





A Bibliometric Analysis of Articles Published in Brazilian Dental Journal over 30 years

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This study assessed bibliometric characteristics of all articles published in Brazilian Dental Journal (BDJ) in its 30 years of existence (1990–2019) and factors associated with citation rates. A document search was carried out in Scopus in December, 2019 and information about the articles were exported, including citations. Type of study and main subject in each article were categorized. Number of citations was categorized in tertiles. Logistic regression models were used to assess the association between variables related to articles' characteristics and number of citations. In 30 years, 1705 articles were published and 18507 citations received, with average 57 articles and 334 pages published yearly and 10.9 cites/doc. The most frequent types of study were laboratorial (63%), clinical (18.5%), and case reports (11%); the main subjects were dental materials (21.6%), endodontics (19.3%), and oral pathology/stomatology (13.1%). Most articles had origin in Brazil (90%), followed by USA (4.6%) and UK (1.5%). Aside from BDJ, Journal of Endodontics (3.5%) and International Endodontic Journal (2.2%) were journals that most often cited BDJ. Main origins of citations were Brazil (36.7%), USA (10.6%), and India (9%). Older articles had higher odds to be highly cited (12% increase/year), longer articles had lower odds (9% decrease/page). Narrative reviews and epidemiological studies were associated with more citations and systematic reviews with less citations. In conclusion, BDJ covered many subjects and study types in 30 years, showing increased growth in international audience. The journal may be regarded as one of the leading Brazilian journals in dentistry published in English.

Key Words: publishing, bibliometrics, citation counts, dentistry.

Introduction

Brazil is the second country with most dental articles published yearly since 2006, according to Scimago Journal & Country Rank (1), which is powered by the Scopus database. In 2018, 2,218 international articles were published by authors affiliated to Brazil. Those articles gathered 873 citations (386 self-citations), reflecting a 0.39 cites per document rate. This citation rate is only fifth amongst the top-10 publishing countries in dentistry. However, in 1999 Brazil published 142 articles, reflecting an overwhelming 1,460% increase in international dental articles published in two decades. Considering the year 1999, the Brazilian Dental Journal (BDJ) was the only journal from Brazil listed in Scimago Ranks for the category Dentistry. In contrast, 10 international dental journals from Brazil were present in the list in 2018, with H-indexes varying from 2 to 48 (BDJ is highest). The remarkable increase in international science output from Brazil in the last two decades has been discussed before (2,3) and there are many factors and variables involved in the process. Concurrently, BDJ has experienced many changes as a journal since its first issue in 1990, including increase in subjects covered and types of

study published, growth in international audience and in number of articles published yearly. In its three decades of existence, BDJ has contributed significantly to the dental science as one of the main sources for dissemination of the Brazilian research in dentistry. In celebration to the 30 years of BDJ, this study assessed bibliometric characteristics of all articles published in BDJ in its 30 years of existence (1990–2019) and factors associated with citation rates.

Material and Methods

In this retrospective longitudinal study, a document search for the articles published in BDJ was carried out in Scopus in December, 2019 including the full 2019 record. A census was carried out with all articles, no exclusion criterion was used. Information about the articles were exported from the database to a comma separated value file, including the following variables: authors, authors' affiliations, document title, year, volume, issue, number of pages, citation counts (including self-citations but not separate), and funding text. Funding was categorized as present or absent. By assessing titles and abstracts (and full-texts when necessary), the type of study was categorized as

case report, clinical, epidemiological, laboratorial, narrative review, qualitative/survey/questionnaire, systematic review/metanalysis, or other, when the study did not match any of the previous types. The main subject addressed by the article also was categorized: basic science (e.g. cell biology, genetics, microbiology), dental education, dental materials, endodontics, implantology, operative dentistry/cariology, oral and maxillofacial surgery, oral pathology/stomatology, oral radiology, orthodontics, pediatric dentistry, periodontology, prosthodontics/occlusion, public health/epidemiology, or other (3). Additional information regarding all articles published during the 30 years of BDJ were obtained in Scopus: top publishing authors and institutions, main funding sponsors, top cited articles, and country of origin of articles and citations. Data were analyzed descriptively. In addition, number of citations per article was collected and categorized in three groups according to tertiles distribution: 0 to three citations; four to 10 citations and; more than 10 citations, generating an ordinal variable used as outcome. Ordered Logistic Regression models were used to assess the association between variables related to articles' characteristics and number of citations. Results were expressed in odds ratios (OR) and 95% confidence intervals (CI). Analyses were performed using software Stata 14.2 (StataCorp. College Station, Texas, USA).

