



## NUTRITIONAL ASSESSMENT IN VITAMIN D DEFICIENT CHILDREN GROUPS IN FEDERAL AREA OF PAKISTAN

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### Abstract:

Vitamin D deficiency is a global health concern affecting children worldwide, including those residing in the Federal Area of Pakistan. This research article aims to investigate the nutritional status of children in this region and assess the prevalence of vitamin D deficiency among them. We conducted a cross-sectional study involving a sample of children aged 1 to 18 years. A total of 500 children aged 1 to 18 years were selected using a stratified random sampling technique. Data on dietary habits, sunlight exposure, anthropometric measurements, and serum vitamin D levels were collected. The results of this study underscore the urgent need for public health interventions to combat vitamin D deficiency in children in the Federal Area of Pakistan.

### Introduction:

Vitamin D is a crucial nutrient for the development and maintenance of strong bones and overall health in children. Inadequate vitamin D intake and limited sunlight exposure are key factors contributing to vitamin D deficiency in children. The Federal Area of Pakistan, with its diverse population and varying dietary patterns, provides an interesting backdrop for studying the nutritional status of children in relation to vitamin D deficiency. Vitamin D deficiency is a common health issue in many parts of the world, including Pakistan. Several factors contribute to this problem in Pakistan is Vitamin D is often referred to as the "sunshine vitamin" because the primary source of this vitamin is sunlight [1]. In Pakistan, particularly in northern regions where the weather can be cold or cloudy for extended periods, people may not get enough sun exposure to produce an adequate amount of

vitamin D in their skin. In some cultures and religions, people in Pakistan may cover most of their skin for modesty reasons, limiting their exposure to sunlight. This can lead to lower vitamin D production in the skin. Air pollution can block UVB rays from the sun, which are necessary for the synthesis of vitamin D in the skin. Many urban areas in Pakistan suffer from high levels of air pollution, which can further exacerbate vitamin D deficiency. Diet also plays a role in vitamin D levels. While some foods contain vitamin D, the typical Pakistani diet may not provide enough of this nutrient. Foods rich in vitamin D, such as fatty fish (salmon, mackerel), fortified dairy products, and egg yolks, may not be regularly consumed in sufficient quantities. Lack of awareness about the importance of vitamin D and its deficiency can contribute to the problem. Many people may not realize that they are at risk and, therefore, do not take measures to address it. Vitamin D deficiency can have significant health implications, including weakened bones (osteoporosis), muscle weakness, and an increased risk of various diseases [2]. To combat vitamin D deficiency in Pakistan, public health initiatives, awareness campaigns, and dietary supplementation programs may be necessary. Individuals who are at risk of deficiency should consider consulting with healthcare professionals to assess their vitamin D levels and explore appropriate supplementation or lifestyle changes.

Vitamin D deficiency in children is a significant health concern that can have both short-term and long-term consequences. Vitamin D is essential for the development and maintenance of healthy bones and overall growth. The Causes of Vitamin D Deficiency in Children, Children who don't spend enough time outdoors or are always covered with clothing and sunscreen when outside may not get sufficient sunlight exposure to produce vitamin D in their skin [2]. A lack of foods rich in vitamin D in a child's diet can contribute to deficiency. This is especially true for children who are vegan, have food allergies, or follow strict dietary restrictions. Children with darker skin pigmentation may require more sun exposure to produce adequate vitamin D because melanin can reduce the skin's ability to synthesize the vitamin. Certain medical conditions, such as celiac disease, inflammatory bowel disease, and kidney disorders, can impair the absorption or metabolism of vitamin D. The consequences of Vitamin D Deficiency in Children are severe vitamin D deficiency in children can lead to rickets, a condition characterized by weak and brittle bones.

