

Bibliometric analysis of undergraduate final research projects in Nutrition courses in the state of *Rio Grande do Norte*, Brazil

Análise bibliométrica de trabalhos de conclusão de cursos de Nutrição do Rio Grande do Norte

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ABSTRACT

Objective

To evaluate the profile of academic production of undergraduates in Nutrition courses in the state of *Rio Grande do Norte*, Brazil.

Methods

The bibliometric study was conducted with undergraduate final research projects from five courses in Nutrition in the state of *Rio Grande do Norte* during 2013 and 2014. The following variables were collected: institution, title of project, number of authors, academic degree of the advisor, study design, area of study interest, type of study, study setting, submission to the ethics committee, and keywords. Pearson's Chi-square test was used to assess the variable area of study interest with a significance level at $p \leq 0.05$ and 95% confidence interval.

Results

Of the 195 projects analyzed, 79.0% were developed at universities. We found a higher frequency of academic articles (68.2%) developed by a single student (65.6%), advised by a professor with a Masters degree (57.9%), with a cross-sectional study design (48.2%), and without submission to the research ethics committee (49.2%). The mean adequacy of keywords was 50.0%.

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Article based on master's thesis of TB MENÊZES, intitled "A formação do nutricionista para atuação no SUS: um olhar sobre a produção científica obrigatória dos cursos do Rio Grande do Norte". Universidade Federal do Rio Grande do Norte; 2015.

Conclusion

The quantitative approach was the most predominant characteristic of the final research projects and the most frequently researched area of knowledge was public health. The methodological approaches of the research projects were considered weak, which suggests the need to improve the quality of scientific methodology during undergraduate studies, considering the important benefits derive from researches as an active methodology.

Keywords: Bibliometrics. Education, higher. Nutricionist. Research.

RESUMO

Objetivo

Analisar o perfil da produção acadêmica dos cursos de Nutrição do Rio Grande do Norte a partir dos trabalhos de conclusão de curso.

Métodos

Estudo bibliométrico realizado com trabalhos de conclusão de cinco cursos de graduação em Nutrição do estado do Rio Grande do Norte nos anos de 2013 e 2014. Foram coletadas as seguintes variáveis: instituição de origem, título do trabalho, número de autores, titulação do professor orientador, modelo do trabalho, núcleo de saberes de interesse, tipo de estudo, cenário de realização, submissão a comitê de ética e descritores. Foi realizado o teste Qui-quadrado de Pearson para a variável núcleo de saberes de interesse, atribuindo-se nível de significância ao valor de $p \leq 0,05$ e um intervalo de confiança de 95%.

Resultados

Dos 195 trabalhos analisados, 79,0% foram desenvolvidos em universidades. Observou-se maior frequência de trabalhos na forma de artigos científicos (68,2%), desenvolvidos por um único aluno (65,6%), orientados por professores mestres (57,9%), com desenho de estudo transversal (48,2%) e sem necessidade de submissão a comitê de ética em pesquisa (49,2%). A mediana de adequação dos descritores correspondeu a 50,0%.

Conclusão

Foi possível destacar como característica predominante dos trabalhos de conclusão de curso a abordagem quantitativa, sendo o núcleo de saberes de interesse mais pesquisado a saúde coletiva. Foram identificadas fragilidades metodológicas que sugerem a necessidade de fortalecer a metodologia científica na graduação, tendo em vista os importantes benefícios advindos da pesquisa como metodologia ativa.

Palavras-chave: Bibliometria. Educação superior. Nutricionista. Pesquisa.

INTRODUCTION

In Brazil, the most recent nacional curricular guidelines regulate nutrition undergraduate courses¹. According to these guidelines published in 2001, graduation is conditioned to the development of a final research project advised by a professor.

The need to integrate education, research, and outreach programs/assistance by encouraging experiments and research projects to socialize the knowledge produced has been previously pointed out².

