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Research in Dentistry at Saudi Arabia: Analysis of Citation Impact

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Abstract

Aim: The study aims to assess the Saudi Arabian publications on dentistry and their citation impact as reflected in the Web of Science (WoS).

Methods: WoS database categorized dental research under “Dentistry Oral Surgery Medicine”. Dental sciences publications with citation impact by Saudi Arabian affiliated authors produced during 2009-2018 have been searched by using suitable searching strategy and dental research of 10 randomly selected countries has been carried out for comparison. The downloaded data was transferred into Microsoft Excel format to measure the bibliometric indicators and citation impact of publications.

Results: A total of 1,771 documents on dentistry were published by Saudi Arabia from the time span of 2009 to 2018. These publications received a total of 10,320 citations with an average of 5.83 citations per paper. The subcategory of “Engineering biomedical” in dentistry got maximum citation impact. Review articles received higher citations as compared to original research articles. Dataset by organizations showed that the research carried out in the hospital sector have a higher number of citations as compared to teaching institutions. The research collaboration by Saudi Arabian authors with the researchers of the University of Michigan, USA got maximum citations while by country analysis shows that research collaboration with Italy, Germany and Japan have more citations as compared to the US, Egypt and England.

Conclusion: Although there is promising growth in dental research in Saudi Arabia, even then researchers need to write on the novel and innovative ideas to get global attention and citations. Articles published in Q1 impact factor journals and research collaboration with talent-rich countries got higher citations.

Keywords: Bibliometrics; Publications; Citation Impact; Dentistry; Scholarly Productivity; Saudi Arabia; Web of Science;

Introduction

Saudi Arabia has been significantly progressing in the field of higher education, remarkably contributing to research & development, and creation of knowledge, particularly during the last decade. The Saudi government is striving hard and doing concert efforts to the provision of adequate funds to the education sector and establishing new academic setups (Pavan, 2016). The *Time Higher Education (2019)* released the world university ranking 2019 which includes more than 1,250 universities belonging to 86 countries. United States stands on the top with 172 universities, followed by Japan and United Kingdom by 102 and 98 universities respectively. Six universities of Saudi Arabia are included in this ranking as shown in Table-1. King Abdulaziz University reaches in the world ranking of 201-250 and first in Saudi Arabia, followed by Alfaisal University and King Saud University. There were five universities of Saudi Arabia in 2018 ranking; King Saud bin Abdulaziz University for Health Sciences reached the first time in this ranking.

Table-1, Saudi Arabian Universities in Time Higher Education 2019

Rank	University Name	Overall Score	Teaching	Research	Citations
201-250	King Abdulaziz University	49.5-53.0	27.8	16.3	99.0
301-350	Alfaisal University	44.0-46.3	19.3	23.0	78.1
501-600	King Saud University	33.5-37.0	23.7	28.2	39.4
501-600	King Saud bin Abdulaziz University for Health Sciences	33.5-37.0	31.0	7.4	62.1
601-800	King Fahd University of Petroleum and Minerals	26.0-33.4	28.7	15.4	36.7
1001+	Imam Abdulrahman Bin Faisal University	9.8-18.9	19.3	7.2	7.0

Education, research and development have been prioritized by the Saudi government and ambitious goals have been set to attain an international standard in higher education through the Kingdom’s Vision 2030 declared in April 2016 (Saudi Arabia, 2016).

“In the year 2030, we aim to have at least five Saudi universities among the top 200 universities in international rankings. We shall help our students achieve results above international averages in global education indicators.”

