et al. 2016; Larson et al. 2017). As a matter of fact, pre-school children are prone to high deficiencies in iron, zinc, folic acid, vitamin A, vitamin B12, and vitamin D (Nasreddine et al. 2018).

ISSUES RELATED TO MALNUTRITION AMONG INDIAN PRE-SCHOOL CHILDREN

The major health problem in India is malnutrition whose prevalence is seen to be the highest among pre-school children (World Bank 2014). Under-nutrition shows highest incidence among such children in this country (Khor 2008; Ahmed et al. 2012). Malnutrition is also directly related to the amounts of micronutrients which comprises of both vitamins and minerals present in the body. The Sustainable Development Goals (SDGs) aim to reduce under-nutrition by reducing mortality and morbidity among children. It has been promised by the Government of India to achieve these goals by the year 2030. Lower nutritional availability for pre-school children shows adverse effects on health both during the adolescent and the adult phases of life. Importantly, nutritional status during the pre-school stage also determines growth and development of the child starting from juvenile phase through reproductive phase to senescence phase of life.

The crisis of malnutrition in India is such that it accounts to more than three out of every ten stunted children in the world. The Global Nutrition Report (2018) states that 46.6 million children out of 150.8 million children in the world remained stunted, 25.5 million out of 50.5 million children globally were wasted and more than a million children were overweight. The incidence of malnutrition in India in comparison to the global data is depicted in Figure 1.

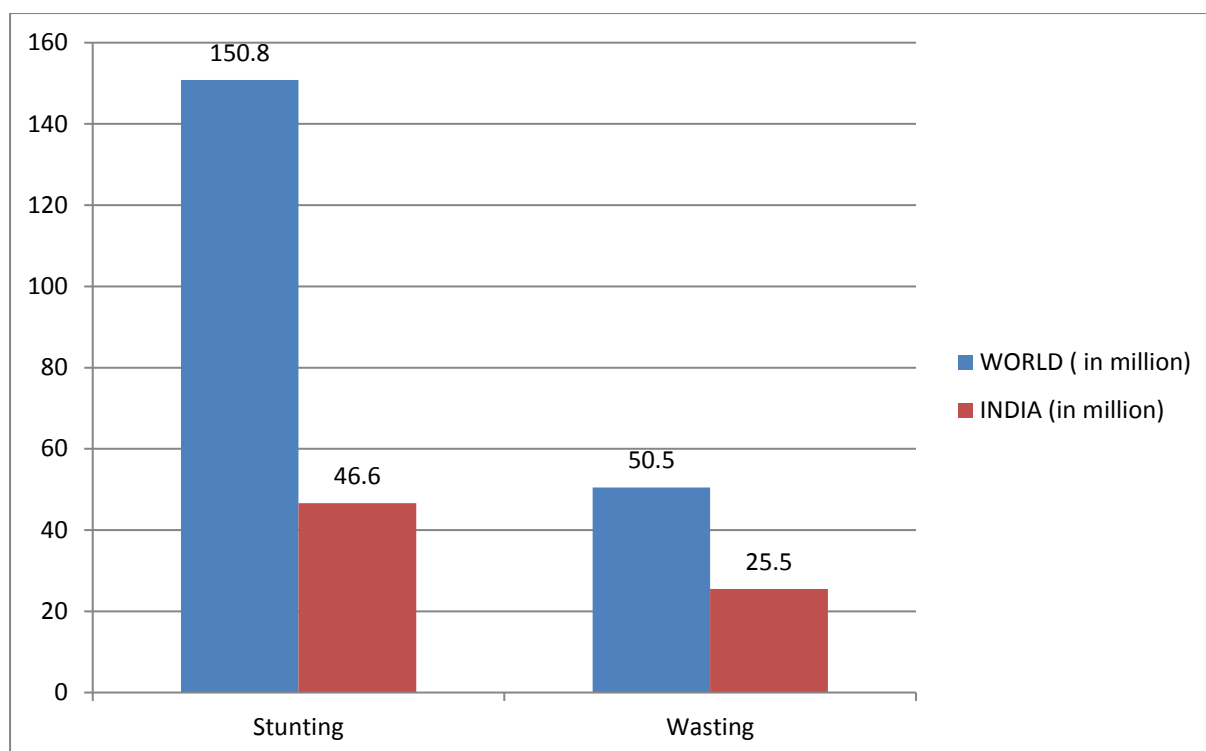


Figure1: Incidence of malnutrition in India in comparison to the global data (Source: Global Nutrition Report 2018)

Deaths among pre-school children due to malnutrition have been estimated to be 69%. Deaths due to stunting were 35%, wasting 17% and overweight 2% (UNICEF2019). The prevalence of malnutrition in the country is graphically represented in Figure 2.