As for active methodologies, Berbel³ has shown that scientific research is largely stimulated

in higher education, enabling students to acquire different levels of intellectual abilities such as observation, description, analysis, discussion, synthesis as well as collecting, analyzing and processing information, which can be developed, for example, during scientific initiation or when writing final research projects.

The final research project at the *Universidade Federal do Rio Grande do Norte* is an academic work that expresses the competencies and abilities developed by the students, as well as the knowledge acquired during undergraduate courses⁴.

Practicing science promotes the education of a professionals and citizens and it is essential

for the education of the university students and for the university, as the publication of research studies are imperative in the academic world, particularly among undergraduate nutrition students⁵.

Thus, scientific research should be seen as an activity of utmost importance and, as it requires significant public and private resources, it is important to analyze the study results and impact on the scientific, economic and social spheres⁶.

The concept of the scientific field adopted in this study refers to the competitive struggle for space against the monopoly of scientific competence, which is understood as the ability to speak and act legitimately socially granted to a particular agent⁷.

Based on the concept of the scientific field, we adopted the concept of knowledge areas described by Nunes⁸, which places different areas of specialization in different directions within a field, assuming an understanding of the existence of sets of disciplinary areas and knowledge developed over the history of science. Science is considered as an investigation activity and research, but it is also susceptible to manipulation and social interests of certain groups⁹.

Considering that few studies in the literature address the characteristics of the final research project in nutrition courses, the aim of the present study was to analyze the profile of mandatory academic projects for Nutrition courses in the state of *Rio Grande do Norte*.

METHODS

This is a bibliometric study. The term bibliometrics derives from the Greek word *biblion* (=book) and the Latin word *metricus* or Greek word *metrikos* (=to measure), referring to a concept defined as the process of counting and analyzing a book or document¹⁰. This methodology has been used by several areas of knowledge as a method to obtain indicators of scientific production¹¹.

Rodríguez *et al.*¹² pointed out that with the growing development of science and, consequently, increasing number of publications, it is necessary and almost inevitable to evaluate objectively the results of scientific research. Thus, bibliometrics emerges as an important evaluation system for this purpose, as it is possible to obtain an overview of the scientific production in a particular country, journal, author, among other possibilities. However, according to these authors¹², the limitation of this methodology is the lack of qualitative data on scientific production.

The present study used final research projects of undergraduate nutrition students from different higher education institutions in the state of *Rio Grande do Norte*.

We included final research projects from studies that had begun in the second half of 2013. The final research projects concluded by 2013 or later were selected because these projects are the most up-to-date mandatory academic project for undergraduate courses. From this criterion, 5 courses from 3 universities were included in the study, 3 located in the capital city and 2 in state. Thus, a total of 195 final research projects were selected, of which 171 were from 2013 (courses A, C, D and E) and 24 from 2014 (course B).

The course B underwent a curriculum update that caused the absence of undergraduate classes and final research projects in 2013. As admission is annual, the final research projects obtained in 2014 correspond to the universe of projects produced in 2014.

Among the selected final research projects, no projects were excluded from the study. The research projects would have been excluded if they did not contain basic information, such as a title, names of author(s), or if permission was not granted by the university.

Data were collected using a specific spreadsheet developed for the research protocol, which contained the following information: institution, academic organization, administrative category, location, title of project, number of

authors, academic degree of the advisor, study design, area of study interest, type of study, study setting, submission to the ethics committee, keywords, and percent adequacy of keywords.

As for the academic organization, institutions were classified as “university” or “university center” and they have been classified as ‘public’ or ‘private’ in the administrative category.

The area of study interest of the final research project was defined in accordance with resolution nº 380/2005 of the *Conselho Federal de Nutricionistas* (CFN, Federal Council of Nutritionists)¹³. According to this resolution, the exercise of the nutritionist professional can be in the following areas: nutrition in meal production, clinical nutrition, public health, teaching, food industry, sports nutrition, and marketing in the field of food/nutrition.

