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Original Article

A Qualitative Exploration of Patient Knowledge Gaps and Reliance on Bone-Support Supplements in Pakistan

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ABSTRACT

Background: Vitamin D and calcium deficiencies remain important nutritional and musculoskeletal health concerns, yet appropriate supplementation depends not only on product availability but also on patients' understanding of deficiency, treatment expectations, safety, and professional guidance. Qualitative evidence is needed to clarify how these factors shape supplementation practices in routine healthcare settings in Pakistan. Objective: To explore patients' knowledge, attitudes, perceptions, and experiences regarding vitamin D and calcium supplementation, with particular attention to perceived benefits and adverse effects, understanding of deficiency, and reliance on healthcare professionals. Methods: An exploratory qualitative study was conducted among 10 adults recruited purposively from community pharmacies and outpatient clinics in Islamabad and Rawalpindi, Pakistan. Semi-structured face-to-face interviews were audio-recorded, transcribed verbatim, and analyzed inductively using thematic analysis. Results: Four overarching themes were identified: knowledge and understanding of supplementation; experiences of deficiency and supplement use; reliance on healthcare professionals for guidance and counselling; and perceptions of efficacy, safety, access, and broader value. Participants commonly described limited or experience-based knowledge, linked deficiency to pain, diet and sunlight exposure, and relied strongly on physician recommendations. Pharmacist counselling was valued when available but was inconsistently experienced. Perceived symptom improvement supported favorable attitudes among some participants, whereas uncertainty regarding efficacy, preference for particular brands, gastrointestinal adverse effects, and financial concerns were also reported. Conclusion: Vitamin D and calcium supplementation was generally perceived positively, but participants' accounts revealed important knowledge gaps and dependence on professional guidance. Patient-centered counselling, clearer information on appropriate use and safety, improved access to pharmacist guidance, and integration of dietary and lifestyle advice may support more informed supplementation practices. Keywords: Vitamin D; Calcium; Patient Perceptions; Supplements; Pakistan; Qualitative Research

INTRODUCTION

Vitamin D and calcium are fundamental to skeletal homeostasis, bone mineralization, and normal neuromuscular function. Adequate vitamin D status facilitates calcium absorption and contributes to maintenance of bone and muscle health, whereas deficiencies may contribute to impaired mineralization, osteoporosis, rickets, muscle dysfunction, and increased fracture susceptibility. Calcium and vitamin D status are therefore closely related to musculoskeletal health across the life course, particularly among individuals at increased risk of skeletal complications (1–3).

Vitamin D deficiency remains an important public-health concern internationally, particularly in low- and middle-income countries where population-level risk is influenced by dietary inadequacy, limited ultraviolet-B exposure, food-fortification practices, socioeconomic circumstances, and behavioral factors (4). South Asian populations have particularly high reported burdens of vitamin D deficiency, although prevalence estimates vary according to population characteristics, diagnostic thresholds, geographical setting, and methods of measurement (5–7). Pakistani studies similarly demonstrate a substantial burden across different age groups, while reviews from Pakistan identify dietary patterns, sunlight exposure, and other contextual factors as important contributors (8,9). Wider evidence also indicates considerable international variation in vitamin D status and dietary intake, emphasizing the importance of contextual nutritional and public-health approaches in low- and middle-income settings (10,11).

Patients' decisions concerning vitamin D and calcium supplements are shaped by more than clinical recommendations. Qualitative research has shown that interpretations of vitamin D deficiency can be influenced by uncertainty, previous treatment experiences, communication with physicians, and patients' own understanding of health and supplementation (12). Misconceptions about vitamin D and supplementation remain common, while safety concerns become particularly relevant where vitamins and minerals are viewed as inherently harmless despite potential adverse effects associated with inappropriate or excessive use (13,14). Previous qualitative work has also shown that patients may strongly favor testing and professional guidance when deciding whether vitamin D supplementation is necessary (15). Quantitative studies from different populations have demonstrated continuing gaps in vitamin D knowledge, attitudes, sources, preventive practices, and supplement-related behaviors, including among university students and adults in Pakistan and neighboring or regional populations (16–20). Together, these findings indicate that general awareness of vitamin D does not necessarily translate into detailed understanding of deficiency, indications for supplementation, potential adverse effects, or appropriate preventive behavior.