The recent survey data of NFHS-4 (National Family Health Survey-4) has documented 35.7% underweight and 38.4% stunting among pre-school children all over India. Studies have also documented that under-nutrition in the form of wasting to be around 21% and over-nutrition in the form of overweight to be approximately 2% (Debnath and Bhattacharjee 2016; Hemalatha et al. 2018; Mondal et al. 2018). Gender differences were not pronounced as the data showed similar results among both boys and girls. Rural areas showed higher incidences of stunting than urban areas. State-wise prevalence of stunting indicated that the state of Bihar had the highest incidence (48%) followed by Uttar Pradesh(46%), Jharkhand and Meghalaya(44%). Jharkhand remains the only state which exhibited the critical condition of both wasting (29%) and underweight(48%) along with stunting(45%). Prevalence of stunting among pre-school children in India is graphically represented in Figure 3.

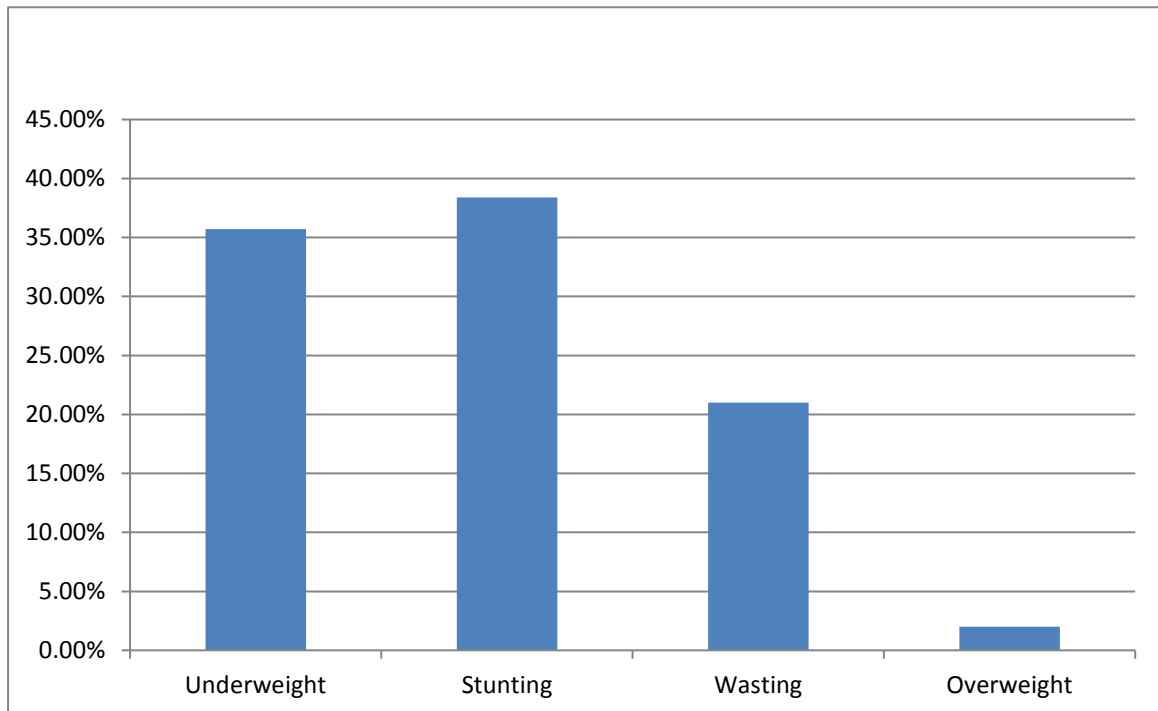


Figure 2: Prevalence of malnutrition among pre-school children in India (Source: NHFS -4,2015-16)