The variable type of study was divided into the following categories: case-control, cohort, experimental, laboratory research, documentary research, qualitative research, literature review,

and cross-sectional. Chart 1 shows the definitions adopted for each type of study and the literature consulted.

A cover letter and statement of responsibility was addressed to the course coordinators or administrative bodies requesting permission to access the final research projects. After permission was granted, the research projects were collected in June, July and December 2014.

The research projects available on CD-ROM were copied using a laptop and those obtained from the virtual library system were sent via e-mail. The relevant excerpts of printed research projects were photographed with a smartphone and uploaded to a virtual disk.

The classification of the area of study interest of the final research project was performed in accordance with the objective of the project, type of study, and the information from the cover, inside front cover, title, abstract, objectives, and methodology. If the academic degree of advisors was not mentioned in the project, we consulted the Lattes plataforma

Chart 1. Study design and its definitions according to authors.

Type of study	Definition	Author
Case-control	Studies focusing on a disease of interest are identified and classified according to degree of exposure to the risk factor or prognosis of interest and compared with a group of healthy individuals (controls).	Block & Coutinho ¹⁴
Cohort	Studies in which a group of individuals without the disease of interest is divided into groups according to the degree of exposure to a risk factor or prognosis, then followed-up to compare the occurrence of disease in each group throughout time.	Block & Coutinho ¹⁴
Experimental	Studies in which the researcher interferes directly in the variables studied by manipulating the exposure factor to which randomly allocated individuals will be exposed at different degrees.	Block & Coutinho ¹⁴ ; Lyra <i>et al.</i> ¹⁵
Laboratory research	Research conducted in a controlled way in a specific laboratory.	Lyra <i>et al.</i> ¹⁵
Documentary research	Search for primary sources, that is, documents that have not been analytically treated or published.	Lyra <i>et al.</i> ¹⁵
Qualitative research	Interpretive research related to the meanings people give to experiences in the social world and how they understand the world.	Uchôa ¹⁶
Literature review	Analysis and synthesis of information provided by all relevant published studies on a given topic to summarize the body of existing knowledge and lead to a conclusion on the subject of interest.	Mancini & Sampaio ¹⁷
Cross-sectional	Characterized by the direct observation of a certain number of individuals for a period of time, within a specific period.	Klein & Block ¹⁸

website of the *Conselho Nacional de Desenvolvimento Científico e Tecnológico* (CNPq, National Council for Scientific and Technological Development).

For the keyword analysis, the *Descritores em Ciências da Saúde* (DeCS, Health Science Descriptors) was consulted to verify indexing. Percent adequacy of keywords from each final research project calculated using the following formula:

$$\% \text{ adequacy} = \frac{\text{Number of keywords of final work indexed in DECS} * 100}{\text{Total number of keywords of final work}}$$

The data tabulation was performed using the Microsoft Excel 2010 software (Microsoft Corporation®, Redmond, Washington, United States). The database was exported to the Statistical Package for the Social Sciences (SPSS Inc., Chicago, Illinois, United States) version 20 for statistical analysis.

First, we conducted descriptive analysis of the variables. The Pearson nonparametric Chi-square test was used to assess the variable 'area of study interest' with a significance level at $p \leq 0.05$ and 95% confidence interval if the category of the variable was significant.

Since the research projects are considered as public domain, approval from the research ethics committee was not required.

RESULTS

A total of 195 final research projects were analyzed from 5 courses, according to the distribution shown in Table 1.

As for the administrative category, final research projects from private institutions were more prevalent (56.4%). Most research projects (79.0%) were from courses from universities.

As shown in Table 2, a higher frequency of research projects were academic articles (68.2%), developed by a single student (65.6%), advised by professors with a Master's degree (57.9%), cross-sectional study design (48.2%),

Table 1. Distribution of final research projects according to different courses in the state of *Rio Grande do Norte*, Brazil - 2013/2014.

Course	n	%
A	61	31,3
B	24	12,3
C	52	26,7
D	17	8,7
E	41	21,0
Total	195	100,0

conducted in a laboratory (25.6%), and submission to the research ethics committee was not required (49.2%).

