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Literature on Dental and Oral Health by King Saud bin Abdulaziz University for Health Science, Saudi Arabia; A Bibliometric Study

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ABSTRACT

This present paper examines the bibliometric assessment of research performance on dental science literature by researchers affiliated to King Saud bin Abdulaziz University for Health Sciences (KSAU-HS), its teaching hospitals and Research Centre, to determine the statistical scenario and highlight the emerging trends in dental research. It is a retrospective observational study that had been carried out in of College of Dentistry library, KSAU-HS during January 2018. Published research on dentistry in authorship affiliated to KSAU-HS was collected from different online sources; Web of Science, PubMed, Google Scholar, ResearchGate and the archival record of King Abdullah International Research Centre from inception of KSAU-HS to December 2017. Year-wise distribution of articles, subject-wise segregation, collaboration pattern, authorship, and most productive authors have been calculated. The data is analyzed by using Microsoft Excel 2010. The finding of the study exposed that 144 research items published in 84 different journals contributed by 586 authors with an average of 4.06 authors per article. The rising tendency in publication and collaborative research was observed, 68% articles published during 2015-2017. Original research article (72.22%) being favorite design and Public Health Dentistry (30.55%) found to be the most preferred area of research. Dr. Khalid Al Fouzan emerged as most productive author. Authorship and citations pattern had also been calculated. Assessment of dental research revealed that there has been a growing emerging trend in publications. It's the first bibliometric study on dental research in KSA, highlighted the collaboration style and pointed out the strong and weak areas of research.

Keywords: Bibliometrics; Dentistry; Saudi Arabia

INTRODUCTION

Kingdom of Saudi Arabia (KSA) the largest and oil-rich country in the Arabian Peninsula has made a remarkable development in different fields of education including medical and dental sciences during last two decades. The quantity and quality of hi-tech research centers and universities have been increased significantly. Similarly, the research productivity has also been boosted, especially in the field of medical and dental sciences. King Saud bin Abdulaziz University for Health Sciences (KSAU-HS) came into being 2005, whereas the College of Dentistry started in 2012. KSAU-HS perceives its mission to provide academic programs in an ideal academic setting to raises excellence in learning and scientific research (Haq and Al-Fouzan, 2017). The first university-based dental training started in the Arabian Gulf at King Saud University, Riyadh KSA in 1975. Now there are 29 dental institutions in KSA, providing training to the local population in the art and science of dentistry, who are providing dental care throughout the KSA and neighboring countries also. Following list of dental colleges was prepared on the bases of data retrieved from Internet (Mosa 2017).

1. Al Baha University/ College of Dentistry
2. Al Jawf University in Sakakah / College of Dentistry
3. AlFarabi College of Dentistry and Nursing
4. Batterjee Medical College/ College of Dentistry
5. Dar al-Uloom University/ College of Dentistry
6. IbnSina National College for Medical Studies/ College of Dentistry
7. King Abdulaziz University Jeddah / College of Dentistry
8. King Faisal University in Al Ahsa/ College of Dentistry
9. King Khalid University in Abha/ College of Dentistry
10. King Saud bin Abdulaziz University for Health Science/College of Dentistry
11. King Saud University/ College of Dentistry
12. Majmaah University in Zulfie / College of Dentistry
13. Najran University/ College of Dentistry
14. Prince Sattam Bin Abdulaziz University in Al Kharj / College of Dentistry
15. Princess NourabintAbdulrahman University/ College of Dentistry
16. Qassim University/ College of Dentistry
17. Riyadh Colleges of Dentistry and Pharmacy
18. Taibah University in Medina/ College of Dentistry
19. Taif University/ College of Dentistry

20. Al-Imam Abdulrahman Bin Faisal University (University of Dammam) / College of Dentistry
21. The University of Hail in Ha'il/ College of Dentistry
22. Jazan University / College of Dentistry
23. Umm Al Qura University / College of Dental Medicine

Research publications and academic communication in the form of journal literature is the noteworthy gauge to measure research growth of any country, organization and specific branch of knowledge. Journal literature provides current and up-to-date information which has been considered a backbone of the research collection and compulsory for the education, researcher, and patient care. Rattan (2014) opined that *innovative research with original findings and emerging applications of existing knowledge are published in journals*. KSA was standing on 26 positions with 29 dental sciences publications in 2005 according to the indexing of Scimago Journal and Country Ranking but reached in 11th position with 285 publications in 2016. The United States is top of the rank with 1580 publications followed by Brazil (1285), India (891) and United Kingdom (734) during 2016. The overall position of KSA in the field of dentistry based upon Scimago database is 1851 documents with 13959 citations and H-Index rank is 45 (SJR 2017).

