DOI: https://doi.org/10.54393/pjhs.v4i03.586

PAKISTAN JOURNAL OF HEALTH SCIENCES

https://thejas.com.pk/index.php/pjhs

Volume 4, Issue 3 (March 2023)

Original Article

A Scientometric Analysis of Research Productivity in Surgery from Arab Countries (2001-2021)

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ARTICLE INFO

Key Words:

Surgery, Research, Arab Countries, Bibliometrics, Web of Science

How to Cite:

Imran, M., & Malik , A. A. (2023). A Scientometric Analysis of Research Productivity in Surgery from Arab countries (2001-2021): Research Productivity in Surgery from Arab countries. Pakistan Journal of Health Sciences, 4(03). https://doi.org/10.54393/pjhs.v4i03.586

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Received Date: 14th February, 2023

Acceptance Date: 16th March, 2023

Published Date: 31st March, 2023

ABSTRACT

Several surgical procedures are being performed on daily basis globally along with continuously expanding research in all surgery fields. **Objective:** To assess the surgery related research trends and performance in Arab countries using bibliometric indicators. **Methods:** In this descriptive bibliometric study, data were extracted from the Web of Science (WoS). All surgery related English language articles, from 2001 to 2021 from Arab countries were analyzed in R-Bibliometric package. **Results:** There were 10,269 articles in English language, with 158 authors' countries. There was increase in publications each year with escalating trend from 2017 onwards. Al-Qattan MM was the leading author with >200 publications and >2000 total citations (TC), while the highest h-index was demonstrated by Alio 25. Egypt, USA and Saudi Arabia were leading in production and TC. Cairo University (Egypt) and King Saud University (Saudi Arabia) were the leading affiliations. International Journal of Surgery Case Reports was the leading source. Case report, bariatric surgery, surgery, laparoscopy and sleeve gastrectomy were the most frequently used keywords. **Conclusions:** This study showed increasing publications over time with more productivity since 2017. The magnitude and increasing trend of obesity and bariatric surgery-research was observed. Egypt and Saudi Arabia were leading contributors, which signifies the need of more efforts from other Arab countries. More collaboration among Arab researchers, increase in funding sources, efforts toward high impact research in the field of surgery, and support for less resourceful countries are warranted in future.

INTRODUCTION

Surgical interventions and procedures are part of human history, and some procedures can be traced back to twelve thousand years [1]. With better anesthesia and surgery techniques, number of surgical procedures has increased significantly. In 2004, it was estimated that more than two hundred and thirty million surgeries were performed worldwide, and the number was increased to approximately three hundred and ten million in 2012 [2, 3]. Several surgical procedures are being performed on daily basis globally. It is not surprising that research is also evolving in surgical fields. Research is expanding in all surgery fields. A lot of surgical procedures are being performed in Arab countries. For example, more than 3.86 million surgeries were performed in Saudi Arabia from 2016-2019 [4]. Disease burden is also increasing in Arab population. A study shows high burden of thyroid diseases in the Arab world [5]. Similarly, number of surgeries in Saudi Arabia has increased substantially [6]. In an alarming study, it is predicted that there will be four-to-fivefold increase in cancer diseases and cancer-related deaths in the Gulf Cooperation (GCC) Countries by the year 2040 [7]. The incidence of obesity and prostate cancer is also increasing in these countries [8, 9]. Disease burden of vision loss is also substantial [10]. It can be assumed that disease load is high in Arab countries, and so the need of surgery to manage those diseases. With this increase in number of surgeries, it is predicted that research production would be boosted as well. Research is an integral component in the

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knowledge-based economy of GCC countries, and it is included in the Saudi Vision 2030 as well [11, 12]. Although, many research publications can be found in literature from Arab countries, but it would be worth noting whether the contribution is significant. Consequently, we cannot appreciate whether surgery research is strategically targeting areas where research need is the greatest in the Arab countries to improve health care outcomes in society. To the best of our knowledge, no study in the literature seems to have investigated about surgery publications holistically from Arab countries. The objective of this study was to provide the first bibliometric analysis of surgery research generated by Arab countries. Specifically, the study aimed to identify trends and performance in surgery publications, country-specific and author-specific contributions, the degree of national and international collaboration, the major areas of research focus and highly cited research work.

