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ORIGINAL ARTICLE

Latin American and Caribbean research on nutrition: analysis of the period 2000-2023 in Scopus

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ABSTRACT

Objective. This study aims to examine Latin American and Caribbean scientific production in nutrition, specifically its presence in the Scopus database from 2000 to 2023.

Design/Methodology/Approach. A bibliometric methodology was implemented to identify the main research areas by analyzing social networks and reviewing the literature. In this sense, the distinctive characteristics of the articles published on nutrition in the Latin American and Caribbean regions were examined in Scopus.

Results/Discussion. There is evidence of a wide range of authorship and the formation of various clusters, predominantly in countries such as Brazil, Mexico, and the United States. There is limited thematic specialization and a significant presence of transient authors. The articles published in 2017 and 2019 have had the most significant impact on nutrition research.

Conclusions. There is evidence of stability in the growth of scientific output on nutrition. Brazil's leadership stands out in the analysis, corresponding with the higher periods reported in the country indexes according to the *Scimago Journal Rank*.

Originality/Value. Although it is not common to find bibliometric studies exclusively focused on this subject, various literature reviews have been carried out, either as a type of independent study or as part of the analysis of the resulting research

Keywords: nutrition; Latin America and the Caribbean; bibliometric analysis; scientific production.

1. INTRODUCTION

The current global crisis and poverty, aggravated by COVID-19, have hindered food production and equitable and sustainable access to healthy, responsible, and sustainable food. According to achieving the Sustainable Development Goals (SDGs) of the 2030 Agenda agreed upon by the United Nations (Cabezas, 2024), this problem seems unsolvable in the short or medium term and remains a priority issue in public agendas.

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Guidance towards proper nutrition provides quality of life, as non-pharmacological strategies, such as increased physical activity and a healthy diet, can delay the progression of chronic diseases. Nutritional interventions in different age groups are the subject of study in nutrition (Cardoso *et al.,* 2023). Studies on nutrition are extensive and diverse. They are scattered in an abundant medical literature due to their impact on human health. Bibliometric studies of the published scientific literature on nutrition in the Latin American and Caribbean regions do not abound despite the remarkable volume of studies on the subject.

In this regard, we identified a work that constitutes a direct antecedent of the present work: a review of food science and nutrition. This review offers a critical view of food security based on using wheat as a global food base (Lemos *et al.,* 2023). It provides an overview of the literature in PubMed, Embase, Web of Science, and Scopus databases, addressing the contaminants in wheat processing for manufacturing traditional foods. Review studies also abound in nutrition research.

Systematic literature review is a research practice that appears due to the volume of publications in the health field. For example, in 2023, in the Scopus database itself, multiple review articles of varied typology appear that systematize contents and knowledge around the nutritional theme, whether in humans or in animal nutrition (Artoni De Carvalho *et al.,* 2023; Bellot *et al.,* 2023; de Sousa Coelho *et al.,* 2023; Della Lucia *et al.,* 2023; Diniz Largueza, Mocellin, Nunes, & Ribas, 2023; Evangelista *et al.,* 2023; Ferreira *et al.,* 2023; Gomes Soares, Bevilaqua, Marcondes Tassi, & Reolon Schmidt, 2023; Jafarzadeh, Hadidi, Forough, Nafchi, & Mousavi Khaneghah, 2023; Marques de Brito, Campos, Neves, Ramos, & Tomita, 2023; Pelosi *et al.,* 2023; Salgado *et al.,* 2023; Silva *et al.,* 2023; Singh, Hernandez-Rauda, & Peña-Rodas, 2023).

The elements of nutrition are based on the cultivation of all types of food, so the environmental phenomenon is a decisive factor for mankind. Nutrition research addresses these issues in search of alternatives that minimize the impact of ecological and efficient fertilizers for crops. Intensive agricultural practices lead to soil degradation, prompting research into sustainable options such as algal biomass. The potential of algal biomass as a non-synthetic fertilizer underscores the need to shift to more environmentally friendly agricultural practices Cassani, Marcovich, & Gomez-Zavaglia, 2023; Soto-Sánchez *et al.,* 2023).

Although they systematize and document research on the published literature, review articles are necessary to advance the specific results achieved. Thus, they are an effective method for advancing science in a given field since they increase the results and publications on a topic. The need for more comprehensive studies to validate findings and guide future recommendations is alluded to in nutrition.

