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MAPPING THE INTELLECTUAL LANDSCAPE OF NUTRITIONAL SUPPLEMENT AWARENESS: A BIBLIOMETRIC ASSESSMENT OF PRE- AND POST-COVID-19 RESEARCH TRAJECTORIES

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Abstract
Purpose – *This study maps how research on nutritional supplement awareness is organised intellectually and how that organisation shifted across the COVID-19 divide. Drawing on Scopus records for 2014–2019 and 2020–2025, it traces growth, leading contributors, collaboration patterns, conceptual structure, and the gaps that should shape future enquiry.*
Design/methodology/approach – *Following the PRISMA 2020 protocol, 235 peer-reviewed articles were retrieved from Scopus and analysed with Biblioshiny (the bibliometrix interface in RStudio) and VOSviewer. Performance indicators — production, citation, authorship, and country output — were combined with science-mapping techniques (keyword co-occurrence, bibliographic coupling, and thematic mapping) and computed separately for the whole corpus and the two sub-periods.*
Findings – *Output over 2020–2025 ran 173% higher than in the preceding six years, and the compound annual growth rate rose from 11.8 to 21.5 per cent. Production also became less concentrated in the United States: its share of articles fell from 20.6 to 8.1 per cent as Saudi Arabia, Malaysia, Turkey, and Lebanon moved toward the centre. Thematically, descriptive knowledge–attitude–practice surveys gave way to work on health literacy, purchase intention, clinical nutrition, and pandemic-era supplementation; yet bibliographic coupling shows the newer literature building on the older rather than replacing it.*
Originality/value – *No previous study has treated nutritional supplement awareness as a single, mappable field or measured what the pandemic did to its structure. This analysis supplies that map together with a research agenda grounded in it.*
Paper type – *Literature review (bibliometric study)*

Keywords – *nutritional supplement awareness; bibliometric analysis; COVID-19; knowledge–attitude–practice; science mapping*

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1. Introduction

The growing popularity of personal health and preventive self-care has led to a huge and rapidly expanding consumer category of nutritional supplements (also referred to as dietary supplements), nutraceuticals, minerals, vitamins, and herbal products (Dickinson et al., 2014; Bailey et al., 2013). Additionally, it is a concern as surveys in high and middle-income nations have revealed that significant proportions of adults use these regularly, typically without medical guidance, and are misled by incomplete or commercially manufactured information (Axon et al., 2017; Willis & Royne Stafford, 2016). This type of activity has been recognized by multiple disciplines, such as public health, consumer protection, clinical nutrition, and pharmacovigilance.

It was a different story when COVID-19 came along. During the time of the acute uncertainty, vitamin C, vitamin D, zinc, and various herbal remedies use increased significantly, and so did the output of scientific research (Hamulka et al., 2021; Mohsen et al., 2021; Tariq et al., 2020). This explosion raises not just a rhetorical question, but one that is genuinely open: has the pandemic just accelerated an ongoing agenda, or is it reshaping the field, focusing on new themes, populations, and places? It requires a systematic literature over time to answer, rather than a narrative summary.

The bibliometric analysis is designed to do this. It quantifies publishing trends, cites the extent of citation, collaboration networks, and conceptual connections, revealing the internal structure of a research field and monitoring its evolution (Aria & Cuccurullo, 2017; Donthu et al., 2021). Previous bibliometric research has focused on smaller segments: vitamin D and COVID-19 (Grant et al., 2020) and sports supplementation (Sekulic et al., 2019), but no research has examined the nutritional supplement awareness as a whole, or compared the pre- and post-pandemic periods side by side.

The bibliometric approach is particularly appropriate because of three characteristics of the subject. The literature is remarkably diverse and spans clinical pharmacology, public-health epidemiology, sports science, consumer marketing, and ethnobotany; a typical systematic review, based on a single method or theme, would only address a fraction of this. Mapping, by contrast, makes the relational structure visible — which authors and countries carry the field, which conceptual clusters sit at its core and which at its margins, and how those positions shift. And because the method quantifies output and impact within clearly bounded windows, it is well suited to gauging what a discrete shock such as the pandemic did to the field. Used this way, bibliometrics is less a descriptive convenience than a means of drawing inferences about how knowledge accumulates (Donthu et al., 2021).

The existing work falls into several loosely connected strands. The largest is the knowledge–attitude–practice (KAP) survey, conducted across many populations and concentrated in the Middle East and Southeast Asia (Alhomoud et al., 2016; El Khoury et al., 2016; Žeželj et al., 2018). A second concern is supplementation among athletes, with its own theoretical and measurement conventions (Finamore et al., 2022; Wardenaar et al., 2024; Yager & McLean, 2020). A third, more recent strand draws on consumer-behaviour ideas such as purchase intention and health consciousness (Royne et al., 2014; Willis & Royne Stafford, 2016). That these strands rarely speak to one another is itself a reason to attempt an integrative map.

The conceptual scaffolding of the field is similarly mixed. The KAP paradigm, long dominant in public health, assumes that better knowledge feeds attitude change and, in turn, behaviour; yet in the supplement setting the knowledge–behaviour link has often proved weak or inconsistent (Bukic et al., 2018; Karbownik et al., 2019). Ideas from consumer psychology, including the theory of planned behaviour and constructs such as health consciousness and perceived behavioural control, have been brought in to explain why awareness does not translate cleanly into prudent use, particularly where advertising and social influence are at work (Willis & Royne Stafford, 2016). Holding clinical, epidemiological, and marketing lenses together in one field makes it conceptually rich but structurally loose, which again argues for a mapping exercise.

The pandemic intensified these strains. Anxiety, reduced access to formal care, and a flood of unverified online claims pushed supplements forward as a perceived line of defence, frequently ahead of the clinical evidence (Grant et al., 2020; Hamulka et al., 2021). Early studies recorded steep rises in the use of immune-related micronutrients and in self-medication, much of it guided by digital sources of uneven quality (Mohsen et al., 2021; Tariq et al., 2020). Whether this amounts to a lasting reorientation of supplement awareness or a passing reaction is an open and consequential question, and one a time-split bibliometric analysis is well placed to address.

This study therefore examines 235 Scopus-indexed articles published between 2014 and 2025, divided into pre-COVID-19 (2014–2019) and post-COVID-19 (2020–2025) phases, and is guided by four questions:

RQ1. How has the volume and growth of nutritional supplement awareness research changed since the pandemic, and what does the pattern of annual output look like?

RQ2. Who are the field's leading contributors, and how have its collaboration networks and geographic hubs shifted in response to COVID-19?

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RQ3. What thematic and conceptual changes are visible before and after the pandemic?
RQ4. What gaps, neglected populations, and methodological limits remain, and what should future research prioritise?

2. Methodology

2.1 Data Extraction

It was decided to use the data from Scopus because the journal covers a broad spectrum of peer-reviewed literature in the health, nutrition, social-science and business fields relevant to this study and because the data format is easily readable for bibliometric software (Donthu et al., 2021). The search was performed on the article title field and included supplement-type terms that were matched with the awareness- and behaviour-related terms. In full: *("nutritional supplement*" OR "dietary supplement*" OR "nutraceutical*" OR "vitamin supplement*" OR "herbal supplement*" OR "health supplement*" OR "immune-boosting supplement*" OR "food supplement*" OR "mineral supplement*") AND ("awareness" OR "knowledge" OR "perception" OR "attitude" OR "consumer behavior*" OR "purchase intention*" OR "health consciousness" OR "self-medication" OR "literacy").* Truncation picked out singular and plural forms and morphological variants, and Boolean ANDs demanded that each record covered both a supplement category and an awareness or behavioural dimension, excluding clinical efficacy studies without an awareness dimension. The query was executed on one day to get the same and fixed data-set to be used.

2.2 Selection of the Final Sample

Screening followed PRISMA 2020 (Page et al., 2021) and is set out in Figure 1. The query returned 400 records. Restricting the years to 2014–2025 left 359; limiting the results to the 17 subject areas relevant to the field — Medicine, Agricultural and Biological Sciences, Nursing, Pharmacology, Health Professions, Biochemistry, Social Sciences, Business, Environmental Science, Neuroscience, Immunology, Chemistry, Economics, Psychology, Veterinary, Chemical Engineering, and Multidisciplinary — left 290. Confining records to original journal articles brought the total to 247, and an English-language restriction produced the final corpus of 235. Of these, 63 (26.8%) fall in the pre-COVID-19 period and 172 (73.2%) in the post-COVID-19 period.

