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Review

Milk, Cheese, and Fatty Acid Characterization in Latin America: A Bibliometric Analysis of Trends, Methodological Gaps, and Emerging Analytical Approaches (2010–2025)

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Abstract

Milk and cheese research in Latin America includes nutritional composition, processing, and fatty acids (FAs) characterization, but a well-founded structure and the analytical tools employed have not been mapped. This bibliometric review gathers the structure, thematic evolution, collaboration networks, and analytical capacity of research on milk, cheese, and FA characterization in the region. Scopus records (2010–2025) with at least one of the authors affiliated with a Latin American institution were screened following PRISMA 2020, yielding 651 documents, analyzed with Bibliometrix (v4.3.3) and VOSviewer (v1.6.20). Brazil contributed 66% of the output, and 20.43% of the documents involved international co-authorship, mainly with Spain and the United States. Cheese, whey, and lactic acid bacteria were prominent topics, while gas chromatography and conjugated linoleic acid were the main analytical and FA terms; terms linked to high-resolution techniques and chemometrics were rare or recent. These patterns suggest a consolidated thematic base, with opportunities to integrate advanced analytical and multivariate approaches and to strengthen interinstitutional collaboration.

Keywords: dairy lipids; bibliometrics; conjugated linoleic acid; chemometrics; Latin America; gas chromatography

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1. Introduction

Milk is one of the most widely consumed foods worldwide and is recognized for its high nutritional value due to its content of proteins, fats, carbohydrates, vitamins, and minerals [1]. Among the lipid components of milk, fatty acids play a fundamental role in human health, not only because of their energy function but also due to their effects on metabolism, cognitive development, and the prevention of chronic and cardiovascular diseases [2]. The two essential fatty acids—linoleic acid (C18:2, n-6) and alpha-linolenic acid (C18:3, n-3)—cannot be synthesized de novo by humans and must be obtained from the diet; their long-chain derivatives, including eicosapentaenoic acid (EPA, C20:5, n-3)

and docosahexaenoic acid (DHA, C22:6, n-3), are critical for neurological development and inflammatory regulation. Non-essential but physiologically important monounsaturated fatty acids, such as oleic acid (C18:1, n-9), are also relevant components of the dairy lipid matrix [3]. The composition and profile of fatty acids in milk can vary significantly depending on factors such as animal diet, genetics, production processes, and the handling and processing of dairy products [4].

Beyond their nutritional value, fatty acids (FAs) play a pivotal role in the sensory quality and consumer acceptance of dairy products. In products like artisanal Latin American cheeses, FAs serve as primary precursors of volatile aromatic compounds (such as esters), ketones, and aldehydes formed through lipolysis. These compounds define the characteristic flavor profile that drives consumer choice and food preference in the region. Therefore, mapping the current state of FAs characterization is not merely a matter of analytical chemistry, but a fundamental step toward understanding the factors that determine the quality of dairy products and competitiveness in Latin America.

Cheese production, one of the most widely consumed dairy derivatives, represents one of the main uses of milk in the food industry. The cheese-making process involves rigorous stages that transform milk components, resulting in a wide diversity of products with distinct sensory and nutritional characteristics. These characteristics are closely related to the lipid composition of the milk used, particularly the FAs profile [4].

Despite the global relevance of Latin American dairy production, where Brazil, Mexico, and Argentina collectively rank among the world's leading dairy producers, the scientific landscape of FAs characterization in the region remains fragmented and methodologically uneven. In this context, a systemic mapping of the region must be conducted, not only to identify research priorities in Latin America, but also to assess whether existing analytical studies meet the requirements regarding dairy product quality.

Regarding analytical methods, the techniques most commonly used for the characterization of FAs in dairy products include gas chromatography (GC) and high-performance liquid chromatography (HPLC) [5]. Gas chromatography is widely applied due to its high accuracy, resolution, and sensitivity for the quantification of the different FAs present in samples [5,6]. In addition, mass spectrometry (MS) and nuclear magnetic resonance (NMR) spectroscopy are increasingly employed to obtain detailed lipid profiles that enable the identification and quantification of fatty acids under complex conditions [7–9].

In Latin America, research on the nutritional composition of milk and the characterization of FAs in dairy products, particularly cheese, has experienced significant growth over recent decades. Nevertheless, the region faces substantial challenges in terms of research infrastructure facilities, funding, and interinstitutional collaboration, which limit the expansion and further development of these studies. Despite these constraints, researchers have highlighted the importance of FAs characterization in dairy products by using chromatographic techniques that allow more precise and detailed identification of lipid profiles [10,11].

For Latin America, the dairy research marks a pivotal moment, as new opportunities arise from the intersection of resources, advantages production conditions and challenging global trends. Some of the world's major dairy producers are hosted in this region [12]. On the other hand, the production systems developed (tropical and temperate grazing, smallholder systems, and artisanal cheeses with local identity) differ markedly from those implemented in the confined systems of other countries, with diet and production systems being factors recognized for modifying milk FA composition [4,13]. In addition, analytical technologies and grade of funding are not comparable to other world regions, which may shape which techniques are used and which questions are asked.

