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Bibliometric analysis of the literature on Ramadan fasting and diabetes in the past three decades (1989–2018)

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ABSTRACT

Objectives: To quantify the research contribution related to Ramadan fasting and diabetes.
Methods: We searched for the combination of "Ramadan" and Diabetes" in the title, abstract and keywords in the Scopus database between 1989 and 2018. Articles were analysed for standard bibliometric methodology and VOSviewer was used to construct bibliometric diagrams.
Results: The total number of retrieved articles was 424 articles; 112 were "Open Access". Two-thirds of articles covered original research. Articles were published in medical journals of varying influence. UK-based authors and affiliated institutions were dominant. A single author has an evident dedication to Ramadan research whereas for many authors it Ramadan research was just one aspect of their academic interest. The number publications and the extent of international collaborations were lower than expected, given the world-wide practice of Ramadan fasting by many populations with an increased prevalence of diabetes. The need to share experiences and generalizable conclusions.
Conclusions: This is the first bibliometric study on diabetes in Ramadan. It is a good starting point to evaluate gaps in research activity in the field and should help identify future research directions and foster more collaboration.

1. Introduction

The daytime fasting during the month of Ramadan is a fundamental article of faith in Islam [1]. People with serious medical conditions, including many with diabetes are exempted. However, a substantial number of patients may wish to participate, even against medical advice [2,3]. The medical profession has recently shown increased interest in the health aspects of Ramadan in general [4,5] and in the impact of fasting on diabetes in particular [6,7]. A focus on diabetes is evidently supported with the recently achieved greater harmony and more mutual understanding between doctors and religious scholars [8]. Potential risks for those with diabetes who wish to observe the fast have been described and led to clear risk stratification criteria [9–13]. However, concerns have been raised about the

consensus-type rather than evidence-based approaches [14,15].

Clinical management guidelines of Type 1 and Type 2 diabetes during Ramadan have been developed based on expert opinion and some observational and experimental studies. The key areas covered include epidemiology, the physiology of fasting, risk stratification, nutrition advice and medication adjustment [9–13].

Knowledge of the academics and clinicians who share an interest in this area clinical practice and research, their academic affiliations and their expertise and available resources may help foster more collaborations with more confidence and trust [16,17]. The bibliometric methods have been used in many disciplines of sciences to investigate the scientific production and research trends on a given theme, populations, or region [18–20]. There are many examples of such studies that helped shed light on issues related to specific ethnic groups, socioeconomic conditions, personal behaviours, or professional practices [21–23]. To the best of our knowledge, there has not been any quantification of the global research production about the impact of Ramadan fasting on diabetes. We have, therefore, wished to give a bibliometric overview of the literature on the interplay between Ramadan fasting and diabetes. Such a study should assess the volume of work and the extent of interaction of various international critical players in the field Ramadan-related aspects of diabetes care.

2. Materials and methods

2.1. Objectives

To explore the interplay between Ramadan fasting and diabetes through a bibliometric analysis. The principal objectives were to quantify the research contribution related to Ramadan fasting and diabetes at the global level as well as to determine its relative growth rate, collaborative measures are taken, productivity at the institutional level and the most prolific journals publishing on the topic.

2.2. Design

Data were obtained from the Scopus database between 1989 and 2018. Research tendency was investigated by analysing the distribution of languages, countries, journals, author, keywords, authorship pattern, and co-authorship relations. Scientific output was assessed based on a methodology used in several previously published theme-based bibliometric studies [20–22].

2.3. Search strategy

The term "Ramadan" used in the search is universally accepted. No additional records were detected by ad the phrases of "Ramadan fasting" or "fasting of Ramadan". Also, using the term of Ramzan, commonly used in some Asian regions did not add any records. Exclusion of the authors' names prevented the possible false positive retrieval of records with "Ramadan" an author name. The scope of the

research went from as far back as January 1st 1989 through to December 31st 2018 reflecting most of the published work. Earlier records were examined individually for a commentary for historical interest. Documents that were published as errata were excluded.