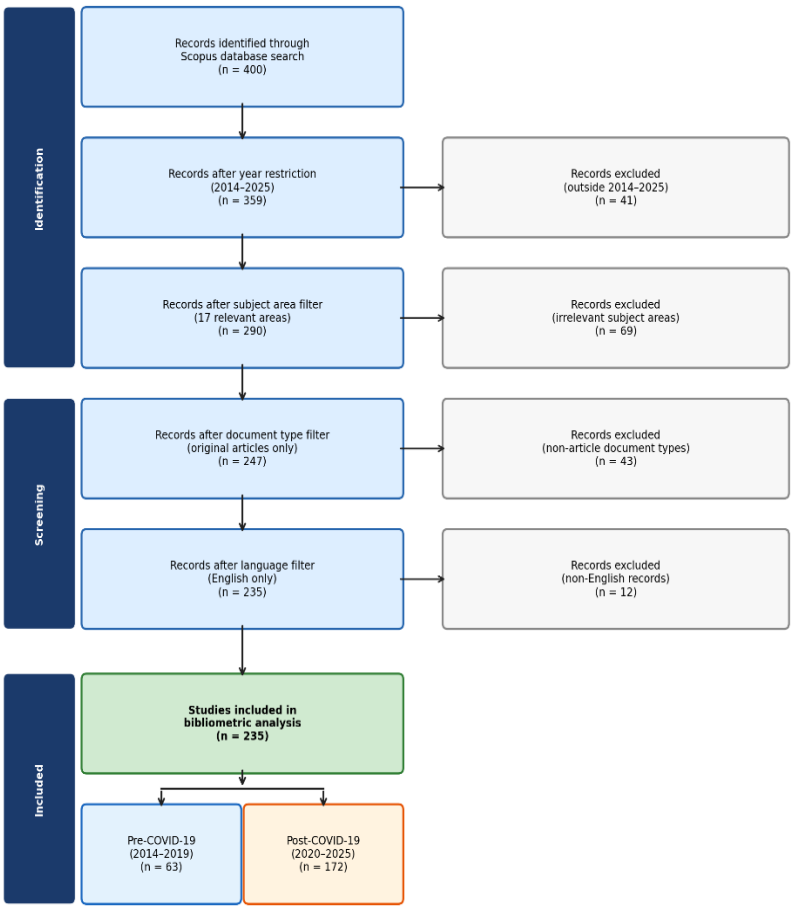

Figure 1. PRISMA 2020 flow diagram of study identification, screening, and inclusion
Source: authors' construction following Page et al. (2021)

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Two kinds of technique were applied. Performance analysis measured the productivity and impact of the field's components — documents, authors, sources, and countries — through total and average citations, the h-, g-, and m-indices, and growth rates. Science mapping examined relational structure through co-occurrence analysis of author keywords, bibliographic coupling of documents, and strategic (thematic) mapping based on co-word clustering. In VOSviewer the networks used association-strength normalisation, with minimum-occurrence thresholds set to each dataset's size so that coverage and readability stayed in balance. Thematic maps were produced in Biblioshiny using Louvain clustering on the merged keyword field. Pairing performance metrics with several mapping techniques follows accepted practice and lets independent analytical lenses be checked against one another (Aria & Cuccurullo, 2017; Donthu et al., 2021).

Bounding the corpus at 2014 was a deliberate choice: six pre-pandemic years give a long enough baseline to characterise the field before the disruption, while 2025 captures the most recent complete and near-complete years of output. The symmetry of the design — six years before the pandemic and six spanning and following its onset — helps separate the pandemic's effect from ordinary long-run growth, and that comparison runs through the whole analysis.

Complete bibliographic records — authorship, affiliations, sources, citations, references, and keywords — were exported as CSV and analysed in Biblioshiny, the web interface of the bibliometrix R package (Aria & Cuccurullo, 2017), and in VOSviewer (van Eck & Waltman, 2010). Performance and mapping analyses were run separately for the whole corpus and the two sub-periods to allow direct comparison. Table 1 reports the main characteristics of the three datasets.

Table 1. Principal characteristics of the three datasets

Metric	Pre-COVID (2014–2019)	Post-COVID (2020–2025)	Whole (2014–2025)
Documents (articles)	63	172	235
Sources (journals)	54	113	156
Authors	292	916	1,181
Author keywords	176	529	651
Total citations	1,405	978	2,383
Average citations per document	22.30	5.69	10.14
Cited references	7,656	27,861	35,517
Collaboration index (% multi-authored)	95.2%	96.5%	96.2%
Annual growth rate (CAGR)	11.8%	21.5%	10.8%

Source: *Compiled and computed data; Courtesy: RStudio*

The gap in average citations between the two periods — 22.30 for the pre-COVID corpus against 5.69 for the post-COVID corpus — reflects the longer window earlier papers have had to accumulate citations. It is a familiar bibliometric artefact, not a sign that recent work matters less (Donthu et al., 2021).

3. Results and Interpretation

3.1 Annual Scientific Production and Growth

Figure 2 plots annual output against the mean total citations per year (MTCPY). The pre-COVID-19 period produced 63 articles at a compound annual growth rate of 11.8%, rising from 12 in 2014 to 21 in 2019. The post-COVID-19 period produced 172 — an increase of 173% — at a markedly higher rate of 21.5%, with matching peaks of 37 articles in 2022 and again in 2025. The two-humped shape suggests an early rapid-response wave in 2021–2022 followed by a consolidation phase in 2024–2025, much like the pandemic surges seen in neighbouring health-behaviour literatures (Di Renzo et al., 2020).

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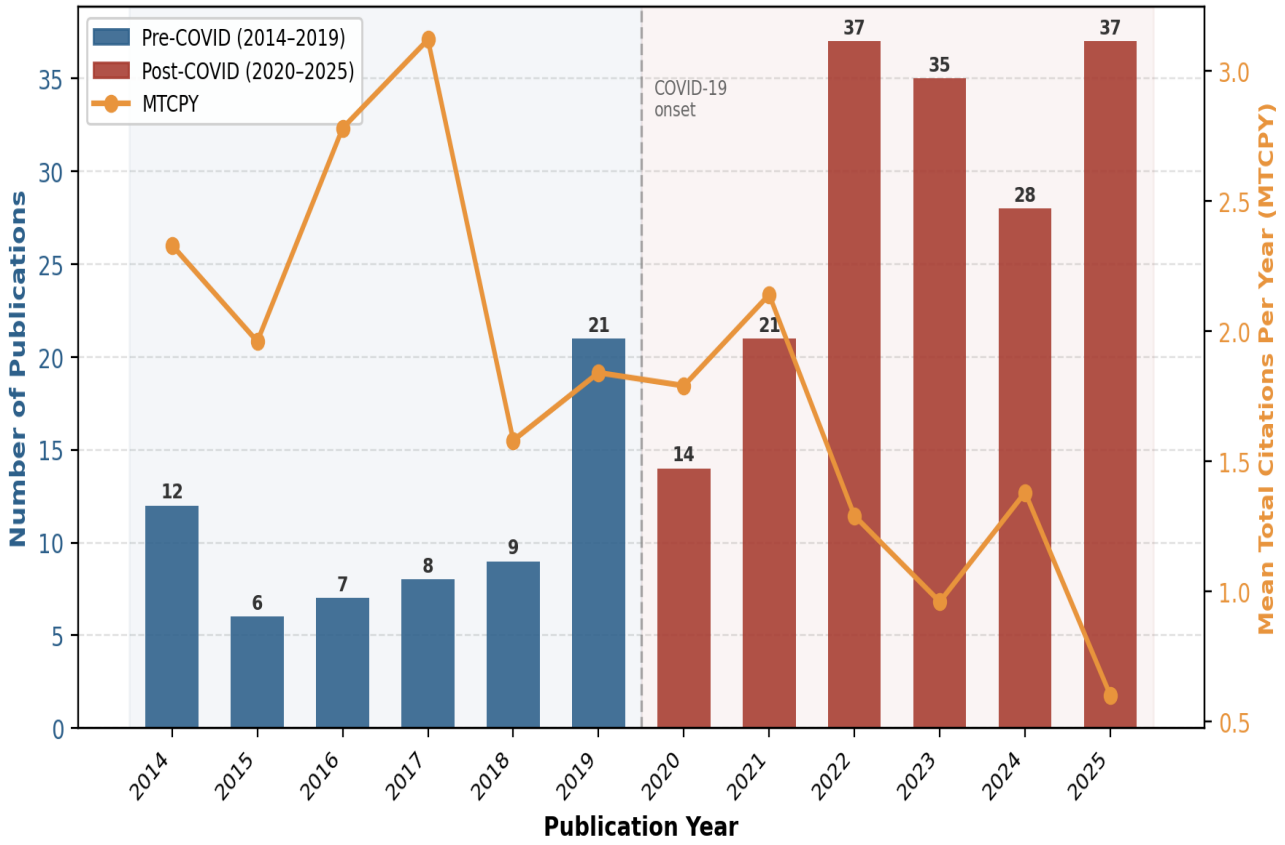

Figure 2. Annual scientific production (bars) and mean total citations per year (line), 2014–2025

Source: *Compiled and computed data; Courtesy: RStudio*

The trajectory is broken, which emphasizes the part played by the pandemic. The field expanded at an average rate of approximately ten articles per year, with the typical characteristics of a young domain, through 2014-2019. There were already fourteen articles published in 2020, bringing the total to just over one year of articles before news of the pandemic came, which drove output to twenty-one articles in 2021 and thirty-seven articles in 2022. The growth of almost treble in three years is difficult to interpret as organic growth and in any case points to the pandemic as an external catalyst. The high level of output that has continued through 2023–2025 suggests the interest gained is not diminishing, but it also has implications for the future size and direction of the field.

