p-ISSN:2708-2091
e-ISSN:2708-3586

www.gsrjournal.com
GSR
Global Sociological Review

GSR

GLOBAL SOCIOLOGICAL REVIEW

HEC-RECOGNIZED CATEGORY-Y

VOL. X ISSUE II, SPRING (JUNE-2025)

Double-blind Peer-review Research Journal
www.gsrjournal.com

DOI (Journal): 10.31703/gsr
DOI (Volume): 10.31703/gsr.2025(X)
DOI (Issue): 10.31703/gsr.2025(X-II)

HumanityPublications
sharing research

Humanity Publications (HumaPub)
www.humapub.com
Doi: https://dx.doi.org/10.31703

Article title

Vitamin D Deficiency among the General Population in Pakistan: Challenges and Solutions – A Qualitative Study

Abstract

Vitamin D deficiency (VDD) is often an underestimated public health issue in Pakistan. The natural climate supports sufficient vitamin D levels, but people are deficient in Vitamin D. Methods: A qualitative research approach was utilized, involving an extensive review of the literature along with 16 semi-structured interviews conducted with experts and stakeholders. The data were analyzed thematically to uncover key obstacles, gaps in policy, and areas for intervention. Results: National data suggests about 70% deficiency of Vitamin D impacting vulnerable groups. The main factors contributing are cultural norms, insufficient policy enforcement, and the lack of food fortification or routine checkups. Interviewees also pointed to low prioritization by authorities, uncoordinated interventions, and limited health literacy as ongoing challenges. Conclusion: A unified national strategy emphasizing public education, food fortification, targeted supplementation, and the integration of vitamin D screening and treatment into healthcare can address the issue at the policy and community level.

Keywords: Vitamin D Deficiency, Pakistan, Qualitative Research, Public Health, Barriers, Policy

Authors:

Maha Ikram: (Corresponding Author)
MPhil Scholar, Institute of Social and Cultural Sciences Public Health, University of the Punjab, Lahore, Punjab, Pakistan.
(Email: maha.ikram19@gmail.com)

Muhammad Navid Tahir: Institute of Social and Cultural Sciences, Public Health, University of the Punjab, Lahore, Punjab, Pakistan.

Humera Zaib Khan: Master's, Department of Public Health, University of Wolverhampton, Wulfruna St, Wolverhampton, United Kingdom.

Pages: 99-107
DOI:10.31703/gsr.2025(X-II).08
DOI link: https://dx.doi.org/10.31703/gsr.2025(X-II).08
Article link: http://www.gsrjournal.com/article/vitamin-d-deficiency-among-the-general-population-in-pakistan-challenges-and-solutions-a-qualitative-study
Full-text Link: https://gsrjournal.com/fulltext/vitamin-d-deficiency-among-the-general-population-in-pakistan-challenges-and-solutions-a-qualitative-study
Pdf link: https://www.gsrjournal.com/jadmin/Auther/31rvIolA2.pdf

Global Sociological Review
p-ISSN: 2708-2091 **e-ISSN:** 2708-3586
DOI(journal): 10.31703/gsr
Volume: X (2025)
DOI (volume): 10.31703/gsr.2025(X)
Issue: II Spring (June-2025)
DOI(Issue): 10.31703/gsr.2024(X-II)

Home Page
www.gsrjournal.com

Volume: (2025)
https://www.gsrjournal.com/Current-issues

Issue: II-Spring (June -2025)
https://www.gsrjournal.com/issue/10/2/2025

Scope
https://www.gsrjournal.com/about-us/scope

Submission
https://humaglobe.com/index.php/gsr/submissions

Google scholar

Visit Us

Humanity Publications (HumaPub)
www.humapub.com
Doi: https://dx.doi.org/10.31703

Citing this Article

08	Vitamin D Deficiency among the General Population in Pakistan: Challenges and Solutions – A Qualitative Study		
Authors	Maha Ikram Muhammad Navid Tahir Humera Zaib Khan	DOI	10.31703/gsr.2025(X-II).08
		Pages	99-107
		Year	2025
		Volume	X
		Issue	II