The reserve of knowledge has been improving extensively by creative, innovative and systemic research. Publication of research findings is an integral part of the knowledge creation process. The performance of authors, institutions, journals, branch of knowledge, nation, country and specific region can be judged by research publications (Haq, Elahi & Dina, 2019). The evaluation of research has become very significant in research policy, management and funding. The quantitative aspect of research deals with the number of research productivity while the qualitative feature deals with citation analysis (Herther 2009; Ellegaard, & Wallin 2015). WoS, Scopus and Google Scholar databases provide various citation indexes to analyze the scientific activity. These databases have gain popularity in the academic arena and the scientific community (Adriaanse, & Rensleigh, 2013). Citation analysis is the now recognized procedures

to evaluate the qualitative aspects of the research publication domain. The citation impact calculates the number of citations received in scholarly publications. It represents the total number of citations to articles divided by the number of articles (Moed, 2010).

$$\text{Citation impact} = \frac{\sum \text{citations}}{\sum \text{papers}}$$

It indicators of quality and characteristic of excellence of scholarly publication is citation counting of publications (Garfield, 1955). It means, that how many times, the research dataset has been cited by the other scholars in their publications. The citations are evidence of fair sharing and exchange of scholarly work. The exchange of communication attributes to build a knowledge-based society and meaningfully subsidize the positive input to the existing body of knowledge (Davis, 2011).

The concept of citation indexing and counting its impact on knowledge was originated by Dr. Eugene Garfield in 1955. He established a firm in 1960 at Philadelphia, United States for the provision of journal content services, later this firm renamed as Institute of Scientific Information (ISI). The first volume of Science Citation Index was published in 1964, in the following year 1965, first journal impact factor was generated, and Journal Citation Report was launched in 1975. ISI launched a Web of Science (WoS) database in 1997, now maintained by Clarivate Analytics. Web of Science provides accessibly to distinguished research literature precisely arranged metadata with citation impact (Masic, 2017).

The high and low frequency of citations depend on various elements such as the nature of research work, collaborative pattern and journal impact factor. The citation analysis has been pragmatic on a single article, collective research productivity, on an academic publication, the research output of an institution, and total scholarly growth of the specialty (Jabeen, et al. 2015; Jabeen 2019). Dr. Jorge E. Hirsch, Physicist of the University of California introduced another quality indicator in 2005 known as Hirsch Index (H-Index). H-Index measures the relationship of productivity and citation impact, the set of most cited publications and numbers of citations, the publications retrieved. If H-index is 5, it means that 5 papers have been cited 5 or more than 5 times, and the 6th article has received less than 5 citations (Hirsch, 2005).

The impact factor represents the total number of citations to a journal's articles divided by the number of articles published during the previous two years as reflected in WoS. It is widely used in the academic world as a yardstick of a journal's prestige. While comparing the quartile factor of the journals, a subject category in percentile rank, the top 25% of journals in a specific category are placed in Q1, next in Q2 and so on (Meo & Jawaid 2018).

Saudi Arabian authors produced substantial research on dentistry (Haq et al. 2019) but the qualitative aspects such as citation analysis have not been carried out yet. The paper is attempted to fill this gap. The main aim of this report is to analyze the citation impact on dental research produced by Saudi Arabian affiliated authors published during the last ten years from 2009 to 2018. WoS database has been used to retrieve the dataset because WoS indexed more than 20,000 journals, including 12,271 titles in Journal Citation Report (JCR) of 2017, which is known as the gold standard in scholarly communication (Miri, et al. 2012).

Review of Literature

The promising growth of scholarly publications in medical and allied health sciences at Saudi Arabia has been reported by [Zaher et al. \(2018\)](#), [Shehatta and Mahmood \(2016\)](#), [Meo \(2015\)](#) and [Latif \(2015\)](#). All these studies are mostly focused on the quantitative aspect and numerical growth of publications. [Zaher et al. \(2018\)](#) elucidated the research productivity of Saudi health care institutions published from 2006 to 2016. This paper also highlighted the citation impact of publications that King Saud University found the most productive with 9954 publications with 9.84 average citations per article but the publications produced by King Fahad Medical City got highest citation impact with an average of 15.12 citations per article. [Shehatta and Mahmood \(2016\)](#) indicated that research conducted in the collaboration of developed countries by the Saudi authors got highest number of citations. [Meo \(2015\)](#) examined the Scopus based database SCImago Journal and Country Rank and revealed that Saudi Arabia produced 1,61,717 publications, almost 44% of citable documents received an average of 8.09 citations per paper. [Latif \(2015\)](#) pointed out that one-fourth of the total medical sciences articles indexed in PubMed published in journals with ≥ 1 impact factor between 2008 and 2012.

