EVALUATION OF THE BRAZILIAN NATIONAL COUNCIL FOR SCIENTIFIC AND TECHNOLOGICAL DEVELOPMENT RESEARCH PRODUCTIVITY FELLOWS IN THE FIELD OF ENDOCRINOLOGY

AVALIAÇÃO DOS PESQUISADORES BOLSISTAS DE PRODUTIVIDADE EM PESQUISA DO CONSELHO NACIONAL DE DESENVOLVIMENTO CIENTÍFICO E TECNOLÓGICO DA ÁREA DE ENDOCRINOLOGIA

EVALUACIÓN DE LOS INVESTIGADORES BECARIOS DE PRODUCTIVIDAD EN INVESTIGACIÓN DEL CONSEJO NACIONAL DE DESARROLLO CIENTÍFICO Y TECNOLÓGICO EN EL ÁREA DE ENDOCRINOLOGÍA

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Abstract

The objective was to describe the profile and scientific production of researchers of scientific productivity of the Brazilian National Council for Scientific and Technological Development in the field of Endocrinology. The study utilized a cross-sectional, census of 40 researchers in the field of Endocrinology from the Brazilian National Council. The curriculum vitae of each selected researcher was reviewed using the Lattes Platform. The extracted data were analyzed using SPSS® 26.0 and organized into three dimensions: researcher profiles, scientific production, and human resource training. The majority were women (60%), concentrated in São Paulo (52.5%), Rio de Janeiro (20%), and Rio Grande do Sul (17.5%). Collectively, they published 6,683 scientific articles (mean=169.6), indexed in the Web of Science. In terms of human resource training, they supervised 1,004 undergraduate research students, 731 master's students, and 724 PhD students, with the highest average number of supervisions per researcher observed in level A. The median H-index for this group was 28.08. The researchers demonstrated notable scientific productivity, highlighted by active involvement in the supervision of undergraduate research, master's, and PhD students. A predominance of female researchers and a strong concentration of researchers in a few Brazilian regions were observed.

Keywords: bibliometrics; research personnel; scientific publication indicators; endocrinology.

Resumo

O objetivo foi descrever o perfil e a produção científica dos pesquisadores com produtividade científica do Conselho Nacional de Desenvolvimento Científico e Tecnológico na área de Endocrinologia. O estudo utilizou um levantamento transversal, abrangendo 40 pesquisadores na área de Endocrinologia do Conselho. Os currículos de cada pesquisador selecionado foram revisados utilizando a Plataforma Lattes. Os dados extraídos foram analisados utilizando o SPSS® 26.0 e organizados em três dimensões: perfis dos pesquisadores, produção científica e formação de recursos humanos. A maioria era composta por mulheres (60%), concentradas em São Paulo (52,5%), Rio de Janeiro (20%) e Rio Grande do Sul (17,5%). Coletivamente, publicaram 6.683 artigos científicos (média=169,6), indexados na Web of Science. Em termos de formação de recursos humanos, supervisionaram 1.004 estudantes de graduação, 731 mestrandos e 724 doutorandos, com o maior número médio de supervisões por pesquisador observado no nível A. O índice H mediano para este grupo foi de 28,08. Os pesquisadores demonstraram uma notável produtividade científica, destacada pelo envolvimento ativo na supervisão de estudantes de graduação, mestrado e doutorado. Observou-se uma predominância de pesquisadoras mulheres e uma forte concentração de pesquisadores em algumas regiões brasileiras.

Keywords: bibliometria; pesquisadores; indicadores de produção científica; endocrinologia.