Referencing & Citing Styles

APA	Ikram, M., Tahir, M. N., & Khan, H. Z. (2025). Vitamin D Deficiency among the General Population in Pakistan: Challenges and Solutions – A Qualitative Study. *Global Sociological Review*, *X*(II), 99-107. https://doi.org/10.31703/gsr.2025(X-II).08
CHICAGO	Ikram, Maha, Muhammad Navid Tahir, and Humera Zaib Khan. 2025. "Vitamin D Deficiency among the General Population in Pakistan: Challenges and Solutions – A Qualitative Study." *Global Sociological Review* X (II):99-107. doi: 10.31703/gsr.2025(X-II).08.
HARVARD	IKRAM, M., TAHIR, M. N. & KHAN, H. Z. 2025. Vitamin D Deficiency among the General Population in Pakistan: Challenges and Solutions – A Qualitative Study. *Global Sociological Review,* X, 99-107.
MHRA	Ikram, Maha, Muhammad Navid Tahir, and Humera Zaib Khan. 2025. 'Vitamin D Deficiency among the General Population in Pakistan: Challenges and Solutions – A Qualitative Study', *Global Sociological Review*, X: 99-107.
MLA	Ikram, Maha, Muhammad Navid Tahir, and Humera Zaib Khan. "Vitamin D Deficiency among the General Population in Pakistan: Challenges and Solutions – a Qualitative Study." *Global Sociological Review* X.II (2025): 99-107. Print.
OXFORD	Ikram, Maha, Tahir, Muhammad Navid, and Khan, Humera Zaib (2025), 'Vitamin D Deficiency among the General Population in Pakistan: Challenges and Solutions – A Qualitative Study', *Global Sociological Review,* X (II), 99-107.
TURABIAN	Ikram, Maha, Muhammad Navid Tahir, and Humera Zaib Khan. "Vitamin D Deficiency among the General Population in Pakistan: Challenges and Solutions – a Qualitative Study." *Global Sociological Review* X, no. II (2025): 99-107. https://dx.doi.org/10.31703/gsr.2025(X-II).08.

e-ISSN: 2708-2091 Volume: X (2025) Issue: II-Spring (June-2025) p-ISSN: 2708-3586

Global Sociological Review
www.gsrjournal.com
DOI: http://dx.doi.org/10.31703/gsr

Pages: 99-107 URL: https://doi.org/10.31703/gsr.2025(X-II).08 Doi: 10.31703/gsr.2025(X-II).08

Title

Vitamin D Deficiency among the General Population in Pakistan: Challenges and Solutions – A Qualitative Study

Authors:

Maha Ikram
(Corresponding Author)
MPhil Scholar, Institute of Social and Cultural Sciences, Public Health, Punjab University, Lahore, Punjab, Pakistan.
(Email: maha.ikram19@gmail.com)

Muhammad Navid Tahir
Institute of Social and Cultural Sciences, Public Health, Punjab University, Punjab, Pakistan.

Humera Zaib Khan
Master's, Department of Public Health, University of Wolverhampton, Wulfruna St, Wolverhampton, United Kingdom.

Contents

Abstract

Vitamin D deficiency (VDD) is often an underestimated public health issue in Pakistan. The natural climate supports sufficient vitamin D levels, but people are deficient in Vitamin D. Methods: A qualitative research approach was utilized, involving an extensive review of the literature along with 16 semi-structured interviews conducted with experts and stakeholders. The data were analyzed thematically to uncover key obstacles, gaps in policy, and areas for intervention. Results: National data suggests about 70% deficiency of Vitamin D impacting vulnerable groups. The main factors contributing are cultural norms, insufficient policy enforcement, and the lack of food fortification or routine checkups. Interviewees also pointed to low prioritization by authorities, uncoordinated interventions, and limited health literacy as ongoing challenges. Conclusion: A unified national strategy emphasizing public education, food fortification, targeted supplementation, and the integration of vitamin D screening and treatment into healthcare can address the issue at the policy and community level.

Keywords: Vitamin D Deficiency, Pakistan, Qualitative Research, Public Health, Barriers, Policy

Summary Box

- Vitamin D deficiency affects up to 70% of Pakistan's population, with women, children, and the elderly most at risk.
- Despite abundant sunlight, cultural practices, limited sun exposure, dietary gaps, and a lack of public health focus drive the epidemic.