2.4. Bibliometric and citation analysis:

The collected data were used to create the following measurements: growth rate collaborative measures productivity at the institutional level the most productive authors the most prolific countries with citation patterns and the most prolific journals. All of these measurements were ranked according to the order that is now popularly called standard competition ranking (SCR) as in similar bibliometric studies. The quality of publications related to Ramadan fasting was measured using the h-index which was established by Jorge Hirsch in 2005 where index h is defined as the number of papers with a citation number more than or equal to h [23]. Furthermore, the quality of the journals was assessed by two indicators: the impact factor (IF) using the Journal Citation Report (JCR; Web of Knowledge) 2017or 2018 and the SCImago Journal Rank (SJR) (https://www.scimagojr.com/journalrank.php).

2.5. Data management and statistical analysis

The online Scopus tools were used for making the various calculations. Besides, data were entered in a Microsoft Excel sheet for data management and analyses. VOSviewer for Mac OS, version 1.6.10 (Centre for Science and Technology Studies, Leiden University, The Netherlands) was used to construct commonly used bibliometric diagrams [24]. Data are presented as absolute (numbers) or relative (percentages) frequencies or mean ± SD.

3. Results

A total of 424 publications on 'Ramadan fasting and diabetes", published between 1989 and 2018 by 1447 authors were retrieved from the Scopus online database. Fig. 1 indicates that the number of articles increased steadily during the 30 years with 315 (74.3%) articles published in the last ten years. The numbers of retrieved records per year using the search terms "Ramadan and Diabetes" in Scopus and PubMed databases were compared (Fig. 1). A general homology was evident between the two databases with a marginally greater number of records from Scopus. The annual rates of published articles and their citation analyses over the past 20 years in reverse chronological order. The high citations followed the publication of the landmark EPIDIAR study and the two expert opinion statements which were published in an international diabetes journal (Diabetes Care) with a high reputation. The citations were independent of the total number of publications in the same year. As times goes by, increasing of the publications get recognised and cited. Predictably, there was no direct relationship between the numbers of article and citation by year (Table 1).

The distribution of article types and top 10 languages are shown in Table 2. All types of articles were entered into the
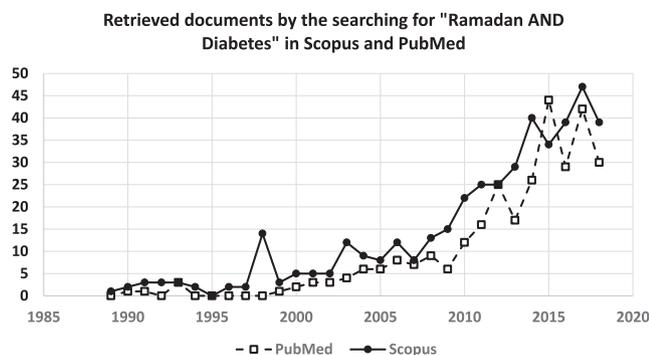
Retrieved documents by the searching for "Ramadan AND Diabetes" in Scopus and PubMed

Fig. 1 – The numbers of retrieved records per year using the search terms "Ramadan and Diabetes" in Scopus and PubMed databases. A general homology is observed between the two databases with marginally greater number of results from Scopus. The differences in 1995 and 2015 is caused by differences in database coverage of special supplements on "Ramadan and Diabetes" by Practical Diabetes International and Journal of Pakistan Medical Association respectively.

analysis. Of them, 67.0% were original articles and 15.1% were review articles. As expected, the majority of the articles were written in English (89.4%) followed by French (5.7%). Subject areas were dominated by medicine (379) followed in decreasing order by biochemistry, genetics and molecular biology (92), nursing (52), pharmacology, toxicology and pharmaceutics (40), and health professions (16). The top 5 subject areas of the publications were overwhelmingly medicine (285), followed by biochemistry, genetics and molecular biology (64), nursing (39), pharmacology, toxicology and pharmaceutics (31), health professions (15) and social sciences (10). The top 10 keywords used by authors were fairly generic including human (369), dietary restriction (336) fasting (277), Islam (231), article (225), female (220), humans (219), male (214, religion (202) and adult (194).

The top 15 most cited articles on diabetes and Ramadan fasting over the past three decades including the type of article, journal, country of origin, access type and the number of citations are shown in Table 3. The highest 3 number of citations were for the EPIDIAR study and the two consensus state-

ments. However, on an individual basis, a single author (MM Hassanein) co-authored the highest number of articles on the topic of the study (19 articles) followed by Abdul Basit (9 articles). Seven authors published 7–8 article and eight authors published six articles (Table 4). Furthermore, 12, 14, 42 and 62 authors published 5, 4, 3 and two articles respectively. The remaining authors contributed to a single article. Fig. 2A demonstrates the co-authorship network of the most prolific authors. Five clusters could be identified (clusters located close to each other in the figure indicate related topics). Overlay of the time scale (possible for 2008–2016 only) on the clusters provide information on the time of publications. Analysis of the clusters suggest that the number of publications and the extent of international collaborations is lower than expected with most of the clusters are locally based (Fig. 2A). Furthermore, the focus of the research workers on Ramadan is reflected in the percentage of Ramadan work to their total scholarly contributions (Table 4).