Resumen

El objetivo fue describir el perfil y la producción científica de los investigadores con productividad científica del Consejo Nacional de Desarrollo Científico y Tecnológico en el campo de la Endocrinología. El estudio utilizó un levantamiento transversal, abarcando a 40 investigadores PQ en el campo de la Endocrinología del Consejo. Los currículos de cada investigador seleccionado fueron revisados utilizando la Plataforma Lattes. Los datos extraídos fueron analizados con el SPSS® 26.0 y organizados en tres dimensiones: perfiles de los investigadores, producción científica y formación de recursos humanos. La mayoría eran mujeres (60%), concentradas en São Paulo (52,5%), Rio de Janeiro (20%) y Rio Grande do Sul (17,5%). Colectivamente, publicaron 6.683 artículos científicos (media=169,6), indexados en la Web of Science. En términos de formación de recursos humanos, supervisaron a 1.004 estudiantes de pregrado, 731 estudiantes de maestría y 724 estudiantes de doctorado, con el mayor número promedio de supervisiones por investigador observado en el nivel A. El índice H mediano para este grupo fue de 28,08. Los investigadores demostraron una notable productividad científica, destacándose por su involucramiento activo en la supervisión de estudiantes de pregrado, maestría y doctorado. Se observó una predominancia de investigadoras mujeres y una fuerte concentración de investigadores en algunas regiones brasileñas.

Palabras clave: bibliometría; investigadores; indicadores de producción científica; endocrinología.

1 Introduction

Brazilian research in the medical field has grown significantly, as has the number of postgraduate programs (Oliveira *et al*., 2012). On the other hand, there are important discrepancies between scientific production in the areas of Medicine, including Endocrinology

(Martelli *et al*., 2019). There is also an important concentration of medical research in the Southeast and South regions of Brazil, particularly in the state of São Paulo, which also coincides with the postgraduate programs with excellent grades 6 and 7 (CAPES, [2024]).

Brazilian scientific production presented substantial growth and international visibility. This fact influenced the country's position in the world ranking in the number of publications in journals indexed in the Scopus database (National Science Board; National Science Foundation, 2019). During the COVID-19 pandemic, the role of science for Brazilian citizens has become even more evident, particularly in the country's response to the enormous challenge of the pandemic. Despite the enormous challenges faced by Brazil throughout the COVID-19 pandemic, its scientific production was highlighted together with China, India, South Korea, Turkey, and Iran (Oliveira *et al*., 2022).

Brazil has two main national science funding agencies: the Brazilian Federal Agency for Support and Evaluation of Graduate Education (CAPES) (www.capes.gov.org) and the Brazilian National Council for Scientific and Technological Development (CNPq). Both agencies were established in the 1950s. The CAPES provides financial support and evaluates student performance in postgraduate courses. On the other hand, the CNPq is devoted primarily to research funding. It also offers a particular form of research grant called Research Productivity fellows or PQ, as called in Brazil. These researchers are currently classified into categories A, B, C, D, E, and senior (CNPq, 2023a). This scholarship was implemented in the 1970s, and is intended for researchers with notable scientific contributions in their respective areas (CNPq, 2023b).

Previous studies highlighted the importance of PQ performance and its contributions in areas such as Neurosciences, Cardiology, Nephrology and Clinical Medicine (Oliveira et al., 2011; Martelli-Junior *et al*., 2010; Romano-Silva *et al*., 2013; Oliveira *et al*., 2013a; Martelli *et al.,* 2019). There is an absence of studies involving PQ in the area of Endocrinology, although the specialty has an important history and scientific trajectory (Arnott, 2011) . In this context,

the aim of the present study was to describe the profile and scientific production of PQ in endocrinology.

2 Methods

A cross-sectional and census study was conducted. We initially established a database of 548 PQ registered as CNPq medical fellows based on a list provided by the research funding itself in December 2022 (CNPq, 2022). Of the 548 medical researchers, the main areas of investigation of 40 researchers were Endocrinology. Researchers who are the recipients of this grant are currently classified into categories: senior, A, B, C, D and E (CNPq, 2023a).

The curriculum vitae of each selected researcher was consulted though the CNPq Lattes platformand was used to extract the information needed for the study. The data obtained were used for construction of a database, which was constructed and analyzed using the Statistical Package for the Social Sciences® 26.0 statistical program. The data obtained were grouped into three sets of variables for analysis: characteristics of the researcher (gender, comprising geographical, institutional distribution and H-index), scientific publications and human resource training.

