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Scientometric analysis of the major Iranian medical universities

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Abstract Nowadays, scientometrics has become an important field of study to monitor the progresses in scientific performance of a research group, a department, a university etc. A number of scientometrical studies have been done about Iranian scientific outcome in recent years. But there is no comparison between major Iranian medical universities. In this study, by using Scopus as search engine, the scientific outcomes of the Iran University of Medical Sciences, Isfahan University of Medical Sciences, Mashhad University of Medical Sciences, Shahid Beheshti University of Medical Sciences, Shiraz University of Medical Sciences, Tabriz University of Medical Sciences, and Tehran University of Medical Sciences have been compared with each other. These universities were compared by the number of published articles per year, number of citations received per year, number of citations received per year per article, total H-indices, top ten authors, and top ten journals. The results of this study show that the order of the studied universities in research performance is as follow: Tehran > Shiraz = Shahid Beheshti > Isfahan = Iran > Tabriz = Mashhad universities of medical sciences. In addition, the data of Tehran University of Medical Sciences as the top medical university of Iran was compared with some of top medical universities around the world.

Keywords Iran · University of Medical Science · Number of article · Scientometric

Introduction

Higher education in Iran (Persia) goes back to centuries before the birth of Jesus, for example in schools of Nisibis, Sarouyeh, Reishahr and the first educational complex in

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form of university was Academy of Gundishapur in Ahvaz. After spread of Islam in Iran, almost higher education teachings were taught in clerical schools (Hawza) and nizamiyya which was a kind of higher education school in the region on that time and was established by Khwaja Nizam al-Mulk on eleventh century. Another famous university on thirteenth century, was Rab'-e Rashidi complex in Tabriz which was built and founded by efforts of Rashid al-Din Hamedani, the minister of the ruler of that era. Modern higher education was brought to Iran by Mirza Taghi Khan Amir Kabir with foundation of Dar ul-Funun school of higher education in Tehran on 1851. Following that, some other modern higher education schools were also established in Tehran. On 1934, University of Tehran was established by efforts of Professor Mahmoud Hessaby. It became the mother university of Iran and after that, universities through Iran was established in major cities including Tabriz, Ahvaz, Isfahan and Shiraz. University in Tabriz was established on 1945 by the name of Azerbaijan University and then changed name to University of Azarabadegan on 1947, and University of Tabriz after 1979 Islamic Revolution of Iran. On 1985, Tabriz University of Medical Sciences was separated from University of Tabriz like other medical universities through Iran in order to merge medical education, research and services. A list of major Iranian universities is available in Wikipedia® (http://en.wikipedia.org/wiki/List_of_universities_in_Iran).

Scientometric has become an important field of study in recent decades (Torres-Salinas et al. 2008; Abramo et al. 2009). It includes quantitative and/or qualitative analysis of the scientific products of many possible classes as objects, such as articles of an individual author, department, university, city, and country. As discussed by Schmoch and Schubert (2009) in details, the bibliometric indices are one of the indicators to evaluate the research performance and other indices should be taken into account for more comprehensive evaluation. The resulted data can be used as a tool for ranking (Alewell 1990), awarding, budgeting, and defining research priorities, which might be helpful in science related decision makings. The data used in this respect, should be as correct as possible. Different methods are available for data gathering which are most based on bibliometric approaches. For this purpose, useful commercial and free tools are available such as ISI Web of Knowledge™, Scopus™, and Google Scholar™. Each of these search engines provides a variety of options for a better and easier search for the user.

One of the problems in bibliography is correct/incorrect spelling of the names of the non-Latin authors (e.g. Chinese, Indian, Arabian, or Persian names). This makes bibliometric analysis difficult and requires careful and accurate data gathering. A possible solution to cover this issue is to check different spellings of a name (e.g. Mahbob, Mahboob, Mahboub, and Mahbub for "محبوب"). But this can be done for a limited number of author names and in large scale bibliometric analyzes (e.g. scientometric comparison of the universities' researchers output) it does not seem to be applicable. In addition, the variations in the names of the authors may be more than this and cannot be covered by different spelling. For example, in Iran accountable proportion of the surnames are two parted and could be indexed completely different of each other. In this case, it sounds better to use affiliation search, instead of author search; because varieties in name of an affiliation is less than varieties in name of related authors. However, there are different addresses for a specific affiliation which should also be considered (Aminpour et al. 2010). Among the most used scientometrical search engines, Scopus™ provides affiliation search which make it accessible to collect as complete as possible data for an institution.