Healthcare professionals therefore occupy an important position in translating clinical recommendations into understandable instructions on indication, dose, duration, safety, and appropriate use. Community-pharmacy research in Pakistan has identified deficiencies in medication counselling and dispensing practices, suggesting that professional guidance may be inconsistent across settings (21). Studies of pharmacists and prescribing clinicians have likewise identified variability in knowledge and counselling practices related to vitamin D supplementation (22,23). Inappropriate supplementation can have clinically important consequences, including vitamin D toxicity, reinforcing the need for professional oversight and rational prescribing (24). Clinician perspectives also influence supplementation practices in specific populations, including mothers and infants, where recommendations may depend on perceived risk, guideline familiarity, and clinical context (25). More broadly, community pharmacists may play a role in identifying potential interactions and advising patients who combine conventional treatment with supplements or complementary products (26). Regulatory oversight of complementary and supplement-related products and patients' priorities regarding pharmacy services may also shape confidence, expectations, and product use (27,28). Qualitative research among culturally diverse populations further demonstrates that beliefs surrounding sunlight, diet, supplementation, and cultural practices can influence how vitamin D deficiency is interpreted (29), while recent Pakistani mixed-method evidence emphasizes the importance of clinician awareness in local health facilities (30).

Quantitative measures of deficiency or supplement consumption alone cannot explain why patients trust particular recommendations, how they interpret deficiency-related symptoms, why they perceive particular products as more effective, or how interactions with physicians and pharmacists shape continuing use. A qualitative approach is therefore appropriate for examining the meanings, beliefs, experiences, and contextual influences associated with supplementation. This study aimed to explore the knowledge, attitudes, perceptions, and lived experiences of adults using vitamin D and/or calcium supplements in routine healthcare settings in Islamabad and Rawalpindi, Pakistan. Specifically, it

examined participants' understanding of supplementation and deficiency, experiences of supplement use, perceptions of efficacy and adverse effects, reliance on physicians and pharmacists, and perceived barriers and facilitators to appropriate supplementation.

MATERIALS AND METHODS

This study used an exploratory qualitative design based on semi-structured individual interviews to investigate how patients understood and experienced vitamin D and calcium supplementation. The qualitative approach was selected because the study sought to examine participants' accounts, beliefs, interpretations, and experiences rather than quantify predefined associations. Reporting was structured with reference to the Consolidated Criteria for Reporting Qualitative Research (COREQ), which provides a 32-item framework for transparent reporting of interview- and focus-group-based qualitative research, and the Standards for Reporting Qualitative Research (SRQR), which provide broader recommendations for transparent reporting across qualitative methodologies (31,32).

Participants were recruited from community pharmacies and outpatient clinics in Islamabad and Rawalpindi, Pakistan. Purposive sampling was used to identify individuals with recent, direct experience of vitamin D and/or calcium supplementation while seeking variation in age, gender, and socioeconomic background. Eligible participants were adults aged 18 years or older who had used vitamin D and/or calcium supplements during the preceding six months and had been formally diagnosed with vitamin D or calcium deficiency by a physician. Potential participants were approached in person, informed about the study, and invited to participate voluntarily. Ten participants were included in the qualitative sample.

A semi-structured interview guide was developed following review of relevant literature and expert consultation and was pilot-tested for clarity before use. The guide addressed knowledge and awareness of vitamin D and calcium products, personal patterns and experiences of supplement use, perceived effectiveness and adverse effects, attitudes toward supplementation, symptoms and perceptions associated with deficiency, and the perceived roles of physicians and pharmacists in recommending, dispensing, and counselling about supplements. The semi-structured format allowed participants to elaborate on their experiences while ensuring that the principal areas relevant to the study objectives were addressed consistently.

Face-to-face interviews were conducted individually in private spaces to protect confidentiality and facilitate discussion. Interviews lasted approximately 20–30 minutes. With participants' consent, interviews were audio-recorded, and field notes were used to capture relevant contextual information. Written informed consent was obtained before participation. Interview recordings were subsequently transcribed verbatim for analysis.

Data were analyzed inductively using thematic analysis informed by Braun and Clarke's six-phase framework: familiarization with the data, generation of initial codes, development of candidate themes, review of themes, definition and naming of themes, and production of the analytic account (33). Researchers repeatedly read the transcripts to become familiar with the dataset before generating initial data-driven codes. Codes addressing related concepts were compared and organized into candidate subthemes and broader themes, which were iteratively reviewed against the transcripts to ensure that the thematic structure reflected participants' accounts. Coding was conducted manually rather than with qualitative data-analysis software.