As for the percent adequacy of keywords, adequacy mean was 50.0% (Q25-Q75=41.7), that is, the minimum score was 0 for 9.7% of the research projects and the maximum score was 100.0 for 14.4% of research projects.

Regarding the area of study interest of the final research projects, we found that projects dealing with public health were significantly more frequent ($p < 0.001$) (Figure 1).

DISCUSSION

In 2015, the national curricular guidelines will have been in effect for 14 years. The present study has endeavored to characterize the scientific production according to these guidelines, without establishing absolute knowledge, but instead fostering a discussion on how the research of the final projects have been conducted.

According to the data, we observed that most final research projects were articles. By adopting this approach, knowledge developed and discussed in the academia may contribute to its dissemination beyond the institution's walls. On the other hand, this type of approach could be the result of the need to produce and publish. According to Costa¹⁹, the performance and criteria for career progression of professors is based on their scientific production rather than on their teaching activity. The golden standard

Table 2. General characteristics of final research projects in Nutrition courses in the state of *Rio Grande do Norte*, Brazil - 2013/2014.

Variable	n	%
<i>Type of study</i>		
Academic article	133	68,2
Monograph	62	31,8
<i>Number of authors</i>		
1 student	128	65,6
2 students	67	34,4
<i>Academic degree of advisor</i>		
Expert	20	10,3
Master	113	57,9
Doctor	61	31,3
Not identified	1	0,5
<i>Study design</i>		
Case-control	1	0,5
Cohort	1	0,5
Experimental	9	4,6
Laboratory research	39	20,0
Documentary research	3	1,5
Qualitative research	12	6,2
Literature review	32	16,4
Cross-sectional	94	48,2
Others	4	2,1
<i>Setting</i>		
Public documents	4	2,1
Area of free movement of people	17	8,7
Laboratory	50	25,6
Literature	33	16,9
Private service	17	8,7
Public service	21	10,8
Public service and private service	2	1,0
Private health service	-	8,2
Public health service	20	10,3
Information system	1	0,5
Not identified	1	0,5
Others	13	6,7
<i>Submission to the research ethics committee</i>		
Yes	83	42,6
No	16	8,2
Not applicable	96	49,2

for researchers is based on the number of scientific manuscripts accepted for publication in indexed journals, particularly international journals, a productivity system that guides the academic assessments in Brazil^{20,21}.

Although most final research projects were developed by a single student, 34.4% of final research projects was conducted in pairs. Intellectual abilities developed within the framework of scientific research favor more

favorable and safe conditions for students to adopt new initiatives and perceive that they can promote the desired changes³. Therefore, not ignoring other possible opportunities for the development of undergraduate scientific research activities, but understanding that the final research project is a singular opportunity that certainly all future nutritionists will experience, we recommend that this activity be developed by a single student.

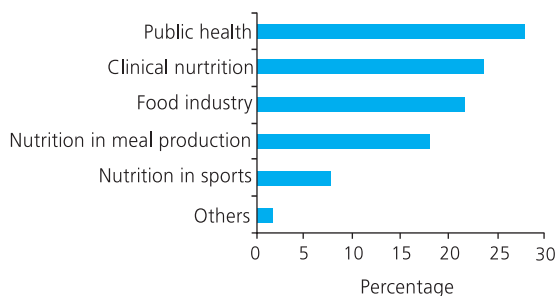


Figure 1. Area of study interest of final research projects in Nutrition courses in the state of Rio Grande do Norte, Brazil, 2013/2014.

According to the results related to the study design of final research projects, we observed that most research projects conducted quantitative studies. They were more frequently cross-sectional studies due to the limited time for the development of final research projects.

According to Freitas *et al.*²², studies in nutrition, in general, express the hegemony of the biomedical paradigm and, from a philosophical point of view, the field adopted the positivist way of thinking, researching and acting. Positivist approaches consider research as scientific if it is based on experience and data observation using sophisticated measurement instruments to understand objectively the magnitude and causes of social phenomena, with no interest in the subjective dimension²³.