METHODS

It was a descriptive bibliometric study. The study explored all the published documents from 2001 to 2021 on surgery research in Arab countries. The database was accessed through the electronic library portal of King AbdulAziz University (KAU). On November 4th, 2022, an online search of the Web of Science (WoS) database, hosted by Clarivate Analytics, was conducted as described in previous studies [13, 15]. The WoS database is of the leading and reliable sources of scientific literature [16, 17]. From the Web of Science Categories, 'Surgery' was selected as it includes the documents related to our study scope only. Institutional review board approval was not required given the publicly available nature of the data without protected health information. The twenty-two countries of the Arab League were included in the study. The countries, already mentioned in the literature [18, 19], are: Algeria, Bahrain, Comoros, Djibouti, Egypt, Iraq, Jordan, Kingdom of Saudi Arabia (KSA), Kuwait, Lebanon, Libya, Mauritania, Morocco, Oman, Palestine, Qatar, Somalia, Sudan, Syria, Tunisia, United Arab Emirates (UAE), and Yemen. Two researchers (MI and AAM) independently searched and extracted articles to verify the process on the same day (November 4th, 2022). The Boolean search query method was exercised. The searching key terms comprised a wide range of key terms and included Keywords. The key data features that were extracted included: study title, author(s) name(s), key words, institution, publication year, journal name, and country. All data, including the number of publications, number of citations, and other aspects, were based on the Web of Science Core Collection (WoSCC) database. R-Bibliometric package, a comprehensive and widely used tool [20], was utilized. The documents related to Dentistry, Oral Surgery and Medicine were also excluded. The search strategy used was: WC = (Surgery NOT Dentistry, Oral Surgery & Medicine) AND CU= (Algeria or Bahrain or Comoros or Djibouti or Egypt or Iraq or Jordan or Kuwait or Lebanon or Libya or Mauritania or Morocco or Oman Or Palestine or Qatar or Saudi Arabia or Somalia or Sudan or Syria or Tunisia or United Arab Emirates or Yemen) and English (Languages) and Article (Document Types). The bibliometric flowchart is shown in figure 1.