Citation velocity, captured by MTCPY, peaks for the 2017 cohort at 3.12 and stays high across the pre-pandemic years, tailing off for recent cohorts because of citation lag. A corpus-wide mean of 10.14 citations per document, alongside a single 2017 article cited 119 times (Barsics et al., 2017), confirms that foundational pre-pandemic studies still anchor the citation structure even though post-pandemic work now dominates by count. Together these patterns answer RQ1: the pandemic produced a step-change in volume without an immediate matching shift in citation impact.

Set against the wider bibliometric record, the profile fits the known capacity of major health events to accelerate research, but its scale — a near-tripling in three years — is unusual even by that measure. Part of the explanation lies in the low cost of entry to survey-based supplement research, which can be designed and fielded quickly when a new concern appears. In effect the pandemic lowered the threshold for newcomers to the field, a reading the authorship analysis below supports.

3.2 Most Productive and Influential Sources

There were 156 journals that published the 235 articles, which was quite broad and somewhat dispersed. The ten most productive are shown in Table 2. Nutrients (MDPI) are clearly the leader with 14 articles, followed by PLoS ONE (8) and Frontiers in Nutrition (7). The applied nature of nutrition and the quicker dissemination prevalent in pandemic research efforts is evident in the positioning of these open-access, high-throughput journals at the top.

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Table 2. Ten most productive sources

Sl No.	Source title	Articles	h-index	Publisher
1	Nutrients	14	9	MDPI
2	PLoS ONE	8	6	PLOS
3	Frontiers in Nutrition	7	4	Frontiers
4	Int. J. Environmental Research and Public Health	6	5	MDPI
5	British Food Journal	5	4	Emerald
6	Food Quality and Preference	5	4	Elsevier
7	Food Research	4	2	Rynnye Lyan
8	Journal of Dietary Supplements	4	3	Taylor & Francis
9	BMC Public Health	3	3	BMC
10	Clinical Nutrition ESPEN	3	2	Elsevier

Source: *Compiled and computed data, Courtesy: RStudio*

The top journals also give some clues as to the field's form. Most of the KAP and prevalence work goes into general nutrition outlets, such as Nutrients and Frontiers in Nutrition, while more specialised outlets include the British Food Journal, the International Journal of Pharmaceutical and Healthcare Marketing, and the Clinical Nutrition ESPEN for disciplines of sensory and consumer research, marketing, and clinical applications. The field is also quite young, with output spread across 156 sources, none of which account for more than six per cent.

3.3 Author Productivity and Collaboration

There were 1,181 unique authors of the corpus. Lotka's inverse-square law is closely followed where productivity is concerned (Figure 3): one-third (1,113) of the authors authored one article and one author authored five. A distribution of this skew is typical of a young, rapidly growing field with no well established research groups (Price, 1963).

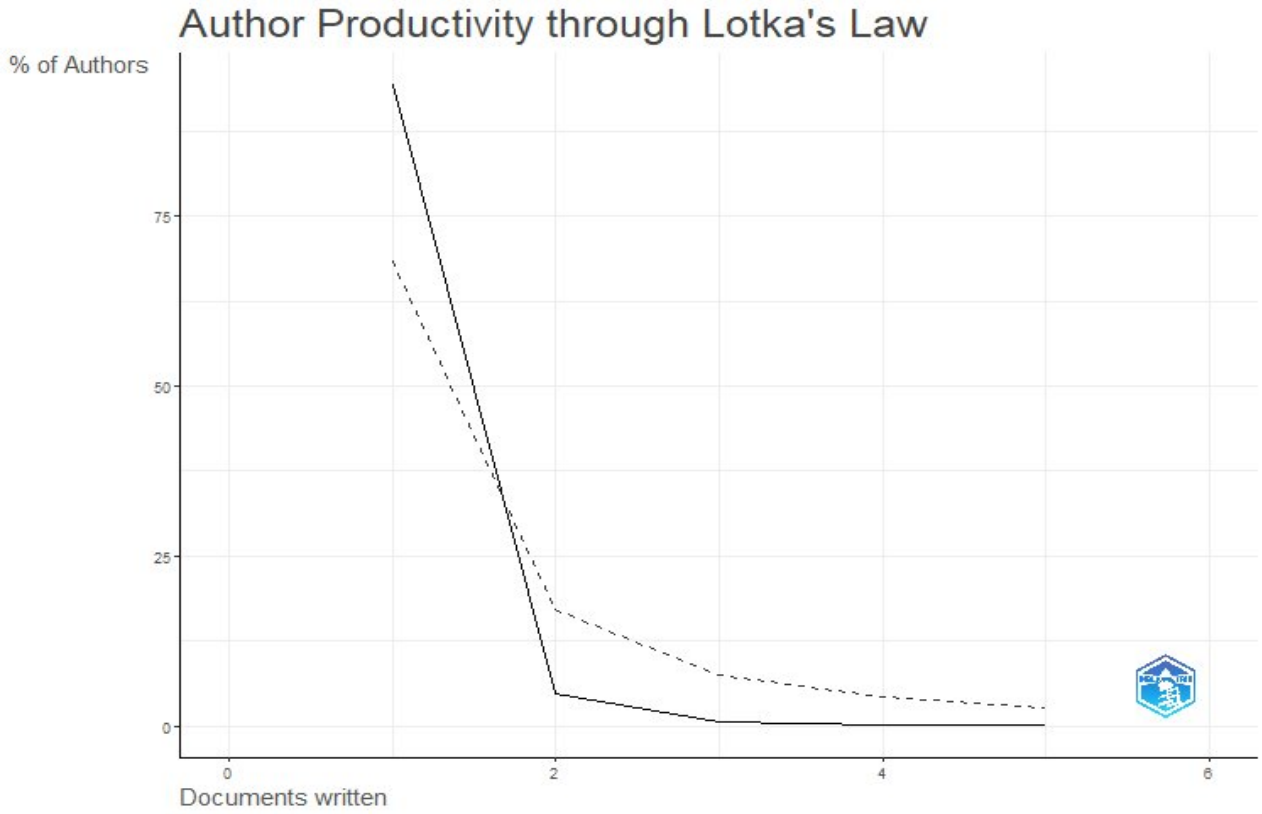

Figure 3. Author productivity: observed distribution versus theoretical Lotka prediction

Source: *Compiled and computed data; Courtesy: RStudio*

The 15 most influential authors are ranked in table 3 according to their h-index. Hoteit M. (h = 4; 62 citations over five articles from 2021) is both the most prolific and the most cited recent contributor, and anchors a

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Lebanon-based programme on supplement KAP across Middle Eastern populations. A clear separation between productivity and impact is found in the table, Caneva G. and Sujarwo W., who have two articles each, have the highest number of citations (105 each) and have a single foundational study on ethnobotany from 2014. The pattern shows that the intellectual asset of the field is disseminated in a few highly cited pre-pandemic publications.

Table 3. Fifteen most influential authors by h-index

Sl. No.	Author	h	g	m-index	TC	NP	PY
1	Hoteit M.	4	5	0.667	62	5	2021
2	Mohsen H.	3	3	0.500	57	3	2021
3	Chiba T.	3	3	0.375	48	3	2019
4	Regan E.	3	4	0.375	34	4	2019
5	O'Neill G. J.	3	4	0.375	34	4	2019
6	Hutchings S. C.	3	4	0.375	34	4	2019
7	Caneva G.	2	2	0.154	105	2	2014
8	Sujarwo W.	2	2	0.154	105	2	2014
9	Aschemann-Witzel J.	2	2	0.167	71	2	2015
10	Grunert K. G.	2	2	0.167	71	2	2015
11	Bian J.	2	2	0.250	60	2	2019
12	Al-Jawaldeh A.	2	2	0.333	44	2	2021
13	Karbownik M. S.	2	2	0.250	47	2	2019
14	Al-Daghri N. M.	2	2	0.222	27	2	2018
15	Blebil A.	2	2	0.667	10	2	2024

Notes: TC = Total citations; NP = Number of publications; PY = Publication Year
Sources: *Compiled and computed data; Courtesy: RStudio*

These authors also have a message to tell. The most-cited authors Caneva, Sujarwo, Aschemann-Witzel, and Grunert published their influential works in 2014-2015, while the most prolific recent authors Hoteit, Mohsen, and Al-Jawaldeh came from 2021 onwards coinciding with the pandemic's research priorities. This is a form of overhanging or stacking of a younger, more prolific population that surfaces over an older, more cited population, which represents an admixture of expansion and continuity of the field as a whole. It also marks a new trend towards Middle East-based intellectual leadership, with its focus on the region's populations increasingly moving the empirical focus of the field.

Multiauthor articles are the norm: 96.2% of articles are authored by more than one author. The most resilient teams come from Lebanon (Hoteit, Mohsen, Al-Jawaldeh) and Ireland (Regan, O'Neill, Hutchings) and are focused on the perception of ONS in older individuals. The geographic findings below address RQ2.