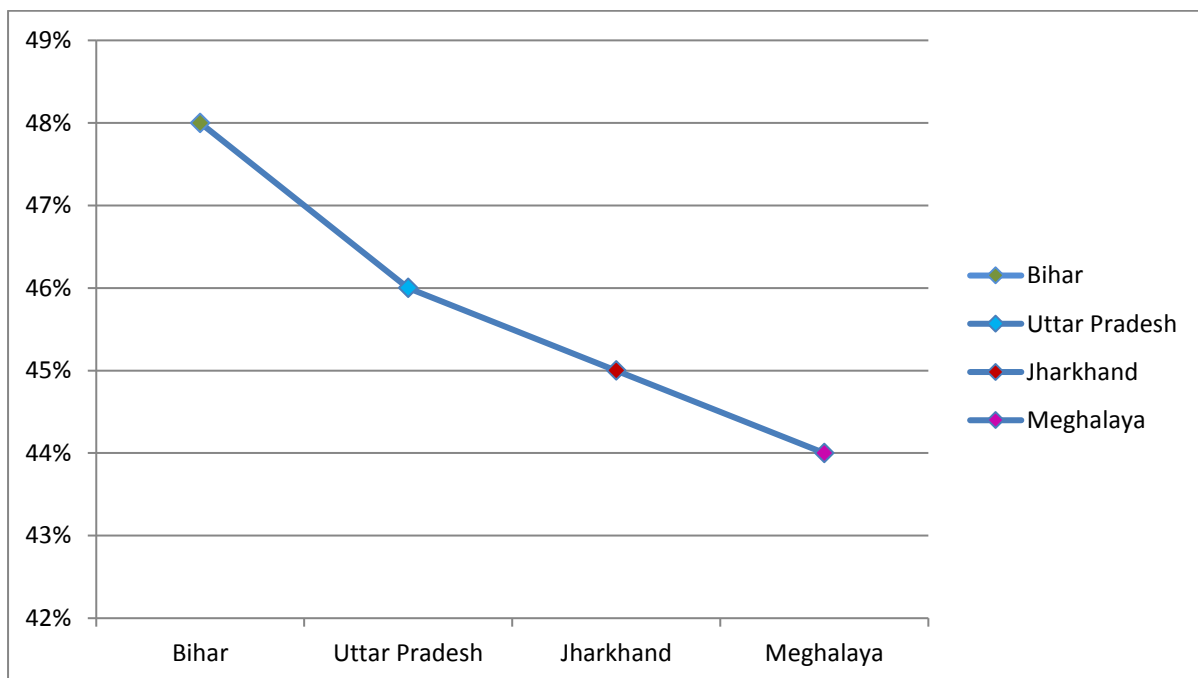


Figure 3: Prevalence of stunting among pre-school children in India (Source: NHFS-4, 2015-16)

The NHFS-4 data has divided anemia into mild, moderate and severe. It was subsequently observed that 59% of the pre-school children were affected by anemia. This was sub-divided into mild anemia (28%), moderate(29%) and severe(2%) (Table 1).The prevalence of anemia

tended to be highest in Haryana (72%) followed by Jharkhand (70%) and Madhya Pradesh (69%). It has been reported that inadequate iron supplement to children leading to anemia condition imbalances body coordination in relation to physical and mental health thus giving rise to various chronic infections and cognitive defects (Kotecha, 2011). Pre-school children have also been shown to be more vulnerable to deaths due to different micronutrient deficiencies such as iron, iodine, zinc, vitamin-A and folic acid deficiencies (Kotecha 2008).

Table 1: Prevalence of anemia among pre-school children based on NHFS-4 data (2015-16)

Category	Percentage
Mild anemia	28
Moderate anemia	29
Severe anemia	2
Total	59

The study of Priyanka et al. (2016) which consists 360 such children of both genders showed 28.3% of them to be underweight and 14% to be stunted. This study also documented a higher prevalence of both underweight and stunting among girls than boys. Chronic under-nutrition among children aged between six months to fifty nine months was reported by Corsi et al. (2016). Urban residing pre-school children in Maharashtra showed 16% wasting and 38.15% underweight which were associated with a number of socio-economic factors (Purohit et al. 2017). The same study observed that highest incidence of stunting (40.46%) was associated with family type, family size, education availability, birthweight and birth order. Children from high income families showed high prevalence of stunting and wasting (27% and 13%) as reported by Gupta and Kapil (2017). Very recently a community-based longitudinal study was conducted among tribal children aged below three years to observe severe acute malnutrition. The study had a sample of 179 children and it was observed that 78% of the children improved the severity whereas 37% were considered normal which were considerably good (Prasad et al. 2017). Sachdev et al. (2017) examined severely wasting recovery to survival period among pre-school children in Meerut District, Uttar Pradesh and showed that 2.7% to be dead and severely low wasting 25%-2.7% whereas 25%-30% were back to normal. Under-nutrition was also reported from pre-school children in Yavatmal district by Ambadekar and Zodpey (2017) and Delhi by Mathur et al. (2018). Borkotoky et al. (2018) related stunting, wasting as well as underweight with socio-economic factors that directly diversify the food habits both at community and state levels. Ansuya et al. (2018) correlated underweight to socio-economic and environmental factors in their study among preschool children in Karnataka. Tribal children from Palghar, Maharashtra aged between one to six years were reported to be affected by high levels of stunting, wasting and underweight (59%, 20% and 53%) respectively (Ghosh and Varerkar 2019). This study