A number of scientometric reports about Iranian researchers and universities are already published. Osareh and Wilson (2000) have studied publications from Iran in Science Citation Index during 1985–1989 and 1990–1994. Mehrdad et al. (2004) reported a brief

status of basic sciences in Iran. Moin et al. (2005) reported scientific output of Iran during 1967–2003. Yalpani and his co-authors (2005) have studied the relation of science policy and productivity of the researchers. Harirchi and co-workers (2007) have studied the reasons of co-authorship between Iranian and other countries scientists in the fields of physics, chemistry, and biology. Asemi (2010) has studied the proportion of citations to open access journals, which showed a huge difference in compare with citation to other journals. Recently, Sotudeh (2010) has studied the impact of Iranian scientific publications on the global science of the world.

Noori and his co-authors (2006), have reviewed scientific production of the researchers of the Isfahan University of Medical Sciences by using ISI. Shahbodaghi and Shekofteh (2009) have studied articles published by Shahid Beheshti University of Medical Sciences by using ISI. Hayati and Ebrahimy (2009) have studied the number of articles and related citations for three groups from Iran including: universities, research institutes, and other organizations. Finally, Aminpour et al. (2009) have performed a webometric analyses on Iranian medical universities.

But they did not compare the articles published by the researchers of the Iranian major medical universities. In this regard, the aims of this work are to compare articles published by the researchers of Iranian major medical sciences universities extracted from Scopus™ and discuss the differences among them, and a brief comparison between the top medical universities of Iran and other countries is provided.

Data

Total number of articles published by Iran affiliation which are already indexed in Scopus were collected. The 7 major Iranian medical universities including Iran University of Medical Sciences (IrUMS), Isfahan University of Medical Sciences (IUMS), Mashhad University of Medical Sciences (MUMS), Shahid Beheshti University of Medical Sciences (SBUMS), Shiraz University of Medical Sciences (SUMS), Tabriz University of Medical Sciences (TUOMS), and Tehran University of Medical Sciences (TUMS), were selected to be compared. The names of the cities for each university were searched in affiliation section of the Scopus™, and all related affiliations to each university were selected according to their details. The resulted documents considered as all available indexed articles of the related universities by Scopus™. The summary results of these searches used to compare productivity of the researchers of the universities. These are including: number of articles per year (NAPY), number of citations received per year (NCPY), number of citations received per year per article (NCPYPA), total H-index (THI), top ten authors (TTA), and top ten journals (TTJ) which the authors used to publish their articles.

The resulted lists of TTA of each university were searched through Scopus™ author search to find their complete list of articles, H-index, and current affiliation. (The searches of this work were done on 04–06 of July 2010.).

However, as the scientometric output of universities surely affected by the number of researchers, it has been tried to provide a list of number of researchers for the studied universities in recent years (http://www.old.hbi.ir/page.php?slct_pg_id=369&sid=17&slc_lang=fa, website in Persian language).

The top medical university for some of the countries including Austria, Belarus, Bulgaria, China, Hungary, Japan, Poland, Russia, Ukraine, and United States was found based on affiliation search using Scopus. The affiliation related to the medical university

with highest number of articles was selected as top medical university for the respected country. These countries were selected based on their education system which provided medical education in medical universities. The main limitation of the proposed comparison is that, in most of the universities around the world, different departments varying from chemistry department to the literature department exist in the university and a medical department is a small part of the university. However, in the case of Iranian medical sciences universities, the university includes only basic biomedical and clinical sciences. Fortunately, there are a number of similar medical sciences universities in some countries and we compared their data with those of the investigated universities from Iran. The restrictions of Scopus for the citations of the publications received before 1996 should also be kept in mind.

Results

Figure 1 shows total numbers of articles published from Iran since 1961. The affiliations found in relation to each university are listed in Table 1. Table 2 shows the oldest papers published by related studied affiliations which are indexed in Scopus. Figures 2, 3, and 4 show the NAPY, NCPY, and NCPYPA of the researchers of each university. The THI for the articles of each university are 27, 31, 22, 39, 34, 24, and 46 for IrUMS, IUMS, MUMS, SBUMS, SUMS, TUOMS, and TUMS, respectively. The TTA and TTJ for each university are listed in Tables 3 and 4. Table 5 shows the details of TTJ for all studied universities. Tables 6, 7, 8, and 9 listed more details of number of researchers, subject area, type of documents, number of citations of the published articles, H-index and G-index and their statistical data. As Table 6 shows, TUMS employs the highest and TUOMS the lowest number of staff. We had no access to the number of staff in the universities before 2004. In comparing the increase rate from 2004 to 2009, TUMS possesses the highest rate (85.3%) and IUMS possesses the lowest (69.6%) rate (Fig. 5). Careful review of Table 7 reveals that almost the same relative frequencies were observed for the subject area of the published articles from the investigated universities. As Table 8 shows, there are no differences between the relative frequencies of document types published with the