Information on scientific publications involved the number of scientific articles published throughout the PQ career (period defined between the first scientific publication until December 2022), scientific articles published in the last five years (2018-2022) and total citations in the SciELO, Scopus and Web of Science), databases. In the dimension, human resource training, the information obtained was about guidelines scientific initiation, master's and PhD in the career and in the last five years (2018-2022). The study used public and secondary data, not requiring submission to the Research Ethics Committee.

3 Results

Of the 548 researchers in Medicine, 40 (7.7%) work in the area of Endocrinology. The majority were female (n=24; 60%) and grants in category E (n=17; 42.5%), as demonstrated in Table 1.

Table 1 - Distribution of researchers in area of Endocrinology with a research productivity scholarship from the Brazilian National Council for Scientific and Technological Development (CNPq), according to gender, and to the level of the scholarship (n=40).

	Male		**Female**		**Total**
Category	**n**	**%**	**n**	**%**	**n (%)**
A	4	10	6	15	10 (25)
B	1	2.5	3	7.5	4 (10)
C	2	5	0	0	2 (5)
D	3	7.5	3	7.5	6 (15)
E	6	15	11	27.5	17 (12.5)
SR	0	0	1	2.5	1 (2.5)
Total	16	40	24	60	40 (100)

Source: research data (2022).

Among the 40 researchers, there was a concentration in the states of São Paulo (n=21; 52.5%), Rio de Janeiro (n=8; 20%), and Rio Grande do Sul (n=7; 17.5%). All researchers were identified only in three Brazilian regions: Southeast (n=29; 72.5%), South (n=7; 17.5%), Northeast (n=1; 2.5%) and Federal District (n=3; 7.5%). Although Endocrinology researchers were from 8 different institutions, 77.5% worked in only four of them, namely Universidade de São Paulo (n=14; 35%), Universidade Federal do Rio de Janeiro (n=8; 20%), Universidade Federal do Rio Grande do Sul (n=6; 15%), and Universidade Estadual de Campinas (n=5; 12.5%), as illustrated in Table 2.

Table 2 - Distribution of researchers in area of Endocrinology with a research productivity scholarship from the Brazilian National Council for Scientific and Technological Development (CNPq), by institution (n=40).

Institution	Category						Total
	A	B	C	D	E	SR	n (%)
Universidade de São Paulo	3	2	1	2	5	1	14 (35)
Universidade Federal do Rio Grande do Sul	3	0	1	0	2	0	6 (15)
Universidade Estadual de Campinas	1	2	0	1	1	0	5 (12.5)
Universidade Federal do Rio de Janeiro	3	0	0	1	4	0	8 (20)
Universidade de Brasília	0	0	0	1	2	0	3 (7.5)
Pontifícia Universidade Católica do Rio Grande do Sul	0	0	0	0	1	0	1 (2.5)
Universidade Federal de São Paulo	0	0	0	1	1	0	2 (5)
Universidade Federal do Ceará	0	0	0	0	1	0	1 (2.5)
Total	10	4	2	6	17	1	40 (100)

Source: research data (2022).

The 40 Endocrinology researchers published 6,683 papers in scientific journals, with an average of 169.6 articles per PQ – average from 60 to 517 articles/researcher –, throughout their careers, whereas 1,123 (16.8%) were indexed at Web of Science, average of 28.08 articles/researcher. The categories with the highest absolute number of papers published are A and E, with 2,253 and 1,679, respectively. The same can be observed for the scientific production of the last five years. Those with the lowest absolute number are categories C and D, 173 and 619, respectively. However, this scenario changes when analyzing the relative numbers of articles per researcher. Production was significant mainly in category A, it presented the highest average number of papers per researcher in whole career (225.3 per researcher) and in the last 5 years (52.3 per researcher). The lowest average was at category E (98.7 per researcher). The same is also observed when evaluating the five-year period 2018-2022 (30.1 per researcher), as demonstrated in Table 3.

