International Collaboration of Turkey in Liver Transplantation Research: A Bibliometric Analysis

K. Bas, M. Dayangac, O. Yaprak, Y. Yuzer, and Y. Tokat

ABSTRACT

Objectives. Scientific publications are valuable markers of scientific activity for countries. We performed a bibliometric study to evaluate the number of publications written by Turkish authors. The aim of this study is to evaluate Turkey's contribution in terms of number of publications included in Science Citation Index Expanded (SCI-E) in the scientific field of liver transplantation compared with other countries. To our knowledge, this is the first bibliometric study in liver transplantation research of Turkey.

Materials and methods. ISI Web of Knowledge-Science was used for the analysis. All scientific works published included in SCI-E in English from 1980 to August 10, 2011, were analyzed. A retrospective search was performed using key words "liver transplantation," "hepatic transplantation," "liver transplant," and "hepatic transplant." We further analyzed these results by the "analyze" function of the software in terms of number of papers for each country, type of documentation, number of publications per year, journal, institute, and author. The number of citations to published works was calculated by using the citation function of the same software. We also used the same function of the software to analyze publications from Turkey in the last three decades between 1980 and 1989, 1990 and 1999, and 2000 and 2009 for statistical evaluation. Collected data from the comparison periods were statistically analyzed using the chi-square test.

Results. In all, 48,418 publications related to liver transplantation were included in SCI-E in English between 1980 and August 2011. Overall, 675 of those publications were from Turkey (2.05%). There was no publication from Turkey between 1980 and 1989; 37 between 1990 and 1999; and 511 between 2000 and 2009. The rank of Turkey among other countries according to the number of publications was 25th between 1990 and 1999 and improved to 14th between 2000 and 2009. The number of scientific publications in the field of liver transplantation from Turkey among other countries increased during the last three decades.

Conclusions. Turkey showed a significant positive trend in publications in the scientific field of liver transplantation in the last 30 years, and the rank of Turkey among other countries improved in recent decades. Currently, Turkey is one of the top 17 countries in terms of number of scientific publications listed in SCI-E. This can be considered as another indicator for Turkey's progress in the field of liver transplantation.

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Table 1. Distribution of Top 20 Countries by the Publications Included in Science Citation Index Expanded Between 1980 and August 2011 in the Field of Liver Transplantation

Rank	Country	*n*	Percentage (%)
1	USA	17,964	37.1
2	Japan	3932	8.1
3	England	3742	7.7
4	Germany	3664	7.5
5	Italy	3311	6.8
6	France	2573	5.3
7	Spain	2534	5.2
8	Canada	1583	3.2
9	China	1452	2.9
10	Netherlands	1085	2.2
11	Belgium	962	1.9
12	Australia	947	1.9
13	South Korea	946	1.9
14	Brasil	800	1.6
15	Switzerland	707	1.4
16	Taiwan	690	1.4
17	Turkey	675	1.3
18	Austria	546	1.1
19	Sweden	543	1.1
20	Poland	356	0.7

