

Quantitative and Qualitative Evaluation of Iranian Researchers' Scientific Production in Dentistry Subfields

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ABSTRACT

Background: As in other fields of medicine, scientific production in the field of dentistry has significant placement. This study aimed at quantitatively and qualitatively evaluating Iranian researchers' scientific output in the field of dentistry and determining their contribution in each of dentistry subfields and branches. **Methods:** This research was a scientometric study that applied quantitative and qualitative indices of Web of Science (WoS). Research population consisted of 927 indexed documents published under the name of Iran in the time span of 1993-2012 which were extracted from WoS on 10 March 2013. The Mann-Whitney test and Pearson correlation coefficient were used to data analyses in SPSS 19. **Results:** 777 (83.73%) of indexed items of all scientific output in WoS were scientific articles. The highest growth rate of scientific production with 90% belonged to endodontic sub field. The correlation coefficient test showed that there was a significant positive relationship between the number of documents and their publication age ($P < 0.0001$). There was a significant difference between the mean number of published articles in the first ten-year (1993-2003) and that of the second one (2004-2013), in favor of the latter ($P = 0.001$). **Conclusions:** The distribution frequencies of scientific production in various subfields of dentistry were very different. It needs to reinforce the infrastructure for more balanced scientific production in the field and its related subfields.

Key words: Dentistry, Publication, Scientometrics, Research Personnel, Scientific production, Iran.

1. INTRODUCTION

In spite of the fact that in the past, countries were categorized based on such indicators as their military powers, national assets and national outcomes, nowadays, research and scientific indicators have a main role in determining the worldwide placement of a country, too (1). Measuring scientific publications and research output is of important indicators in evaluating the research and scientific activities of a particular country. In addition, identifying and evaluating research conducted in a particular country is considered not only by specialists in every scientific field, but also is valuable for scientific administrators and research policy-makers of the country. For example citation analysis show that In Iran, religious resources were used in composing medical and dental thesis; But the rate of such usage is limited (2). The main tool for measuring research and scientific output is scientometrics. In scientometrics, evaluating the quan-

tity and quality of scientific production as well as citations is of main importance (3). UNESCO report in 1982 conceived the production and absorption of technical and scientific information as a basic and main precondition for developing countries (4).

The number of published papers indexed in the credible citation databases such as the Web of Science (WoS) and the scientific impact of these papers in their related scientific fields are of main indicators of scientometrics throughout the world (3). The active scientific contribution of developing countries, especially Iran in this context is very important. Medical scientific fields as critical technical and highly-expert ones need new and continuous up-dated information, and scientific production in these fields is effective and necessary. As one of the main and highly-interested fields of biomedicine subject category, dentistry discipline annually attracts many medical students who choose it as their study field in various medical

universities under supervision of Iran's Ministry of Health, Treatment and Medical Education. As an applied field, dentistry requires huge amount of budget for its training. Based on 2012 statistic report, there are 16 dentistry colleges in Iran in 16 different subfields of dentistry (5).

As a result, it is necessary to monitor the worldwide status of the scientific production of dentistry researchers and educators in Iran case. Opening new horizons of and perspectives on the field and its researchers, this type of monitoring can be valuable in country-wide scientific policy-making as well as identifying the possible gaps in and barriers to research in the field. Some related studies have been conducted in Iran and other countries. Serati Shirazi and colleagues studied the indexed items in WoS in a 10-year time spam of 2000-2009 and found that the average growth rate of scientific production in the field was 5.68%. Iran's contribution in total scientific production was .63% and U. S. A. and British Kingdom were in the top of countries in terms of published documents (6).

Zera'atkar and colleagues measured Iranian researchers' contribution in dentistry scientific production and found that of 383 worldwide produced documents in the field, 350 items (91.4%) belonged to Iranian researchers. The world rank of Iran in this contribution was 28. The Journal of Endodontics was in the highest rank in including the published items in the field with 34 published papers (4). In some different study, Ghasemi and colleagues investigated the barriers to scientific production in dentistry field from Iranian dentistry students' viewpoints. The subjects enumerated the potential barriers as: the lack of a licensed and reliable center for editing scientific items prepared in English, the lack of financial support for research, the lack of appropriate motivating conditions and their inability to scientifically write (5). With more specialized exploration, Eghbal and colleagues studied the scientific production in endodontic field among 28 selected countries indexed in PubMed. Of 5 countries with high ranks in Asia, Iran ranked second after Turkey (7).

Comparing the dentistry scientific production in three time scopes, including 1986-88, 1996-8 and 2006-8, Pulgar and colleagues concluded that the scientific production in the field significantly increased in 2006-8 in comparison with the other studied time spams (8). These studies showed that although a few studies have been conducted in the field of dentistry scientific production in recent years, the studies relating to quantitative and qualitative evaluation of scientific production in the specific disciplines and subfields of dentistry have not been enough and satisfactory in Iran. As a result, this study aimed to quantitatively and qualitatively evaluate the scientific production in Iran's dentistry field as well as exploring this country's worldwide contribution in each subfield.