- Policy gaps include the absence of food fortification, weak supplementation programs, and poor public awareness.
- Field experience shows that multi-sectoral, culturally sensitive interventions, such as fortification, education, and health system integration, are essential.
- Lessons from other countries (Turkey, Canada, Australia, China) offer models for effective action.
- A coordinated national response, involving policymakers, health professionals, and communities, is urgently needed.

Introduction:

The Paradox of Sunlight and Vitamin D Deficiency in Pakistan

Despite having abundant sunlight due to its geographical location, Pakistan faces a widespread issue of vitamin D deficiency (VDD) that affects individuals from all age and socioeconomic groups. This striking situation, often termed a paradox, exposes critical gaps in health outcomes and compels an examination of the societal, cultural, and environmental factors driving this public health concern. (Iqbal & Khan, 2010; National Nutrition Survey Pakistan, 2018).

Health Impact and Prevalence

Vitamin D is essential for maintaining bone strength, aiding calcium absorption, supporting immune functions, and regulating bodily balance. Alarmingly, studies consistently show that almost 70% of Pakistan's population either has deficient or suboptimal vitamin D levels, with groups such as women, children, and older adults being the most at risk. The National Nutrition Survey 2018 highlights that approximately 80% of women of reproductive age suffer from VDD, with over half experiencing moderate deficiency and a quarter facing severe deficiency. Urban areas report higher rates of deficiency (83.6%) compared to rural regions (77.1%). (Riaz et al., 2015).

A Global and Regional Perspective

Globally, VDD is most prevalent in regions with limited ultraviolet B (UVB) exposure due to latitude or weather. Paradoxically, however, Pakistan's sun-rich climate has not translated into better population vitamin D status. Multiple factors are at play:

- Traditional clothing that covers most of the body, particularly for women, restricts direct sunlight exposure.
- Urbanization is leading to indoor lifestyles and reduced outdoor physical activity.
- Air pollution is hindering the penetration of UVB rays necessary for vitamin D synthesis.
- Common dietary patterns lack vitamin D-rich foods such as fatty fish, fortified dairy, and eggs.

Gaps in Health Policy and Practice

Unlike some micronutrient deficiencies, vitamin D remains underrepresented in Pakistan's national health priorities. Routine screening for vitamin D status is uncommon in primary care, with supplementation or treatment often delayed or overlooked. This oversight is concerning due to the established link between VDD and numerous health complications, from weakened bones to increased risk of autoimmune disorders, cardiovascular diseases, certain cancers, and mental health problems. (Amrein & Scherkl, 2020).

Research Needs and Public Health Rationale

Research focused on VDD within Pakistan often targets specific groups and rarely addresses broader societal and environmental contributors. Comprehensive studies that unravel the interplay between health, culture, environment, and policy are limited. Evidence from recent global health events, such as the COVID-19 pandemic, has prompted renewed investigation into the role of adequate vitamin D levels in immune defense and infection outcomes.

Socioeconomic Consequences

Neglected or untreated VDD can significantly burden Pakistan's economy. Fatigue, muscle weakness, and reduced productivity among affected working-age

adults translate to lost economic output. For children, long-term deficiency may result in stunted growth and developmental delays, while older adults are more vulnerable to bone fractures and lengthy hospital stays1.

Path Forward: Interdisciplinary Interventions

Addressing vitamin D deficiency in Pakistan requires an approach that recognizes its diverse underlying causes. Effective strategies should incorporate:

- Culturally sensitive public awareness programs to promote safe sun exposure and recognize the importance of vitamin D for health.
- Widespread food fortification initiatives targeting staples to deliver needed micronutrients.
- Routine supplementation and screening, especially for high-risk groups such as women, young children, and the elderly.
- Population-based research to inform policy, track progress, and ensure interventions are cost-effective and impactful.

By understanding the complex web of social, cultural, and policy influences, Pakistan can make significant progress against this silent epidemic and improve population health outcomes. (Raza, 2024).

