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Nayna P Raval
Assistant Professor,
Department of Food Science
and Nutrition, ASPEE College
of Nutrition and Community
Science, Sardarkrushinagar
Dantiwada Agricultural
University (SDAU),
Sardarkrushinagar, Gujarat,
India

Sunil Purohit
M.Sc. (Community Science)
Food and Nutrition,
Department of Food Science
and Nutrition, ASPEE College
of Nutrition and Community
Science, Sardarkrushinagar
Dantiwada Agricultural
University (SDAU),
Sardarkrushinagar, Gujarat,
India

Shraddha Kapadiya
Assistant Professor,
Department of Food Science
and Nutrition, ASPEE College
of Nutrition and Community
Science, Sardarkrushinagar
Dantiwada Agricultural
University (SDAU),
Sardarkrushinagar, Gujarat,
India

Corresponding Author:
Nayna P Raval
Assistant Professor,
Department of Food Science
and Nutrition, ASPEE College
of Nutrition and Community
Science, Sardarkrushinagar
Dantiwada Agricultural
University (SDAU),
Sardarkrushinagar, Gujarat,
India

Assessment of dietary intake and nutritional deficiency among primary school children of deodar taluka of Banaskantha district

Nayna P Raval, Sunil Purohit and Shraddha Kapadiya

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Abstract

The school-age period is a critical phase for developing essential life skills, including independent eating habits and the formation of food preferences. Establishing healthy dietary practices during this stage lays the groundwork for long-term well-being and adult health. Despite the importance of nutrition during childhood, there remains a significant gap in research focused on the dietary habits and nutritional status of school-going children, particularly in rural areas.

This study aimed to evaluate the dietary patterns and identify nutritional deficiencies among primary school children residing in rural areas of Deodar taluka in Banaskantha district. A cross-sectional approach was adopted, involving a sample of 300 children aged between 6 and 12 years. Data on food intake were collected using a 24-hour dietary recall along with a food frequency questionnaire. Clinical assessments were also performed to detect visible signs of nutritional deficiencies.

The findings revealed that several nutrient deficiencies were present among the children surveyed. The typical diet of the participants showed low intake of pulses, green leafy vegetables, fruits, and animal-based foods such as meat. These suboptimal dietary habits may stem from unequal food distribution within households and personal food preferences among children.

Therefore, dietary practices need to be improved to avoid nutritional deficiencies that lead to a decrease in the growth spurt, for both physical and mental health.

Keywords: Primary school children, Dietary pattern, Nutritional deficiency

Introduction

Diet plays a fundamental role in determining an individual's health and nutritional status. Inadequate dietary intake—both in terms of quality and quantity—is a leading factor contributing to widespread malnutrition, especially among children. To address this issue, dietary assessments form a vital component of evaluating nutritional status, as they help in determining whether an individual's intake meets their nutritional needs.

The school-age years represent a critical phase in a child's development, marked by the acquisition of self-feeding skills and the formation of personal food preferences. Establishing healthy eating habits during this stage is essential, as they lay the groundwork for long-term health and nutrition in adulthood.

A well-balanced diet during childhood and adolescence is not only important for immediate growth and health (WHO/FAO, 2003) [11], but also helps form sustainable eating patterns that can last a lifetime (Westenhoefer J, 2002) [16]. Adequate consumption of energy and macronutrients is necessary for physical development, while micronutrients play key roles in metabolic processes (B vitamins), bone health (calcium), blood formation (iron), and growth (zinc). Deficiencies in essential micronutrients—such as vitamin A, iron, and iodine—continue to be prevalent in many developing countries, including India, and have severe implications for children's health, learning abilities, and overall productivity (Bowley A, 2008; Vijayaraghavan K, 2002) [3, 15].

Malnutrition among children remains a major public health concern in tropical and subtropical regions. Importantly, it goes beyond merely satisfying hunger. A child may consume enough to feel full, yet still suffer from hidden hunger due to nutrient deficiencies. Malnutrition is closely linked to poverty and has profound physical and psychological impacts. It is increasingly being recognized not just as a health issue, but also as a violation

of children's basic human rights. The causes of malnutrition are complex and multifaceted, often involving inadequate diets, recurrent infections, and insufficient caregiving.

Objectives

The specific objectives of the above study were the following:

1. To evaluate the dietary intake of the primary school children
2. To assess the prevalence of nutritional deficiency through clinical signs and symptoms of primary school children

Methods and Materials

This cross-sectional study was carried out in the rural regions of Deodar Taluka, located in Banaskantha District. Deodar Taluka was specifically chosen for the study due to its classification as a socially and educationally backward area. Out of the 72 villages in the Taluka, 10 were selected using a random sampling method to ensure unbiased representation.

