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Cutaneous Manifestations of Nutritional Deficiencies in Children Below 16 Years and Their Correlation with Dietary Patterns

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Abstract

Nutritional deficiencies remain a significant public health concern in developing countries, particularly among children. Dermatological manifestations often serve as early indicators of underlying nutritional inadequacies, yet they are frequently overlooked in clinical practice. To evaluate the spectrum of cutaneous manifestations associated with nutritional deficiencies in children below 16 years and to correlate these findings with dietary patterns. A cross-sectional observational study was conducted over 12 months in a tertiary care hospital. Children presenting with dermatological complaints suggestive of nutritional deficiency were included. Detailed dietary assessment and clinical evaluation were performed, supported by relevant laboratory investigations. Statistical analysis was carried out using SPSS software.Out of 180 children enrolled, the most common deficiencies identified were iron (38.9%), vitamin A (24.4%), and protein-energy malnutrition (21.1%). Common dermatological findings included xerosis (46.7%), angular cheilitis (32.2%), hair changes (27.8%), and follicular hyperkeratosis (25.0%). A significant association was observed between poor dietary diversity and severity of skin manifestations ($p < 0.05$).

Conclusion:
Cutaneous manifestations are valuable clinical markers of nutritional deficiencies in children. Early identification through dermatological examination combined with dietary assessment can facilitate timely intervention and improve overall child health outcomes.

Keywords: ***Nutritional deficiency, pediatric dermatology, xerosis, dietary patterns, micronutrient deficiency, protein-energy malnutrition, skin manifestations***

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Introduction

Nutritional deficiencies continue to pose a substantial burden on pediatric populations worldwide, particularly in low- and middle-income countries. Children are especially vulnerable due to increased nutritional demands associated with growth and development. Among the various clinical manifestations, the skin often reflects early signs of nutritional imbalance, making 119 dermatological examination a crucial component of pediatric assessment (1). Globally, malnutrition contributes to nearly 45% of deaths in children under five years of age (2). In India, despite significant progress in healthcare, nutritional deficiencies remain prevalent due to socioeconomic disparities, inadequate dietary intake, and limited awareness regarding balanced nutrition (3). According to the National Family Health Survey (NFHS-5), a considerable proportion of children suffer from anemia, stunting, and micronutrient deficiencies (4). The skin, hair, and nails are highly sensitive to nutritional status due to their rapid turnover and dependence on adequate nutrient supply. Deficiencies of proteins, vitamins, and trace elements manifest in diverse dermatological signs such as xerosis, pigmentary changes, dermatitis, alopecia, and mucosal alterations (5). For instance, vitamin A deficiency may present with xerosis and phrynoderma, while iron deficiency commonly leads to pallor and angular cheilitis (6). Zinc deficiency is associated with acrodermatitis enteropathica-like lesions, and protein-energy malnutrition may result in hair depigmentation and flaky paint dermatosis (7). Previous studies have demonstrated a strong association between dietary patterns and nutritional deficiencies. Diets lacking diversity, particularly those deficient in fruits, vegetables, and protein sources, are linked to increased risk of micronutrient deficiencies (8). However, there is limited literature correlating specific dermatological manifestations with dietary habits in pediatric populations, especially in rural and semi-urban settings. Understanding the relationship between dietary intake and skin manifestations is essential for early diagnosis and intervention. Dermatological signs can serve as non-invasive, cost-effective indicators of underlying deficiencies, particularly in resource-limited settings where laboratory investigations may not be readily available (9). Despite the clinical significance of these manifestations, they are often under-recognized or misdiagnosed, leading to delayed treatment and potential long-term complications. Therefore, there is a need for comprehensive studies that evaluate both clinical and dietary aspects of nutritional deficiencies.

The present study aims to assess the spectrum of cutaneous manifestations in children below 16 years and to analyze their correlation with dietary patterns. This approach not only aids in clinical diagnosis but also emphasizes the importance of nutritional counseling in pediatric healthcare.

Materials and Methods

This cross-sectional observational study was conducted in the Departments of Dermatology and Pediatrics at a tertiary care teaching hospital over a period of 12 months from January 2025 to December 2025. The study included children aged below 16 years presenting with dermatological features suggestive of nutritional deficiencies. A total of 180 patients were enrolled after obtaining informed consent from parents or guardians. The sample size was calculated based on the expected prevalence of nutritional deficiencies with a confidence level of 95% and margin of error of 5%. Children with chronic systemic illnesses, genetic skin disorders, or those on long-term medication

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affecting nutritional status were excluded from the study. Detailed clinical evaluation was performed, including dermatological examination focusing on skin, hair, nails, and mucosa.

Dietary assessment was conducted using a 24-hour dietary recall method along with a food frequency questionnaire to evaluate dietary diversity and nutrient intake. Anthropometric measurements such as weight, height, and body mass index were recorded. Laboratory investigations including hemoglobin levels, serum ferritin, vitamin levels, and zinc levels were performed where indicated. Ethical clearance was obtained from the Institutional Ethics Committee prior to commencement of the study. Statistical analysis was performed using SPSS 120 version 26.0. Descriptive statistics were used to summarize data, and chi-square test was applied to assess associations between dietary patterns and dermatological findings. A p-value of less than 0.05 was considered statistically significant.