Authors from a total of 60 countries or regions contributed to the published articles. The United Kingdom had the most published articles and consequently the largest number of citations, followed by the Saudi Arabia in the second position, almost equal contribution from the United Arab Emirates, Pakistan and USA, followed by India, Egypt, Malaysia, Qatar and Kuwait (Table 5). Majority of the articles (80.0–91.7%) from all countries were cited at least once. However, the citation to article ratio varied between 13.4 and 26.2.

Institution-wise analysis revealed that the Imperial College London and associated institutions jointly with Hamad Medical Corporation of Qatar were the two leading institutions/organisations. They were followed closely by Baqai Medical University and Dubai hospital (Table 6). International collaboration was observed in less than one-third of publications. Table 7 detail the top fifteen journals publishing on diabetes and Ramadan fasting over the last three decades, the frequency of the article, citations and average citation/article ratios together with the SJR and h-index are detailed. Although Practical Diabetes International had the highest number of articles [18], Diabetes Care had the highest number of citations (758) compatible with its high SJR and h-index (Table 7).

The top ten pharmaceutical funders were Novo Nordisk (8), AstraZeneca (7), Merck (7), Novartis (7), Eli Lilly and

Table 1 – Types of retrieved documents and their primary languages on Ramadan fasting over thirty years (1989 and 2018).

Type of document*			Primary language**		
Type	Number	Percentage	Language	Number	Percentage
Article	284	67.0%	English	379	89.4%
Review	64	15.1%	French	24	5.7%
Letter	33	7.8%	German	7	1.7%
Conference paper	15	3.5%	Dutch	6	1.4%
Short survey	14	3.3%	Persian	3	0.7%
Note	13	3.1%	Hebrew, Turkish, Spanish	6 (2 each)	1.4%
Editorial	9	2.1%			
Articles in press	5	1.2%	Arabic, Catalan, Danish, Italian, Polish	5 (1 each)	1.2%
Book chapter	3	0.7%			

* Errata were not included.
** Some articles are published in two languages; hence the total is 430. But translations of abstracts to other languages were not considered.

Year	Articles per year		Citations	C/A	Articles with citations [N (%)]	
	Number	Percentage			Yes	No
Table 2 – Annual number of published articles and citations analysis over the years 1999-2018[*] in reverse chronological order.						
2018	39	9.2%	15[**]	0.4[**]	11 (28.2%)[**]	28 (71.8%)
2017	47	11.1%	178	3.8	36 (76.6%)	11 (23.4%)
2016	39	9.2%	144	3.7	31(79.5%)	8 (20.5%)
2015	34	8.0%	273	8.0	26 (76.5%)	8 (23.5%)
2014	40	9.4%	259	6.5	34 (85.0%)	6 (15.0%)
2013	29	6.8%	162	5.6	16 (55.2%)	13 (44.8%)
2012	25	5.9%	252	10.1	22 (88.0%)	3 (12.0%)
2011	25	5.9%	348	13.9	23 (92.0%)	2 (8.0%)
2010	22	5.2%	649	29.5	22 (90.9%)	2(9.1%)
2009	15	3.5%	165	11.0	12 (80.0%)	3 (20.0%)
2008	13	3.1%	187	14.4	12 (92.3&)	1 (7.3%)
2007	8	1.9%	109	13.6	5 (62.5%)	3 (37.5%)
2006	12	2.8%	250	20.8	11 (91.3%)	1 (8.3%)
2005	8	1.9%	272	34.0	8 (100%)	0 (0%)
2004	9	2.1%	527	58.6	7 (77.8%)	2 (22.2%)
2003	12	2.8%	300	25.0	9 (75.0%)	3 (25.0%)
2002	5	1.2%	121	24.2	5 (100%)	0 (0%)
2001	5	1.2%	126	25.2	5 (100%)	0 (0%)
2000	3	1.2%	56	18.7	3(100%)	0 (0%)
1999	2	0.7%	41	20.5	1 (50.0%)	1 (50.0%)

TC total citations, C/A number of citations per article calculated by dividing the total number of citations retrieved for each year by the total number of publications in that year.