Results and Discussion

As shown in Table 1, a total of 1705 articles was published between 1990-2019, with 18507 citations received by 15080 unique documents, with an average 57 articles and 334 pages published yearly, 10.9 citations per document published, and H-index =48. The year with best average cites/doc was 2002, but the year with most unique articles citing BDJ irrespective of the year of publication of the article cited was 2018, indicating that BDJ is gathering more attention from other journals in the literature in recent years. In fact, the number of documents citing BDJ articles increased each year. Figure 1 shows the three main subjects addressed in articles published each year since the first issue of BDJ. One can notice that endodontics (26 times), dental materials (20 times), and oral pathology/stomatology (19 times) were the subjects most frequently addressed yearly, although variations depending on the year of publication were present. For instance, oral and maxillofacial surgery appeared in top-3 subjects in seven years, periodontology in six years, and operative dentistry/cariology in four years. This analysis indicates that BDJ in fact is a multidisciplinary journal, although with higher number of articles and citations in some subjects compared to others.

Table 2 presents the distribution of articles and citations by type of study, main subject addressed by the article, and

presence/absence of funding text. The three most frequent types of study published in BDJ in 30 years were laboratorial studies (63%), clinical studies (18.5%), and case reports (11%). For the different types of study, the two highest cites/doc were observed for narrative reviews and epidemiological studies. For the different subjects, the two highest cites/doc were observed for public health/epidemiology and endodontics. The three main subjects addressed in articles were dental materials (21.6%), endodontics (19.3%), and

Table 1. Articles and pages published yearly, citations gathered by articles, cites/doc, and number documents citing the articles

Year	Articles	Pages	Citations*	Cites/doc	Cited by**
1990	7	48	35	5.0	NA
1991	10	71	67	6.7	NA
1992	18	122	207	11.5	NA
1993	15	99	195	13.0	NA
1994	22	127	163	7.4	NA
1995	22	129	291	13.2	1
1996	17	102	189	11.1	1
1997	17	103	136	8.0	6
1998	17	104	177	10.4	15
1999	17	104	160	9.4	12
2000	22	151	386	17.5	22
2001	44	195	801	18.2	25
2002	40	201	1046	26.2	44
2003	41	211	885	21.6	77
2004	49	270	983	20.1	119
2005	44	247	917	20.8	178
2006	67	336	1230	18.4	242
2007	65	338	1106	17.0	319
2008	60	336	1115	18.6	406
2009	74	420	1068	14.4	550
2010	85	504	1409	16.6	645
2011	88	505	1230	14.0	852
2012	119	716	1366	11.5	1051
2013	114	644	981	8.6	1120
2014	100	563	702	7.0	1255
2015	120	682	671	5.6	1389
2016	130	765	609	4.7	1499
2017	111	734	267	2.4	1618
2018	88	601	108	1.2	1834
2019	82	586	7	0.1	1800
Total	1705	10014	18507	-	15080
Average	57	334	617	11	603

NA: data not available in Scopus for those years. *Number of citations gathered by year of publication. **Number of unique documents citing the articles.

oral pathology/stomatology (13.1%), which is in line with data shown in Figure 1. In addition, it has been shown that Brazil is a great contributor to the international dental materials science output, with a substantial number of articles and patents published yearly (4). Interestingly, the presence of funding text was not high in the sample, only 1.4% of articles, with an average 1.4 cites/doc. One should notice that the absence of funding text in the database may not actually mean that the study was not funded since we notice a very low frequency of sponsors mentioned in Scopus. We believe that the low number of studies considered funded by the database could be explained by problems of Scopus in identifying Brazilian funding agencies.

