




Global Research Trends of Health-Related Publications on Ramadan Fasting from 1999 to 2021: A Bibliometric Analysis

Reema A. Karasneh¹ · Sayer I. Al-Azzam² · Karem H. Alzoubi^{3,4} ·
Sahar S. Hawamdeh² · Waleed M. Sweileh⁵ 

Accepted: 16 April 2022 / Published online: 7 May 2022

© The Author(s), under exclusive licence to Springer Science+Business Media, LLC, part of Springer Nature 2022

Abstract

Ramadan fasting is one of the five pillars of Islam. The current study aims to examine, analyze, and identify trends of health-related publications on Ramadan fasting. In total, 1468 documents retrieved from Scopus were analyzed. The mean number of authors per document was 3.7, with an average of 13.3 citations per document. The UK ranked first (12.3%, $n=181$) regarding the number of documents, followed by Iran (10.4%, $n=153$) and then Saudi Arabia (9.8%, $n=144$). The most active journal was “Diabetes Research and Clinical Practice” (4.9%, $n=72$). Publications related to diabetes and fasting constituted around 29.7% ($n=436$) of the literature. The research volume on Ramadan fasting has been noticeably growing. More reliable research is required to aid healthcare professionals in providing patient-specific care.

Keywords Bibliometric analysis · Fasting · Islamic fasting · Ramadan

✉ Waleed M. Sweileh
waleedsweileh@najah.edu

¹ Department of Basic Medical Sciences, Faculty of Medicine, Yarmouk University, Irbid 21110, Jordan

² Department of Clinical Pharmacy, Faculty of Pharmacy, Jordan University of Science and Technology, Irbid 21110, Jordan

³ Department of Pharmacy Practice and Pharmacotherapeutics, University of Sharjah, Sharjah, United Arab Emirates

⁴ Faculty of Pharmacy, Jordan University of Science and Technology, Irbid, Jordan

⁵ Department of Physiology and Pharmacology/Toxicology, College of Medicine and Health Sciences, An-Najah National University, Nablus, Palestine

Introduction

Ramadan fasting is a form of intermittent fasting globally practiced by Muslims during the holy month of Ramadan. Fasting takes place from sunrise to sunset and consists of abstinence from foods, drinks, and sexual intercourse. The period of fasting varies between geographical areas and time of the year, with fasting hours reaching their peak in summer. According to the Islamic creed, Muslims are exempted from fasting in situations where health might be compromised by the lack of feedings, such as illness, travel, old age, and certain cases of pregnancy (Rouhani & Azadbakht, 2014).

A common practice in Ramadan is to have a meal called "Suhoor" that takes place before dawn, to provide the body with energy throughout the day. This practice alters the sleeping patterns of the practitioners, which ensues changes in circadian rhythm and physiological processes (BaHammam et al., 2010; Roky et al., 2001). Effects on insulin circulating levels, cortisol circadian secretion, and sleep cycles have been detected (Bahijri et al., 2013; Haouari et al., 2008).

The effect of Ramadan fasting on various disease states has also been studied. Interestingly, fasting has been found to cause no negative effects on chronic kidney disease (CKD) patients, or those with a transplanted kidney, while its safety has not been confirmed for nephrolithiasis patients (Bragazzi, 2014). A study on patients with stable chronic obstructive pulmonary disease (COPD) found no effects of Ramadan fasting on the spirometric data of patients enrolled (Zouari et al., 2018).

An improvement in the lipid profiles and blood glucose levels has been reported among athletes who practiced fasting during the month of Ramadan. Weight reduction has also been linked to Ramadan fasting, although only among men, and weight was regained shortly after the month (Rouhani & Azadbakht, 2014).

One study reported an increase in the number of gastric ulcer cases during the month of Ramadan compared to the preceding month, although with no effect on disease outcomes (El Mekkaoui et al., 2013). Moreover, it was concluded that fasting may have notorious impacts on patients with various gastrointestinal (GI) diseases and may increase the risk of complications (Sadeghpour et al., 2012). Effects on psoriasis, infectious diseases, cancer, pregnancy, and immune system have also been examined (Awwad et al., 2012; Bragazzi et al., 2015; Damiani et al., 2019; Develioglu et al., 2013; Faris et al., 2012; Van Ewijk et al., 2013).

The impact of Ramadan fasting on diabetes management and glycemic control has been extensively studied. Eating patterns during the month may result in alternating episodes of hyperglycemia and hypoglycemia. Although fasting and postprandial blood sugar were found to be decreased during Ramadan, the risk of hyperglycemia is still present due to overeating during feasting hours. A reschedule of insulin regimens is also warranted for type 1 and insulin-dependent type 2 diabetes mellitus (DM) patients to prevent hypoglycemia (Hassanein et al., 2017; Rouhani & Azadbakht, 2014).