Two researchers independently coded the transcripts. Coding differences were discussed and resolved through consensus during development and refinement of the thematic structure. An audit trail of analytic decisions was maintained, and field notes, independent coding, consensus discussion, and direct participant quotations were used to strengthen transparency and the linkage between interpretations and the underlying accounts. Representative quotations were retained in the Results to demonstrate the

relationship between the reported themes and participants' experiences. Participant identifiers were used with quotations to preserve anonymity.

Ethical approval was obtained from the Ethics Review Committee of Hamdard University, Pakistan. Participants were informed about the objectives and procedures of the study before providing written informed consent, including consent for audio recording. Participation was voluntary, and anonymity and confidentiality were maintained throughout the research process.

RESULTS

Ten participants contributed to the study, including six women (60%) and four men (40%). Six participants (60%) had education ranging from matriculation to intermediate level, three (30%) had bachelor's- to master's-level education, and one (10%) had no formal education. Five participants (50%) reported approximately 1–2 hours of daily sun exposure, whereas five (50%) reported 3–4 hours. Seven participants (70%) reported using one or two vitamin D and/or calcium tablets per day, while three (30%) reported using an injectable preparation.

Table 1. Characteristics of Participants Included in the Qualitative Interviews

Characteristic	n (%)
Gender	
Male	4 (40)
Female	6 (60)
Education	
No formal education	1 (10)
Matric–Intermediate	6 (60)
Bachelor's–Master's	3 (30)
Reported daily sun exposure	
1–2 hours	5 (50)
3–4 hours	5 (50)
Reported supplement regimen	
1–2 tablets per day	7 (70)
Injectable preparation	3 (30)

The thematic analysis generated four overarching themes: (1) knowledge and understanding of vitamin D and calcium supplementation; (2) experiences of deficiency and supplement use; (3) reliance on healthcare professionals for guidance and counselling; and (4) perceptions of efficacy, safety, access, and broader value of supplementation.

THEME 1: KNOWLEDGE AND UNDERSTANDING OF VITAMIN D AND CALCIUM SUPPLEMENTATION

Participants demonstrated varying levels of understanding regarding vitamin D and calcium supplementation. Several participants described their knowledge as limited and primarily derived from personal use or prescriptions received from healthcare professionals. Their accounts suggested that familiarity with specific supplement products did not necessarily correspond to a broader understanding of their indications, physiological roles, or potential risks.

> *"Yes, I have little bit of knowledge of calcium and vitamin-D, but only those products that I used. I am diabetic patient, and my doctor recommended vitamin-D injections."*
>
> *(Pt 1)*
>
> *"Yes, I have used Qalsium-D and Bonex-D tablets. These supplements are prescribed by my doctor."*
>
> *(Pt 2)*

Some participants associated vitamin D and calcium mainly with bone strength, teeth, immunity, or general bodily strength. These explanations reflected partial awareness of their perceived health functions but were often broad and nonspecific.

"Yes, vitamin-D is for bone health and teeth health, and calcium is also for bone, heart, immunity, and maintaining weight."

(Pt 4)

"No, I don't have any specific information, but they are used for strength, right? Vitamin-D and calcium, which are also necessary for the body's nutrition."

(Pt 6)

Other participants explicitly acknowledged having limited knowledge about supplementation and relied largely on professional advice.

"I have very limited knowledge about calcium and vitamin-D supplements."

(Pt 7)

Participants also commonly understood deficiency through personally experienced or observed symptoms. Bone and joint pain, weakness, hair loss, nail changes, and limited sunlight exposure were among the factors they associated with vitamin D or calcium deficiency.

"As far as I know, the calcium-deficient patients face hair loss and nail problems, and their bones become weak. Vitamin D deficiency also causes bone and joint pain. No, I don't know about any adverse effects related to this. My doctor didn't tell me about it."

(Pt 8)

"Yes, I know. Calcium and Vitamin-D supplements are used by those who are suffering from bones diseases. I am using these supplements as I have a lot of pain in my joints."

(Pt 8)

Participants further emphasized the importance of public awareness and appropriate guidance before using supplements. They perceived knowledge about indications, correct use, and possible harms as important for safer supplementation.