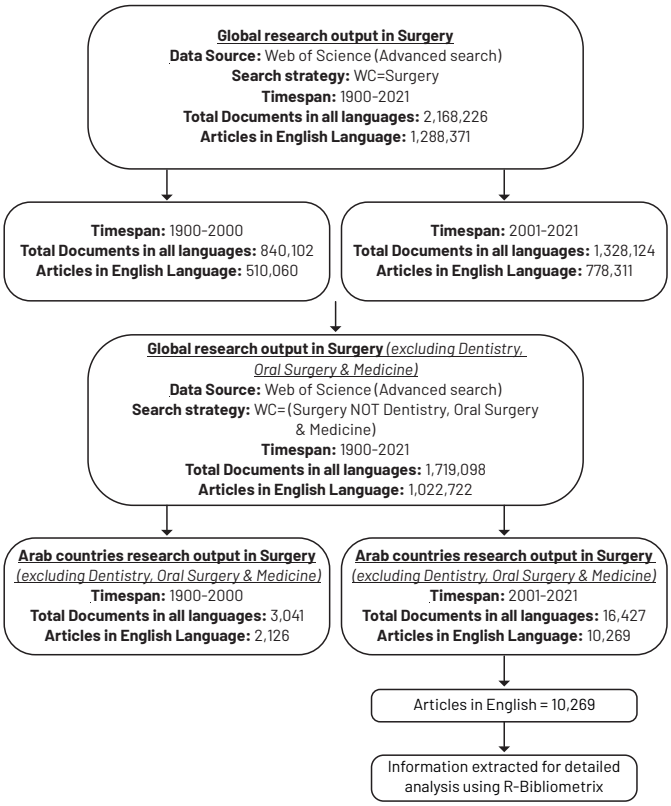

Figure 1: Bibliometric flowchart

RESULTS

The total number of documents indexed in WoS, with surgery as web of science category (excluding Dentistry, Oral Surgery & Medicine), from 2001 to 2021 were 1,090,816 from 476 sources and > 206 countries, with USA, England, Japan, German and China contributing around 60.6%, 34.6%, 7.9%, 6.9%, 6.3% & 4.9% respectively, while top 10 countries collectively contributed for > 2/3rd. Documents were found to be related to 42 research areas and 52 WoS categories (other than surgery) led by Transplantation (13.7%), Clinical Neurology (11.8%), Cardiac Cardiovascular Systems (9.1%) and Orthopedics (8.3%). Articles (58%) were found to be the leading document type (n=632,800) followed by meeting abstracts (17.2%). Reviews articles were around 4.8%. The total number of authors' appearances was > 100,000. Around 256,062 (23.5%) documents were in the open access category and 13.8 %

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showed any funding source. Arab countries contribution was 16,427 documents, representing around 1.5% of the global productivity. Among them, Egypt (n=5649), KSA (n=3812), Lebanon (n=1,345), U Arab Emirates (n=1310) and Morocco (1,007) were leading from the region with global ranking (%) at 28th (0.51%), 35th (0.35%), 48th (0.12%), 49th (0.12%) and 54th (0.09%) respectively. Articles represented 65.1% (10,691) followed by meeting abstracts 2,440 (14.8%) and review papers 1,293 (7.9%). The results, including documents with English language, are summarized in table 1.

Description	2001-2021
Documents	10269
Annual growth rate (%)	10.65%
Open access	3136
Sources (Journals, Books, etc.)	302
Average years from publication	6.98
Average citations per documents	10.04
Average citations per year per doc	1.166
References.	199356
Document Contents	
Keywords Plus (ID)	14342
Author's Keywords (DE)	17881
Authors	43731
Author Appearances	74141
Authors of single-authored documents	515
Authors of multi-authored documents	43216
Authors Collaboration	
Single-authored documents	850
Documents per Author	0.235
Authors per Document	4.26
Co-Authors per Documents	7.22
Authors' countries	158
Group Authors	121
Collaboration Index	4.59
Other Information	
Research Areas	32
Web of Science categories	36
Affiliations	7967
Funding Sources	1259
Document Types	
Article	32
Article; early access	36
Article; proceedings paper	7967
Article; proceedings paper; retracted publication	1259
Article; retracted publication	

Table 1: Summary table (2001-2021)

Figure 2 shows the rising publication trend which significantly increased from 2017 onwards with a maximum production in the year 2021. Mean total citation (TC) was higher in the first decade, with a maximum number in 2002 (figure 2).

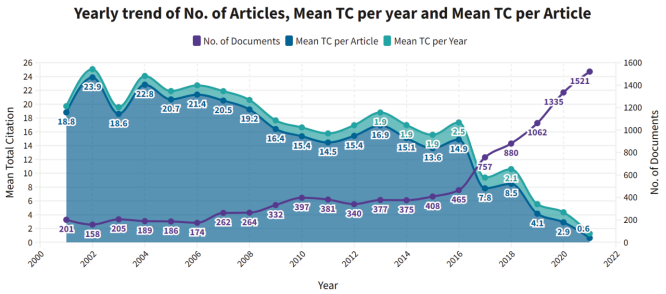

Figure 2: Yearly trend of no. of articles, mean total citation (TC) per article and mean total citation per year (2001-2021)

Table 2 shows the top twenty most productive authors along with their impact. Al-Qattan MM was leading in the number of publications (>200), total citations (TC) (>2000), first and corresponding authorship. The highest h-index was displayed by Alio JL (25) followed by Al-Qattan MM (23).

