

Scientific Profile of Pharmacology, Toxicology and Pharmaceutics Fields in Middle East Countries: Impacts of Iranian Scientists

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Abstract

In the present investigation, a statistical analysis was conducted to evaluate the production of scientific papers in the fields of Pharmacology, Toxicology and Pharmaceutical during a period of 1996-2007. The study identified the most active countries in the Middle East in comparison with some more developed countries, in which the most scientific impacts have been exerted. Our screenings through the most accessed data bases revealed that USA, Japan, UK and Germany are the leading countries regarding scientific publications and citations, since 51% of all citable-publications and 58% of total citations in the subject area belong to these scientifically prolific countries. The contribution of different world region during the studied period was: Western Europe (34.10%), Northern America (31.40%), Asiatic Region (21.50%), Eastern Europe (4.60%), Pacific Region (2.20%), Middle East (1.90%), Southern Africa (0.40%), Central Africa (0.30%), and Northern Africa, (0.10%). Within Middle-East region, Islamic Republic of Iran has produced 21.5% of total citable-publication and 13.7% citations, while such values for Egypt are 23% and 17.4%, respectively. A significant increase in scientific trend of the related subjects by Iranian scientists not only reveals a rapid and substantial growth of the number of scientific publications but also highlights the impacts of Iranian scientists within world scientific community.

Keywords: Pharmacology, Toxicology, Pharmaceutical, publication, Scientific output, Citation, Iran.

Introduction

In the era of third millennium, information and knowledge are going to become the main capitals of mankind. Such resources are deemed to play a key role in terms of international rules and regulations from politic, economic and scientific view points. In

fact, there exist a direct relationship between the economic advances and improvements with scientific production even though scientific productions are somehow contingent upon economical/political situations. For prophesy of scientific impacts, we need to investigate the profile of scientific achievements using subject-wise careful procedures.

The most general policy implication is that today scientific societies experiencing rapid growth of scientific data, which definitely needs to be scientometrically evaluated by screening the growth profiles of the target subject within decades to get reliable corollaries.

In this strategic region of globe, we perceive enhanced prolific outcomes for good sciences despite the cost of education in higher level which is considerably being exacerbated with endogenous/exogenous political/economical problems resulting in increased brain drain from this region towards more developed countries. For example, the Islamic Republic of Iran has the highest rate of "brain drain" among 61 "developing" and "less developed" countries according to the International Monetary Fund. Regardless of these burdens that result in awkward scientific state, in this current study, we aimed to look at the scientific production profile of pharmacology, toxicology and pharmaceuticals domains within the Middle-East region to highlight the scientific impacts of Iranian scientists. This will directly and globally represent the role of Iranian scientists in the scientific community even though the country itself has being under political sanction that has exerted a direct influence on the Iranian scientists productivities.

Methodology

To measure the quantity and quality of science in the subject area of "*Pharmacology, Toxicology and Pharmaceutics*", 20 top prolific countries were compared with the Middle-East countries. All data was extracted from The SCImago database (<http://www.scimagojr.com/>), which is based on Scopus data-base. These data represent scientific information from more than 17,087 journals. Only citable-publications were taken under consideration. We made comparison across 20 more active countries as well as Middle-East countries. Data about the number of populations were extracted from U.S. Census Bureau, Population Division (<http://www.census.gov/ipc/www/idb/>).

Findings:

Table 1: Number of Publications for 20 top active countries in the subject area of Pharmacology, Toxicology and Pharmaceutics 1996-2007