[*] Publications in earlier years were small in number and attracted small number of citations.

[**] Low citations of 2018 publications is predictable due to the short time since the publications.

Company (6), Boehringer Ingelheim (4), Sanofi (4), Takeda Oncology (3), Bristol-Myers Squibb (BMS) (2) and Pfizer (2). Small number of publications were funded by charitable, academic and government institutions.

4. Discussion

In this study, we made some significant observations regarding the research productivity on Ramadan fasting in people with diabetes over the past third of a century. This is the first bibliometric study of Ramadan fasting in general and on the interplay of diabetes and Ramadan fasting in particular. The period we covered witnessed an increasing expansion in the quantity research area and academic interest, although some concerns have been voiced on the relatively low volume and quality [15,16]. We mapped the literature using a basic descriptive bibliometric methodology with view to analyse the productivity of nations, institutions, and individuals; the relative intensity of research; the level of research (clinical or basic); levels of scientific impact; and levels of collaboration (methods). We have adopted the approaches used in recent studies [20–22] We have used Scopus to collect data about the current study because it includes almost all MEDLINE journals and it contains all authors' country affiliations which were needed for seeing international collaborations institutional phenomena and countries' production rates. Furthermore, Scopus is considered to be the most extensive international multidisciplinary database in the world, and it covers a broader range of journals from developed and developing countries than does MEDLINE or Web of Science.

We retrieved fairly large number of articles for the purposes of this study (424 articles). We are confident that all relevant articles were picked by searching the crucial three fields (title, abstract and key words). Also the homology between Scopus Pubmed databases is reassuring. However, closer examination detected the differences in 1995 and 2015 were attributed to opposing database coverage strategies of two special supplements on "Ramadan and Diabetes" by Practical Diabetes International (covered by Scopus only) and Journal of Pakistan Medical Association (covered by PubMed only). The reasons for the difference in coverage policies between the two databases is unclear.

The number of articles per year increased exponentially albeit slowly over the study period when compared with other similar studies [21,22]. Open access was possible in one-third of publications. Two-thirds of articles covered original research. Articles were published in medical journals of varying influence. UK-based authors and affiliated institutions were dominant. A single author had an evident dedication to Ramadan research whereas for many authors it Ramadan research was just one aspect of their academic interest. The number publications and the extent of international collaborations were lower than expected, given the world-wide practice of Ramadan fasting by many populations with an increased prevalence of diabetes. The need to share experiences and generalizable conclusions. The pattern of authorship reflects more of a personal interest rather than research directed by institutional policies and long term academic strategies.

The present study is a good starting point to evaluate research activity in the field of research on Ramadan and diabetes, a prime example of ethnically-sensitive diabetes care for a large population. To the best of our knowledge, this is the first study that evaluated the quantity of global Ramadan

Table 3 – The top 15 most cited articles on diabetes and Ramadan fasting over the past three decades including the type of article, journal, country of origin, access type and number of citations.