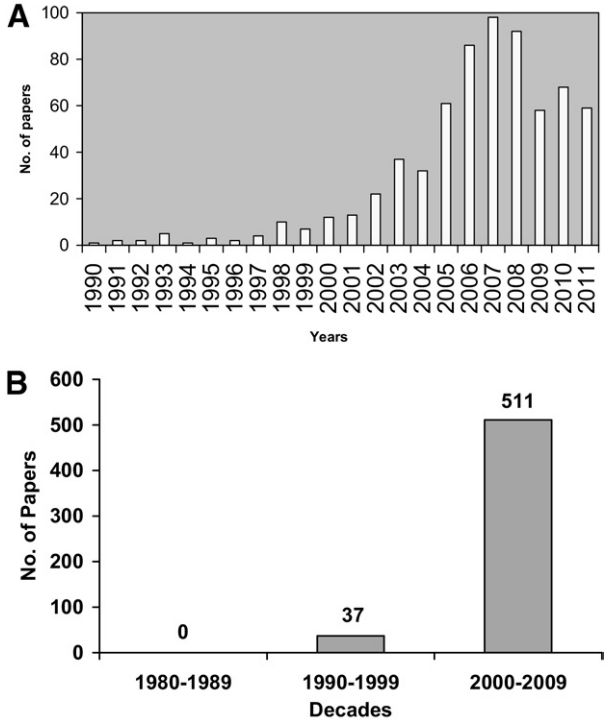

Fig 1. **(A)** Number of publications in journals included in Science Citation Index Expanded from Turkey, between 1980 and August 2011 in the field of liver transplantation. **(B)** Distribution by last three decades of publications included in Science Citation Index Expanded, from Turkey in the field of liver transplantation.

Table 2. Distribution in the Types of Publications Included in Science Citation Index Expanded From Turkey, Between 1980 and August 2011 in the Field of Liver Transplantation

Document Type	*n*	Percentage (%)
Article	452	66.9
Meeting abstract	186	27.5
Proceeding paper	139	20.5
Review	16	2.3
Letter	14	2.0
Others	6	0.8

THE NUMBER OF SCIENTIFIC PUBLICATIONS can be an important indicator of scientific activity for countries. Bibliometric studies, such as evaluation of those works, have an important impact on academic staff. These bibliometric studies may be used to determine the scientific productivity of a country.[1] Science Citation Index was introduced in 1961 as a tool for bibliographical retrieval and provides a large database for the analysis of journals and publications.[2] Web of Science (WoS) is software that can be used for the analysis of scientific publications indexed in the Science Citation Index Expanded (SCI-E) according to various parameters.[3] The aim of the current study is to analyze the scientific publications in the field of liver transplantation included in SCI-E published by Turkish authors for evaluating the trend of their contribution among other countries to the literature in recent years. To our knowledge, this is the first bibliometric study in the scientific field of liver transplantation for Turkey.

MATERIALS AND METHODS

This research was conducted on August 10, 2011, using the WoS software to analyze the liver transplantation publications included in SCI-E. ISI Web of Knowledge-Science was used for the analysis. We retrospectively searched all publications in the field of liver transplantation between 1980 and August 10, 2011, using the terms "liver transplantation," "liver transplant," "hepatic transplantation," and "hepatic transplant" in topic search section, then refined the search to include all results in English. By using the "analyze" function of the software, we analyzed the number of publications for each country, author, institute, and journal as well as publications per year and type

Table 3. Distribution of Top 10 Turkish Authors Ranked by the Number of Publications Included in Science Citation Index Expanded, Between 1980 and August 2011 in the Field of Liver Transplantation

Author	*n*
1. Haberal, M.	331
2. Karakayali, H.	242
3. Sevmis, S.	129
4. Moray, G.	127
5. Kilic, M.	125
6. Ozcay, F.	124
7. Tokat, Y.	113
8. Arslan, G.	101
9. Torgay, A.	94
10. Yuzer, Y.	79