Considering these elements, the following research question is defined: what are the main characteristics of the scientific literature published on nutrition in the Latin American and Caribbean context between 2000 and 2023 indexed in the Scopus database?

2. MATERIALS AND METHODS

The following describes the procedure used in the study and the different stages of the methodological design.

2.1. Source of data

The Scopus database retrieved literature published on nutrition in Latin America and the Caribbean. Scopus processes scientific information from the Elsevier publishing house and was used as a source of information. Since 1970, it has had more than 2.4 billion references cited, making it a very valuable source for this bibliometric analysis.

Based on this source of information, a search strategy was formulated using an advanced search, using field codes that allowed the retrieval of information on a research theme or topic. In this sense, an equation was formulated with the exact search for the term "nutrition" in the title of the articles. In addition, Boolean operators were combined to extract literature from the Latin American and Caribbean regions within the study period (2000-2023):

> SRCTITLE ("nutrition") AND PUBYEAR > 1999 AND PUBYEAR < 2024 AND (LIMIT-TO (AFFILCOUNTRY, "Brazil") OR LIMIT-TO (AFFILCOUNTRY, "Mexico")

OR LIMIT-TO (AFFILCOUNTRY, "Chile") OR LIMIT-TO (AFFILCOUNTRY, "Argentina") OR LIMIT-TO (AFFILCOUNTRY, "Colombia") OR LIMIT-TO (AFFILCOUNTRY, "Peru") OR LIMIT-TO (AFFILCOUNTRY, "Ecuador") OR LIMIT-TO (AFFILCOUNTRY, "Uruguay") OR LIMIT-TO (AFFILCOUNTRY, "Guatemala") OR LIMIT-TO (AFFILCOUNTRY, "Costa Rica") OR LIMIT-TO (AFFILCOUNTRY, "Venezuela") OR LIMIT-TO (AFFILCOUNTRY, "Puerto Rico") OR LIMIT-TO (AFFILCOUNTRY, "Cuba") OR LIMIT-TO (AFFILCOUNTRY, "Paraguay") OR LIMIT-TO (AFFILCOUNTRY, "Trinidad and Tobago") OR LIMIT-TO (AFFILCOUNTR, "Jamaica") OR LIMIT-TO (AFFILCOUNTRY, "Panama") OR LIMIT-TO (AFFILCOUNTRY, "Bolivia") OR LIMIT-TO (AFFILCOUNTRY, "Honduras") OR LIMIT-TO (AFFILCOUNTRY, "Dominican Republic") OR LIMIT-TO (AFFILCOUNTRY, "El Salvador") OR LIMIT-TO (AFFILCOUNTRY, "Barbados") OR LIMIT-TO (AFFILCOUNTRY, "Nicaragua") OR LIMIT-TO (AFFILCOUNTRY, "Haiti") OR LIMIT-TO (AFFILCOUNTRY, "Saint Lucia") OR LIMIT-TO (AFFILCOUNTRY, "Grenada") OR LIMIT-TO (AFFILCOUNTRY, "Dominica")) AND (LIMIT-TO (DOCTYPE, "ar") OR LIMIT-TO (DOCTYPE, "re"))

The recovered records were delimited by geographic area, and the sample consisted of 12,254 records.

2.2. Study Design, Approach and Methodology

The study design is non-experimental (cross-sectional) and quantitative (descriptive). The sample is intentional and non-probabilistic because the records dealing with nutrition topics were selected in abstract, title, and keywords and then delimited in the Latin American and Caribbean regions. From a quantitative approach, documentary analysis and bibliometric techniques were combined to analyze the calculated indicators. In addition, social network analysis techniques were used to identify the levels of cooperation in this research topic.

The basic methodology used was based on bibliometric techniques. It consisted of four fundamental stages: determining the metric object of study, searching, retrieving, and processing information, defining indicators, and analyzing the resulting information quantitatively and qualitatively.