In reference to the first studies published in the field of nutrition, Freitas *et al.*²² pointed out that the production of knowledge was, for more than fifty years, hegemonically inspired by clinical research such as laboratory, epidemiological and food technology studies, *i.e.*, obvious approaches in the field of natural sciences.

The dominance of the quantitative approach was also observed in a recent study published by Vasconcelos²⁴, who studied theses and dissertations produced by postgraduate students in nutrition programs in Brazil between 2002 and 2013. This study found that 92.5% of the theses preferred the quantitative methodological approach.

In general, laboratory studies were the most common study setting (25.6%), researching new raw materials or food preparations. In the field of education, the responsibilities of academic and scientific training need to be in compliance with the public interest, that is, the dissemination of knowledge produced by services, social movements and popular practices must be taken into account when producing knowledge and furthering scientific, technological and cultural advances²⁵. According to Ceccim & Feuerwerker²⁵ “technical-professional training, knowledge production and the provision of services by educational institutions only make sense when they are socially relevant” (p.47).

Of the total final research projects, 49.2% were conducted without the need for submission to the research ethics committee and the most of them were related to food or literature review. Sixteen final research projects (8.2%), in some respect, approached humans or animals in its methodology and didn't make reference to the approval by a ethics committee in research or signing a free and informed consent form.

In Brazil, resolution n° 466 from December 12, 2012, which regulates research involving humans, defines research as the direct or indirect participation of individual or collective participants, including the management of data, information or biological materials²⁶. Breeding or using animals for teaching and scientific research is regulated by law n° 11.794 from October 8, 2008²⁷. According to Silva *et al.*²⁸, the ethical notion associated with research is beyond compliance with formal research protocols for, if reduced to a contract between researcher and participant, research will fail to fulfill its main role that is to enable the researcher to reflect on the ethical aspect of scientific production. It may be that many final research projects did not submitted their studies to the research ethics committees because the process is slow and undergraduate students may delayed if many aspects of their study require revision.

The result of the keyword analysis showed great variability and, in general, low adequacy. DeCS consists of a structured and trilingual vocabulary (English, Portuguese and Spanish) to serve as a unique language for indexing articles in scientific journals, books, conference proceedings, technical reports, and other materials and used to search and retrieve themes from the scientific literature in information sources available in the Virtual Health Library, providing a consistent and unique way for information retrieval, irrespective of the language²⁹.

This result contrasts with the variable type of study, as most research projects were scientific articles, which indicates possible weakness in the methodological preparation for the development of final research project.

The analysis of area of study interest of final research projects were significantly related to public health (27.7%). When analyzing the knowledge area related to natural sciences, represented by the sum of the frequency of studies in clinical nutrition and food industry, we found that 45.1% final research projects were dedicated to these areas of study interest. In view of the beginning of the Brazilian nutritionist training process, idealized by the medical field, the early years of the Nutrition field was centered in the Health Sciences area and characterized at first as a biological science³⁰.

Scientific articles from the *Arquivos Brasileiros de Nutrição* (Brazilian archives of Nutrition), one of the first documentary sources in the history of nutrition, showed that 64% of the articles (from 1944 to 1968) were conducted from a biological perspective of nutrition, considered by the author as basic and experimental nutrition, food science and technology, clinical nutrition (including physiology, pathology and diet therapy) and nutrition and dietetics; while 36% were from a social perspective, characterized by nutritional assessment of populations, policy and planning in food and nutrition, nutritional epidemiology, determinants of nutritional status of populations and nutrition education. These results showed

that, during the existence of the journal, the biological perspective drove the production and dissemination of knowledge in Nutrition, corresponding mostly to laboratory research about the chemical composition and nutritional value of Brazilian food³¹.

