

Investigating the Most Cited Articles of Ahvaz Jundishapur University of Medical Sciences Indexed in Web of Science Database between Years 1990 and 2011

Parastoo Parsaei Mohammadi¹, Zivar Sabaghinejad¹, Fatemeh Rafieinasab² and Raziye Hassanzadeh Beheshtabad²

¹Lecturer at Ahvaz Jundishapur University of Medical Sciences and a Phd Candidate of Shahid Chamran University, Ahvaz, Iran.

²Department of Paramedicine School, Ahvaz Jundishapur University of Medical Sciences, Ahvaz, Iran.

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This study aims to analyze the published articles of Ahvaz Jundishapur University of Medical Sciences indexed in web of science database in a 22 year period between years 1990 and 2011. This is a descriptive study which investigates different aspects of articles published by researchers of the target university and indexed in ISI web of science database from the start of year 1990 till the end of year 2011 such as number of citations, place of publication, year of publication, author and other relevant information. The data gathering tool used in this study was internet and information extracted from ISI Web of Science database. The most cited articles published by the target university were published in year 2008 and the most number of citations were in year 2005 with 88 and 67 citations. Among the most cited articles, original research articles received the most number of citations. Eskandar Hajian was the most cited author of the target university. The most scientific cooperation was with Canada, Belgium, France and South Korea. Also the most cited journals were *Toxicon* and *Journal of Dermatological Treatment*. Among different fields of study, the most cited fields were Pharmacology and Medicine, Dermatology, General and Internal Medicine and Toxicology. Although the number of articles indexed in web of science database has increased steadily over the years, the number of citations to these articles hasn't shown the same increase which is not in agreement with national scientific progress roadmap.

Key words: Scientometrics, ISI articles, Indexing, Ahvaz Jundishapur University of Medical Science, Citation

Today, evaluating the research performance of people, universities, organizations and on the national, regional and international levels is important for policy makers, authorities and planners in various scientific fields. The results of evaluating scientific and research activities can help policy makers to reduce costs and make better use of human and financial resources in order to optimize and improve social and economical situation of a

country. Scientometrics is one of the methods used in evaluating scientific activities¹. Scientometrics is one of the reasons behind continuous flow of knowledge in scientific activities which is directly related to quantitative assessment of knowledge^{2,3}.

Given the importance of Scientometrics, various tools have been developed to help such evaluations, the most important of which are indexes and citation databases. Scopus and ISI databases are the most famous of these types of database (in this study the commonly used name of ISI which is the appreciation of Institute for Scientific Information is used in the place of the

* To whom all correspondence should be addressed.
E-mail: ftmhrafiei@gmail.com

current, official name of the database which is Thomson Reuters web of science). In recent years and after the possibility of online access to web of science database⁴ most universities and scientific institutions worldwide evaluated their scientific production using this database. This led to quantitative evaluation of scientific products to become an important factor when comparing different universities and countries.

In Iran and with the help of these indexes, various studies have been conducted in different scientific fields. Based on a report by Nature magazine, in year 2012 Iran is considered among one of the active countries in scientific production with a total of 20065 articles. However, only 0.44% of the Iranian scientific articles are among the top 1% most cited articles worldwide^{5,6}.

Today the number of published articles indexed in various databases and number of citations are among the criteria used in ranking universities^{7,8}. Therefore if scientific articles are indexed in various indexes and databases, their visibility and consequently their number of citations will increase⁹.

Given the fact that in recent years the number of Iranian the scientific productions related to medicine and Medical Sciences indexed in ISI database has shown a great increase¹⁰ and due to the role of universities as centers for scientific research and since often science stats as research and educational institutions before being used by other parts of society, it is important to evaluate the quality of scientific activities in universities. Therefore given the long history of Ahvaz Jundishapur University of Medical Sciences and its place as one of the type one universities in Iran, the evaluation of the scientific productions of this university is of great importance.

A literature review shows that to this date no study as concentrated on citation situation of articles by Ahvaz Jundishapur University of Medical Sciences and most studies only investigated the general situation of scientific production in this university. Since nowadays the number of citations to an article is one of the criteria for its evaluation or in other words, articles with more citation have better quality, investigating the citation situation of articles published by a university can provide information useful for long-term planning and improving the ranking of the

university in national and international level. Therefore this study aims to investigate the citation situation of articles published by Ahvaz Jundishapur University of Medical Sciences and indexed in WOS database in a 22 year period between years 1990 and 2011. The results of this study can be used to determine the strengths and weaknesses of research policies of this university which in turn can be used to improve its scientific and research situation.