Table 3 presents the top-10 authors, top-10 affiliations, top-10 origin of articles (countries), top-5 funding sponsors, top-10 citing journals, and top-5 origin of citations from all articles published in the 30 years of BDJ. Three main publishing authors were JD Pecora (4.3%), C Estrela (2.6%), and L Correr-Sobrinho (2.2%), whereas three main affiliations were all from the Brazilian São Paulo state: University of São Paulo (USP, 34.5%), considering all USP *campi*, State University of Campinas (UNICAMP, 14.7%), and Paulista State University (UNESP, 14.2%), also considering

all UNESP *campi* together. Most articles published by BDJ had origin in Brazil (90%), which was followed by USA (4.6%) and UK (1.5%). Main funding sponsors were CNPq/Brazil and FAPESP/Brazil (3.5% each). BDJ is the journal that most often cite BDJ articles, which is something expected in every journal worldwide. Aside from BDJ, Journal of Endodontics (3.5% of unique documents) and International Endodontic Journal (2.2%) were journals that most often cited BDJ papers. This finding is in line with the observations that endodontics is a subject very often published in BDJ that shows one of the highest citation rates among subjects published in the journal. Other journals with good bibliometrics and international audience are in the top-10 list of main citing journals. Main origins of those citations (author affiliations) were Brazil (36.7%), USA (10.6%), and India (9%). These numbers indicate that despite the national character in the title of BDJ, and that most articles published were originated in Brazil, only 1/3 of all citations gathered by those articles derived from articles published by Brazilian authors, reflecting again that BDJ has a very good international audience and may be regarded effectively as an international journal.

The 30 top cited articles published in BDJ are listed in Table 4 (5-34). Number of citations varied between 238

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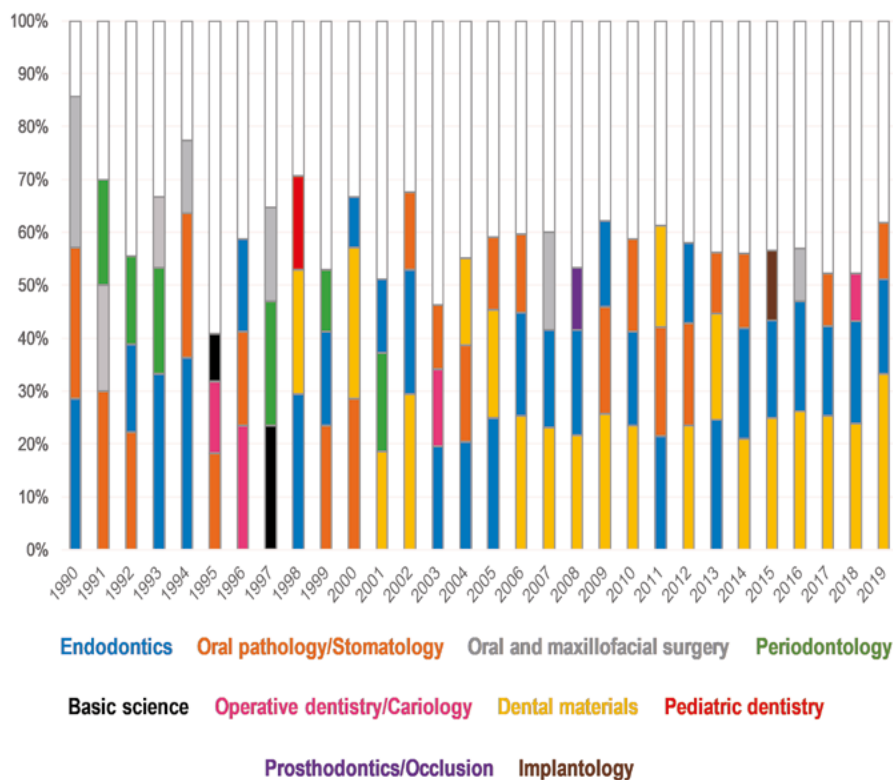