[Haq et al. \(2019\)](#) revealed in the quantitative assessment of dental research output that 2,427 publications produced by Saudi Arabian scholars during the period of 20 years from 1998 to 2017. The data for this report was retrieved from Scopus database. Most of the dental research produced by the researchers of King Saud University and King Abdulaziz University. United State has been on the top in research collaborating countries followed by Egypt, India and England. Most of the articles published in the Journal of Contemporary Dental Practice and Saudi Dental Journal. The findings of the report showed that there is significant growth of dental publications in Saudi Arabia.

A Scopus based scientometric analysis on dental research output in India revealed that India produced 1380 papers on dentistry from 1999 to 2008 with an average of 138 papers per year. These papers received 1910 citations with an average of 1.38 citations per paper. Manipal College of Dental Science found most productive institute with 166 publications and 0.67 citations per paper. Although All India Institute of Medical Science, New Delhi produced only 70 papers but got the highest citation impact (2.13) during the targeted period. List of frequently used journals with publications and, top 15 most productive authors along with citation impact and H-Index have been pointed out. India clutches 14th rank in global dental research output and it's contributed 1.66% share in total dental research. United States holds the first position with 20123 publications, which counted almost one quarter (24.16%) share of the total global productivity in dentistry. The international collaborative share has been recorded 87 (6.30%), the paper concluded to increase the international research collaboration to enhance the quality and urgently needed investment from government to increase the publication output in India ([Kaur & Gupta 2010](#)).

A PubMed based analysis of dental publications from Iran exposed that Iran produced 3,835 publications between the years of 2008 to 2015 with an average of almost 256 papers per year. Nearly one quarter (24.56%) of papers written by four-author pattern and the majority of papers written on subcategory of endodontics (19.82%). PubMed doesn't provide citation-counting, so the investigators used Scopus and Google Scholar for citation counts. It is found that 3109

0(81.06%) papers received citations in Google Scholar while 1881 (49.04%) papers found citations in Scopus database. Citation per paper has not been calculated in this study (Asgary et al. 2016).

Research Objectives

The study has been carried out to achieve the following objectives:-

1. To compare the dental sciences research and its citation impact of Saudi Arabia with ten randomly selected countries of the world published between the years of 2009 to 2018.
2. To assess the growth of dental publications in Saudi Arabia with citation counts and H-index.
3. To highlight the subcategories of dentistry and research type with the highest citation impact.
4. To describe the most productive Saudi organizations, international research collaborating organizations, countries, journals and authors in term of citation count of dental publications.

Methods

Data for this study have been retrieved from WoS database on 7th of March 2019. “Saudi Arabia” has been written in the main search box and “Address” option has been selected from Web of Science Core collection. Custom year range from 2009 to 2018 has been selected from the timespan option. Database produced the detail of all documents produced by Saudi Arabian affiliated authors in this period. WoS classified dental research under “Dentistry Oral Surgery Medicine”, so this category has been selected. The dataset was downloaded to assess impact factor by year, by dental subcategory, by research-type, and by organizations. Productive authors, collaborative international organization and countries have also been explored. Comparison of dental research of Saudi Arabia with 10 randomly selected countries has been drawn. Data has been presented in tabulation format.

Results

WoS database produced the list of 1,771 documents produced by Saudi Arabian researchers on dentistry between the years of 2009 to 2018 with an average of 177 publications per year. These publications received 10,320 citations with the citation impact of 5.83. Table-2 stated the comparison of dental research carried out by Saudi Arabia with 10 other randomly selected countries of the world. United State produced maximum papers (n=20720) on dentistry, followed by Brazil and China. The share of dental research in total publications of county analysis revealed that Brazil produced 2.21% of its total research on dentistry. WoS doesn't produce the result of citation impact if the publications are more than 10,000. Only the United States and Brazil produced more than 10,000 publications in the projected period. Amongst other countries, Italy has the highest citation impact with 11.39 citations per paper. The citation impact of Saudi Arabia in dental research found 5.83 citations per paper with 39 h-index papers.