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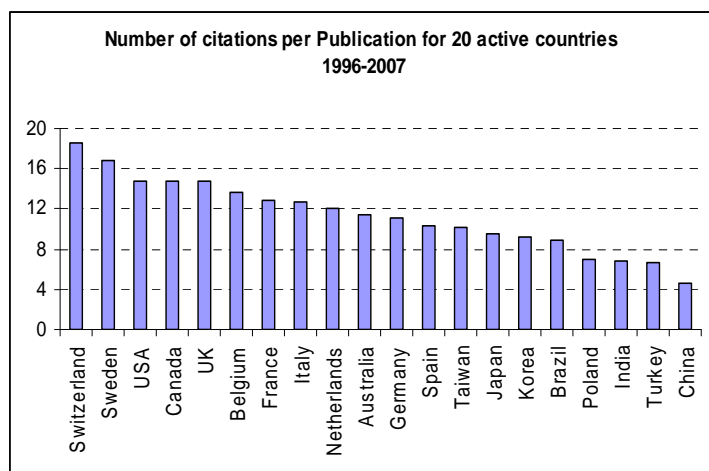
Ranked by Productivity (Publication)	Country	Publications	Citations	Citation per Publication
1	USA	108,592	1,613,027	14.81
2	Japan	36,807	355,724	9.45
3	UK	26,393	415,913	14.76
4	Germany	23,545	266,668	11.08
5	China	19,343	72,637	4.57
6	France	15,541	203,858	12.92
7	Italy	15,012	184,677	12.66
8	Canada	12,736	186,479	14.8
9	India	10,743	64,803	6.8
10	Spain	9,168	94,493	10.25
11	Netherlands	8,522	105,986	12
12	Australia	7,183	84,394	11.44
13	Korea (Republic)	6,950	56,004	9.24
14	Brazil	6,307	45,722	8.86
15	Sweden	5,760	97,762	16.82
16	Switzerland	5,276	96,458	18.56
17	Poland	5,146	34,955	6.91
18	Belgium	4,594	61,404	13.62
19	Taiwan	4,175	39,508	10.14
20	Turkey	3,969	25,125	6.6

Table 1 shows total number of citable-publications for 20 top productive countries and their citations share in *The SCImago*. As the table indicates the USA heads the list of countries in the volume of citable-publications and citations in the subject area of Pharmacology, Toxicology and Pharmaceutical. The following countries are Japan, UK and Germany.

Since the number of publications does not usually represent the quality of the research, we have also looked at the citations per publication that demonstrates the worthiness of the research work to other scientists. It is assumed that the citation frequency of an article normally mirror its value and usefulness. "*When a physician or a biomedical researcher cites a journal article, it indicates that the cited journal has influenced him or her in some*

manner." [Garfield 1987, p. 7]. The number of publications in China is high and this country has been ranked as the fifth top country (Table 1), however when the analysis comes to the citations per publication the rank of this country drops dramatically down. As shown in Table 1, in this ranking China is the 20th country, while Switzerland has achieved much higher ranking place (the 1st rank). Comparing this small but high scientific impact country with leading countries such as USA, UK and Japan, it is clear that the quality and/or the orientation of the science in this country is in high and in right track.

Fig. 1: Number of citations per publication for 20 most active countries 1996-2007



The figure shows the rank of countries based on their citations per paper; only the 20 top productive countries were taken under consideration. Switzerland with possessing 18.6 citations per publication get the first place on the ranking following Sweden (16.8 citations per paper), USA (14.8 citations per paper), and Canada (14.8 citations per paper). In terms of citation per paper, the European countries as well as English language countries are at the top ranks of lists in the figure. The Asian countries are at 13 (Taiwan), 14 (Japan), 15 (Korea), 18 (India) and the last one is China; where as their corresponding rank in term of publications (Table1) are 2 (Japan), 5 (China), 9 (India), 13(Korea) and 19 (Taiwan)

Table 2: Number of publications from Middle East provided in SCImago 1996-2007

According to the information of table 2, Israel with producing 46% of total citable-publications and 73% of total citations coming from Middle East, is the most productive country in the region following Iran (17% publications and 7% citations) and Egypt (14% of total publications and 8% of citations) through 1996-2007. On behalf of countries H-Index Israel is more than 2 times greater than Iran and Egypt.

