

# Scientific production of researchers in the Nutrition field with productivity fellowships from the National Council for Scientific and Technological Development

## *Perfil e produtividade de pesquisadores da área de Nutrição bolsistas do Conselho Nacional de Desenvolvimento Científico e Tecnológico*

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### ABSTRACT

#### Objective

To characterize researchers in the Nutrition field awarded with *Conselho Nacional de Desenvolvimento Científico e Tecnológico* research productivity fellowships and evaluate their scientific production according to an analysis of curricula registered on the Lattes Platform.

#### Methods

The study is cross-sectional and descriptive in scope, and was developed from October 2014 to February 2015. The productivity fellowships/*Conselho Nacional de Desenvolvimento Científico e Tecnológico* researchers were identified from the Lattes Platform, and their curriculum lattes were downloaded for data collation. Information on the profiles of the researchers and the bibliometric data of productivity (published articles, articles and citations registered on ISI/Web of Science and Scopus databases, impact of the publications, and academic advising) were collected.

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## Results

Eighty researchers were identified and evaluated. A total of 67.5% were female and 53.5% were classified as category 2. Approximately two-thirds (65.0%) were located in Southeastern Brazil. The sum of articles published by the researchers from the beginning of their career until the end of the study came to 7,358 (median=84 per researcher, interquartile range=53–285). Of these publications, 45.0% were indexed in the Web of Science and 62.0% in Scopus. Of the journals where the articles were published, 70.0% had an impact factor.

## Conclusion

Most publications were performed in journals with an impact factor, indicating the influence of Brazilian nutrition studies on society and their potential for guiding public policies on nutrition and health.

**Keywords:** Bibliometry. Nutrition. Research personnel.

## RESUMO

### Objetivo

*Caracterizar pesquisadores da área de Nutrição cadastrados como bolsistas de produtividade em pesquisa junto ao Conselho Nacional de Desenvolvimento Científico e Tecnológico e avaliar sua produção científica através da análise de currículos cadastrados na Plataforma Lattes.*

### Métodos

*Trata-se de estudo transversal e descritivo, desenvolvido no período de outubro de 2014 a fevereiro de 2015. Os pesquisadores bolsistas produtividade em pesquisa/Conselho Nacional de Desenvolvimento Científico e Tecnológico foram identificados na Plataforma Lattes e seus currículos obtidos para coleta de dados. Foram coletadas informações do perfil dos pesquisadores e dados bibliométricos de produtividade (artigos publicados, artigos e citações cadastradas nas bases de dados ISI/Web of Science e Scopus, impacto das publicações e orientações acadêmicas).*

### Resultados

*Foram identificados e avaliados 80 pesquisadores, 67,5% eram do sexo feminino e 53,5% bolsistas na categoria 2. Aproximadamente dois terços (65,0%) estavam localizados na região Sudeste do país. A soma de trabalhos publicados por eles do início da carreira até o término da pesquisa foi de 7 358 (mediana=84 por pesquisador, intervalo interquartil=53–285). Desses, 45,0% foram indexados no Web of Science e 62,0% no Scopus. Dos periódicos das publicações, 70,0% possuíam fator de impacto.*

### Conclusão

*A publicação da maioria dos trabalhos em periódicos com impacto indica a expressão das pesquisas em Nutrição brasileiras para a sociedade e seu potencial em influenciar políticas públicas de alimentação e saúde.*

**Palavras-chave:** Bibliometria. Nutrição. Pesquisadores.

## INTRODUCTION

Nutrition is a multidisciplinary science, characterized by the integration of biological, social, and environmental dimensions [1]. According to The Global Nutrition Report [2], suitable food and nutrition are basic requirements for health promotion and protection, as well as for sustainable development. Adequate food is, in fact, an essential part of the hunger and poverty eradication programs of the World Health Organization, such as the Millennium

Development Goals [3]. Nutrition is, therefore, a fundamental area for the development of public policies and the agenda of international organizations focused on human development and the planet's sustainability [4].