SCR	First author, Year	Title/Theme	Type	Journal	Country	Access	Citation
1st	Salti, I, 2004	A population-based study of diabetes: The EPIDIAR study.	Article	Diabetes Care	Multiple	Open	306
2nd	Al-Arouj, M, 2010	Recommendations for management of diabetes during Ramadan 2010	Review	Diabetes Care	Multiple	Open	153
3rd	Al-Arouj, M, 2005	Recommendations for management of diabetes during Ramadan 2005	Review	Diabetes Care	Multiple	Open	133
4th	Leiper, JB, 2003	Effects on health of fluid restriction during fasting in Ramadan	Review	European J Clin Nutrition	UK and Kuwait	Open	123
5th	Bravis, V, 2010	Ramadan Education and Awareness in Diabetes programme for Muslims with type 2 diabetes who fast during Ramadan	Research Article	Diabetic Medicine	UK	–	108
6th	Benaji, B, 2006	Diabetes and Ramadan: Review	Review	DRCP	Morocco	–	90
7th	Belkhadir, J, 1993	Muslims with NIDM fasting during Ramadan: Treatment with glibenclamide	Research Article	BMJ	Morocco	–	71
8th	Azizi, F.2010	Islamic fasting and health	Review	Ann Nutrition Metabolism	Iran	Open	69
9th	Kadiri, A, 2001	Treatment of T1DM with insulin lispro during Ramadan	Article	Diabetes and Metabolism	Morocco	–	68
10th	Hui, E, 2010	Management of people with diabetes wanting to fast during Ramadan	Review	BMJ (Online)	UK	–	65
10th	Sari, R, (2004)	The effects of diet, sulfonylurea, and repaglinide therapy on clinical and metabolic parameters in T2DM patients during Ramadan.	Research article	Endocrine Research	Turkey	–	65
12th	Rashed, AH, (1992)	The fast of Ramadan	Editorial	BMJ	Qatar	–	64
13th	Mafauzy, M, (1990)	A study of the fasting diabetic patients during the month of Ramadan.	Research article	Med J Malaysia	Malaysia		63
14th	Al Sifri, S, (2011)	The incidence of hypoglycaemia in Muslim patients with T2DM treated with sitagliptin or a sulphonylurea during Ramadan:	Research article	Intern J Clin Practice	Multiple	–	60
14th	Mafauzy, M, (2002)	Repaglinide versus glibenclamide treatment of T2DM during Ramadan fasting	Research article	DRCP	Malaysia	–	60

Table 4 – Top most prolific authors publishing on diabetes and Ramadan fasting over the last three decades. (1989–2018) and their authorship contribution to Ramadan expressed in authorship frequency and a percentage of their contribution to global literature on Ramadan and diabetes and as a proportion of their own research production in addition to the authors h-index and country of affiliation.

SCR	Author	Authorship frequency		Contribution to global literature (%)	Proportion of own research production (%)	h-index	Country
		Ramadan & diabetes (n)	All authorship (n)				
1st	Hassanein, M	19	30	4.5	63.3	14	UK, UAE
2nd	Basit, A	9	262	2.1	3.4	25	Pakistan
3rd	Beshyah, SA	8	54	1.9	14.8	22	UAE
3rd	Hanif, W	8	32	1.9	25.0	13	UK
3rd	Hui, E	8	14	1.9	57.1	9	UK
6th	Ahmedani, MY	7	29	1.7	24.1	9	Pakistan
6th	Azar, ST	7	115	1.7	6.1	25	Lebanon
6th	Bener, A	7	428	1.7	1.6	43	Turkey, UAE, Qatar
6th	Kalra, S	7	461	1.7	1.5	22	India
10th	Al-Arouj, M	6	27	1.4	22.2	15	Kuwait
10th	Boussery, K	6	104	1.4	0.0	18	Belgium
10th	Bravis, V	6	10	1.4	60.0	6	UK
10th	Devendra, D	6	38	1.4	15.8	17	UK
10th	Kamaruddin, NA	6	88	1.4	6.8	16	Malaysia
10th	Mehuys, E	6	81	1.4	7.4	29	Belgium
10th	Wilbur, K	6	72	1.4	8.3	15	Canada
10th	Zargar, AH	6	127	1.4	4.7	19	India

UAE: United Arab Emirates, UK: United Kingdom USA: United States of America.
a SCR Standard competition ranking. Equal authors were given the same ranking number, and then a gap is left in the ranking numbers.

and diabetes research. The number of published articles was used as an indicator of the quantity of research activity in the field of Ramadan and diabetes. Understanding of how research related to diabetes in Ramadan has progressed is essential in developing evidence-based guidelines for management and counselling of potential fasting people with diabetes. Several experts have called for evidence-based guidelines and practices rather than relying on consensus statements and expert opinions [15,16]. The current bibliometric study also adds to the bibliometric literature in general and in mapping studies on the ethnic and cultural perspectives of clinical practices [20,21].