Figure 1. Main three subjects addressed in articles yearly. White bars refer to all other topics published in that year. One can notice that endodontics (26 times), dental materials (20 times), and oral pathology/stomatology (19 times) were the subjects most frequently addressed yearly, although variations depending on the year of publication were present. For instance, oral and maxillofacial surgery appeared in top-3 subjects in seven years, periodontology in six years, and operative dentistry/cariology in four years.

and 60, the most recent article was published in 2013, the oldest was published in 1992. Two authors (Estrela and Holland) have respectively five and three papers as first authors in the top-30 cited list. The main subject of articles in the top-30 citation list was endodontics (43%), reinforcing it as one of the main topics published by BDJ and also that endodontics perhaps is the subject that gathers most attention from international authors and journals among all others. Figure 2 shows tag clouds for terms in article titles from all articles in the sample. This is an interesting and simple way of observing which specific terms are most frequently quoted in BDJ articles and, in turn, most frequent topics covered, including experimental methods. The most frequent terms found in titles included common and expected words such as effect, evaluation, influence, study, dental, oral, enamel, dentin, analysis, and Brazilian. Words related to types of study were also frequent, including case, report, clinical, and trial. Other terms frequently reported were related to the subjects addressed by the articles, such as terms often related to endodontics (root, canal, systems) and dental materials (cement, acid, strength, resin, adhesive). Other terms frequently quoted were bone, laser, denture, stress, rats, glass, and repair, among others.

Table 5 shows the results of association between characteristics of articles and citations. Regarding the year since publication, the odds of being in higher cited groups increase 12% per each additional year. This is expected since older articles in the literature have higher chance of being cited than newer articles (3). The number of pages was negatively associated with citations: each additional page decreases in 9% the odds of the article being in highly cited groups. This is a very interesting finding that perhaps is difficult to explain, although we speculate that longer articles may be less reader friendly. If the reader loses the interest in the article, the chance of quoting it in a future paper may be lower. It has been shown that journals which

publish papers with shorter titles receive more citations per paper (35); the authors of the study hypothesized that shorter titles may be easier to understand and attract more citations. If longer titles lead to lower citations, perhaps the same could happen with longer articles, as observed here. Presence of funding text was associated with a reduction on citations, but caution should be used when interpreting this finding because, as explained before, we believe that issues regarding funding information are present in the Scopus database. A recent study (3) observed that presence

Table 2. Distribution of articles and citations by type of study, main subject and presence or absence of funding text (n=1705 articles, 18507 citations)

Type of study	Articles, n (%)	Citations	
		Total, n	Cites/doc
Case report	187 (11.0)	1479	7.9
Clinical	315 (18.5)	2899	9.2
Epidemiological	14 (0.8)	312	22.3
Laboratorial	1073 (62.9)	12081	11.3
Narrative review	31 (1.8)	772	24.9
Qualitative/survey/questionnaire	50 (2.9)	544	10.9
Systematic review/meta-analysis	13 (0.8)	33	2.5
Other	22 (1.3)	387	17.6
Subject			
Basic science	96 (5.6)	295	7.8
Dental education	9 (0.5)	63	7.0
Dental materials	368 (21.6)	3891	10.6
Endodontics	329 (19.3)	4566	14.0
Implantology	90 (5.3)	883	9.8
Operative dentistry/Cariology	122 (7.2)	1384	11.3
Oral and maxillofacial surgery	118 (6.9)	1381	11.7
Oral pathology/Stomatology	224 (13.1)	2076	9.3
Oral radiology	33 (1.9)	313	9.5
Orthodontics	34 (2.0)	211	6.2
Pediatric dentistry	51 (3.0)	592	11.6
Periodontology	114 (6.7)	722	6.3
Prosthodontics/Occlusion	74 (4.3)	797	10.8
Public health/Epidemiology	18 (1.1)	322	17.8
Other	25 (1.5)	198	7.9
Funding text			
No	1151 (91.0)	18293	15.9
Yes	154 (9.0)	214	1.4

30 years of BDJ



Figure 2. Tag cloud for words in titles of all articles published between 1990 and 2019. Bigger words mean more frequent mentions in titles.