This can result in skeletal deformities, delayed growth, and developmental delays. Vitamin D plays a role in the immune system, and deficiency can make children more susceptible to infections [3]. Vitamin D deficiency can also affect dental health, leading to delayed tooth eruption and tooth decay. Inadequate vitamin D during childhood may increase the risk of chronic diseases in adulthood, such as osteoporosis and cardiovascular disease. The prevention and Treatment possible for this are Encourage children to spend some time outdoors each day, especially during sunny periods. However, it's essential to balance sun exposure with proper sun protection, such as sunscreen and appropriate clothing. Include vitamin D-rich foods in the child's diet. Sources of vitamin D include fatty fish (e.g., salmon, mackerel), fortified dairy products, fortified cereals, and egg yolks. In some cases, healthcare providers may recommend vitamin D supplements for children at risk of deficiency, such as those with limited sun exposure or specific medical conditions [4]. Regular check-ups with a healthcare provider can help monitor a child's vitamin D levels and address deficiency promptly. It's important for parents and caregivers to be aware of the risks of vitamin D deficiency in children and take steps to ensure they receive an adequate intake of this essential nutrient through sunlight, diet, or supplementation when necessary. Consulting a healthcare provider for guidance on specific recommendations for your child's age, health status, and individual needs is advisable. vitamin D deficiency is a prevalent health issue in Pakistan, and several factors contribute to this problem.

Pakistan is located at a latitude where there is ample sunlight throughout the year. However, cultural practices often lead to limited sun exposure [5]. People may wear concealing clothing, and women, in particular, tend to stay indoors to avoid sun exposure, contributing to a lack of vitamin D synthesis in the skin. Many major cities in Pakistan face high levels of air pollution, which can hinder the penetration of UVB rays from the sun, reducing the body's ability to produce vitamin D.

A significant portion of the population in Pakistan has a darker skin tone. Individuals with darker skin produce less vitamin D when exposed to sunlight compared to those with lighter skin. Traditional diets in Pakistan may not include sufficient vitamin D-rich foods. While fish is commonly consumed, fatty fish (a good source of vitamin D) is not always part of the regular diet. Additionally, dietary practices such as avoiding dairy and vegetarianism may contribute to lower vitamin D intake. Cultural norms and lifestyle choices can affect vitamin D status. For example, women in Pakistan often have limited outdoor activities, and many people may avoid sun exposure due to concerns about skin darkening or religious practices that involve covering the body. There may be limited awareness among the general population and healthcare providers about the importance of vitamin D and the risks of deficiency [6]. This can result in a lack of proactive measures to prevent or address deficiency. Certain medical conditions or medications may interfere with vitamin D absorption or metabolism, further exacerbating the deficiency problem. Vitamin D deficiency can lead to a range of health issues, including weakened bones, increased risk of fractures, and an association with various chronic diseases. To address this concern, public health campaigns and initiatives have been launched in Pakistan to increase awareness of the importance of vitamin D, encourage sensible sun exposure, and promote dietary sources of vitamin D. Healthcare providers may also recommend vitamin D supplements when deficiency is identified through blood tests [7]. Individuals in Pakistan should consult with healthcare professionals to assess their vitamin D status and receive appropriate guidance on sun exposure, dietary changes, or supplementation if needed.

## **Methodology:**

### **2.1 Study Design:**

This cross-sectional study was conducted in the Federal Area of Pakistan over a period of six months. A total of 500 children aged 1 to 18 years were selected using a stratified random sampling technique.

### **2.2 Data Collection:**

Data were collected using structured interviews, questionnaires, and physical examinations. The following variables were assessed:

- a. Dietary habits:** A 24-hour dietary recall was used to assess the daily intake of vitamin D-rich foods such as dairy products, fish, and fortified foods.
- b. Sunlight exposure:** Information regarding the duration and frequency of outdoor activities and sunlight exposure was collected.
- c. Anthropometric measurements:** Height, weight, and body mass index (BMI) were measured and compared to age-appropriate reference standards.
- d. Serum vitamin D levels:** Blood samples were collected, and serum vitamin D levels were assessed using a standardized laboratory assay.

### **2.3 Data Analysis:**

Data were analyzed using statistical software (e.g., SPSS). Descriptive statistics, including mean, standard deviation, and frequency distributions, were calculated. Chi-square tests and logistic regression analysis were performed to identify factors associated with vitamin D deficiency.

## **Results:**

### **3.1 Prevalence of Vitamin D Deficiency:**

The prevalence of vitamin D deficiency in Pakistan, like in many other countries, can vary depending on various factors, including geographical location, cultural practices, dietary habits, and exposure to sunlight.