Hundreds of millions of Muslims around the world practice intermittent fasting during Ramadan, yet literature assessing the impact of fasting on health and body

physiology remains scarce. This is especially a matter of concern to healthcare professionals who get consulted during the month of Ramadan. In such cases, guidelines are warranted to provide patient-specific care. To this date, no bibliometric analysis has been conducted to appraise the entire literature on Ramadan fasting. An analysis was recently conducted by Husain et al. covering the top 100 cited documents on Ramadan fasting (Husain et al., 2020). However, this approach warrants the inclusion of older articles over recent ones, as the latter has had less time to gain citations. Moreover, documents written in languages other than English were not included. Another bibliometric study was conducted on Ramadan fasting and diabetes and found a total of 424 documents, with the domination of authors and institutions based in the UK (Beshyah & Beshyah, 2019). This study aims to assess and analyze research trends of all Ramadan-related literature published in the past two decades. Moreover, research growth, the geographical distribution of outputs, authorship trends, and citation analysis were examined.

Methods

Bibliographic Database

This cross-sectional study was conducted in February 2022 using a bibliometric methodology. Scopus database was used to retrieve study data considering its previous use in several bibliometric studies and 100% inclusion of PubMed, in addition to the several search and analysis functions it offers. Scopus was used because it is the largest online database with abstracts and citations of over 23,700 peer-reviewed journals (Falagas et al., 2008). Only documents published in peer-reviewed journals were included.

Research Strategy and Keywords

The study period was set from 1999 to 2021. The following search keywords were used in title/abstract search. The keywords included ("Ramadan AND fast*"), ("Islam* AND fasting"), ("Ramdan"), and ("Islam* AND diet AND restriction"). Documents were set to be retrieved if the previous keywords appeared in their title or abstract. To ensure accuracy and maximal retrieval of relevant documents, asterisks and quotation marks were used. Literature was also surveyed to obtain commonly used author keywords on Ramadan fasting. To refine the retrieved documents to health areas, results were filtered to be within the following subject areas: medicine, nursing, biochemistry, genetics, molecular biology, neuroscience, dentistry, pharmacology, immunology, microbiology, and psychology. Hirsh index (h-index) was used to assess the quality of retrieved documents (Mikhailov, 2014).

Data Analysis

Retrieved data were analyzed for annual growth, authorship pattern and collaboration, citation analysis, country and institution productivity, and articles with the highest number of citations. The number of citations per article and year was obtained from Scopus. Annual growth was presented as the total number of articles per year. Relative growth rates (RGR), annual growth rates (AGR), and doubling time (DT) were calculated. RGR is the increase in the number of publications in a specified time and is calculated using the following formula: $RGR = [\log W_2 - \log W_1] / (T_2 - T_1)$, where $\log W_1$ is the log of the initial number of articles; $\log W_2$ is the log of the final number of articles after the ascertained period, and $T_2 - T_1$ is the difference between the initial and the final time. This was then used to calculate the doubling time, which is the time required for publications to double in number in 1 year. The following formula was used to calculate DT: $DT = 0.693 / RGR$. The annual growth rate (AGR) (the percentage change in the number of publications over 1 year) was also calculated based on the following formula: $AGR = [(Ending Value - Beginning Value) / Beginning Value] * 100$. Citation analysis was presented as frequency, mean, and median of citations per year. Authorship analysis was presented as the number of single-authored and multi-authored articles. Furthermore, the degree of collaboration was calculated according to the following formula: $Degree of collaboration = C = N_m / (N_m + N_s)$, where N_m = number of multi-authored papers and N_s = number of single-authored papers (Khaparde Professor & Pawar, 2013; Santha kumar & Kaliyaperumal, 2015).

Visual maps were created using VOS viewer software (van Eck & Waltman, 2010).

Results

Description of the Retrieved Literature

In total, 1468 documents were retrieved. Most documents (91.9%, $n = 1349$) were in the field of medicine. Other common subject areas were nursing (14.5%, $n = 213$), biochemistry and molecular biology (13.7%, $n = 201$), and health professions (5.6%, $n = 82$). Areas with less than 50 publications included pharmacology, psychology, and neuroscience. Of the total number of documents, 29.7% ($n = 436$) were diabetes related. The remaining bulk of literature covered a wide array of topics, including general health, clinical biomarkers, physical performance, kidney disease, cardiovascular disease, pregnancy, and diet. Analysis of the retrieved documents based on the subject area indicated that medicine was the most prolific area in all years. Meanwhile, interest in psychology, immunology, and dentistry remained modest throughout the study period.