further observed that although 32% were moderately stunted, severely stunted accounted for 27%. Similarly 18% of the children were severely underweight and 4% severely wasted. Both genders showed almost equal prevalence of stunting and underweight but wasting outnumbered boys which were higher than girls (Ghosh and Varerkar 2019). Pre-school children of migrant workers showed 40.4% stunting, 22.1% wasting and 50.4% underweight (Ravindranath et al. 2019). A study from Bengaluru reported 41% under-nutrition with 48.5% stunting (George et al. 2019). A state and district level study among malnutrition was conducted by Varghese and Stein (2019). In a recent study, Singh et al. (2019) observed high stunting (38%) and underweight (35%).

Birth order was also a very important factor which directly resulted in under-nutrition among such children (Mondal and Sen, 2010). Associations between feeding habits and stunting and wasting were reported from Mumbai pre-school children by Bentley et al. (2015). Chatterjee et al. (2016) in their study from Gumla, Jharkhand showed 54.3% of pre-school children to be underweight. Chaturvedi et al. (2018) reported high under-nutrition among children from Jharkhand (52% severely wasted and 83% underweight). Khan and Mohanty (2018) analyzed the NHFS-4 2015-16 data to relate mixed population and stunting, wasting and underweight children. Sarkar (2016) studied the socio-economic factors in relation to under-nutrition among pre-school children in Bankura district of West Bengal and reported that stunting was highest (51%) followed by underweight (41%) and finally wasting (22%). Bengali pre-school children had a high incidence of underweight (51.07%) and wasting (35.37%) which was seen to be comparatively higher than stunting (26.22%) (Giri et al. 2017). A community based study among 311 Santhal pre-school children in West Bengal showed 47.9% stunting, 23.5% underweight and 13.2% wasting (Mahapatra et al. 2019).

OVER-NUTRITION (OVERWEIGHT AND OBESITY) AMONG INDIAN PRE-SCHOOL CHILDREN

Over-nutrition comprises dietary habits related to overweight and obesity which is observed mainly among pre-school children due to faulty eating habits, lack of physical exercise which definitely leads to a very inactive lifestyle. Rise in income among individuals shows positive relation with sedentary living styles (Wang et al. 2009; Popkin et al. 2012; Rengma et al. 2015; Debnath et al. 2019). Studies show that prevalence of obesity was much higher among urban residing pre-school children due to the improper intake of high calorie diet (Popkin 1998; Wang et al. 2002). It has been reported that healthy children were more prone to be overweight and obese (Khadiolkar et al. 2011). Increases in both overweight and obesity was observed among low as well as high income families (Ranjani et al. 2016) which was primarily related to the change to better lifestyle and also improvement in socio-economic and demographic conditions. A recent study has reported that the number of sibling in a particular family with all other related socio-economic factors were associated with abdominal adiposity among urban children (Kuriyan et al. 2018). Dandona (2019) observed that the prevalence of overweight among pre-school children increased from 2010 to 2017. Overweight among pre-school children showed relation with mothers who rather tended to be overweight (Harding et al. 2019).