Table-2, Comparison of citation impact on dental research in selected countries

Rank	Country	Total publications	Publications on Dentistry	Percentage of Dentistry	Total citations	Citation impact	<i>h</i> -index
1	USA	6,443,239	20,720	0.32%	Web of Science doesn't analyze if the number is more than 10,000		
2	Brazil	581,822	12,908	2.21%			
3	China	3,475,382	7,072	0.20%	69,829	9.87	70
4	England	1,569,640	6,267	0.39%	61,400	9.80	82
5	Germany	1,535,153	7,629	0.49%	83,934	11	82
6	Italy	971,203	6,019	0.61%	68,572	11.39	81
7	India	891,649	5,250	0.58%	22,236	4.24	42
8	Turkey	396,172	4,794	1.21%	34,876	7.27	48
9	Saudi Arabia	131,929	1,771	1.34%	10,320	5.83	39
10	Egypt	126,529	1,131	0.89%	8,176	7.23	35
11	Jordan	24,850	424	1.70%	3,575	8.43	27

Table-3 exposed the growth of dental publications in chronological order produced by Saudi Arabian researchers. The analysis of data revealed that older publications have higher citation impact as compare to documents published during the last two years.

Table-3, Publications on dentistry by Saudi Arabia by year (n=1771)

Year	Publications	Citations	Citation Impact	<i>h</i> -Index	Percentage
2009	32	669	20.91	15	1.80%
2010	66	936	14.18	18	3.72%
2011	105	1487	14.16	20	5.92%
2012	91	1397	15.35	22	5.13%
2013	118	1138	9.64	18	6.66%
2014	137	1297	9.47	18	7.73%
2015	247	1440	5.83	17	13.94%
2016	296	1134	3.83	12	16.71%
2017	306	606	1.98	9	17.27%
2018	373	216	0.58	5	21.06

WoS classified dental research into various sub-categories; Table-4 presented the list of top 10 dental subcategories with numbers of publications and citation impact. Although, Saudi researchers wrote maximum articles on sub category of Material science biomaterials, the highest citation impact (17.07) found on Engineering biomedical sub-category.

Table-4, Top 10 Subcategories of dentistry in Saudi Arabia

Subcategories of Dentistry	Publications	Citations	Citation Impact	<i>h</i> -Index
Material science biomaterials	75	818	10.91	15
Pediatrics	61	179	2.93	7
Surgery	52	358	6.88	11
Oncology	32	152	4.75	4
Engineering biomedical	30	512	17.07	13

Pathology	24	103	4.29	7
Education scientific discipline	23	163	7.09	6
Dermatology	22	23	1.05	3
Radiology, medical imaging	11	109	9.91	4
Public environment occupational health	6	30	5	3

The examination of publications by research type has been shown in Table -5 that majority of the researchers wrote their research in the shape of original research articles (n=1506; 85%), follows by the review articles (n=183; 10.33%). Surprisingly, the review articles received higher numbers of citations (7.9) as compared to original research articles (5.87).

Table-5, Distribution of publications by research type

Research-Type	Publications (n)	Citations	Citation Impact	h-Index	Percentage
Articles	1506	8840	5.87	35	85.03%
Review	183	1445	7.9	20	10.33%
Letter	34	18	0.53	2	1.91%
Meeting Abstract	18	0	0	0	1.01%
Editorial Material	12	10	0.83	1	0.67%
Correction	12	4	0.33	1	0.67%
Proceeding Papers	10	16	1.60	2	0.56%

Table-6 scrutinized the productive Saudi research organization and disclosed that almost 55% of the total dental research produced by only two universities, King Saud University and King Abdulaziz University. Only three organizations produced more than 100 publications while four organizations produced between the ranges of 50-99 publications. The research carried out in the hospitals' sector has higher citations impact (9.39) as compared to the teaching institutions (7.29).