Table 3. Main authors, affiliations, origins, funders, citing journals, and origins of citations for 1,705 articles with 18,507 citations received from 15,114 unique documents

	n	%
Top-10 authors		
Pecora JD	73	4.3
Estrela C	45	2.6
Correr-Sobrinho L	38	2.2
Sinhoreti MA	36	2.1
Sousa-Neto MD	32	1.9
Novaes Jr. AB	30	1.8
Silva-Sousa YT	30	1.8
Demarco FF	28	1.6
Soares CJ	28	1.6
Consani S	24	1.4
Top-10 author affiliations*		
Universidade de São Paulo	587	34.5
Universidade Estadual de Campinas	250	14.7
Universidade Estadual Paulista	241	14.2
Universidade Federal de Pelotas	73	4.3
Universidade Federal de Uberlândia	62	3.6
Universidade de Ribeirão Preto	62	3.6
Universidade Federal de Goiás	61	3.6
Universidade Federal de Minas Gerais	60	3.5
Universidade Federal do Rio Grande do Sul	53	3.1
Universidade Federal Fluminense	47	2.8
Top-10 origin of articles*		
Brazil	1538	90
United States	78	4.6
United Kingdom	25	1.5
Turkey	16	0.9
Canada	15	0.9
Italy	14	0.8
Spain	13	0.8
India	11	0.6
Iran	11	0.6
Portugal	10	0.6
Top-5 funding sponsors		
CNPq	60	3.5
FAPESP	60	3.5
CAPES	58	3.4
FAPEMIG	17	1.0
FAPERJ	10	0.6

Table 3. Main authors, affiliations, origins, funders, citing journals, and origins of citations for 1,705 articles with 18,507 citations received from 15,114 unique document (cont.)

	n	%
Top-10 citing journals**		
Brazilian Dental Journal	702	4.6
Journal of Endodontics	524	3.5
International Endodontic Journal	340	2.2
Journal of Applied Oral Science	274	1.8
Clinical Oral Investigations	227	1.5
Operative Dentistry	197	1.3
Journal of Prosthetic Dentistry	172	1.1
Journal of Contemporary Dental Practice	169	1.1
Journal of Dentistry	150	1.0
Lasers in Medical Science	147	1.0
Top-10 origins of citations**		
Brazil	5542	36.7
United States	1609	10.6
India	1348	8.9
Turkey	908	6.0
Iran	780	5.2
China	696	4.6
Italy	585	3.9
UK	530	3.5
Germany	480	3.2
Saudi Arabia	358	2.4

Data retrieved December 16, 2019. *Accounts for multiple institutions and origins.**Relative to documents.

of funding did not influence citation rates of dental articles with authors from Brazil. Another bibliometric study observed that citations are more closely associated with the nationality of authors than funding itself (36).

Regarding the type of study, compared with case

reports, the odds of being highly cited was higher in Narrative reviews and Epidemiological studies. Systematic reviews/Meta-analysis presented lower odds of being cited compared with case reports. BDJ did not publish many systematic reviews in its 30 years of existence, the average