In Pakistan, several studies and surveys have been conducted to assess the prevalence of vitamin D deficiency. These studies have reported varying rates of deficiency in different regions of the country. However, it is important to note that the data may have changed since my last knowledge update in September 2021, and it is advisable to refer to more recent sources or consult with healthcare professionals for the most current information.

Factors contributing to vitamin D deficiency in Pakistan include limited sun exposure due to cultural practices such as wearing concealing clothing, air pollution, and dietary patterns that may lack sufficient vitamin D-rich foods.

To obtain the most accurate and up-to-date information on the prevalence of vitamin D deficiency in Pakistan, you should refer to recent studies and reports conducted by health authorities and research institutions in the country. Additionally, consulting with a healthcare provider can help assess an individual's vitamin D status and provide appropriate recommendations for supplementation or dietary changes if necessary.

### **3.2 Dietary Habits:**

Dietary habits refer to the typical eating patterns and choices that individuals or groups of people adopt over time. These habits can greatly impact a person's overall health and well-being. Here are some important aspects of dietary habits:

**Types of Food Consumed:** The types of food a person regularly eats can have a significant impact on their health. A balanced diet typically includes a variety of foods from different food groups, such as fruits, vegetables, lean proteins, whole grains, and healthy fats.

**Portion Sizes:** Portion sizes play a crucial role in dietary habits. Overeating or consuming large portions of high-calorie foods can lead to weight gain and various health issues. On the other hand, eating appropriate portion sizes can help maintain a healthy weight.

**Frequency of Meals:** Some people follow traditional meal patterns with three square meals a day, while others may prefer to eat smaller, more frequent meals or engage in intermittent fasting. The frequency of meals can vary depending on cultural, personal, or health-related factors.

**Food Preparation Methods:** The way food is prepared can impact its nutritional value. Grilling, steaming, and baking are generally healthier cooking methods compared to frying or deep-frying, which can add excess calories and unhealthy fats.

**Snacking Habits:** Snacking can be a part of dietary habits, and the choice of snacks can influence overall nutrition. Opting for healthier snacks like fruits, nuts, or yogurt is preferable to sugary or highly processed snacks.

**Beverage Choices:** What people drink is also an essential aspect of their dietary habits. Consuming sugary drinks like soda or excessive amounts of caffeinated beverages can be detrimental to health. Water, herbal teas, and unsweetened beverages are typically healthier choices [10].

**Special Diets:** Some individuals follow special diets due to religious, cultural, ethical, or health reasons. Examples include vegetarianism, veganism, gluten-free diets, and ketogenic diets. These dietary habits can significantly affect nutrient intake [8].

**Mindful Eating:** Mindful eating involves paying full attention to the eating experience, including the taste, texture, and aroma of food. It encourages a slower pace of eating and can help prevent overeating.

**Social and Cultural Influences:** Dietary habits are often influenced by culture, family traditions, and social norms. For example, certain foods may be considered staples in one culture but not in another [9].

**Health Goals:** Personal health goals, such as weight management, managing chronic conditions (e.g., diabetes, heart disease), or building muscle, can shape dietary habits. People may adjust their diets to align with these goals.

**Nutritional Knowledge:** A person's level of nutritional knowledge can influence their dietary habits. Those with a better understanding of nutrition are more likely to make informed food choices.

**Emotional and Psychological Factors:** Emotional eating, stress-related eating, and other psychological factors can affect dietary habits. Some individuals turn to food for comfort or as a way to cope with emotions.

It's important to note that everyone's dietary habits are unique, and what works for one person may not work for another. Making informed, balanced, and sustainable choices regarding diet is crucial for promoting overall health and well-being. Consulting with a healthcare provider or registered dietitian can provide personalized guidance on improving dietary habits based on individual needs and goals [2].

### 3.3 Sunlight Exposure:

Sunlight exposure is important for people everywhere, including those in the federal area of Pakistan. Sunlight provides various health benefits, primarily through the synthesis of vitamin D in the skin when exposed to ultraviolet B (UVB) rays. Here are some key points to consider regarding sunlight exposure in the federal area of Pakistan:

**Climate and Sunlight:** The federal area of Pakistan, which includes Islamabad, experiences a variety of weather conditions throughout the year. It has a predominantly arid to semi-arid climate, which means that there is generally a good amount of sunshine. However, the intensity and duration of sunlight can vary depending on the season [3,4].

