

Profile and scientific production of Brazilian researchers in dentistry

Perfil e produção científica dos pesquisadores brasileiros em Odontologia

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ABSTRACT:

Aim: The present study seeks to investigate the profile and scientific production of Brazilian researchers in dentistry from the National Council for Scientific and Technological Development (CNPq). **Methods:** An observational study was conducted. The sample consisted of productivity researchers from CNPq with fellowships awarded in February 2013. Data were collected from Lattes Curriculum. Analyzed parameters corresponded to the years 2011 and 2012. **Results:** The sample consisted of 209 researchers. Most of the researchers were male, who received a category 2 fellowship, distributed in 12 Brazilian States. Regarding the area of expertise, most of the researchers worked in dentistry clinics, oral pathology, and periodontics. A predominance of publications was found in Qualis B journals and in the supervision of scientific initiation. **Conclusion:** The results of this study reveal both a significant contribution from dentistry researchers towards the consolidation of national scientific production as well as the updating of information regarding dentistry production.

Uniterms: Dentists. Dental research. Scientific publication indicators.

INTRODUCTION

The aim of scientific research is to improve human welfare through the advancement of knowledge or mere human satisfaction before the “necessity of knowledge” recognized as an enhancer of world development and economic growth¹. Bibliometric indicators point to changes that happened in the scientific research panorama due to the expansion in international and Brazilian scientific production^{2,3}. Although the increase in scientific production is clearly measurable, Brazil is still behind countries such as The United States, the United Kingdom, and Japan in terms of publication, when considering quantitative and qualitative criteria⁴. Conducting bibliometric studies or assessment of scientific production allows for the identification of groups and areas of academic excellence towards the construction of knowledge.

Scientific production indicators have been increasingly important as a tool for analysis of scientific activity. The construction of quantitative

indicators of scientific production has been encouraged by research funding agencies in order to achieve a better understanding of the orientation and dynamics of science, and thus subsidize the planning of scientific policies and assess their results⁵. The expansion in international and Brazilian scientific production leads to a considerable increase in competition for research funding. A representative portion of Brazilian scientific production comes from the National Council for Scientific and Technological Development (CNPq) researchers³. The quantitative increase in the productivity of Brazilian researchers possibly reflects the various incentive mechanisms that have been implemented by Brazilian research agencies. Among these mechanisms, the development of national graduate school programs and the granting of research productivity fellowships from CNPq stand out as a means through which to motivate researchers with a doctoral degree⁶. The criteria for fellowship selection and classification include scientific

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production; human resource training; contributions to innovation, coordination, and participation in research projects; as well as participation in editorial activities and scientific management⁶. Scientific production in dentistry has witnessed its greatest increase in the area of Brazilian healthcare⁴.

In Brazil, dentistry stands out as one of the core areas in terms of scientific production and training in human resources². Prior studies have been aimed at evaluating scientific production in the field of dentistry in Brazil^{4,7,8}, as well as the evaluation of similar scientific production in other countries^{1,9}. These assessments take a certain time interval into account. The updating of information regarding the production and profile of Brazilian researchers is of utmost importance to foster the implementation of scientific development policies to keep pace with the current growth of national scientific work, especially in the area of dentistry. In this context, the present study proposes to investigate the profile and scientific production of Brazilian CNPq researchers in the field of dentistry.

METHODS

This research was a cross-sectional, observational, descriptive-analytical study that made use of secondary data. The samples consisted of CNPq dentistry fellowship researchers, with productivity fellowships awarded in February 2013¹⁰. These fellowships are granted to researchers who stand out among their peers in order to enhance their scientific production according to normative criteria established by CNPq. The criteria established by CNPq to grant fellowships includes: candidate's scientific production; training in human resources at a graduate level; contributions in science, technology, and innovation; coordinating or leading participation in research projects; participation in editorial and scientific management; and the administration of institutions and/or centers of scientific and technological excellence. The researchers with fellowships are categorized according to requirements established by the funding agency: 1A, 1B, 1C, 1D, and 2. In addition to these categories, CNPq also supports researchers who stand out among their peers as leaders and paradigms in their field of expertise by granting a Senior Productivity fellowship (SR). Researchers whose fellowships have been suspended due to internships or post-doctoral research conducted abroad, or due to their appointment to a position in a CNPq group of Management and Superior Advisory, were excluded from the sample.