2. MATERIALS AND METHODS

This research was a scientometric study that applied quantitative and qualitative indices of Web of Science (WoS). Data was extracted from citation report section of WoS database in March 2013. The following search strategy was applied to locate all items that have been published by Iranian dentistry researchers until now:

- Address= (Iran)
- Refined By: Web of Science,

- Categories= (Dentistry Oral Surgery Medicine),
- Timespan=All Years,
- Databases=Sci-Expanded, Ssci.

The subject categorization of each retrieved item was done by a dentistry specialist. The items were categorized in 16 dentistry subfields in the end. Collected data was analyzed by using Excel 2013 and SPSS 19 software.

3. RESULTS

In a 20-year time spam, 297 scientific documents in dentistry field were published by Iranian dentistry researchers and indexed in the WoS. The document types of the items ranked as articles (777 items), proceedings (65 items), reviews (40 items), and letters to editor (30 items), in descending order. The most productive year in publishing documents was 2012 with 177 published papers (Figure 1). The highest growth rate occurred between 2001-2003, revealing a sort of growth starting point and resulting in consequent increase in paper production in 2009-2012 (Figure 2). As figure 1 shows, the publication trend was not significant until 2002 and started to increase then and reached its highest rate in 2012, about 10 times more than that in 2002.

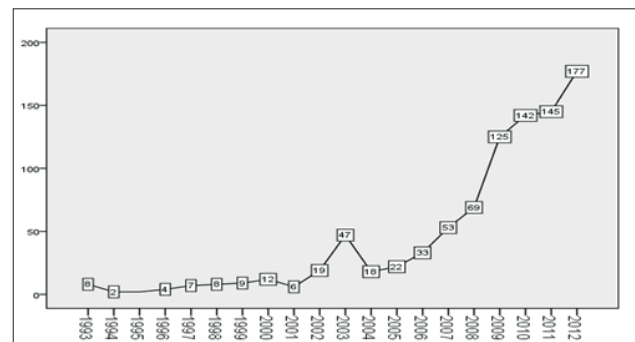


Figure 1. The rate of Iran's scientific production in dentistry field by year of publication

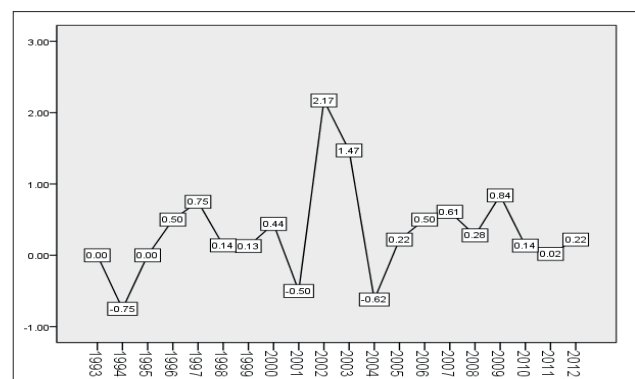


Figure 2. The growth rate of Iran's scientific production in dentistry field in the time spam of 1993-2012

Using Mann-Whitney test, the mean rates of published items in the first 10 year (1993-2002) and the second 10-year (2003-2012) were compared. The results showed that these means are significantly different in favor of the latter ($p < .05$).

The amounts of scientific production in dentistry subfields were very different. The highly-ranked subfields in terms of published items included endodontics, surgery, orthodontics and operative dentistry, respectively. The scientific production rates in the other subfields were relatively similar. The highest growth rate belonged to endodontic subfield with

90%. Figure 3 depicts the number of scientific production in all 16 subfields of dentistry.

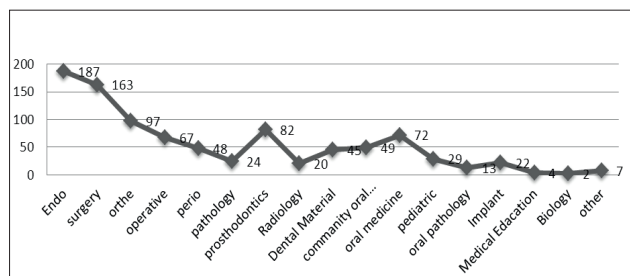


Figure 3. Iran's dentistry scientific production by its subfields

Regarding citation, the total documents in the field have been cited in 4805 citing works, with 763 self-citations (16%) and the mean of 5.18 citations for each cited item. The h-index of the field was estimated 29. The most highly-cited paper (including 229 citations) was authored by Monsef and Torabi-Nejad in 1993. A paper published in 1995 with 179 received citations and one published in 2003 with 136 received citations, both authored by Torabi-nejad and colleagues were in the second and third ranks, respectively (Figure 4).