Nutrition was only recognized as an area of knowledge by the *Coordenação de Aperfeiçoamento de Pessoal de Nível Superior* (CAPES, Coordination of Improvement of Higher Level Personnel) in 2011. Today, it is included among the 48 areas that make up the National Graduate System [5] and, although a complex

and heterogeneous area, its study has been expanding in the country [6]. In 2016, CAPES listed 28 programs and 40 postgraduate programs specifically associated with the area of nutrition. The latter comprises 25 masters, 12 PhDs, and 3 professional masters' programs [5]. This growth has been followed by a significant increase in Brazilian academic production in the field of Nutrition [7]

The investment policies focused on Brazilian researchers have also contributed to research advances in Nutrition. Among the incentives is the Productivity Research Grant provided by the *Conselho Nacional de Desenvolvimento Científico e Tecnológico* (CNPq, National Council for Scientific and Technological Development). According to the normative criteria established by CNPq, productivity research grants are classified into three levels: Level 1, Level 2, and Senior, with Level 1 being subdivided into four categories: 1A, 1B, 1C, and 1D [8]. As recognized by the government and the scientific community, researchers with productivity research grants should be systematically evaluated. Such a continuous analysis allows for the development of tools for the definition of guidelines, allocation of investments and resources, program formulation, and evaluation of activities related to scientific and technological development according to each activity area in Brazil [9].

Several studies [10-16] have analyzed the profiles and scientific production of researchers with productivity research grants in different areas of knowledge. The bibliometric indicators used in these studies include the number of people who have received academic or scientific qualifications, the number of patents registered by scientists, the number of scientific articles published, the number of scientists who have published scientific articles, the number of bibliographical references cited in scientific articles, the number of citations per scientific article, the number of research grants awarded to scientists, and the amount of resources

allocated to the research activities promoted by the various agencies [17]. It is also important to know the profile of the researchers and to examine their area of research, professional experience, and contribution to training new professionals. However, there are still no quantitative or qualitative indicators for the scientific productivity of researchers in the field of Nutrition in Brazil [18].

Nutrition is a strategic area for the development of teaching and research as well as for public health, where professionals are active in Primary Health Care teams. Therefore, knowledge of the scientific performance of researchers in Nutrition is key, both to analyze the current status of the area and to design future scenarios. In this context, this study is aimed at characterizing professionals in the field of Nutrition with productivity research grant/CNPq grants and evaluating their scientific production through an analysis of curricula registered on the Lattes Platform.

## METHOD

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This is a cross-sectional and descriptive study, developed between October 2014 and February 2015. The data were obtained during the period of the study from the curricula of professionals identified from the productivity research grant/CNPq grants list available on CNPq's website [17]. The following search filters were used: Country=Brazil; States=All; Institutions=AllInstitutions; Large Areas=All Large Areas; Areas=Nutrition; Modalities=Productivity in Research; Levels=All Levels. The curricula of 80 researchers available on CNPq's [19] Lattes Platform were analyzed. The curricula were checked to determine whether they were up to date.

The curricula were then analyzed to characterize the researchers and collect bibliometric data regarding their scientific production, following previous studies [10-13,20]. The characterization of the researcher consisted of determining

their gender, degree, the type of grant (2, 1A, 1B, 1C, 1D or senior) received, the federative unit (professional address), the institution and country where the PhD (*stricto sensu*) was obtained and the postdoctoral studies were developed, the number of years of experience after completing their PhD (*stricto sensu*), and the research area based on the categories of the Lattes Platform (Nutrition, Biochemistry of Nutrition, Epidemiology, Public Health, and Maternal and Child Health). Analysis of the *ratio* of the number of productivity research grant fellows per inhabitant of each state was also performed based on *Instituto Brasileiro de Geografia e Estatística* data [11,21].

Scientific production was determined by each researcher's number of publications during their career, including articles, books, and book chapters. The quantity of papers in indexed journals and of article citations in the ISI/Web of Science and Scopus databases was evaluated. The articles published in journals with an impact factor were also assessed. Evaluation of the academic career was based on the number of supervised researchers, including scientific initiation students and masters, PhD, and postdoctoral researchers.

The data were organized on a spreadsheet (Microsoft Excel) and then analyzed with the Statistical Package for the Social Sciences (SPSS Inc., Chicago, Illinois, United States) program for Windows, version 21.0. A descriptive statistical analysis was performed and the absolute frequency and percentage of the variables investigated were calculated. Regarding bibliometric data (number of scientific articles, number of supervised students and researchers, and publications and citations indexed in the databases) the mean, median, and Interquartile Ranges (IQ) were calculated between the percentiles 25 and 75.

## RESULTS

The curricula of the 80 investigated productivity research grant/CNPq research fellows

in the Nutrition field were as follows: 67.5% (n=54) were female; 51.2% held a degree in Nutrition, and the remaining had degrees in Medicine (26.2%), the Biological Sciences (8.8%), Pharmacy (2.5%), or Physical Education (2.5%). There were no senior fellows, and 52.5% were classified as Level 2 (Table 1).