MICRONUTRIENTS DEFICIENCIES/EXCESS (VITAMINS AND MINERALS) AMONG CHILDREN PRE-SCHOOL CHILDREN

Micronutrient comes from the words “micro” meaning “small” and includes vitamins and minerals required for human body in trace amounts. Often they are also referred to as “trace elements”. Micronutrient deficiencies are an area of serious concern for pre-school children as they remain vulnerable to death due to deficiency of such nutrients (e.g., vitamin-A, vitamin-B12, iodine, calcium, iron and zinc). Micronutrients in excess or deficit amounts are directly associated with malnutrition (Gonmei and Toteja 2018). Micronutrient deficiency is also closely associated with underweight, stunting and wasting (Imdad and Bhutta 2012). Non-availability or low quantity of vitamins in the body like vitamin-B12 leads to delay in growth and development (Green et al. 2017). The cognitive skill and physical activities also decrease (Swaminathan et al. 2013). Neurological problems arise when malabsorption occurs by decreasing the intake capacity of the body. Deficiency in vitamin B12 among mothers also shows deficiency among infants and young children by affecting their neurological and physiological process (Anand et al. 2018). Besides causing anemia, iron deficiency among children disturbs the development of cognitive and physiological skills (Swaminathan et al. 2013). These, in turn, disturb the state of mind where attention lapses increase with distracting behaviour with few defects like dysphagia, diminishes function of cerebral hemisphere (Bharadva et al. 2019). Vitamin-A which includes mainly retinol and retinal compounds adversely affect children in excess or in deficit amounts. Excess of this vitamin leads to various problems such as nausea, anorexia and many more whereas deficiency leads to problems related to eye and uro-genital infections. The NHFS-4 data observed that pre-school children receiving vitamin-A has increased to 60.2% in 2015-16. Arlappa et al. (2010, 2011a, 2011b) documented deficiencies in micronutrients among rural pre-school children of West Bengal and Madhya Pradesh. A community based study in eight states by Laxmaiah et al. (2013) reported high vitamin-A deficiency, Bitot’s spot and iron deficiency among schedule caste and schedule tribal pre-school children. Zinc is another very important for normal growth of body. Studies have indicated that psychological development was directly related to zinc availability (Kodkany et al. 2013). Prevalence of vitamin-A deficiency was observed to be 2.49% (overall) from a study in Meghalaya (Nongrum and Kharkongor 2015). Samundeeswary et al. (2016) observed a 20% deficiency in iodine and 25% in vitamin-A. Micronutrient deficiencies were also reported from pre-school children from Nagaland (Longvah et al. 2017). Zinc bio-fortified wheat has helped to lessen morbidity among pre-school children (Sazawal et al. 2018). Very recently Houghton et al. (2019) assessed micronutrient status among children aged two years from New Delhi and observed that 74% exhibited vitamin-D deficiency, 37% folate deficiency, 29% vitamin-B12 deficiency, 25% zinc deficiency and 17% vitamin-A deficiency.

MALNUTRITION AND DISEASES AMONG INDIAN PRE-SCHOOL CHILDREN

The Comprehensive National Nutrition Survey (CNNS) documented anemia among pre-school children. It was reported that 41% of them were anemic which was directly related to stunted growth at about 34.7%, 33.4% underweight and wasting 17.3%. In another study, among pre-school children by Samundeeswary et al. (2016) reported that 40% of the children

were anemic. A recent study among the Chakhesang tribe of Nagaland showed prevalence of anemia to be 26% which was related with underweight (14%), stunting (22%) and wasting (7%) among 661 pre-school children (Longvah et al. 2017). The NHFS-4 data observed that 58.4% of pre-school children exhibited high prevalence of anemia and that a high percentage of expecting mothers and women bearing children who breastfeed as well as adolescents were observed to be anemic (Toteja et al. 2006; Gonmei and Toteja 2018). It has been observed by Gosdin et al. (2018) that anemia and stunting were also closely related. A study in Bihar consisting of 5,664 children reported the overall prevalence of anemia and stunting to be 21.5%. Diseases related to respiratory function was 22.6% and diarrhoea was 13.3% (Dandona 2019). In another recent study, Gope et al. (2019) observed that children aged below three years remained very much prone to mixed dietary habits which cause under-nutrition resulting in diarrhoea and malaria like diseases. Iron deficiency was observed the highest, which cause anemia of about 86%-93% among children aged two years from New Delhi (Houghton et al.2019).

PROGRAMMES IMPLEMENTED BY THE GOVERNMENT TO ERADICATE CHILD MALNUTRITION

The National Nutrition Mission (Rashtriya Poshan Mission) was launched in 2017-18 by the Ministry of Health and Family, Government of India. Other such schemes to overcome malnutrition among pre-school children include Home Based Care for Young Child, Anemia Mukth Bharat, Defeat Diarrhoea Initiative, Intensified Mission Indradhanush 2.0 and National Deworming (Dandona 2019).