The information regarding the profile and scientific production of researchers was collected from the Lattes platform from CNPq¹¹. A database was constructed based on information from Lattes Curricula related to: gender, fellowship category (2,

1A, 1B, 1C, 1D, and SR), geographic distribution, specialization courses, affiliated institution, institution where graduate degree was obtained, area of expertise, doctoral completion time, Ph.D. completion, doctoral and post-doctoral institution, papers published in journals (Qualis A, B, and C), book or chapter authorship, member of editorial committee, journal editor, scientific initiation, Masters and Doctoral degree, post-doctoral supervision, and participation and/or research group coordination. The division of the Qualis ranking in international and national journals was conducted according to the location where the journal is published, according to BIREME (Portal of Scientific Journals). After this, the sum of the average of the national journals in each Qualis with the average of the journals from other countries in each Qualis was calculated.

The Portal, WebQualis, from the Coordination for the Improvement of Higher Education Personnel (CAPES), was used as a parameter to evaluate the journals¹². The correct name or ISSN of journals was used to check the Qualis ranking. The stratum in the area of dentistry was considered to be an evaluation criteria. When that stratum was nonexistent, the interdisciplinary stratum of CAPES, as it is an area that covers different academic areas, including dentistry, was taken into account, excluding those that have no strata in the evaluation area, or no ISSN nor name results could be identified. The researchers' area of expertise was either determined by that described in their curriculum or by the area of expertise informed on the text in the researcher's profile. The area with the highest number of publications was used for those who reported working in more than one field during the years of evaluation.

All parameters corresponded to the years 2011 and 2012. Data were collected between February and April 2013.

Statistical analyses were carried out using the Statistical Package for the Social Sciences (SPSS) 17.0. Absolute frequency (n), relative frequency (%), and mean measures were included in the descriptive analysis. The Pearson chi-square test was used in bivariate tables. The significance level used in the decision for statistical tests was 5% (0.05).

RESULTS

Researchers' profile

The study sample consisted of 209 researchers who received a productivity category 2 fellowship, from CNPq, distributed in 12 Brazilian states, with a title of specialist (Table 1). The ratio of men to women for the total sample of researchers was 1.5:1. The distribution of researchers according to gender and category was statistically significant ($p=0.014$), and most researchers held an overseas postdoctoral degree.

Table 1 – Characterization of CNPq dentistry researchers regarding category, state, postdoctoral degree, and member of a research group. n = 209.

Variables	n	%
Researcher category		
1A	15	7.2
1B	22	10.5
1C	19	9.1
1D	27	12.9
2	124	59.3
SR	2	1.0
Federation State		
São Paulo	137	65.6
Minas Gerais	19	9.1
Rio Grande do Sul	16	7.7
Rio de Janeiro	10	4.8
Goiás	6	2.9
Bahia	5	2.4
Paraná	4	1.9
Rio Grande do Norte	4	1.9
Pernambuco	3	1.4
Paraíba	2	1.0
Sergipe	2	1.0
Ceará	1	0.5
Specialist course		
Yes	106	50.7
No	103	49.3
Postdoctoral degree concluded		
Yes	101	48.3
No	108	51.7
Member of a research group		
Yes	206	98.6
No	3	1.4

Source: Lattes Platform.

Most researchers had an overseas postdoctoral degree. However, as regards the doctoral degree, the opposite was true (Table 2).

Table 2 – Description of research fellows' productivity according to the category related to gender, doctoral degree completion time, and researchers' doctoral and postdoctoral institutions. n = 209.

(continua)

	Researcher category						Total (%)	p Value
	1A	1B	1C	1D	2	SR		
Gender								
Female	4	6	7	4	61	1	83 (39.7)	0.014
Male	11	16	12	23	63	1	126 (60.3)	

(conclusão)

	Researcher category						Total (%)	p Value
	1A	1B	1C	1D	2	SR		
Doctoral degree completion time *								
Up to 10 years	0	0	1	4	41	0	46 (22.1)	0.000
11 to 20 years	5	16	14	18	72	0	125 (60.1)	
20 years or more	10	6	4	5	11	1	37 (17.8)	
Researchers' doctoral institution *								
Brasil	14	20	19	24	118	1	196 (94.2)	
Abroad	1	2	0	3	6	0	12 (15.8)	
Researchers' postdoctoral institution **								
Brazil	0	2	0	1	21	0	24 (23.8)	0.007
Abroad	7	11	12	12	35	0	77 (76.2)	

*n = 208 / ** n = 101 (only researchers that hold a postdoctoral degree). Source: Lattes Platform.