American Journal of Dental Science was the first journal on dentistry started its publication in 1839 and following year the first dental school, the Baltimore College of Dental Surgery, was established at USA (Hook 1985). Currently 163 journals on dentistry are indexed in PubMed, out of total 5,634 journals (PubMed). Following four journals on dentistry are being published from KSA, only *The Saudi Dental Journal* is indexed in PubMed.

1. ***The Saudi Dental Journal***: started its publication from 1989 published by Saudi Dental Society <http://www.sciencedirect.com/journal/the-saudi-dental-journal>
2. ***Saudi Endodontic Journal***: started its publication from 2011, published by Saudi Endodontic Society in collaboration with MedKnow/Wolters Kluwer. <http://www.saudiendodj.com/>
3. ***The Saudi Journal of Dental Research***, previously known as King Saud University Journal of Dental Sciences started its publication from 2011 published by King Saud University in collaboration with Elsevier. <https://www.sciencedirect.com/journal/the-saudi-journal-for-dental-research> (SCImago Journal Rank (SJR): 0.178)

4. *Saudi Journal of Oral Medicine*, started its publication from 2014, published by Riyadh College of Pharmacology and Dentistry. <http://www.saudijos.org/>
5. *Journal of Orthodontic Science*. Official publication of Saudi Orthodontic Society, started its publication from January 2012. <http://www.jorthodsci.org/>
6. *Saudi Journal of Oral and Dental Research*, published by Scholars Middle East Publishers (UAE). <http://scholarsmepub.com/sjodr/>.
7. *Afaq* (Arabic journal on Dental Sciences) published by King Saud University and Saudi Dental Society. <http://afaq.ksu.edu.sa/>

Bibliometric studies have been carried out by information scientists to appraise and evaluate the research growth of the published literature for the targeted period to recognize the trends of academic community e.g. potential publications, authorship pattern, regional, national and international collaboration and other significant detail of any specific literature (Swain and Panda 2012). Bibliometric studies have been playing significant role in formulating policies and medical decision-making in relation to the advancement of research programs and allocation of resources (Jamjoom 2017). The aim of this study is to analyze the research output on dentistry by the researchers of KSAU-HS, KSA and to identify tendency in research, collaboration and authorship pattern.

MATERIALS AND METHOD

A retrospective observational study was conducted at the library of College of Dentistry, KSAU-HS during January 2018. Data was collected from various online databases; Web of Science, PubMed, Google Scholar, ResearchGate, Google Scholar Citations and archival record of King Abdullah International Medical Research Centre (KAIMRC) from inception of KSAU-HS to December 2017. Year-wise distribution of articles, subject-wise segregation, local and international collaboration pattern, authorship, and most productive authors had been calculated. All publications were manually reviewed in order to exclude false retrievals and duplication. Microsoft Excel spreadsheet had been made to organize and manage the results.

RESULTS

Total 144 publications had been collected and used for this study. Chronological distribution showed in Table-1, that before the start of College of Dentistry (COD) at KSAU-HS in 2012, eight research papers (5.55%) were being published by the researchers of KSAU-HS and Dental Services Department of King Abdulaziz Medical

City, the affiliated hospital during 2007 to 2011. After the establishment of COD, the research activities in dentistry had been increased rapidly, seven papers were published in 2012, but publications reached on fortyone (28.47%) in the year 2016. More than 68% of the publications were produced from 2015 to 2017.