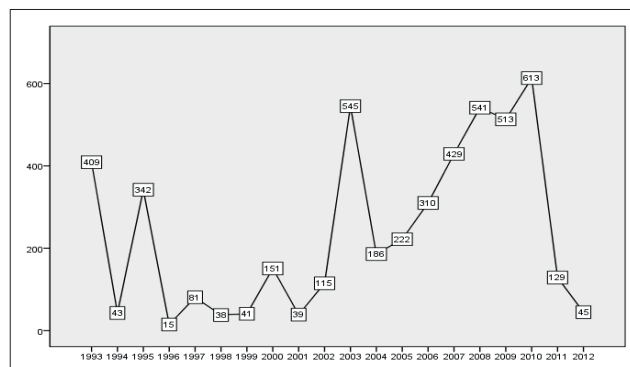


Figure 4. The number of citations to dentistry papers by year of publication

If divided by the paper's publication age, the citation numbers as ranked in figure 4 change significantly. In this case, the noted papers published in 2010, 2003, and 1993 ranked first, second and third, respectively (Figure 5).

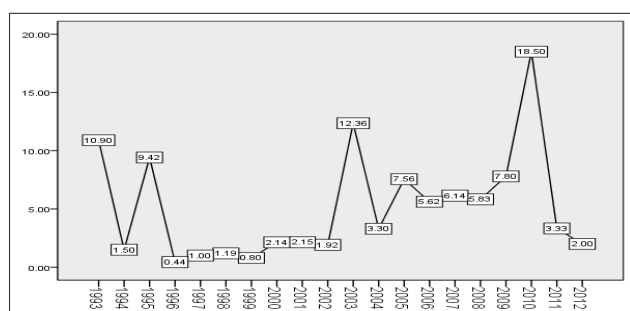


Figure 5. The number of citations to papers by their publication age

Measuring the correlation coefficient between citation number and paper publishing age showed a positively significant correlation ($r = .375, p < .05$). This means that as the paper publishing age increases, the number of citations increases, too.

Iranians' international contributions to dentistry field were in collaboration with U. S. A. (84 papers), Australia (45 pa-

pers), British Kingdom (39 papers) and Finland (23 papers), ranked in descending order. In the case of Asian countries, collaborations with South Korea (10 papers), India and Japan (8 papers in each) were in higher ranks (Figure 6).

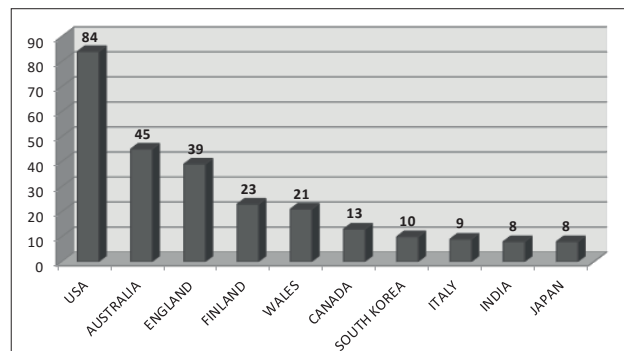


Figure 6. The status of Iranian researchers' collaboration with those of other countries worldwide

More than half of the papers were published in 10 journals among them Journal of Endodontics (with 79 papers), Journal of Oral and Maxillofacial Surgery (with 76 papers) and Medicina Oral Patologia Oral Y Cirugia Bucal (with 46 papers) had the first, second and third ranks, respectively. The core journals of the field can be depicted as shown in Figure 7.

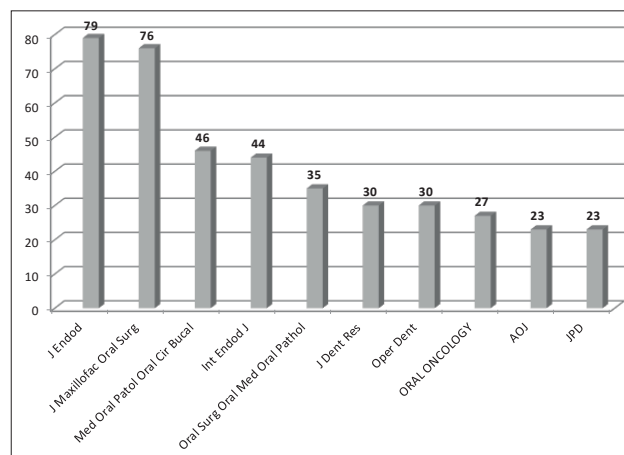


Figure 7. The core journals of dentistry field

Of Iran's top universities and research institutes, ten top ones published 93% (859 papers) in the field. Tehran University of Medical Sciences (with 244 papers, 26.29%), Shahid Beheshti University of Medical Sciences (with 137 papers, 14.76%) and Mashhad University of Medical Sciences (with 90 papers, 9.7%) were in first, second and third ranks as to the number of published papers affiliated by them, respectively.