It was obvious that research performance in the field of Ramadan has been neglected for so many years. Over the first 20 years of Medline indexation (1966–1988) there were only a handful of articles. Perhaps, the international scene article by Sulimani et al in 1988 [6], was the first semi-scientific account of the subject, although earlier work could be traced Baquet as early as 1966 [25]. The leading institution (Imperial College London) for this research area is not surprisingly based in the west rather than in a Muslim-majority nation. The gap North-South divide seems as true for Ramadan research as it is for other research areas [26]. However, it could have been enhanced by the Imperial's local affiliation in UAE. Nonetheless, this observation calls for more trans-national North-South collaboration between those who have the research methods and expertise and those who have access to large numbers of patients observing the fast and perhaps more importantly (South-South collaborations [27]. The benefits of increasing collaborations are that it leads to easier access to financing more opportunities to achieve higher research productivity and it facilitates translation research

expertise to countries that require. There are some promising signals of repatriation to regions of Saudi Arabia, Gulf and Pakistan. The influence of the pharmaceutical industry is undeniable in the numbers of pharma involvement in so many articles [28]. The analysis reveals that to date research collaborations in the field of Ramadan is low other than what is being instigated by the pharmaceutical industry or is generated by individual and group attempts of reaching consensus instead generating an evidence-base. Interestingly, many of the the ten most prolific countries that published articles on Ramadan fasting include many new countries that are usually not as recognisable to readers as other scientific research productivity rankings such as Saudi, Arabia, United Arab Emirates and Pakistan.

The present study has some noteworthy limitations mostly related to the bibliometric nature of the study. Bibliometric studies provide quantitative documentation of the volume and pattern without in-depth analysis of the contents usually performed for narrative and systematic reviews [19]. However, bibliometric methods or "analysis" are now firmly established as scientific specialities and are an integral part of research evaluation methodology [18,19]. Many studies on Ramadan fasting that were published in journals notindexed in databases other than Scopus may not have been included. The authors are cognizant of the fact that several important articles which were fairly frequently cited were published in emerging journals that are not yet included in Scopus database including some of their own publications [5,8]. Previous workers have demonstrated that many researchers publish their work in local journals that are not indexed in any international citation databases [29], perhaps out of loyalty or support to their institutions [30]. Being the first study of its
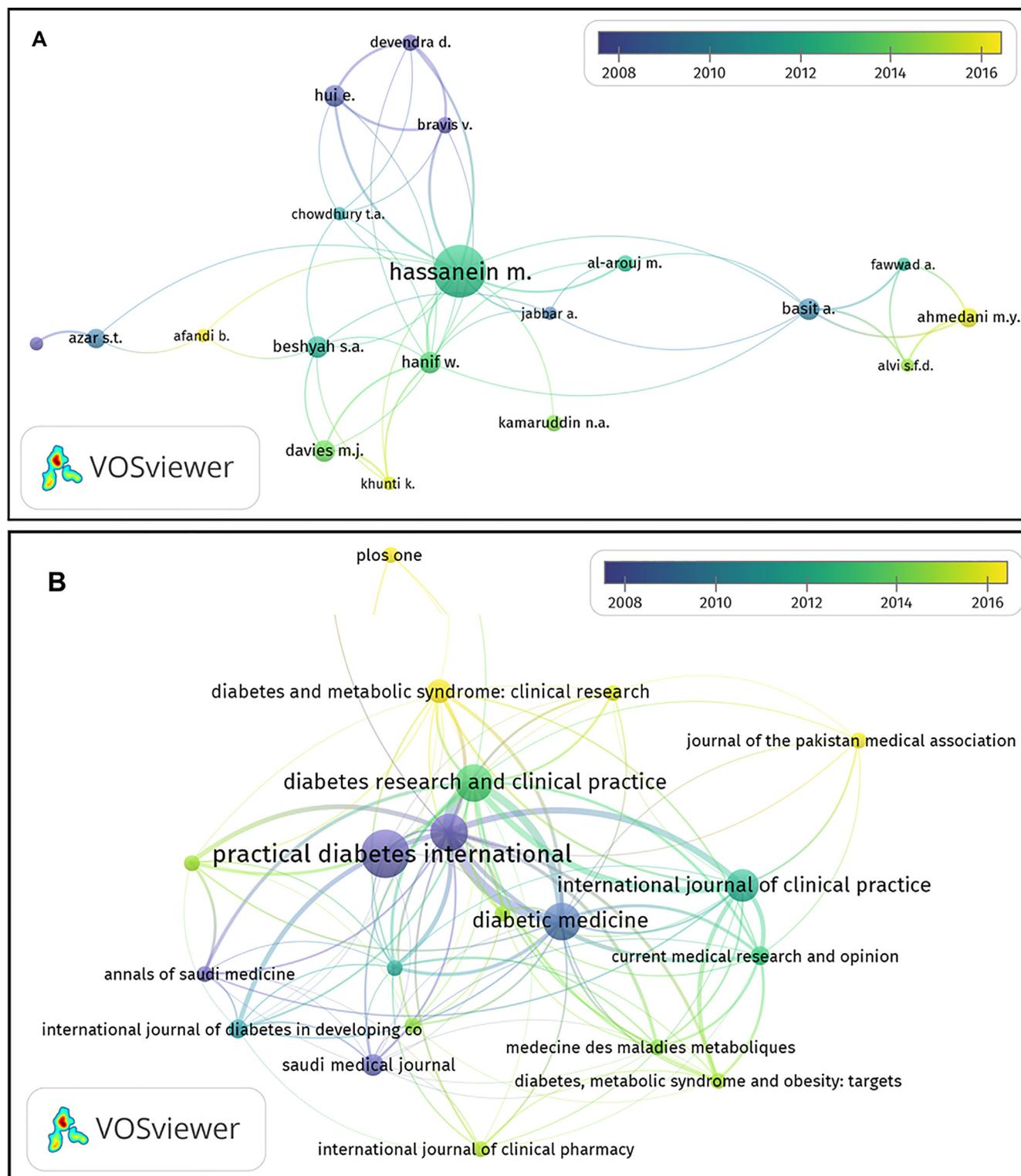
Fig. 2 – Co-citation network of most prolific authors (A) and journals (B) with articles on Ramadan fasting published between detected between 2008 and 2016. For the authors, five clusters were identified and for the journals, size of the circle reflects the numbers of articles and thickness of the lines reflects numbers of shared authors between journals. Clusters located close to each other in the figure indicate related topics. Overlay of the time scale on the clusters adds information on the time of publications.