3.4 Country Contributions and Geographic Shift

A distinct geographic reordering can be seen in Table 4 and Figure 4. On absolute numbers, the United States still has the highest share for absolute output (27 articles), but it decreased from 20.6% of pre-pandemic articles to 8.1% post-pandemic. Saudi Arabia (6 to 12 articles), Malaysia (2 to 12), Turkey (0 to 10) and Lebanon (1 to 7) all grew significantly, shifting the field's centre of gravity into the Middle East and Southeast Asia.

Table 4. Ten leading countries by corresponding-author output

Country	Articles	Share %	Pre-COVID	Post-COVID	MCP %
United States	27	11.49	13	14	14.8
Saudi Arabia	18	7.66	6	12	44.4
Malaysia	14	5.96	2	12	28.6
China	12	5.11	1	11	8.3
Poland	10	4.26	4	6	20.0
Turkey	10	4.26	0	10	0.0
Ireland	8	3.40	1	7	62.5
Italy	8	3.40	2	6	12.5
Lebanon	8	3.40	1	7	37.5
Thailand	8	3.40	0	8	12.5

Note. MCP = multiple-country publications
Source: *Compiled and computed data; Courtesy: RStudio*

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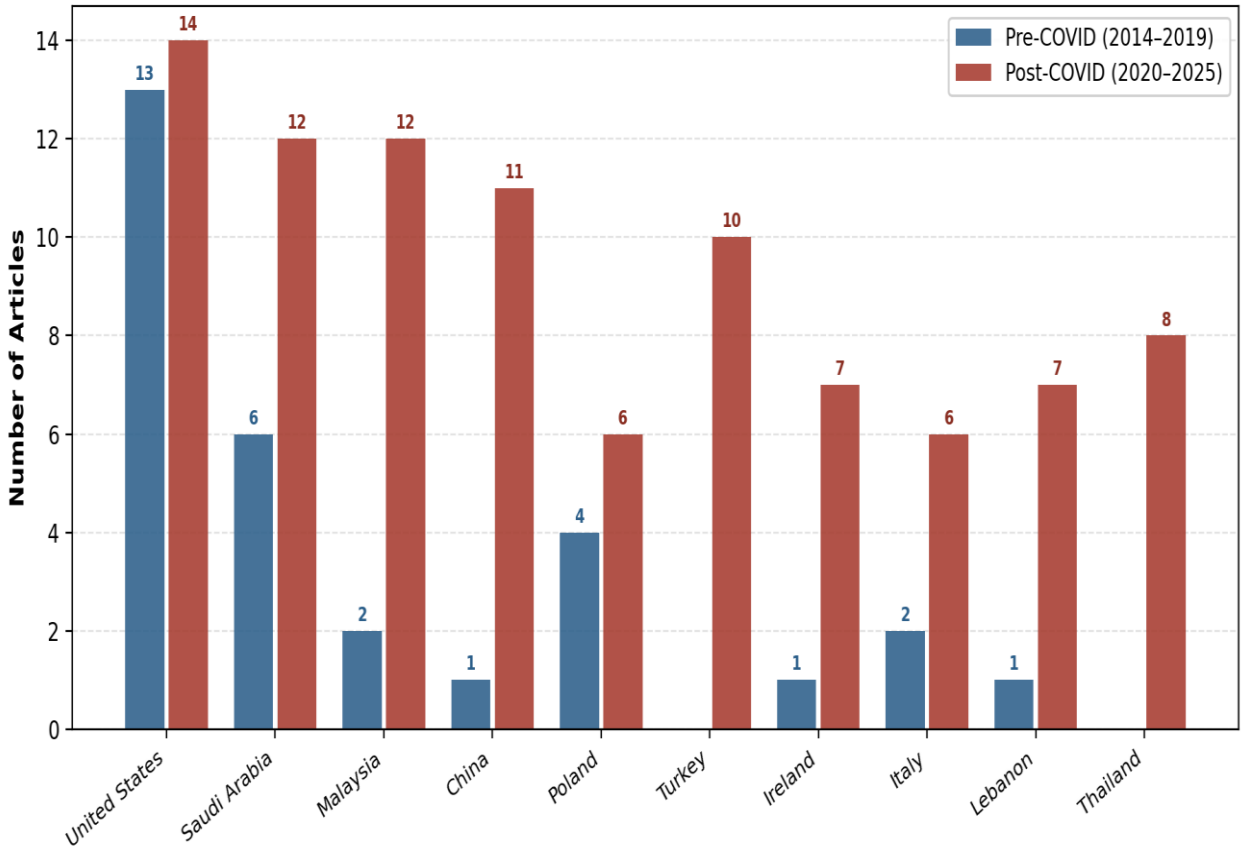

Figure 4. Country scientific production, pre- versus post-COVID-19 (top ten countries)

Source: *Compiled and computed data; Courtesy: RStudio*

The rates of multiple-country publication (MCP) rates provide additional insight into collaboration. Ireland (62.5%) and Saudi Arabia (44.4%) are the most internationally oriented, while Turkey and India remain almost entirely domestic. The increased salience of cultural and religious norms and values, which supports the permissibility of products — in this case, the halal certification — in Muslim-majority countries (Hoteit et al., 2022) — is mirrored in an overall shift of the production of global health research toward Muslim-majority countries (Adams, 2013).

These shifts carry into the substance of the work. The ascendant Middle Eastern and Southeast Asian literature is built largely on cross-sectional KAP surveys of national and sub-national populations, reflecting both the policy relevance of supplement regulation in fast-developing health systems and the ready availability of student and clinic samples. The steadier Western contribution holds a larger share of consumer-behaviour and sensory-science work. Redistributing output therefore redistributes methodological and thematic emphasis, shaping the kinds of questions the field is collectively equipped to answer. The persistence of mostly domestic collaboration in several high-output countries also points to untapped scope for cross-national comparison — a theme the future-research agenda returns to.

3.5 Keyword Co-occurrence and Thematic Clusters

Keyword co-occurrence networks were built for each sub-period to follow the field's conceptual development. The pre-COVID network (Figure 5a) has 30 nodes in five clusters, dominated by descriptive terms — "dietary supplements," "knowledge," "attitude," and "survey" — alongside a distinct sports-nutrition cluster ("nutritional supplements," "athletes," "sport," "doping") and a peripheral ethnobotany cluster. The post-COVID network (Figure 5b) grows to 49 nodes in seven clusters: "covid-19" appears as a substantial node, and entirely new clusters form around health literacy, purchase intention, malnutrition, and oral nutritional supplements.

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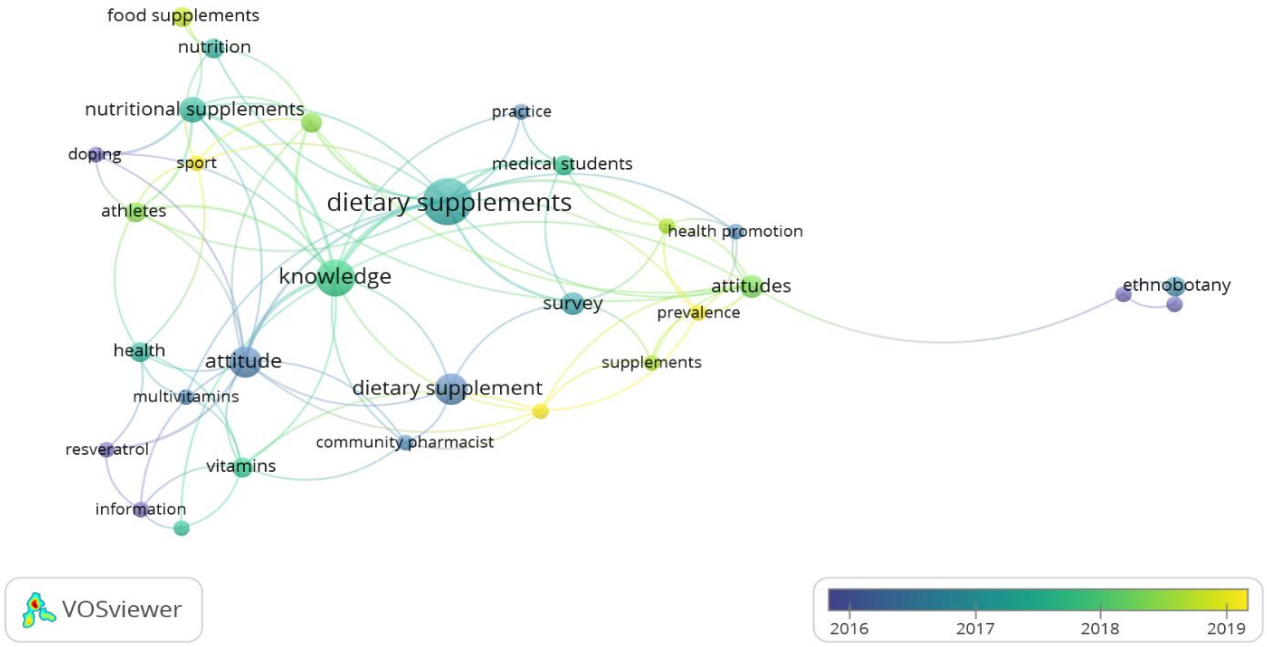