Bibliometric analysis provides a quantitative and visual framework for the identification of thematic clusters, methodological gaps, and collaboration structures that individual studies cannot reveal [14], by means of the combination of statistical and mathematical methods that analyze the scientific literature. As a result, the identification of patterns, trends, and knowledge structures within specific research domains is possible [14].

Previous bibliometric studies on dairy research have addressed global trends or processing technologies [4,13–18], but none, to our knowledge, has integrated milk composition, cheese production, and FA characterization in Latin America. This study addresses three questions: (1) How has research on milk, cheese, and FA characterization in Latin America evolved and who led it? (2) Which topics, analytical techniques, and FA of interest highlight? (3) Which methodological and collaborative gaps can be identified?

This study was aimed to map research on milk composition, cheese production, and fatty acid characterization in Latin America (2010–2025) from (i) the description of the progressive changes in the production, the geographic distribution, and collaboration network; (ii) the identification of the main thematic clusters and their evolution; and (iii) the detection of the analytical techniques most frequently reported and the methodological gaps in FA characterization, in order to provide a focus for future research and decision-making in dairy and cheese production.

2. Materials and Methods

This study presents a bibliometric analysis of dairy products, specifically milk and cheese, in Latin America, using descriptive statistical methods. The aim is to analyze the current state of research, emerging trends, challenges, and opportunities in this field, to enhance visibility and collaboration, as well as to identify research gaps and priority areas for future studies [19].

A bibliometric approach that combines performance analysis and science mapping was adopted to examine the intellectual, conceptual, and social structure of the field. Performance analysis was conducted in R (v 4.3.3) using the *bibliometrix* package through its web interface, *biblioshiny* [20], to quantify descriptive indicators across the selected corpus, including annual scientific production, author productivity, journal dispersion, country-level output, and citation impact (total citations and average citations per document). Science mapping was then performed to uncover the field's underlying structure. The conceptual structure was explored through co-word analysis, using multiple correspondence analysis and thematic mapping to identify motor, basic, niche, and emerging or declining themes. The intellectual structure was examined through co-citation network analysis, while the social structure was assessed through country collaboration networks. In all network analyses, clusters were identified using community detection algorithms, namely Louvain [21] and Walktrap [22].

Specifically, co-word factorial analysis and thematic mapping were used to delineate emerging and consolidated research fronts, while co-citation network analysis and cross-variable modeling assessed international collaboration dynamics and citation impact performance [23,24].

The bibliometric analysis was conducted following the guidelines proposed by Donthu et al. [25], which provide a framework for performing statistical analysis within a specific domain, and considering the approach presented by Pineda Ospina [26], for analyzing the food sector within the industry. To this end, selected guidelines from the Science Mapping Workflow methodology were adapted [23] and adopted as a reference for the bibliometric analysis. Scopus was used as the primary data source, given its recognition for the high quality of its scientific research documents. Bibliometric analyses were performed using the

Bibliometrix package in R (4.3.3) and VOSviewer (1.6.20), with RStudio (4.3.3) employed for the generation of graphical outputs [20,24].

2.1. Data Collection

The literature search was executed in the Scopus database using a structured, multivariable query that combined Boolean logic, thematic operators, and geographic filters (Table S1). Keywords related to the target food matrices (milk and cheese), chromatographic analytical methods, physicochemical parameters, nutritional composition, and product authenticity, including technological applications and synonyms, were grouped using the disjunctive operator (OR). To isolate relevant studies on fatty acid characterization, the dataset was refined by applying the logical negation operator (NOT) to exclude the literature on human milk, clinical outcomes (e.g., allergies and hypersensitivity), and plant-based substitutes. Furthermore, the search was geographically constrained to publications affiliated with Latin American institutions via the country filter [LIMIT-TO (AFFILCOUNTRY, ...)]. The resulting dataset was subsequently extracted and downloaded for bibliometric and thematic analyses.

Publication with the affiliation of at least one of the authors with a Latin American institution were selected.

The temporal scope of the search was restricted to documents published up to 31 December 2025. Publications from 2026 were excluded to avoid time-truncation bias, ensuring that only complete calendar years were analyzed for accurate trend identification and full data comparability. This temporal boundary ensured data stability during the multi-stage extraction, cleaning, and bibliometric modeling procedures.

2.2. Search for Execution and Document Selection

For the bibliometric analysis, a targeted search approach was applied, carefully examining the titles, abstracts, and keywords of academic articles. Peer review was established as a prerequisite for inclusion, ensuring the academic rigor and relevance of the literature in this field. The search covered a fifteen-year period (2010–2025) that concluded in December 2025.