nature, we could not make comparisons with Ramadan-type studies, but we contrasted our findings with other bibliometric analyses that addressed themes of comparable ethnic and

personal behavioural nature [20–22]. Finally, although the data showed a promising increase in the quantity of Ramadan-related research, it is still too little considering

Table 5 – Top ten active countries in number of publications on diabetes and Ramadan fasting over the last three decades (1989–2018) .

SCR**	Country	Articles (N (%))	Citations	C/A Ratio	Ever cited [N (%)]
1st	UK	62 (14.2%)	1273	20.5	50 (80.7%)
2nd	KSA	56 (13.2%)	909	16.2	46 (82.1%)
3rd	UAE	36 (8.5%)	707	19.1	33 (89.4%)
4th	Pakistan	34 (8.0%)	687	20.2	28 (82.4%)
5th	USA	32 (7.5%)	730	22.8	27 (84.4%)
6th	India	28 (6.6%)	267	9.5	24 (85.7%)
7th	Malaysia	26 (6.2%)	446	17.2	20 (80.0%)
7th	Egypt	25 (5.9%)	654	26.2	24 (92.3%)
9th	Qatar	24 (5.7%)	321	13.4	22 (91.7%)
10th	Turkey	22 (5.0%)	440	20.0	20 (90.0%)

KSA: Kingdom of Saudi Arabia, UAE: United Arab Emirates, UK: United Kingdom, USA: United States of America.

*Production and impact are presented as number of article and percent contribution to total, number of citations, Citation/article (C/A) ratio and number (percentage) of articles ever cited (even once).

** SCR Standard competition ranking. Equal countries were given the same ranking number, and then a gap is left in the ranking number.

Table 6 – Top ten productive institutions in publications on diabetes and Ramadan fasting over the last three decades. (1989–2018).

SCR	Institution	Articles		Country	TC	TC/A
		Number	Percentage			
1st	Imperial College London	14	3.3%	UK	385	27.5
1s	Hamad Medical Corporation	14	3.3%	Qatar	273	19.5
3rd	Baqai Medical University	13	3.1%	Pakistan	225	17.3
4th	Dubai Hospital	12	2.8%	UAE	393	32.8
5th	King Saud University	9	2.1%	KSA	254	28.2
6th	Glan Clwyd Hospital	8	1.9%	UK	319	39.9
6th	University of Kuwait	8	1.9%	Kuwait	166	20.8
6th	American University of Beirut	8	1.9%	Lebanon	144	18.1
9th	Qatar University	8	1.9%	Qatar	49	6.1
10th	Universiti Kebangsaan Malaysia	7	1.7%	Malaysia	61	8.7

TC total citations. C/A ratio: Citation to articles ration. UAE: United Arab Emirates; UK United Kingdom. National Health Services was removed as it is too generic to be meaningful of any specific affiliation.