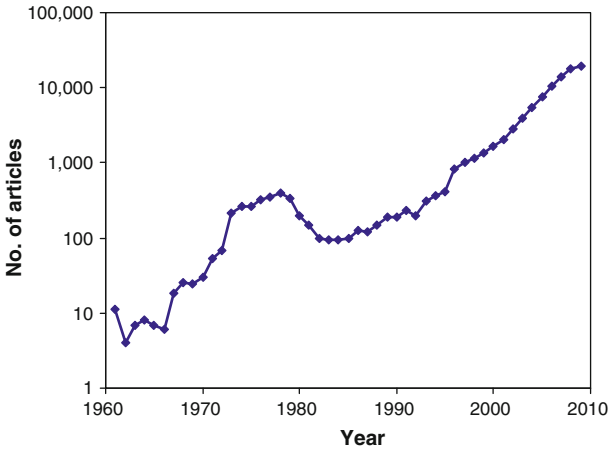

Fig. 1 Number of articles per year published from Iran including medical and non-medical sciences universities (indexed in Scopus)

Table 1 Related affiliation addresses of studied medical universities in Scopus™

University	Affiliations
IrUMS	"Daneshgahe Oloom Pezeshki va Khadamat Behdashti Darmani Iran", "Shahid Hashemi Nejad Kidney Hospital"
IUMS	"Isfahan University of Medical Sciences", "Alzahra University Hospital", "Isfahan Cardiovascular Research Center", "Imam Mousa Kazem Burns Hospital, Iran"
MUMS	"Mashhad University of Medical Sciences", "Ghaem Hospital", "Imam Reza Hospital"
SBUMS	"Shahid Beheshti Medical University", "Labbafinejad Medical Center", "National Research Institute of Tuberculosis and Lung Disease Tehran", "Loghman-Hakim Hospital", "Shahid Beheshti Medical University, Modarres Hospital", "Mofid Children's Hospital, Tehran", "Taleghani Hospital"
SUMS	"Shiraz University of Medical Sciences", "Namazi Hospital", "Faghihi Hospital Shiraz", "Hafez Hospital Shiraz", "Shiraz University of Medical Sciences, Chamran Hospital"
TUOMS	"Tabriz University of Medical Sciences", "National Public Health Management Center, Tabriz", "Tabriz University of Medical Sciences, Imam Khomeini Hospital", "Tabriz University of Medical Sciences, Tabriz Children Hospital", "Sina Hospital Tabriz", "Al-Zahra Hospital, Tabriz"
TUMS	"Tehran University of Medical Sciences", "Shariati Hospital", "Imam Khomeini Hospital", "Endocrinology and Metabolism Research Center", "Razi Hospital", "Sina Hospital Tehran", "Amiralam Hospital", "Tehran University of Medical Sciences, School of Medicine"

affiliation of the investigated universities in which 88.8% of the articles are the original articles. Concerning the H-index, TUMS is the leading one followed by SBUMS, SUMS, IUMS, IrUMS, TUOMS and MUMS. The order of G-index is TUMS > SBUMS > IUMS > IrUMS = SUMS > TUOMS > MUMS.

The Medical University of Vienna and the Belarussian State Medical University are the highest and the lowest ranked studied medical university based on total number of articles, respectively. The Medical University of South Carolina and the Vladivostok State Medical University are the highest and lowest ranked studied medical university based on H-index, respectively. The TUMS is ranked in the middle, both based on total number of papers and H-index. A complete detail of the comparison is available in Table 10.

Discussion

There is good agreement between registered addresses in Scopus™ for studied universities with the results of work of Aminpour et al. (2010). The trend of the changes in number of articles published from Iran is in good agreement with previously reported data (Mehrdad et al. 2004; Moin et al. 2005; Yalpani et al. 2005). The main trend of number of articles published by studied Iranian universities in this work, is similar to the trend of Fig. 1.

In comparing medical universities, the results of this study show that TUMS is the highest ranked medical university among others based on NAPY. The SBUMS and SUMS are comparable with each other in the second place of ranking based on NAPY. The remaining universities have a similar pattern of NAPY in recent years. The growth pattern of NAPY for TUOMS shows a sharp increase from 2005 to 2008, but has a reduction in 2009 where compared to 2008. There is no article from TUOMS before 1990, because it was indexed as Tabriz University. There are significant decrease and increase patterns in

Table 2 The oldest published articles by studied universities which are indexed in Scopus

