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Diabetes Research in Iran: a Scientometric Analysis of Publications Output

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ABSTRACT

Introduction: In the developing countries, diabetes mellitus as a chronic diseases, have replaced infectious diseases as the main causes of morbidity and mortality. International Diabetes Federation (IDF) recently estimates 382 million people have diabetes globally and more than 34.6 million people in the Middle East Region and this number will increase to 67.9 million by 2035. The aim of this study was to analyze Iran's research performance on diabetes in national and international context. **Methods:** This Scientometric analysis is based on the Iranian publication data in diabetes research retrieved from the Scopus citation database till the end of 2014. The string used to retrieve the data was developed using "diabetes" keyword in title, abstract and keywords, and finally Iran in the affiliation field was our main string. **Results:** Iran's cumulative publication output in diabetes research consisted of 4425 papers from 1968 to 2014, with an average number of 96.2 papers per year and an annual average growth rate of 25.5%. Iran ranked 25th place with 4425 papers among top 25 countries with a global share of 0.72 %. Average of Iran's publication output was 6.19 citations per paper. The average citation per paper for Iranian publications in diabetes research increased from 1.63 during 1968-1999 to 10.42 for 2014. **Conclusions:** Although diabetic population of Iran is increasing, number of diabetes research is not remarkable. International Diabetes Federation suggested increased funding for research in diabetes in Iran for cost-effective diabetes prevention and treatment. In addition to universal and comprehensive services for diabetes care and treatment provided by Iranian health care system, Iranian policy makers should invest more on diabetes research.

Key words: Bibliometrics, Diabetes Mellitus, bibliographic database, Scopus, Iran.

1. INTRODUCTION

In the developing countries, diabetes mellitus as a chronic diseases, have replaced infectious diseases as the main causes of morbidity and mortality (1, 2). Diabetes mellitus is a common chronic diseases in both developing and developed world (3). The characteristics of the disease is blood glucose as a result of too little insulin or resistance to insulin (4). Unfortunately its incidence and prevalence are increasing in most populations. The trend is particularly worrying in developing countries (5). Kidney failure result mainly from diabetes; however, its occurrence is associated with its severity and duration and is dissimilar from country to country. Diabetic foot disease often leads to ulceration and limb amputation due to changes in blood vessels and nerves and has major economic consequences for the patients, their families, and society (6). Depression has been found to be more prevalent among people with diabetes than in the general population (7, 8, 9,10).

In 2010, 70% of people with diabetes lived in the relatively poor countries, and Africa and the Middle East has greatest relative increase in the burden of diabetes mellitus (11, 12). Mortality due to diabetes is more than 80% in the low and middle income countries (13). WHO predicts diabetes will be the 7th most important cause of mortality in 2030 (14) and in 2035 near to 592 million people will die due to diabetes (15).

The complications of diabetes greatly influence the quality

of life in patients suffering from diabetes. According to the recent estimates of the International Diabetes Federation (IDF), 382 million people have diabetes globally and more than 34.6 million people in the Middle East and this number will increase to 67.9 million by 2035 (16,17). Prevalence of diabetes is higher in developed countries than in developing and it will raise to 5.4% in 2025 (18).

In Iran, which is located in the Middle East, the prevalence of diabetes mellitus was predicted to reach 8.43% in 2013 and the total health cost for diabetes mellitus was estimated to be roughly 471 million US dollars. In 2013, there were over 4.39 million cases of diabetes in Iran and diabetes related deaths were 38002 cases (18, 19). Diabetes high prevalence among working-age individuals is a threatening sign for this developing country. As the relatively young Iranian population will age in the future and urbanization continues to accelerate; therefore, there will likely be an escalation in the prevalence of diabetes (20).

In a study conducted by Gupta et al, they analyzed the Indian research output in diabetes during 1999-2008 based on different parameters including growth, rank and global publications share, citation impact, overall share of international collaborative papers, and share of major collaborative partners. They also analyzed the characteristics of most productive universities, authors, and highly-cited papers. The publi-

cations output, impact and collaborative publication share of India was compared with China, South Korea and Brazil as developing countries (21).

The aim of this study was to analyze Iran research performance on diabetes in national and international context, as reflected in its publications indexed in Scopus database. The following aims also considered: To evaluate the Iranian research output, its growth, rank and world publications share and impact, as well as to study the patterns of international collaboration and major collaborative partners.

2. METHODS

This study was based on the publications of diabetes research from Iranian authors retrieved Dec 31, 2014 from Scopus Citation database [http://www.scopus.com]. The string used to retrieve the data was developed using “diabetes” keyword in title, abstract and keywords and “Iran” in the affiliation field was our main string. We searched above mentioned terms in document search tab of Scopus. The date range was not set for any specific time and we searched all the total documents (4425) indexed in Scopus for Iran from beginning to the end of 2014. We used searching and analyzing features of Scopus. For this purpose data were searched using searching system of Scopus, and then results were analyzed using analyzing result system of Scopus.