Table-6, Productive research organizations on dentistry at Saudi Arabian

Ranks	Organization	Publications	Citations	Citations Impact	h-Index	Percentage
1	King Saud University	667	4932	7.29	32	37.66%
2	King Abdulaziz University	304	2209	7.27	24	17.61%
3	Imam Abdulrahman bin Faisal University	142	606	4.27	12	8.01%
4	Jazan University	81	161	1.99	7	4.57%
5	Taibah University	73	513	7.03	11	4.12%
6	King Khalid University	70	218	3.11	9	3.95%
7	King Saud bin Abdulaziz University for Health Sciences	50	155	3.10	7	2.82%
8	Al Farabi College	48	233	4.85	8	2.71%
9	Al Jouf University	47	138	2.94	7	2.65%
10	Prince Sattam Bin Abdulaziz	42	80	1.9	5	2.37%

	University					
11	Princes Nora University	41	58	1.41	5	2.31%
12	Riyadh Coll of Den and Phar	39	103	2.64	5	2.20%
13	King Abdulaziz Medical City	26	288	8.77	7	1.46%
14	King Faisal Specialized Hospital & Research Centre	18	169	9.39	8	1.01%
15	Riyadh Military Hospital	16	82	5.13	6	0.90%

Saudi Arabian’s authors have been actively collaborating with international organizations in dental research. The research collaboration with 12 international universities shown in Table-7, amongst these, seven universities belongs to the United States, three from Egypt and one each from England and Jordan. Alexandria University is on the top with 68 publications followed by Cario University with 65 papers. Highest citation impact (13.18) found in research collaboration with the University of Michigan and followed by the University of London with 8.66 citations per paper.

Table-7, International research collaboration organization on dentistry with Saudi Arabia

Organization	Country	Publications	Citations	Citation Impact	<i>h</i> -Index
Alexandria University	Egypt	68	478	7.03	11
Cairo University	Egypt	65	359	5.52	10
University of Rochester	USA	57	475	8.33	12
University of London	England	53	459	8.66	12
State University of New York	USA	47	371	7.89	12
University of Michigan	USA	44	580	13.18	13
Al Azhar University	Egypt	43	173	4.02	8
Harvard University	USA	41	349	8.51	10
Tufts University	USA	37	280	7.57	9
Loma Linda University	USA	33	107	3.24	7
Indiana University	USA	32	121	3.78	5
Jordan University of Science and Technology	Jordan	30	134	4.47	7

International research collaboration by country has been presented in Table-8. United States in stands on the top with 436 (24.61%) publications includes 27 *h*-index papers followed by Egypt (n=234; 13.21%), India (n=139; 7.84%) and England (n=133; 7.50%). High citation impact found in research collaboration with the researchers affiliated to Italy (13.63), Germany (10.45) and Japan (10.11). Lowest citation impact found with the researchers of India.

Table-8, International research collaboration by country

Country	Publications	Citations	Citation Impact	<i>h</i> -Index
USA	436	3393	7.78	27
Egypt	234	1337	5.87	16
India	139	342	2.46	10
England	133	1176	8.84	17
Canada	92	603	6.55	12

Germany	65	679	10.45	13
Pakistan	62	358	5.77	11
Jordan	54	354	6.65	11
Italy	51	695	13.63	13
Japan	46	465	10.11	13

Amongst the top 16 most frequently used journals by Saudi Arabian dental researchers, 10 journals published from the United States, three from England and one each from India, Saudi Arabia and Netherlands (Table-9). The Netherlands journal, Oral Oncology has the highest impact factor (4.63) and 302 (17.05%) papers published in seven journals consisted of Quartile factor Q1. Most of the papers published in the Journal of International Society of Preventive and Community Dentistry (n=88) followed by Saudi Dental Journal (n=85), both journals have no impact factor. A journal published from the United States, Clinical Oral Implants Research has the highest citation impact with 17.07 and maximum 17 h-index papers published in the Journal of Prosthetic Dentistry.