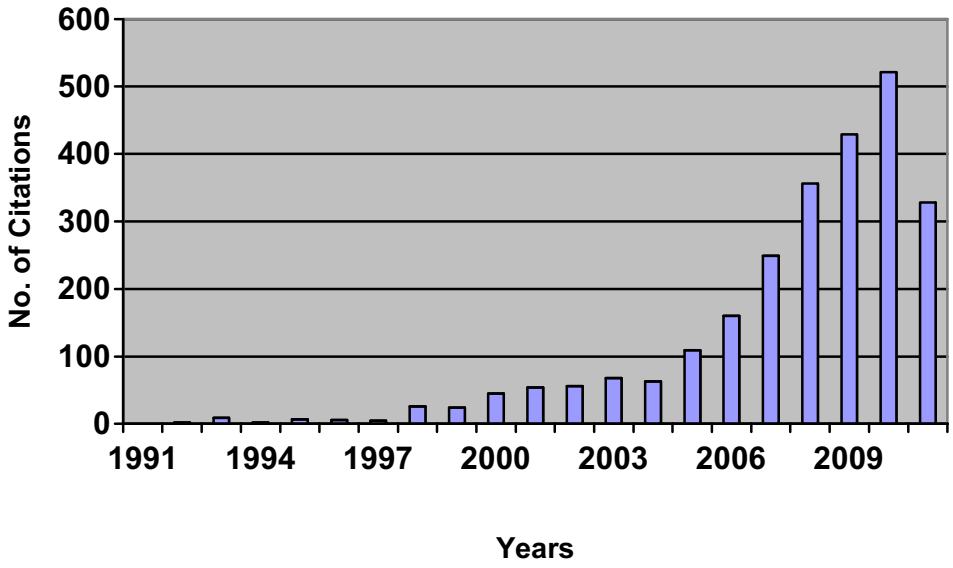

Fig 2. Number of cited publications included in Science Citation Index Expanded of Turkish authors.

of documentation. Number of citations to published work was calculated by using the citation function of the same software. We also separately analyzed the contribution and the rank of Turkey among other countries in the last three decades between 1980 and 1989, 1990 and 1999, and 2000 and 2009. Collected data from the comparison periods were statistically analyzed using the chi-square test.

RESULTS

Overall, 48,418 works were published in the field of liver transplantation and included in SCI-E in English between 1980 and August 10, 2011. In this time, the biggest contribution was from the United States with 37.1%, followed by Japan (8.1%), England (7.7%), Germany (7.5%), Italy (6.8%), France (5.3%), and Spain (5.2%). Other countries' contributions were under 5%. Of those, 675 papers published from Turkey amounted to 1.39%, ranking 17th among other countries in this period (Table 1). The first article included in SCI-E published from Turkey was in 1990. The number of publications from Turkish authors increased dramatically in later years (Figs 1A and 1B). Only

Table 4. Distribution of Publications Between 1980 and August 2011, in the Field of Liver Transplantation with 5 Year' Impact Factors (IF) Due to Journal Citation Reports-ISI Web of Knowledge and SCImago Journal & Country Rank

Journal	*n*	%	IF
Journals publishing over 10 publications by authors from Turkey			
1. *Transplantation Proceedings*	184	27.2	0.821
2. *Liver Transplantation*	97	14.3	4.219
3. *Pediatric Transplantation*	63	9.3	1.604
4. *Transplant International*	19	2.8	1.918
5. *American Journal of Transplantation*	18	2.6	5.931
6. *Experimental and Clinical Transplantation*	17	2.5	0.820*
7. *Hepatology*	11	1.6	10.497
8. *Journal of Hepatology*	10	1.4	5.994
Journal of Pediatric Gastroenterology and Nutrition	10	1.4	2.140
Top 10 journals ranked by the number of publications by all authors around the world			
1. *Liver Transplantation*	5881	12.1	4.219
2. *Transplantation Proceedings*	4960	10.2	0.821
3. *Hepatology*	4208	8.6	10.497
4. *Transplantation*	3146	6.4	3.527
5. *American Journal of Transplantation*	2364	4.8	5.931
6. *Transplant International*	1543	3.1	1.918
7. *Journal of Hepatology*	1298	2.6	5.994
8. *Gastroenterology*	1139	2.3	12.424
9. *Pediatric Transplantation*	844	1.7	1.604
10. *Clinical Transplantation*	663	1.3	1.994

*4 years IF.