Regarding the area of expertise, most researchers worked at dental clinics, in oral pathology, and in periodontics. The area of expertise was statistically significant with regard to the researchers' category (Table 3).

Table 3 – Description of research fellows' productivity according to category and area of expertise. n = 209.

	Researcher category						Total (%)
	1A	1B	1C	1D	2	SR	
Biostatistics	0	1	0	0	0	0	1 (0.5)
Cariology	1	0	0	0	2	0	3 (1.4)
Maxillo-facial surgery	0	0	0	0	3	0	3 (1.4)
Dental Clinic	3	2	2	1	22	2	32 (15.3)
Dentistry	1	0	0	0	5	0	6 (2.9)
Temporomandibular dysfunction *	0	0	0	0	1	0	1 (0.5)
Endodontics	3	4	3	1	5	0	16 (7.7)
Pharmacology	0	1	0	0	0	0	1 (0.5)
Physiology	0	0	0	0	1	0	1 (0.5)
Implantology	0	0	0	0	1	0	1 (0.5)
Dental materials	1	6	5	9	5	0	26 (12.4)
Microbiology	0	0	0	2	2	0	4 (1.9)
Social and preventive dentistry	0	2	1	0	4	0	7 (3.3)
Pediatric dentistry	0	0	2	2	14	0	18 (8.6)
Orthodontics	2	0	0	0	3	0	5 (2.4)
Oral Pathology	3	4	2	4	19	0	32 (15.3)
Periodontics	1	1	0	6	24	0	32 (15.3)
Prosthodontics	0	1	0	1	5	0	7 (3.3)
Radiology	0	0	2	1	1	0	4 (1.9)
Public Health	0	0	2	0	7	0	9 (4.3)

*Temporomandibular dysfunction. Chi square test p = 0.025. Source: Lattes Platform.

As for contributing and working in editing and evaluating journals, a significant number of researchers are journal editors (92.3%). Moreover, among the evaluated researchers, 165 (78.9%) are editorial board members of at least one journal.

According to educational institutions,

Universidade de São Paulo (USP), Universidade Estadual Paulista “Júlio de Mesquita Filho” (UNESP), and Universidade Estadual de Campinas (UNICAMP) were the three institutions with the highest number of researchers in the distribution of CNPq fellowship researchers (Table 4).

Table 4 – Distribution of 10 graduate schools with the highest number of research fellows.

Institutions	n	%
Graduate School		
USP	51	24.4
UNESP	39	18.7
UNICAMP	33	15.8
UFMG	7	3.3
UFRGS	7	3.3
UFRN	5	2.4
UFU	4	1.9
UFPEL	4	1.9
PUC-Campinas	4	1.9
PUC-Minas	3	1.4
Institutional affiliation		
USP	53	25.4
UNICAMP	35	16.7
UNESP	35	16.7
UFMG	10	4.8
UFRGS	7	3.3
UFG	5	2.4
UNG	5	2.4
UFRJ	4	1.9
UFBA	4	1.9
SLMANDIC	4	1.9

Source: Lattes Platform.

Scientific production and training in human resources

According to evaluation criteria regarding scientific production of fellowship researchers, 4,433 scientific articles were published in journals in 2011

and 2012. A relatively higher mean of publications can be found in Qualis B journals in all categories. Likewise, there is also a higher total mean for the supervision of scientific initiation (Table 5).

Table 5 – Mean of research fellows’ scientific production in national and international journals, books, book chapters, and training in human resources in 2011 and 2012.