During the data collection phase, a list of primary school children aged 6 to 12 years was obtained from schools within the selected villages. From each of these schools, 30 students (including both boys and girls) were randomly chosen, resulting in a total study sample of 300 children.

To gather dietary information, a pre-designed and pre-tested food frequency questionnaire was administered through face-to-face interviews with the participants (as referenced in Basch *et al.*, 1990; Lytle *et al.*, 1998) ^[1, 7]. This approach ensured accurate recall and detailed dietary intake data.

In addition to dietary assessment, clinical evaluations were conducted to identify signs of nutritional deficiencies. These assessments were performed by a qualified physician or healthcare expert. The clinical evaluation followed the guidelines provided by the National Advisory Committee and the Indian Council of Medical Research (NAC-ICMR), as recommended by Swaminathan (2003) ^[12]. These guidelines facilitated a structured assessment of health conditions in relation to dietary intake. The data obtained were collated and statistically analyzed.

Results and Discussion

Dietary survey of the respondents

Dietary surveys play a crucial role in evaluating the nutritional status of individuals or populations. They offer valuable insights into the quantity and quality of nutrient intake, food sources, dietary habits, and attitudes toward

food. In this study, the dietary habits of participants were analyzed based on diet type, meal frequency, and regularity of food consumption.

As shown in Table 1, a significant majority (94.67 per cent) of the surveyed primary school children followed a vegetarian diet, while only 05.33 per cent consumed non-vegetarian foods. To understand the participants' nutrient intake, their food consumption patterns were examined using a structured dietary assessment.

Cereals and millets were found to be the dietary staple, forming the foundation of most meals. This aligns with general dietary trends among low-income populations in India and other developing nations, where cereals and millets often contribute 70–80 per cent of the total diet. Table 2 highlights that 100 per cent of the participating children consumed cereals and millets on a daily basis, reflecting their essential role in the diet.

Pulses, known for their high protein content (ranging from 19.00 per cent to 24.00 per cent), were also evaluated. They serve as important sources of B-complex vitamins and minerals. However, pulses are generally low in vitamins A, D, B12 and C. Despite these limitations, pulses effectively complement the nutrient profile of cereals when consumed together, making them a vital component of a balanced vegetarian diet.

Table 1: Distribution of primary school children according to their general dietary habits (n=300)

Food habit	Boys		Girls		Total	
	f	%	f	%	f	%
Vegetarian	143	94.08	141	95.27	284	94.67
Non-vegetarian	009	05.92	007	04.73	016	05.33
Total	152	100	148	100	300	100.00

The analysis of pulse consumption, as presented in Table 2, reveals that only 21.7% of the primary school children consumed pulses on a daily basis. A larger proportion—47.3 per cent—reported consuming pulses once a week, while 25.00 included them in their diet twice a week. A small fraction, about 6.00 per cent, consumed pulses only on a monthly basis. These findings are in line with the observations of Garg and Vermani (2014) ^[5], who noted that while cereal intake was consistently high, pulse consumption showed a satisfactory pattern across both genders. In the rural setting of this study, children primarily consumed locally available pulses, such as green gram and Bengal gram, reflecting regional dietary practices and availability.

Table 2: Distribution of primary school children according to their food consumption pattern (n=300)

Food products	Daily (per cent)	Twice a Week (per cent)	Once a Week (per cent)	Monthly (per cent)	Occasionally Or seasonally (per cent)	Never (per cent)
Cereals	300 (100)	—	—	—	—	—
Pulses	65 (21.70)	75 (25.00)	142 (47.30)	18 (06.00)	—	—
Green leafy vegetables	50 (16.67)	110 (36.67)	93 (31.00)	40 (13.33)	7 (02.33)	—
Other vegetables	48 (16.00)	126 (42.00)	90 (30.00)	34 (11.40)	02 (0.60)	—
Roots and tubers	145 (48.30)	98 (32.70)	45 (15.00)	11 (3.7)	01 (0.3)	—
Fruits	12(04.00)	41 (13.70)	79 (26.30)	79 (26.30)	89 (29.70)	—
Milk and milk products	91 (30.00)	64 (21.50)	113 (37.70)	26 (08.70)	06 (02.00)	—
Fats and oils	283 (94.50)	17 (05.50)	—	—	—	—
Sugar and confectionary	153 (51.00)	83 (27.60)	64 (21.40)	—	—	—
Preserved and processed foods	—	—	52 (17.30)	85 (28.30)	163 (54.30)	—
Fast foods	—	—	—	02 (00.70)	13 (04.30)	285 (95.00)
Meat and meat products	—	—	—	09 (03.00)	32 (10.66)	259 (86.33)
Special foods	—	—	—	16 (05.33)	284 (94.67)	—