University	Title	Author(s)	Journal	Year	Cited
IrUMS	Photoreaction of benzofurazan and dimethyl acetylenedicarboxylate. Synthesis of isomeric isoxazoles. Carbon-13 nuclear magnetic resonance spectra of isoxazoles and oxazoles	Yavari, I., Esfandiari, S., Mostashari, A.J., Hunter, P.W.W.	Journal of Organic Chemistry	1975	4
IUMS	Zinc deficiency as a possible etiological factor of hepatosplenomegaly in Isfahan, Iran	Daneshgar, H., Maleky, M., Farivar, H., Moghimy, G.	Pahlavi Medical Journal	1974	0
MUMS	Clinical observations in 67 cases of arteritis	Shahidi, H.	Folia Angiologica	1973	0
SBUMS	Environmental iodine intake affects the response to methimazole in patients with diffuse toxic goiter	Azizi, F.	Journal of Clinical Endocrinology and Metabolism	1985	19
SUMS	Glutathione stability of the erythrocytes in Iranians	Walker, D.G., Bowman, J.E.	Nature	1959	2
TUOMS	A model for linearizing drug dissolution data	Barzegar-Jalali, M.	International Journal of Pharmaceutics	1990	2
TUMS	Studies on Schistosoma bovis in Iran	Arfaa, F., Sabbaghian, H., Bijan, H.	Transactions of the Royal Society of Tropical Medicine and Hygiene	1965	0

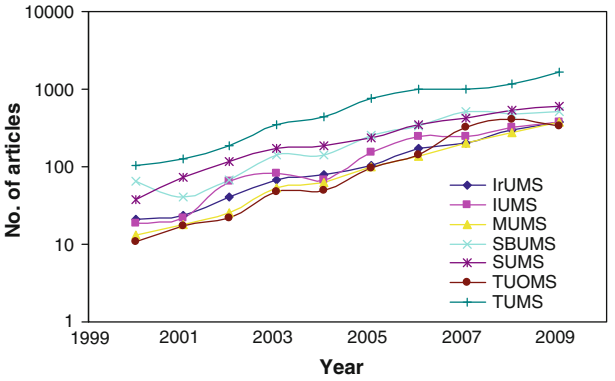

Fig. 2 Number of articles per year for each studied university of medical sciences during 2000–2009 (indexed in Scopus)

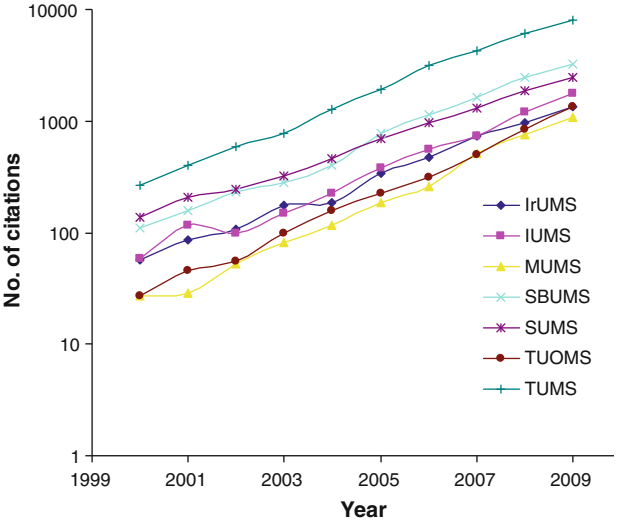

Fig. 3 Number of citations received per year for each studied university of medical sciences during 2000–2009 (indexed in Scopus)

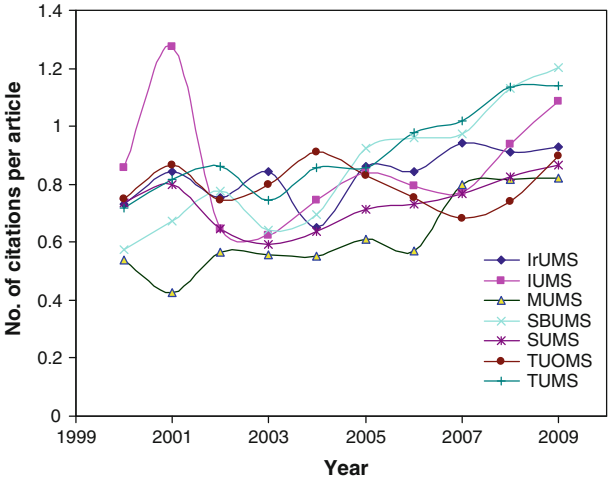

Fig. 4 Number of citations received per year per article for each studied university of medical sciences during 2000–2009 (indexed in Scopus)

Table 3 Details for ten top authors of each studied universities, searched by Scopus™