Table-9, Top 16 Journals with number of publications

Rank	Publication Title with country	Impact & Quartile Factor	Publications	Citations	Citation Impact	h-Index
1	Journal of International Society of Preventive and Community Dentistry (India)	0	88	123	1.4	5
2	Saudi Dental Journal (Saudi Arabia)	0	85	158	1.86	6
3	Journal of Prosthetic Dentistry (USA)	2.34 (Q1)	65	373	5.74	10
4	Journal of Periodontology (USA)	3.39 (Q1)	48	800	16.67	17
5	Dental Material (England)	4.03 (Q1)	47	696	14.81	15
6	Journal of Prosthodontics-Implant Esthetic and Reconstructive Dentistry (USA)	1.75 (Q2)	47	222	4.72	7
7	Journal of Endodontics (USA)	2.88 (Q1)	45	522	11.6	13
8	BMC Oral Health (England)	1.60 (Q2)	37	144	3.89	7
9	Journal of Dentistry (England)	3.77 (Q1)	35	351	10.03	11
10	Oral Oncology (Netherland)	4.63 (Q1)	32	152	4.75	4
11	Angle Orthodontist (USA)	1.59 (Q3)	31	302	9.74	11
12	Implant Dentistry (USA)	1.30 (Q3)	31	322	10.39	10
13	Clinical Oral Implants Research (USA)	4.30 (Q1)	30	512	17.07	13
14	American Journal of Orthodontics and Dentofacial Orthopedics (USA)	1.84 (Q2)	29	150	5.17	7
15	Journal of Oral Implantology (USA)	1.21 (Q4)	28	106	3.79	5
16	Journal of Investigative and Clinical Dentistry (USA)	0	27	33	1.22	3

Amongst the ten productive authors, seven belongs to King Saud University, Dr. F. Javed was found most productive with 81 publications followed by Dr. Khalid Al-Hezaimi and Dr. Vohra F. Dr. Khalid Al-Hezaimi, a prolific Saudi dental researcher’s publications have received the citation impact of 16.36, even higher than some United States researchers, who collaborated with Saudi researchers.

Table-10, Productive authors on dental research in Saudi Arabia

Researcher's Name	Affiliation	Publications	Citations	Citation Impact	<i>h</i> -Index
Javed F.	Now in USA (served King Saud University)	81	866	10.69	18
Al Hezaimi K.	King Saud University	78	1276	16.36	19
Vohra F.	King Saud University	39	264	6.77	10
Patel S.	Jazan University	33	40	1.21	3
Anil S.	Prince Sattam Bin Abdulaziz University	32	224	7.0	11
Uysal T.	Dokuz Eylul University, Izmir, Turkey	31	362	11.68	12
Wang HL	University of Michigan, USA	31	475	15.32	12
Romanos GE	Brook University USA	28	441	15.75	13
Akram Z	University of Western Australia	27	93	3.44	5
Al Amri MD	King Saud University	27	152	5.63	7
Al-Kheraif AA	King Saud University	25	193	7.72	9
Alhelal A	King Saud University	22	59	2.68	4
Abduljabbar T	King Saud University	21	70	3.33	5

The research collaboration by Saudi Arabian authors with the researchers of the University of Michigan, USA got maximum citations while by country analysis shows that research collaboration with Italy, Germany and Japan have more citations as compared to the US, Egypt and England.

Discussion

Information communication technologies brought revolution in research and scholarly publications during last the two decades. The technology contributed significantly to dental research productivity in Saudi Arabia (Haq et al. 2019). Web of Science, Scopus, Google Scholar and other databases provide citation counts of articles and journals indexed in respective databases (Adriaanse, & Rensleigh, 2013). ISI Web of Science is the main, and certainly exclusive, in providing interdisciplinary exposure and citation analysis (Martín-Martín et al. 2018). Citation analysis has been considered as an influential method of measuring the intellectual and scholarly impact and prominence of researchers, disciplines, journals, countries and regions (Borgman and Rice, 1992).