Green leafy vegetables are rich in carotene and serve as good sources of calcium, riboflavin, iron, folic acid, vitamin C, and dietary fiber. Among protective foods, they are also the most economical. Table 2 shows that 36.67 per cent of children consumed green leafy vegetables twice a week, 31 per cent consumed them once a week, and 16.67 per cent consumed them daily. A smaller proportion, 13.3 per cent, consumed them monthly, while only 2.3 per cent consumed them seasonally. The relatively low consumption may be attributed to the limited variety and seasonal availability of green leafy vegetables in the study area. Local varieties such as spinach, coriander leaves, and fenugreek leaves were consumed primarily during their growing season (NIN, 2011).

This category includes a wide range of vegetables that provide essential vitamins, minerals, and dietary fiber. According to Table 2, 16 per cent of children consumed these vegetables daily, 42 per cent twice a week, 30 per cent once a week, 11.4 per cent monthly, and only 0.6 per cent consumed them seasonally. Commonly consumed vegetables in the area included green chilies, bottle gourd, brinjal, radish, tomato, and carrot—largely because they were cultivated locally and readily available.

Roots and tubers are rich in carbohydrates and starch, although most are low in protein, with the exception of potatoes. Table 2 shows that 48.3 per cent of the children consumed roots and tubers daily, 32.7 per cent twice a week, 15 per cent once a week, 3.7 per cent monthly, and just 0.3 per cent seasonally. Onions, garlic, and potatoes were consumed frequently, primarily due to their easy availability in local markets and households.

Fruit consumption was heavily influenced by seasonal availability. As shown in Table 2, 29.7 per cent of the children consumed fruits seasonally, 26.3 per cent once a week, another 26.3 per cent monthly, 13.7 per cent twice a week, and only 4 per cent consumed them daily. The low intake can be attributed to factors such as limited household income, lack of homegrown fruit sources, and insufficient awareness of nutritional benefits. Fruits are valuable for their glucose, fructose, vitamin C, β -carotene content, and high water content. Donaldson (2004) highlighted that lifestyle and dietary changes, including increased fruit intake, could prevent 30–40 per cent of cancers.

Milk is a near-complete food, with the exception of iron and vitamins C and D. It contains high-quality proteins. Table 2 indicates that 30 per cent of children consumed milk daily, 21.5 per cent twice a week, 37.7 per cent once a week, 8.7 per cent monthly, and 2 per cent occasionally. According to NDDB (2015–16), Gujarat ranks third in India in milk production, with over 12 million tonnes annually.

Fats and oils primarily provide energy, essential fatty acids, and fat-soluble vitamins (A, D, E, and K). Table 2 reveals that 94.5 per cent of children used fats and oils daily, while 5.5 per cent consumed them twice a week. Commonly used cooking fats included mustard oil and groundnut oil, with vegetable ghee used occasionally.

Sugars and sweets are quick energy sources and are commonly used in traditional diets. As indicated in Table 2, 51.00 per cent of the children consumed sugar daily, 27.6 per cent twice a week, and 21.4 per cent once a week. Traditional dietary habits may explain this high sugar intake. According to the India Sugar Trade Industry (2013), India is the largest sugar consumer globally and the second-largest producer (USDA, 2014).

Table 2 shows that 54.3 per cent of the children consumed processed foods occasionally, 28.30 per cent monthly, and 17.30 per cent once a week. This trend reflects a moderate presence of processed foods in rural diets.

Fast foods, typically fried and spicy, are more commonly found in urban settings. Table 2 indicates that 95 per cent of children had never consumed fast food, 4.3 per cent did so occasionally, and only 0.7 per cent consumed it monthly.

Meat, eggs, and poultry offer high biological value proteins along with nutrients such as iron, thiamine, phosphorus, and cholesterol. According to Table 2, 86.33 per cent of children never consumed meat or related products, 10.66 per cent consumed them occasionally, and 3 per cent consumed them monthly. Similar dietary patterns were observed by Swaminathan *et al.* (2004) ^[13], who found that children from higher socio-economic backgrounds consumed more fats and proteins and ate out more frequently.

Data from Table 2 also explored the consumption of special or traditional foods like homemade sweets (e.g., laddu, shira, sukhad). About 94.67 per cent of children and their families consumed such foods occasionally, while 5.33 per cent did so monthly. These foods are often prepared during festivals or special family occasions.