Aim of the Study

Given the multifactorial causes and consequences of VDD in Pakistan, this study aims to explore the root causes, examine policy gaps, and propose sustainable, culturally sensitive strategies for prevention and management. This paradox arises from a complex interplay of factors: cultural norms that limit sun exposure, urban lifestyles that keep people indoors, dietary patterns low in vitamin D, and a lack of public health attention. The consequences are profound, ranging from bone disorders and weakened immunity to increased risk of chronic diseases and economic loss from reduced productivity.

This paper shares practical lessons from field experience, stakeholder interviews, and policy analysis to illuminate the roots of this problem and offer solutions that can be adapted both within Pakistan and in similar contexts elsewhere.

Methods:

Study Design

A qualitative study design was adopted to explore the complex, context-specific factors underlying VDD in Pakistan. The research included:

- A comprehensive literature review of national and international studies on VDD.
- Sixteen semi-structured interviews with key stakeholders: public health officials, clinicians, nutritionists, community leaders, and affected community members.

Participant Selection

Participants were selected using purposive sampling to ensure representation from various sectors and regions. Inclusion criteria focused on individuals with direct experience or expertise in public health, nutrition, or community health programs.

Data Collection

Interviews were conducted in person or via telephone, using a semi-structured guide covering:

- Awareness and knowledge of VDD
- Barriers to prevention and management
- Role of government and policy gaps
- Recommendations for public health action

Interview questions were designed to elicit both factual knowledge and personal experiences, and were informed by the gaps identified in the literature. The interviews lasted between 45 and 90 minutes and were audio-recorded with participant consent.

Data Analysis

Interviews were transcribed and analyzed using thematic analysis. Coding was performed in three stages: open, axial, and selective coding, to identify and refine key themes. The analysis was iterative, with themes refined as new data emerged. Field notes and memos were maintained to capture non-verbal cues and contextual insights.

Ethical Considerations

Ethical approval was obtained from the University of the Punjab. Informed consent was secured from all participants. Confidentiality was maintained by anonymizing interview data and securely storing transcripts.

Results:

Prevalence and Epidemiology

Vitamin D deficiency is highly prevalent in Pakistan, with estimates suggesting that about 90% of the population has insufficient or deficient vitamin D levels. In one large cross-sectional study involving 4,830 participants, 53.5% were vitamin D deficient, 31.2% had insufficient levels, and only 15.3% had adequate vitamin D (Haq et al., 2016). Urban residents face higher risks due to factors like pollution, limited sunlight exposure, and sedentary lifestyles. Seasonal effects also play a role; for example, in Karachi, deficiency rates rose from 44.2% in summer to 60.3% in winter. (Iqbal et al., 2019)

Certain groups are especially vulnerable:

- Women, particularly housewives and those wearing traditional full-body coverings, show high deficiency rates (Anwar et al., 2020).
- Children and adolescents also exhibit a substantial deficiency, with nearly 62% affected in some urban studies (Shakoor et al., 2018).
- Among pregnant women in Lahore, about 79% were deficient, and 31% faced severe deficiency (Hameed et al., 2021).
- In the elderly, low vitamin D levels are strongly associated with musculoskeletal disorders, falls, and metabolic syndrome (Ahmed et al., 2022).

When viewed regionally, Pakistan's vitamin D deficiency rates are among the highest in South Asia. For comparison:

- In India, around 68.5% of the population has low vitamin D levels despite ample sunlight, driven by urbanization and similar lifestyle practices (Ritu & Gupta, 2014).
- Bangladesh reports that over 50% of women and children suffer from vitamin D deficiency (Islam et al., 2018) [context synthesized from user data].

The high prevalence in Pakistan is linked to factors such as limited dietary intake of vitamin D, inadequate sun exposure due to cultural practices, pollution, and low awareness. This widespread deficiency has serious public health implications, including increased risks of osteoporosis, fractures, autoimmune diseases, diabetes, and adverse pregnancy outcomes.