Table 1 Annual growth of retrieved publications on Ramadan fasting from 1999 to 2021

Year	No	% N = 1468	AGR	Cumulative total publications	RGR	DT
1999	13	0.9	–	13	–	–
2000	18	1.2	38.46	31	0.87	0.80
2001	13	0.9	– 27.78	44	0.35	1.98
2002	17	1.2	30.77	61	0.33	2.1
2003	26	1.8	52.94	87	0.35	1.98
2004	31	2.1	19.23	118	0.31	2.24
2005	24	1.6	– 22.58	142	0.19	3.65
2006	40	2.7	66.67	182	0.25	2.77
2007	40	2.7	0.00	222	0.00	–
2008	53	3.6	32.5	275	0.21	3.3
2009	48	3.3	– 9.43	323	0.16	4.33
2010	52	3.5	8.33	375	0.15	4.62
2011	60	4.1	15.38	435	0.15	4.62
2012	84	5.7	40	519	0.18	3.85
2013	80	5.5	– 4.76	599	0.14	4.95
2014	106	7.2	32.5	705	0.16	4.33
2015	72	4.9	– 32.08	777	0.10	6.93
2016	85	5.8	18.06	862	0.10	6.93
2017	99	6.7	16.47	961	0.12	5.78
2018	84	5.7	– 15.15	1045	0.08	8.66
2019	128	8.7	52.38	1173	0.12	5.78
2020	153	10.4	19.53	1326	0.12	5.78
2021	142	9.7	– 7.19	1468	0.10	6.93

Growth of Publications

The mean number of publications during the study period was 63.8 documents per year. An increase in the number of publications with time was observed, although not without fluctuations. Table 1 shows the annual number of publications on Ramadan fasting during the study period. The highest productivity was observed in 2020, with a total of 153 (10.4%) documents, while the least number of publications was in 1999 and 2001 with 13 (0.9%) articles for each. As indicated in Table 1, AGR alternated between positive and negative values, showing a fluctuating pattern during the study period. The average AGR was 27. Meanwhile, RGR declined from 0.87 in 2000 to 0.00 in 2007 and rose slightly to 0.10 by the end of the study period (2021). These fluctuations translated into an unstable, fluctuating DT, indicating a non-exponential growth rate. Figure 1 shows the annual growth of publications during the study period. The total number of documents published from 2017 to 2021 constituted approximately 40.0% (n=606) of the total number of retrieved documents.

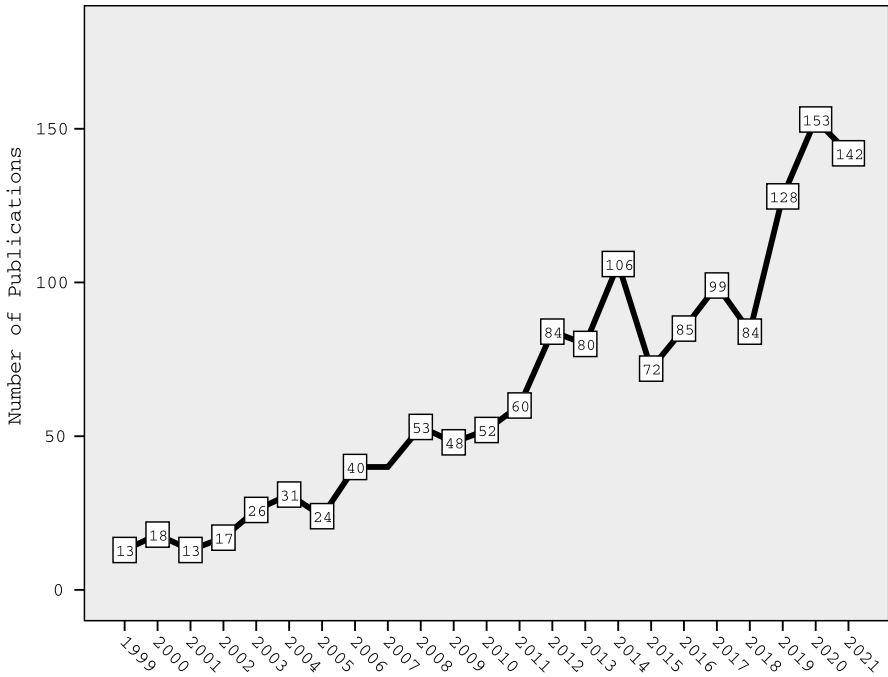


Fig. 1 Annual growth of health-related publications on Ramadan fasting (1999–2021)