Table 5. Distribution of Top Six Institutions Ranked by the Number of Publications Included in Science Citation Index Expanded, From Turkey, Between 1980 and August 2011 in the Field of Liver Transplantation

Institutions	*n*
1. Baskent University, Ankara	279
2. Ege University, Izmir	132
3. Hacettepe University, Ankara	36
4. Ankara University, Ankara	35
Istanbul University, Istanbul	35
5. Florence Nightingale Hospital, Istanbul	31

37 works were published between 190 and 1999, rising to 511 between 2000 and 2009, with contribution rates of 0.28% and 1.8% in these periods. The most common type of publications from Turkey were articles (66.9%), followed by meeting abstracts (27.5%), and proceedings papers (20.5%; Table 2). Haberal Mehmet was the most frequent contributor among all Turkish authors in terms of number of publications included in SCI-E in the field of liver transplantation between 1980 and August 2011 with 331 publications (Table 3). For 675 publications from Turkey, the total citations during this time until August 2011 was 2518 (2222 excluding self-citations) and the citation-to-work ratio was 3.73 with h-index of 17. The first citation was in 1992 and the number of citations increased consistently year by year (Fig 2), average citations per year being 125.9. The top nine journals published over 10 works from Turkish authors were *Transplantation Proceedings* (n = 184), *Liver Transplantation* (n = 97), *Pediatric Transplantation* (n = 63), *Transplant International* (n = 19), *American Journal of Transplantation* (n = 18), *Experimental and Clinical Transplantation* (n = 17), *Hepatology* (n = 11), *Journal of Hepatology* (n = 10), *Journal of Pediatric Gastroenterology and Nutrition* (n = 10; Table 4). *Liver Transplantation* was the most frequently published journal in this period with a rate of 12.1% of all publications in the liver transplantation field around the world (Table 4). Institutions that made up the highest percentages of all publications from Turkey were from the biggest Turkish cities such as Ankara, Istanbul, and Izmir (Table 5). The rank of Turkey among other countries in terms of published items has been improving during the last two decades, from 25th to 14th, with contribution percentage increasing from 0.28% to 1.85% ($P < .05$; Fig 3).

DISCUSSION

Bibliometric studies, such as the number of medical publications, have valuable impact on researchers and physicians. These studies may also be used for the evaluation of countries' performances in a specific health area domestically or internationally.[1] However, little is known about the contribution of Turkish medical researchers to the scientific field of liver transplantation. To our knowledge, this is the first study that evaluated Turkey's research productivity in this field.

The first human liver transplantation was performed in 1963 by a surgical team led by Thomas Starzl in the United States.[4] In Turkey, the law on harvesting, storage, grafting, and transplantation of organs and tissues was enacted in 1979, and the first cadaveric liver transplantation was performed by Mehmet Haberal et al in 1988.[5] The first article contributed by a Turkish author in the liver transplantation field included in SCI-E was published in 1990.[6] There was no publication included in SCI-E between 1980 and 1989, 37 publications between 1990 and 1999, and 511 between 2000 and 2009, with contribution percentages of 0%, 0.28%, and 1.85% in these periods, respectively. The number of publications from Turkey in the liver transplantation field has increased significantly in the last decades. The rank of Turkey among other countries has also improved from 25th to 14th in the last two decades. Internationally the majority of the publications in SCI-E between 1980 and August 2011 were articles, at 58% of 48,418 publications. The highest percentage (66.9%) of articles was also from Turkey, which may be considered of higher value in this scientific field. Nourbala et al found that Turkey is the only country that has a rising trend in terms of publications in the transplantation field among other Muslim countries.[7]

The quantification of scientific activity of a country could show that country's development in research status in a