The National Nutrition Monitoring Bureau (NNMB, 2012) supports these findings, reporting that Gujarat showed relatively high consumption of cereals, pulses, fats, oils, and dairy products compared to other Indian states.

Distribution of the primary school children according to the clinical signs and symptoms Clinical examination is a vital method for assessing the nutritional status of both individuals and communities. It involves identifying physical signs that are commonly associated with nutrient deficiencies. These signs are typically observed in superficial epithelial tissues such as the skin, eyes, and other easily accessible body parts.

In this study, clinical assessments were conducted to evaluate the condition of the hair, face, eyes, lips, tongue, teeth, gums, nails, and skin of primary school children. The findings, summarized in Table 3, reveal the presence of various clinical symptoms indicative of nutritional deficiencies.

Observations related to hair health showed that 15.7 per cent of the children had thin and sparse hair. Flag sign, a condition where strands of hair show alternate bands of pigmentation, was present in 11.3 per cent. Additionally, 2.3 per cent exhibited a lack of luster in hair, while 1.7 per cent had hair that could be plucked easily—another potential indicator of protein-energy malnutrition.

Most children showed normal facial appearance. However, 0.7 per cent exhibited diffuse depigmentation, and 1.7 per cent had a "moon face," which may suggest underlying nutritional or metabolic issues.

Vitamin A deficiency was rare, identified in just 0.33 per cent of participants. Signs of xerosis (dryness of the conjunctiva) and Bitot's spots—both classic indicators of vitamin A deficiency—were observed in 4 per cent of the children.

Deficiency in vitamin B-complex was evident in several participants. Cheilosis (cracks at the corners of the mouth) was present in 13 per cent, and angular scars were seen in 11 per cent. Tongue-related issues included oedema in 13.33 per cent and glossitis (inflammation) in 13 per cent of the children.

Dental assessments showed that 2.3 per cent of the children had mottled enamel, a symptom often associated with fluorosis. Dental caries were observed in 27 per cent of the participants, and 17 per cent showed symptoms of spongy or bleeding gums—indicative of potential vitamin C deficiency or poor oral hygiene.

Among nail-related findings, 6 per cent had rigid nails, 2 per cent had brittle nails, and another 2 per cent had spoon-shaped nails (koilonychia), which can be a sign of iron deficiency.

Skin examinations revealed that 15 per cent of children showed signs of bilateral oedema—a symptom of severe protein deficiency. Pellagrous dermatitis, associated with niacin (vitamin B3) deficiency, was seen in 12.67 per cent of the children.

These clinical findings are consistent with those reported in earlier studies by Gopalan (2004) ^[6] and Bhattacharya *et al.* (2004) ^[2], suggesting a significant prevalence of nutrient deficiencies among school-aged children in rural areas.

Table 3: Clinical signs and symptoms of primary school children (n= 300)

Signs and symptoms		f	%
Hair			
i)	Lack of luster	007	02.30
ii)	Thinness and sparseness	047	15.70
iii)	Flag sign	034	11.30
iv)	Easy pluckability	005	01.70
v)	Normal	207	69.00
Face			
i)	Diffuse depigmentation	002	00.70
ii)	Moon face	005	01.70
iii)	Normal	293	97.60
Eyes			
i)	Xerosis	001	00.33
ii)	Bitot's spot	012	04.00
iii)	Normal	287	95.67
Lips			
i)	Angular scars	33	11.00
ii)	Cheilosis	39	13.00
iii)	Normal	228	76.00
Tongue			
i)	Oedema	040	13.33
ii)	Glossitis	039	13.00
iii)	Normal	221	73.67
Teeth			
i)	Molted enamel	007	02.30
ii)	Caries	081	27.00
iii)	Normal	212	70.70
Gums			
i)	Spongy bleeding gums	051	17.00
ii)	Normal	249	83.00
Nails			
i)	Brittle nails	006	02.00
ii)	Ridged nails	018	06.00
iii)	Spoon shape	006	02.00
iv)	Normal	270	90.00
Skin			
i)	Oedema bilateral	045	15.00
ii)	Pellagrous dermatitis	038	12.67
iii)	Normal	217	72.33

The frequency pattern of the respondents was not satisfactory and they did not cover all the food groups in their regular diet. The kinds and amount of food eaten are may be affected by the money that can be spent for food

stated by Omidvar and Begum (2014) ^[10] which is the root cause of the current result.

Conclusion

The dietary habits observed among the participants were found to be suboptimal. This may be attributed to unequal distribution of food within households and personal food preferences of the children. To prevent nutritional deficiencies that can hinder both physical and mental development, it is essential to promote improved and balanced dietary practices.

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