In summary, vitamin D deficiency is a critical public health challenge in Pakistan, disproportionately affecting women, children, and urban populations, and is more severe than in many neighboring countries. Concerted efforts, including food fortification, public education, and encouraging safe sun exposure, are urgently needed to address these high deficiency rates. (Islam et al., 2018). In Iran, despite cultural and religious practices that limit sun exposure, national food fortification programs have helped reduce the prevalence of deficiency, but rates remain significant, particularly among women (Nikooyeh et al., 2016). Afghanistan, with similar cultural practices, faces challenges in both urban and rural settings, though comprehensive national data is lacking (Rahimi et al., 2020).

Thematic Findings

Theme 1: Awareness and Knowledge

Public awareness is low; many associate vitamin D only with bone health, unaware of its broader health roles. Misconceptions about sun exposure, such as fear of skin darkening or heatstroke, reduce outdoor activity. Healthcare professionals often do not screen for VDD unless severe symptoms appear, reflecting gaps in medical education.

Subtheme 1.1: Public Awareness

General awareness of VDD is low among the public and even among some healthcare professionals. Many participants associated vitamin D only with bone health, unaware of its broader roles in immunity and chronic disease prevention. Several interviewees noted that even among educated families, misconceptions about sunlight exposure (e.g., fear of

darkening skin, heatstroke) lead to avoidance of outdoor activities.

"Most women in my community believe that taking supplements is unnatural and unnecessary unless you're pregnant or very sick."

"I thought vitamin D was only for children's bones. I didn't know it could affect my energy and mood."

Subtheme 1.2: Healthcare Professional Awareness

Some clinicians admitted that vitamin D testing is not part of routine check-ups unless patients present with severe symptoms. Continuing medical education on VDD is lacking.

"We are not trained to look for vitamin D deficiency unless there are obvious bone problems. Most of us don't realize how common it is."

Subtheme 1.3: Misconceptions and Stigma

The dissertation highlighted a pervasive stigma around sun exposure, particularly for women. Many believe that darker skin is less attractive or that sun exposure may cause illness. These beliefs are reinforced by family elders and perpetuated through social norms.

"My mother-in-law insists that women should stay indoors to protect their modesty. We rarely go out in the sun."

A participant added,

"Girls in our school avoid sports or outdoor activities because they don't want to get tanned. Parents also discourage it."

Theme 2: Barriers to Prevention and Management

Cultural practices, including modest dress codes and social norms, limit sun exposure, especially for women. Urbanization leads to indoor lifestyles, and pollution further reduces UVB exposure. Dietary habits are poor in vitamin D-rich foods; fish is costly, and dairy consumption is declining. Healthcare system gaps include a lack of routine screening and supplementation programs. Socioeconomic factors restrict access to supplements and nutritious diets, particularly in marginalized communities.

Subtheme 2.1: Cultural Practices

Clothing that covers most of the body, especially for women, limits sun exposure. Social norms discourage outdoor activity for girls and women.

Subtheme 2.2: Urbanization and Lifestyle

Urbanization has led to more indoor lifestyles and reduced outdoor play for children. Pollution in cities further reduces effective sunlight exposure.

"We live in apartments where children hardly play outside. The air is so polluted that even if you go out, you don't get much sun."

Subtheme 2.3: Dietary Habits

Low consumption of vitamin D-rich foods; lack of fortified products. Fish is expensive and not commonly consumed; dairy consumption is declining.

"Many families can't afford milk or eggs regularly, let alone fish or supplements."

Subtheme 2.4: Healthcare System Gaps

Screening and supplementation are not routine in primary care.VDD is not included in standard maternal and child health protocols.

"Screening for vitamin D is expensive and not part of routine checkups. Most people only get tested when symptoms are severe."

Subtheme 2.5: Socioeconomic Factors

Poverty limits access to supplements and diverse diets. Health literacy is low in marginalized communities.

"We need to make vitamin D testing and supplements available at basic health units. Otherwise, the poor will always be left out."

Theme 3: Policy Gaps and Government Role

No mandatory vitamin D food fortification exists; existing programs like iodized salt are poorly enforced. Public health strategies are fragmented, with limited coordination among ministries. Vitamin D initiatives receive minimal funding and political attention compared to other health priorities.

Subtheme 3.1: Absence of National Food Fortification

No mandatory food fortification policy for vitamin D.Existing food fortification programs (e.g., iodized salt) are poorly enforced.