Table 1: Chronological Distribution

Year	Article Published (%)
2007 -2011	8 (5.55%)
2012	7(4.86%)
2013	13 (9.02%)
2014	18 (12.50%)
2015	30 (20.83%)
2016	41(28.47%)
2017	27(18.75%)

There were six types of publications created by our researchers; Table -2 showed that the share of original research article (n=104; 72.22%) was on the top, followed by review article (n=15; 10.41%), conference abstract (n=13; 9.02%) and case report (n=8; 5.55%). Three full-text conference papers and one editorial were also on the credit of our researchers.

Table 2: Design of Publication

Type of Writing	Article Published (%)
Research Articles	104 (72.22%)
Review Article	15 (10.41%)
Conference Abstract	13 (9.02%)
Case Report	8 (5.55%)
Full-Text Conference Papers	3 (2.08%)
Editorial	1 (0.69%)
Total	144 (100%)

Publications on dentistry had been originated not only by COD researchers but also from other colleges, dental services centerthe affiliated hospital of KSAU-HS and KAIMRC. Table -3 presented the breakdown picture that most of the research (n=104; 72.22%) was

produced by the researchers of COD, KSAU-HS followed by the Dental Services Department of King Abdulaziz Medical City, Riyadh (n=15; 10.41%), College of Public Health and Health Informatics (n=8; 5.55%), College of Medicine (n=7; 4.86%) and King Abdullah International Medical Research Centre (n=5; 3.47%).

Table 3:Contribution from KSAU-HS affiliated Colleges/Hospital/KAIMRC

KSAU-HS affiliated Colleges/Hosp/KAIMRC	Number of Publications (%)
College of Dentistry	104 (72.22%)
College of Medicine	7 (4.86%)
College of Public Health and Health Informatics	8 (5.55%)
King Abdulaziz Medical City – Riyadh	15 (10.41%)
King Abdulaziz Medical City – Jaddah	4 (2.77%)
King Abdulaziz Medical City – Alhasa	1 (0.69%)
King Abdullah International Medical Research Centre	5 (3.47%)

Research items were segregated in 13 subspecialties of dentistry, Public Health Dentistry found to be the most favorite topic (n=44; 30.55%) for conducting research, followed by Endodontic (n=32; 22.22%). Some research papers were written on the subject of Orthodontic (n=9; 6.25%), Restorative Dentistry (n=9; 6.25%) and Oral Pathology (n=8; 5.55%). There is dire need to conduct more research on Periodontology, Implantology, Oral Medicine, Oral Surgery, Prosthodontics Dental Anatomy and Pedodontics.

Table 4: Subject Wise Distribution of Publications

S.No	Subject	Article Published (%)
1	Public Health Dentistry	44 (30.55%)
2	Endodontic	32 (22.22%)
3	Orthodontic	9 (6.25%)
4	Restorative Dentistry	9 (6.25%)
5	Oral Pathology	8 (5.55%)
6	Dental Education and Research	7 (4.86%)
7	Periodontology	7 (4.86%)
8	Dental Radiology	7 (4.86%)
9	Implantology	5 (3.47%)

10	Oral Medicine	5 (3.47%)
11	Oral Surgery	5 (3.47%)
12	Prosthodontics	4 (2.77%)
13	Dental Anatomy	1 (0.69%)
14	Pedodontics	1 (0.69%)

Total 144 research item on dentistry had been published in 84 different journals, the highest number of articles (n=9) published in Romanian Bi-monthly dental journal “*Oral Health and Dental Management*”, followed by *Saudi Endodontic Journal* and *The Saudi Dental Journal* eight articles each, and six articles appeared in *Journal of Endodontic*. Sixty one (42.36%) articles published in 13 (15.47 %) journals. There were 58 (69.04%) journals where one article each was published by our researchers.

Table 5: Journals with High Publication Percentage

Name of Journal	Number of Articles Published
<i>Oral Health and Dental Management</i>	9
<i>Saudi Endodontic Journal</i>	8
<i>The Saudi Dental Journal</i>	8
<i>Journal of Endodontic</i>	6
<i>International Journal of Dentistry,</i> <i>Journal of International Oral Health,</i> <i>The Journal of Contemporary Dental Practice</i>	4 articles in each Journal
<i>Australian Endodontic Journal,</i> <i>International Endodontic Journal,</i> <i>Journal of Public Health in Developing Countries,</i> <i>Oral & Maxillofacial Pathology Journal,</i> <i>Saudi Medical Journal,</i> <i>Studies in Health Technology and Informatics</i>	3 articles in each Journal

Authorship pattern was elucidated in Table – 6, that majority of research (n=119; 86.86%) was carried out in collaborative efforts; only 18 (12.50%) items were produced by pattern of single authorship, 21 (14.58%) article were reported by two authors, three authors portion consisted of 22 (15.27%), followed by four authors 28 (19.44%), which

had been preferred pattern of authorship. There had been 22 (15.32%) articles, where the numbers of author were more than six.