The initial search identified 1708 articles published between 2010 and 2025. A four-stage screening process was applied: (1) removal of duplicate records: $n = 112$ excluded; (2) removal of records with incomplete metadata fields (title, abstract, author affiliation, or year): $n = 892$ excluded; (3) title and abstract screening for relevance to FAs characterization in dairy products: $n = 53$ excluded; a final corpus of 651 unique documents was achieved. A flow diagram adapted from selected PRISMA methodology parameters is presented in Figure S1. The discrepancy between the total corpus ($n = 651$) and the sum of classified document types ($n = 641$) reflects 10 records categorized as non-standard types by Scopus (errata, editorials, or undefined) that were retained for publication-trend analysis but excluded from type-specific analyses.

3. Results

This section presents the main findings derived from the bibliometric analysis focused on the nutritional composition of milk, cheese production, and fatty acid characterization in Latin America. The study highlights key aspects such as the most influential authors, the most highly cited articles, the most consulted journals, scientific output by country, the conceptual structure of the research domain, institutional affiliations, and the interrelationships within the field. From this, an overview of the current state of the research area and the identification of the trends, challenges, and opportunities for future studies are established.

3.1. Domain Information

This section provides an overview of the analysis of scientific publications related to the topic under study, with a specific focus on Latin America (Figure 1).



Figure 1. General domain information in Latin America. Source: Authors' own elaboration using R.

The documents identified focusing on the nutritional composition of milk, cheese production, and fatty acid characterization in Latin America include scientific articles (609), book chapters (20), conference proceedings (0), review articles (1), short surveys (2), and conference papers (9). Scientific articles predominated, with a total of 609 documents. The sum of classified document types ($609 + 20 + 0 + 1 + 2 + 9 = 641$) differs from the total corpus of 651 documents; the remaining 10 records correspond to document types not assigned to any of the listed categories (e.g., erratum, editorial, or undefined type as classified by Scopus) and were retained in the corpus for publication-trend analysis but excluded from type-specific analyses (see Table S1).

The average number of citations per document is approximately 12.87, suggesting that citation rates are typical of specialized areas within food science, particularly in Latin America. However, the total number of references, 25,270, reflects substantial thematic diversity and strong scientific support across these publications. The 651 documents analyzed after data cleaning contain 3143 keywords Plus and 1834 author-provided keywords. The total number of authors is 3145, reflecting international collaborations as discussed in subsequent sections.

Collaborations in the analyzed articles show an average of 6.02 authors per paper, and the percentage of international co-authorship is 20.43%, indicating frequent international collaboration in this field of research. Independent contributions are also present, with two documents authored by a single researcher.

3.2. Annual Scientific Production in the Domain

Figure 2 illustrates the trend in scientific publications within the studied domain over the period 2010–2025. A sustained flow of publications was recorded throughout this interval. Between 2010 and 2019, annual publications fluctuated between 29 and 41 documents. The year 2020 showed the highest number of publications (78 documents), and although a decline was observed in subsequent years, publication levels remained above pre-2020 values. The lowest annual count was recorded in 2011 (27 documents), suggesting scientific interest in the topic has grown progressively over the fifteen-year period analyzed.

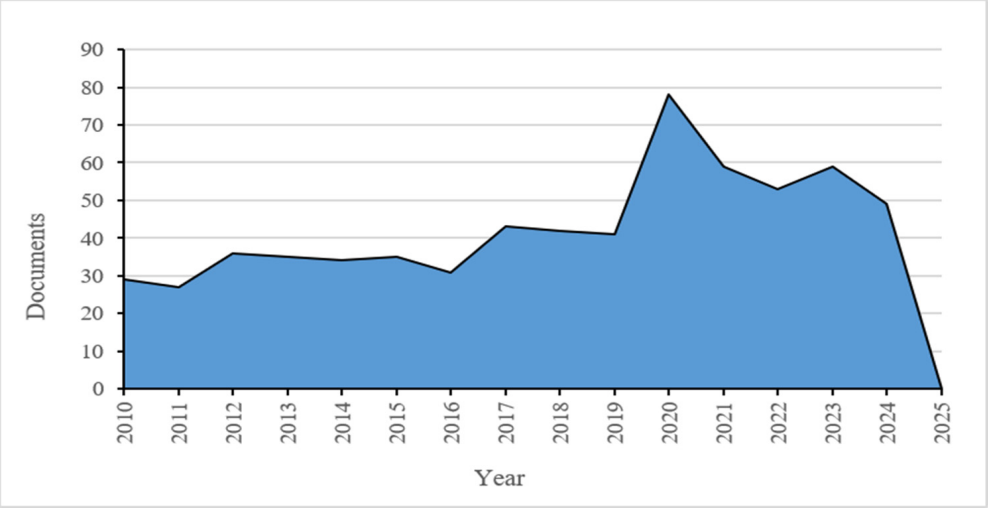


Figure 2. Publications focused on the nutritional composition of milk, cheese production, and fatty acid characterization in Latin America from 2010 to 2025. Source: Authors' own elaboration using R.

3.3. Relevant Sources in the Domain

The distribution of the different sources is presented in Figure S2. In total, approximately 233 sources were identified within the domain, with the 10 most relevant highlighted. The source with the highest number of published articles is *LWT—Food Science and Technology*, with 37 articles (15% of the publications), followed by the *International Dairy Journal*, with 26 articles (11% of the total).