2.3. Data analysis and processing

Once the information had been searched and retrieved in Scopus, the records were exported in CSV and RIS format for processing, determining the variables to be measured, and defining indicators. Indicators were calculated to assess the productivity of authors, the evolution of the subject matter in the period through the number of documents per year, and the rate of variation. The documentary typology and the number of journals or publications registered by Scopus for the subject during this period were identified. In addition, the papers with the highest scientific impact and citation indicators were identified to determine this subject's use.

The VOSviewer tool elaborated co-authorship networks and two maps of countries and words. In both cases, the presence of both variables was determined in documents with more than 15 frequencies. In addition, Excel was used to represent tables and graphs.

3. RESULTS AND DISCUSSION

Only 12.3% of the 12,254 articles retrieved are review articles. This indicates that most works analyzed are original studies or articles that contribute novelties to the field of study. Another distinctive feature of the analysis is that, although the scientific production corresponds to authorship mainly from the Latin American and Caribbean region, 12,247 of the 12,254 articles are published in English.

More than 30,000 authors comprise the sample in this scientific production; of these, 63% have only one published work. This phenomenon occurs frequently in health research, where there is a high degree of co-authorship and multi-affiliation. In this case, the average co-authorship is 2.7 authors per article. Many authors who participated in this research were identified; however, 10 were the most representative in this period. Representativeness was determined for those who published 62 or more papers (Table 1).

#	Authors	# of doc.	Institution / Country
1	Solomons, Noel W.	106	Centro de Estudios en Deterioro Sensorial, Envejecimiento y Metabolismo (CeSSIAM), Guatemala City, Guatemala.
2	Uauy, R.	88	Institute of Nutrition and Food Technology (INTA), University of Chile, Santiago, Chile.
3	Gonzalez, María Cristina	87	Postgraduate Program in Behavioral Health, Catholic University of Pelotas, Pelotas, RS, Brazil.
4	Davisson Correia, Maria Isabel Toulson	85	Faculty of Medicine, Federal University of Minas Gerais, Belo Horizonte, Minas Gerais, Brazil.
5	Fisberg, Regina Mara	75	Department of Nutrition, School of Public Health, University of São Paulo, São Paulo, Brazil.
6	Waitzberg, D. L.	72	Department of Gastroenterology, School of Medicine, University of São Paulo, Brazil.
7	Sichieri, Rrosely	69	Department of Epidemiology, Institute of Social Medicine, State University of Rio de Janeiro, Brazil.
8	Bressan, Josefina	69	Department of Nutrition and Health, Universidade Federal de Viçosa, Minas Gerais, Brazil
9	Macedo Rogero, Marcelo	65	Department of Nutrition, School of Public Health, University of São Paulo, São Paulo, Brazil.
10	Mafra, D.	62	Postgraduate Program in Medical Sciences, Universidade Federal Fluminense, Niterói-Rio de Janeiro, Brazil.

Table 1. Top 10 most productive authors on nutrition in the Latin American and Caribbean region (Scopus 2000-2023).

Within the top 10 most prolific authors, a leadership of Brazilian universities and health schools is identified; however, the researchers in the first two positions are from Guatemala and Chile.[1] The predominance of Brazil in this analysis is to be expected, considering its leadership in nutrition and dietetics research in the region.

Figure 1 shows the evolution of scientific production to analyze the trajectory of articles on nutrition. Two indicators have been used: the number of documents or articles published in each year and the rate of variation expressed in percentage values.

The net values of articles produced in each year show a systematic increase in research results associated with nutrition, supported by variation from one year to the next. The slight variations shown are not significant; only at the end of the period were results observed to decrease, in the years 2022 and 2023.