(continua)

	Researcher Category						Total mean
	1A	1B	1C	1D	2	SR	
Scientific production							
Qualis A *	11.86	10.86	8.37	11.00	7.34	2.50	8.56

(conclusão)

	Researcher Category						Total mean
	1A	1B	1C	1D	2	SR	
Qualis B *	12.79	15.99	10.47	15.8	12.12	3.50	12.82
Qualis C *	0.19	0.46	0.05	0.14	0.09	0.00	0.13
Published books	0.06	0.22	0.21	0.18	0.14	0.00	0.15
Published books chapters	2.33	1.77	1.15	1.70	1.08	0.50	1.32
Training in Human Resources							
Undergraduate research	0.93	3.09	3.00	4.29	3.67	0.00	3.40
Masters degree	2.13	3.77	3.05	3.11	3.60	0.00	3.36
Doctoral degree	3.86	4.36	2.36	3.62	2.89	0.00	3.13
Postdoctoral supervision	1.0	1.72	0.57	0.62	0.47	0.00	0.67

Source: Lattes Platform. * Sum of the average of national journals in each Qualis ranking with the average of journals from other countries in each Qualis ranking.

The total number of scientific articles published by research fellows was distributed among 514 journals, with 155 in Brazil and 359 from other countries. The ten Brazilian journals with the highest number of published articles, in descending order with number of published articles, were: *Brazilian Dental Journal* (211); *Brazilian Oral Research* (129); *Journal of Applied Oral Science* (122); *Revista de Odontologia da UNESP* (57); *Periodontia* (54); *Perionews* (44); *Dental Press Journal of Orthodontics* (41); *Arquivos em Odontologia* (38); *Pesquisa Brasileira em Odontopediatria e Clínica Integrada* (34); and *Revista Odonto Ciência* (32). As for the publication of full papers in international journals, the ten journals with the highest number of published articles, in descending order with number of published articles were: *Journal of Endodontics* (127); *Journal of Periodontology* (110); *Gerodontology* (87); *Lasers in Medical Science* (74); *The Journal of Craniofacial Surgery* (72); *Archives of Oral Biology* (69); *Journal of Oral Pathology & Medicine* (69); *Oral Surgery, Oral Medicine, Oral Pathology, Oral Radiology and Endodontics* (68); and *Operative Dentistry* (66).

DISCUSSION

The scientific production of dentistry researchers is quantitatively and qualitatively relevant, considering the amount of articles generated and highest mean of publication in Qualis B journals. Satisfactory levels of graduate courses could be observed, leading to a stimulating scientific production. Moreover, a constant training in human resources generated by the researchers, highlighting the supervision of scientific initiation, was observed. However, there is still a significant concentration of scientific output in dentistry in Southeastern Brazil.

A total of 209 researcher curricula were assessed, with the majority (59.3%) found in the category 2 fellowship, that is, those researchers who had a doctoral degree for least 3 years. Previous studies have also identified category 2 as the most prevalent among dentistry researchers^{4,7}.

The researchers investigated are distributed in 12 Brazilian states, with a higher concentration, 166 researchers (79.5%), in the Southeast region, with an absolute predominance (65.6%) in the state of São Paulo. This fact can be explained due to the concentration of more conceptualized Brazilian dentistry graduate courses in São Paulo¹³, in addition to the city's public institutions regarded as centers of academic excellence. It is also important to mention the existing academic incentives available in the state of São Paulo and embodied in the public university system, as well as the research funding agency, São Paulo State Research Foundation (FAPESP), which contributes to São Paulo leadership⁷. A growing number of research fellows could be found in Minas Gerais as well, when compared to prior studies carried out in previous years,⁷ ranking the state second in the number of research fellows. Although half of the states where the researchers are located belong to the Northeast region of Brazil (six states), this region showed a low number of researchers (8.2%), only surpassing the Midwest region (2.9%). Therefore, the geographical concentration of the Brazilian scientific-technological park in the Southeastern region is an outstanding fact¹⁴. This fact can be explained by the greater concentration of governmental investments in that region, with regard to fellowships and research sponsorships.

A representative portion of the sample consisted of researchers with a specialization course.