The predominance of scientific articles indicates that research in this field is primarily focused on the generation of new experimental data and their dissemination. The diversity of document types, including book chapters and conference papers, demonstrates that researchers are collaborating and sharing their findings across multiple formats and forums, suggesting a dynamic and growing research field with significant potential for future studies and collaborations.

Figure S3 shows the chronological evolution of publications on the nutritional composition of milk, cheese production, and fatty acid characterization in Latin America over the period 2010 to December 2025.

3.4. Relevant Authors in the Domain

This section presents the authors with the most prominent publications in research on the nutritional composition of milk, cheese production, and fatty acid characterization in Latin America. Figure 3 shows authors ranked according to the number of published articles, with Cruz, A.G. from Brazil being the most prolific author (11 articles), followed by Conte-Junior, C.A., Pimentel, T.C., and Visentainer, J.V., with the same nationality, each with 10 publications. From Argentina, Bergamini, C.V. has nine publications, while González-Córdova, A.F. from Mexico has eight publications.

Regarding the temporal production of the most relevant authors, their publications cover the period 2010–2025, with an average of one to two articles per year in this field. Cruz, A. G. has maintained a consistent publication output from 2013 to 2024. In contrast, Conte-Junior, C.A. was active between 2014 and 2021, with 2021 being his most productive year, during which four articles on the topic were published. Pimentel, T.C., Visentainer, J.V., Esmerino, E.A., and González-Córdova, A.F. have continued their interest in the topic, with one publication in 2024.

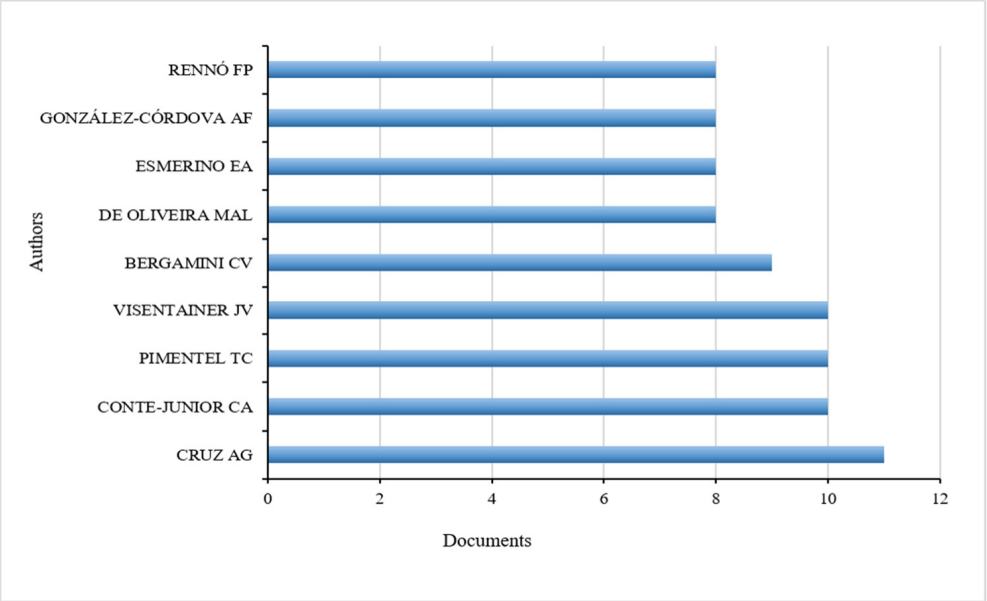


Figure 3. Distribution of the most prominent authors in the domain and their number of publications. Source: Authors' own elaboration using R.

3.5. Most Productive Countries in the Domain

The analysis of productivity in research on the nutritional composition of milk, cheese production, and fatty acid characterization in Latin America is presented in Figure S4. Brazil is the country with the highest number of publications (2287 document-country attributions), followed by Mexico (603), Argentina with 321, Colombia (112), Chile (62), and Peru (53). It is important to highlight that Brazil accounts for 66% of the publications between 2010 and 2025, while the combined contributions of Uruguay, Ecuador, Venezuela, Costa Rica, and Cuba over the same period represent 2.7%. It should be noted that country-level frequencies reflect international co-authorship and/or multiple affiliations per document, which explain values exceeding the number of unique documents, a common pattern in well-established scientific fields.

3.6. International Collaboration Between Countries

In Latin America, the presence of numerous research networks can be observed, which are not limited exclusively to the region but extend globally, indicating the existence of intercontinental relationships (see Figure 4). This can be explained by the participation of various organizations that collaboratively support teaching and learning processes within the field of study, as well as by institutions that provide funding for research projects.

In the analysis of transnational relationships, Latin American countries are observed to collaborate more with Spain and the United States, with 106 documents published. This is followed by Italy, Egypt, Portugal, and France, with 95 documents. Canada, Iran, Pakistan, Belgium, India, Australia, Denmark, and Ireland are involved in collaborations to a lesser extent, with 76 documents.