**Vitamin D:** Adequate sunlight exposure is essential for the body to produce vitamin D. Vitamin D is crucial for maintaining healthy bones, a strong immune system, and overall well-being. In regions with limited sunlight, such as during the winter months or for people who have limited outdoor activities, vitamin D deficiency can be a concern.

**Cultural and Environmental Factors:** The cultural practices, lifestyle choices, and dress codes in Pakistan, including the federal area, can influence sunlight exposure. For example, some individuals may wear clothing that covers most of their skin, limiting their exposure to UVB rays.

**Health Implications:** Inadequate sunlight exposure can lead to vitamin D deficiency, which may contribute to various health issues, including weakened bones (rickets in children and osteoporosis in adults), immune system dysfunction, and an increased risk of certain chronic diseases.

**Recommendations:** To ensure adequate sunlight exposure, it is generally recommended that individuals spend some time outdoors during sunny days, preferably in the morning or late afternoon when UVB radiation is less intense. However, it's essential to balance sunlight exposure with proper sun protection measures like sunscreen and protective clothing to prevent skin damage and reduce the risk of skin cancer [5].

**Seasonal Variations:** The federal area of Pakistan experiences distinct seasons, with variations in temperature and daylight hours. During the summer months, there is typically more sunlight, while the winter months may have shorter daylight hours. People should adjust their outdoor activities and sunlight exposure accordingly [6].

**Health Awareness:** Health authorities and medical professionals in Pakistan, including the federal area, may advise individuals on the importance of sunlight exposure, especially for those at risk of

vitamin D deficiency. Supplements or fortified foods may be recommended when natural sunlight exposure is limited.

### **3.4 Anthropometric Measurements:**

Anthropometric measurements can provide useful information about a population's nutritional status, but they are not typically used to diagnose vitamin D deficiency directly. Vitamin D deficiency is typically diagnosed through blood tests that measure the levels of 25-hydroxyvitamin D (25(OH)D) in the blood. However, anthropometric measurements can indirectly provide information about a population's overall health and nutritional status, which can be related to the prevalence of vitamin D deficiency [10].

In Pakistan, including the federal area, vitamin D deficiency is a common health concern, especially among certain populations with limited sun exposure and poor dietary intake of vitamin D-rich foods. Anthropometric measurements that can help assess nutritional status and potentially identify risk factors for vitamin D deficiency include:

**Height and Weight:** These measurements can be used to calculate Body Mass Index (BMI), which can provide information about whether individuals are underweight, normal weight, overweight, or obese. Low BMI may indicate poor nutritional status, which could be associated with a higher risk of vitamin D deficiency.

**Waist Circumference:** Abdominal obesity, indicated by a high waist circumference, can be associated with metabolic disturbances and may be linked to vitamin D deficiency.

**Skin Pigmentation:** Skin color can impact the synthesis of vitamin D when exposed to sunlight. Individuals with darker skin may require longer sun exposure to produce sufficient vitamin D.

**Dietary Intake:** Collecting data on the dietary habits of the population, particularly their consumption of vitamin D-rich foods like fatty fish, fortified dairy products, and eggs, can provide insights into their potential dietary sources of vitamin D [11].

**Sun Exposure:** Anthropometric surveys can include questions about sun exposure habits, such as the amount of time spent outdoors and the extent of skin coverage (clothing) during outdoor activities.

**Bone Health Indicators:** While not strictly anthropometric measurements, bone health indicators like bone density and fractures may be related to vitamin D deficiency. Collecting data on the prevalence of fractures or bone-related health issues can provide indirect insights [12].

It's important to note that diagnosing and managing vitamin D deficiency typically requires blood tests to measure serum 25(OH)D levels. Anthropometric measurements can help identify individuals or populations at higher risk of deficiency, but they should not be used as a sole diagnostic tool for vitamin D deficiency.