Literature review

Due to the limited number of studies about most cited articles, in this part studies investigating all scientific productions and other similar articles are also investigated.

Hassan Zadeh *et al.* in a study titled "Investigating the Scientific Production of Iran University of Medical Sciences with Co-Authorship Network in Web of Science Database till the End of Year 2007" investigated the indexed articles published by this university. This study showed that the largest number of indexed articles was published in year 2006 and that original papers had the highest ratio. Also articles related to surgery were the most numerous while articles in the field of immunology had the highest co-authorship ratio¹¹.

Dabbaghmanesh *et al.* in an article titled "Most cited articles Shiraz University of Medical Sciences in ISI database during the years 1990 to 2008" investigated the indexed situation of articles published by Shiraz University. Their findings showed that among total 1633 articles indexed in ISI database during the study period, 175 articles (10.7%) were cited more than 10 times. The most number of citations to a paper was 94 and original papers were cited more than other articles. The least number of citations belonged to review papers which constituted 3.4% of all investigated articles. Also 89.1% of the articles had Iranian authors with Iranian affiliations while 10.9% of the articles were the results of international research activities. Also United States, England and Germany were the countries with the most number of co-authored articles with the target university with 23.1, 19.2 and 11.5% of all international articles respectively¹².

Tabari in his study called "The production of scientific papers by faculty members of Guilan University of Medical Sciences"

investigated the scientific production of Guilan University. Among total 879 articles, 77% was published by department of medicine and faculty of internal medicine was the most active faculty of this department with 66% of all the articles. Also the results showed an increasing trend in the number of articles published by all departments of this university although the rate of increase is different in different departments¹³.

Shahbodaghi and Shekofteh in a study titled "survey the status of the publication and citation Articles Shahid Beheshti University of Medical Sciences in citation indexes Thomson (ISI) in 1998 to 2007" investigated the articles published by Shahid Beheshti University and indexed in ISI database. Their findings showed that a total of 1421 articles were indexed in the investigated time period. The most number of articles was indexed in year 2007 with 499 and year 2006 with 257 articles. In addition, American Journal of Gastroenterology and Journal of Endourology had published the most number of articles from this university. In addition, from 1421 articles, 1001 articles had Shahid Beheshti University as their first affiliation and then researchers from University of Tehran with 131 articles, from Tarbiat Modares University and Pasteur Institute with 27 articles, Baghiatallah University with 23 articles and researchers from other research institutions with 212 articles had been the first affiliation of the investigated articles⁹.

Mobasheri *et al.* in his paper titled "Output of Science Shahrekord University of Medical Sciences at the database ISI-SCIE by the end of 2011, based on scientometrics indicators" investigated the scientific productions of Shahrekord University. Their results showed that the number of articles by this university indexed in ISI-SCIE database was a total of 142 articles in 89 different journals. In addition, the total number of citations to this university's articles was 352 with an average of 2.48 citations per article¹⁴.

In his study, Lukenda investigated the influence of the 1991-1995 war on creation of publications in the Medline database in Croatia. He investigated the affect of war on scientific production in several universities and research institutions in various cities. The results showed that despite the negative effects of the war, Croatia showed a good scientific progress in the field of medicine¹⁵.

Adkins and Budd also investigated the scientific productions of United States in the field of librarianship between years 1999 and 2004. Based on their results, Tenopir was the leading manufacturer of knowledge in this field. In addition, the results of this study showed that the most number of citations was to articles by Saracevic and that University of Indiana had published the largest number of articles¹⁶.

A report published in year 2007 by department for innovation, universities and skills (DIUS) titled "UK Government: International Scientific Collaborations on the rise" showed that around 40% of scientific productions of United Kingdom between years 2001 and 2005 is the result of international collaboration. Also the scientific collaboration had increased by 50% compared to the collaboration between years 1996 and 2000. In addition, the results showed that most of these collaborations were with United States, Germany and France and most numerous articles were in the fields of clinical medicine, biology and environmental science¹⁷.

Osareh and Zare in their study investigated the scientific productions of University of Tehran indexed in WOS database between years 1989 and 2009. Their results showed that University of Tehran is the leading university in scientific productions in Iran. In addition, Ganjali from department of chemistry was the most active author. In addition, the growth rate of articles indexed in WOS database was 37.8%. The scientometric map of scientific productions of this university was created using Hysteresis software. The results obtained from this map showed that the main clusters belonged to department of chemistry and institutions of Biochemistry and biophysics¹⁸.