Figure 5a. Keyword co-occurrence network, pre-COVID-19 (2014–2019)

Source: *Compiled and computed data; Courtesy: VOSviewer*

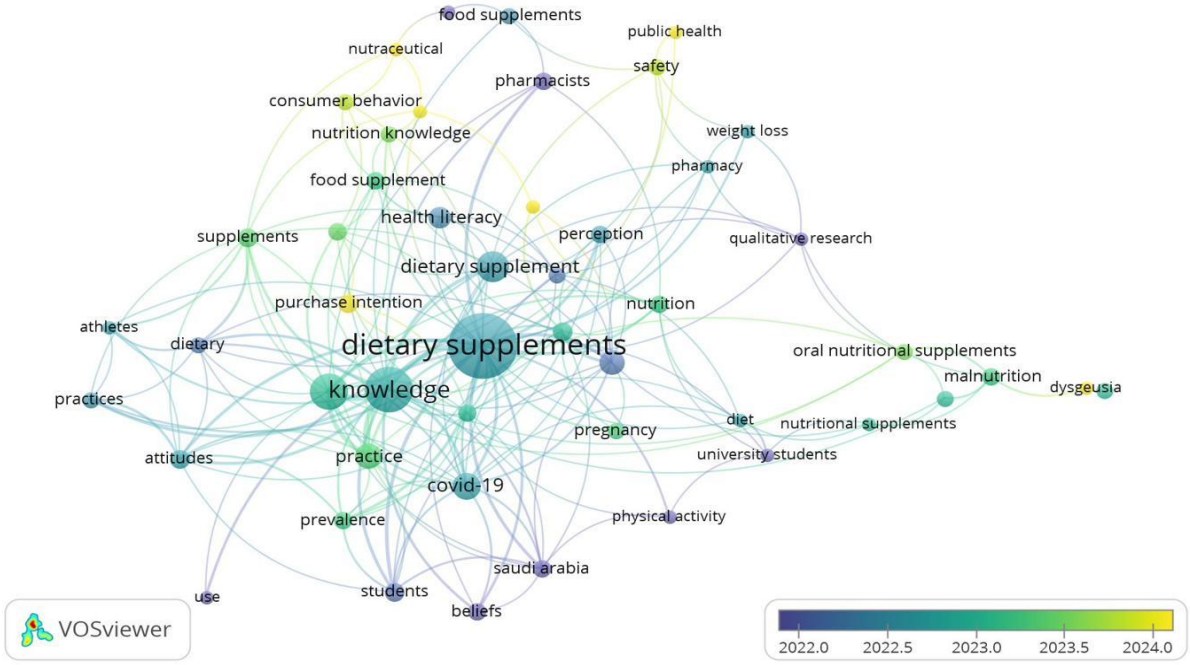

Figure 5b. Keyword co-occurrence network, post-COVID-19 (2020–2025)

Source: *Compiled and computed data; Courtesy: VOSviewer*

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The change in content is as telling as the change in size. In the pre-pandemic network the leading clusters revolve around measurement and description — surveys of knowledge and attitudes, the profiling of medical and pharmacy students as convenient samples, and the documentation of supplement use among athletes. The ethnobotany cluster, though small, marks an early anthropological interest in traditional supplementation that later receded. The post-pandemic network reveals a shift toward consumer agency and decision making as indicated by a separate health-literacy, purchase-intention, and awareness cluster, and a separate malnutrition and oral-nutritional-supplements cluster raises clinical concerns and geriatric issues. As a structurally central node, "covid-19" is connected to beliefs, prevalence, and students and the pandemic's footprint is embedded in the conceptual fabric of the field.

The whole-period overlay (Figure 6) demonstrates a clear temporal gradient, with ethnobotanical and vitamin related terms in the earliest average years around 2016-2017, and "health literacy", "purchase intention", "awareness" and "covid-19" in 2022-2023. Network density roughly doubled between the periods, from 86 links to 191, so the field became not only larger but more tightly interconnected — directly addressing RQ3.

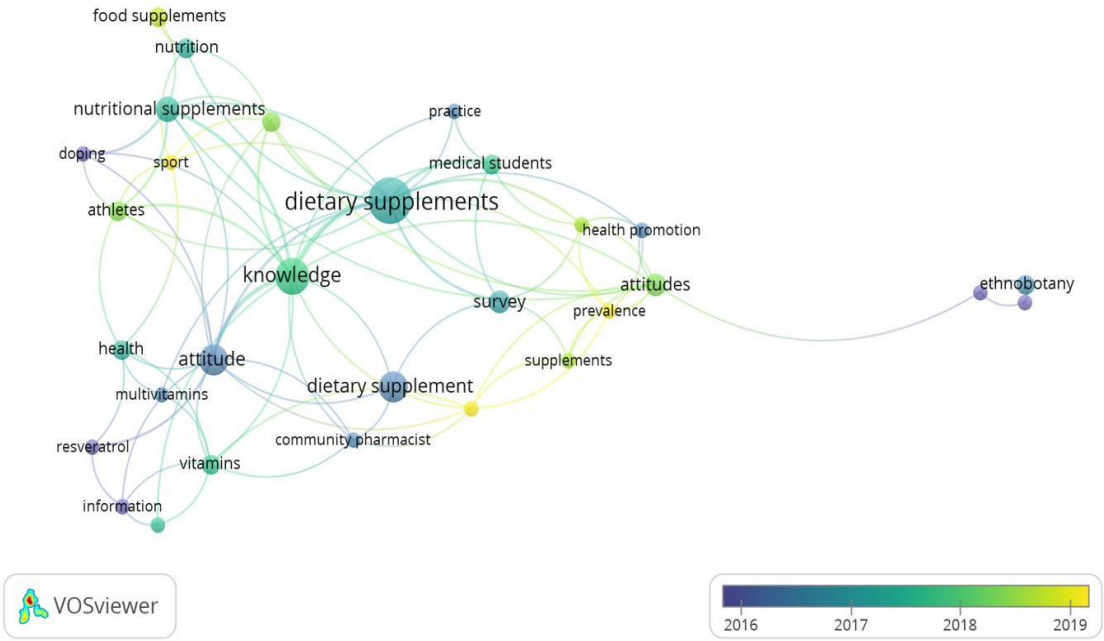

Figure 6. Keyword co-occurrence overlay for the whole corpus (2014–2025)

Source: *Compiled and computed data; Courtesy: VOSviewer*

3.6 Bibliographic Coupling and Intellectual Structure

Bibliographic coupling, which connects documents that share references, exposes the field's intellectual base. The pre-COVID coupling network (Figure 7a) resolves into six clusters along disciplinary lines — pharmacist-mediated counselling (Alhomoud, 2016; Dickinson, 2014), Middle Eastern KAP (Axon, 2017; El Khoury, 2016), consumer marketing (Royne, 2014; Willis, 2016), and European food-marketing research (Aschemann-Witzel, 2015). The post-COVID network (Figure 7b) expands to nine clusters with much denser linkage, including a prominent bridging cluster (Tariq, 2020; Chiba, 2020; Stanojević-Ristić, 2022) that joins educational-intervention and pandemic-attitude research, plus newly distinct clusters in sports nutrition (Finamore, 2022; Wardenaar, 2024) and East Asian consumer behaviour (Sun, 2023; Yang, 2025).

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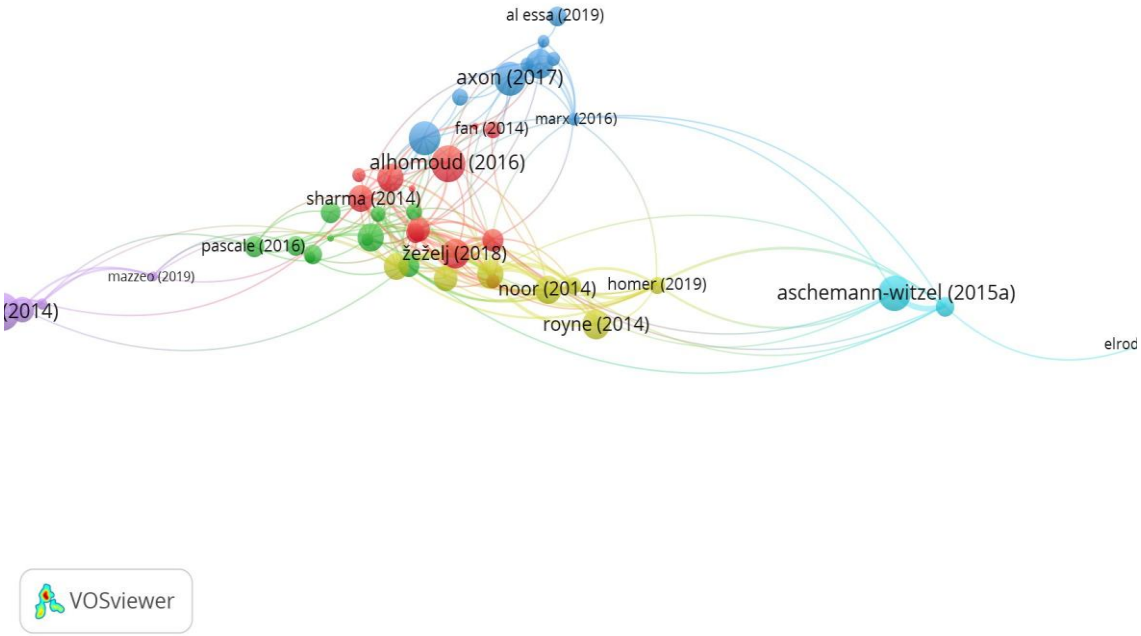