Authors	*PY start	No. of Documents	% as *FA	% as *CA	*AF	h-index	*TC
Al-Qattan MM	2001	206	86.9%	97.1%	140.22	23	2022
Abu-Zidan FM	2001	65	26.2%	66.2%	16.64	17	856
El Nakeeb A	2009	52	36.5%	69.2%	7.35	19	1019
Emile SH	2006	52	40.4%	76.9%	10.21	11	333
Shafik A	2001	48	95.8%	95.8%	13.57	11	422
Alio JL	2014	44	63.6%	88.6%	10.38	25	1739
El-Menyar A	2014	41	22.0%	65.9%	5.7	11	343
Farid M	2007	40	17.5%	0.0%	6.89	15	723
Al-Thani H	2010	39	15.4%	5.1%	5.51	11	335
Shafik AA	2002	38	10.5%	10.5%	9.88	13	260
Nampoory MRN	2002	37	8.1%	2.7%	4.67	11	305
Youssef M	2001	37	8.1%	2.7%	5.17	14	717
Ibrahim M	2014	35	22.9%	25.7%	8.04	11	343
Omar W	2003	33	9.1%	6.1%	5.83	13	440
Salah T	2015	33	3.0%	0.0%	3.62	11	451
Wahab MA	2008	33	54.5%	30.3%	3.97	10	342
Al-Mousawi M	2010	32	9.4%	9.4%	4.86	11	300
Morris DL	2008	32	0.0%	75.0%	5.68	10	268
Samhan M	2010	31	22.6%	22.6%	5.01	12	319
Ansaloni L	2001	30	0.0%	0.0%	0.61	17	1046

*:PY - Publication year, FA - First author, CA - Corresponding author, AF - Articles Fractionalized, TC – Total citations

Table 2: Top 20 most productive Authors and their impact (2001-2021)

Table 3 shows that Egypt was leading with the highest productivity (n=6548) followed by USA (n=4330) and Saudi Arabia (n=4287). Regarding TC, again Egypt, Saudi Arabia and USA were prominent with the number of citations 22504, 14060, and 13691 respectively. Overall, Egypt showed highest MCP (n=383) followed by Saudi Arabia (n=315).

DOI: https://doi.org/10.54393/pjhs.v4i03.586

Country	Articles	CA	Percentage Contribution	SCP	MCP	MCP Ratio	*TC
Egypt	6548	2811	27.5%	2428	383	0.136	22504
USA	4330	886	8.7%	21	865	0.976	13691
Saudi Arabia	4287	1562	15.3%	1247	315	0.202	14060
United Kingdom	1845	252	2.5%	12	240	0.952	5940
Canada	1399	274	2.7%	3	271	0.989	4663
Lebanon	1396	437	4.3%	319	118	0.270	3618
Italy	1243	122	1.2%	1	121	0.992	1592
France	1239	290	2.8%	83	207	0.714	3443
Tunisia	956	428	4.2%	400	28	0.065	3627
Morocco	930	414	4.1%	389	25	0.060	1971
Jordan	786	298	2.9%	231	67	0.225	2305
Germany	748	173	1.7%	5	168	0.971	2479
Spain	699	102	1.0%	0	102	1.000	2663
Qatar	618	187	1.8%	112	75	0.401	1300
Kuwait	610	271	2.7%	214	57	0.210	3422
Iraq	565	228	2.2%	199	29	0.127	1291
Australia	530	79	0.8%	1	78	0.987	1247
China	415	71	0.7%	1	70	0.986	530
Japan	391	126	1.2%	0	126	1.000	1627
India	349	50	0.5%	5	45	0.900	290

CA - Corresponding author, SCP: Single or Intra-country publication, MCP: Multiple or Inter-country publications, TC – Total citations

Table 3: Top 20 countries with articles and corresponding authors

Cairo University (Egypt) and King Saud University (Saudi Arabia) were the leading universities regarding affiliations, while United States Department of Health Human Services, National Institutes of Health (NIH) USA, and King Saud University, Saudi Arabia were the top funding organizations. Details of the top 10 most frequent affiliations and funding organizations are shown in table 4.