Table 3 - Average number of articles published by researcher in area of Endocrinology with a research productivity scholarship from the Brazilian National Council for Scientific and Technological Development (CNPq), at each category (n=40).

	Average (standard deviation)				
Article published	**A**	**B**	**C**	**D**	**E**
In career	225.3 (39.3)	238.5 (49.3)	174 (50.9)	172.6 (57.9)	98.7 (40.8)
In the last 5 years	52.5 (20)	41.2 (21.3)	31 (0)	39.6 (15)	30.1 (13.8)

Source: research data (2022).
Note: The SR category has only one researcher, so it is not possible to perform average calculations for this category. The only researcher in this category produced 517 articles in his career and 87 in the last 5 years (2018-2022).

Over their careers, endocrinology researchers advised 1,004 scientific initiation, (median of 16; range: 0–100), 731 Master's students (median of 14.5; range: 0-48) and 724 PhD students (median of 14; range: 1–63). There is an absolute prevalence of scientific initiation, Master's degree and PhD students at category A (368, 278 and 311, respectively). However, when corrected by the number of researchers in each category, the highest average of scientific initiation advisory was in B researchers (n=42.7; ranging 6 to 100 orientations), while for Master's degree (n=27.8; ranging 2 to 48 orientations) and PhD students (n=31.1; ranging 18 to 63 orientations) was in A researchers as shown in Table 4.

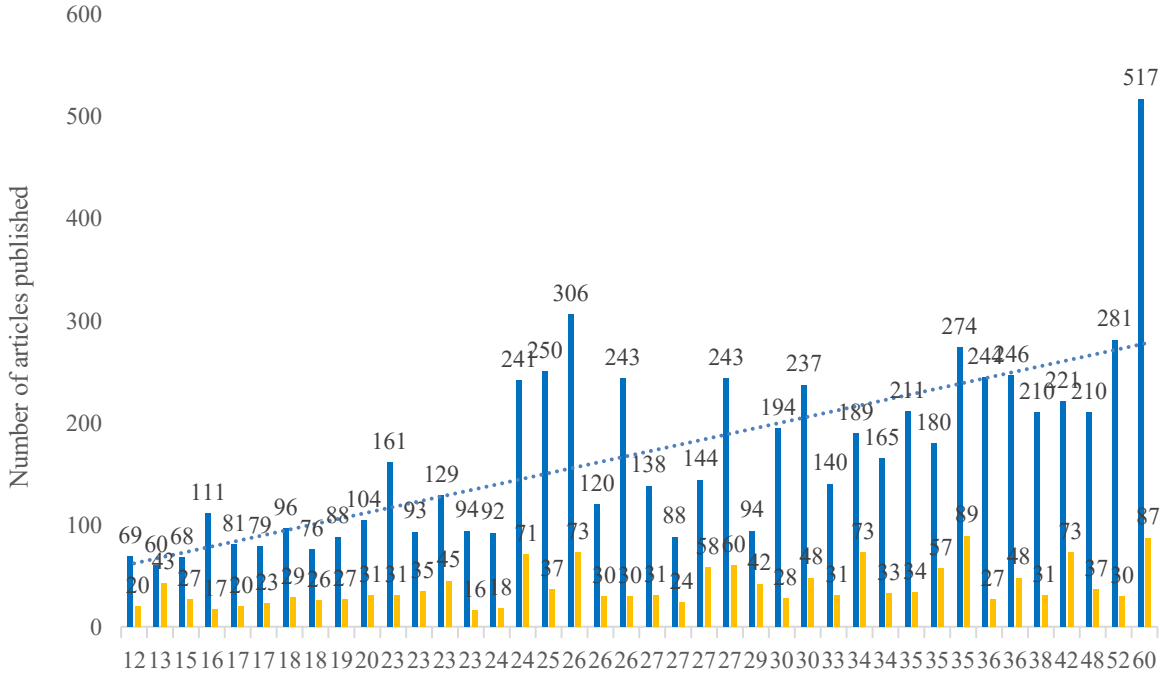
Table 4 - Supervision average per researcher in area of Endocrinology with a research productivity scholarship from the Brazilian National Council for Scientific and Technological Development (CNPq) according to each category (n=40).