Figure 7a. Bibliographic coupling network, pre-COVID-19 (2014–2019)
Source: *Compiled and computed data; Courtesy: VOSviewer*

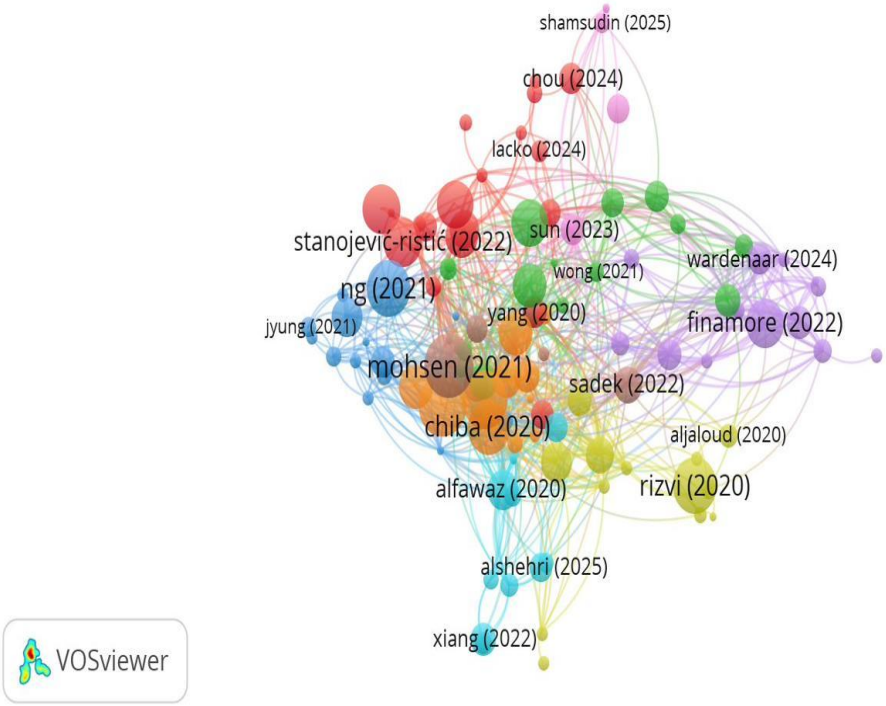

Figure 7b. Bibliographic coupling network, post-COVID-19 (2020–2025)
Source: *Compiled and computed data; Courtesy: VOSviewer*

The two networks differ in shape, not just size. The pre-pandemic network is comparatively sparse and modular — distinct clusters with little citation crossing between them — describing a field in which disciplinary communities pursued parallel agendas with limited exchange. The post-pandemic network is more clustered and more densely connected within clusters, indicating that the pandemic experience provided a common citational anchor to previously separate communities. It is significant that educational-intervention studies are

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so prominent in the bridging cluster: the urgency to enhance the literacy of supplements in a health crisis appears to have brought together two otherwise separate traditions.

The whole-corpus coupling map (Figure 8) brings both periods together and shows that the densest cluster straddles the pandemic divide, anchored by Žeželj (2018), Alhomoud (2016), and Mohsen (2021). This continuity matters theoretically: rather than displacing earlier scholarship, post-pandemic research extended it, so the field grew thematically on a stable intellectual base — an important qualification to RQ3.

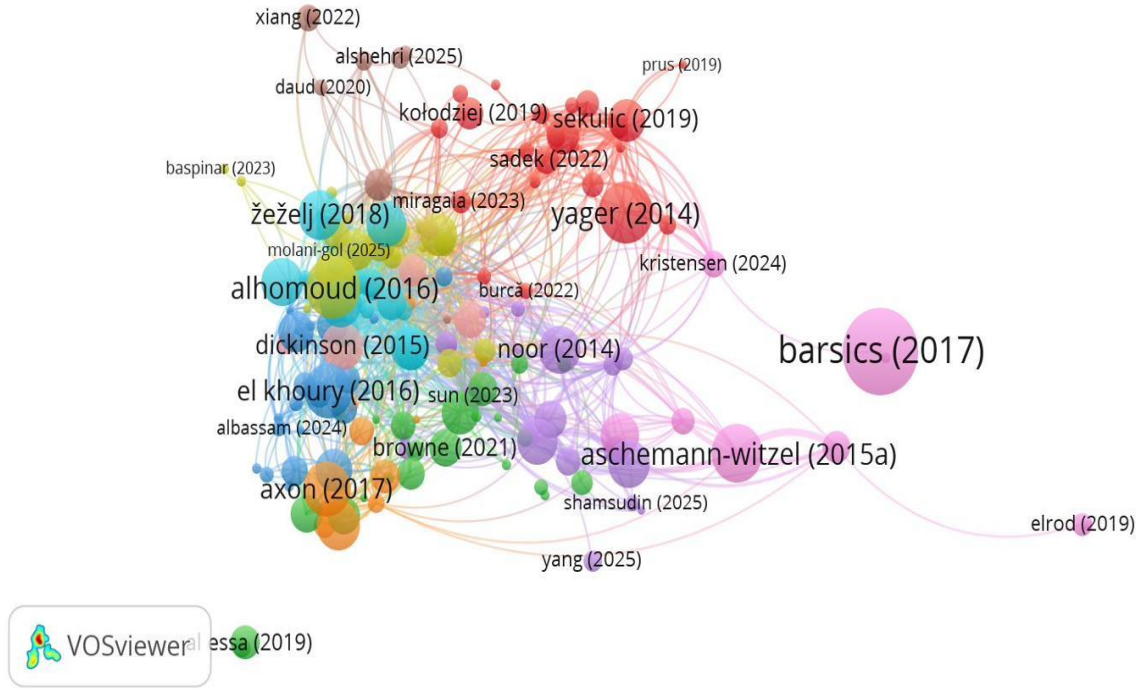

Figure 8. Bibliographic coupling network for the whole corpus (2014–2025)

Source: *Compiled and computed data; Courtesy: VOSviewer*

The central positions in each network tell a parallel story. In the pre-pandemic structure, the heavily cited 2014–2017 studies on consumer attitudes and pharmacist-mediated counseling sit at the core; in the post-pandemic structure, that place is taken by 2020–2022 studies on pandemic-era knowledge and attitudes. As the core moved across the divide, the network reorganised around the newer work — yet the earlier studies stayed linked in rather than stranded as isolated nodes, a sign of their continuing influence.

3.7 Thematic Map and Trend Topics

The thematic map (Figure 9) places themes on axes of centrality (relevance) and density (development). The motor themes — "human," "dietary supplements," and "attitude" — are located at the high-centrality, high-density quadrant and constitute the developed core. Themes of low density, but high centrality, such as "knowledge" and "prevalence" form a cross-cutting foundation. The specialised clinical cluster of "oral nutritional supplements" and "malnutrition" is located in the niche quadrant (high density, low centrality), while emerging themes are grouped in the low density, low centrality quadrant, namely "purchase intention" and "health consciousness" and "awareness".