Top 10 most frequent Affiliations	Articles
Cairo Univ	1129
King Saud Univ	882
Ain Shams Univ	659
Mansoura Univ	603
Amer Univ Beirut	553
King Faisal Specialist Hosp and Res Ctr	424
Univ Alexandria	326
Zagazig Univ	316
Alexandria Univ	238
Univ Toronto	238
Top 10 most frequent funding Organizations	**Articles**
United States Department of Health Human Services	1129
National Institutes of Health NIH USA	882
King Saud University	659
NIH National Cancer Institute NCI	603
European Commission	553
UK Research Innovation UKRI	424
National Institute for Health Research NIHR	326
Medical Research Council UK MRC	316
Qatar National Library	238
Canadian Institutes of Health Research CIHR	238

Table 4: Top 10 most frequent affiliations and funding sources

Figure 3 shows the year-wise growth of the ten most productive sources (journals) over the span of last two decades. International Journal of Surgery Case Reports, Egyptian Journal of Surgery, and Transplantation Proceedings were the leading sources with 669, 476, and 375 articles respectively. Case report (n=293), bariatric surgery (n=204) surgery (n=203), laparoscopy (n=196), and sleeve gastrectomy (n=164) were the most frequently used keywords. Besides, children, obesity, and complications were used >100 times.

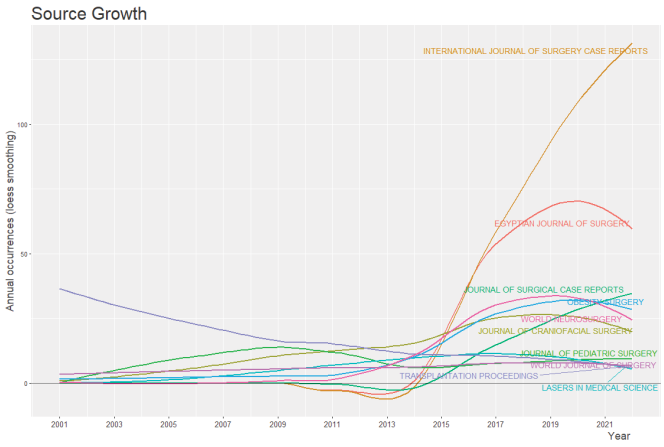

Figure 3: Year-wise growth of 10 most productive sources

Figure 4 shows the conceptual structure word map of twenty most frequent key words with two possible clusters, using the multiple correspondence analysis (MCA). The left (red) cluster is a combination of 15 key words related to different types of surgery and research category. On the other hand, right (blue) cluster manifests 5 key words related to obesity and related procedures.

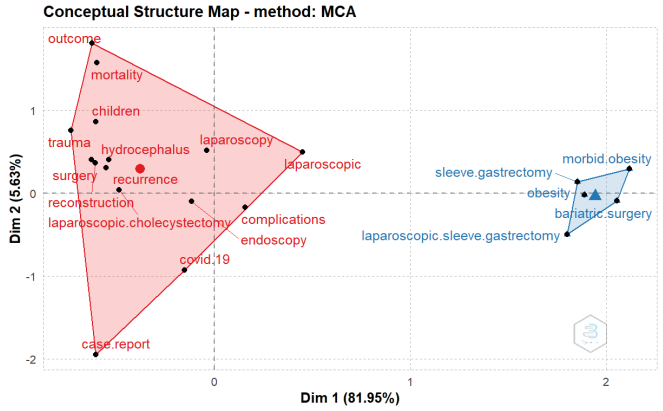

Figure 4: Conceptual structure word map of key words with multiple correspondence analysis

Table 5 summarizes the top 10 highly cited documents. Agha RA was the leading contributor, with three highly cited documents, followed by Noun R, Gagner M, and Hamza AF. International journal of Surgery was the leading journal. Study types were mixed, including guidelines, observational studies, randomized controlled trial,

DOI: https://doi.org/10.54393/pjhs.v4i03.586

retrospective review, and case series.