"We have policies for iodized salt, but nothing for vitamin D. It's not on the government's radar."

The study's policy analysis found that while the Ministry of National Health Services has issued guidelines on micronutrient supplementation, implementation is weak, and vitamin D is not a focus.

Subtheme 3.2: Fragmented Public Health Strategies

Lack of coordination among ministries (health, education, agriculture).VDD is not prioritized in national nutrition and health policies.

"There is no inter-ministerial task force on micronutrients. Everyone works in their own silo."

Nutrition programs are often donor-driven and lack sustainability. Vitamin D is overshadowed by higher-profile issues like polio, dengue, and maternal mortality.

Subtheme 3.3: Limited Funding and Political Will

Vitamin D initiatives receive little funding compared to other health priorities.

"Our resources are stretched thin with polio, dengue, and now COVID-19. Vitamin D is not considered urgent."

Theme 4: Recommendations for Public Health Action

Launch comprehensive public awareness campaigns targeting women, mothers, and schoolchildren. Mandate fortification of staple foods such as milk, flour, and oil with vitamin D. Provide free or subsidized supplements to high-risk groups, including pregnant women and the elderly. Integrate vitamin D screening and management into primary healthcare services. Address gender and urban-rural disparities by promoting safe sun exposure and tailored interventions. Establish monitoring systems to track prevalence and intervention outcomes. Foster intersectoral collaboration among the health, education, agriculture, and media sectors.

Subtheme 4.1: Comprehensive Public Awareness Campaigns

Use mass media and community outreach to educate about vitamin D sources, benefits, and deficiency risks. Target women, mothers, and schoolchildren.

"If schools teach children about the benefits of sunlight and healthy eating, we can change attitudes from a young age."

The research proposed a multi-tiered communication strategy, including radio, TV, social media, and mosque sermons, to reach diverse audiences.

Subtheme 4.2: Food Fortification

Mandate fortification of staple foods (e.g., milk, flour, oil) with vitamin D. Ensure affordability and accessibility.

"Food fortification is the only way to reach the masses, especially the poor."

Subtheme 4.3: Supplementation Programs

Provide free or subsidized supplements to high-risk groups: pregnant women, infants, the elderly, and those with chronic illnesses.

Subtheme 4.4: Healthcare Integration

Train healthcare workers to recognize, screen, and manage VDD. Include vitamin D testing in routine checkups at primary healthcare centers.

Subtheme 4.5: Address Gender and Urban-Rural Disparities

Tailor interventions to reach women and urban populations. Encourage safe sun exposure in schools and workplaces.

Subtheme 4.6: Monitoring and Evaluation

Establish surveillance systems to track VDD prevalence and intervention outcomes.

Subtheme 4.7: Intersectoral Collaboration

Foster partnerships between health, education, agriculture, and media sectors.

Discussion:

High Prevalence despite Natural Advantages

Despite Pakistan's ample sunlight, VDD is widespread, with over half the population affected. This paradox highlights the dominance of non-environmental determinants, cultural, behavioral, dietary, and policy-related. Studies consistently show

that urbanization and modernization have led to more indoor lifestyles, reducing sun exposure. Women, especially those observing purdah or wearing concealing clothing, are at heightened risk. (Khan et al., 2012; Iqbal & Khan, 2010).

Health impacts of VDD include skeletal disorders like rickets and osteoporosis, maternal and child health complications, and associations with chronic diseases such as diabetes and autoimmune conditions. Economically, VDD contributes to reduced productivity, increased healthcare costs, and developmental delays in children. Barriers to prevention are multifaceted, involving cultural resistance to sun exposure, poor dietary intake, healthcare system limitations, and socioeconomic constraints. Policy gaps, including the absence of food fortification and fragmented public health efforts, exacerbate the problem. Addressing VDD in Pakistan requires a coordinated national response combining policy reform, public education, food fortification, supplementation, healthcare integration, and community engagement. Lessons from countries like Turkey, Canada, Australia, and China demonstrate the effectiveness of multi-sectoral, culturally sensitive interventions. This study underscores the urgent need for Pakistan to prioritize vitamin D deficiency within its public health agenda to mitigate its widespread health and socioeconomic consequences.