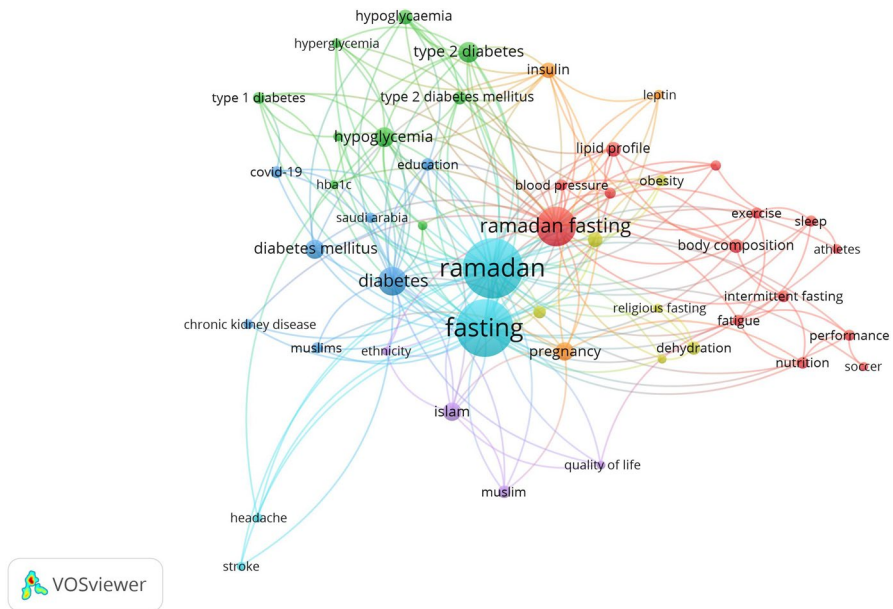


Fig. 2 Network visualization map of author keywords with a minimum occurrence of 10 times. Node size correlates with the frequency of occurrence. Words that commonly co-occur tend to be located close to each other. Terms with common attributes are grouped into clusters with different colors

Most Frequent Keywords

Figure 2 is a network visualization map of author keywords with a minimum frequency of 10 times. The map included 47 keywords. The node size is proportional to the frequency of occurrence of the keyword. The most frequent keywords were Ramadan and fasting. Other frequent keywords included diabetes-related keywords, nutrition-related keywords, blood pressure, and chronic kidney disease. The map also showed the keyword "COVID-19" indicative of publications on Ramadan fasting during the pandemic.

Authorship Pattern, Collaboration, and Prolific Authors

The average number of authors per document was 3.7. The vast majority of retrieved documents were multi-authored (88.6%, $n = 1300$), while only 11.4% ($n = 168$) were single-authored. The degree of collaboration was therefore 0.89 (89%). Table 2 shows the top ten productive authors. The most prolific author was Hassanein, M. ($n = 42$) from Dubai Hospital, Dubai, UAE, followed by Chtourou, H ($n = 33$) and Souissi, N.R ($n = 25$).

Figure 3 is a visualization map of author networking. Only authors with a minimum contribution of 10 documents were included. The map shows 29 scholars, distributed into six clusters. The largest cluster (red cluster) included 11 scholars. The cluster represented an international network of scholars from the Arab Gulf, Pakistan, and the UK. This cluster included the top active author; Hassanein, M. from the United Arab Emirates. The second-largest cluster (green cluster) included eight scholars including Chtourou, H. (Tunisia); one of the top active authors. The map showed no interaction between the two largest clusters.

Geographical Distribution of Publications

Authors from 87 countries contributed to the retrieved literature. Table 3 shows the top ten active countries in the field of Ramadan fasting. The UK ranked first with 181 (12.3%) publications, followed by Iran (10.4%, $n = 153$) and Saudi Arabia (9.8%, $n = 144$). The top ten most productive countries were distributed across West Asia, the Middle East and North Africa, and Western Europe.

Figure 4 shows cross-country (international) research collaboration among countries with a minimum contribution of 10 publications. The map included 35 countries. Three countries showed a large node size indicative of high research connections with other countries. These countries were the United Arab Emirates, Saudi Arabia, and the UK. The UK exists in the center of the map with connections links with most countries on the map. The map showed Tunisia with connections to France and Canada indicative of research collaboration among these countries. The green cluster included several Islamic countries with close research collaboration.