Title	First Author	Study Type	Source	IF/ JIF Quartile	Year	IC	GC
The SCARE 2018 statement: Updating consensus Surgical Case Report (SCARE) guidelines	Riaz A Agha	Guidelines	International Journal of Surgery	13.4/ Q1	2018	328	2327
The SCARE 2020 Guideline: Updating Consensus Surgical Case Report (SCARE) Guidelines	Riaz A Agha	Guidelines	International Journal of Surgery	13.4/ Q1	2020	107	875
The SCARE Statement: Consensus-based surgical case report guidelines	Riaz A Agha	Guidelines	International Journal of Surgery	13.4/ Q1	2016	103	1273
One thousand consecutive mini-gastric bypass: short- and long-term outcome	Roger Noun	Observational	Obesity Surgery	3.479/ Q2	2012	25	161
Survey on laparoscopic sleeve gastrectomy (LSG) at the Fourth International Consensus Summit on Sleeve Gastrectomy	Michel Gagner	Survey	Obesity Surgery	3.479/ Q2	2013	16	201
Caustic esophageal strictures in children: 30 years' experience	Alaa F Hamza	Observational	Journal of Pediatric Surgery	2.549/Q2	2003	14	103
Laparoscopic hernia repair in infancy and childhood: evaluation of 2 different techniques	Rafik Shalaby	Randomized controlled	Journal of Pediatric Surgery	2.549/Q2	2010	14	47
Phalangeal neck fractures in children: classification and outcome in 66 cases	M M Al-Qattan	Case series	Journal of Pediatric Surgery	2.206/Q3	2001	13	56
Laparoscopic sleeve gastrectomy in 108 obese children and adolescents aged 5 to 21 years	Aayed R Alqahtani	Retrospective review	Annals of Surgery	13.787/Q1	2012	13	116
Neurosurgical virtual reality simulation metrics to assess psychomotor skills during brain tumor resection	Hamed Azarnoush	Pilot study of innovative metrics	International Journal of Computer Assisted Radiology and Surgery	3.421/Q2	2015	13	49

IF - Impact Factor, IC - Internal Citation (Citations within study selected documents), GC - Global Citation (Citation in Web of Science)
Table 5: Top 10 highly cited documents

DISCUSSION

Overall, 22 Arab countries had <2 % research output comparing to global research production. The USA, England, Japan, German, and China were main contributors. Other studies, also, supports our findings of such predominance. In a recent analysis, it is shown that around 30% of publications on spinal stenosis are contributed by the U.S.A. [21]. In one bibliometric analysis of head and neck surgeries, the publications from Arab world were negligible [22]. However, in the region, a substantial increase can be observed during last two decades. Articles were the major type of publication among Arab countries. Egypt was leading in the number the publications, followed by KSA, Lebanon and U Arab Emirates. This shows the trend of research productivity. Our findings are consistent with a bibliometric study on research production in Arab countries, in which overall research productivity was analyzed, and Egypt and Saudi Arabia were leading [23]. Last five year were quite significant in surgery-related research production, and a gradual increase is encouraging. It was observed that, overall research growth rate in Saudi Arabia alone was 17.7%. Collaborative work of Egypt and Saudi Arabia is also worth mentioning [24]. In GCC countries, Saudi Arabia has the highest number of publications related to road traffic accidents. Again, collaborative work of Saudi Arabia with USA and Egypt was observed [25]. It is a noteworthy that publications from the resource-limited Arab counties are less – the issue which need global attention. Among countries, Egypt and Saudi Arabia, from the Arab region, are leading in most of the parameters, including the number of articles, CA, percentage contribution, SCP, MCP, and TC. Interestingly, USA is leading in many aspects. Number of articles, MCP and MCP ratio are more significant, showing collaboration at country level. Our study is aligned with the literature that USA is leading in many areas of research. For instance, USA is leading in surgery-related research topics, such as urology, robotic surgery, and pancreaticoduodenectomy, among many other areas [26-28]. It is worth mentioning that, though, majority of articles from Arab countries are contributed as single or intra-country publications and MCP ratio of Arab countries is relatively quite low – the area to be focused for future work. Among top funding organizations, only two were from Arab countries - one from Saudi Arabia and the other from Qatar; all others were from USA, Canada, and European countries. It has been argued that funding and international collaboration have a key position in scientific research [29]. More efforts are needed by Arab countries in this context, especially the low-income countries. When Journal Impact Factor (JIF) Quartile among top ten productive sources was searched, four journals fall in Q2, one in Q3, two in Q4, while three in Emerging Sources Citation Index (ESCI). Among four journals with more than 300 published articles, International Journal of Surgery Case Reports had a sudden peak during last seven years. Egyptian Journal of Surgery also shows same trend, but