Table 6: Authorship Pattern

Number of Contributors	Article Published (%)
Single Author	18 (12.50%)
Two Authors	21 (14.58%)
Three Authors	22 (15.27%)
Four Authors	28 (19.44%)
Five Authors	20 (13.88%)
Six Authors	13 (9.02%)
Seven and Above authors	22 (15.27%)

It had been revealed that in 93 (64.58%) publications, the principal author belonged to KSAU-HS, whereas the principal investigators belonged to other organizations counted 51 (35.41%). In 42 publications (30.16%), all the researchers belonged to KSAU-HS, its affiliated hospital and research center, KAIMRC. Majority of research (n=102; 70.83%) was conducted in collaboration with 41 organizations of the world. Table -7 showed that 60 items were produced with 14 organizations located in KSA, among them King Saud University, KSA had been highest (n=35; 24.30%), scale followed by Riyadh College of Dentistry and Pharmacy (n=6; 4.16%). Forty two items (29.16%) were created with the collaboration of 26 international organizations belonged to 14 different countries, 5 publications with three universities of USA, and the same numbers with two universities of Canada were on the top, four articles each with Japan, India, Malaysia and Netherland, three papers with each country, Jordan and Syria, two each with the UK, UAE and Pakistan, and one article each with Sudan, Paraguay and Italy had been traced as exposed in Table - 8.

Table 7: Research Collaboration at National Level

S.No	Name of Organization	Articles
1	King Saud University	35
2	Riyadh College of Dentistry and Pharmacy	6
3	King Abdulaziz University	3
4	Saudi Endodontic Board	3

5	Al Farabi Dental College	2
6	King Faisal Specialist Hospital & Research Center	2
7	Ministry of Health	2
8	Armed Forces Hospital, Riyadh	1
9	King Fahad Medical City	1
10	King Khalid University Hospital	1
11	Prince Sattam Bin Abdulaziz University	1
12	Prince Sultan University	1
13	Princess Noura BintAbdulrahman University	1
14	Saudi Board of Pediatric Dentistry	1

Table 8: Research Collaboration at International Level

S.No	Names of Organizations	Country	Articles
1	Case Western Reserve University (02); Indiana University School of Dentistry (2); West Virginia University, Morgantown (1)	USA	05
2	University of British Columbia (3); University of Manitoba (2)	Canada	05
3	Chettinad Dental College and Research, Kanchipuram (2); Pushpagiri College of Dental Sciences (1); Sharavathi Dental College and Hospital (1); SreeChitra Tirunal Institute for Medical Sciences and Technology (1);	India	05
4	Erasmus University Rotterdam (4)	Netherland	04
5	Tokyo Medical and Dental University (3); Showa University (1)	Japan	04
6	Universiti Sains Malaysia (2); USM Health Campus, Kelantan (1); Swinburne University of Technology Sarawak Campus (1)	Malaysia	04
7	University of Al-Baath Dental School Hamah (2); University of Hama (1)	Syria	03
8	Jordan University of Science & Technology	Jordan	03
9	School of Clinical Dentistry, University of	UK	02

	Sheffield		
10	College of Medicine and Health Sciences (1); United Arab Emirates University, Al Ain, (1)	UAE	02
11	Karachi Medical and Dental College (1); Nishter Institute of Dentistry (1)	Pakistan	02
12	University of Khartoum	Sudan	01
13	National University of Asuncion	Paraguay	01
14	Siena University	Italy	01

Total 586 researchers (including multiple counts) contributed in 144 publications with the average of 4.06 authors per articles, 264 (45.05%) belongs to KSAU-HS, its affiliated hospital and research center KAIMRC, whereas 322 (54.95%) contributors were associated with organizations other than KSAU-HS. Table – 9 uncovered that Dr. Khalid Al Fouzan emerged a most productive author with 27 research items on his credit followed by Dr. Jagan Kumar Baskardoss with 16, Dr. Ahmed Jamleh with 11, Dr. Amrita Geevarghee and Azzam Al Jundi with 10 publications by each Dr. Azzam AlJundi and Dr. Nora Saleh Al Nomay.