The government had taken serious steps for implementing various policies, programmes and intervention to eradicate malnutrition among pre-school children as much as possible. The Infant and Young Child Feeding (Bharadva et al. 2019) guidelines has recently focussed on the Poshan Abhiyaan in creating awareness for better nutrition thus to overcome malnutrition among infant and young children. Insufficient food quality is the ultimate cause of malnutrition (Chellaiyan et al. 2020). The implementation of Poshan Abhiyaan has made little success by reducing stunting, underweight and low birth weight by 2% per year whereas anaemia has decreased by 3%. Underweight among pre-school children is related with intestinal worms which results in death which in turn is monitored by Integrated Child Development Services (Awasti et al. 2013). The Kuposhan Mukth Bharat which is malnutrition-free India by 2022 programme is another significant programme. The list of such programmes is outlined in Table 2.

Table 2: Programmes implemented by the Government of India to eradicate child malnutrition

Sl. No.	Nutritional programme	Focus	Beneficiary
1.	Integrated Child Development Scheme (ICDS) 1975	The programme aims to better the nutritional status related to malnutrition and health opportunities (mortality and morbidity) among infants, children below six years and expecting and lactating mothers.	Infants, children below six years, pregnant and lactating women
2.	Special Nutritional Programme 1970-1971	The programme entangles in improvement of nutritional status among pre-school children, expecting and lactating mothers by providing supplementary nutrition feeding habits and health services.	Pre-school children, lactating and expecting mothers
3.	National Nutritional Anemia Prophylaxis Programme(1970)	Maternal and Child Health (MCH) Division of Ministry of Health and Family Welfare have implemented the programme for both mothers and their children of age group one to five years to prevent nutritional anemia by intake of required amount of iodine and folic acid.	Mothers and their children of age group one to five years
4.	National Iodine Deficiency Disorders Control Programme (1962, 1992)	This programme aims to increase the usage of iodised salts so to eradicate goitre	Children, pregnant and lactating women
5.	Applied nutritional Programme (1960; Orissa and Andhra Pradesh, 1961: Tamil Nadu, 1962: Uttar Pradesh, 1973: all states	Nutritional and protective food is provided to children aged between two to six, breast-feeding and expecting mothers	Children aged between two to six, breast-feeding and expecting mothers
6.	Vitamin-A Prophylaxis	This programme aims to decrease the deficiency of	Children aged six months to

	Programme (1970)	vitamin-A among children aged six months to six years	six years
7.	Balwadi Nutrition Programme (1970)	Children aged between three to six years of age are provided with supplementary nutrition (three hundred calories and fifteen grams of protein grams) for 250 days.	Children aged three to six years

CONCLUSION

Food habits, the transition from healthy to junk food is increasing at alarming rate which further is lowering body's capacity to fight with various infections and diseases. This shift in food patterns also causes change in balance diet which either in excess or in deficiency directly results in malnutrition including both under nutrition and over nutrition. Micronutrients and malnutrition are very much related to one another as they are the main cause of global burden which hampers the public health to a great extent. Deficiencies impair multi-development skills of the body in relation to cognitive, behaviour, physical, emotional and physiological skills. Causes of malnutrition and its associated factors should be studied in depth among pre-school children by government and private sectors. Government interventions if properly implemented then SDGs 2030 goal can be easily achieved. Lastly areas of research on malnutrition among pre-school should be moreover encouraged for better understanding the consequences and working upon it.

RECOMMENDATIONS

Malnutrition is now a very important public health issue strongly related to nutrient intake. Imbalance in consumption of healthy foods, non-availability of foods as well as unhealthy dietary habits are the main cause of malnutrition whose prevalence can be assessed only by determining the nutritional status. The present paper has discussed underweight, overweight, micronutrient deficiencies and diseases related to malnutrition among pre-school children (children aged under-five years of age). The following recommendations can be looked upon:

- Counsellors in different local areas should be assigned by health services to conduct counselling of mothers of pre-school through home visit regarding issues related to malnutrition.
- Health centres should built crèches and ask the *Anganwadi* workers to look after the children's nutritional requirements and work accordingly.
- The government should frequently organize awareness camps so as to disseminate knowledge about healthy feeding habits, importance of physical activities, proper hygiene and safe drinking water, infant and childhood diseases which affect later in adult phase of life.

- People residing in many remote areas are unaware about the government policies and interventions programmes. The governmental agencies should make spread awareness for the well-being of the communities living there.
- Eradication of malnutrition can be only possible if feeding habits are improved. Food containing supplements and micronutrients such as iodine, iron and vitamin-A should be made cost effective. These may also be provided free of cost to the pre-school children at regular intervals.
- Screening of pre-school children for various diseases should be implemented and appropriate treatment should be made by providing necessary action without any delay.

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