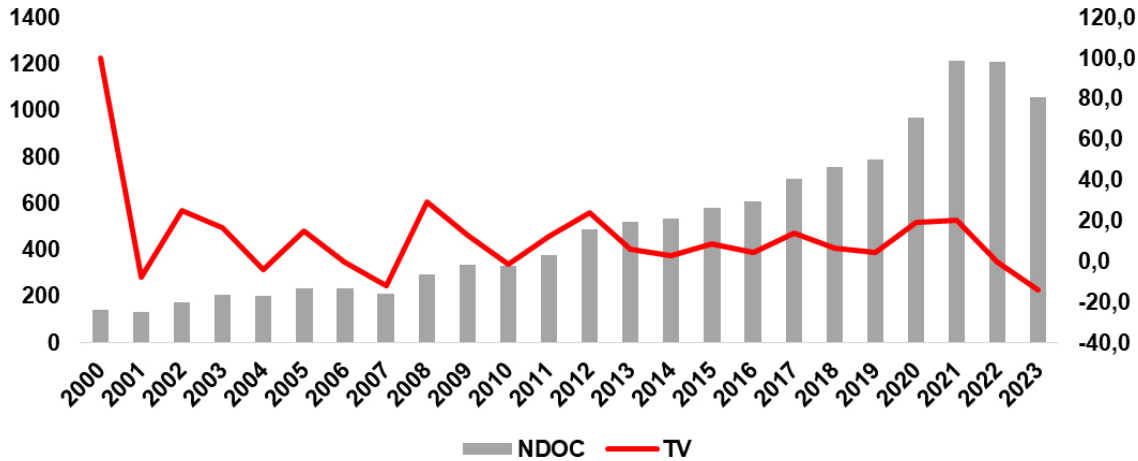

Figure 1. Number of articles and rate of variation of scientific production on nutrition in the Latin American and Caribbean region (Scopus 2000-2023).

[1] The *SCImago Journal and Country Rank* report these results for the period 1996-2023. Available at: https://www.scimagojr.com/countryrank.php?category=2916&region=Latin%20America

Figure 2 shows the co-authorship network generated using the strength of association method. Four fundamental clusters (C) were identified that show the levels of collaboration between authors. Cluster C1 comprises 24 authors who collaborate in research on dietary aspects of food and different populations and age groups, led by the Brazilian Carlos Augusto Monteiro from the University of Sao Paulo, Brazil.

Cluster C2 consists of 17 authors who primarily focus on dietary supplements and body mass. Brazilian researchers lead this cluster as well. The third cluster revolves around Brazilian researcher Maria Cristina Gonzalez, who has collaborated with authors from Canada, Portugal, and the United States. This cluster emphasizes clinical studies on body composition.

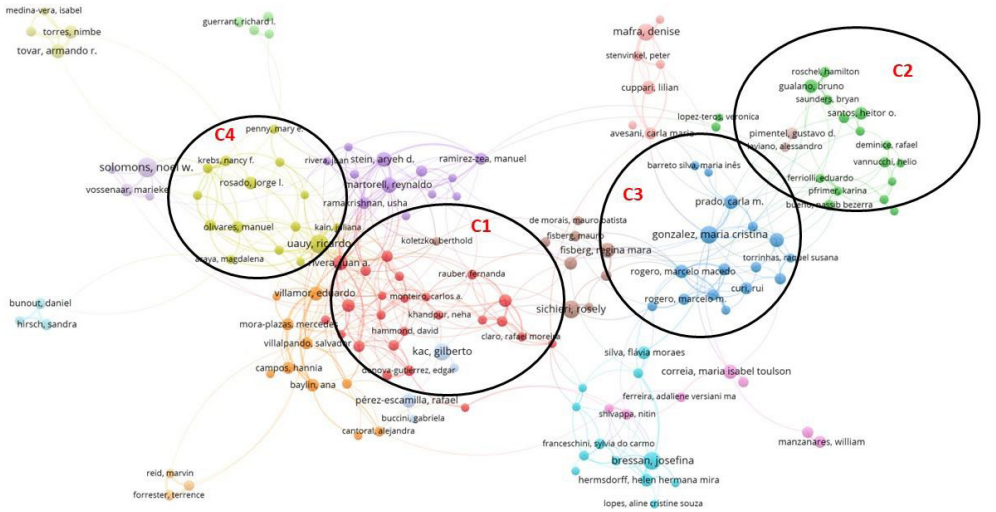

Figure 2. Co-authorship clusters in the scientific production of nutrition in Latin America and the Caribbean (Scopus 2000-2023).

Cluster C4 is led by Ricardo Uauy from the Department of Nutrition and Public Health at the London School of Hygiene and Tropical Medicine in the UK. This cluster examines nutrition in early childhood and, fundamentally, the daily supplements required to achieve sufficient nutrition through controlled feeding studies. Additionally, several review articles on these subjects have been identified.