Table 2 Top ten productive authors in the field of Ramadan fasting from 1999 to 2021

Author's rank*	Author	Frequency	Affiliation
1st	Hassanein, M	42	Dubai Hospital, Dubai Health Authority, Dubai, United Arab Emirates
2nd	Chtourou, H	33	High Institute of Sport and Physical Education, University of Sfax, Tunisia
3rd	Souissi, N.R	25	Research Laboratory "Sports performance Optimization" National Center of Medicine and Science in Sports (CNMSS), Tunis, Tunisia
4th	Bragazzi, N.L.	22	Department of Health Sciences (DISSAL), Postgraduate School of Public Health, University of Genoa, 16,132, Genoa, Italy
4th	Chamari, K	22	Research Laboratory "Sports performance Optimization" National Center of Medicine and Science in Sports (CNMSS), Tunis, Tunisia
6th	Chaouachi, A	19	Research Unit Evaluation, Sport, Health, National Centre of Medicine and Science in Sport, Tunis, Tunisia
6th	Trabelsi, K	19	5 University of Sfax, Laboratory of Pharmacology, Faculty of Medicine, Sfax, 3029, Tunisia
8th	Ahmedani, M.Y	16	Department of Medicine, Baqai Institute of Diabetology and Endocrinology, Baqai Medical University, Karachi, Pakistan
8th	Beshyah, S.A	16	Division of Endocrinology, Institute of Medicine, Sheikh Khalifa Medical City, Abu Dhabi, UAE; Department of Medicine, Dubai Medical College, Dubai, UAE
10th	Aloui, A	15	High Institute of Sport and Physical Education, University of Sfax, Tunisia
5th			
5th			

*Subjects with equal research output were given the same rank, and then, a gap was left in the ranking numbers

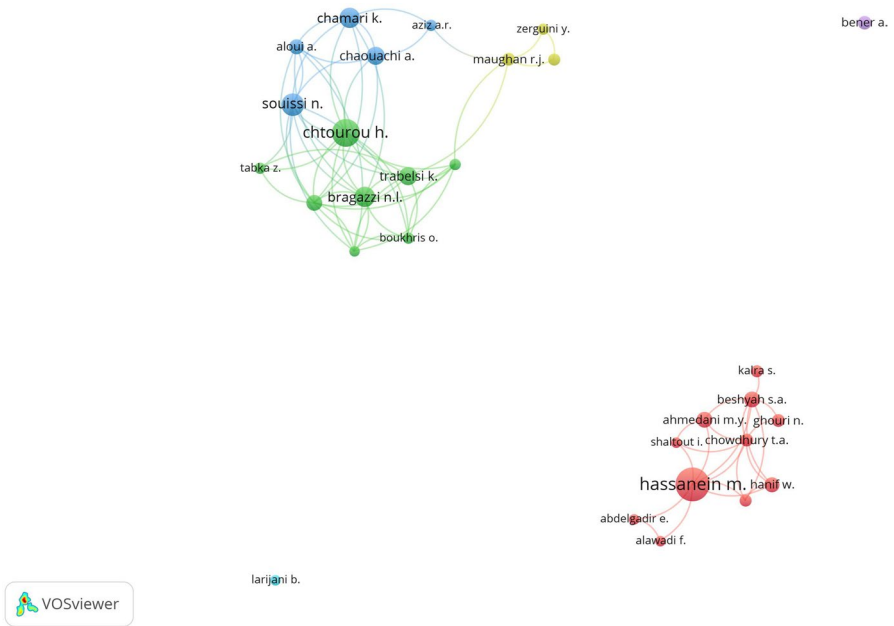


Fig. 3 Network visualization map of author networking. Only authors with a minimum contribution of 10 documents were included. The map shows 29 scholars, distributed into six clusters

Table 3 Top ten active countries in the field of Ramadan fasting from 1999 to 2021

Countries Rank*	Country	Number of publications (%); N = 1468
1st	UK	181 (12.3)
2nd	Iran	153 (10.4)
3rd	Saudi Arabia	144 (9.8)
4th	Turkey	139 (9.5)
5th	USA	137 (9.3)
6th	Tunisia	128 (8.7)
7th	United Arab Emirates	106 (7.2)
8th	Pakistan	93 (6.3)
9th	Egypt	87 (5.9)
10th	France	70 (4.7)

*Subjects with equal research output were given the same rank, and then, a gap was left in the ranking numbers