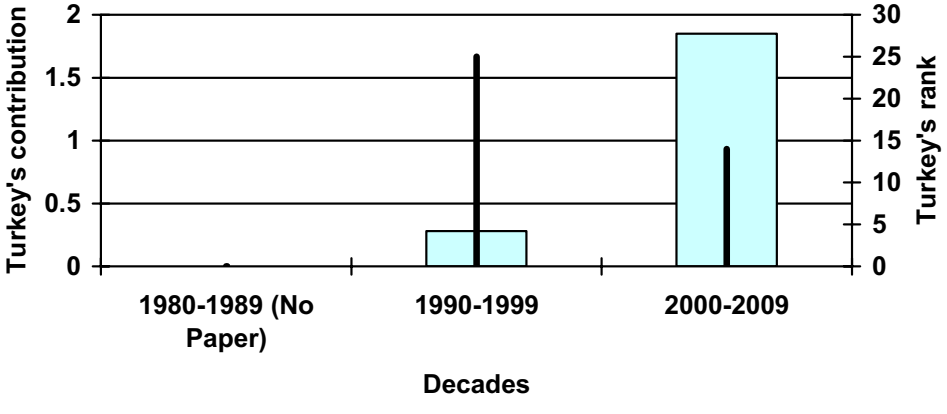

Fig 3. Increasing contribution of Turkey to the literature (bars) and the rank of Turkey among other countries (lines) by publications included in Science Citation Index Expanded, from Turkey, between 1980 and 2009, in the field of liver transplantation.

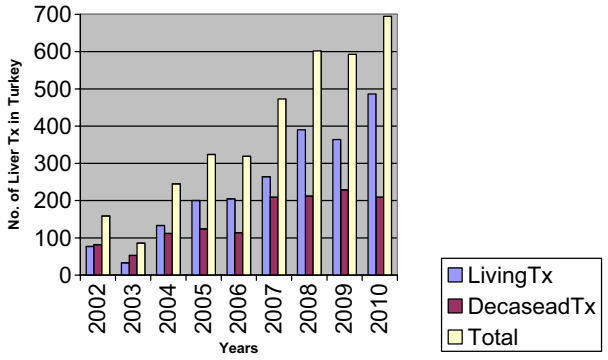

Fig 4. Number of liver transplantations (Tx) in Turkey in the last decade.

specific area.[8] This increased number of publications in liver transplantation is also in line with progress in this field in terms of increasing number of transplanted patients in Turkey. In the last decade, there was a significant increase in liver transplantation in Turkey. According to annual registry reports of the Republic of Turkey Ministry of Health between 2002 and 2010, there were 3496 liver transplantations performed in Turkey[9] (Fig 4). The number of transplantation centers has also increased during this period (Fig 5).

Among other countries, between 1980 and August 10, 2011, the United States published the most research with 37.1%, followed by other developed countries such as Japan, England, Germany, and Italy. The United States has more than one-third of the publications, which correlates with its high number of liver transplantations. Due to annual report of Newsletter Transplant-2010, for the year 2009, 16,536 liver transplantations were performed in 45 countries and 6320 of those were performed in the United States (38.2%).[10] Different countries have different profiles for performing liver transplantation and publishing work related to this activity. For example, even though Portugal performed the most liver transplantations per million population (p.m.p.) with number of 24 in 2009 (n = 255), the authors from Portugal published only 21 papers included in SCI-E in 2010. The ratio of publications included in SCI-E in 2010 to the number of liver transplantations performed in 2009 was 8.2% for this country. Regarding this ratio, Netherland has the best publishing performance with 65% but the liver transplantation p.m.p. was 8 for this country. Average number of liver transplantation p.m.p. was 9.2 among those 45 countries, and this number for Turkey was 7.9 in the same year. Average ratio of publications per transplantation among those countries for those years was 20.2% and 11% for Turkey. Due to these calculations, liver transplantation activity approaches that of other countries, but Turkish authors are still below the average publication ratio compared with those countries (Fig 6).

For journals, *Transplantation Proceedings* was the most preferred journal by authors from Turkey and *Liver Transplantation* was the first place on the world's list. There are seven common journals in top lists with authors from Turkey and authors from other countries. Turkish authors seem to prefer mostly the same journals for publications as their colleagues from other countries. When calculating the average of impact factors (AIF) of two groups' journals, there was little difference between them. AIF of preferred journals by all authors around the world was 4.892 and by authors from Turkey was 3.771 (Table 4). Work from Turkish authors is published by journals that have high impact factors as much as other countries' authors.