These findings indicate that language barriers do not hinder international relationships and that geographical proximity and established research networks can facilitate such connections. The United States collaborates primarily with Mexico and Brazil, while Spain collaborates with most Latin American countries, particularly Brazil and Mexico.



Figure 4. Relationships between Latin American bloc countries and other international blocs. Darker shades indicate a higher frequency of collaboration. Source: Authors' own elaboration using R.

3.7. Country Relationships Based on Author Affiliations

For the analysis of productivity based on article correspondence and collaborative relationships (Figure 5), two categories of publications can be identified: single-country publications (SCPs) and multi-country publications (MCPs).

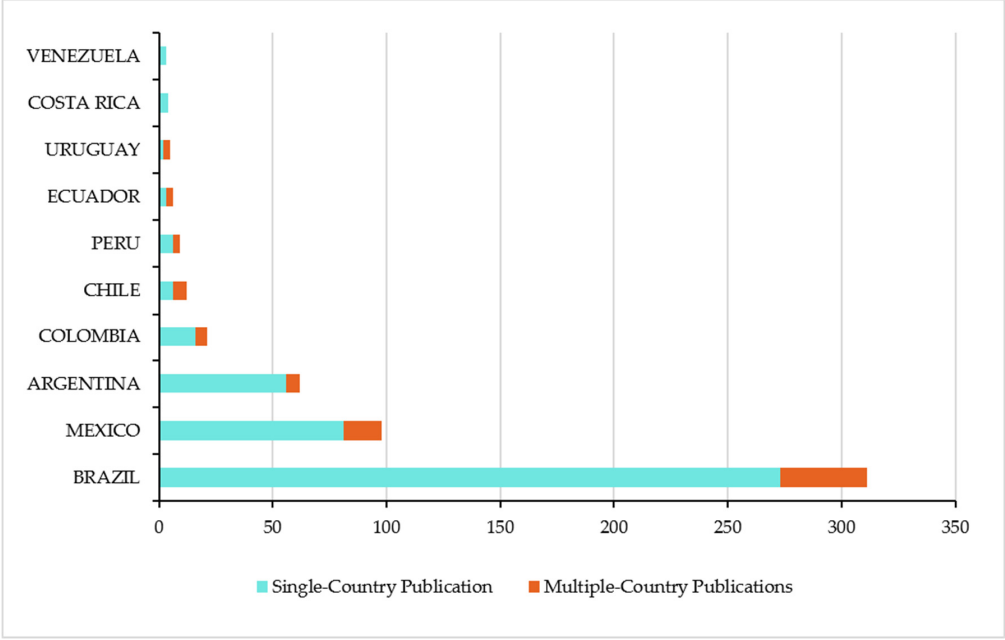


Figure 5. Documents segmented by single-country publications (SCPs, in turquoise) and multi-country publications (MCPs, in orange). Source: Authors' own elaboration using R.

Brazil stands out as the leading country, with the highest number of SCPs, a total 317 articles, of which 40 involve collaboration with other countries (12.6%). Mexico follows with 99 single-country publications and 18 internationally co-authored articles (18.2%). Argentina, with 58 domestic publications and 6 collaborative ones (9.4%), and Colombia, with 17 domestic publications and 5 collaborative ones (22.7%), also demonstrates a growing interest in this field. Chile shows an equal number of domestic and collaborative publications (six each). Uruguay exhibits a stronger tendency toward collaborative publications, whereas Costa Rica and Venezuela predominantly produce single-country publications.

3.8. Conceptual Structure of the Domain

The conceptual structure of a domain encompasses the concepts, terms, relationships, and principles that define and describe a specific area of knowledge. To this end, author-provided keywords from the analyzed documents were used, along with Keywords Plus [19].

Keywords related to microbiology, fermentation, and whey were frequent in the corpus. These terms are considered within the declared scope, since the search covered dairy matrices and their processing; hence, FAs characterization is one of several research topics to explore in the region. Their interpretation is limited to the thematic structure of the field.

Analysis of the reviewed documents and the keywords proposed by the authors (Figure S5) revealed that the term "cheese" appeared 54 times, while "cheese whey" appeared 36 times, "fatty acids" 28 times, and "milk" 21 times. Regarding fatty acids of the greatest interest, "conjugated linoleic acid" was mentioned 24 times, and the most frequently cited analytical technique was "gas chromatography", with 13 mentions.

At a general level, the keywords can be grouped into three main categories. (1) Product: Includes terms such as cheese, milk, dairy products, whey, and cheese whey; (2) Nutritional component: Encompasses components such as fatty acids, conjugated linoleic acid, probiotics, and lactic acid; and (3) Analysis or processes: Includes methods and techniques such as shelf life, proteolysis, ripening, fermentation, gas chromatography, sensory analysis and texture.

Regarding Keywords Plus (Figure S6), "cheese" shows a significant frequency, with 126 occurrences. In addition, within the analysis or processes category, terms such as "pH", "mass spectrometry", "liquid chromatography", and "food handling" were included. The appearance of microbiological topics as driving terms is related to the transversal indexing of studies on food quality and safety in dairy products, even though the primary focus of the domain is lipid characterization.