Table 2: Number of publications from Middle East provided in SCImago 1996-2007

RANK	Country	Publications	Citations	Self-Citations	Citations Per Publication	H index
1	Israel	2,203	30,172	5,142	13.9	64
3	Egypt	1,671	10,502	2,174	6.62	32
2	Iran	1,592	8,268	2,999	6.98	29
4	Saudi	923	4,996	776	5.36	28
5	Jordan	312	1,638	228	5.62	20
6	Emirate	221	1,290	187	6.25	18
7	Kuwait	216	1,498	240	7.6	18
8	Lebanon	116	1,163	168	14.7	19
10	Qatar	36	101	18	5.76	5
9	Oman	33	142	21	6.05	6
11	Palestine	27	139	14	6.11	5
12	Iraq	20	136	12	7.16	6
13	Yemen	19	153	18	8.88	7
14	Syria	18	88	14	6.29	6
15	Bahrain	14	23	4	2.47	3

The Figure shows the number of publications of four active countries in Middle East in the subject area of Pharmacology, Toxicology and Pharmaceutics through 1996-2007.

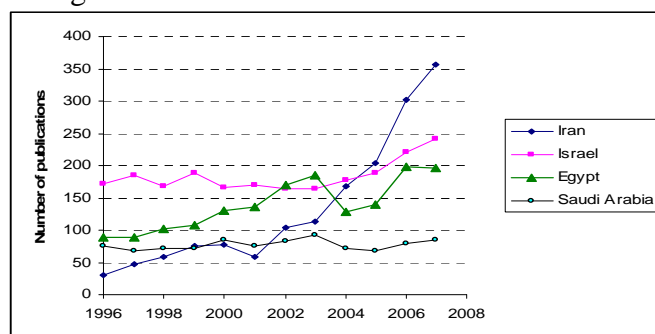


Fig. 2: Number of publications of 4 countries in Middle East 1996-2007

It indicates that there has been significant growth in the Research literature on Pharmacology, Toxicology and Pharmaceutics in Middle East countries. The literature of science contributed by Iranian authors since 1996 till 2001 stand under other 4 countries, but from 2002 take a sharp raise and since 2005 with an exponential growth ahead all countries and placed at the first place in the region. In 2007 the number of publications emanated by Iranian authors is 5 times greater than in 2001. The number of scientific literature produced by Iranian authors in 2007 is 48% greater than the publications emanated by authors from Israel.

Table 3: Number of publications form Iran

Years	No. of Publications	% of Publications
1996-1999	211	13%
2000-2003	352	22%
2004-2007	1029	65%
Total	1592	100%

The number of publication in the field of Pharmacology, Toxicology and Pharmaceutics by Iranian authors accurately can be divided in 3 phases. As the Table indicates the most active phase of Iranian author publishing scientific literature in the field of Pharmacology, Toxicology and Pharmaceutics is 2004-2007. From a total number of 1,592 publications, provided by Iranian authors in SCImago 1,029 (65%) of them was produced during these years.

Table 4: Number of publications per million populations for countries in SCImago 1996-2007

Rank	Country	Mean Value of Population 1996-2007	No. of Citable Publications	Publication per million population
1	Switzerland	7,349	5,276	718
2	Sweden	8,952	5,760	643
3	Netherlands	16,058	8,522	531
4	Belgium	10,293	4,594	446
5	UK	59,759	26,393	442
6	Canada	31,485	12,736	405
7	USA	285,937	108,592	380

8	Australia	19,431	7,183	370
9	Israel	6,283	2,203	351
10	Japan	126,879	36,807	290
11	Germany	82,242	23,545	286
12	Italy	57,828	15,012	260
13	France	61,719	15,541	252
14	Spain	40,122	9,168	229
15	Poland	38,612	5,146	133
16	Kuwait	2,086	216	104
17	Jordan	4,927	312	63
	United Arab Emirates	3,492	221	63
18	Turkey	68,924	3,969	58
19	Qatar	677	36	53
	Saudi Arabia	24,130	923	38
21	Brazil	180,094	6,307	35
22	Lebanon	3,656	116	32
23	Iran	63,578	1,592	25
24	Egypt	67,467	1,671	25
25	Bahrain	650	14	22
26	China	1,278,350	19,343	15
27	Oman	2,684	33	12
28	India	1,031,503	10,743	10
29	Syria	17,223	18	1
30	Yemen	18,335	19	1
31	Iraq	23,736	20	1

Ranking the countries activity based on publication per million population we see that Switzerland ahead all countries following Sweden and Netherlands. The USA in spite of producing the majority of related publications places on the seventh in the ranking. Iran located in the 24th place of ranking.

