

# Dietary Diversity in School Going Children: Review

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**Abstract:** Child malnutrition is a public health problem in developing countries, and dietary diversity is one of the important determinants of undernutrition. Different nutrients are obtained from different food groups and to meet the requirement of recommended Dietary Allowances entitled as Dietary Diversity. The current review revealed that the nutrition status of children is directly related to the food groups consumed. Food diversity depends on many factors such as Socio-economic Status, education level, sex, and age of the subjects. The food group consumed and food items taken from each group were low in the low Socio-Economic Status (SES) subjects, rural areas, females, and less educated families, resulting in malnutrition among children of various countries. Low level of Dietary Diversity can be the reason for undernutrition in children worldwide, especially in developing countries. Many studies thus supported that Dietary Diversity and Food Variety can provide nutritional adequacy.

**Keywords:** Food Variety, Dietary Diversity, Dietary Diversity Score, Nutritional adequacy, Micronutrient Deficiencies.

## INTRODUCTION

The food group consumed by a person in a reference period of time, which is more probably twenty-four hours, is called Dietary Diversity [1]. All nutrient-rich foods are important elements for every individual. Six primary nutrients are required for adequate nourishment necessary for growth, development, and to lead an active and healthy life. The main nutrients are Carbohydrates, Proteins, Fats, Minerals, Vitamins, and Water. These nutrients are obtained from different food groups. All the eatables are divided into following food groups Carbohydrates (cereals, grains, millets, roots, and tubers), Proteins (pulses, legumes, meat, eggs, poultry, flesh foods, milk, and milk products), Fats (nuts and oilseeds, fish, liver, and organ meat), Vitamins (vegetables and fruits), Minerals (condiments, spices, and salt), Water and Dietary fiber [2]. Dietary Diversity Score (DDS) is the scale to measure Dietary Diversity. All eatable items which are part of our food are provided by consuming the items from one of these food groups. Non-consumption of food items from these groups and a variety of items from within the groups leads to a deficiency of any macro or micro-nutrient, which leads to nutritional deficiency and morbidity. To assess the dietary adequacy in the Individual Dietary Diversity Score is the instrument. The total of Food groups consumed by a person in twenty-four hours gives the Dietary Diversity Score of the person [3].

Food Variety (FV) is a number of food items taken from different food groups. Food Variety is also an indicator of nutrient adequacy for an individual [4]. Nutrition adequacy for a person was directly linked to the number of food groups, and food items consumed [5]. Various researches show Food Variety affects the nutritional status of the children, whether under nutrition or over nutrition [6]. Food provided to children is not sufficient to fulfill the body diet requirement given to young children. It is often inadequate to meet nutritional needs based on food variety and Dietary Diversity [7]. A study on children in the Caribbean showed anemia [8].

Dietary diversity is classified into two groups that are Household Dietary Diversity (HDD) and Individual Dietary Diversity (IDD). The number of Food groups taken by an individual on the previous day at home is known as Household Dietary Diversity (HDD). This Dietary Diversity excludes the food purchased and eaten outside the home and is related to the socio-economic level of the household. Individual Dietary Diversity (IDD) is the number of food groups taken by a person in time in the last twenty-four hours, whether from home or outside of the home. It gives an idea about the nutritional quality of an individual's diets. It includes Women's Dietary Diversity (WDD) and Composite Dietary Diversity (CDD). Women's Dietary Diversity (WDD) gives the account of micronutrient adequacy of the diet. Composite Dietary Diversity (CDD) is given by the sum of food groups reported by mothers for each child from total food groups in a given reference of time in the last 24 hours [9].

In the developing countries, the main nutrition problem in children is the low Dietary Diversity

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commonly lack protein, vitamins, and minerals, especially vegetables and fruits, but it has been shown that amount of carbohydrates and fats increased from 1970 to 2002 [10]. Many types of research show that the main cause of child malnutrition double burden of malnutrition, cardiovascular risk, dyslipidemia, and higher metabolic syndromes was in adequate Dietary Diversity and food variety [11-14]. Another study in Ethiopia showed that lacking animal source food resulting in the inadequate growth nutrients such as vitamin A and vitamin B, calcium zinc, and iron [15, 16].

Dietary diversity can be measured by taking detailed data on household food assess and individual dietary intake, which is a very difficult and typical task. For this purpose, a questionnaire is a very user-friendly and low-cost tool that can be used to measure the Dietary Diversity in a limited time. The quality measure of food consumption is reflected by the data collected through the questionnaire is converted into Dietary Diversity Score [3]. A total food group taken in the diet reference period gives nutritional adequacy [17].