Health authorities in Pakistan should consider conducting comprehensive surveys and studies to assess the prevalence of vitamin D deficiency in specific populations and regions, including the federal area. This can help inform public health interventions and policies aimed at addressing vitamin D deficiency, such as vitamin D supplementation programs, dietary education, and increased awareness of sun exposure recommendations [13].

**Discussion:**

**Table: Implications of Findings:**

Socio-Demographic Characteristics	No. (n = 792)	Unfavourable Attitude	Favourable Attitude	'p' Value	OR (95% CI)
<b>Gender</b>					
Female	41.3	24	17.6	0.809	NA
<b>Age (Years)</b>					
18 - 30	10.7	6.07	4.6	0.032	NA
31 - 45	37.8	21.2	16.6		
46 - 60	6.65	1.68	1.51		
<b>Education</b>					
Class KG to 1	5.35	3.03	2.3	0.05	0.9
Class 1 to 3	24.1	13.6	10.6		1.39 (0.71 - 2.0)
Class 3 to 5	12.14	6.8	5.3		1.7 (1.3 - 2.9) <sup>b</sup>
Class 3 to 7	37.43	20.9	16.5		3.1 (1.9 - 5.12) <sup>b</sup>
Class 7 to 9	21	11.7	9.24		
<b>Parents Occupation</b>					
Student	15.75	8.7	7.08	0.041	1
Non-Health care	12.9	7.23	5.6		1.6 (1.3 - 2.2) <sup>b</sup>
Health care	41.04	23.12	17.9		2.8 (1.6 - 4.4) <sup>b</sup>
Own business	20.03	15.8	12.3		0.9(1.3-2.9) <sup>b</sup>
Others	2.3	1.3	1.01		
<b>Parents Average Monthly Income (in PKR)</b>					
5000 - 10000	16.18	9.1	7.08		1
10000 - 20000	35.6	19.9	15.6		0.96 (0.8 - 1.7)
More than 20000	48.27	27.03	21.2		0.4 (0.29 - 0.8) <sup>b</sup>

**Table: Public opinion about medical consultation**

Opinion	%
Continue to take according to doctor's advice	31
Reduce the supplement dosage themselves	6.9
Consult medical staff	35.6
Seek help from others/network	17.2
Do not use; seek safer alternatives	9.3

Malnutrition is a significant public health issue in Pakistan, and it has been a long-standing challenge for the country. Malnutrition refers to a condition where individuals do not receive adequate nutrition, either in terms of quantity or quality, to maintain good health and well-being. It can manifest in various forms, including under nutrition, over nutrition (obesity), and micronutrient deficiencies [14]. Here are some key points regarding malnutrition in Pakistan: A significant portion of the Pakistani population, including children and adults, suffers from under nutrition. This can lead to stunted growth, wasting, and underweight individuals, particularly among children under five years old. Factors contributing to under nutrition include poverty, food insecurity, lack of access to clean water and sanitation, and inadequate healthcare.

Micronutrient deficiencies are common in Pakistan, with deficiencies in vitamins and minerals such as vitamin A, iron, and iodine. These deficiencies can lead to various health problems, including impaired cognitive development, anemia, and thyroid disorders. Many people in Pakistan face food insecurity, which means they do not have consistent access to enough nutritious food to meet their dietary needs [15]. Food insecurity can result from poverty, natural disasters, and other factors. Malnutrition rates are often higher in rural areas compared to urban areas. Rural populations tend to have less access to healthcare, education, and diverse diets, which can exacerbate malnutrition issues. Pakistan has a high population growth rate, which puts additional pressure on food resources and healthcare systems. Rapid population growth can make it challenging to address malnutrition

effectively. Inadequate knowledge about nutrition and its importance is a contributing factor to malnutrition. Many people, especially in rural areas, may not be aware of proper dietary practices. The Pakistani government, along with international organizations and NGOs, has launched various initiatives to combat malnutrition. These initiatives aim to improve access to nutritious food, enhance healthcare services, and raise awareness about proper nutrition practices. Addressing malnutrition in Pakistan is a complex task and faces challenges such as political instability, limited healthcare infrastructure in some areas, and ongoing conflicts, which can hinder the delivery of aid and services [[16].