3.9. Thematic Evolution of the Domain

Figure S7 illustrates a bibliometric analysis of thematic trends related to milk, cheese, and fatty acids in Latin America, divided into four periods: 2010–2014, 2015–2019, 2020–2021, and 2022–2025. During the 2010–2014 period, the predominant terms include "fat", "lactic acid bacteria", "shelf life", and "cheese", reflecting an initial interest in basic aspects of nutritional composition and preservation. For the 2015–2019 period, more specific terms emerge, such as "fatty acid profile", "ripening", and "conjugated linoleic acid", evidencing a growing focus on chemical characterization and processes related to cheese quality. Between 2020 and 2021, a transition toward advanced analytical techniques such as "gas chromatography" is observed, along with applied topics such as "edible films" and "cheese whey". In the 2022–2025 period, the focus further diversifies, integrating advanced tools such as "chemometrics" and terms related to quality and production conditions, including "milk quality" and "temperature".

Over time, concepts such as "lactic acid bacteria" and "fatty acid profile" remain relevant, evolving to adapt to new techniques and applications. In addition, the characterization of FAs has become increasingly important since 2015, likely in response to the increasing demand for more functional and health-oriented products. The growing use of advanced analytical techniques, such as gas chromatography, and statistical approaches like chemometrics reflects a strong interest in improving the characterization and quality of dairy products.

3.10. Thematic Map of the Domain

The thematic map represents an analysis of research topics in the field of milk, cheese, and fatty acids in Latin America (Figure 6), using a quadrant diagram based on two axes: degree of development (density) and relevance (centrality). The themes are grouped into four main categories: motor themes, basic themes, niche themes, and emerging or declining themes.

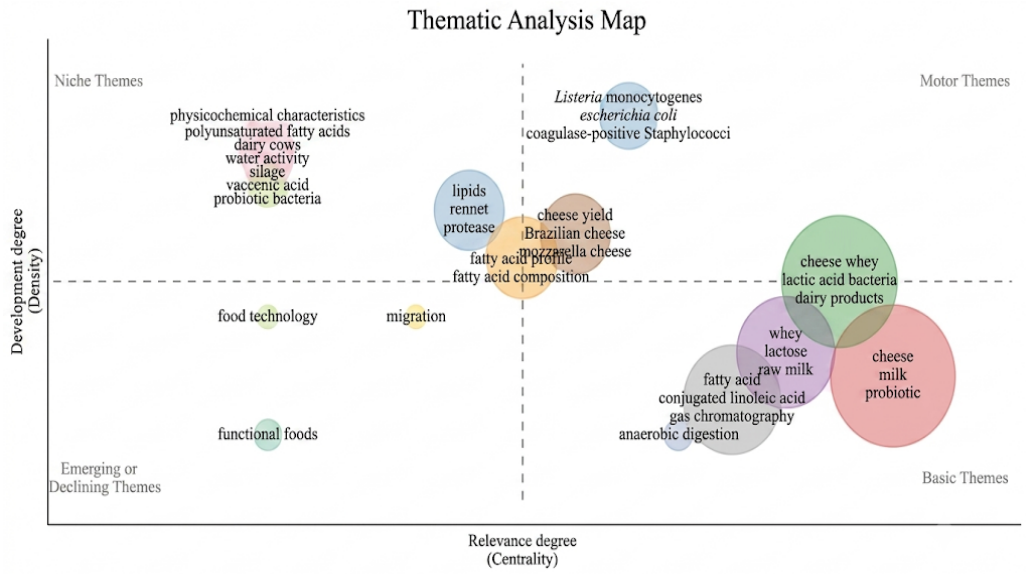


Figure 6. Thematic map of author-suggested keywords. The overlapping of the circles shows how the keywords are framed between clusters. Source: Authors' own elaboration using R.

In the quadrant of motor themes, which combine high relevance and high development, terms such as "Listeria monocytogenes", "Escherichia coli", and "coagulase-positive staphylococci" are identified, focusing on microbiological safety. Basic themes include concepts such as "cheese", "milk", "probiotic", "cheese whey", and "lactic acid bacteria". Niche themes, including "physicochemical characteristics", "polyunsaturated fatty acids", and "vaccines", correspond to highly specialized areas relevant to specific subfields such as nutrition and functional products. In the quadrant of emerging or declining themes, terms such as "functional foods" and "food technology" appear.

The network of related terms (Figure 7) associated with fatty acids highlights their connections with multiple areas of study and applications. At the center of the network is the term "fatty acid", which acts as a main node with multiple links to key concepts such as "conjugated linoleic acid (CLA)", "gas chromatography", "omega-3", and "lipid profile". Gas chromatography and mass spectrometry emerge as central analytical techniques for the identification and quantification of fatty acids. A strong association with nutritional aspects such as digestion, human health, and nutrition is also observed, highlighting the scientific interest in the health-related benefits of fatty acids.