## METHODS AND MATERIALS

All the studies for this review paper were obtained from various sources such as Research Gate, Pub Med, Google Scholar, American Journal of Clinical Nutrition, and a book "Nutritive Value of Indian Foods", NIN (ICMR) for review of the literature. Out of 36 researches, 30 researches were from outside of India [1], [4-6, 11-21, 23-25, 27-30, 32, 36-38] and [40] that are global level and six were from India [22, 31, 34, 35, 39] and [41] that is national level. In all the studies, the Individual Dietary Diversity Questionnaire was used, and the reference period was taken as per the FAO guidelines using a twenty-four-hour recall period. The food was categorized into the main seven groups. (1) Carbohydrates (cereals, millets, sugars and jaggery, roots and tubers), (2) Proteins (pulses, legumes, meat, eggs, poultry, flesh foods, milk, and milk product), (3) Fats (nuts and oilseeds, fish, liver, and organ meat), (4) Vitamins (vegetables and fruits), (5) Minerals (condiments, spices, and salt), (6) Water, (7) Dietary Fiber. Anthropometric measurements were used for children's nutritional status. The obtained data were reviewed with respect to Dietary diversity with the nutritional status of children, gender, Socio economy of household, education level of the parents. The researches were selected from the medium of advance research, and the articles were open access distributed under the creative commons attribution license, which permits unrestricted use, distribution, and reproduction

in any medium provided the original work properly cited.

## RESULTS

The studies reviewed showed the following observations in a different context related to dietary diversity in children.

### (DDS) Dietary Diversity Score

Dietary Diversity Score (DDS) is the measurement of the number of food groups taken by a person in a given period of time. It is calculated by the sum of the number of food groups in a given reference of time. As per the study, the one-day and three-day reference period may not give the actual position in all the subjects due to individuals eating habits, so the reference period for a longer period that is seven to fifteen days may give a more accurate assessment of Dietary Diversity [18]. To measure the Dietary Diversity in some developed countries, a simple count of foods or food groups was used, called Dietary Diversity Score (DDS). Food Variety Score (FVS) is defined as the number of food items consumed by an individual from a particular food group in a given reference of time and measured by a simple count of individual food items in over last 24 hours. Food Variety Score is also given equal points to each of four food groups for four servings that are a total of sixteen points in twenty-four hours—Kant in 1991 and 1993 changes this scoring system from sixteen to twenty points [19]. Dietary Diversity Score (DDS) is categorized into three categories, (1) Low Dietary Diversity Score (LDDS) - It is defined as the consumption of three or less than three food groups out of seven food groups. (2) Minimum Dietary Diversity Score (MDDS) - It is defined as the consumption of at least four food groups out of seven food groups. (3) Adequate Dietary Diversity Score (ADDSD) - It is defined as the consumption of more than four food groups out of seven food groups [33]. In most of the studies the mean Dietary Diversity Score was low, only a few studies showed that a fraction of children get adequate Dietary Diversity Score such as in a cross-sectional study in Meskan district of southern Ethiopia shows that only 27.5% (Mean Dietary Diversity Score =  $4.66 \pm 1.85$ ) school-going children had adequate Dietary Diversity [20]. In USA, Florida, a study shows 48% of preschoolers had minimum dietary diversity, 19% have low Dietary Diversity. The mean score was  $4.19 \pm 0.83$  [21]. In a study of Aligarh on 326 children in which 161 were male and 165 were female, adequate Dietary Diversity

was found in 42.6% of study participants [22]. The proportion of children with a low Dietary Diversity Score was 42.1% in Moramanga and 47.6% in Morondava [23]. Similarly, a study conducted in three developing countries Peru, Bangladesh, and Sierra Leone, showed a minimum Dietary Diversity Score. Peru 89%, Bangladesh 61%, and 53% of children Sierra Leone got minimum Dietary Diversity [24]. In a study from Ghana, there was also low Dietary Diversity in children, 47% consumed four food groups, 25% consumed three food groups, and 13% had none of the food groups [25]. In Iran and India study, the Food Group Score was higher in children of India ( $F=10.759$ ,  $p=0.000$ ) than Iran ( $F=5.825$ ,  $p=0.001$ ) [26]. In a study of rural Nigerian school children, only 22.2% had a high Dietary Diversity Score [27]. The Dietary Diversity Score in African children was 3.6, and Food Variety Score was 5.5, which is very low [28]. In a study in Rwanda and Burundi, children had low Dietary Diversity scores [29]. In a Nigerian study, the prevalence of low Dietary Diversity Score (DDS) was 73.5%, medium 25.2%, and high 1.3%. Only 25% of children met with Minimum Dietary Diversity [30]. In a study in Maharashtra in India, most of the children were met Minimum Dietary Diversity Score [31]. DDS in ethnic minorities of south-central China were found much lower than their peers in other areas [32]. In a study in Tanzania, 74% of children did not meet Minimum Dietary Diversity [33]. Overall mean DDS was low (2.26); only 23% of children achieved Minimum Dietary Diversity Score (MDDS) [34]. Dietary Diversity Score (DDS) was found 1 in 8%, 2 in 48%, 3 and 5 in 6%, 4 in 24% and 6 in 8%. The average Dietary Diversity Score (DDS) was low. 30% of children were found stunted [35]. In East Java, Indonesia Dietary Diversity Score was 9.1(for twelve food groups) [36].