	Average (standard deviation)				
Completed supervision	**A**	**B**	**C**	**D**	**E**
Scientific initiation	36.8 (28.6)	42.7 (40.4)	20.5 (20.5)	18.6 (19.6)	18.1 (16)
Master's degree	27.8 (15.7)	22.7 (9.7)	15 (1.4)	17 (8.8)	13 (10)
PhD	31.1 (12.9)	24 (1.8)	13 (2.8)	18 (12)	9 (4.4)

Source: research data (2022).
Note: The SR category has only one researcher, so it is not possible to perform average calculations for this category. The only researcher in this category has completed four scientific initiation orientation, nine master's orientation and 30 PhD orientations.

The average H-index at this group of 40 researcher was 28.08 (median=26,50; minimum and maximum=12-60; SD=10,396). There is a tendency to increase the H-index with the increase in papers published in the career (Graphic 1).

Graph 1 - Relationship between the H index and the number of scientific articles published in the career and in the last five years (n=40).



Source: research data (2022).

4 Discussion

The Endocrinology area of CNPq registered an increase of only six scholarships in the last 16 years (Martelli-Junior *et al*., 2010). It is important to analyze the profile and impact of the scientific production of researchers in this field of study. Identifying existing gaps may lead

to the development of new scientific proposals, with the aim of promoting significant improvements in the area and stimulating the growth of the number of scholarships.

A predominance of female researchers (60%) was observed; however, a study with PQ in the medical field demonstrated a predominance of men (68%) (Martelli-Junior *et al*., 2010), even in specific areas such as Cardiology (Oliveira *et al*., 2011), Neuroscience (Romano-Silva *et al*., 2013; Dias *et al*., 2020), and Pediatrics (Gonçalves *et al*., 2014; Oliveira *et al*., 2013b). The literature confirms that gender inequalities between men and women persist in research production at a global level (Larivière *et al*., 2013). Despite the fact that in this study the majority of researchers are women, they still present a lower proportion in the highest positions of the academic career, especially those associated with higher earnings and scientific prestige (Moschkovich; Almeida, 2015; Leta, 2003).

Significant scientific production in both quantity and quality was evidenced among PQ. However, there is a great concentration of this group in a few institutions in the South, Southeast, and Northeast. Five states concentrate all PQ in the field of Endocrinology, with São Paulo and Rio de Janeiro holding 72.5% of the researchers in this group. Four institutions from the Southeast and South of the country (Universidade de São Paulo, Universidade Estadual de Campinas, Universidade Federal do Rio de Janeiro and Universidade Federal do Rio Grande do Sul) are strong centers for training and producing scientific knowledge in the field of Endocrinology in Brazil. This concentration observed in these regions is also reported by other studies evaluating fields of knowledge such as Cardiology (Oliveira *et al*., 2011), Neuroscience (Romano-Silva *et al*., 2013; Dias *et al*., 2020), and Physical Therapy and Occupational Therapy (Sousa *et al* 2023). The institutions considered important centers for training and producing scientific knowledge, which have the oldest and most consolidated postgraduate programs, are located in these regions (Gonçalves *et al*., 2014; Oliveira *et al*., 2013a), specifically in institutions in the South (Federal University of Rio Grande do Sul) and Southeast (University of São Paulo, Federal University of Rio de Janeiro, and Federal University of São Paulo) (CAPES, [2024]).