The professional qualification, at specialization levels, establishes a mechanistic link between theory/practice and competence in which these researchers are considered more “competent”¹⁵. Nearly half of the investigated researchers (47.4%) held a postdoctoral degree. The Brazilian government created the Postdoctoral National Program (PNPD) in an attempt to encourage this type of graduate studies, in addition to the financial incentive to accomplish it abroad. Regarding the participation in research groups, almost all researchers took part in some group (98.6%). The Research Group Directory in Brazil, a project developed by CNPq in 1992, consists of a database with information on the research groups working in the country. The information from these databases is related to: human resource constituent groups, lines of research in progress, knowledge areas, scientific and technological production, and patterns of interaction with the productive sector¹⁶.

In the male to female ratio (1.5:1) among research fellows, a high predominance of male researchers was observed, which is similar result to that found in dentistry research fellows from 2003 to 2005⁴ and in 2007⁷. The predominance of male researchers was also observed in other fields, such as public health³ and medicine¹⁷. Historically, there has been a predominance of males in institutions of higher education and in the labor market, in various knowledge areas. However, according to the 2010 census from the Brazilian Institute of Geography and Statistics (IBGE), the level of education among females was higher than that among males as regards one’s completion of graduate studies at the age of 25 or more¹⁸. Despite the significant increase of females in dentistry¹⁹, this fact does not seem to be relevant to obtaining productivity fellowships. It is worth noting that, with the feminization process of dentistry, there has been an increase in female dentists in the labor market and in institutions of higher education over the years, despite the fact that many women also take on other tasks in the family household²⁰.

The doctoral completion time is one of the criteria used by CNPq to award productivity fellowships and create a classification according to CNPq categories. This fact may explain the statistically significant relationship between the doctoral completion time and the researcher category in this investigation. Most of the investigated researchers earned the doctoral degree in 11 to 20 years. Similar results were found in previous investigations with dentistry researchers⁴, oral pathology⁶, and public health³. It is believed that the longer the completion time of a graduate school program, the higher the researchers’ scientific production, thus facilitating the process of receiving a grant. Most investigated researchers earned their doctoral degrees in national

institutions, while the majority of these same researchers achieved graduate degrees in international institutions. Similar results were found among dentistry researchers evaluated in 2007⁷. A significant increase was observed in the number of titles issued in Brazil due to the expansion and decentralization policies regarding graduate school courses²¹.

An equal predominance was found within the areas of clinical dentistry, periodontics, and oral pathology regarding the researchers’ area of expertise. These areas reflect the emphasis that Brazilian Dentistry allots to studies on biological or technical issues, which is the result of a hegemonic biomedical model of health. The areas of clinical dentistry and oral pathology were reported more frequently in the evaluation of dentistry research fellows in 2007⁷. It is notable that the area of clinical dentistry is quite extensive, since it encompasses various specialties. In addition, there are graduate programs in CAPES which place special emphasis on vocational modalities of dental knowledge. In a study that evaluated dentistry research in the state of Minas Gerais, from research projects in official notifications from the Minas Gerais State Research Support Foundation (FAPEMIG), Oral Pathology was one of the most representative areas in the number of proposals presented, thus corroborating with some of the findings in this article²².

The literature review conducted by members of the reference community is known through the arbitration system, original paper, or peer review system. Among the researchers evaluated in this study, most were either journal editors or members of their editorial boards and, therefore, ensured journal quality, ethics, accuracy, and relevance of publications because of their careful evaluations²³.

Most educational institutions are located in the state of São Paulo, since a higher number of research fellows are affiliated with institutions in that state. The University of São Paulo, the State University of Campinas, and Paulista State University Julio de Mesquita Filho stand out as regards the number of affiliated dentistry research fellows. A greater incentive from governmental agencies to scientific production and technological innovation of educational institutions in that state may have substantially contributed to those findings. USP stands out for being among the top 100 reputable institutions of higher education in the world. Times Higher Education (THE), a prestigious British magazine, ranked USP 50th in the Life Sciences category²⁴. UNICAMP has a graduate-level dentistry program that is ranked first in level of quality in Brazil, according to CAPES 2010 triennial classification¹³.