These WoS-based bibliometric studies have some limitations. It is not possible to obtain articles included in SCI-E published before 1980, and as the list is updated regularly, the numerical changes in results should be taken into consideration. Another handicap is the uncertainty of addresses; some researches even from the same clinic could be noted differently, and therefore, the standardization of the addresses during publication carries importance.[3] We also encountered the same problem during the study of authors' names. Authors should be encouraged to use the same initials for listing properly.

In conclusion, bibliometric measurement of scientific research productivity is one of the most practical methods for evaluating scientific activity for countries. With this bibliometric study, we found that there is a significant improvement of scientific activity in the liver transplantation field in Turkey among other countries in recent years, which is also in line with increasing transplantation activi-

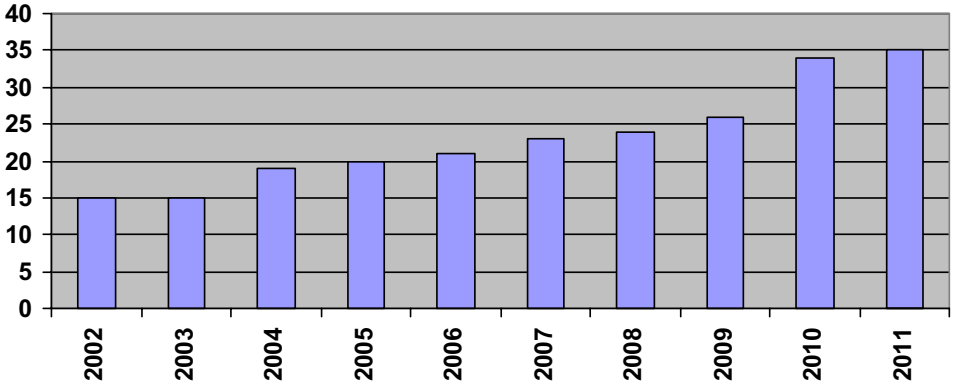

Fig 5. Number of liver transplantation centers in Turkey by years according to Republic of Turkey Ministry of Health.

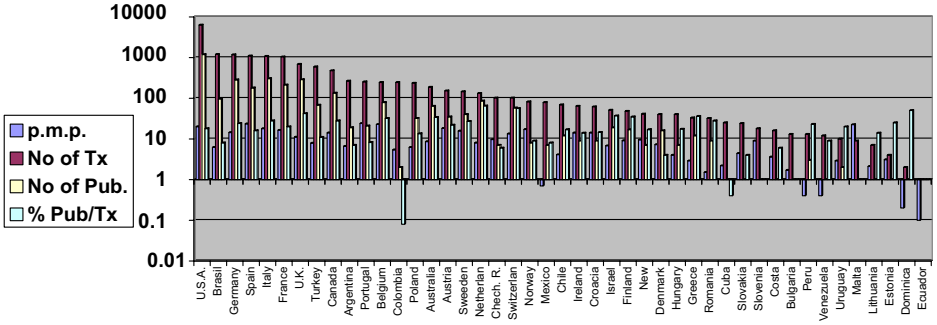

Fig 6. The logarithmic chart of 45 countries by number of liver transplantations in 2009 (blue bars), number of publications included in Science Citation Index Expanded (SCI-E) 2010 (red bars), number of liver transplantation in per million population in 2009 (yellow bars), and ratio of publications included in SCI-E in 2010 to liver transplantation in 2009 (green bars) according to Newsletter Transplant-2010 and ISI Web of Knowledge-Science.

ties in the country. Other countries may use bibliometric analyses to evaluate their situation.[11] We can claim that Turkey is the leading Middle Eastern country in liver transplantation research; thus, Turkey can be a model for other developing countries in this area of health.

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