The researchers considered in the study came from 13 different Brazilian states (Table 2). Approximately two-thirds (65.0%) were from the Southeast region, with 36.3% working in *São Paulo*, 17.5% in *Rio de Janeiro*, and 11.3% in *Minas Gerais*. In the Northeast region, where 21.3% of the researchers were found, 15.0% worked in *Pernambuco*. The lowest percentage of researchers was recorded in the South and Center-West regions (11.3% and 2.6% respectively). Productivity research grant/CNPq research fellows in the area of Nutrition in the Northern region were not identified.

Analysis of the researchers' affiliations showed that 26.3% of them were from the *Universidade de São Paulo* (USP), 12.5% from the *Universidade Federal do Pernambuco* (UFPE), 7.5% from the *Universidade Federal de São Paulo* (Unifesp), 7.5% from the *Universidade Federal do Rio de Janeiro* (UFRJ), 6.3% from the *Universidade Federal de Santa Catarina* (UFSC), 6.3% from the *Universidade do Rio de Janeiro*

**Table 1.** Distribution of research productivity fellows in nutrition according to data collected between October 2014 and February 2015 and following the categorization by the *Conselho Nacional de Desenvolvimento Científico e Tecnológico*.

Productivity grants category	n	%
2	42	52.5
1D	22	27.5
1C	4	5.0
1B	5	6.3
1A	7	8.8
Senior	0	0.0
Total	80	100

Source: <http://www.cnpq.br/documents/10157/5f43cefd-7a9a-4030-945e-4a0fa10a169a>

**Table 2.** Geographic distribution (states of the federation) of *Conselho Nacional de Desenvolvimento Científico e Tecnológico* research productivity fellows in Nutrition based on data collected between October 2014 and February 2015.

State of the Federation	n	%	Population*	Grants/Million inhabitants
São Paulo	29	36.3	44,749,699	0.65
Rio de Janeiro	14	17.5	16,635,996	0.85
Pernambuco	12	15.0	9,410,336	1.27
Minas Gerais	9	11.3	20,997,560	0.43
Santa Catarina	5	6.3	6,910,553	0.72
Rio Grande do Sul	4	5.0	11,286,500	0.35
Distrito Federal	1	1.3	2,977,216	0.34
Bahia	1	1.3	15,276,566	0.06
Rio Grande do Norte	1	1.3	3,474,998	0.29
Piauí	1	1.3	3,212,180	0.31
Mato Grosso do Sul	1	1.3	2,682,386	0.37
Ceará	1	1.3	8,963,663	0.11
Alagoas	1	1.3	3,358,963	0.30
Total	80	100.0	206,081,432	0.14

Source: \*Instituto Brasileiro de Geografia e Estatística [21].

(UERJ), 3.8% from the *Universidade Federal de Viçosa* (UFV), 3.8% from the *Universidade Federal de Minas Gerais* (UFMG), and 3.8% from *Universidade Estadual de São Paulo* (Unesp) (Table 3).

With respect to the researchers' experience after completing their PhDs (*stricto sensu*), the mean was 18 years (IQ=10–39 years). Among them, 38.8% attended the *stricto sensu* program at the USP and 10.0%, the Unifesp, representing, therefore, almost half of the PhDs. More than half of the researchers (58.8%) conducted postdoctoral studies, most of them abroad. Regarding the area of specialization described in the curricula, 27.2% of the professionals worked in nutrition, 22.0% in nutrition biochemistry, 12.5% in epidemiology, 7.5% in public health, and 5.0% in maternal and child health.

Analysis of the *ratio* of the number of productivity research grant fellows per inhabitant showed that the national average was 0.14 per million inhabitants. The states of *Bahia* and *Ceará* showed a lower *ratio* than the national average, with an average of 0.06 and 0.11 per

million inhabitants respectively. The average of the other 11 regions was much higher than the national average, varying between 0.29 and 1.27 researchers per million inhabitants.

The productivity indexes displayed in Table 4 show the descriptive measures of the publication of scientific articles of productivity research grant/CNPq research fellows in Nutrition and of their participation in the training of human resources. During the period of the academic career considered in the study, the researchers published 7,358 articles in scientific journals, ranging from 25 to 310 articles per researcher (median=84 articles per researcher, IQ=53–285).

Among the articles published over the period, 3,316 (approximately 45%) were indexed in the ISI/Web of Science database (median=33 per researcher; IQ=32–161) and 4,542 articles (about 62%) were indexed in the Scopus database (median=48.5 per researcher; IQ=37–204). It was observed that 5,166 articles (70%, median=61 per researcher, IQ=34–205) were published in journals evaluated by the impact factor index.

**Table 3.** Distribution of *Conselho Nacional de Desenvolvimento Científico e Tecnológico* research productivity fellows in Nutrition by institution based on data collected between October 2014 and February 2015.