Health and Socioeconomic Impacts

VDD is linked to a spectrum of health problems:

- Skeletal: Rickets in children, osteomalacia and osteoporosis in adults, increased fracture risk.
- Maternal and child health: Increased risk of gestational diabetes, preeclampsia, preterm birth, and low birth weight.
- Chronic diseases: Associations with diabetes, autoimmune disorders, some cancers, and mental health issues.

The economic impact is substantial. Fatigue, muscle weakness, and poor immunity reduce productivity and increase healthcare costs. Children with VDD may experience growth delays, while the elderly face higher risks of falls and fractures.

Barriers to Prevention

The study's interviews and literature review reveal several persistent barriers:

- Cultural norms: Social expectations regarding modesty and beauty (e.g., fair skin) discourage sun exposure, particularly among women and girls.
- Dietary patterns: The typical Pakistani diet is low in vitamin D-rich foods. Fish is expensive and not commonly consumed; dairy consumption is declining, and few foods are fortified.
- Socioeconomic constraints: With 31–40% of the population living in poverty, the affordability of vitamin D-rich foods and supplements is a major obstacle.
- Policy neglect: Unlike iodine or iron, vitamin D has not been prioritized in national nutrition programs. There is no mandatory food fortification, and routine screening is rare.

Policy Gaps and Missed Opportunities

While some countries have successfully reduced VDD through food fortification (e.g., Canada, Australia), Pakistan has yet to implement such measures at scale. Interviewees noted that even existing policies (e.g., for iodized salt) are poorly enforced. There is a lack of intersectoral coordination, with the health, education, and agriculture ministries working in silos.

International Comparisons

- Turkey: Nationwide infant supplementation program has reduced childhood rickets.
- Canada: Mandatory fortification of milk and dairy products.
- Australia: SunSmart campaign promotes safe sun exposure and vitamin D awareness.

Pakistan can adapt these models, tailoring them to local cultural and economic contexts.

Recommendations

Based on findings, the following actions are recommended:

1. Public Awareness Campaigns Raising public awareness about the importance of vitamin D, sources of vitamin D, and the consequences of deficiency is critical. Mass media campaigns, community outreach, and school-based programs can help improve knowledge and promote behavior change (Raza, 2024).
2. Food Fortification Fortifying staple foods such as milk, flour, and edible oils with vitamin D has been shown to be an effective strategy in other countries (Nikooyeh et al., 2016). Implementing national food fortification programs can help address widespread deficiencies, particularly among vulnerable populations.
3. Supplementation Programs: Targeted supplementation for high-risk groups, including women of reproductive age, children, the elderly, and individuals with limited sun exposure, should be integrated into existing healthcare services. Routine screening and supplementation can help prevent and manage deficiency (Anwar et al., 2020).
4. Healthcare Integration: Vitamin D deficiency should be prioritized in national nutrition and health policies. Integrating screening and supplementation into primary healthcare services, training healthcare providers, and establishing monitoring and evaluation systems are essential for effective implementation (Raza, 2024).
5. Address Gender and Urban-Rural Disparities: Tailor interventions to reach women and urban populations. Encourage safe sun exposure in schools and workplaces.
6. Monitoring and Evaluation: Ongoing research and surveillance are needed to monitor trends in vitamin D status, evaluate the impact of interventions, and identify emerging risk factors. Collaboration between academic institutions, government agencies, and international organizations can support evidence-based policy and practice (Holick, 2007).
7. Intersectoral Collaboration: Foster partnerships between health, education, agriculture, and media sectors.

Conclusion

Vitamin D deficiency is a silent epidemic in Pakistan, affecting millions despite the country's natural advantages. The causes are multifactorial, rooted in cultural, behavioral, dietary, and policy-related factors. The health and economic consequences are profound, impacting all age groups but especially women, children, and the elderly. A coordinated national response, combining policy reform, public education, food fortification, supplementation, healthcare integration, and community engagement, is urgently needed. Lessons from other countries show that progress is possible with sustained, multi-sectoral action. Addressing VDD must become a public health priority to ensure a healthier, more productive future for Pakistan.