"Yes, it is necessary to be aware of the medicines that a person uses. People should know how to use supplements properly so that after eating them, they wouldn't get any harmful effects."

(Pt 8)

"I think these supplements are only prescribed when the test will perform. Then anyone can prescribe a nutritionist or physician. Without a test, no one is eligible to prescribe these supplements."

(Pt 7)

Overall, participants' understanding of vitamin D and calcium supplementation was heterogeneous and was commonly shaped by personal symptoms, previous prescriptions, and healthcare-professional advice.

Theme 2: Experiences of Deficiency and Supplement Use

Participants described both oral and injectable forms of supplementation, generally in the context of physician recommendations. Their accounts indicated that supplementation practices were closely linked to individual health conditions and perceived symptom changes.

"I am a diabetic patient, and my doctor recommended vitamin-D injections. Those injections are Sunny D, and the other one I forget the name of, which I take every week."

(Pt 1)

"I used Qalsium-D and Bonex-D tablets once daily. I am an arthritis patient. These are effective medicines I use on a regular basis. I overcame my pain with these medicines, but I also used some pain killers."

(Pt 2)

Participants commonly described perceived improvement during supplementation, although not all were certain about the extent to which supplements were responsible for these changes.

"I am not sure, but people say that vitamin D and calcium supplements have a great effect on people's health. In my personal experience, it has a good effect."

(Pt 3)

"I am taking these medicines twice a day; in morning and evening. I went to the doctor, he prescribed me those medicines. I feel much better now."

(Pt 8)

Perceptions regarding the causes of vitamin D and calcium deficiency were largely related to lifestyle and nutritional factors. Participants referred to unhealthy diets, inadequate nutritional awareness, low sunlight exposure, and insufficient attention to health as possible contributors.

"Yes, because people don't eat a healthy diet nowadays. They prefer junk food over homemade food. They drink beverages that are not good for our health."

(Pt 8)

"Yes, many of us suffer from this deficiency. The reason is simple: we didn't have any awareness related to these deficiencies; we just focused on other diseases and taking medicine. People are not even taking their health seriously."

(Pt 10)

Not all participants perceived the deficiency burden in the same way. One participant questioned the extent to which vitamin D and calcium deficiency was widespread.

"According to me, the prevalence of vitamin D and calcium in our country is not greater, but it is still present."

(Pt 5)

Participants suggested several approaches to addressing deficiency, including improved diet, regular physical activity, appropriate supplementation, increased sunlight exposure, and broader public-awareness initiatives.

"I think we should take our proper diet, and we should do proper exercise or at least a 30-minute walk. For every person, diet and exercise should be mandatory."

(Pt 1)

"Our diet should be based on healthy foods that are full of nutrients. For vitamin D-deficient patients, they should spend some time in the sunlight."

(Pt 8)

These accounts indicate that participants generally conceptualized deficiency management as involving both supplementation and lifestyle-related measures rather than supplementation alone.

Theme 3: Reliance on Healthcare Professionals for Guidance and Counselling

Reliance on physicians was prominent throughout participants' accounts. Decisions regarding supplement initiation, formulation, dosage, and frequency were commonly described as being based on medical prescriptions.

"Yes, I used according to my doctor's prescription. He gave me one tablet once a day. Injection in one month."

(Pt 7)

Participants frequently linked professional qualification with safe supplementation and expressed reservations about unsupervised use.

> *"Yeah, sure, definitely, as doctors prescribe it as needed. It must be prescribed by a qualified person; it is necessary for safety."*
>
> *(Pt 3)*

Pharmacists were also perceived as potentially important sources of practical information, particularly regarding dosage and administration. Some participants reported receiving useful counselling when supplements were dispensed.

> *"They have written all the instructions on my tablet box, and they also guide me when they are dispensed."*
>
> *(Pt 2)*
>
> *"He counseled me… how to use tablets, how many days, and how much dose should be taken."*
>
> *(Pt 2)*

However, experiences with pharmacist counselling were inconsistent. Some participants reported little or no interaction with pharmacists, either because another family member purchased medicines or because qualified pharmacists were perceived as unavailable.

> *"No. I didn't receive any instructions from the pharmacists. I sometimes visit the pharmacy because mostly my brother goes there and buys my medicine. Because in Pakistan, the availability of pharmacists is limited; they are not present in every pharmacy, but when I go there and a pharmacist is available, I still get no instructions from them."*
>
> *(Pt 8)*

Another participant described broader concerns about staffing and professional visibility within community pharmacies.