To retrieve the data from world diabetes research, the key word ‘diabetes’ was searched in the title, keyword, and abstract fields of the document search tab.

3. RESULTS

Total number of papers for diabetes research indexed in Scopus was 610439 papers until the end of 2014. Top 25 countries with 515582 papers had the most number of papers and a global share of 84.46 %. From top 25 countries with the most number of papers in diabetes research, 20 countries were in the category of developed country including: United States, United Kingdom, Japan, Germany, Italy, France, Canada, Australia, Spain, Sweden, Netherlands, Denmark, South Korea, Switzerland, Poland, Belgium, Finland, Israel, Austria, Taiwan and 5 are developing countries including ; China, India, Brazil, Turkey and Iran (Table 1).

More than fifty % (52.77%) of the world diabetes research had been conducted by 6 developed countries including: US, UK, Japan, Germany, Italy and France. From top 25 developing countries; China and India ranked 8th and 9th, respectively. Altogether, share of 5 developing countries in the world diabetes research was 8.98% (Table 1).

Iran’s cumulative publication output in diabetes research consisted of 4425 papers during the years 1968 to 2014, with an average number of 96.2 papers per year and an annual average growth rate of 25.5%. In this direction, Iran’s annual growth rate showed minus 14.16 % in the years 2013–2014. The total publications output of Iran in diabetes research increased from 49 papers during 1968–1999 to 4376 papers during 2000–2014 (Table 2). Hence; with 4425 paper, Iran ranked 25th among the top 25 countries with a global share of 0.72 %.

Concerning research quality, as measured by field-weighted citation impact, Iran’s publication output as measured by average citation per paper was 6.19 on the whole. So, in dia-

Country	No. of Papers	Share of papers	Rank
United States	161034	26.38	1
United Kingdom	47887	7.83	2
Japan	33274	5.45	3
Germany	31634	5.18	4
Italy	26582	4.35	5
France	21767	3.56	6
Canada	20151	3.30	7
China	18499	3.01	8
India	16139	2.63	9
Australia	15876	2.59	10
Spain	14991	2.45	11
Sweden	12961	2.12	12
Netherlands	12581	2.06	13
Denmark	10128	1.65	14
South Korea	8010	1.31	15
Brazil	7895	1.29	16
Switzerland	7744	1.26	17
Turkey	7523	1.22	18
Poland	6666	1.09	19
Belgium	6640	1.08	20
Taiwan	6479	1.05	21
Finland	5967	0.92	22
Israel	5655	0.92	23
Austria	5074	0.83	24
Iran	4425	0.72	25
Total	609079	100	-

Table 1. World publication output, share and rank of top 25 most productive countries in diabetes research

Year	Papers	Citations	Average Citations per Paper
2014	618	6443	10.42
2013	720	5872	8.15
2012	685	4498	6.56
2011	596	3478	5.83
2010	433	2514	5.80
2009	357	1619	4.53
2008	275	1148	4.17
2007	237	714	3.00
2006	179	452	2.52
2005	138	264	1.91
2004	60	117	1.95
2003	39	82	2.10
2002	25	49	1.96
2001	6	35	5.83
2000	8	23	2.87
1968–1999	49	89	1.63
Total	4425	27397	6.19

Table 2. Iranian research papers in diabetes research according to number of papers, citations and average citations per paper by year

betes research, Iranian publication average citation per paper increased from 1.81 in the years 1968–1999 to 10.42 in 2014. Overall, the received citations were 27397 citations during those years (Table 2).

In diabetes research, Iran’s collaborated with 84 countries

Country	No. of Papers	%%
United States	173	18.56
United Kingdom	93	9.97
Canada	92	9.87
Australia	75	8.04
Sweden	35	3.75
India	34	3.64
Malaysia	28	3.00
Netherlands	23	2.46
Germany	21	2.25
Italy	20	2.14
Switzerland	15	1.60
China	15	1.60
France	14	1.50
Singapore	13	1.39
Pakistan	12	1.33
Japan	11	1.20
Saudi Arabia	11	1.20
Denmark	10	1.08
Brazil	10	1.08
Other 65 Countries	227	24.35
Total	932	100

Table 3. Iranian papers with respect to their international collaborative with different countries in diabetes research

with no more than 932 of its papers (21% of its total papers). In the years 1968 to 2014, among top 19 Iranian international collaborative partners with more than 10 collaborative research papers in diabetes, United States ranked highest in the list by contributing 18.56% of its publications, followed by the following countries: United Kingdom (9.97%), Canada (9.87%), Australia (8.04%), Sweden (3.75%), India (3.64 per cent), Malaysia (3%), Netherlands (2.46%), Germany, Italy, Switzerland (between 2.25 to 2.14%), and, China, Singapore, France, Pakistan, Japan, Denmark, Saudi Arabia, and Brazil (between 2.25% to 1.07%). Other 65 countries were Iran's international collaborative partners with a total share of 227 papers (24.35%) (Table 3). Altogether, 160 institutes and universities contributed with Iran to produce 4425 papers in diabetic research.