Table9:Most Productive Researcher

Name of Researchers	Number of Publications
Khalid Al Fouzan	25
Jagan Kumar Baskaradoss	16
Ahmed Jamleh	11
Amrita Geevarghese&Azzam Al Jundi	10
Nora Saleh Al-Nomay	9
Sukumaran Anil	8
Mansour Al-Rejaie, RaveendranathRajendran, Lubna Al-Nasser, Hideaki Suda, Khalid Al Hezaimi, Anwar E. Ahmed & Ashraf El Metwally,	7 researchers with 6 publications each
Abeer A. Al Subait, Marey A. Alshehry, Abdullah M. Alzahem&HichamRiba,	4 researchers with 5 publications each
Ali Al-Ehaideb, AbdulazizAlsuwyed, ArataEbihara,	10 researchers with 4 publications each
AsirvathamAlwin Robert, Emad M Masuadi, HariPillai, Nada M. Al-Ibrahim, Sebastian G. Ciancio, Sultan A.	

Out of 144 publications, 12 conference abstracts were without any reference, whereas a number of references were not traced out in two articles. Table – 10 illustrated that total 4123 citations/references had been used in writing 130 publications with an average of 31.74 citations per articles. Preferred citation pattern was 21-30 (29.86%), followed by 11-20 (20.83%) and 21-30 (20.83%). There were only nine publications (6.25%) with more than 50 citations/references. Low score with 1-10 citation patterns was recorded in two articles (1.45%) only.

Table 10: Reference / citation pattern

Pattern of Citations/ References	Articles (%)
1-10	4 (2.77%)
11-20	28 (19.44%)
21-30	43 (29.86%)
31-40	28 (19.44%)
41-50	18 (12.50%)
51-100	8 (5.55%)
Above 100	1 (0.69%)
Without Reference, Conference Abstract	12 (8.33%)
Not Known	2 (1.38%)
Total	144 (100%)

DISCUSSION

No bibliometric study has been carried out in the field of dentistry in KSA so far. Present data on dentistry showed that 144 papers published authorship affiliated with KSAU-HS during 2007 to 2017, with the average of 13.09 papers per year. List of dental colleges located at KSA and dental journal published from KSA has also been included in this report.

Few studies on the assessment of biomedical publications from KSA had been published. Haq and Fouzan (2017) analyzed the research productivity of 775 items produced by the researchers of KSAU-HS in which only 14 articles on dentistry were identified. This research was based on the information collected from Thomson Reuters Web of Science

database. Alhaider et al. (2015) measured the pharmaceutical research publication from KSA during 2001-2010. Total 1386 research items were retrieved from the Scopus international multidisciplinary bibliographical database. The international collaboration share was n=562; 40.55%, largest number of research had been carried out with the association of Egypt (n=247; 17.82%) and USA (n=88; 6.34%). Most of the papers were written on the subject of Cancer (n=149; 10.75%), tailed by Heart Diseases, Diabetes and Respiratory Medicine. King Saud University was the most productive organization with 690 publications (49.75%), and most of the articles (n=145; 10.46%) published in *Saudi Pharmaceutical Journal*. Latif(2015) scrutinized the study on medical and biomedical research productivity from KSA during 2008-2012 based on peer-reviewed journals indexed in PubMed. There were 1562 publications the targeted period with the average of 312.4 publications per year, majority research consisted of original articles (n=1182; 75.99%), followed by case reports (n=243; 15.56%) and more than half (n=843; 54.3%) of the research had been created from Riyadh. Majority of publications (40.9%) were originated from King Saud University followed by King Abdul Aziz University (13.6%) and KSAU-HS (9.8%). It was pointed out that in spite the visible increase in research publications in KSA but It is still needed to boost the culture of conducting innovative and creative research in the country.