N = number of retrieved research articles

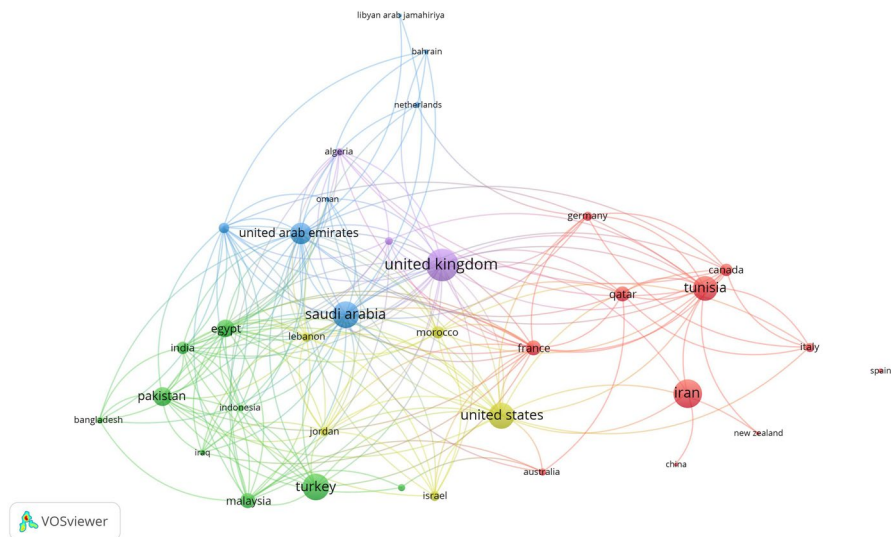


Fig. 4 Cross-country (international) research collaboration among countries with a minimum contribution of 10 publications. The map included 35 countries

Table 4 Top ten active institutions in the field of Ramadan fasting from 1999 to 2021

Institution's Rank*	Institution	Number of publications (%); N = 1468	Country of Institution
1st	University of Sfax	46 (3.1)	Tunisia
2nd	Dubai Hospital	42 (2.9)	UAE
3rd	King Saud University	41 (2.8)	Saudi Arabia
4th	Tehran University of Medical Sciences	38 (2.6)	Iran
5th	Baqai Medical University	26 (1.8)	Pakistan
6th	Aspetar Orthopaedic and Sports Medicine Hospital	24 (1.6)	Qatar
7th	University of Toronto	23 (1.6)	Canada
7th	Università degli Studi di Genova	23 (1.6)	Italy
7th	Hamad Medical Corporation	23 (1.6)	Qatar
10th	Imperial College London	22 (1.5)	UK
10th	King Saud bin Abdulaziz University for Health Sciences	22 (1.5)	Saudi Arabia

*Subjects with equal research output were given the same rank, and then, a gap was left in the ranking numbers

N = number of retrieved research articles

Table 5 Top ten active journals in the field of Ramadan fasting from 1999 to 20,212,018

Journal's activity rank**	Journal	Number of publications (%)	Subject area (category)	Journal rank**	Country	IF***
N = 14,681,042						
1st	Diabetes Research And Clinical Practice	72 (4.9)	Biochemistry, Genetics, Molecular Biology, Endocrinology, and Medicine	Q1	Netherlands	5.602
2nd	Saudi Medical Journal	30 (2)	Medicine (miscellaneous)	Q3	Saudi Arabia	1.484
3rd	Tunisie Medicale	22 (1.5)	Medicine (miscellaneous)	Q4	Tunisia	NA
4th	Journal Of Sports Sciences	21 (1.4)	Health professions and medicine	Q1	UK	3.337
4th	Pakistan Journal Of Medical Sciences	21 (1.4)	Medicine (miscellaneous)	Q3	Pakistan	1.088
6th	Eastern Mediterranean Health Journal	19 (1.3)	Medicine (miscellaneous)	Q3	Switzerland	1.628
7th	International Journal Of Clinical Practice	18 (1.2)	Medicine (miscellaneous)	Q2	US	NA
7th	Plos One	18 (1.2)	Multidisciplinary	Q1	US	3.240
9th	Nutrients	17 (1.2)	Agricultural and Biological Sciences (Food Science), Nursing (Nutrition and Diетetics)	Q1	Switzerland	5.717
10th	Diabetes And Metabolic Syndrome Clinical Research And Reviews	15 (1)	Medicine	Q2	Netherlands	NA

N = total number of retrieved literatures, IF = impact factor, Q = quartile

*Subjects with equal research output were given the same rank, and then, a gap was left in the ranking numbers

**Journal rank was obtained from Scimago Journal rank. Q1 = highest rank; Q4 = lowest rank

***Obtained from the 20,212,018 Journal Citation Reports by Clarivate Thomson Reuters

Most Active Institutions

Table 4 shows the top ten most active institutions in the field of Ramadan fasting. Eight of the most active institutions were academic, while three were hospitals. The University of Sfax ranked first with 46 (3.1%) publications, followed by Dubai Hospital (2.9%, $n=42$), and King Saud University (2.8%, $n=41$).