Universities and institutions of higher education are the most important channels of scientific production in a country. Therefore evaluating the activities of universities had always been important to various researchers and policymakers. Investigating similar studies in this field showed that most scientometrics studies on scientific output of universities had investigated the articles indexed in ISI database and used scientometrics tools in order to evaluate the scientific productions of universities. In addition, an important trend in the previous literature

included an increase in scientific production and original papers, increase in scientific collaboration and participation of Iranian authors in international collaborations. The current study aims to use the previous studies as groundwork for investigating the most cited articles in the target university and uses the number of citations to evaluate the quality of scientific productions.

Study Method

This descriptive study was carried out in 2013 in Ahvaz Jundishapur University of Medical Science. During the study all articles published by researchers from the target university indexed in ISI database between years 1990 and 2011 were investigated. The reason for selecting year 2011 as the last year of the study period was to provide new articles for at least two years time which creates suitable opportunities for citation to articles. A two year period is also the standard used citation report of journals. The data gathering tool was library method with the help of internet of extraction of articles from ISI Web of Knowledge internet database.

Due to two possible spelling used for "Ahvaz" (Ahvaz and Ahvaz) search was carried out twice. First using the spelling "Ahvaz" the search was carried out for the period between years 1990 and 2011 and a total of 2434 records were returned. After refining, organizing and enhancing the search with 32 terms related to Jundishapur University, a total of 865 records were extracted in this step. Among these numbers 457 articles had not been cited. The same method was used using the spelling "Ahvaz" and a total of 671 record was returned in the initial search and a total of 408 record was extracted after refining, organizing and enhancing the search with 25 terms related to Jundishapur University. By matching the results of two searches, 361 records that were similar to those with the spelling "Ahvaz" were eliminated and a total of 42 records remained. Among these 29 articles had not been cited and were eliminated and the remaining 13 records were added to the 408 records obtained from the previous search.

Findings

The most cited articles of Ahvaz Jundishapur University of Medical Sciences indexed in WOS database between years 1990 and 2011

Among total 421 articles investigated in this study, 116 articles (56%) had 5 or more citations.

Figure 1: the number of most cited articles of Ahvaz Jundishapur University of Medical Sciences based on the number of citations

Based on figure 1, the most number of citations to an article was 88 citations which belonged to an article titled "Simultaneous pre-concentration and determination of copper, nickel, cobalt and lead ions content by flame atomic absorption spectrometry" published in 2005. An article titled "Epidemiological aspects of canine visceral leishmaniasis in the Islamic Republic of Iran" with 67 citations published in 2005 and two articles titled "Friction factors for coniferous trees along rivers" and "Highly selective and sensitive pre-concentration of mercury ion and determination by cold vapor atomic absorption spectroscopy" published in 2000 and 2006 respectively with 63 citations each had the second and third place. Figure 2 shows the increasing trend in number of articles cited more than 5 times and shows that less than 10 articles with more than 5 citations existed in 1990s while the total number of articles

Table 1. Most cited articles of Ahvaz Jundishapur University of Medical Sciences based on article type

Article type	Frequency	Percent
Review	4	3.7
Article, Proceedings paper	3	2.3
Original article	108	93.5
Analytical Letter	1	0.5
Total	116	100

Table 2. Most cited authors of Ahvaz Jundishapur University of Medical Science

Author	Number of articles
Hajiani, Eskandar	7
Jalali, Amir	6
Masjedi-Zadeh, Abdolrahim	6
Radmanesh, Mohammad	6
Samarbaf-Zadeh, Ali Reza	6
Hashemi, Jalal	5
Mohammadi, Mohammad-Reza	5
Pipelzadeh, Mohammad Hassan	5
Salavati, Mahyar	5
Alavi, Seyed Mohammad	4
Makvandi, Manochehr	4
Mazaheri, Masood	4
Negahban, Hossein	4

increased to 116. In addition, the most number of highly cited articles were published in year 2008 with 18 articles while in years 1994, 1996 and 2001 only 1 article with more than 5 citations was

published.