Haq et al. (2019) conducted in the quantitative evaluation of dental research output by Saudi Arabian scholars for the period of 1998 to 2017 as reflected on the Scopus database. A total of 2,477 publications were produced by Saudi researchers on dentistry. A comparison with other Arabian countries revealed that Saudi Arabia has been most productive in dental research. The findings of the report showed that there is significant growth of dental publications in Saudi Arabia. Asgary et al. (2016) carried out a bibliometric analysis of dental research produced by Iran based on PubMed results. PubMed doesn't provide the citation counts so Google Scholar and Scopus have been used for citation impact. Iran produced 3835 papers on dentistry between the years of 2008 to 2015 with an average of 256 papers per year whereas Saudi Arabia produced 1771 papers with an average of 177 papers per year. Kaur & Gupta (2010) presented the scientometric assessment of 1380 dental research papers produced by Indian authors during the period of 1999-2008 based upon the Scopus database. These papers received 1910 citation with an average of 1.38 citations per paper. As shown in Table-2, presently the Indian authors produced 5250 papers on dentistry with average of 4.24 citations per papers from the year 2009 to

2018. Although Saudi authors produced 1771 papers on dentistry during the same period, the impact of Saudi dental research has been recorded 5.83 citations per paper, which has been higher as compared to India.

The present study highlighted that research published in impact factor journal and with international collaboration got the highest number of citations. The previous study conducted by Frenken et al (2010) also assessed that collaborative research publications have positively received the high number of citations.

Conclusion

The findings of this study shed light on the citation impact of dental research in Saudi Arabia. The result portrayed that research published in high impact factor journals and research collaboration with talent-rich countries received remarkable attention. Saudi Arabia has an eminent place in Arab world and contributed a valuable addition in global dental research output. They are not only conducting and publishing plenty of research but also considering the benchmark for others. This paper also suggests that Saudi Arabian dental researchers should write more on novel and innovative ideas; and publish their research in Q1 impact factor journals. They should also create their personal research archive on Google scholar, Researchgate and other academic networking sites for better visibility and ultimately higher citation impact of their scholarly work.

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REFERENCES

- Adriaanse, L. S., & Rensleigh, C. (2013). Web of Science, Scopus and Google Scholar: A content comprehensiveness comparison. *The Electronic Library*, 31(6), 727-744.
- Asgary, S., Sabbagh, S., Shirazi, A. S., Ahmadyar, M., Shahravan, A., and Akhondi, M. S. A. (2016). PubMed-Indexed Dental Publications from Iran: A Scientometric Study. *Journal of dentistry (Tehran, Iran)*, 13(3), 157-167.
- Borgman, C. L., & Rice, R. E. (1992). The convergence of information science and communication: A bibliometric analysis. *Journal of the American Society for Information Science and Technology*, 43(6):397-411.
- Davis, P. M. (2011). Open access, readership, citations: a randomized controlled trial of scientific journal publishing. *The FASEB Journal*, 25(7), 2129-2134.
- Ellegaard, O., & Wallin, J. A. (2015). The bibliometric analysis of scholarly production: How great is the impact?. *Scientometrics*, 105(3), 1809-1831.
- Frenken, K., Ponds, R., & Van Oort, F. (2010). The citation impact of research collaboration in science-based industries: A spatial-institutional analysis. *Papers in Regional Science*, 89(2), 351-271.
- Garfield, E. (1955) Citation indexes for science: a new dimension in documentation through association of ideas. *Science* 122, 108-111.