Table 4 shows 12 most productive universities with more than 100 papers in the field of diabetic research. In collaboration with Iran, they produced 3928 papers with a share of 88.76%. Other 159 institutes and universities produced 497 papers with a collaboration share of 11.23%.

Based on publication output of Iran, highly cited papers were also evaluated. In this regard, 170 papers were cited up to 30 times and identified as the papers with the highest citations. From the list, the highest cited paper received 742 citations and ranked 1st.

Regarding the type of Iranian publication being indexed, the most publication type in the field of diabetes research was articles (87.35%), the second most published document was allocated to review articles (5.68%), and the lowest publication documents in the field of diabetes research were books (0.02%).

The 10 authors with 48 or more papers, (in diabetic re-

University	No. of Papers	%
Tehran University of Medical Sciences	1335	30.16
Isfahan University of Medical Sciences	493	11.14
Shahid Beheshti University of Medical Sciences	431	9.74
Shiraz University of Medical Sciences	281	6.35
Daneshgah Azad Eslami	279	6.30
Tabriz University of Medical Sciences	201	4.54
Iran University of Medical Sciences	192	4.33
Mashhad University of Medical Sciences	170	3.85
Tarbiat Modares University	162	3.66
University of Tehran	144	3.26
Ahvaz Jundishapur University of Medical Sciences	136	3.07
Kerman University of Medical Sciences	104	2.36
Other 148 Institutes and Universities	497	11.24
Total	4425	100

Table 4. Contribution and share of top 12 Iranian Universities in diabetes research

search in Iran) contributed 972 papers, which accounted for 22 per cent in country's research output. Among these 10 top authors, three authors have recorded more than 100 papers namely; Larijani, B. (225 papers), Azizi, F. (149 papers), and Amini, M. (108 papers) (Table 5).

4. DISCUSSION

According to the results of this Scientometric study, Iran had 0.72% of the total global share in the field of diabetes research. Despite increasing diabetic population in Iran, diabetes research is not sufficient. International Diabetes Federation requested increase in funding for cost-effective diabetes prevention and treatment in Iran (16). Although the Iranian health care system provides universal and comprehensive services for diabetes care and treatment, Iranian government should invest on diabetes research as a way to increase social awareness leading to diabetes prevention.

Among 5 developing countries producing the highest numbers of papers in diabetes research, Iran ranks 5th. Apart from Turkey which has a close population to Iran, population of other 3 developing countries including China, India, and Brazil is 18, 16 and 3 times more respectively. In terms of population, Iran's papers in diabetic research is considerable; however, more effort should be made.

In 1968, the first Iranian article was published on diabetes research. Later, Iran had no publication in the field of diabetes research for several years (1978-1987). This may be due to the Iran revolution and its involvement in the war with its neighboring country, Iraq. Just in one decade (from 2005 to 2014), out of 4425 Iranian research papers, 4238 papers were published in the field of diabetes, which shows an increasing annual growth in diabetes research in Iran. The total publications output of Iran in diabetes research increased from 49 papers during 1968-1999 to 4376 papers during 2000-2014, showing a 25.5% increase in the Iran's annual average growth rate in diabetes research. This may be related to the increase in the general Iranian population as well as a substantial increase in diabetes prevalence in Iran (20). Another factor could be in-

Name	Address	No. of Papers	No. of Citations	Average Citations per Paper	H-index
Larijani, B.	Endocrinology and Metabolism Research Center, Tehran University of Medical Science	225	2162	9.60	23
Azizi, F.	Endocrine Research Center, Shahid Beheshti University of Medical Sciences	149	2339	15.70	26
Amini, M.	Endocrinology and Metabolism Research Center, Tehran University of Medical Science	108	410	3.80	11
Esteghamati, A.	Endocrinology and Metabolism Research Center, Tehran University of Medical Science	96	912	9.50	15
Nakhjavani, M.	Endocrinology and Metabolism Research Center, Tehran University of Medical Science	94	566	6.02	13
Hadaegh, F.	Endocrine Research Center, Shahid Beheshti University of Medical Sciences	67	663	9.90	14
Abdollahi, M.	Pharmaceutical Sciences Research Center, Tehran University of Medical Sciences	65	1489	22.90	19
Heshmat, R.	Endocrinology and Metabolism Research Center, Tehran University of Medical Science	64	385	6.01	10
Roghani, M.	Endocrine Research Center, Shahid Beheshti University of Medical Sciences	56	372	6.65	11
Janghorbani, M.	Department of Epidemiology and Biostatistics, School of Public Health, Isfahan University of Medical Sciences	48	636	13.25	12

Table 5. Productivity and impact of top 10 Iranian authors in diabetes research

creased university's acceptance rate of Medical Assistant - Endocrine / Metabolism in universities across Iran. Nitrini in his study mentioned to this factor, he believed that the growth in Brazilian publications was due to the development of the post-graduate programs in the country (22).