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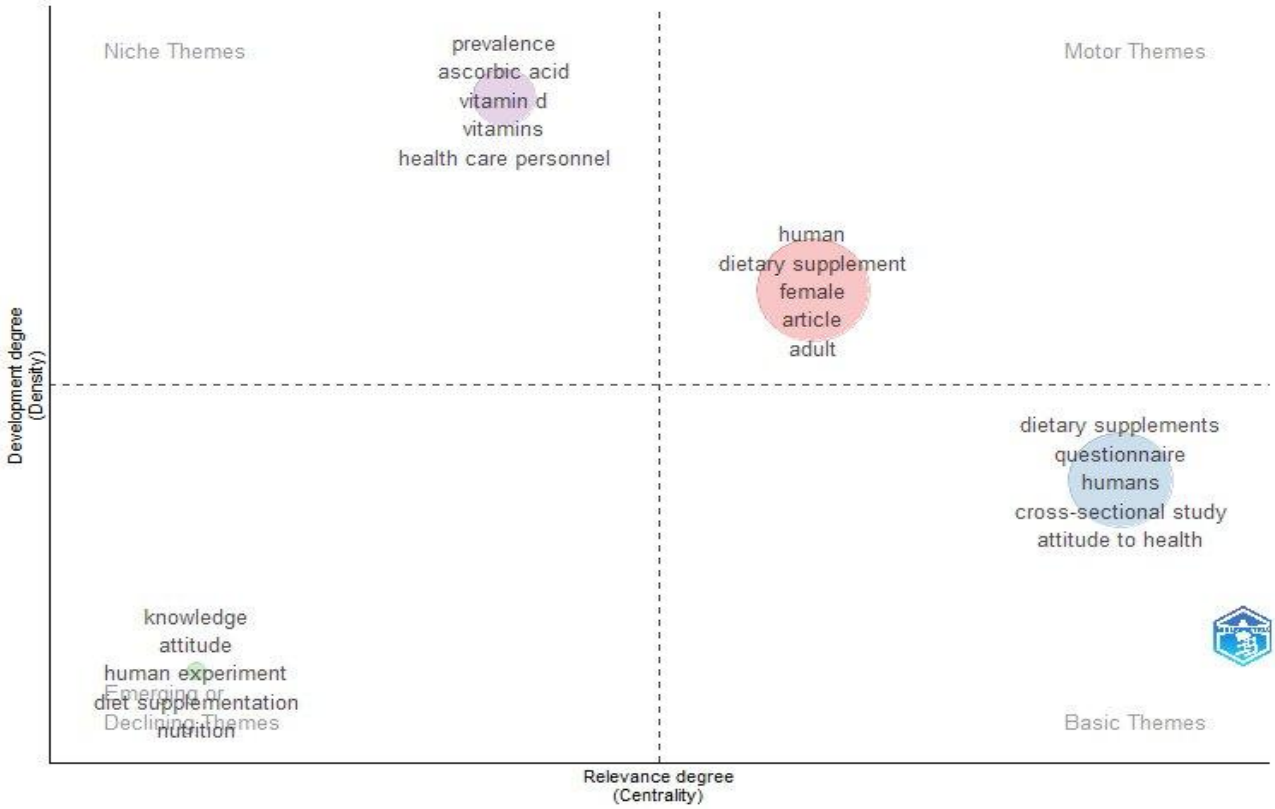

Figure 9. Thematic map of the whole corpus (2014–2025)

Source: *Compiled and computed data; Courtesy: R Studio*

Over time, trend-topic analysis (Figure 10) tells the same story. Early terms like "diet supplementation" and "health behaviour" are followed by "attitude to health" and "practice" around 2021, then the new frontier of the field: "awareness" (2023), "aged" and "athletes" (2024), and "purchase intention" and "vitamin B complex" (2025). The trend towards consumer-behaviour- and population-specific terms is the new research frontier and is connected to RQ4.

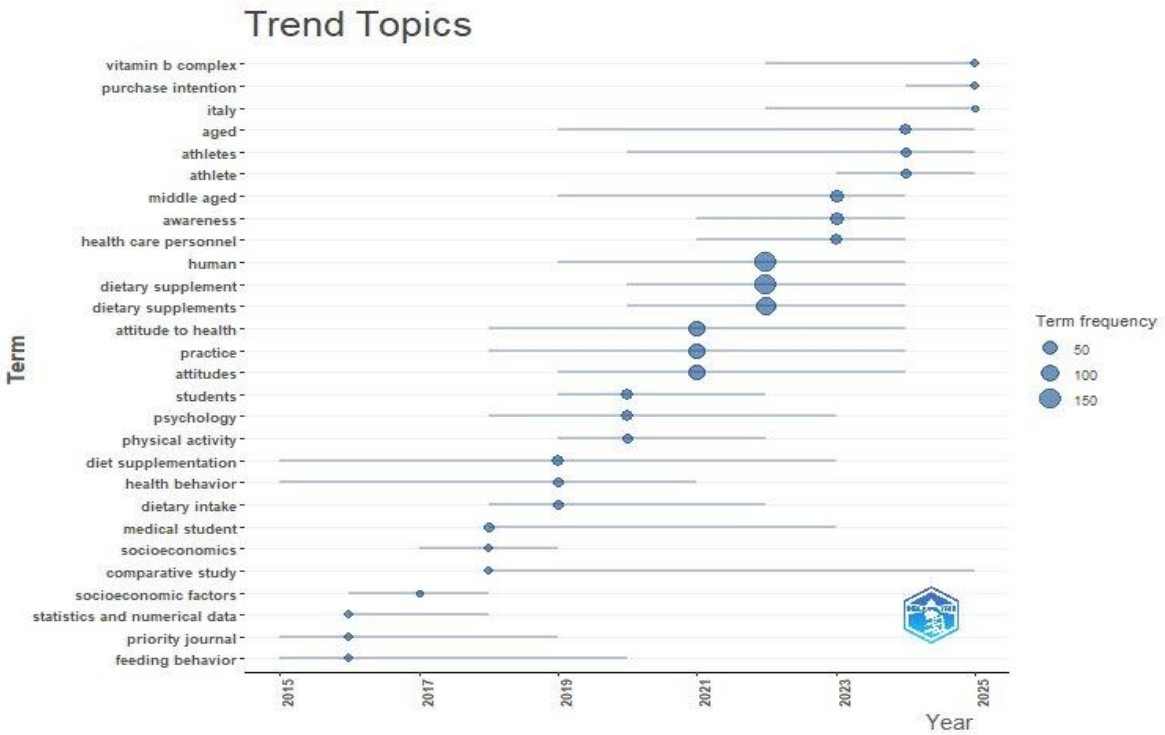

Figure 10. Trend topics across the study period

Source: *Compiled and computed data; Courtesy: R Studio*

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When read together, the thematic map and the trend timeline provide an understandable description of the evolution of the field. The themes that supported the pre-pandemic literature (general descriptions of supplement knowledge and attitudes) have become the firmly entrenched motor and basic quadrants. Meanwhile, a more recent group of themes centered on consumer agency, clinical application and population specificity have ascended from the new quadrant on the heels of the post-pandemic momentum, marking up from emerging themes. The study's main discovery, a field growing outward from a solid center, is captured in this double movement — old themes consolidating, new ones emerging — in one frame.

4. Discussion and Major Findings

4.1 A Structural Surge in Research Volume (RQ1)

The evidence demonstrates that COVID-19 is creating a structural, not incremental, increase in the field. The growth rate increased by almost double, and the output increased by 173%, figures comparable to those of neighbouring fields (Di Renzo et al., 2020); the extended period of high citation impact for pre-pandemic works suggests an asymmetry, a volume and influence built on different time scales. The two peaks after the pandemic refer to two research logics: an urgent one, oriented to immunity, followed by a more contemplative, consumer and clinically oriented one.

Volume vs. influence is also a method warning. If bibliometric analysis is only based on the number of citations, then recent publications will be undervalued, particularly in very active research areas in which the most influential publications have not yet been cited. Triangulating production, citation and network indicators, as suggested here, helps to maintain the field's emerging directions while citation evidence is at a fledgling stage. In the context of bibliometric practice in nutrition and public health, the lesson is that designs ought to be multi-indicator in nature to be interpreted in time-sensitive fashion for domains that have been transformed by acute shocks.

4.2 Reconfiguration of the Geographic and Collaborative Landscape (RQ2)

Geographic is the most impressive change in structure. The relative decline of the United States and the rise of Saudi Arabia, Malaysia, Turkey, and Lebanon signifies real globalisation of the field. This shift is not only quantitative; Middle Eastern and Southeast Asian scholarship introduces culturally specific issues; namely, religious permissibility, traditional native medicine, population-specific KAP, which were not as much on the forefront of the previous literature with a western orientation. Altogether, the Lotka distribution and the high collaboration index indicate that the field is expanding its number of contributors at a quick rate, but it isn't developing enduring groups with only a few teams, the Lebanon and Irish set above all, maintaining programmatic output.

This change is underpinned by a unique way of working together. Multi-authorship is nearly universal, and single-publication authors describe a field in which collaboration often takes place in short-lived project teams and not long-term consortia. The exceptions are illustrative: the Lebanese and Irish clusters reveal the impact that long-term collaboration can have, setting up coherent research lines that produce output and citations. More of these long-lasting, ideally cross-national structures will be necessary to mature the field, while the existing fragmentary structures facilitate topical diversification, but curtail the cumulative depth of more established disciplines. The regional concentration of collaboration, however, with limited interaction between the Middle East, Southeast Asia and the West, is an area that is both underrepresented in the current literature, and a space in which integration can be achieved.

In response to a shift in leadership towards regions where there is rapid growth in supplement markets, the field's priorities have broadened to include culturally specific drivers of supplement use that previous scholarship on the topic largely ignored, following the thematic consequence.

4.3 Thematic Expansion on a Stable Foundation (RQ3)

The common theme from keyword co-occurrence, bibliographic coupling and thematic mapping is the same: thematising intellectual continuity. Pre-pandemic research was organised around descriptive KAP surveys, sports nutrition; a new cluster of pandemic-specific supplementation, health literacy, purchase intention, and clinical nutrition were introduced, and in some cases amplified, during the pandemic; the coupling structure of the research shows that this was not an override of the pre-pandemic research, but rather an addition to it. There was no shift in paradigm, no transformation of the language, but rather a rapid normal-science elaboration of the field, as defined by Kuhn (1962): a field whose vocabulary became more diverse and more thickened, but whose fundamentals remained.