Higher education institution	n	%
<i>Universidade de São Paulo</i>	21	26.3
<i>Universidade Federal de Pernambuco</i>	10	12.5
<i>Universidade Federal de São Paulo</i>	6	7.5
<i>Universidade Federal do Rio de Janeiro</i>	6	7.5
<i>Universidade Federal de Santa Catarina</i>	5	6.3
<i>Universidade do Estado do Rio de Janeiro</i>	5	6.3
<i>Universidade Estadual Paulista</i>	3	3.8
<i>Universidade Federal de Minas Gerais</i>	3	3.8
<i>Universidade Federal de Viçosa</i>	3	3.8
<i>Universidade Federal de Pelotas</i>	2	2.5
<i>Universidade Federal Fluminense</i>	2	2.5
<i>Instituto de Medicina Integral Professor Fernando Figueira</i>	2	2.5
<i>Universidade Federal de Ouro Preto</i>	2	2.5
<i>Universidade Federal da Bahia</i>	1	1.3
<i>Universidade Federal do Rio Grande do Norte</i>	1	1.3
<i>Universidade Federal do Rio Grande do Sul</i>	1	1.3
<i>Universidade de Brasília</i>	1	1.3
<i>Universidade Federal do Piauí</i>	1	1.3
<i>Universidade Federal do Mato Grosso</i>	1	1.3
<i>Universidade Federal de Ciências da Saúde de Porto Alegre</i>	1	1.3
<i>Universidade Federal de Alagoas</i>	1	1.3
<i>Universidade Federal do Ceará</i>	1	1.3
<i>Universidade do Vale do Rio dos Sinos</i>	1	1.3
Total	80	100.0

**Table 4.** Descriptive measures of the publication of scientific articles and training of human resources based on data from *Conselho Nacional de Desenvolvimento Científico e Tecnológico* research productivity fellows in Nutrition collected between October 2014 and February 2015.

Variables	Production Modes	Quantity	Mean	Standard Deviation
Publication of scientific articles	Scientific articles	7,358	91.98	46.870
Human resources supervision	Scientific Initiation supervision	1,746	21.83	18.053
	Masters supervision	1,847	23.09	12.970
	PhD supervision	775	9.69	7.640
	Postdoctoral supervision	72	0.90	1.658
Total		4,440	55.50	29.100

The researchers' publications were cited 31,585 times in the WoS database (median=256.5, IQ=397–2,351, from 1 to 2,352 citations) and 48,318 in Scopus (median=409, IQ=509–3,704; 3,706 quotes). The median of the most cited

article in WoS was 50 citations (IQ=68–701), and in Scopus was 59 citations (IQ=55–866).

Evaluation of the academic career over the period of the study showed that the researchers supervised 1,746 scientific



initiation fellows (median=20, IQ=20–106) and 1,847 masters (median=21.5, IQ=16–68) and 775 PhD theses (median=8; IQ=10–36), as well as 72 postdoctoral projects (median=0.1; IQ=1–8) (Table 4).

## DISCUSSION

This study provides scientific production indicators for productivity research grant/CNPq research fellows in Nutrition and identifies some characteristics that help to characterize this population. In Brazil, both as a science and as a profession, Nutrition is a relatively new field [22]. Therefore, the collected data are essential for a current analysis of this area of knowledge. Although a previous study showed an increase in the number of nutrition researchers and scholars between 2000 and 2008 [23], the present study is unprecedented with respect to analyzing data from the curricula of productivity research grant/CNPq research fellows available on the Lattes Platform. The latter is a national standard system in the registration of the academic and professional activities of the scientific community implemented and maintained by the Brazilian government for the management of information of an internationally recognized quality related to researchers, institutions, and research activities in the country. Although the curricula currently available on the Lattes Platform are considered a standard for the evaluation of researchers [24], this system has some limitations since the information is provided by the users. Thus, the accuracy of the information, as well as its updating, depends exclusively on the researchers.

Regarding the analysis of the profile of the productivity research grant/CNPq researchers in Nutrition, a predominance of females was observed. Analysis of the profile of the performance of nutritionists in Brazil performed by the Federal Nutrition Council in 2005 identified a feminization of the profession, with 96.5% shown to be women. The predominantly

female performance among productivity research grant/CNPq fellows was also reported in the areas of Nursing [10] and Physiotherapy [25], which also share the characteristic of being dominated by females. In this study, however, it was not possible to associate the greater participation of women exclusively with the nutritionist profession since many of the evaluated researchers graduated in other areas, especially Medicine. According to Guedes *et al.* [26], the country's general situation reflects how men continue to represent the majority of the grant holders, although there is a clear trend of greater numbers of female researchers, suggesting a change in this scenario. It is also necessary to consider the multidisciplinary nature of postgraduate courses in nutrition, which receive health professionals from different backgrounds and different *ratios* of men and women.