About half of the papers produced in the field in this 20-year time span were authored only by 25 Iranian top researchers in the field, showing the low activity of other related researchers. The highly-ranked authors in the field were Mo'tamedi (with 55 papers), Safari (with 25 papers), and Lotfi and Parirokh (each with 22 papers).

Regarding dentistry researchers' interdisciplinary collaboration with researchers in other fields, the results showed that they collaborated with surgery specialists (with 47 papers), oncologists (with 27 papers), material scientists (24 papers) and pediatricians (with 18 papers).

4. DISCUSSION

This study showed that Iranian dentistry researchers published 297 scientific WoS indexed papers in a 20-year period, 1993-2012. Of them, more than 80% belonged to the second 10-year period, i.e. 2003-2012. While the number of papers indexed in this database has been increased, the growth rate experienced an increasing-decreasing trend. As a result, it can be said that there was no acceptable constant trend in Iranians' scientific production in dentistry field (Figure 2). This is true in terms of each dentistry subfield. Of 16 studied subfields, the most productive ones belonged to endodontic, surgery, and orthodontic and the least productive ones belonged to medical education, implant and oral pathology (Figure 3). One possible reason is that some subfields are emergent. The individual nature and features of some other subfields, as multidisciplinary nature in case of surgery are another possible reason, resulting in conducting multidisciplinary research in these fields and subsequently increasing in scientific production in them. The growth rate in endodontic subfield was 90%, revealing that the research activity in the subfield was significantly more than in other subfields. In a similar study in 2008, the amount of scientific production in orthodontic subfield was more than those in other subfields worldwide (8). In a study in Argentina, however, the most productive subfield belonged to dental material subfield and orthodontic subfield put in the second rank (9).

The scientific production in dentistry field is rather in qualitatively appropriate statues. If we put citation as a measure for quality, the papers in the field were cited 4805 times (with average citation of 5.18). As the h index of the field was 29, this index is lower than those in medicine (h=82), psychology (h=26), pharmacology (h=57), and more than those in ophthalmology (h=27), nursing (h=19), anatomy (h=16) (10) and Sport Science with h 17 (11).

Iranian dentistry researchers mostly collaborated with U. S. A. and Australian researchers worldwide and South Korean and Indian researchers in case of Asian countries. This finding accords that of Zera'atkar and colleagues conducted in 2009 (4). Iranian researchers' collaboration with U. S. A. researchers was in the highest level in psychology (12) and agriculture (13), too.

Findings also showed that there was a positively significant relationship between citation count and paper publication age. This means that more the paper age is, more the received citations is. The comparison of the mean rates of papers published in the first 10-year period (1993-2002) and the second 10-year period (2003-2012) showed a significant difference. Because of the lack of similar comparable studies, it can be only concluded that due to no development in information technologies and networks and consequent country-wide problems in information access and exchange in the first period, such conditions in scientific productions in most fields in Iran can be observed. In recent years, however, as a result of development of information technologies as well as facilitated information exchange along with some positive changes in science and technology policies, scientific production in all fields has been increased. As an evidence, the ranks of Iran in scientific production in the world and Middle East are 17 and 2, respectively (10).

Most importantly, more than half of the papers in dentistry

field were published in 10 journals (Figure 6) and about 93% of the published items belonged to 25 researchers affiliated in 10 top universities in the country. As a result, the distribution of the published papers in the field followed Lotka's law, highlighting that few authors produce most output in the field (14). In similar vein, distribution of the publishing journals in dentistry field followed Bradford's law, highlighting that few core journals publish most papers in the field (15). However, studies in the fields of geology (16), social capital (17) and supply chain management (18) did not follow Lotka law. In line with our study, in another study conducted in TAM (Technology Acceptance Model) field in SCI and SSCI Expanded databases in the time span of 1982-2009, the distribution of authors' productions followed Lotka's law, two (19).

5. CONCLUSIONS

The frequency distributions of scientific production in various dentistry subfields are not well-balanced. It is necessary to set context for developing these subfields in terms of required software and hardware facilities. As more than half of produced papers in the field were authored by 25 researchers working in 10 top Iranian universities, most researchers and related universities in these subfields are less-productive. In spite of Iranians' acknowledgeable scientific contributions in recent years, it is need to provide appropriate and ideal conditions by empowering motivational and financial factors, offering effective opportunities for researching and writing, holding needed courses for scientific writing and so on. By such ways, scientific movement will continue and reach on top in Iran.

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CONFLICT OF INTEREST: NONE DECLARED.

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