The case is more than just a cautionary tale about crisis-driven growth because external shocks need not bring paradigmatic rupture. They can alternatively accelerate the elaboration and integration of an existing knowledge

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base, expanding the thematic perimeter without changing its contents. It was more of a catalyst than a revolution, as the pandemic took a few years to diversify what could've taken 10. The distinction is important because it helps to predict the future – the new clusters of consumer-behavioural and clinical are likely to continue and develop, even if pandemic-specific terms fall out of use.

It alludes to the conceptual stability of a field that could survive such a jolt by simply adding new items to the existing core, such as immunity, health literacy and consumer-decision constructs without breaking the backbone of the KAP survey. What really makes this a discovery, rather than an assertion, is the coupling evidence that connects the work in the pre-pandemic period with the work in the pandemic era in the densest cross-period cluster. An absorptive core in this manner is well suited for whatever health and policy shifts lie ahead.

4.4 Knowledge Gaps and Research Frontiers (RQ4)

There are some key areas of concern. First, public health implications of pandemic-induced supplement behaviour are of clear interest, yet the long-term persistence of this behaviour has yet to be studied. Second, the consumer-economic side — purchase intention, health consciousness, label literacy, e-commerce — remains underdeveloped even though the trend analysis identifies it as the field's leading edge. Third, high-risk populations (older adults, children, and people with chronic disease) are markedly underrepresented next to the dominant focus on students and general adults. Fourth, the field leans heavily on cross-sectional surveys — "cross-sectional study" is among the most frequent index terms — which constrains causal inference and calls for longitudinal and mixed-methods designs.

The four gaps add up to a field broad in description but comparatively thin in explanation and prediction. The dominance of cross-sectional KAP designs has produced a large catalogue of what populations know, believe, and report doing with supplements, but limited insight into the causal mechanisms linking awareness to behaviour, the stability of those links over time, or the moderating force of cultural, economic, and digital context. Closing these gaps will take not only methodological diversification but deeper engagement with the consumer-behaviour and health-psychology frameworks that the bibliometric evidence shows to be only thinly represented so far.

5. Potential Avenues for Future Research

Building on these gaps, Table 5 sets out a five-part research agenda, each theme paired with illustrative questions and candidate keywords.

Table 5. Proposed future research agenda for nutritional supplement awareness research

Future research theme	Illustrative research questions	Candidate keywords
Persistence of pandemic-driven supplement behaviour	(1) Have COVID-19-induced supplement behaviours persisted, attenuated, or reversed in the post-acute phase? (2) What psychological and social mechanisms mediate the move from pandemic-motivated to habitual use? (3) How do online misinformation and social-media exposure moderate post-pandemic awareness?	"COVID-19"; "dietary supplements"; "health behaviour change"; "misinformation"; "social media"
Consumer decision-making and purchase intention	(1) Which cognitive and affective antecedents drive supplement purchase intention among post-pandemic consumers? (2) How do health consciousness and nutrition literacy jointly moderate purchasing behaviour? (3) What roles do clean-label claims, price sensitivity, and sustainability perceptions play?	"purchase intention"; "health consciousness"; "consumer behaviour"; "nutrition literacy"; "e-commerce"
Underexplored populations	(1) What are the awareness and KAP profiles of older adults regarding supplement–drug interactions? (2) How do caregivers shape paediatric supplement use? (3) What supplement-awareness gaps exist among patients with non-communicable diseases?	"older adults"; "paediatric"; "caregiver"; "chronic disease"; "drug interaction"; "polypharmacy"
Digital and AI-assisted supplement awareness	(1) How do digital-health platforms and mobile applications shape supplement knowledge and decisions? (2) Can AI-driven recommendation systems improve	"digital health"; "mHealth"; "artificial intelligence";

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	supplement-safety awareness? (3) What is the influence of influencer marketing on Generation-Z adoption?	"influencer marketing"; "Generation Z"
Methodological advancement	(1) How do supplement attitudes evolve longitudinally across pandemic and post-pandemic cycles? (2) Can mixed-methods designs capture the nuance of supplement belief systems? (3) What cross-cultural frameworks generalise findings across the now-dominant Middle Eastern, Asian, and Western contexts?	"longitudinal study"; "mixed methods"; "cross-cultural"; "supplement beliefs"; "causal inference"

Source: *Authors' creation; Courtesy: Praharaj and Chhatoi (2025)*

Each theme answers a gap from the analysis. The first addresses the temporal blind spot left by predominantly cross-sectional, pandemic-contemporaneous studies; only longitudinal follow-up can show whether raised awareness and use have lasted. The second operationalises the consumer-behaviour frontier flagged in the trend and thematic analyses, where purchase intention and health consciousness are nascent but rising fast. The third confronts the demographic narrowness of a corpus built on student and general-adult samples, turning attention to the populations — older adults, children, the chronically ill — for whom supplement risks are most acute. The fourth takes up the conspicuous absence of digital-health and artificial-intelligence terms from the keyword networks, despite the central place of online information in today's supplement decisions. The fifth targets the methodological monoculture of cross-sectional surveys, pressing for designs that can support causal and cross-cultural inference.

Pursuing this agenda would tackle the field's main limitations — its descriptive bent, methodological sameness, and demographic narrowness — while building on its emerging strengths in consumer behaviour and digital health. Cross-cultural, longitudinal, and theory-driven studies are especially needed to convert the field's descriptive breadth into explanatory and predictive depth.

6. Concluding Remarks

The intellectual landscape of nutritional supplement awareness research was mapped in this study by analyzing 235 articles published between 2014 and 2025 in the Scopus database, through analysis of pre- and post-COVID-19 trajectories using the software tools Biblioshiny and VOSviewer. The pandemic stands out as a clear turning point: output rose by 173%, the contributor base globalised toward the Middle East and Southeast Asia, and the thematic structure broadened from descriptive KAP surveys to health literacy, purchase intention, clinical nutrition, and pandemic-specific supplementation — all while keeping a continuous intellectual foundation in pre-pandemic scholarship. These findings answer the four research questions and provide the first integrative map of a field previously studied only in fragments.

The contributions are threefold. Theoretically, the study offers a temporally disaggregated, multi-method demonstration that crisis-driven surges can widen a field's thematic scope without dislodging its intellectual foundations. Methodologically, it shows the value of combining performance analysis with several science-mapping techniques — keyword co-occurrence, bibliographic coupling, and thematic mapping — to triangulate evidence about a field's structure and change. Empirically, it furnishes a baseline against which the post-pandemic development of the field can be tracked.

6.1 Practical Implications

The findings carry practical weight for several groups. Public-health authorities should recognise that pandemic-era uptake was driven by awareness and attitude shifts whose durability is unverified, which argues for targeted, evidence-based communication — particularly in the now-prominent Middle Eastern and Southeast Asian markets. Healthcare professionals, especially pharmacists and dietitians, need updated KAP frameworks that cover immune-oriented supplementation and supplement–drug interactions. Industry and marketing practitioners should attend to the consumer-behaviour frontier, designing health-literacy-oriented communication that connects awareness with informed purchasing among underserved groups. Research funders and journal editors, finally, can prioritise longitudinal, mixed-methods, and cross-cultural studies and support the integration of digital-health and consumer-behaviour theory into a field that has so far been mostly descriptive.

The analysis suggests context-sensitive regulation and policy-making for regulators and policy makers. Recent research focuses on areas characterized by a rapidly expanding supplement market where regulatory frameworks might still be developing, indicating a critical need for evidence-based regulation, including clear labelling standards, readily available consumer education, and monitoring of social media and online promotion. The documented disconnect between awareness and the use of evidence also suggests that

information alone is not enough; interventions based in behavioural science, which take into account the cognitive and social determinants of supplement use, have a better chance of sustaining these changes. Research that meets these needs would increase the societal significance of a field that in this study is demonstrated to have expanded rapidly in size and scope and yet has significant potential to contribute to greater understanding and translation.

6.2 Limitations

These conclusions are subject to the following limitations. Using only one database, Scopus, will not account for articles that are only indexed in another repository (e.g. PubMed or Web of Science), but the worry is mitigated somewhat by this breadth. The title-field search is exact but it might miss studies that report on awareness of supplements but do not include it in the title. The restriction to English-language articles is a potential language bias and the 2025 cut-off date will bias the most recent publications. Lastly, bibliometric techniques provide with structural patterns, but they are unable to evaluate the quality or validity of a single study. The evidence base presented here could be reinforced by future work involving multi-database retrieval, a wider search approach, and normalisation of citations.

In summary, COVID-19 not only contributed to the scope and scale of nutritional supplement awareness research, but it also shaped the geography, expanded the contributors to the research, and expanded the themes of the research while maintaining the continuity that is present between the current research and its pre-pandemic roots. The study provides a visualisation of these dynamics through systematic science mapping, providing a snapshot of the past and a sense of the possible future direction of the field. Ongoing research, drawing on a now-dispersed geography of the discipline, but using methodological rigour and theoretical sophistication, will be key to meeting the challenge of linking public awareness of supplements with safe, informed and equitable supplement use.

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