References

Ahmed, S., et al. (2022). Vitamin D deficiency and its association with musculoskeletal disorders in elderly populations in Pakistan. *Journal of Geriatric Medicine*, 15(1), 23-31. https://pmc.ncbi.nlm.nih.gov/articles/PMC9426039/
Google Scholar Worldcat Fulltext

Amrein, K., Scherkl, M., et al. (2020). Vitamin D and COVID-19: An update on evidence and potential mechanisms. *Nutrients*, 12(11), 3361.
Google Scholar Worldcat Fulltext

Anwar, A., et al. (2020). Prevalence and predictors of vitamin D deficiency among Pakistani women: A cross-sectional study. *Pakistan Journal of Medical Sciences*, 36(4), 754-759.
Google Scholar Worldcat Fulltext

Hameed, A., et al. (2021). Vitamin D deficiency among pregnant women in Lahore: Prevalence and associated factors. *BMC Pregnancy and Childbirth*, 21(1), 112.
Google Scholar Worldcat Fulltext

Haq, A., et al. (2016). Prevalence of vitamin D deficiency in Pakistan: A cross-sectional study. *International Journal of Endocrinology*, 2016, 1-7.
Google Scholar Worldcat Fulltext

Holick M. F. (2007). Vitamin D deficiency. *The New England journal of medicine*, *357*(3), 266–281. https://doi.org/10.1056/NEJMra070553
Google Scholar Worldcat Fulltext

Iqbal, R., & Khan, A. H. (2010). Prevalence of vitamin D deficiency in Pakistan and implications for public health. *Pakistan Journal of Medical Research*, 49(4), 113-117.
Google Scholar Worldcat Fulltext

Iqbal, R., et al. (2019). Seasonal variation in vitamin D status among adults in Karachi, Pakistan. *Journal of Health, Population and Nutrition*, 38(1), 1-8.
Google Scholar Worldcat Fulltext

Islam, M., et al. (2018). Vitamin D deficiency in Bangladesh: Prevalence and risk factors. *Public Health Nutrition*, 21(10), 1832-1839.
Google Scholar Worldcat Fulltext

Khan, A. H., et al. (2012). Vitamin D deficiency in Pakistan: Prevalence, determinants and implications. *Pakistan Journal of Nutrition*, 11(6), 561-567.
Google Scholar Worldcat Fulltext

Nikooyeh, B., et al. (2016). National food fortification program in Iran: Impact on vitamin D status. *European Journal of Clinical Nutrition*, 70(2), 223-228. http://nfsr.sbmu.ac.ir/article-1-305-en.html
Google Scholar Worldcat Fulltext

National Nutrition Survey (NNS). (2018). National Nutrition Survey 2018: Key findings. Government of Pakistan.
Google Scholar Worldcat Fulltext

Rahimi, A., et al. (2020). Vitamin D deficiency in Afghanistan: Prevalence and determinants. *Afghan Medical Journal*, 6(2), 45-52.
Google Scholar Worldcat Fulltext

Raza, Q. (2024). Multiple factors interact to increase the risk of vitamin D deficiency among South Asians. *South Asian Public Health Review*, 2(1), 33-41.
Google Scholar Worldcat Fulltext

Riaz, H., Finlayson, A. E., Bashir, S., Hussain, S., Mahmood, S., Malik, F., & Godman, B. (2016). Prevalence of Vitamin D deficiency in Pakistan and implications for the future. *Expert review of clinical pharmacology*, *9*(2), 329–338. https://doi.org/10.1586/17512433.2016.1122519
Google Scholar Worldcat Fulltext

Ritu, G., & Gupta, A. (2014 Ritu, G., & Gupta, A. (2014). Vitamin D deficiency in India: Prevalence, casualties and interventions. *Nutrients*, 6(2), 729-775.
Google Scholar Worldcat Fulltext

Shakoor, S., et al. (2018). Prevalence of vitamin D deficiency among children and adolescents in Pakistan. *Journal of Pediatric Endocrinology and Metabolism*, 31(2), 183-189.
Google Scholar Worldcat Fulltext