### **Dietary Diversity (DDS) and Children's Nutritional Status**

Different studies showed an association between Dietary Diversity and the nutritional status of children. Since most of the children were found stunted, the studies also showed that Food Variety and Dietary Diversity were not adequate in most subjects. The data from eleven demographic health surveys in Africa, Asia, and Latin America reviewed by Mary Arimond, Marie T Ruel, showed that Dietary Diversity is significant as the main effect in seven countries [37]. These findings suggest that Dietary Diversity strongly related to the nutritional status of the children. In an Ethiopian study, stunting was 10.15% in school going children [20]. In East Java, Indonesia, 39.4% of

children were found stunted [36]. In USA Florida study shows that malnutrition was 11.35% in preschool children [21]. There was a high level (78.86%) of chronic malnutrition, with 40.65% severely stunted [38]. In a study of Ghana, South Africa, 1/4<sup>th</sup> children were found malnourished due to low Dietary Diversity [25]. Various studies proved that stunting is directly related to Dietary Diversity and Food Variety in children [30, 31, 39]. Dietary diversity and stunting were associated with inadequate dietary diversity; 83% of children were reported with chronic malnutrition [22]. Both the Dietary Diversity Score (DDS) and Minimum Dietary Diversity Score (MDDS) are directly related to reducing malnutrition in children [33].

Research conducted in Ethiopia in urban children had a better diversity score than their counterparts in rural areas; thinness is also less prevalent in urban areas than in rural areas [20]. A study in Ghana on children showed a positive association in dietary diversity and agriculture diversity. Moreover, the household with more crops, livestock, fisheries, and poultry had high food variety in their children [40].

### **Dietary Diversity and Gender**

In the review, females got less Dietary Diversity and Food Variety as compared to their counterparts males. A study of Ekese BN, Blomme G, Garming H 2011, 25% among males, and 30.9% among females show stunting [38]. In the study of NITHYA D. J., BHAVANI R. V. 2017, 53.8% of boys had low Dietary Diversity, 33.3% moderate, and 12.8% high. 62.9% girls had low, 22.9% moderate and 14.3% high Dietary Diversity [41].

### **Dietary Diversity (DDS) and Household's Socio-Economic Status**

Children from high socio-economic status families have twice more likely Dietary Diversity than the low socio-economic status families [20]. The household expenditure is directly related to Dietary Diversity and Food Variety [39]. A study concluded that the household's Socio-Economic Status (SES) also positively related to the Dietary Diversity of the children [37].

### **Dietary Diversity and Education Level**

Dietary diversity scores of children were low in the low level of maternal education, then the mothers who attended at least one year of primary school [23]. A study of Peru, Bangladesh, and Sierra Leone also proved the maternal education positive association with

the Dietary Diversity Score of the children [24, 34]. Ghana's study also supports education's positive association with Dietary Diversity [25]. Level of Education of family, dietary diversity score, and food variety was also found to have a positive association with the education of family [42]. A strong positive association was seen between Maternal and Children's Dietary Diversity. However, all food items taken by mothers were not consumed by children; however, it was found some foods such as cereals, pulses, fruits with vitamin A and fish were taken by both mother and children [43].

## DISCUSSION

Malnutrition has a long life effect on children in the later stages of life. It is the responsibility of all that is the parents, teachers, social workers, government, researchers, and all dieticians, and caregivers should give regular and continuous attention to the health and children's nutritional status. Today's children are responsible citizens of tomorrow, which will play an important and more significant role in the growth and development of society. However, there is an upward trend in the children's nutritional status has been seen, but still, many children are undernourished in the developing and underdeveloped countries. This has been proved to have a strong association between Dietary diversity in children's nutritional status. It was found that Dietary Diversity is strongly related to gender, education, SES (Socio-Economic Status), demographic conditions, and agricultural diversity. The children whose mothers were having higher education were found to have higher dietary diversity because educated caregivers/mothers know the importance of a balanced diet, so emphasis should be given on girls' education because they will become future mothers. Also, effort should be made to improve the families' economic status and the diversification of agriculture. The curriculum of schools and other institutions should include nutrition and health topics so that the nutritional status of children is improved.

## CONCLUSION

From the review of this paper, it is concluded that there is a positive correlation between the Dietary Diversity and Food Diversity with all the indicators and parameters of nutritional status of children such as anthropometric, biochemical, clinical and dietary measurements. This means that diverse food gives good health to children and decreases malnutrition in children. It is recommended that the policymakers,

parents, and caregivers pay regular attention to the children's diet. The anganwaris (preschools) in Ujjain, mid-day-meal in schools, and other feeding programs should be regularly evaluated from time to time. They should be restructured as per the availability of seasonal food items, so the requirement of each food group and (DDS) dietary diversity score and food items from every group (FVS) can be met in children.

## DISCLOSURE STATEMENT

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