Figure 2: the number of articles cited more than 5 times based on publication year

Table 3. Amount of national collaboration in publishing most cited articles of Ahvaz Jundishapur University of Medical Science

University name	Frequency
Jundishapur Univ Med Sci, Ahvaz, Iran	223
Tehran University of Medical Sciences	101
Beheshti University of Medical Sciences, Tehran, Iran	25
Shiraz University of Medical Sciences Shiraz, Iran	11
Mashhad University of Medical Sciences, Mashhad, Iran	8
Islamic Azad Univ, Sci & Res Branch, Dept Bioengn, Tehran, Iran.	8
Isfahan Med Univ, UNRC, Esfahan, Iran.	8
Baghiatallah Med Univ, UNRC, Tehran, Iran.	6
Kerman Shah Univ Med Sci, Fac Med, Kermanshah, Iran	5
Tarbiat Modares Univ, Dept Soil Sci, Tehran, Iran.	5

Table 4. International scientific collaboration in publishing most cited articles of Ahvaz Jundishapur University of Medical Science

University Name	Frequency
Univ Montreal, Ctr Excellence Neur, Montreal, PQ H2L 2W5, Canada.	10
Univ Leuven, Res Grp Funct Genom & Prote, B-3000 Leuven, Belgium.	8
university paris descartes, paris, france	8
Gyeongsang Natl Univ, Coll Vet Med, Jinju 660701, South Korea.	6

Table 5. Most cited articles of Ahvaz Jundishapur University of Medical Sciences divided by journal

No.	Journal	Frequency	IF
1	Toxicon	5	2.924
2	Journal of dermatological treatment	4	1.963
3	World journal of gastroenterology	3	2.547
4	Microbiological research	3	1.993
5	Hepatitis monthly	3	1.245
6	Communications in algebra	3	0.347
7	American journal of tropical medicine and hygiene	3	2.896
8	Scandinavian journal of clinical & laboratory investigation	2	1.294
9	Saudi medical journal	2	0.122
10	Pharmacological research	2	0.315
11	Pakistan journal of medical sciences	2	0.10
12	Medical sciences monitor	2	1.36
13	Jundishapur journal of microbiology	2	0
14	Journal of venomous animals and toxins including tropical diseases	2	0.55
15	International journal of dermatology	2	1.342
16	Indian journal of medical microbiology	2	0.907
17	European journal of pharmaceuticals and biopharmaceuticals	2	3.826
18	Cornea	2	1.746
19	Analytical letters	2	0.965

Type of most cited articles published by Ahvaz Jundishapur University of Medical Sciences indexed in WOS database between years 1990 and 2011

Another important factor is the type of most cited articles. Table 1 shows that most number of articles cited more than 5 times (108 articles, 93.5%) were original articles and the least number of articles was analytical letter with only 1 article (0.5%).

Most cited authors of Ahvaz Jundishapur University of Medical Sciences indexed in WOS database between years 1990 and 2011

As seen in table 2, the most cited author was Eskandar Hajiani with 7 articles with 5 or more citations while Amir Jalali, Abdolrahim Masjedi-Zadeh, Mohammad Radmanesh and Ali Reza Samarbaf-Zadeh with 6 articles and Jalal Hashemi, Mohammad-Reza Mohammadi, Mohammad Hassan Pipelzadeh and Salavati, Mahyar with 5 articles each had the second and third place respectively.

Scientific collaboration in national and international level in most cited articles of Ahvaz Jundishapur University of Medical Sciences indexed in WOS database between years 1990 and 2011

The scientific collaboration was calculated using the following equation:

$$cc = 1 - \left\{ \sum_{j=1}^k \left(\frac{1}{j} \right) \times \frac{F_j}{N} \right\}$$

In this equation F_j is the number of articles with j authors, j is the number of authors for each article, N is the total number of articles and K is the most number of authors in an article.

The least amount of collaboration belonged to two authors with 0.67% while the highest amount of collaboration was 0.99% (for 9, 15, 16, 21, 26 and 34 authors). The amount of collaboration was separately calculated for the least number of authors (a single author) to the most number of authors (34 authors). Then the average collaboration was calculated to be 0.92.

According to table 3, Ahvaz Jundishapur University of Medical Sciences with 223 articles, Tehran University of Medical Sciences with 101 and Tehran Shahid Beheshti University of Medical Sciences with 25 articles were the first, second and

third universities in national collaboration respectively while Shiraz University of Medical Sciences with 11 articles, Mashhad University of Medical Science, Tehran Azad University and Isfahan University of Medical Sciences with 8 articles, Tehran Baghiatallah University of Medical Sciences with 6 and Kermanshah University of Medical Sciences and Tehran Tarbiat Modares University with 5 articles had the next number of national collaborations.

Furthermore, University of Montreal, Canada with 10 articles is the first university in international scientific collaboration with Jundishapur University while University of Leuven, Belgium and University Paris Descartes, France with 8 and Gyeongsang Natl University of south Korea with 6 articles are the second and third universities in international scientific collaboration respectively.