No.	University	Author	Count	H-index
1	IrUMS	Mahmoudian, M. (49)	96	11
2	IrUMS	Ghods, A.J. (36)	60	11
3	IrUMS	Roghani, M (27)	40	7
4	IrUMS	Baluchnejadmojarad, T. (25)	34	6
5	IrUMS	Kashkouli, M.B. (25)	45	7
6	IrUMS	Farhadi, M. (25)[a]	45	11
7	IrUMS	Nojomi, M. (22)	27	4
8	IrUMS	Mohamadnejad, M. (22)	39	13
9	IrUMS	Daneshi, A. (20)	22	5
10	IrUMS	Fereshtehnejad, S.M. (20)	20	2
11	IUMS	Kelishadi, R. (84)[b]	87	13
12	IUMS	Janghorbani, M. (46)	58	13
13	IUMS	Amini, M. (75)[b]	87	9
14	IUMS	Varshosaz, J. (35)	41	10
15	IUMS	Sajjadi, S.E. (34)	43	9
16	IUMS	Aminorroaya, A. (33)	35	7
17	IUMS	Hashemipour, M. (31)	33	5
18	IUMS	Ghannadi, A. (29)	34	9
19	IUMS	Azadbakht, L. (29)	57	13
20	IUMS	Asilian, A. (28)	32	9
21	MUMS	Hosseinzadeh, H. (80)	97	15
22	MUMS	Boskabady, M.H. (61)[b]	68	10
23	MUMS	Ramezani, M. (35)	48	10
24	MUMS	Iranshahi, M. (30)	43	10
25	MUMS	Shakeri, M.T. (30)	35	5
26	MUMS	Ghayour-Mobarhan, M. (28)	30	6
27	MUMS	Zakavi, S.R. (26)	40	4
28	MUMS	Sadeghi, R. (26)	28	3
29	MUMS	Behravan, J. (24)	33	6
30	MUMS	Balali-Mood, M. (21)	38	13
31	SBUMS	Azizi, F. (183)	230	23
32	SBUMS	Masjedi, M.R. (70)	101	11
33	SBUMS	Mirmiran, P. (67)	76	17
34	SBUMS	Zali, M.R. (87)[b]	153	12
35	SBUMS	Velayati, A.A. (57)	75	8
36	SBUMS	Simforoosh, N. (55)	79	10
37	SBUMS	Basiri, A. (53)	75	9
38	SBUMS	Kazemi, B. (49)	92	6
39	SBUMS	Zarghi, A. (48)	69	11
40	SBUMS	Kamalinejad, M. (47)	59	12
41	SUMS	Namazi, M.R. (118)[b]	152	9
42	SUMS	Karimi, M. (90)	111	11
43	SUMS	Kumar, P.V. (86)	122	10

Table 3 continued

No.	University	Author	Count	H-index
44	SUMS	Miri, R. (97)[b]	105	15
45	SUMS	Ghaderi, A. (93)	111	15
46	SUMS	Ghanizadeh, A. (76)	82	9
47	SUMS	Geramizadeh, B. (71)	87	7
48	SUMS	Ahmadi, J. (68)[a]	126	19
49	SUMS	Bahador, A. (65)	73	7
50	SUMS	Salahi, H. (64)	75	8
51	TUOMS	Shoja, M.M. (160)[b]	227	7
52	TUOMS	Jouyban, A. (95)[b]	126	16
53	TUOMS	Loukas, M. (71)[a]	212	10
54	TUOMS	Tubbs, R.S. (130)[a, b]	480	14
55	TUOMS	Ardalan, M.R. (66)[b]	79	6
56	TUOMS	Oakes, W.J. (57)[a]	400	29
57	TUOMS	Nokhodchi, A. (60)[a, b]	77	15
58	TUOMS	Barzegar-Jalali, M. (41)	68	12
59	TUOMS	Argani, H. (33)	44	5
60	TUOMS	Delazar, A. (30)	37	11
61	TUMS	Larijani, B. (252)	299	17
62	TUMS	Dehpour, A.R. (215)	294	20
63	TUMS	Abdollahi, M. (193)	233	25
64	TUMS	Shafiee, A. (191)	291	22
65	TUMS	Zarrindast, M.R. (173)	272	25
66	TUMS	Malekzadeh, R. (155)[b]	187	22
67	TUMS	Rezaei, N. (88)	115	17
68	TUMS	Akhondzadeh, S. (74)	95	19
69	TUMS	Davatchi, F. (71)	90	11
70	TUMS	Pourpak, Z. (68)	96	14

[a] These authors are not indexed with the searched affiliation at the time of this study

[b] These authors have more than one profile in search results

NAPY during years of 1977 to 1988 for all of the studied universities. Some of the related reasons for this pattern were discussed by Mehrdad et al. (2004).

Based on NCPY and THI, the TUMS is the highest ranked university and SBUMS and SUMS are comparable with each other in the second place. In the third place of ranking are the IrUMS and IUMS. Finally TUOMS and MUMS, are placed. The webometric results of the work of the Aminpour et al. (2009) show that the ranking of the studied universities is as follow: TUMS > IrUMS > IUMS > SUMS > TUOMS > MUMS > SUMS. This shows rather different ranking for studied universities. However, it must be taken to account that the analyses of present work is different from webometric ones. In webometrics, number of web pages with the name of the university and redirection to those pages from other web pages (which can be found by using search engines such as Google™) are counted.

