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Scientometric Analysis of Scientific Publications on Persian Medicine Indexed in the Web of Science Database

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Abstract

Persian medicine (PM), also known as Iranian traditional medicine, is a collection of ancient experience, knowledge and skills that has been long practiced by Iranian experts for prevention, diagnosis and treatment of diseases. Given the importance of assessing scientific outputs and the rising popularity of traditional medicine, such as PM, we aimed to perform scientometric analysis and draw a scientific map of PM-related publications to present a research perspective in this field of science. This descriptive and analytical study was carried out with a scientometric approach on all PM-related scientific publications in the Web of Science (WoS) database until November 2018. The VOSviewer software was used for drawing the scientific maps. The results showed that until 18 November 2018, 1717 documents related to the field of PM have been indexed in the Web of Science. Average citation rate in the field of PM was 8.11 citations per document. H-index of these documents was 49. The amount of scientific productions in the field of PM has increased dramatically since 2013 (growth rate= 61.06%). Journal of Ethnopharmacology, which is specifically dedicated to integrative and complementary medicine, has published the greatest number of PM documents (4.834 %). Moreover, 92.02 Percent of the authors of the retrieved articles were from Iran. Kamalinejad M. with 63 documents was the most prolific author in the field of PM, and the Tehran University of Medical Sciences with 336 articles contributed the most to publication of papers on this field. Based on the findings, PM is not well known enough among international researchers, and Iranian researchers and organizations contribute the most to publication of papers on this field of science. Collaborative writing, international co-authorship and participation in international conferences and meetings could fill this gap and boost popularity of this field of science worldwide.

Keywords

Iranian traditional medicine; Persian medicine; Research outcomes; Scientometric; Scientific map; Citation analysis

Introduction

According to the World Health Organization (WHO), "Traditional medicine is the total sum of knowledge, skill, and practices based on the theories, beliefs and experiences of indigenous different cultures whether explicit or implicit that is use in the maintenance of health as well as in the prevention, diagnosis, improvement or treatment of physical and mental illness" (WHO, 2018). Traditional and complementary medicine is a compelling and diverse field of medical science that has been used in different societies for thousands of years to promote health in the general population or to treat those with various illnesses (Hodhodinejad, Zahedianaraki & Ashrafirizi, 2012; Woo et al., 2014), In most developed countries, such as the United States, Australia, France, Canada and Japan, nearly half of the population regularly use traditional therapies. Similar trends have been reported in developing countries, including China, Chile, Colombia, and Taiwan (Woo et al., 2014).

Traditional medicine is often the preferred option where access to conventional medical services is denied either due to unavailability of resources or financial constraints (Shim, 2016). According to some studies, nearly 40 percent of all healthcare services are delivered via traditional and complementary medicine, which could be due to it perceived effectiveness. High cost and side effects of chemical/synthetic medications and emergence of drug resistance etc. are some of the reasons why western medicine is been neglected (Danell & Danell, 2009; Fu, Zhang, Zhao, Chen & Huang, 2012). Recently, the WHO has launched a strategic plan with the aim of developing of policies that will reinforce the role of traditional medicine in maintaining a healthy society (Mozafari, Yoosefpour, Mozafari, Sofizadeh & Yosefi, 2016). In the United States, the National Institutes of Health (NIH) has made a huge investment and is still making more in complementary and alternative medicine research (Dutt, Kumar & Garg, 2009). Persian medicine (PM), also known as Iranian traditional medicine, is an ancient medical discipline that has been practiced by great scholars, such as Avicenna, Razi, Jorjani and Aghili for almost two thousand years. These collections of knowledge and experiences can now be integrated with modern medicine to improve human health and contribute to prevention, diagnosis and treatment of diseases (Mozafari et al., 2016; Zeinalian et al., 2016). Hence, interest in the field of complementary and traditional medicine has been growing rapidly, thus increasing the number of scientific publications in this area (Fu, Zhang, Zhao, Huang & Chen, 2011).

Bibliometric analysis is a set of methods utilized for qualitative and quantitative assessment of scientific outputs, written publications and research productivity within a specified field, which could reveal current trends or estimate future trends (Fu et al., 2012). Scientometric studies can shed light on the future of knowledge production as well as the existing gaps in a scientific field (Fu et al., 2011). Moreover, bibliographic analysis helps planners and policymakers to identify key research areas for evidence-based decision making (Sharma, Bairwa, Gowthamghosh, Gupta & Mangal, 2018). Therefore, hundreds of bibliographic studies have been carried out in various fields of medicine and healthcare (Sanee, Mohammadi & Ghazi Mirsaeid, 2016; Sweileh, 2016). Given the importance of assessing scientific outputs and the rising popularity of traditional medicine, such as PM, we aimed to draw a scientific map of PM-related publications and present a research perspective in this field of science.