Brazil's leadership in the region is clear in the network of country co-authorship (Figure 3). However, the United States has the highest number of links in this network, indicating strong collaboration on these issues. Along with the United Kingdom, Mexico ranks as the fourth nation forming the most relationships through its research in the region, according to the *Scimago Country Rank* indexes.

The study's citation analysis yielded high results (Table 2). During the study, 33,205 citations were received. Of the articles in the sample, 96.1 % received at least one citation, representing this research topic's high scientific impact. This implies that the articles receive an average of 27 citations once published. In general, this analysis corroborates that the discipline of nutrition in human health achieves high impact rates due to the flow of communication and scientific production.

Citation indicators	Data
Number of citations received	332050
Total number of documents or articles published	12254
Total number of documents cited	11780
Percentage of documents cited	96.1
Average number of citations per published papers or articles	27.1

Table 2. Total citation indicators of the study.

The articles with the greatest scientific impact in this period were identified from the general citation data. The top 5 most cited articles

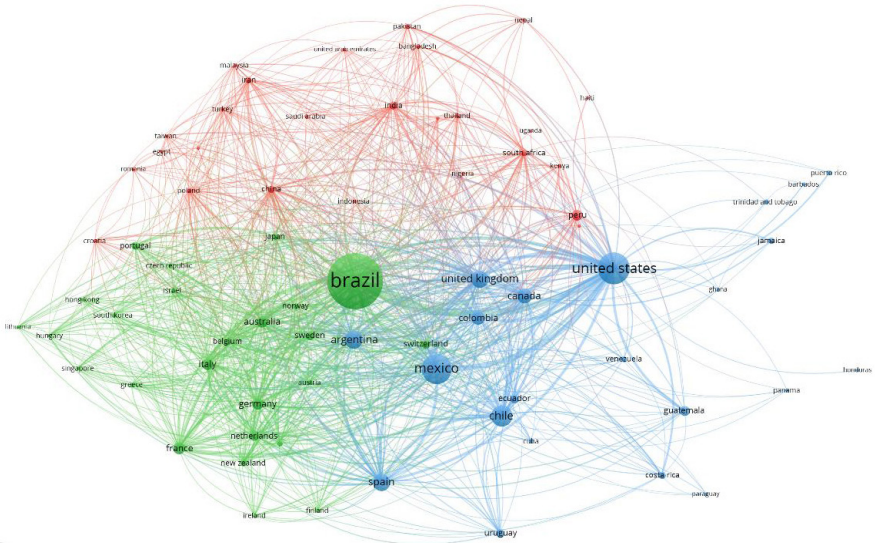

Figure 3. Co-authorship network of Latin American and Caribbean countries on nutrition studies (Scopus 2000-2023).

were determined. The journals specialized in nutrition and non-local journals in the region stand out. These papers address nutritional status and malnutrition according to male and female sex. Nutrition and the primary studies for this evaluation are also evaluated.

Top	Articles	Quotations
#1	Tremblay, M. S., Aubert, S., Barnes, J. D., Saunders, T. J., Carson, V., Latimer-Cheung, A. E., ... Wondergem, R. (2017). Sedentary Behavior Research Network (SBRN) - Terminology Consensus Project process and outcome. International Journal of Behavioral Nutrition and Physical Activity, 14(1). doi:10.1186/s12966-017-0525-8	2291
#2	Cederholm, T., Jensen, G. L., Correia, M. I. T. D., Gonzalez, M. C., Fukushima, R., Higashiguchi, T., ... Fuchs, V. (2019). GLIM criteria for the diagnosis of malnutrition – A consensus report from the global clinical nutrition community. Clinical Nutrition, 38(1), 1-9. doi:10.1016/j.clnu.2018.08.002	1699
#3	McLean, E., Cogswell, M., Egli, I., Wojdyla, D., & De Benoist, B. (2009). Worldwide prevalence of anaemia, WHO Vitamin and Mineral Nutrition Information System, 1993-2005. Public Health Nutrition, 12(4), 444-454. doi:10.1017/S1368980008002401	1642
#4	Cederholm, T., Barazzoni, R., Austin, P., Ballmer, P., Biolo, G., Bischoff, S. C., ... Singer, P. (2017). ESPEN guidelines on definitions and terminology of clinical nutrition. Clinical Nutrition, 36(1), 49-64. doi:10.1016/j.clnu.2016.09.004	1598
#5	Correia, M. Isabel, & Waitzberg, D. L. (2003). The impact of malnutrition on morbidity, mortality, length of hospital stay and costs evaluated through a multivariate model analysis. Clinical Nutrition, 22(3), 235-239. doi:10.1016/S0261-5614(02)00215-7	1434

Table 3. Most relevant articles on nutrition in Scopus (2000-2023).