Preferred Journals

The top 10 productive journals are listed in Table 5. The most active journal was “Diabetes Research and Clinical Practice” (4.9%, $n=72$), followed by “Saudi Medical Journal” (2%, $n=30$) and “Tunisie Medicale” (1.5%, $n=22$). Most of the top ten productive journals were categorized in the subject area of medicine. Others also published in the subject area of biochemistry, genetics, molecular biology, food sciences and nutrition, and multidisciplinary areas.

Growth of Citations and Top-Cited Documents

Retrieved publications were cited 19,585 times in total, with a mean of 13.3 citations per document. The h-index of retrieved documents was 60. An increase in citations can be observed from 1999 to 2014, with a decline in 2015, followed by another increase for the rest of the study period. The top 10 cited documents in the field of Ramadan fasting are listed in Table 6. The most cited publication was "A Population-Based Study of Diabetes and Its Characteristics During the Fasting Month of Ramadan in 13 Countries", published in 2004 in *Diabetes Care* journal and received 452 citations. The number of citations per document was highest for documents published in 2004 (36.6 citations per document), while the lowest was for those published in 2021 (0.85 citations per document). Six of the top 10 cited documents were DM-related, while the other four discussed general health.

Co-citation Analysis

Figure 5 is a co-citation analysis of journals that received a minimum of 50 citations. The map included 86 journals. The clusters in the map represent scientific disciplines that helped in the emergence of the field of health issues and Ramadan fasting. The map shows three main clusters. The first cluster is related to diabetic medicine. The second cluster is related to nutrition, while the third cluster is related to sports medicine. These three disciplines were the foundation of the field: diabetes, nutrition, and sports.

Table 6 Top ten cited articles in the field of Ramadan fasting from 1999 to 2021

Article rank*	Title	Subject theme	Cited by
1st	"A Population-Based Study of Diabetes and Its Characteristics During the Fasting Month of Ramadan in 13 Countries"	Diabetes Mellitus	452
2nd	"Recommendations for management of diabetes during Ramadan: Update 2010"	Diabetes Mellitus	242
3rd	"The changes of metabolic profile and weight during Ramadan fasting"	General Health	192
4th	"The impact of religious fasting on human health"	General Health	191
5th	"Recommendations for management of diabetes during Ramadan"	Diabetes Mellitus	177
5th	"Effects on health of fluid restriction during fasting in Ramadan"	General Health	177
5th	"Effects on health of fluid restriction during fasting in Ramadan"	General Health	177
7th	Ramadan Education and Awareness in Diabetes (READ) programme for Muslims with type 2 diabetes who fast during Ramadan	Diabetes Mellitus	157
8th	"Diabetes and Ramadan: Practical guidelines"	Diabetes Mellitus	153
9th	"Impact of caloric and dietary restriction regimens on markers of health and longevity in humans and animals: A summary of available findings"	General Health	139
10th	"Diabetes and Ramadan: Review of the literature"	Diabetes Mellitus	116

*Subjects with equal research output were given the same rank, and then, a gap was left in the ranking numbers

Other health states on which the impact of Ramadan fasting has been studied include CKD, nephrolithiasis, COPD, psoriasis, cancer, and gastrointestinal diseases (Rouhani & Azadbakht, 2014). However, literature on these illnesses remains scarce. Moreover, some of the studies lack optimal control of confounders, which calls for more accurate and reliable studies to derive clinical guidelines (Rouhani & Azadbakht, 2014).

The impact of Ramadan fasting on healthy individuals was also studied. Weight loss during Ramadan was reported by several studies, although only to be regained shortly over the course of the following months (Faris et al., 2012; Kul et al., 2014). Beneficial effects of fasting on lipid profile were seen in men, mainly as a decrease in total cholesterol and triglycerides levels. HDL was increased in women after Ramadan compared with pre-Ramadan values (Kul et al., 2014). Studies on pregnant women showed no fasting-associated negative health outcomes on offspring. However, due to the limitations of those studies, fasting is not recommended during pregnancy (Rouhani & Azadbakht, 2014).

Muslims consider Ramadan as a month of blessing, and very few studies have been published to investigate the negative psychological impact of fasting on Muslims. Ramadan tends to have a positive psychological impact on Muslims due to social gatherings and religious activities all during the month (Bayani et al., 2020).