Materials and Methods

This descriptive-analytical study was carried out with a scientometric approach to analyze scientific productions about PM that have been indexed in the Web of Science database until November 18, 2018. All databases and indices developed by the Web of Science including Science Citation Index Expanded (SCIE), Social Sciences Citation Index (SSCI), Conference Proceedings Citation Index-Science (CPCI-S), Conference Proceedings Citation Index-Social Science & Humanities (CPCI-SSH) and Emerging Sources Citation Index (ESCI) were utilized in this study. The search strategy and keywords used to search PM-related scientific productions

were as follows:

(Iranian OR Iran OR Persian) AND (Herb* medic* OR plant* medic* OR traditional medic* OR traditional herb* OR plant* pharmaceutical OR healing plant* OR acupuncture OR pharmacopuncture OR electroacupuncture OR electro_acupuncture OR traditional complementary and alternative medicine OR Home Remed* OR primitive medic* OR folk medic* OR indigenous medic* OR folk Remed* OR ethnomedicine).

Also, to achieve more robust and comprehensive results, the search was performed in all fields. At this stage, 2221 documents were obtained that were later reviewed by a specialist physician in the field of traditional medicine. After removing unrelated articles, 1717 documents were included in the study. We used the VOSviewer software developed by the Center for Science and Technology (Leiden University, The Netherlands) for constructing and visualizing bibliometric maps (Fu et al., 2011). Based on similar studies (Fu et al., 2012; Fu et al., 2011), we considered threshold of 30 appearances for each keyword in the scientific mapping process.

Results

Overall, 1717 documents related to the field of PM were indexed in the Web of Science. Majority of the documents were either original (n=1369, 79.73%) or reviewed documents (n=223, 12.98%), which have been published in 515 journals (Figure 1).

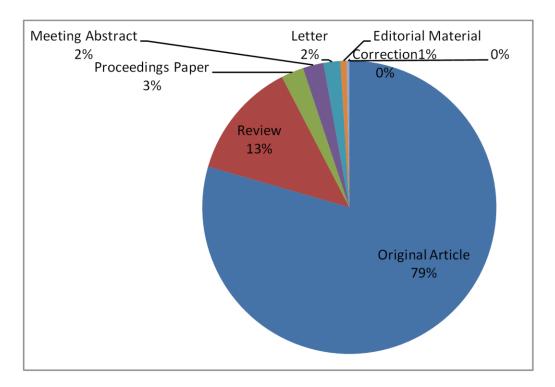


Figure 1. Distribution of PM-related documents indexed in the Web of Sciences until 2018

The retrieved documents were cited 13,721 times (11831 times excluding self-citations), generating average citation of 8.11 times (6.89 times) per item. H-index of the documents was 49, and most citations were from Iran (n=3540, 35.12%), India (n=859, 8.52%), China (n=815, 8.08%), the United States (n=679, 6.37%) and Turkey (n=597, 5.92%). In addition, citation analysis showed that the documents were mainly cited in the categories of Pharmacology/Pharmacy (n=2.17, 21.56%) and Integrative Complementary Medicine (n=994, 9.86%) (Figure 2).

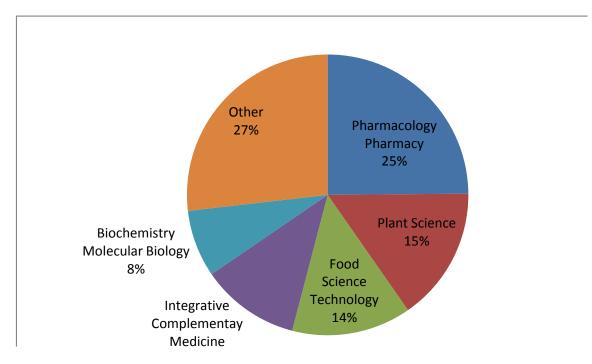


Figure 2. Frequency of documents citing PM-related papers in terms of subject area

The trend of PM-related scientific production was almost stagnant until 2005, but has been growing relatively well ever since. The rising trend of publishing PM-related scientific documents in the Web of Science (WoS) database became more progressive since 2013 (Figure 3). The average growth rate of scientific publication in the field of PM was calculated to be 61.06 percent using the following formulas:

1.
$$G = \sqrt[n]{G1' * G2' * G3' ... Gn'}$$

2. $G' = Y_t - Y_{t-1}/Y_{t-1}$
3. $G' = Y_t - Y_{t-1}/Y_{t-1} + 1$

 Y_t represents the number of articles per year, G' is the annual growth rate and G is the mean growth rate. Equation 3 is used when a negative G' value is obtained in equation 2.