Journals that published most cited articles of Ahvaz Jundishapur University of Medical Sciences between years 1990 and 2011 Based on table 5, *Toxicology* with 5 articles, *Journal of dermatological treatment* with 4 articles were the first and second journals with most number of published articles from the target university while five journals with 3 articles each and twelve journals with 2 articles each had the next ranks.

Fields of study for most cited articles of Ahvaz Jundishapur University of Medical Sciences between years 1990 and 2011

Table 6 shows that subjects of Pharmacology and Pharmacy with 14 articles, Dermatology; General & Internal Medicine and Toxicology with 8 articles and microbiology with 7

Table 6. Most cited articles of Ahvaz Jundishapur University of Medical Sciences divided by subject

Subject Category	Frequency
Pharmacology and Pharmacy	14
Dermatology	8
General and Internal Medicine	8
Toxicology	8
Microbiology	7
Neurosciences & Neurology	6
Chemistry	5
Environmental Sciences & Ecology	5
Gastroenterology & Hepatology	5
Research & Experimental Medicine	5

articles are the first three frequent articles among the most cited articles and fields of Neurosciences and Neurology with 6 and Chemistry, Environmental Sciences and Ecology, Gastroenterology and Hepatology and Research and Experimental Medicine with 5 articles each are the next frequent fields of study in the most cited articles.

DISCUSSION

Today, the scientific output of universities is one of the criteria used in their ranking. Therefore publication of articles and evaluation and ranking of countries based on their scientific collaboration in national and international levels has also become important. Quantitative Bibliometric methods are used in order to evaluate the publications and scientific production of a country or a certain field of study. Usually scientometrics methods are used in order to determine key and active authors, most cited articles, core and main journals in each field and comparison between scientific output of countries and universities. Therefore this study aimed to investigate the most cited articles published by Ahvaz Jundishapur University of Medical Science.

In regards for most cited articles in different years, the study by Hassanzadeh¹¹ the most cited articles of Iran University of Medical Sciences were published in year 2006 while the most cited articles in Shahbodaghi and Shekofteh's work⁹ were published in 2007. The most cited articles in this work were published in year 2008.

The results of study by Hassanzadeh *et al.*,¹¹ and Dabbaghmanesh *et al.*,¹² showed that most cited articles were original articles. These results are in similar to those reported in this study. On the other hand, review articles that are among the most important articles in regards to citation show the least number of citations. This emphasizes the need for improving the quality of review papers of this university and providing incentives for the researchers in order to produce better review articles.

In regards to the most cited authors, in Adkins and Budd's study Saracevic was the author with the most cited articles (16) and in the study by Osareh and Zare, Ganjali was reported to be the most cited author. In this work, the most cited

articles belonged to Eskandar Hajiani.

In relation to international collaborations, the report by Department for innovation, universities and skills (DIUS) (17) showed that the most amount of scientific collaboration was with United States, Germany and France. Similarly, in the study by Dabbaghmanesh *et al.* (12) United States, United Kingdom and Germany and in this study Canada, Belgium, France and South Korea were the countries with the most amount of scientific collaboration with the target university. As can be seen United States has the most amount of scientific collaboration in the other two studies while in this study Canada is the country with the most amount of collaboration which can be due to recent sanctions which reduced the amount of collaboration between two countries.

In the study by Shahbodaghi and Shekofteh (9), American Journal of Gastroenterology and Journal of Endourology were the two journals that had published the most number of articles while in this work Toxicon and Journal of Dermatological Treatment were the most popular journals.

The study by Hassanzadeh *et al.* (11) showed surgery to be the subject with the most amount of publication while in the study by Tabari (13) Internal medicine and in the report by DIUS (17) clinical studies, healthcare, life sciences and environmental science were the subjects with the most number of publications. The results of this study showed that pharmacology and pharmacy, dermatology, general and internal medicine and toxicology were the subjects with the most number of publications. The difference between the subjects in various works can be due to the different interests in each subject in different universities and the fact that some universities are more active in certain subjects compared to others.

Suggestions

The researcher suggests the following steps to be taken in order to improve the scientific production of Jundishapur University of Medical Science:

- Introducing credible journals with high IF to the faculty and researchers of the university in order to attract most citations

- Use of incentives, improving the motivation for writing of articles with more citations and improvement of research infrastructure

· Conducting group and collaborative projects with researchers from other countries.

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