SCR standard competition ranking. Equal countries were given the same ranking number, and then a gap is left in the ranking numbers. The tenth position was empirically truncated to the first provided by the system.

the large number of people who are observing the Ramadan fast in many countries particularly those with a with the high prevalence of diabetes. This restricts the role of the current report to a mere exploratory exercise. We could not fail to notice the heavy pharmaceutical involvement in the leading research. Although collaboration between industry and the professionals undoubtedly has a pivotal place, the quantity and quality of Ramadan research can be further enhanced by unconditional funding by industry coupled with the creation of committed "Ramadan Research Centres" and developing more regional and international collaborations [16,17].

5.   Conclusions

This study is the first bibliometric analysis of Ramadan fasting and diabetes research. Prolific authors, core journals, and clusters of Ramadan fasting research in the past three decades were identified. This study provides a systematic overview of productivity and visibility of research work in the field of diabetes and Ramadan fasting, and the findings could be used for informing future efforts in Ramadan fasting-related research.

The interplay between Ramadan fasting and diabetes is an area of research that is gathering an increasing interest of academic and practising health care professionals. The study provides a systematic overview of productivity and visibility of research work on diabetes control and complications during Ramadan fasting and on the knowledge, attitudes, and practices of both patients and health care professionals regarding this topic. Systematically measuring the trends of the scientific literature using bibliometric methodology should help quantify the completed research work and widely held expert opinion on the subject. The findings should help interested researchers realise the gaps in knowledge on Ramadan fasting and also could be used for prioritising future research directions, and fostering potential collaborations.

Table 7 – Top fifteen journals publishing on diabetes and Ramadan fasting over the last three decades (1989–2018).

SCR[*]	Journal	Frequency		Citations	C/A	SJR	h-Index
		N	%				
1st	Practical Diabetes International[**]	17	4.0	54	3.2	0.172	23
2nd	Diabetes Care	13	3.1	758	58.3	6.693	319
2nd	Diabetes Research & Clinical Practice	13	3.1	264	20.3	1.54	95
2nd	Diabetic Medicine	13	3.1	219	16.9	1.63	128
5th	International Journal of Clinical Practice	11	2.6	255	23.2	0.89	84
6th	Diabetes and Metabolic Syndrome Clinical Research and Reviews	8	1.9	13	1.2	0.88	22
7th	Saudi Medical Journal	7	1.7	91	13	0.35	41
8th	Current Medical Research and Opinion	6	1.4	177	29.5	0.94	96
8th	International Journal of Diabetes In Developing Countries	6	1.4	55	9.2	0.17	21
10th	Annals of Saudi Medicine	5	1.2	61	12.2	0.24	35
10th	Diabetes and Metabolism	5	1.2	128	25.6	1.33	78
10th	Diabetes Metabolic Syndrome & Obesity Targets & Therapy	5	1.2	29	5.8	1.34	29
10th	Diabetes Technology and Therapeutics	5	1.2	43	8.6	1.73	74
10th	Indian Journal of Endocrinology and Metabolism	5	1.2	24	4.8	0.57	15
10th	International Journal of Clinical Pharmacy	5	1.2	28	5.6	0.70	51
10th	Journal of Diabetes and Metabolic Disorders	5	1.2	34	6.8	0.82	18
10th	Journal of The Pakistan Medical Association[**]	5	1.2	29	5.8	0.28	35
10th	Medecine Des Maladies Metaboliques	5	1.2	8	1.6	0.12	7
1oth	PLOS One	5	1.2	25	5	1.16	241
10th	Medical Journal Of Malaysia	5	1.2	111	22.2	0.22	28

TC total citations, C/A ratio average number of citations per article calculated by dividing the total citation by number of articles for each journal, IF impact factor.

[*] SCR standard competition ranking. Equal countries were given the same ranking number, and then a gap is left in the ranking numbers.

[**] The SCR positions are affected by the coverage strategy of the Scopus in 1989 and 2015 (Fig. 1).

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Competing interests

The authors declare that they have no potential competing interests that may jeopardise the results of the study.

Compliance with ethical principles

Not applicable.

Appendix A. Supplementary material

Supplementary data to this article can be found online at https://doi.org/10.1016/j.diabres.2019.03.023.

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