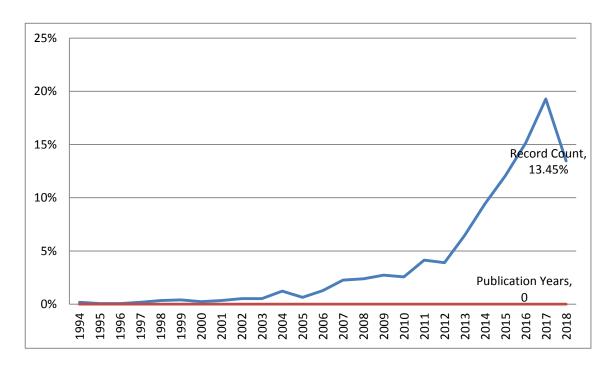


Figure 3. The trend of PM-related publication in the Web of Science until 2018

As shown in Table 1, 38 percent (n= 651) of all PM-related documents have been published in 20 journals, among which only two journals (*Journal of Ethnopharmacology*, and *The Complementary Therapies in Clinical Practice*) are specifically dedicated to the field of integrative and complementary medicine. In other words, only 104 articles (4.71%) on PM have been published in specialized journals. Most of these journals fall into quartile 2 (Q2, n=3, 15%) and quartile 4 (Q4, n=4, 35%). Articles published in the *Journal of Ethnopharmacology* had received more citations (average of 28 citations) than other journals.

Table 1. Top 20 journals that have published with the highest publications on PM

Journal	<u>C</u> .	Percent	O	C/P	IF	5-year IF	JCR Category	Quartile in Category
Journal of Ethnopharmacology	83	4.834	2314	27.8 7	3.11	3.49	Integrative & Complementary Medicine	Q1
Iranian Red Crescent Medical Journal	81	4.718	323	3.98 7	0.78	1.11	Medicine, General & Internal	Q4
Research Journal of Pharmacognosy	63	3.669	60	0.95	N/A	N/A	N/A	N/A
Iranian Journal of Pharmaceutical Research	61	3.553	64	1.04	1.37	1.58	Pharmacology & Pharmacy	Q4
Journal of Essential Oil Bearing Plants	48	2.796	80	1.66	0.68	0.72	Plant Sciences	Q4
Avicenna Journal of Phytomedicine	35	2.038	91	2.60	N/A	N/A	N/A	N/A
Industrial Crops and Products	35	2.038	419	11.9 7	3.84	4.07	Agricultural Engineering	Q2
Journal of Medicinal Plants Research	31	1.805	152	4.90	0.87	0.87	Chemistry, Medicinal	Q4
Journal of Evidence-Based Integrative Medicine	30	1.747	34	1.13	N/A	N/A	N/A	N/A
Pharmaceutical Biology	29	1.689	325	11.2	1.91	1.82	Medical Laboratory Technology Pharmacology & Pharmacy	Q3 Q3
Iranian Journal of Public Health	27	1.573	133	4.92	1.05	1.13	Plant Sciences Public, Environmental & Occupational Health	Q2 Q4
Daru Journal of Pharmaceutical Sciences	22	1.281	197	8.95	2.36	2.52	Pharmacology & Pharmacy	Q2
Iranian Journal of Basic Medical Sciences	20	1.165	180	9	1.51	1.68	Medicine, Research & Experimental Pharmacology &	Q4 Q4
Indo American Journal of Pharmaceutical Sciences	18	1.048	0	0	N/A	N/A	Pharmacy N/A	N/A
Galen Medical Journal	15	0.874	10	0.66	N/A	N/A	N/A	N/A
Journal of Integrative Medicine Jim	15	0.874	72	4.8	N/A	N/A	N/A	N/A
Phytotherapy Research	11	0.640	182	16.5 4	3.34	3.11	Chemistry, Medicinal	Q2