DOI: https://doi.org/10.54393/pjhs.v4i03.586

there is a plateau during the last two years and then a gradual fall can be observed. On the other hand, Transplantation Proceedings was on top during first decade, and a gradual decrease can be observed. Journal of Craniofacial Surgery also contributed more during the last decade. Obesity Surgery and World Neurosurgery, with >250 articles, are also trendy. Journal Of Surgical Case Reports, with >150 articles, is gaining prominence among research from Arab region, especially from 2015 onward. Keywords and top ten productive sources interrelate the observations of research trend in Arab region. For most frequent keywords, case report is at the top, which may suggest more articles were published as case reports. One interesting observation is the use of bariatric surgery, sleeve gastrectomy and obesity under the most frequent keywords. The keyword – children is also prominent, indicating that research related to pediatric surgery is gaining consideration. The importance of research in this area is also exhibited by a cluster in the conceptual structure map. This signifies the magnitude of research work on obesity and bariatric surgery in the Arab world. There is a strong correlation with obesity-related and bariatric surgery publications globally. A study shows a high flow of research in this area even two decades ago [30]. In a relatively recent bibliometric analysis by Paolino *et al.*, similar results, with increasing publication trends were observed [31]. While analyzing top ten highly cited articles, it can be observed that various study types are included; however, guidelines are leading. It is worth noting that, mostly, the highly cited articles were published in Q1 and Q2 journals. The highly cited documents, in our study, are published in journals which mostly have open access (OA). It has been investigated that OA journals, with and without article processing charges, have a positive correlation with journal impact factors and h-indexes [32]. So, when we compare ten most productive sources and ten highly cited documents, it can be suggested that researchers, from Arab region, should also be encouraged to publish their research in Q1 and Q2 journals. Our findings corelate with other studies. A study, focuses on orthopedic journals, finds paucity of publication from Arab countries in Q1 journals [33]. Another study by Baeesa *et al.*, recommends higher quality spine surgery research papers from Arab countries [34]. In some Arab countries, quantity and quality of breast cancer research is low [35]. It is suggested, in a study by Almarghoub and Al-Qattan, that plastic surgery publications, though growing in number in Arab countries, but mostly are of low-quality research [36]. In ophthalmology, there is a relatively low productivity [37].

CONCLUSIONS

This study showed that the number of publications has increased over time with more publications since 2017. The magnitude and increasing trend of obesity and bariatric surgery-research in the region. Top ten highly cited documents show mostly guidelines and observational study, though other types are also included. Egypt and Saudi Arabia are leading in publications, which signifies the need of more efforts from other Arab countries. Study findings are of value for surgeons, doctors, and researchers to explore insights into research trends in the field of surgery in Arab countries.

Conflicts of Interest

The authors declare no conflict of interest.

Source of Funding

The authors received no financial support for the research, authorship and/or publication of this article.

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