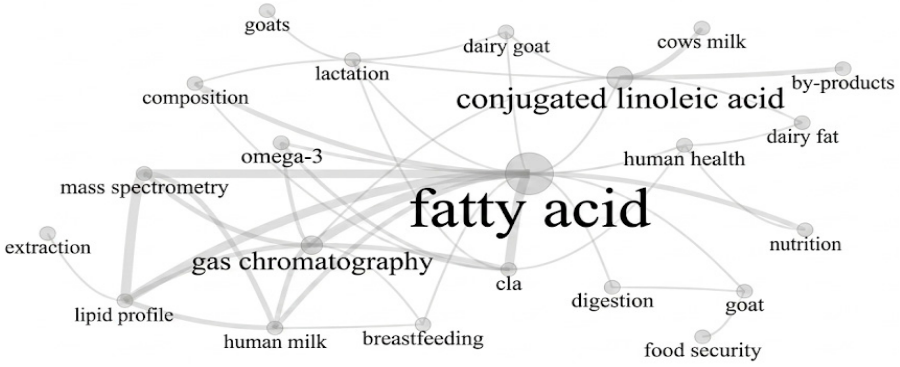


Figure 7. Cluster network. Source: Authors' own elaboration using VOSviewer.

3.11. Fatty Acid Characterization Within the Corpus

Documents addressing FA were identified when their title, abstract, or keywords included FA or lipid-profiling terms, covering volatile, short-, medium-, and long-chain FA, in free or esterified form, and when these were associated with bovine milk or bovine-milk cheese exclusively. This group comprised 99 documents (15.2% of the 651 analyzed). Annual output rose from 23 documents in 2010–2014 (4.6 per year) to 32 in 2021–2024 (8.0 per year), while its share of the total corpus remained stable (14.3% vs. 14.5%). Among analytical techniques, gas chromatography with flame ionization or mass spectrometric detection was explicitly reported in 12.1% of the subcorpus (GC-FID, 5.1%; GC-MS, 7.1%), and gas chromatography in any form appeared in 34.3%. HPLC was mentioned in 6.1% of the documents, NMR in 2.0%, and comprehensive two-dimensional GC in none of the documents. The most frequent FA terms were oleic acid (46.5%), saturated FA (35.4%), linoleic acid (35.4%), conjugated linoleic acid (CLA, 29.3%), polyunsaturated FA (18.2%), volatile FA (16.2%), trans FA (14.1%), short-chain FA (13.1%), monounsaturated FA (11.1%), and omega-3 FA (10.1%). FA-related documents more frequently tackled animal feeding and diet (47.5% vs. 14.5% of the remaining documents), ruminants (31.3% vs. 7.1%), milk fat, butter, and cream (32.3% vs. 9.1%), and plant-derived ingredients or oils (20.2% vs. 5.4%), whereas cheese (29.3% vs. 88.0%) and whey (7.1% vs. 31.2%) were comparatively less represented. International co-authorship was 25.3% in FA-related documents compared with 20.1% in the remaining corpus.

4. Discussion

Overall, research in Latin America on the nutritional composition of milk, cheese production, and fatty acid characterization exhibits a diverse and dynamic profile, with sustained evolution over time. Among the most prominent keywords are cheese, lactic acid bacteria, and fatty acids, which reflect a balance between basic research into chemical composition and microorganisms, and applied studies on fermentation technology and functional product development.

Terms such as fatty acid, conjugated linoleic acid, and gas chromatography highlight a strong emphasis on the chemical characterization of lipids present in milk and its derivatives. Gas chromatography, in particular, is identified as a crucial analytical tool for fatty acid analysis that enables the assessment of composition and quality of these compounds in dairy products such as cheeses and whey. This approach is essential for the study of lipid profiles, especially those associated with functional properties, such as polyunsaturated fatty acids and conjugated linoleic acid, which are well-known for their benefits to metabolic and cardiovascular health [20,24,27]. CLA comprises a family of positional and geometric isomers of linoleic acid (C18:2); among them, rumenic acid (C18:2, c-9, t-11) has been most extensively studied for its biological effects. This predominant isomer in ruminant milk

accounts for approximately 80–90% of total CLA content. In previous studies, rumenic acid has been associated specifically to reductions in body fat, modulation of inflammatory responses, and decreases in atherogenic risk biomarkers. However, reported outcomes have been inconsistent, depending on dietary dosage, formulation, the form of administration (dairy matrix vs. supplement), and the metabolic status of the study population [28,29].

The placement of these terms in the basic themes quadrant (Figure 6) suggests that, while these areas have been explored and are methodologically established, there is potential for technological innovation and functional application.

In the analyzed corpus, conventional gas chromatography was the most frequently mentioned analytical technique (33 times in keywords plus), whereas GC–MS appeared in five documents and comprehensive two-dimensional GC in one. This distribution reflects how often techniques are named in titles, abstracts, and keywords and does not, by itself, indicate the analytical adequacy of the methods used. Because conventional GC can have limited resolution for some positional and geometric isomers, including those of conjugated linoleic acid, studies that quantify such isomers could be improved from confirmatory or higher-resolution approaches reported by Lee Simas et al. [30] and Fina et al. [31]. Whether this limitation affects the nutritional conclusions of regional studies cannot be determined from bibliometric data and further method-comparison studies are required.