The scientific development in Endocrinology in the North, Northeast and Midwest regions still depends on the creation of new postgraduate courses – at master's and/or doctoral levels – that are often limited. Strategies to minimize the unequal distribution of PQ in Brazil should be considered. Regions with lower researcher density and scientific output require financial and institutional incentives to attract and retain researchers, strengthen master's and doctoral programs, and adopt regional criteria for scholarship allocation (Sousa *et al*., 2023).

Among approximately 6,731 endocrinologists affiliated with the Brazilian Society of Endocrinology and Metabology (Scheffer, 2023), only 40 (0.59%) are PQ from CNPq; moreover, among the 548 medical PQ researchers, 7.2% are linked to the Endocrinology area. In this context, the need for training new human resources for the continuity and development of scientific production in the field of Endocrinology is highlighted; the investigated group focused on scientific initiation (n=1,004), followed by the master's (n=731) and PhD (n=724), similar to other investigations (Romano-Silva *et al*., 2013; Martelli-Junior *et al*., 2010; Oliveira *et al*., 2011; Dias *et al*., 2020; Sousa *et al* 2023).

PQ researchers in the field of Endocrinology demonstrate production efforts, with significant numbers of scientific articles published in journals with impact factors, indicating that the research conducted has qualitative value and international impact, as part of the studies are indexed in the Web of Science database. Despite criticisms of the use of the impact factor of journals in the evaluation of institutions and researchers, this index is still adopted by various research funding agencies, such as CNPq itself (Bordons; Fernández; Gómez, 2002; Simons, 2008; Szklo, 2008; Wilcox, 2008). Publication in indexed journals relates to the effort made by PQ in the quest for quality in scientific productions; it was observed that 16.8% of the productions of PQ in the endocrinology area are indexed in the Web of Science, in contrast with the fields of Neuroscience and Psychiatry, which had 70% of their production in this select database (Martelli-Junior *et al*., 2010). It is noteworthy that other indicators should be taken into consideration, such as the number of citations received, human resource training, scientific, technological, and innovation contributions, including patents, participation or coordination in

research projects, editorial activities, and scientific and academic management (CNPq, 2020). However, it is necessary to incorporate other factors, especially to measure the transition of academic products to solving concrete problems in society, such as literary works aimed at reducing stigma and promoting inclusion, particularly in the school environment (Costa; Martelli; Martelli-Junior, 2021).

No studies were found in the literature evaluating the H-index of PQ in the field of Endocrinology, which hinders the analysis of this indicator over time. The H-index seeks to quantify the impact of researchers' scientific production without favoring a high number of scientific articles with few citations or the opposite, allowing for a better analysis of the productions generated by the scholarship holders (Hirsch, 2005). The median H-index found among the scholarship holders in this study was 26,50, higher compared to other fields of knowledge such as Neurosciences (23.75) (Dias *et al*., 2020) and Physical Therapy and Occupational Therapy (19) (Sousa *et al*., 2023). A positive relationship was observed between the publication of scientific articles throughout the career and the increase in the H-index.

The Lattes Platform of CNPq is an important tool for the registration and dissemination of Brazilian science; however, there is a chance that the information provided in the Lattes curriculum of the investigated PQ may be outdated or inaccurate at the time of analysis, posing a limitation to this study. It is emphasized that it is the responsibility of researchers to ensure the accuracy of published information, as well as its update. In the completion of the Lattes Platform, researchers declare their agreement with the system's terms of adherence and conditions of use and are warned that such a declaration is made in compliance with Articles 297 and 299 of the Brazilian Penal Code.

5 Conclusion

The PQ researchers in the field of Endocrinology demonstrated significant scientific production both quantitatively and qualitatively, although they represent a small percentage

compared to the medical professionals working in the country. Notably, there is a predominance of female researchers and a strong concentration of PQ in a few Brazilian regions.

Decentralization strategies should be designed to encourage the development of the area in other regions and states of the country. Other factors should be considered in future studies for a better analysis of this scenario, such as the impact of citations PQ researchers and the visibility of the authors, as these elements significantly impact.

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