Table 4 List of ten top journals of studied universities, searched by Scopus™

No.	IrUMS	IUMS	MUMS	SBUMS	SUMS	TUOMS	TUMS
1	Archives of Iranian Medicine (4.4%)	Journal of Research in Medical Sciences (12.6%)	Iranian Journal of Medical Sciences (3.8%)	Archives of Iranian Medicine (4.6%)	Iranian Journal of Medical Sciences (7.5%)	Pakistan Journal of Biological Sciences (3.2%)	Archives of Iranian Medicine (3.3%)
2	Transplantation Proceedings (2.5%)	Archives of Iranian Medicine (2.4%)	Pharmacologyonline (3.0%)	Tanaffos (3.9%)	Acta Cytologica (3.2%)	Transplantation Proceedings (3.0%)	Acta Medica Iranica (2.8%)
3	Acta Medica Iranica (2.2%)	Daru (1.9%)	Archives of Iranian Medicine (2.7%)	Eastern Mediterranean Health Journal (2.0%)	Iranian Red Crescent Medical Journal (2.9%)	Saudi Medical Journal (3.0%)	Iranian Journal of Public Health (2.4%)
4	Iranian Biomedical Journal (2.1%)	Pakistan Journal of Biological Sciences (1.6%)	Journal of Contemporary Dental Practice (1.8%)	Transplantation Proceedings (1.5%)	Transplantation Proceedings (2.5%)	Daru (2.4%)	Daru (2.4%)
5	Burns (1.3%)	Iranian Journal of Medical Sciences (1.5%)	Transplantation Proceedings (1.7%)	Daru (1.4%)	Archives of Iranian Medicine (2.3%)	International Journal of Pharmaceutics (1.9%)	Tehran University Medical Journal (1.5%)
6	Iranian Journal of Public Health (1.3%)	Eastern Mediterranean Health Journal (1.4%)	Journal of Medicinal Plants (1.7%)	Urology Journal (1.1%)	Medical Hypotheses (2.1%)	Folia Morphologica (1.7%)	Iranian Journal of Diabetes and Lipid Disorders (1.4%)
7	Journal of Research in Medical Sciences (1.3%)	Iranian Biomedical Journal (1.3%)	Saudi Medical Journal (1.4%)	Iranian Journal of Medical Sciences (1.1%)	Eastern Mediterranean Health Journal (1.6%)	Rawal Medical Journal (1.6%)	Journal of Medicinal Plants (1.2%)
8	Iranian Journal of Ophthalmology (1.2%)	Saudi Medical Journal (1.3%)	Iranian Biomedical Journal (1.4%)	Acta Medica Iranica (1.1%)	International Journal of Gynecology and Obstetrics (1.1%)	Pakistan Journal of Medical Sciences (1.6%)	Pakistan Journal of Biological Sciences (1.2%)
9	Daru (1.1%)	Journal of Essential Oil Research (1.3%)	Urology Journal (1.4%)	Journal of Pharmacy and Pharmacology (1.0%)	Journal of Applied Animal Research (0.9%)	Acta Medica Iranica (1.5%)	Transplantation Proceedings (1.2%)
10	Yakhteh (1.0%)	Iranian Journal of Public Health (0.9%)	Journal of Oral Science (1.4%)	Journal of Essential Oil Research (0.9%)	Iranian Journal of Immunology (0.9%)	Medical Hypotheses (1.5%)	Pakistan Journal of Medical Sciences (1.0%)

Table 5 Details of the top journals list of studied universities, searched by Scopus™

Journal	Publisher	Country	SJR	SNIP	H-index
Acta Cytologica	Science Printers and Publishers	USA	0.079	0.540	38
Acta Medica Iranica	Tehran University of Medical Sciences	Iran	0.034	0.090	3
Archives of Iranian Medicine	Academy of Medical Sciences of I.R. Iran	Iran	0.065	0.280	9
Burns	Elsevier BV	Netherlands	0.141	1.130	38
Daru	Tehran University of Medical Sciences	Iran	0.043	0.420	7
Eastern Mediterranean Health Journal	World Health Organization	Switzerland	0.055	0.360	15
Folia Morphologica	Wydawnictwo Via Medica	Poland	0.049	0.360	9
International Journal of Gynecology and Obstetrics	Elsevier BV	Netherlands	0.134	0.800	41
International Journal of Pharmaceutics	Elsevier BV	Netherlands	0.202	1.670	74
Iranian Biomedical Journal	Pasteur Institute of Iran	Iran	0.051	0.280	5
Iranian Journal of Diabetes and Lipid Disorders	Tehran University of Medical Sciences	Iran	0.033	0.050	1
Iranian Journal of Immunology	Iranian Society for Immunology & Allergy	Iran	0.060	0.160	4
Iranian Journal of Medical Sciences	Shiraz University of Medical Sciences	Iran	0.036	0.160	6
Iranian Journal of Ophthalmology	Iranian Society of Ophthalmology	Iran	0.029	0.050	1
Iranian Journal of Public Health	Iranian Public Health Association	Iran	0.038	0.250	4
Iranian Red Crescent Medical Journal	Iranian Red Crescent Society	UAE	0.032	0.140	1
Journal of Applied Animal Research	Garuda Scientific Publications	India	0.033	0.250	11
Journal of Contemporary Dental Practice	Procter & Gamble Co.	USA	0.058	0.590	13
Journal of Essential Oil Research	Allured Publishing Corp.	USA	0.044	0.530	22
Journal of Medicinal Plants	Institute of Medicinal Plants	Iran	0.031	0.070	2
Journal of Oral Science	Nihon University	Japan	0.071	0.610	13
Journal of Pharmacy and Pharmacology	Pharmaceutical Press	UK	0.140	0.720	50
Journal of Research in Medical Sciences	Isfahan University of Medical Sciences	Iran	0.033	0.100	2
Medical Hypotheses	Elsevier BV	Netherlands	0.124	0.400	37
Pakistan Journal of Biological Sciences	Asian Network for Scientific Information	Pakistan	0.035	0.140	5
Pakistan Journal of Medical Sciences	Professional Medical Publications	Pakistan	0.036	0.230	7
Pharmacologyonline	University of Salerno	Italy	0.033	0.250	3
Rawal Medical Journal	Pakistan Medical Association	Pakistan	–	–	1
Saudi Medical Journal	Saudi Arabian Armed Forces Ministry of Defence and Activation	Saudi Arabia	0.054	0.280	17