Table 5: Total citable publication in the Subject Area of (Pharmacology, Toxicology and Pharmaceutics) in the SCImago 1996-2007.

RANK	Country	Citable Publications	percent world	Citations	Percent world
1	U.S.A.	108,592	28.09	1,613,027	35.48%
2	Japan	36,807	9.52	355,724	7.82%
3	U.K.	26,393	6.83	415,913	9.15%
4	Germany	23,545	6.09	266,668	5.87%
5	China	19,343	5.00	72,637	1.60%
6	France	15,541	4.02	203,858	4.48%
7	Italy	15,012	3.88	184,677	4.06%

8	Canada	12,736	3.29	186,479	4.10%
9	India	10,743	2.78	64,803	1.43%
10	Spain	9,168	2.37	94,493	2.08%
11	Netherlands	8,522	2.20	105,986	2.33%
12	Australia	7,183	1.86	84,394	1.86%
13	Korea, Republic Of	6,950	1.80	56,004	1.23%
14	Brazil	6,307	1.63	45,722	1.01%
15	Sweden	5,760	1.49	97,762	2.15%
16	Switzerland	5,276	1.36	96,458	2.12%
17	Poland	5,146	1.33	34,955	0.77%
18	Belgium	4,594	1.19	61,404	1.35%
19	Taiwan, Province of China	4,175	1.08	39,508	0.87%
20	Turkey	3,969	1.03	25,125	0.55%
21	Russian Federation	2,981	0.77	12,115	0.27%
22	Denmark	2,834	0.73	40,625	0.89%
23	Finland	2,705	0.70	39,187	0.86%
24	Hungary	2,451	0.63	21,422	0.47%
25	Austria	2,395	0.62	30,239	0.67%
26	Mexico	2,235	0.58	15,734	0.35%
27	Israel	2,203	0.57	30,172	0.66%
28	Greece	2,126	0.55	15,859	0.35%
29	Argentina	1,823	0.47	13,427	0.30%
30	Egypt	1,671	0.43	10,502	0.23%
31	Czech Republic	1,655	0.43	12,536	0.28%
32	Hong Kong	1,598	0.41	17,829	0.39%
33	Iran	1,592	0.41	8,268	0.18%
34	Norway	1,492	0.39	19,231	0.42%
35	New Zealand	1,401	0.36	14,172	0.31%
36	Portugal	1,299	0.34	13,247	0.29%
37	Ireland	1,050	0.27	14,938	0.33%
38	Croatia	1,039	0.27	4,356	0.10%

USA with entering 28% of world publications in SCImago is the leading country, from a total number of 386,625 publications provided in SCImago 108,592 (28%) came from the USA, 36,807 (10%) from Japan, 26,393 (7%) from UK, and 23,545 (6%) from Germany. The portion of three active countries from Middle East is as follow: Israel 2,203 (0.57%), Egypt 1,671 (0.43%) and Iran 1,592 (0.41%).

A total number of 386,625 citable publications came from 185 countries. 96% (370,312) of total publications originated by 38 countries, which listed in the table 5; the rest countries (147 countries) published only 4% of total publications, which were not listed in the table. The table restricted to the

countries whose publications' share in the subject area of Subject Area: Pharmacology, Toxicology and Pharmaceutics were higher than 1,000 publications.

Table 6: Total citable Publications by Iranian authors in SCImago 1996-2007

Years	Total citable Publications	Percentage
1996 – 1999	4229	9%
2000 – 2003	10139	20%
2004 - 2007	35282	71%
Total	49650	100%

The number of publications emanated by Iranian authors through 2004-2007 is 146% higher than those published through 1996-2003. One can say that the most active phase of Iranian authors sharing their publications and citations is this phase.