Most of the productivity research grant/CNPq nutrition researchers are located in the Southeast region of Brazil, especially in the state of *São Paulo*, consistent with studies on researchers in other areas of knowledge [12,13,27]. This fact may be related to the historical concentration of graduate courses in nutrition in this region [1,7]. Historically, the first seven institutions to create undergraduate courses in nutrition in Brazil were the USP, the *Universidade Federal do Estado do Rio de Janeiro*, the *Universidade do Estado do Rio de Janeiro* (UERJ), the UFRJ, the *Universidade Federal da Bahia* (UFBA), the UFPE, and *Universidade Federal Fluminense* (UFF) [1]. These institutions nowadays hold most of the productivity research grant/CNPq researchers in Nutrition in the country, and this should be associated with the fact that they have been working in this area for longer periods. The distribution of Brazilian scientific production in different areas of knowledge varies in different regions of the country [28], reinforcing the results of this study on Nutrition.

According to Sacco *et al.* [16], surveys that show gender disparities in professional performance and in the distribution of researchers

and research grants at different institutions are required to reevaluate the distribution of their resources. These authors also stress that the surveys should be carried out periodically to evaluate the evolution of productivity indicators and the area as a whole. It is also important to emphasize the need to develop networks of scientific collaboration in the formulation of science, technology, and innovation policies in Brazil since this integration promotes the quality and regional expansion of scientific activity and, consequently, the development of less favored regions [28].

The relative number of productivity research grant/CNPq research fellows in Nutrition (per million inhabitants) is still low compared to areas like Medicine [11] and Chemistry [29]. This can be expected since the area of Nutrition is relatively new. With its expansion, it can be expected that the number of researchers in the area will increase as well as the resources allocated for research.

The productivity of the scientific community can be evaluated by quantitative bibliometric indicators, reflected in the number of publications and impact indicators, which are based on the number of citations of publications, characterizing the importance of this scientific production according to the recognition granted by other researchers [18]. The impact factor is also used by funding agencies and by CAPES to qualify professionals and degrees, as well as to qualify and define research policies [30]. A study on scientific production in nutrition by Vasconcelos [31], published by the SciELO according to an evaluation by the CNPq, analyzed the scientific production of nutrition and found that most of the publications (62.4%) had no impact factor, as measured by Journal Citation Reports. In this study, the bibliometric data on the productivity research grant/CNPq researchers in Nutrition were much more expressive, reaching 70.0% of articles published in journals with an impact factor. This indicates that to achieve quantitative indicators

of quality, the publications were not restricted to specific Nutrition periodicals. It is suggested that future studies should evaluate the main journals selected by productivity research grant/CNPq researchers in Nutrition and their selection criteria.

Along with the publication of scientific articles, the training of human resources is an important criterion for the evaluation of candidates for research grants [14,32]. As expected for productivity research grant/CNPq researchers, those evaluated in the present study were qualified to train new professionals. This was confirmed by the number of supervisions carried out, from scientific initiation to postdoctoral studies, which can be considered to be high when compared to the results of studies on human resources training in Brazil in the areas of Nursing [13] and Pediatrics [33].

The results allow for a better understanding of Nutrition and can assist in the devising of strategies for new investment policies to enhance the country's overall scientific production.

## **CONCLUSION**

The productivity research grant/CNPq research population in nutrition considered in the period of the study showed a predominance of female fellows and of category 2 researchers. The researchers were found to be concentrated in the Southeast region of the country. The publication of 70% of the scientific articles in impact-oriented journals indicates the influence of Brazilian nutrition research on society and its potential for influencing food and health public policies.

New studies with similar methodologies may be important for characterizing the Brazilian scientific production in the Nutrition field and other areas of knowledge since there are few national studies on the profile of the scientific production generated by CNPq scientific productivity fellows. In addition, for a more practical application of the



results yielded, a continuation of the present study should contemplate the impact of the publications according to different themes in nutrition, identifying the strengths and weaknesses that should lead the way with respect to incentives for new research projects.

## CONTRIBUTORS

L PINHO contributed to the design and execution of the study, the data analysis and interpretation, and the writing of the article. H MARTELLI-JÚNIOR and EA OLIVEIRA contributed to the design and planning of the study, the data analysis and interpretation, and the writing and revision of the article. DRB MARTELLI, H MARTELLI-JÚNIOR and EA OLIVEIRA contributed to the design and planning of the study, the data analysis and interpretation, and the writing and revision of the article.

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