							Pharmacology & Pharmacy	Q2
International Journal Of Pharmacology	10	0.582	82	8.20	0.76	0.77	Pharmacology & Pharmacy	Q4
Asian Pacific Journal o Tropical Medicine	9	0.524	215	23.8	1.63	1.67	Tropical Medicine Public, Environmental & Occupational Health	Q3 Q3
Complementary Therapies in Clinical Practice	8	0.465	70	8.75	1.70	N/A	Integrative & Complementary Medicine	Q2

P = Published Articles on PM; C = Citation; IF = Impact Factor

Figure 4 shows the number of citations received per paper (citation density) in journals based on the years of citation (2000-2018). This map reflects how much each journal received new citations.

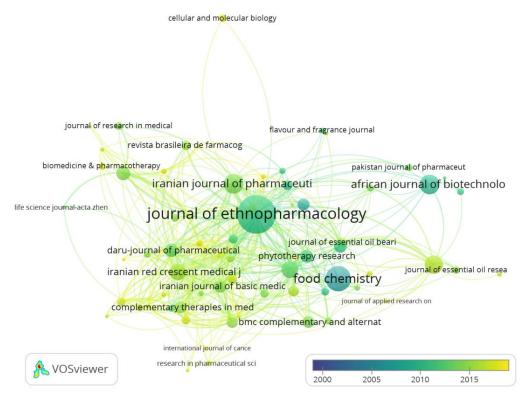


Figure 4. Number of citations received per paper (citation density) in journals based on the years of citation (2000-2018)

The yellow color represents density of newer citations and the blue color represents density of older citations. Size of each circle represents the number of documents published in each journal. As demonstrated in Table 2, Iran is the major contributor to the publication of scientific papers on PM. The U.S. and Italy are ranked second and third behind Iran (Table 2).

Table 2. Distribution of countries contributing to publication of PM-related scientific documents

SCR 1st	Country Iran	Number of documents 1,580	Percent 92.02	TC 1200	C/A 7.59	H-index 47
2^{nd}	U.S.	58	3.671	968	16.69	13
$3^{\rm rd}$	Italy	20	1.266	127	6.35	5
4^{th}	Germany	16	1.013	63	3.94	4
5 th	Malaysia	15	0.949	95	6.33	5
6^{th}	Australia	13	0.823	48	3.69	3
7^{th}	Canada	12	0.759	220	18.33	5
8 th	England	8	0.506	48	6	4
9 th	Pakistan	7	0.443	68	9.71	4
10^{th}	Spain	6	0.380	46	7.67	4

Amongst the 10 most influential authors in this field, four authors are affiliated with Shahid Beheshti University of Medical Sciences and three authors are affiliated with Tehran University of Medical Sciences. Kamalinejad with 62 articles is the most prolific author in the field of PM (Table 3).

Table 3. The 10 most known authors in the field of PM

Author's name	Number of	Percent	Affiliation				
Kamalinejad, M	documents 62	3.611	Shahid Beheshti University of Medical Sciences				
Pirbalouti, AG	42	2.446	Islamic Azad University				
Mosaddegh, M	32	1.864	Shahid Beheshti University of Medical Sciences				
Amin, G	31	1.805	Tehran University of Medical Sciences				
Rafieian-kopaei, M	30	1.747	Shahrekord University of Medical Sciences				
Abdollahi, M	29	1.689	Tehran University of Medical Sciences				
Choopani, R	28	1.631	Shahid Beheshti University of Medical Sciences				
Hajimehdipoor, H	26	1.514	Shahid Beheshti University of Medical Sciences				
Khanavi, M	26	1.514	Tehran University of Medical Sciences				
Zarshenas, MM	26	1.514	Shiraz University of Medical Sciences				

All the top 20 universities involved in the publication of PM-related documents are located in Iran (Figures 5 and 6). Tehran University of Medical Sciences (n= 336, 19.56%) has the highest contribution in the field of PM.

