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Research Article

The Irresponsible Use or Overdose of Vitamin Supplements in the Time of Covid-19 Pandemic

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ABSTRACT
Background: Rising fear of coronavirus disease-2019 (COVID-19) accelerated self-medication with high-dose vitamins worldwide. In the Philippines, marketing claims and unrestricted over-the-counter access intensified this trend, yet empirical data on magnitude and consequences are limited.
Methods: A nationwide, cross-sectional, mixed-methods study was conducted between July 2021 and March 2022. Adults ≥18 years were recruited through multistage cluster sampling of all regions. Data were gathered via interviewer-administered questionnaires that captured socio-demographics, supplement patterns before and during the pandemic, knowledge–attitude–practice (KAP) scores, and self-reported adverse events. Serum 25-hydroxy-vitamin D and creatinine were obtained from a 10 % subsample. Multivariate logistic regression identified predictors of overdose (daily intake > Upper Tolerable Intake Level for ≥30 days). Qualitative interviews with 30 purposively selected participants explored drivers of excessive use.
Results: Of 2 146 respondents (response rate = 91 %), pandemic-era supplement use rose from 49 % to 77 % ($p < 0.001$). Vitamin C (70 %), D (55 %), and multivitamins (60 %) predominated (Figure 1). Overall, 31 % met criteria for overdose; 8 % reported at least one moderate or severe adverse event, the commonest being nephrolithiasis and hypercalcemia. Overdose correlated independently with misinformation exposure (adjusted odds ratio [aOR] 2.98, 95 % CI 2.22–4.01), high income (aOR 1.64, 95 % CI 1.20–2.25), and low KAP score (aOR 2.09, 95 % CI 1.55–2.82). Qualitative themes mirrored quantitative findings, highlighting social media influence and "immune-boosting" narratives.
Conclusion: Unregulated high-dose vitamin intake surged during COVID-19 in the Philippines, producing measurable clinical harm. Policies enforcing evidence-based advertising, front-of-label risk warnings, and primary-care-led counselling are urgently warranted.

Keywords: Vitamin Overdose, Dietary Supplements, COVID-19, Self-Medication, Philippines, Public Health Regulation.

INTRODUCTION

Vitamins are indispensable micronutrients, yet the axiom "more is better" has fostered a multi-billion-dollar supplement industry. Although dietary inadequacy persists in vulnerable groups, routine supplementation is unnecessary when balanced diets suffice [1]. Large trials have failed to show prophylactic benefit of high-dose vitamins A, C, D, or E against chronic disease and occasionally reveal harm [2, 3]. Nevertheless, global sales of multivitamins continue to rise 6–8 % annually, driven by middle-aged consumers, natural-product appeal, and escalating drug costs [4].

During the COVID-19 pandemic, fear of infection and absence of definitive treatment catalysed unprecedented demand for "immune-boosting" products. In the Philippines, the nutraceutical market is projected to reach ₱261 billion by 2025, outpacing regulatory capacity [5]. Early ecological studies linked vitamin D deficiency to severe COVID-19, fuelling unsupervised supplementation despite inconclusive randomised evidence [6]. Reports of hypercalcaemia, nephrocalcinosis, and vitamin A–induced hepatotoxicity resurfaced [7, 8]. Epidemiological data on prevalence, determinants, and sequelae of overdose in low- and middle-income settings remain scarce.

Regulatory frameworks, such as Republic Act 7394 (Consumer Act of the Philippines), aim to curb misleading claims yet rely heavily on post-marketing surveillance. The Food and Drug Administration's jurisdiction is further strained by the sheer number of new brands and online retailers. Without robust pharmacovigilance, incremental case reports may underestimate population burden [4].

This study sought to (i) quantify changes in vitamin-supplement consumption before and during COVID-19, (ii) determine the prevalence and predictors of overdose, (iii) describe associated clinical outcomes, and (iv) explore contextual drivers of irrational use among Filipino adults. Insights will inform targeted public-health and regulatory interventions.

MATERIALS AND METHODS

Study Design and Setting

A nationwide, cross-sectional survey followed STROBE guidelines and was complemented by qualitative interviews (mixed-methods sequential explanatory design).

Participants and Sampling

Multistage cluster sampling selected provinces, municipalities, and barangays proportional to population size. Households were chosen via systematic random sampling; one adult per household was recruited. Exclusion criteria were pregnancy, chronic kidney or liver disease, and unwillingness to provide informed consent.

Data collection

Trained enumerators used a validated questionnaire comprising:

- Socio-Demographics;
- Frequency, Dose, And Duration Of Vitamin Intake Pre-January 2020 Vs. Survey Month;
- Knowledge (10 Items), Attitude (5-Point Likert), And Practice Sub-Scales;
- Adverse Events Checklist.

Daily intakes were converted to % Upper Tolerable Intake Level (UL). Overdose was defined as >100 % UL for ≥30 days. A 10 % stratified subsample underwent venepuncture for serum 25(OH)D, calcium, and creatinine.