- Haq I. H., Elahi G., & Dana I. (2019). Research Publications on Medical Microbiology in Pakistan during the period 2013-2017. *Library Philosophy and Practice (e-journal)* 2253. <https://digitalcommons.unl.edu/libphilprac/2253>
- Haq, I. U., Al Fouzan, S. K., Al Fouzan, R. K., Nadeem, M., & Latif, A. (2019). Bibliometric Appraisal on Dental Research at Kingdom of Saudi Arabia from 1998-2017. *Philosophy and Practice (e-journal)*. 2518.
- Herther, N. K. (2009). Research evaluation and citation analysis: key issues and implications. *The Electronic Library*, 27(3), 361-375.
- Hirsch, J. E. (2005). An index to quantify an individual's scientific research output. *Proceedings of the National academy of Sciences*, 102(46), 16569-16572.
- Jabeen, M. (2019). Mining Citation Patterns of LIS Scholars: An Analysis with Asian Perspective. In 2019 5th International Conference on Information Management (ICIM)(pp. 211-214). IEEE.
- Jabeen, M., Yun, L., Rafiq, M., Jabeen, M., & Tahir, M. A. (2015). Scientometric analysis of library and information science journals 2003–2012 using Web of Science. *International Information & Library Review*, 47(3-4), 71-82.
- Jamjoom, A. B. (2017). Medical speciality research in Saudi Arabia: A bibliometric assessment of productivity and worldwide ranking. *Journal of Health Specialties*, 5(1), 23-29.
- Kaur, H., & Gupta, B. (2010). Mapping of dental science research in India: a scientometric analysis of India's research output, 1999–2008. *Scientometrics*, 85(1), 361-76.
- Latif, R. (2015). Medical and biomedical research productivity from the Kingdom of Saudi Arabia (2008-2012). *Journal of family & community medicine*, 22(1), 25-30.
- Martín-Martín, A., Orduna-Malea, E., Thelwall, M., & López-Cózar, E. D. (2018). Google Scholar, Web of Science, and Scopus: A systematic comparison of citations in 252 subject categories. *Journal of Informetrics*, 12(4), 1160-1177.
- Masic I. (2017). The Most Influential Scientist in the Development of Medical informatics (17): Eugene Garfield. *Acta informatica medica : AIM : journal of the Society for Medical Informatics of Bosnia & Herzegovina : casopis Drustva za medicinsku informatiku BiH*, 25(2), 145.
- Meo, S. A. (2015). Saudi Arabia: A future regional hub for advanced education, research, science and technology. *The Journal of the Pakistan Medical Association*, 65(10), 1112-1115.
- Meo, S. A., & Jawaid, S. A. (2018). Pakistan's Performance in Global Impact Factor Race. *Pakistan journal of medical sciences*, 34(4), 777–780.
- Miri, S. M., Raoofi, A., & Heidari, Z. (2012). Citation analysis of hepatitis monthly by journal citation Report (ISI), Google Scholar, and Scopus. *Hepatitis monthly*, 12(8),e7441
- Moed, H. F. (2010). Measuring contextual citation impact of scientific journals. *Journal of informetrics*, 4(3), 265-277.
- Pavan, A. (2016). Higher education in Saudi Arabia: Rooted in heritage and values, aspiring to progress. *International Research in Higher Education*, 1(1), 91-100.

- Saudi Arabia, (2016, September), “Saudi Arabia Vision 2030” Gazette, Riyadh Tuesday, 26 April 2016. Retrieved from <https://english.alarabiya.net/en/perspective/features/2016/04/26/Full-text-of-Saudi-Arabia-s-Vision-2030.html>
- Shehatta, I., & Mahmood, K. (2016). Research collaboration in Saudi Arabia 1980–2014: Bibliometric patterns and national policy to foster research quantity and quality. *Libri*, 66(1), 13-29.
- Time Higher Education (2019, July), “World University Rankings” Retrieved from <https://www.timeshighereducation.com/world-university-rankings>
- Zaher, W. A., Meo, S. A., Almadi, M. A., & Neel, K. F. (2018). Research Productivity of Health-care Institutions of Saudi Government: Ten-year Based Bibliometric Analysis. *Journal of Nature and Science of Medicine*, 1(1), 13-16.