In terms of scientific output, Brazil clearly leads in the number of publications, both at the national level and through international collaborations, followed by Mexico and Argentina. This geographical concentration of knowledge highlights significant regional gaps, mainly associated with differences in scientific infrastructure, access to advanced analytical equipment, and research funding. Countries such as Colombia, Peru, Ecuador, and several Central American nations exhibit a more fragmented participation, often dependent on external collaborations, which constrains the development of independent research lines and regional thematic specialization. Nevertheless, this scenario also represents a strategic opportunity to strengthen intra-regional cooperation, promote technology transfer, and consolidate analytical capacities in emerging countries.

The thematic maps indicate that FAs and lactic acid bacteria constitute priority and continuously evolving research areas, whereas tools such as gas chromatography, although essential, are perceived as consolidated disciplines with room for further innovation.

An emerging interest is observed in sustainability and the valorization of by-products, particularly whey, as illustrated by recent studies in the region. Rodriguez Lora et al. [32] used whey as a base for the formulation of a fermented dairy beverage with pumpkin (Cucurbita maxima) and corn starch, thereby improving the functional profile of the food and constituting a technological alternative for adding value to sweet whey, a coproduct of the cheese industry. A similar approach is reported by Vargas et al. [33]. The use of high-intensity ultrasound improved the whey Ricotta cheese production. Regarding authentication, Visconti et al. [34] demonstrated the applicability of FT-NIR spectroscopy in the detection of adulterations with microcrystalline cellulose and wheat flour in grated hard cheeses.

These findings indicate that Latin American research on dairy products is currently undergoing a phase of scientific consolidation; while supported by robust foundations in lipid characterization and fermentation processes, clear opportunities remain to advance toward more integrative, innovative, and regionally balanced approaches. This progress will enhance both the scientific impact and the effective transfer of technology to the dairy industry.

4.1. Limitations

First, the analysis is based on Scopus metadata (titles, abstracts, and keywords); techniques that are used but not mentioned there are not captured, and additional techniques may have been omitted because they were not present within the filtered dataset. Future bibliometric studies could capture these methodologies by expanding the search strategy, including alternative keywords, or applying broader filtering criteria. Second, affiliation-based selection reflects regional potential research capacity rather than the geographic origin of samples. Third, the restriction of the corpus to Scopus may underrepresent regional journals indexed elsewhere. Fourth, publication counts measure output, not quality or impact.

4.2. Future Research

Based on the observed gaps, three priorities emerge: (i) longitudinal studies that link FA profiles with feeding, processing, ripening, and storage; (ii) systematic use of confirmatory techniques (GC–MS) and, where isomer resolution is critical, higher-resolution separations, evaluated against conventional GC in method-comparison studies; and (iii) regional networks and shared infrastructure to foster collaboration among smaller countries.

5. Conclusions

Dairy research in Latin America is predominantly addressed toward the characterization of bioactive compounds and the qualitative evaluation of their derivatives, a field in which the study of fatty acids using chromatographic techniques has achieved notable methodological development for milk and cheese analysis. Within this framework, the growing emphasis on sustainability and the valorization of by-products, such as cheese whey, emerges as an opportunity aligned with analytical innovation, operational efficiency, and environmental responsibility. However, the limited integration of high-resolution tools—such as comprehensive two-dimensional gas chromatography (GC × GC) and nuclear magnetic resonance (NMR) coupled with chemometric modeling—remains a challenge for this analytical perspective, though it could be resolved through strategic network collaborations.

Supplementary Materials: The following supporting information can be downloaded at https://www.mdpi.com/article/10.3390/appliedchem6040079/s1. Figure S1: PRISMA-aligned flow diagram of the document selection process for the bibliometric analysis of fatty acid characterization research in Latin American dairy products (2010–2025). Reference [35] is cited in the Supplementary Materials; Figure S2: Distribution of journal and conference sources; Figure S3: Chronology of research output from the most relevant sources; Figure S4: Contributions to the Latin American domain segmented by countries within the regional bloc; Figure S5: Author-proposed keywords used within the domain in Latin America; Figure S6: Keywords Plus used within the domain in Latin America; Figure S7: Thematic evolution of the domain based on author-proposed keywords from Latin American publications over a 15-year period; Table S1: Search string applied to Scopus.

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Abbreviations

The following abbreviations are used in this manuscript:

CLA	Conjugated linoleic acid
DHA	Docosahexaenoic acid
FA	Fatty acids
EPA	Eicosapentaenoic acid
GC	Gas chromatography
GC–MS	Gas chromatography–mass spectrometry
HPLC	High-performance liquid chromatography
MCP	Multi-country publication
NMR	Nuclear magnetic resonance
SCP	Single-country publication

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