The scientific work achieves its ultimate purpose through its publication, in which the results are divulged to the scientific community. Scientific

production is one of the criteria adopted by CAPES for the evaluation of graduate school programs. Scientific publications are essential, and Brazil has been increasing its participation in international journals²⁵, as identified by a greater production of articles in Qualis B journals. However, scientific production from dentistry research fellows was presented, highlighting the fact that, regardless of the category, a high number of Quails A publications were also identified. The same tendency was observed in the evaluation of dentistry researchers' scientific production in 2003-2005⁴ and among Public Health researchers³. A higher number of published articles was observed when compared to previous studies⁷. The high number of publications, in addition to its dissemination in journals of international reputation, can be explained by the current academic demands, particularly in graduate schools which, in one way or another, "force" the researchers to constantly publish their results due to the constant evaluation of their work⁷. The quantitative increase in dentistry researchers' productivity can be correlated to the increase in Brazilian scientific production and may well reflect the various incentive mechanisms that have been implemented by Brazilian research agencies. Furthermore, the productivity fellowship can promote competition among peers and encourage training for new researchers, as well as search for outstanding publications⁸. It was also possible to observe a scientific production of a higher mean of published book chapters than full books.

Another important parameter in the evaluation of research fellows' production is the training of human resources. Among the investigated researchers, a higher total mean of scientific initiation supervision was found, unlike the findings among dentistry researchers in 2003-2005, which found a higher number of master's supervision⁴. A higher number of master's supervision was observed in other fields, such as public health³ and medicine¹⁷, which differs from the findings in the present study. The supervision of undergraduate students can facilitate the implementation of research projects, since the students may be regarded as an important "source of manpower" during the completion of those research projects.

A large number of articles have been published in international journals. It is notable that, even when the chosen publication is national, the international indexations, which many times are divulged only in English, are attractive factors to authors¹⁷, hence the tendency to publish in journals written in the English language.

The results allow one to identify the relevant contribution of these researchers in the advancement of the publications and research in dentistry in Brazil. This has been attributed mainly to the funding provided

by agencies such as CAPES and CNPq. Furthermore, the continued evaluation and classification of journals in stratum by CAPES has encouraged researchers to publish in high impact factor journals, and Qualis²⁶. This fact is also driven by the increased training of Masters and Doctoral students in Brazil in the field of dentistry²⁷. Despite this, it should be noted that a higher concentration of these researchers, fellows of productivity in the field of dentistry, can be found in the southeastern regions of the country, mainly in the State of São Paulo. Therefore, a greater spread of financial incentive for the other regions of Brazil should be considered²⁸.

The present research has some limitations related to its methodological aspects. The main aspect is related to the quality of information available on Lattes Curriculum and the differences regarding researchers filling out information. However, the aim of this study is not to evaluate the reliability of information mentioned by the researchers due to the limitations of its exploratory character. The Lattes Curriculum is one of the assessment criteria for earning a fellowship and fundraising in research notices, and can thus be regarded as a suitable source to characterize the researchers' profile. Another problem to be considered is the relative overestimation of scientific production since, in some cases, the same generated products have more than one author, and thus two or more authors may be a CNPq productivity researcher. However, the results of this study highlight the significant contribution of Brazilian dentistry researchers towards the consolidation of national and international scientific production as well as towards the updating of information regarding dentistry production aimed at supporting scientific policy planning and evaluating their results.

RESUMO

Objetivo: investigar o perfil e a produção científica dos pesquisadores brasileiros em Odontologia bolsistas de produtividade do Conselho Nacional de desenvolvimento científico e tecnológico (CNPq). **Material e Métodos:** Foi realizado um estudo observacional. A amostra consistiu de pesquisadores de produtividade do CNPq, com bolsas de estudo ativas em fevereiro de 2013. Os dados foram coletados do Currículo Lattes. Parâmetros analisados correspondem para os anos 2011 e 2012. **Resultados:** A amostra consistiu de 209 investigadores. A maioria dos pesquisadores era do sexo masculino, categoria 2 de bolsa e distribuídos em 12 Estados brasileiros. Sobre a área de especialização, a maioria dos pesquisadores atuava em Clínica Odontológica, Patologia Bucal e Periodontia. Há uma predominância de publicações em revistas Qualis B e supervisão de

iniciação científica. **Conclusão:** Os resultados deste estudo mostram uma contribuição significativa de pesquisadores de Odontologia para a consolidação da produção científica nacional, além de atualizar informações sobre produção de odontologia.

Descritores: Odontólogos. Pesquisa em Odontologia. Indicadores de produção científica.

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