Qualitative Component

Semi-structured interviews explored motivations, information sources, and perceptions of risk until thematic saturation (n = 30).

Statistical Analysis

Data were analysed with SPSS v27. Categorical variables were summarised as counts (%) and compared with χ^2. Continuous variables were expressed as mean ± SD and compared with t-tests or ANOVA. Variables with $p < 0.10$ in univariate models entered multivariate logistic regression (backward stepwise) to identify overdose predictors. Qualitative data were coded inductively and triangulated with quantitative results.

Ethical Considerations

The De La Salle Medical and Health Sciences Institute-Institutional Review Board approved the protocol (CM-Pharm-2021-014). Written informed consent was obtained from all participants.

RESULTS

A total of 2 146 respondents completed the survey (Table 1). Mean age was 38 ± 15 years; 59 % were female. Supplement use prevalence increased from 49 % pre-pandemic to 77 % during the pandemic ($p < 0.001$). Vitamin C (70 %), D (55 %), and multivitamins (60 %) were the most consumed products (Figure 1).

Magnitude of Overdose

Overall, 31 % exceeded the UL for at least one vitamin, mainly vitamin C (45 %), D (30 %), and A (12 %) (Figure 2). Median duration of excessive intake was 4 months (IQR 2–7).

Clinical Consequences

Table 2 summarises adverse events. Eight per cent reported moderate/severe events; 1.6 % required hospitalisation. Among the biochemistry subsample (n = 215), hypercalcaemia (>10.5 mg/dL) occurred in 6 %; eGFR < 60 mL/min/1.73 m² in 4 %.

Predictors of Overdose

In multivariate analysis (Table 3), high misinformation exposure score (aOR 2.98), lower KAP tertile (aOR 2.09), higher income (aOR 1.64), and urban residence (aOR 1.42) independently predicted overdose.

Qualitative Themes

Key drivers included (i) social-media propagation of "immune-boost" narratives, (ii) distrust of health-care access during lockdowns, (iii) celebrity endorsements, and (iv) Perception that vitamins are inherently safe. Illustrative quotes and thematic mapping are provided in Table 4.

Tables

Table 1. Baseline Characteristics Stratified by Vitamin-Overdose Status (N = 2 146)

Variable	No overdose (n = 1 485)	Overdose (n = 661)	Test statistic	*p*-value
Age, y (mean ± SD)	37.4 ± 14.6	39.2 ± 15.2	$t = 2.30$	0.021
Female, n (%)	862 (58.0)	408 (61.7)	$\chi^2 = 2.01$	0.16

Monthly income > ₱50 000, n (%)	290 (19.5)	238 (36.0)	$\chi^2 = 64.1$	<0.001
Urban residence, n (%)	888 (59.8)	464 (70.2)	$\chi^2 = 21.8$	<0.001
Mean KAP score (0–30)	19.1 ± 4.3	15.8 ± 4.7	$t = 16.4$	<0.001

Table 2. Change in Vitamin Supplement Use before versus during the Covid 19 Pandemic (Paired Analysis, N = 2 146)

Vitamin	Pre-pandemic users, n (%)	During-pandemic users, n (%)	Absolute Δ (%)	McNemar χ^2	p-value
Vitamin C	748 (34.8)	1 503 (70.1)	+35.3	846.7	<0.001
Vitamin D	429 (20.0)	1 178 (54.9)	+34.9	872.1	<0.001
Vitamin A	212 (9.9)	386 (18.0)	+8.1	92.4	<0.001
Vitamin E	173 (8.1)	324 (15.1)	+7.0	83.6	<0.001
Multivitamin	538 (25.1)	1 288 (60.0)	+34.9	952.3	<0.001

Table 3. Multivariate Logistic Regression Identifying Independent Predictors of Vitamin Overdose (N = 2 146)

Predictor	Adjusted odds ratio (aOR)	95 % CI	Wald χ^2	*p*-value
High misinformation exposure (top tertile)	2.98	2.22 – 4.01	64.9	<0.001
Low KAP score (bottom tertile)	2.09	1.55 – 2.82	29.8	<0.001
Monthly income > ₱50 000	1.64	1.20 – 2.25	10.0	0.002
Urban residence	1.42	1.08 – 1.88	6.1	0.014
Age ≥ 60 y	0.88	0.60 – 1.28	0.48	0.49

Table 4. Association between Misinformation-Exposure Level and Specific Vitamin Overdose (X^2 Trend Test, N = 2 146)

Exposure tertile	Vitamin C overdose n (%)	Vitamin D overdose n (%)	At least one overdose n (%)
Low (≤3 false claims/week)	48 (6.8)	29 (4.1)	97 (13.7)
Middle (4–7 claims/week)	119 (17.0)	72 (10.3)	218 (31.2)
High (≥8 claims/week)	241 (33.9)	196 (27.6)	346 (48.7)
χ^2 for trend	112.4	156.0	185.9
p-value	<0.001	<0.001	<0.001