Tremblay, M. S., and collaborators' most cited study is a bibliographic and documentary review on sedentary behavior. The Sedentary Behavior Research Network (SBRN) is particularly involved. Based on feedback from the 87 SBRN participants who responded to the original invitation and survey, the result shows a conceptual model and consensus definitions (including caveats and examples for all age groups and functional abilities).

Cederholm, T.'s research focuses on the proposal to create a global consensus on essential diagnostic criteria for adult malnutrition in clinical settings, proposing five classification criteria, including three phenotypic criteria (unintended weight loss, low body mass index, and reduced muscle mass) and two etiological criteria (reduced food intake or assimilation and inflammation or disease burden).

The study by *McLean, E.* proposes current global and regional estimates of the prevalence of anemia and the number of people affected by population subgroups in the total population. Although the study covers 15 years, it constitutes a background for current and comparative studies on this phenomenon. Cederholm, T., and co-authors again make an impact by investigating clinical nutrition. In this case, to reach a consensus on basic nutritional concepts and procedures terminology. They outlined five key areas related to clinical nutrition: concepts, procedures, organization, delivery, and products. A central concept in clinical nutrition is malnutrition/undernutrition, which includes disease-related malnutrition, with or without inflammation, and non-disease-related malnutrition/undernutrition, e.g., hunger-related malnutrition. Another central concept is overnutrition (overweight and obesity). It was agreed that sarcopenia and frailty were distinct conditions often associated with malnutrition.

Finally, among the top five articles with the highest impact is a 2003 study in which *Correia, M. Isabel,* and their collaborators performed a correlational analysis of the nutritional status of hospitalized patients in relation to their morbidity, mortality, length of hospital stay, and costs. The study concluded that malnutrition, analyzed using a multivariate logistic regression model, is an independent risk factor that influences an increase in complications and mortality, as well as a longer length of hospital stay and an increase in costs.

#	Journals	# of doc.	%
1	Nutrition	873	7.1
2	Public Health Nutrition	650	5.3
3	Journal of Plant Nutrition	566	4.6
4	British Journal of Nutrition	555	4.5
5	Journal of Soil Science and Plant Nutrition	550	4.5
6	Journal of Nutrition	417	3.4
7	Frontiers in Nutrition	411	3.4
8	Plant Foods for Human Nutrition	352	2.9
9	Clinical Nutrition ESPEN	349	2.8
10	Clinical Nutrition	342	2.8

Table 4. Most productive journals in Latin American and Caribbean nutrition research visible in Scopus (2000-2023).

As part of the analysis, they represented the most representative journals in nutrition research (Table 4). A total of 139 journals were identified. In the top 10 are high-impact journals of international scope. That is, the majority of nutrition articles are published in English-language journals.

4. CONCLUSIONS

The analysis of scientific articles on nutrition published by Latin American and Caribbean authors registered in Scopus during the period 2000-2023 is abundant and dispersed. A wide range of authorship and co-authorship was identified, characteristic of scientific communication in the field. Brazilian and Mexican authors stand out. These results were corroborated by the positioning of countries in the *Scimago Journal Rank* for a broader period (2016-2023), showing total coincidence.

In addition, research in this health subdiscipline has a high impact. Most are original articles, consistent with the growing literature on this topic. The timeline of scientific production shows a stable tendency to grow. Logically, this research has a large flow of information since the global social context is changing and affects human health.

Conflict of interest

The authors declare that there is no conflict of interest.

Declaration of data consent

The data generated during this research has been included in the article.

Contribution statement

Conceptualization, research, validation, writing-original version: Gladis Jane Villanueva Cadenas, Cesar Eloy Gamarra Lazaro.

Formal analysis, methodology, visualization: Elizabeth Judith Pablo Agama, Carmen Del Pilar Alvarez Quinteros.

Writing-revision and editing: Norma Elvira Muguruza Crispin.

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