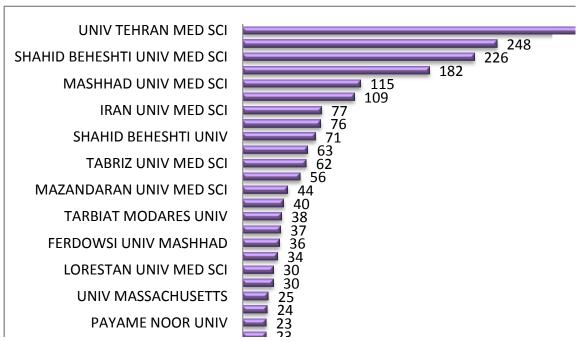


Figure 5. The top 20 universities involved in the publication of scientific papers on PM

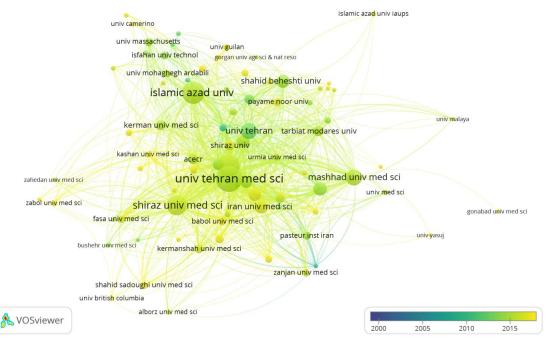


Figure 6. Organizational output in terms of publishing documents on PM between 2000 and 2018

Topics of documents in the field of PM

The purpose of keyword analysis is to discover trends and topics of interest. In this regard, all keywords of documents (author's keywords and keyword plus) were analyzed by the VOSviewer

at threshold of 30 repeats and maps were generated (Figures 7 and 8). The keywords were defined in four clusters. Placement of keywords in the clusters and the distance between nodes were based on the simultaneous use of two or more similar keywords. Size of each circle in the cluster represents the proportion of productivity in that subject. In the first cluster (shown in red), extract (n=150), medical plants (n=120), traditional medicine (n=118), Iranian traditional medicine (n=96) and herbal medicine (n=78) were the most commonly used keywords among the retrieved documents. In the second cluster (shown in green), extract (n=135), medical plants (n=122), chemical composition (n=115), antimicrobial activity (n=87) and antibacterial activity (n=79) were the most frequently used keywords in PM documents. In the third cluster (shown in blue), the most commonly used keywords were antioxidant (n= 163), oxidative stress (n= 85), cytotoxicity (n= 40), inhibition (n= 39) and cancer (n= 37). In the fourth cluster (shown in yellow), the most commonly used keywords were antioxidant (n= 163), oxidative stress (n= 85), cytotoxicity (n= 40), inhibition (n= 39) and cancer (n= 37).

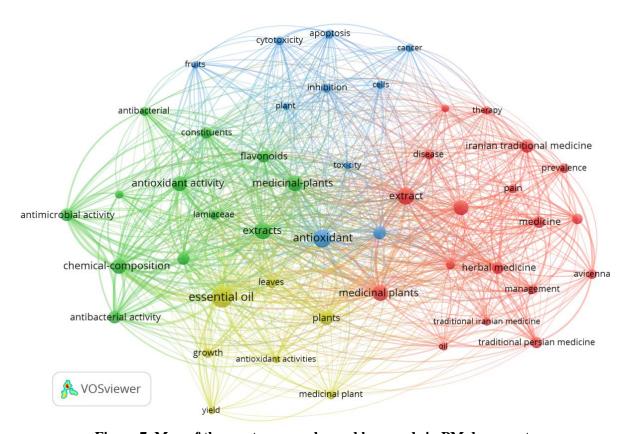


Figure 7. Map of the most commonly used keywords in PM documents

Figure 8 shows the popularity of keywords in PM-related documents between 2013 and 2018.

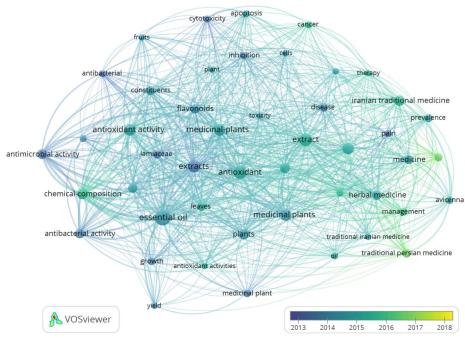


Figure 8. Popularity of keywords used in PM documents between 2013 and 2018

Keywords in blue are older and the ones in yellow are more recent. A greater distance between two keywords indicates a less frequent co-occurrence between the two keywords. The proportion of citations for keywords in the field of PM was analyzed, and a map was obtained based on minimum and maximum of four and 10 citations, respectively (Figure 9).