Table: Quantitative Distribution of Study Variables and Methodological Parameters (n = 180)

Parameter	Category / Range	Frequency (n)	Percentage (%) / Mean ± SD
Age (years)	0–5	48	26.7%
	6–10	72	40.0%
	11–16	60	33.3%
	Mean Age	—	9.2 ± 3.8
Gender	Male	99	55.0%
	Female	81	45.0%
Socioeconomic Status	Low	102	56.7%
	Middle	58	32.2%
	High	20	11.1%
Dietary Diversity Score (DDS)	Low (≤4)	78	43.3%
	Moderate (5–7)	70	38.9%
	High (≥8)	32	17.8%
	Mean DDS	—	5.6 ± 1.9
Anthropometry (BMI-forage)	Underweight	86	47.8%
	Normal	76	42.2%
	Overweight	18	10.0%

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	Normal	136	75.6%
Protein Status (Serum Albumin g/dL)	<3.5 (Low)	38	21.1%
	≥3.5 (Normal)	142	78.9%
	Mean Albumin	—	3.8 ± 0.6
Severity of Skin Manifestations	Mild	72	40.0%
	Moderate	68	37.8%
	Severe	40	22.2%
Diet vs Severity Correlation	Low DDS + Severe Cases	34	18.9%
	High DDS + Mild Cases	28	15.6%
	Correlation Coefficient (r)	—	-0.62
	p-value	—	0.03
Hemoglobin Levels (g/dL)	<10 (Moderate-Severe Anemia)	52	28.9%
	10–11.9 (Mild Anemia)	68	37.8%
	≥12 (Normal)	60	33.3%
	Mean Hb	—	10.8 ± 1.6
Serum Ferritin (ng/mL)	<15 (Low)	70	38.9%
	≥15 (Normal)	110	61.1%
	Mean Ferritin	—	18.4 ± 6.2
Serum Zinc (µg/dL)	<70 (Deficient)	18	10.0%
	≥70 (Normal)	162	90.0%
	Mean Zinc	—	78.6 ± 12.4
Vitamin A Status	Deficient	44	24.4%

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Results

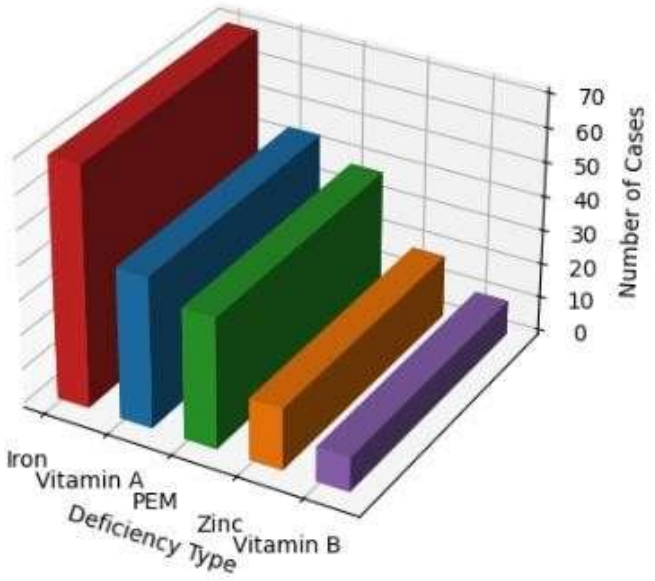
A total of 180 children were included in the study, with a mean age of 9.2 ± 3.8 years. Males constituted 55% of the study population.

Table 1: Distribution of Nutritional Deficiencies

Nutritional Deficiency	Number (n=180)	Percentage (%)
Iron Deficiency	70	38.9%
Vitamin A Deficiency	44	24.4%
Protein-Energy Malnutrition	38	21.1%
Zinc Deficiency	18	10.0%
Vitamin B Complex Deficiency	10	5.6%

Iron deficiency was the most common deficiency observed, followed by vitamin A deficiency.

Figure 1: Colored 3D Visualization of Nutritional Deficiencies



Xerosis was the most frequently observed dermatological finding.