Gupta et al reported that annual average growth rate of Indian publications in diabetes research during the years 1999-2008 was 13.71 %. they also showed that cumulative publications output of India increased from 1534 to 3290 papers from 1999-2003 to 2004-2008. Compared to India, cumulative publications output of China, Brazil, and South Korea increased from 1436 to 5983 papers, 852 to 2383 papers, and 799 to 2270 papers respectively (21).

Harande and Alhaji examined the growth of published literature on diabetes in three countries of Nigeria, Argentina, and Thailand. The results of their study showed that diabetes literatures grow and spread widely. In the years 1986 and after that, countries in the selected regions witnessed exponential growth in the literature (23).

Previous studies (23, 25) showed that, production of global research papers in the field of diabetes followed a growing trend. The studies concerning diabetes over the last 20 years has been growing (24). Krishnamoorthy et al study showed a significant research activity in the field of diabetes in the world (25). These studies are consistent with our study in which total publications output of Iran in diabetes research increased significantly. This shows that Iran seems to follow this global wave.

During the past decade, there has been an emerging interest in the use of highly cited papers as indicators of research assessment. One of the reasons for this is the increasing focus on scientific excellence in the science policy." In this context, highly cited papers have been regarded as potential candidates for identifying and monitoring 'excellent' scientific research "(26). Collaboration between researchers could be the basis of respect for highly cited research papers. Other studies have shown a general correlation between citation counts and number of authors as well as also international collaboration (27, 28).

Results of this study showed that Iran's cumulative publication output in diabetes research had been cited 27397 times and Iran is collaborated with 84 other countries in diabetes research with 932 papers (21% of its total papers). In terms of impact and effectiveness results showed that the average citation per paper for Iran's publications in diabetes research in-

creased from 1.63 in the years 1968-1999 to 10.42 in 2014. The reasons for this increasing rate could be due to Iran's high international collaboration and Iranian authors' interest in institutionalization of scientific collaboration. In addition, this increasing rate shows the growing quality of Iranian research papers. Previous studies showed that influential papers receive more citations than other papers of less utility (29, 30).

Among the top 19 Iranian international collaborative partners, by contributing 18.56% of its publications, United States ranks the highest in the list which is similar to the findings of the study conducted by Gupta et al (21).

By producing 1335 papers (30.16%), Tehran University of Medical Sciences has been the most productive university followed by Isfahan University of Medical Sciences and Shahid Beheshti University of Medical Sciences with 493 (11.14%) and 431 (9.74%) papers respectively. These three universities produced more than 50% of Iran's diabetes research papers. The top 10 Iranian authors in diabetes research are from three mentioned universities.

According to Essential Science Indicators (ESI) Institution Ranking for 2013, the following three Iranian universities are among the world's top universities and research institutes; in terms of ranking, Tehran University of Medical Science's ranked 492, Shahid Beheshti University of Medical Science's ranked 884, and Isfahan University of Medical Sciences ranked 1550 .

5. CONCLUSION

Although diabetic population of Iran is increasing, number of diabetes research is not remarkable. International Diabetes Federation suggested increased funding for research in diabetes in Iran for cost-effective diabetes prevention and treatment. Therefore, in addition to universal and comprehensive services for diabetes care and treatment provided by Iranian health care system, Iranian policy makers should invest more on diabetes research.

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Authors' contributions

Study concept and design: Masoud Rasolabadi, Shahnaz Khaledi, Marlin Ardalan. Acquisition of data: Masoud Rasolabadi, Susan Penjvini, Alireza Gharib. Analysis and interpretation of data: Masoud Rasolabadi, Alireza Gharib, Marya Maryam

Kalhor. Drafting of the manuscript: Masoud Rasolabadi, Shahnaz Khaledi, Marlin Ardalan, Maryam Maryam Kalhor, Critical revision of the manuscript for important intellectual content: Masoud Rasolabadi, Alireza Gharib, Susan Penjvini. Study supervision: Masoud Rasolabadi, Shahnaz Khaledi, Marlin Ardalan, Alireza Gharib.

CONFLICT OF INTEREST: NONE DECLARED.

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