Table 5 continued

Journal	Publisher	Country	SJR	SNIP	H-index
Tanaffos	Shahid Beheshti University of Medical Sciences	Iran	–	–	2
Tehran University Medical Journal	Tehran University of Medical Sciences	Iran	–	–	1
Transplantation Proceedings	Appleton & Lange	USA	0.126	0.540	49
Urology Journal	Urology and Nephrology Research Center	Iran	0.085	0.200	3
Yakhteh	Jehad Daneshgahi of Iran Medical Sciences University	Iran	0.034	0.050	2

SNIP Source Normalized Impact per Paper, *SJR* SCImago Journal Rank

Table 6 The number of researchers for studied Iranian Medical universities in recent years, based on official reports of the Ministry of Health and Medical Education of Iran (http://www.old.hbi.ir/page.php?slct_pg_id=369&sid=17&slc_lang=fa, website in Persian language)

University	2004	2005	2006	2007	2008	2009
IrUMS	803	803	852	889	983	1076
IUMS	628	739	826	713	782	902
MUMS	665	633	700	709	771	843
SBUMS	967	1067	1066	1128	1220	1326
SUMS	622	639	660	664	721	818
TUOMS	528	544	641	645	678	704
TUMS	1710	1633	1690	1768	1857	2004

Table 7 Data summary for subject area of the published articles by studied universities

	IrUMS (%)	IUMS (%)	MUMS (%)	SBUMS (%)	SUMS (%)	TUOMS (%)	TUMS (%)
Medicine	77.5	73.8	67.8	71.9	82.2	64.3	70.2
Pharmacology, Toxicology and Pharmaceutics	8.8	10.4	20.3	13.7	7.4	17.4	14.8
Neuroscience	3.3	3.6	2.5	6.6	2.6	3.9	5.2
Dentistry	0.5	2.2	4.9	3.4	1.0	3.0	2.0
Nursing	2.1	2.6	1.2	1.6	0.9	3.5	1.4
Agricultural and Biological Sciences	2.0	7.6	5.7	7.0	5.2	8.3	4.8
Biochemistry, Genetics and Molecular Biology	15.2	13.1	14.1	13.5	16.3	17.0	12.8
Immunology and Microbiology	6.0	5.0	4.6	4.2	6.7	3.7	6.7
Chemistry	1.4	5.7	7.8	4.7	4.4	9.5	5.2
Health Professions	3.9	1.5	2.8	1.2	1.3	2.3	1.7

Table 8 Data summary for document type of the published articles by studied universities

	IrUMS (%)	IUMS (%)	MUMS (%)	SBUMS (%)	SUMS (%)	TUOMS (%)	TUMS (%)	Average (%)
Article	89.0	90.8	90.9	90.6	83.1	89.3	88.2	88.8
Review	2.8	2.6	2.5	3.0	2.6	3.3	3.9	3.0
Letter	2.6	2.4	3.3	2.9	9.8	4.4	3.2	4.1
Conference paper	4.1	2.2	2.6	2.1	2.0	1.7	2.9	2.5
Short survey	0.2	0.1	0.1	0.1	0.4	0.4	0.2	0.2
Note	0.3	0.2	0.2	0.3	0.3	0.3	0.5	0.3
Article in press	0.5	0.5	0.2	0.5	0.3	0.5	0.3	0.4
Erratum	0.3	0.2	0.1	0.3	0.2	0.3	0.2	0.2