> *"If I talk about Pakistan, there are very few pharmacies have pharmacists. In Pakistan, a person who has a second-year pass stands at the counter and does all the dispensing and all that. And there are very few pharmacists. If he were there, he would not have known that he was a pharmacist or a dispenser. So first of all, we have to improve our pharmacy setup."*
>
> *(Pt 5)*

Participants also expressed concerns about inappropriate self-medication and emphasized the educational responsibilities of healthcare professionals.

> *"Yes, they should not be given to patients without a prescription because, I think, in our country, mostly people ruin their health lives on the basis of assumptions."*
>
> *(Pt 8)*
>
> *"And it is the responsibility of both doctors and pharmacists to raise awareness among the public and tell them about its proper use and misuse."*
>
> *(Pt 5)*

Overall, professional guidance was perceived as central to appropriate supplement use, although the accessibility and consistency of pharmacist counselling varied between participants.

Theme 4: Perceptions of Efficacy, Safety, Access, and Broader Value of Supplementation

Participants expressed mixed perceptions regarding supplement effectiveness. Some evaluated efficacy primarily through personal symptom improvement, whereas others remained uncertain about the extent of benefit.

"I am not sure, but people say that vitamin D and calcium supplements have a great effect on people's health. In my personal experience, it has a good effect."

(Pt 3)

Brand-related perceptions also influenced the way some participants judged supplement quality. One participant expressed greater confidence in imported or well-known brands compared with locally manufactured products.

"Most of them are local products and I think they are not effective as much as the imported ones. I believe that in our country if we use imported medicines or we use medicines of good brand, we will regain our health."

(Pt 8)

Participants' experiences of adverse effects differed. Some described no problems during supplementation, while others associated treatment with gastrointestinal symptoms such as abdominal discomfort or constipation.

"I didn't face any side effect except stomach ache from which I usually suffer on having any medicine. So, I take a dose of medicine for stomach too."

(Pt 8)

"When I used these medications on a regular basis, I experienced constipation, which led me to believe that it was a side effect of the medications. I use syrup for this, and I get relief."

(Pt 2)

Some participants were aware of potential adverse effects even when they had not personally experienced them.

"The adverse effects of calcium and vitamin D are constipation, diarrhea, mood swings, vomiting, and bloating. But I didn't experience them; I just know these things happen in some people."

(Pt 4)

Financial considerations were mentioned less consistently than issues related to knowledge and professional guidance. One participant described supplement prices as high but viewed purchase as necessary when treatment was required.

"I don't know anything related to the profitability of pharmacy. But prices are too high in the market. But when you need them, you have to buy your medicines for your own health."

(Pt 7)

Participants also perceived vitamin D and calcium supplementation and related health education as potentially beneficial for the wider community, particularly among individuals experiencing bone and joint problems.

"Yes, definitely, they have a positive impact on public health. People learn to maintain their health. But in Pakistan, people have no knowledge."

(Pt 4)

"Yes, I saw people getting better after using such products."

(Pt 3)

"Yes, they put positive impacts. If I consider myself, my health condition improved so much after taking these supplements."

(Pt 8)

These accounts demonstrate that participants generally viewed supplementation favorably but differed in their perceptions of effectiveness, safety, affordability, product quality, and the broader value of supplementation.

DISCUSSION

This qualitative study provides insight into how adults using vitamin D and calcium supplements in routine healthcare settings understood deficiency, supplementation, professional guidance, effectiveness, and safety. Four interconnected patterns characterized participants' accounts: knowledge was frequently experiential rather than comprehensive; symptoms and personal health experiences shaped interpretations of deficiency and benefit; physicians were central to decisions about supplementation while access to pharmacist counselling varied; and perceptions of efficacy, safety, brand quality, affordability, and broader health value differed between individuals. These findings suggest that supplementation practices within this sample were embedded in interactions among personal experience, health literacy, professional advice, and everyday beliefs rather than being determined solely by awareness of biomedical indications.