Table 4. Top-30 cited articles published in BDJ between 1990 and 2019

First author, title	Year	Citations
Estrela et al, Mechanism of action of sodium hypochlorite	2002	238
Estrela et al, Antimicrobial and chemical study of MTA, Portland cement, calcium hydroxide paste, Sealapex and Dycal	2000	190
Noaes Jr et al, Influence of implant surfaces on osseointegration	2010	139
Estrela et al, Mechanism of action of calcium and hydroxyl ions of calcium hydroxide on tissue and bacteria	1995	134
Aidar & Line, A simple and cost-effective protocol for DNA isolation from buccal epithelial cells	2007	133
Holland et al, Healing process of dog dental pulp after pulpotomy and pulp covering with mineral trioxide aggregate or Portland cement	2001	133
López et al, Salivary characteristics of diabetic children	2003	109
Holland et al, Reaction of rat connective tissue to implanted dentin tube filled with mineral trioxide aggregate, Portland cement or calcium hydroxide	2001	104
Queiroz et al, pH-Cycling models to evaluate the effect of low fluoride dentifrice on enamel de- and remineralization	2008	99
Cury et al, The importance of fluoride dentifrices to the current dental caries prevalence in Brazil	2004	95
Gajewski et al, Monomers used in resin composites: Degree of conversion, mechanical properties and water sorption/solubility	2012	94
Estrela et al, Mesenchymal stem cells in the dental tissues: Perspectives for tissue regeneration	2011	92
Rosa & Beloti, Effect of cpTi surface roughness on human bone marrow cell attachment, proliferation, and differentiation	2003	90
Shinohara et al, Oral myiasis treated with ivermectin: Case report	2004	86
Vasconcelos et al, Minimum inhibitory concentration of adherence of Punica granatum Linn (pomegranate) gel against S. mutans, S. mitis and C. albicans	2006	84
Ladalaro et al, Laser therapy in the treatment of dentine hypersensitivity	2004	83
Garcia et al, Antioxidant activity by DPPH assay of potential solutions to be applied on bleached teeth	2012	82
Gomes et al, Chlorhexidine in endodontics	2013	78
Zogheib et al, Effect of hydrofluoric acid etching duration on the roughness and flexural strength of a lithium disilicate-based glass ceramic	2011	77
Pinheiro et al, Effect of low level laser therapy on the repair of bone defects grafted with inorganic bovine bone.	2003	74
Pecora et al, Morphologic study of the maxillary molars. Part II: Internal anatomy	1992	74
Nunes et al, Adhesion of epiphany and AH plus sealers to human root dentin treated with different solutions	2008	73
Durack & Patel, Cone beam computed tomography in endodontics	2012	72
Estrela et al, Antimicrobial effect of 2% sodium hypochlorite and 2% chlorhexidine tested by different methods	2003	72
Demarco et al, Dental pulp tissue engineering	2011	66
da Silva et al, Improvement of XTT assay performance for studies involving Candida albicans biofilms	2008	65
Siqueira Jr & Roças, Bacterial pathogenesis and mediators in apical periodontitis	2007	64
Pereira et al, Antimicrobial activity of Arctium lappa constituents against microorganisms commonly found in endodontic infections	2005	61
de Oliveira et al, Comparative chemical study of MTA and Portland cements	2007	60
Holland et al, Reaction of rat connective tissue to implanted dentin tubes filled with a white mineral trioxide aggregate	2002	60

Data accessed December, 2019.

is less than 1 every other year. The dental literature has recently experience a significant increase in number of systematic reviews published (37). Some authors (38,39) in fact have criticized the number and quality of systematic reviews published in health sciences because of their low impact in healthcare. Anyway, articles reporting systematic reviews are usually well cited but that was not the case for BDJ. Finally, the subject of article was also associated with citation rates. Articles on dental materials, basic science, endodontics, operative dentistry/cariology, oral pathology/stomatology, oral and maxillofacial surgery, prosthodontics/occlusion, and public health/epidemiology were associated

with higher odds of being cited compared with articles on periodontology, which was used as reference in the analysis. These results reinforce the observation that BDJ is a multidisciplinary journal that attracts attention from authors and journals of different country origins publishing on distinct subject areas.