Table 9 Data summary for citations of the articles published by the investigated Iranian university of medical sciences

	IrUMS	IUMS	MUMS	SBUMS	SUMS	TUOMS	TUMS
H-index	27	31	22	39	34	24	46
G-index	43	46	31	52	43	32	66
Mean	6.75	6.86	5.73	7.38	5.87	5.48	7.29
Standard deviation	12.62	12.23	7.99	10.56	8.28	7.66	11.53
Kurtosis	80.05	57.49	21.58	29.25	19.37	29.74	154.45
Skewness	7.40	6.13	3.80	4.34	3.73	4.27	8.46
Maximum	190	171	79	140	90	90	317
Sum	5251	6288	3652	12,166	10,304	4357	31,266
Count	778	917	637	1648	1756	795	4288
Uncited	47.0%	46.7%	51.9%	39.4%	43.1%	46.7%	40.6%

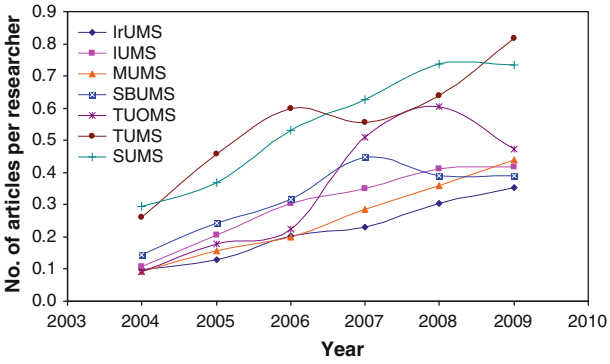

Fig. 5 Number of articles per number of research staff per year for the studied university of medical sciences during 2004–2009 (indexed in Scopus)

The trend of NCPYPA is not like the same as NAPY, NCPY, and THI and does not obey a specific trend. However, it shows that citations received by each university, mostly depends on the number of previously published articles and also might be an indicator of the quality of the papers published by that university.

Table 10 Comparison of total numbers of published papers and H-indices for the top medical universities of countries with medical university, searched by Scopus™

Country	University	Articles	H-index
Austria	Medical University of Vienna	27,815	153
United States	Medical University of South Carolina	24,269	181
Japan	Tokyo Medical and Dental University	20,450	152
Bulgaria	Medical University of Sofia	10,512	50
Poland	Medical University of Warsaw	9772	74
Iran	Tehran University of Medical Sciences	9384	49
Hungary	Semmelweis University of Medical Sciences	8923	81
China	Capital Medical University	7146	42
Russia	Vladivostok State Medical University	6594	14
Ukraine	Donetsk State Medical University	809	24
Belarus	Belarussian State Medical University	773	15

The TTA for each university shows that the top ten authors of the IUMS and MUMS are staffs of those universities, while other five studied universities have authors other than their staffs (or at least current staffs) and considered as co-authors to that universities. Based on total number of articles and H-index of each author, it can be seen that IrUMS, IUMS, and MUMS have a similar staffs in article productivity; SBUMS and SUMS have the same as well, TUMS has the most productive researchers, and TUOMS has a rather different variation of researchers.

The analyses of the TTJ show that except of TUOMS, other studied universities publish a major proportion of their researches in Iranian journals. However, it must be taken to account that two major official journals of TUOMS (Pharmaceutical Sciences, Journal of Faculty of Pharmacy, and Medical Journal of TUOMS) are published in Persian language and do not indexed in Scopus™ at this moment. The TUMS is placed in the middle of studied medical universities of the world. It is comparable with Medical University of Sofia both based on number of articles and H-index.

Conclusion

As concluding remark, it must be mentioned that the overall ranking of the studied medical universities based on their number of articles and related citations, is as follow: TUMS > SUMS = SBUMS > IUMS = IrUMS > TUOMS = MUMS. However this comparison might be normalized based on the number of staffs, researchers, students, and budgeting for each university. Unfortunately these data are not available for all investigated years of publications and also the growth in article publications of the studied universities has been restarted on 1988 which might be considered in scientometric analyses of these universities.

Finally, it should be mentioned that research budget in Iran is much more less than that of the developed countries like United States, and meanwhile, Iran holds a good place in scientific output in compare with other countries. This might show that research in Iran does not consume so money like developed countries, hence by little money consumption, considerable scientific output is achievable. This might provide an opportunity to conduct

joint research projects between Iranian universities and European or American universities.

Recommendations

For improving the scientometric outputs of the universities such as TUOMS, abstracting and indexing of their official journals in search engines (such as Scopus™) is recommended. This is the first step for selection of a journal by databases like ISI.

A robust, standard, and international method of naming for authors and affiliations will be helpful in bibliometric analyses.

Research in Iran does not consume a lot of money resources. So, cooperation between Iranian researchers and other countries is recommended. The input and output will be fruitful for both side.

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