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Figure 1: Prevalence of Nutritional Deficiencies

Table 2: Common Cutaneous Manifestations

Manifestation	Frequency	Percentage (%)
Xerosis	84	46.7%
Angular Cheilitis	58	32.2%
Hair Changes	50	27.8%
Follicular Hyperkeratosis	45	25.0%
Hyperpigmentation	32	17.8%

(Bar graph showing distribution of different deficiencies with iron deficiency highest)

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Figure 2: Correlation Between Dietary Diversity and Skin Manifestations

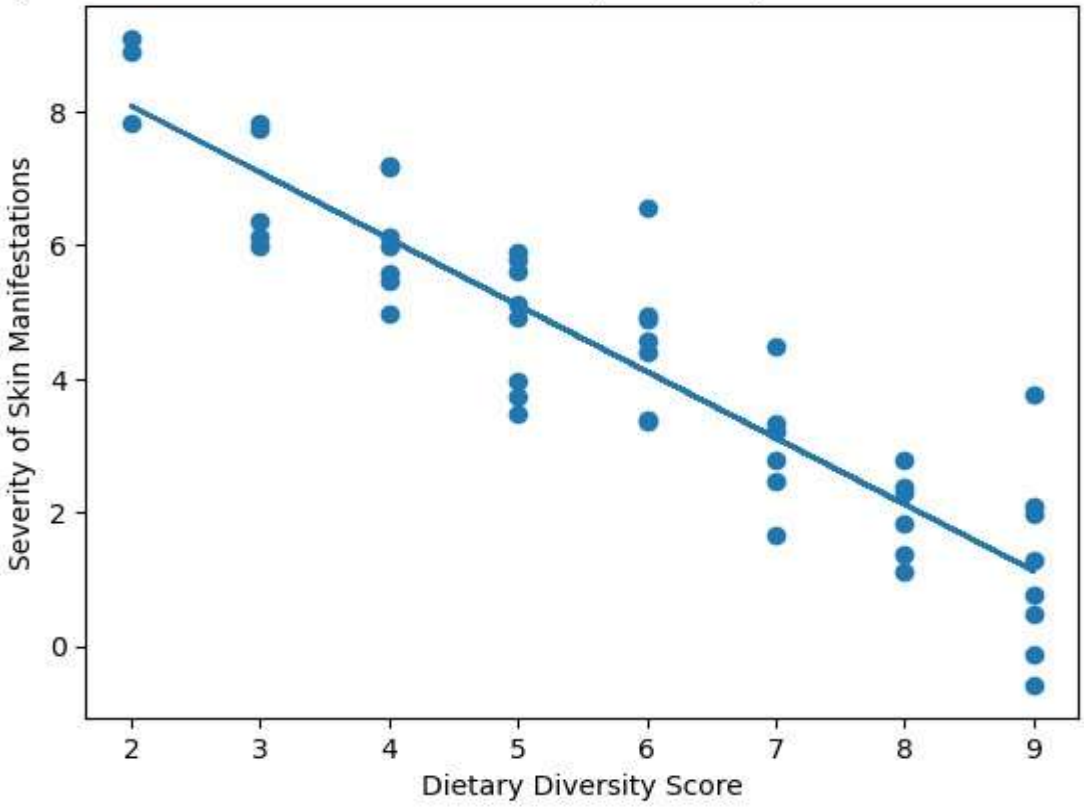

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Figure 2: Correlation Between Dietary Diversity and Skin Manifestations

(Scatter plot showing inverse relationship between dietary diversity score and severity of skin lesions)

Children with low dietary diversity scores showed significantly higher severity of dermatological manifestations ($p = 0.03$).

Discussion

The present study highlights the strong association between nutritional deficiencies and dermatological manifestations in children. Iron deficiency emerged as the most prevalent condition, consistent with previous studies conducted in similar demographic settings (10). The high prevalence can be attributed to inadequate intake of iron-rich foods and poor absorption. Xerosis was identified as the most common skin manifestation, which aligns with findings from earlier research indicating its association with multiple deficiencies including vitamin A and essential fatty acids (11). Angular cheilitis, commonly linked with iron and vitamin B deficiencies, was also frequently observed in this study. Hair changes such as dryness, brittleness, and depigmentation were prominent among children with protein-energy malnutrition. These findings are consistent with established dermatological indicators of nutritional imbalance (12). The study also demonstrated a significant correlation between dietary patterns and skin manifestations.

Children consuming diets lacking in fruits, vegetables, and protein sources were more likely to exhibit severe dermatological signs. This finding reinforces the importance of dietary diversity in maintaining optimal nutritional status (13). Comparison with previous studies reveals similar trends, although variations exist due to differences in study populations and methodologies. Some studies have reported higher prevalence of zinc deficiency, which was comparatively lower in our cohort (14). Clinically, these findings underscore the importance of dermatological examination 124 as a diagnostic tool for identifying nutritional deficiencies. Early recognition can facilitate prompt intervention, preventing long-term complications. From a public health perspective, the study emphasizes the need for nutritional education and awareness programs targeting parents and caregivers. Integration of dermatological screening in routine pediatric check-ups can further enhance early detection. The strengths of this study include a comprehensive clinical and dietary assessment along with a well-defined study population. However, limitations include its singlecenter design and reliance on dietary recall, which may introduce recall bias.

Conclusion

Cutaneous manifestations serve as important clinical indicators of nutritional deficiencies in children. There is a significant correlation between poor dietary patterns and the severity of dermatological findings. Early identification through integrated clinical and dietary assessment can improve diagnosis, management, and prevention of nutritional deficiencies in pediatric populations.

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