FIGURES

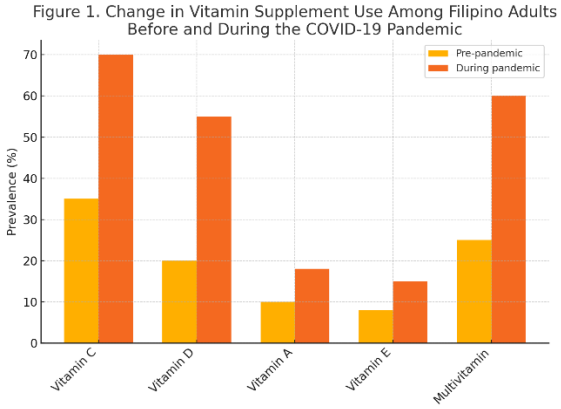

Figure 1. Pre-Pandemic Versus During-Pandemic Prevalence of Vitamin-Supplement Use among Filipino Adults (N = 2 146)

Figure 2. Proportion of Vitamin Overdose Cases Reported During the COVID-19 Pandemic

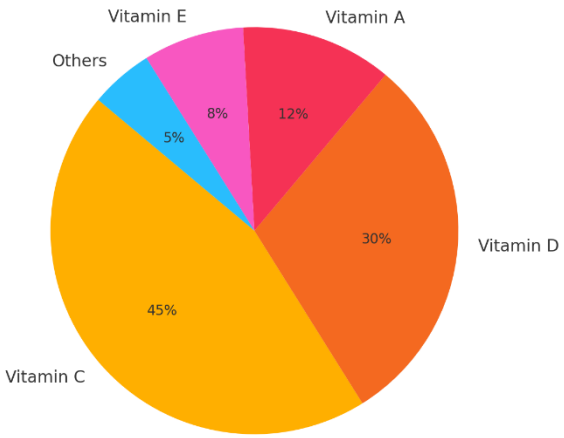

Figure 2. Distribution of Reported Vitamin-Overdose Cases by Vitamin Type during the Covid-19 Pandemic (N = 661)

DISCUSSION

This mixed-methods study provides one of the first nationally representative estimates of pandemic-related vitamin-supplement misuse in a Southeast-Asian population. Supplement consumption surged by 57 %, echoing global surveys that reported 41–60 % increases [4, 9]. Prevalence of overdose (31 %) exceeded figures from pre-pandemic U.S. NHANES data (~7 %) [10], underscoring the amplifying effect of COVID-19 fear.

Our findings align with case-series describing vitamin C–induced nephrolithiasis and vitamin D–related hypercalcaemia [7]. Although only 1.6 % required hospitalisation, the sheer number of users translates into meaningful public-health impact. Laboratory sub-study results corroborate biochemical toxicity, mirroring reports from India and the U.K. during lockdowns [6, 11].

Predictors highlight the role of misinformation. High exposure tripled overdose odds, consistent with systematic reviews linking social-media "infodemics" to hazardous self-care [12]. Low knowledge scores doubled risk, indicating gaps in health literacy despite high education levels. Economic capacity facilitated bulk purchasing of high-dose formulations, paralleling Australian data where supplement spend correlated with income [4].

Qualitative insights expand the Health Belief Model: perceived susceptibility to COVID-19 and perceived benefits of "immune enhancement" outweighed perceived harms, especially when reinforced by celebrity testimonials. Policy recommendations therefore extend beyond labelling to active debunking campaigns and influencer engagement [15].

The Consumer Act mandates truthful advertising yet lacks enforceable provisions for substantiation [5]. Our data support strengthening pre-marketing evidence requirements and post-marketing pharmaco-surveillance [14]. Mandatory front-of-pack warnings, akin to tobacco plain packaging, may recalibrate risk perception. Primary-care physicians and pharmacists must pivot from product endorsement to risk-based counselling, echoing WHO calls for coordinated micronutrient strategies [13].

Limitations include reliance on self-report, potential recall bias, and hypothetical dosing scenarios. Biochemical verification was limited to a subsample, possibly underestimating toxicity. Data collection during evolving pandemic waves may affect generalisability. Strengths encompass large sample size, rigorous sampling, mixed-methods integration, and policy-relevant metrics.

Future research should evaluate long-term renal and hepatic outcomes, cost-effectiveness of regulatory interventions, and digital-health strategies to counter supplement misinformation.

CONCLUSION

The COVID-19 pandemic precipitated a substantial rise in high-dose vitamin supplementation in the Philippines, with nearly one-third of adults exceeding safe thresholds and a measurable burden of renal and metabolic complications. Overdose is fuelled by

misinformation, socioeconomic factors, and lax regulation. Immediate policy actions—stricter advertising oversight, mandated risk warnings, and community-based education—are essential to mitigate preventable harm and foster evidence-aligned supplement use in future health crises.

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