Limited knowledge was one of the most consistent patterns in participants' narratives. Knowledge frequently centered on products previously prescribed or personally used, and deficiency was commonly understood through symptoms such as bone or joint pain, weakness, or other bodily changes. Similar knowledge gaps have been reported in Pakistan and other regional populations, including incomplete understanding of vitamin D sources, deficiency manifestations, sunlight exposure, preventive behavior, and supplementation practices (16–20). Sikandar et al. demonstrated variable knowledge and practices related to vitamin D among a middle-aged Pakistani population, while Tariq et al. identified similar shortcomings among university students in Pakistan (17,20). Studies from Oman and Kuwait also demonstrated incomplete knowledge despite general awareness of vitamin D (18,19). The present qualitative findings extend this evidence by illustrating how such knowledge gaps were expressed through participants' explanations of symptoms, product use, perceived benefits, and dependence on professional advice.

Reliance on physicians was particularly prominent. Participants commonly described beginning or continuing supplementation because it had been prescribed and often viewed professional oversight as protection against inappropriate use. This pattern is consistent with qualitative research demonstrating that physician communication and clinical recommendations influence how patients understand vitamin D deficiency, uncertainty, testing, and supplementation (12,15). Pharmacists were also perceived as potentially important sources of dosage and administration advice, although participants reported inconsistent encounters with pharmacist-led counselling. This finding aligns with evidence from Pakistan showing shortcomings in community-pharmacy counselling and dispensing practices (21). Studies involving pharmacists and prescribers likewise demonstrate that professional knowledge and counselling influence supplementation practices and patient guidance (22,23). Recent Pakistani mixed-method evidence further emphasizes the relevance of clinician awareness within local health facilities (30).

Participants' perceptions of efficacy were not uniform. Several interpreted symptom improvement after supplementation as evidence of effectiveness, whereas others remained uncertain or evaluated products according to brand reputation. One participant explicitly regarded imported or well-known brands as more effective than locally produced alternatives. This view should be understood as a participant perception rather than evidence of comparative pharmaceutical efficacy. Previous qualitative research similarly demonstrates that patients may interpret vitamin D supplementation through personal experiences, expectations, testing practices, uncertainty, and interaction with clinicians rather than through detailed knowledge of the evidence base (12,15). Misconceptions concerning vitamin D and supplement effectiveness can further influence expectations and treatment behavior (13).

Awareness of adverse effects was also uneven. Some participants reported no adverse experiences, whereas others associated supplementation with constipation or gastrointestinal discomfort. These accounts do not establish causality but demonstrate that patients may attribute symptoms occurring during treatment to vitamin or mineral products and may independently use additional remedies. Vitamins and minerals are often perceived as intrinsically safe despite recognized risks associated with excessive or inappropriate intake (14). Reports from Pakistan have documented vitamin D toxicity associated with inappropriate supplementation practices, emphasizing the importance of rational dosing, clinical indication, monitoring where appropriate, and avoidance of indiscriminate use (24). Clinician and pharmacist involvement may therefore be important not only for improving adherence but also for reducing inappropriate supplementation and identifying potential safety concerns (22,23,25,26).

Participants frequently attributed vitamin D and calcium deficiency to insufficient sunlight exposure, unhealthy diets, limited nutritional awareness, and physical inactivity, and they proposed sunlight exposure, improved diet, exercise, supplementation, and awareness initiatives as possible responses. These perceptions broadly overlap with recognized determinants of vitamin D status in low- and middle-income settings, where dietary intake, availability of vitamin D-rich or fortified foods, ultraviolet-B exposure, and behavioral practices contribute to deficiency risk (4,6,7,10,11). Pakistani evidence similarly indicates a considerable burden of vitamin D deficiency across age groups and identifies dietary and lifestyle factors as relevant contextual influences (8,9). At the same time, participants' explanations should be interpreted as perceptions rather than clinical assessments of the causes of individual deficiency.

Cultural and social interpretation of vitamin D deficiency is also important. Qualitative research among minority ethnic populations has demonstrated that beliefs surrounding sunlight exposure, food, supplementation, symptoms, and culturally embedded practices can influence how vitamin D deficiency is recognized and managed (29). These contextual influences may help explain why knowledge derived from formal medical advice can coexist with beliefs based on family experience, social narratives, brand reputation, or perceived bodily responses. The present study similarly found that participants integrated medical recommendations with personal and social interpretations when making sense of supplementation.