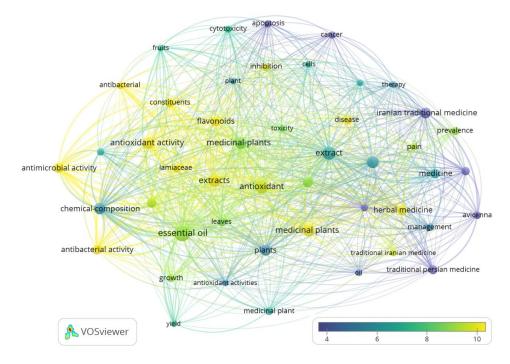


Figure 9. Citation rate of keywords used in the field of PM. The blue color indicates fewer citations and yellow represents more citations

Discussion

Our findings reveal that the amount of scientific productions in the field of PM has increased rapidly since 2013. A similar trend was reported in a study on scientific production of Iranian researchers in the field of traditional medicine (Hodhodinejad et al., 2012). A significant increase in the number of scientific publications in the field of PM since 2012 suggests that although specialists have been active in the field of PM, but the explanation for this situation may be considered in the entry of PhD students in the field of Persian Medicine. Since 2009, in Iran, with the approval of the teaching of Persian Medicine at Ph.D., scientific production has also been multiplied by these students.

Most retrieved documents from the WoS database were original documents totaling (79%) and review documents amounting to (13.98%). Similar to other scientific fields, other document types such as conference proceedings and meeting abstracts account for a smaller fraction of the total scientific productions in the field of PM. Holding international seminars, collaboration, and conferences in the field of PM could help in promoting more interest with quality in researches among students, scholars and researchers in the area of PM. An average of 8.11 citations and H-index of 49 were found for documents published on PM. This is similar to the results of other studies. The H-index of published documents in the fields of cardiovascular disease, cancer, diabetes, chronic respiratory disease, exosome research is 77, 150, 87, 36, and 74, respectively (Fu et al., 2011; Wang et al., 2017).

Most citations to PM documents were made from Iran (35.12%). In addition, Iranian researchers contribute the most (92.02%) to publication of PM-related documents. Once again, these results indicate the inadequate familiarity of international scholars with PM compared to similar medical disciplines, such as the traditional Chinese medicine. Collaboration in international researches and writing joint papers with researchers from other countries can lead to more international recognition and an increase in the citation level of PM-related papers. In the field of traditional Chinese medicine, 35 percent of authors are from China, while 19 percent are from the United States. Moreover, documents written by American authors (29%) receive a higher number of citations compared to those written by Chinese authors (27%) (Zeinalian et al., 2016).

The *Journal of Ethnopharmacology*, which is specifically dedicated to integrative and complementary medicine, has published the highest number of PM documents. This finding is in line with results of a study by Hodhodinezhad et al. (Hodhodinejad et al., 2012). Articles published in this journal have received an average of 28 citations, which highlights the benefit of publishing in specialized journals. According to Figure 4 and Table 1, documents published in journals with no defined/clear category (such as Indo American Journal of Pharmaceutical Sciences) receive the least number of citations.

As illustrated in Figure 8, the recent change in the trend of keywords used in PM documents

indicates that research in the field of PM has moved from a basic aspect to a more clinical- and practical-based approach. However, the amount of citation to documents with the basic aspect has been more than clinical-and practical-based approaches. It can be said that these statistics are normal, because the documents with the basic aspect are older and have more time to receive citations. Publication in specialized journals dedicated to the field of PM and in Iranian journals has become more popular. This could be due to the fact that most authors in the field of PM are Iranian and making payments for the publication fee to journals outside Iran has become more difficult because of the US sanctions and other economic pressures on Iran.

Conclusion

We analyzed scientific productions in the field of PM in the Web of Science database by generating scientific maps using the VOSviewer software. Based on the findings, PM is not well known enough among international researchers, and Iranian researchers and organizations contribute the most to publication of papers in this field of science. Collaboration, international co-authorship and participation in international conferences and meetings could fill this gap and boost the popularity, quality, and an increase in the scientific production in the field of PM worldwide. In any case, given the ancient roots of this science (Persian Medicine) and its academic pursuit in recent decades in Iranian universities, the quantitative and qualitative trend of this science reflects long-term growth and development, giving a clear perspective. Therefore, researchers in this field can more accurately identify trends in these research findings and incorporate them into their research policies.

Acknowledgement

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