Between the 1970s and 1980s, the period was marked by the intensification of scientific and technological developments in the food industry and Nutrition became associated with two other fields of knowledge: Food Technology and Food Engineering³⁰. This interaction can be found in our results since 21.5% of the final research projects were dedicated to issues related to the food industry, exceeding the number of studies in meal production (18.0%), which is one of three major areas of the nutritionist. Vasconcelos³⁰ conducted a historical analysis and pointed out that nutrition is now being considered from a social and environmental perspective in addition to the biological dimension, currently being a multidisciplinary field of knowledge shared by different sciences and professionals and included in Biological Sciences, Social Sciences and Science of Food and Nutrition.

According to Morin⁹, 'for a long time people believed that the error of humanities and social sciences was not able to eliminate the apparent complexity of human experiences to elevate the status of natural sciences that simply created simple laws, simple principles and, according to its concepts, maintain determinism. At present there seems to be a crisis for simple explanation in biological and physical sciences: what seemed to be a non-scientific residue of human sciences, uncertainty, disorder, contradiction, plurality, complication etc, is now part of a general problem of scientific knowledge'.

A survey, conducted from 2000 to 2008, about the number of studies related to food in Brazil revealed a significant increase in research groups that investigated food and nutrition, reaching 1,003 groups in 2008, which corresponded to 4.4% of all research groups in the country. Among the objectives of the research groups, we identified studies related to specific

aspects of food (production, processing for consumption, sanitary quality, chemical composition), physiological or biochemical processes related to "nutrition" of healthy or ill people, issues related to the food, eating as a socially constructed phenomenon, and different combinations of the three previous possibilities³².

According to study of Vasconcelos²⁴, from 2002 to 2013, the majority of theses and dissertations in postgraduate programs were related to nutrition in public health (33.0%) and clinical nutrition (30.0%), followed by basic and experimental nutrition (15.3%) and food science and technology (13.7%), and finally, meal production (5.0%) and social and humanity sciences in food and nutrition (3.0%).

Aside from methodological specificities, these results are similar to those found in the present study as most areas of study interest were related to public health and clinical nutrition.

No final research projects related to teaching or food marketing and nutrition were found. According to Costa¹⁹, professors should observe the professional exercise and encourage students to discuss the political aspects of the profession and their practice in society so students can perceive themselves as citizens and professionals. Marketing is recognized as an area of expertise of the nutritionist and is among the specific competencies and abilities described in the national curricular guidelines².

The analysis of the academic degrees of professors showed that most projects were advised professors who had a Master's degree. According to Recine & Mortoza³³, the rapid increase in the number of nutrition courses over the last decade created the demand for professors that cannot be adequately met, leading to a high turnover of professors, poor postgraduate training, among others.

The study of Souza *et al.*³⁴ highlighted the context of the increasing demand for undergraduate professors, mainly by private institutions, which matches the profile of professors with a Master's degree. Consequently, professors are paid per hour work under

precarious work conditions, accumulating teaching activities and activities related to production knowledge, research and outreach programs.

CONCLUSION

According to the results, the quantitative approach was the most predominant among final research projects. The methodological approaches of the research projects were considered weak, which suggests the need to improve the quality of scientific methodology during undergraduate studies, considering the important benefits derive from researches as an active methodology.

Public health was the most significant area of study interest, which shows that the social perspective of Nutrition has become more significant than the biological perspective.

This indicates the importance of bibliometrics as a methodological possibility to study other areas of knowledge, whether within the context of scientific production established by the national curricular guidelines or not.

We suggest that further studies be conducted focusing on the quality of scientific production as established by the national curricular guidelines, promoting epistemological debates in Philosophy of Science and Sociology of Knowledge.

CONTRIBUTORS

TB MENÊZES planned the study design, conducted the literature review, collection and data analysis and wrote the article. LSB BORGES and LM SANTOS analyzed the data and reviewed the article. LRA NORO planned the study design, analyzed the data and reviewed the article.

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Received: March 20, 2015
Final version: June 23, 2015
Approved: September 30, 2015