Table 7: total number of publications in the field of (Pharmacology, Toxicology and Pharmaceutics) from regions in SCImago 1996-2007

Rank	Region	publication	percentage
1	Western Europe	131,943	34.10%
2	Northern America.	121,328	31.40%
3	Asiatic Region.	83,106	21.50%
4	Eastern Europe	17,646	4.60%
5	Latin America.	13,354	3.50%
6	Pacific Region	8,666	2.20%
7	Middle East	7,421	1.90%
8	Southern Africa	1,424	0.40%
9	Central Africa.	1,229	0.30%
10	Northern Africa	508	0.10%
	Total	386,625	100.00%

From total number of 386,625 publications through the period of study more than 65% came from Western Europe and Northern America. These two regions are also the leading countries sharing the citations in the fields (Table 8). The portion of Middle East is only 1.90%.

Table 8: Number of citations sharing by regions in the SCImago 1996-2007

Rank	Region	Citation	Percentage
1	Northern America.	1,799,506	39.60%
2	Western Europe	1,729,229	38.00%
3	Asiatic Region.	633,492	13.90%
4	Eastern Europe	108,333	2.40%

5	Pacific Region	99,107	2.20%
6	Latin America.	95025	2.10%
7	Middle East	60,309	1.30%
8	Southern Africa	12,986	0.30%
9	Central Africa.	5,026	0.10%
10	Northern Africa	3,506	0.10%
	Total	4,546,519	100.00%

Table 9: Number of publications and citations provided in SCImago from Middle East countries 1996-2007

Rank	Country	Publications	Percentage	Citations	Percentage
1	Israel	2,203	30%	30,172	50.0%
2	Egypt	1,671	23%	10,502	17.4%
3	Iran	1,592	21.5%	8,268	13.7%
4	Saudi Arabia	923	12.4%	4,996	8.3%
5	Jordan	312	4.2%	1,638	2.7%
6	United Arab Emirates	221	3.0%	1,290	2.1%
7	Kuwait	216	2.9%	1,498	2.5%
8	Lebanon	116	1.6%	1,163	1.9%
9	Qatar	36	0.5%	101	0.2%
10	Oman	33	0.4%	142	0.2%
11	Palestine	27	0.4%	139	0.2%
12	Iraq	20	0.3%	136	0.2%
13	Yemen	19	0.3%	153	0.3%
14	Syria	18	0.2%	88	0.1%
15	Bahrain	14	0.2%	23	0.0%
	Total	7,421		60,309	

Israel is the most active country throughout the period of study, following Egypt and Iran. More than 74% of all publications in the region came from Israel, Egypt and Iran.

Conclusion:

The study showed that Pharmacology, Toxicology and Pharmaceutics research in Iran is increasing, it can be said that Iranian researchers in the fields published around 133 literature of science per year which indexed in the database. Worldwide trend of papers showed that the Pharmacology, Toxicology and Pharmaceutics research work is being done on world wide basis. The USA is the largest producer of Pharmacology, Toxicology and Pharmaceutical related papers, following countries are Japan, UK and

Germany. The top 20 prolific countries are (U.S.A., Japan, U.K, Germany, China, France, Italy, Canada, India, Spain, Netherlands, Australia, Korea, Brazil, Sweden, Switzerland, Poland, Belgium, Taiwan, and Turkey). This group accounted of about 87% of total publications and more than 90% of total citations in the fields.

Significant growth in the Research literature on Pharmacology, Toxicology and Pharmaceutics has been done in Middle East countries. Israel is the most active country producing related papers and sharing the citations following Egypt and Iran through the period of study. The literature of science contributed by Iranian authors during 1996-2001 was smaller than Israel, Egypt and Saudi Arabia, but from 2005 take an increasingly effort so that ahead all countries in the region. The numbers of Iranian Publications in the subject area in 2007 was 113% greater then in 2004. Tendency towards self-citation by Iranian authors is greater than other active countries in the region.

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