In conclusion, BDJ covered many subjects and study types in its 30 years of publication. Narrative reviews and epidemiological studies are the study types associated with higher odds of being cited, whereas endodontics, dental materials, and oral pathology/stomatology were the subjects most often addressed in the articles. The increasing

Table 5. Association between citations of articles and interest variables. Ordered Logistic Regression. (n=1705)

Variable	Odds Ratio (95% CI)	p value
Years since publication (numeric)	1.12 (1.11; 1.14)	<0.001
Number of pages (numeric)	0.91 (0.86; 0.96)	0.001
Funding text (ref. absent)	0.06 (0.04; 0.09)	<0.001
Type of article (ref. Case report)		<0.001
Clinical	0.96 (0.69; 1.33)	
Epidemiological	1.94 (0.66; 5.68)	
Laboratorial	1.25 (0.94; 1.65)	
Narrative Review	3.45 (1.64; 7.27)	
Qualitative/Survey/Questionnaire	1.88 (1.03; 3.40)	
Systematic Review/Meta-analysis	0.18 (0.05; 0.67)	
Other	0.57 (0.23; 1.39)	
Topic of article (ref. Periodontology)		0.006
Basic science	1.65 (1.00; 2.72)	
Dental education	1.18 (0.33; 4.14)	
Dental materials	1.61 (1.09; 2.38)	
Endodontics	2.18 (1.47; 3.25)	
Implantology	1.09 (0.65; 1.83)	
Operative dentistry/Cariology	1.69 (1.05; 2.73)	
Oral pathology/Stomatology	2.03 (1.33; 3.07)	
Oral radiology	1.24 (0.59; 2.61)	
Oral and maxillofacial surgery	2.20 (1.38; 3.53)	
Orthodontics	1.18 (0.59; 2.36)	
Other	1.06 (0.48; 2.34)	
Pediatric dentistry	1.70 (0.92; 3.13)	
Prosthodontics/Occlusion	1.94 (1.14; 3.34)	
Public health/Epidemiology	2.56 (1.00; 6.62)	

CI: confidence interval.

growth in international audience of BDJ and its current bibliometric indicators suggest that the next decade will be a period for consolidation of its leadership as one of the main Brazilian journals in dentistry published in English.

Resumo

Este estudo avaliou as características bibliométricas de todos os artigos publicados no Brazilian Dental Journal (BDJ) em seus 30 anos de existência (1990–2019) e fatores associados com taxas de citação. Uma busca pelos documentos foi realizada no Scopus em Dezembro de 2019 e informações acerca dos artigos foram exportadas, incluindo citações. Tipo de estudo e principal assunto em cada artigo foram categorizados. Número de citações foi categorizado em tercís. Modelos de regressão logística foram usados para avaliar a associação entre as variáveis relacionadas às características dos artigos e o número de citações. Em 30 anos, 1705 artigos foram publicados e 18507 citações recebidas, com média de 57 artigos e 334 páginas publicadas ao ano e 10,9 citações/documento. Os tipos de estudo mais frequentes foram laboratorial (63%), clínico (18,5%) e relato de caso (11%); os principais assuntos foram materiais dentários (21,6%), endodontia (19,3%) e patologia oral/estomatologia (13,1%). A maioria dos artigos teve origem do Brasil (90%), seguido dos EUA (4,6%) e Reino Unido (1,5%). Além do BDJ, Journal of Endodontics (3,5%) e International Endodontic Journal (2,2%) foram os periódicos que mais citaram o BDJ. As principais origens das citações foram Brasil (36,7%), EUA (10,6%) e Índia (9%). Artigos mais antigos tiveram maiores chances de serem altamente citados (aumento de 12% ao ano), artigos mais longos tiveram menores chances (redução de 9% por página). Revisões narrativas e estudos epidemiológicos foram associados com mais citações e revisões sistemáticas com menos citações. Em conclusão, o BDJ cobriu diversos assuntos e tipos de estudo em 30 anos, mostrando contínuo crescimento na audiência internacional. O periódico pode ser considerado um dos líderes entre as revistas brasileiras de odontologia publicadas em inglês.

Acknowledgments

This study was financed in part by the Coordenação de Aperfeiçoamento de Pessoal de Nível Superior (CAPES), Brazil (Finance Code 001).

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Received December 18, 2019
Accepted January 9, 2020