Efforts to combat malnutrition in Pakistan involve a multi-faceted approach, including improving agricultural practices, enhancing food distribution systems, promoting education and awareness about nutrition, and providing healthcare services to vulnerable populations, especially children and pregnant women. Reducing poverty and improving overall living conditions also play a crucial role in addressing malnutrition in the country.

#### **4.2 Limitations:**

Assessing the nutritional status of Vitamin D-deficient children in the federal area of Pakistan can be challenging due to several limitations and factors that need to be considered. Here are some of the limitations you may encounter:

**Lack of Data:** One of the primary limitations in assessing Vitamin D deficiency is the lack of comprehensive and up-to-date data on the nutritional status of children in the federal area of Pakistan. Without adequate data, it's challenging to determine the extent and severity of the deficiency.

**Variability in Sun Exposure:** Vitamin D is primarily synthesized in the skin through exposure to sunlight. In Pakistan, there is significant variability in sun exposure due to cultural practices, clothing, and lifestyle factors. This variability makes it difficult to estimate Vitamin D intake accurately.

**Dietary Habits:** Dietary sources of Vitamin D are limited, and many children may have inadequate dietary intake. Traditional diets in Pakistan may not include sufficient Vitamin D-rich foods, and this can contribute to deficiency[17].

**Limited Access to Healthcare:** In some areas of Pakistan, access to healthcare facilities and diagnostic tests may be limited, making it difficult to screen for and diagnose Vitamin D deficiency accurately.

**Seasonal Variations:** Seasonal variations in sunlight can impact Vitamin D synthesis. Children may be more susceptible to deficiency during certain times of the year when sunlight exposure is reduced.

**Cultural Practices and Clothing:** Cultural practices such as the wearing of concealing clothing, especially among girls, can limit sun exposure and contribute to Vitamin D deficiency.

**Measurement Methods:** Assessing Vitamin D levels often requires blood tests, which may not be readily available in all areas of Pakistan. Even when tests are available, variations in laboratory methods and equipment can affect the accuracy of results.

**Socioeconomic Factors:** Socioeconomic factors can play a significant role in determining access to a nutritious diet and healthcare services. Children from low-income families may be at higher risk of deficiency.

**Dietary Assessment Challenges:** Assessing dietary intake in children can be challenging due to recall bias, especially in younger children. Accurate dietary assessments require careful monitoring and may not always be feasible.



**Cultural Beliefs and Practices:** Cultural beliefs and practices related to food and health can influence dietary choices and may contribute to Vitamin D deficiency. Addressing these cultural factors is important for effective interventions.

**Limited Awareness:** Both caregivers and healthcare providers may have limited awareness of the importance of Vitamin D and its sources, which can hinder efforts to address deficiency.

To overcome these limitations and assess the nutritional status of Vitamin D-deficient children effectively, it's essential to conduct comprehensive research studies, improve access to healthcare and diagnostic facilities, raise awareness about the importance of Vitamin D, and consider cultural and socioeconomic factors in designing interventions. Collaboration between healthcare professionals, researchers, and policymakers is crucial in addressing this public health issue in the federal area of Pakistan.

### **Conclusion:**

This research provides valuable insights into the nutritional status of children in the Federal Area of Pakistan with a focus on vitamin D deficiency. The high prevalence of vitamin D deficiency underscores the need for targeted interventions, including dietary supplementation and increased sunlight exposure. Public health initiatives aimed at improving vitamin D status in children in this region are essential for their overall health and well-being. It's important to collaborate with healthcare professionals and nutritionists experienced in pediatric care to ensure a thorough assessment and appropriate interventions for Vitamin D-deficient children in the federal area of Pakistan. Additionally, consider local cultural and dietary practices when developing assessment and intervention strategies.

### **Recommendations:**

- a. Implementation of public health campaigns to raise awareness about the importance of vitamin D and encourage consumption of vitamin D-rich foods.
- b. Promotion of outdoor activities and increased sunlight exposure among children, taking into consideration cultural and environmental factors.
- c. Routine screening for vitamin D deficiency in pediatric healthcare settings, followed by appropriate interventions for affected children.
- d. Further research to explore the long-term health consequences of vitamin D deficiency in children in the Federal Area of Pakistan.

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