Participants generally perceived supplementation and improved awareness as potentially beneficial to public health, particularly for individuals experiencing bone and joint problems. These views are consistent with their personal experiences of symptom improvement and confidence in professional recommendations but cannot establish population-level effectiveness. The findings therefore support an implementation-oriented interpretation: educational efforts may be most useful when linked to the issues participants themselves identified, including recognition of deficiency, appropriate testing and prescribing, correct dose and duration, potential adverse effects, dietary sources, sunlight exposure, and the complementary roles of physicians and pharmacists. Previous evidence emphasizing patient–professional communication, medication counselling, clinician awareness, and pharmacist involvement supports this approach (12,15,21–23,30).

The perceived role of pharmacists deserves particular attention. Some participants described pharmacists as valuable sources of practical guidance, whereas others reported limited interaction or uncertainty regarding pharmacists' availability. Community-pharmacy practice in Pakistan has previously been characterized by variable counselling and dispensing quality (21). International evidence also suggests that pharmacists may contribute to safer use of supplements and complementary medicines by clarifying administration, identifying possible medication-related concerns, and providing patient education (23,26). Patients' satisfaction with community pharmacy services may depend on accessibility, communication, professional competence, and responsiveness to individual priorities (28). Regulatory frameworks governing complementary products and supplements may further influence public confidence in quality and safety (27).

Financial concerns appeared in the accounts but were less consistently represented than knowledge, professional guidance, and perceived efficacy. Accordingly, affordability should be interpreted as a potential concern for some participants rather than as a dominant barrier across the entire sample. A similar caution applies to preferences for imported products: such views remain analytically important because they reveal how patients make sense of quality and trust, but the available qualitative evidence does not justify treating these opinions as universal beliefs. Qualitative research is particularly useful for identifying such minority or contrasting perspectives because these may illuminate aspects of treatment experience that are obscured when findings are reduced only to majority patterns.

Several methodological features strengthen the study. Semi-structured interviews permitted participants to describe supplementation in their own terms, and direct quotations maintained a visible link between thematic interpretations and individual accounts. Independent coding by two researchers, consensus discussion, field notes, and an audit trail supported transparency in the analytic process. The structure of reporting was informed by established qualitative reporting guidance, including COREQ and SRQR, which emphasize transparency regarding study design, data collection, analysis, researcher roles, and the relationship between findings and supporting data (31,32). The thematic analysis was structured using an established six-phase analytic framework (33).

Nevertheless, the findings should be interpreted within the study context. The sample comprised 10 participants recruited purposively from pharmacies and outpatient clinics in Islamabad and Rawalpindi; consequently, the findings are not intended to provide population prevalence estimates and their transferability to rural populations, people not engaged with formal healthcare, or other regions of Pakistan may be limited. Recruitment within healthcare settings may also have favored participants already accustomed to professional advice, potentially contributing to the strong emphasis on physician-directed supplementation. Because experiences, symptoms, and perceived benefits were self-reported, recall and social-desirability influences are also possible. The qualitative findings establish perceptions and experiences rather than objective biochemical outcomes, treatment effectiveness, comparative product quality, or causal effects.

The findings have practical implications for patient education and community-based pharmaceutical care. Counselling should move beyond simply stating a dose and should explain the reason for supplementation, expected duration, appropriate administration, relevant safety considerations, and complementary dietary and lifestyle measures. Greater availability and visibility of trained pharmacists may provide opportunities to reinforce appropriate use at the point of dispensing, while consistent physician–pharmacist communication may reduce uncertainty and discourage inappropriate self-medication (21–26). Public-health communication should also avoid assuming that familiarity with the terms “vitamin D” and “calcium” represents adequate health literacy, because awareness of supplement names may coexist with uncertainty regarding indications, adverse effects, and appropriate use (12,15–20).

CONCLUSION

Adults using vitamin D and calcium supplements in Islamabad and Rawalpindi generally perceived supplementation favorably, but their accounts revealed variable and often experience-based knowledge of deficiency, efficacy, safety, and appropriate use. Trust in physicians was a major influence on supplementation decisions, while pharmacists were considered useful sources of counselling when accessible. Perceived symptom improvement, beliefs about diet and sunlight exposure, concerns about adverse effects and product quality, and occasional financial considerations further shaped participants’ experiences. These findings support patient-centered counselling that clearly explains indications, dosing, duration, safety, and complementary lifestyle measures, together with stronger pharmacist involvement and coordinated professional communication. Because the findings represent perceptions

from a small purposively selected urban sample, they should inform context-sensitive educational and service improvements rather than be interpreted as evidence of population-level treatment effectiveness.

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