Ahmed (2016) examined the articles on dentistry produced in Libya during 2003 to 2013, data of 40 articles were found in PubMed database out of 358 biomedical publications. Out of these publications, 25 (62.5%) were original articles, 9 (22.5%) were case report and one was a review article. Al Arab Medical Sciences University was found to be most productive institute with 17 (42.5%) publications. Majority of research work (n=15; 37.5%) was produced in 2013. A study was conducted by Sadeghi et al. (2012) to evaluate the tendency of dental research produced in Iran over the period of 20 years (1990 to 2009). Data was taken from PubMed and Iran Medex, 671 articles were collected by authors affiliated to Iran. Most of the research (n=431; 64.23%) was published during 2007 to 2009. Dental School of Tehran University of Medical Sciences was the most productive institute. Results on dental research by Asian countries on PubMed identified that Japan was on the upper with 11587 publications followed by China 5405, Turkey 4012, India 1795, Iran 598 and KSA 533 during 1990-2009. Asgary et al. (2016) conducted scientometrics study on 3,835 articles on dentistry by Iranian authors until 31 June 2015 based on the data retrieved from PubMed. The majority of articles were produced by four-authors (24.56%), preferred areas of research were endodontic

(19.82%), orthodontics (11.13%) and oral and maxillofacial surgery (10.33%). Productive universities had also been discovered. Jain et al. (2015) assessed the 601 articles published in dentistry section of the *Journal of Clinical and Diagnostic Research* during 2007 to 2014. The growing trend of publications was observed, case report (42.06%) was popular research design tracked by research articles (21.30%) and majority of the research were carried out by multi-authors (96.3%). Tarazona (2017) evaluated that the 6088 original articles published on the subject of *Implant Dentistry* during 2009 to 2013, browsed from Thomas Reuters' Web of Science database appeared in 79 different journals. These articles were authored by 14,050 different authors, with the average of 4.66 authors per article. The University of Gothenburg, Sweden (n = 232), Sao Paulo State University, Brazil (n = 202) found to be the most productive organizations, 1418 articles (23.29%) were originated from the United States, followed by Germany, Italy, and Brazil. The highest number of articles (n=847) published in *Journal Clinical Oral Implant Research* and *International Journal of Oral and Maxillofacial Implant*. Sukotjo et al. (2010) evaluated the Dental Education Research published in two dental education journals. Total 253 articles found on subject of Dental Education Research, curriculum (24%) was the major area of research and 59% of articles followed the observational study design. Authorship pattern found 3.5 authors per article and 72% studies geographical originated from North America. Morago (2014) examined the bibliometric analysis of dental education journals, the *Journal of Dental Education Journal* and *European Journal of Dental Education* during 2007 to 2013. Analyze results and Citation Report tools Web of Science databases were used to retrieve results. Total 1279 publications were found, majority of publications (n=695; 54.3%) originated from United States followed by England (n=110; 8.6%). Article pointed out the 20 most productive organizations and 20 most cited articles. Bibliometric indicators were used to assess the published material of any journals, regions and period. Shehata and Mahmood (2016) conducted a bibliometric analysis of publications produced by the researchers of KSA during 1980-2014, data was taken from Thomson Reuters Web of Science. Out of total 88,506 papers produced by KSA 24,937 (28.17%) belonged to clinical, Pre-Clinical and Health disciplines. King Saud University created 27,302 (30.85%) publications, whereas the share of KSAU-HS was 573 (0.65%).

Literature review disclosed that a number of research methods had been used, but PubMed / Medline was used frequently. It's a freely accessible bibliographic database

created by the National Center of Biotechnology Information and National Institute of Health, USA.

CONCLUSION

Saudi Arabia has been providing a huge financial support to the education, especially at higher education levels, authorities are generous in providing support to the provision of foreign scholarship and research grant. Present finding witnessed that the number of dental colleges, research journal on dentistry and research publications have been increased during last decade in KSA. Still, concrete efforts are required to enhance the growth of publications in dentistry, through international collaboration, quality research and formulating national research policy.

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