In this study, seven of the most published authors were active in the area of sports. In addition, 4th top journal is sports-related. As Muslim athletes may observe the month of Ramadan during game season, several studies have assessed the effect of Ramadan fasting on physical performance and risk of injury (Memari et al., 2011). Zerguini et al. conducted a study on football players undergoing training camp 3 weeks before Ramadan and during the month (Zerguini et al., 2008). None of the parameters assessed during training, including performance, biochemical, and nutritional variables, were found to be negatively affected by fasting. This was supported by another study that found no effect of fasting on mood states of football players training in the morning period (Chtourou et al., 2014). However, results from a study on untrained persons show negative effects of Ramadan fasting on aerobic fitness, agility, and flexibility scores (Roy & Bandyopadhyay, 2015). Moreover, a study on martial arts competitors has shown a decrease in cognitive function in the form of lowered verbal learning and memory abilities during Ramadan (Tian et al., 2011).

It is estimated that there are around 1.5 billion Muslims around the world (Kul et al., 2014). With globalization, many Muslims now live in western societies, making Ramadan fasting an area relevant not only to countries with Muslim majorities but to societies worldwide. However, research in the field remains to be centralized in areas of south and East Asia, with very little contribution from Europe or North America. No definite explanation can be given for this finding except that non-Muslim researchers and funding agencies might not be interested or are not aware of health-related issues of Ramadan fasting. Muslim researchers in these regions need to focus on the positive psychological aspects of Ramadan fasting on Muslim families in non-Muslim countries. This is an important aspect of religion in general where rates of depression, suicide, and other mental health disorders might be high (Steel et al., 2014).

Limitations

Despite the wide inclusion of the Scopus database, the presence of unindexed journals is still a possibility. The bibliometric nature of the study also carries a risk of both false negatives and positives. However, the search strategy was designed to increase accuracy as much as attainable. The presence of multiple names or different spellings of an author's name may also negatively affect the productivity of the author. Data retrieval was limited to articles published from 1999 to 2021. However, the number of articles published before 1999 was determined to be too little to affect results.

Conclusion

There are around 1.5 billion Muslims around the world, more and more of whom now live in western societies. Fasting during the month of Ramadan is one of the five pillars of Islam. Understanding the impact of Ramadan fasting on body physiology and mental health is vital to the development of clinical recommendations for Muslim populations. Moreover, providing evidence-based guidelines is required to aid physicians in providing patient-specific care during the month of Ramadan. To ensure treatment efficacy and fasting safety among patients who desire to fast, modifications to drug regimens may be required. Many other patients may be advised not to fast during the month. We conclude that there is a progressive growth in the number of publications on Ramadan fasting. However, more data are still required, and more reliable research is important for evidence-based disease management.

Funding The authors have not disclosed any funding.

Declarations

Conflict of interest The authors declare no conflicts of interest.

Ethical approval The study was based on bibliometric data and did not involve any human subjects. Therefore, no ethical approval was required.

References

- Al-Arouj, M., Assaad-Khalil, S., Buse, J., Fahdil, I., Fahmy, M., Hafez, S., Hassanein, M., Ibrahim, M. A., Kendall, D., Kishawi, S., Al-Madani, A., Nakhi, A. B., Tayeb, K., & Thomas, A. (2010). Recommendations for management of diabetes during Ramadan: Update 2010. *Diabetes Care*, *33*, 1895–1902. <https://doi.org/10.2337/dc10-0896>
- Awwad, J., Usta, I. M., Succar, J., Musallam, K. M., Ghazeeri, G., & Nassar, A. H. (2012). The effect of maternal fasting during Ramadan on preterm delivery: A prospective cohort study. *BJOG: an*

- International Journal of Obstetrics and Gynaecology*, 119, 1379–1386. <https://doi.org/10.1111/j.1471-0528.2012.03438.x>
- Babineaux, S. M., Toaima, D., Boye, K. S., Zagar, A., Tahbaz, A., Jabbar, A., & Hassanein, M. (2015). Multi-country retrospective observational study of the management and outcomes of patients with Type 2 diabetes during Ramadan in 2010 (CREED). *Diabetic Medicine*, 32, 819–828. <https://doi.org/10.1111/dme.12685>
- BaHammam, A., Alrajeh, M., Albabtain, M., Bahammam, S., & Sharif, M. (2010). Circadian pattern of sleep, energy expenditure, and body temperature of young healthy men during the intermittent fasting of Ramadan. *Appetite*, 54, 426–429. <https://doi.org/10.1016/j.appet.2010.01.011>
- Bahijri, S., Borai, A., Ajabnoor, G., Abdul Khaliq, A., AlQassas, I., Al-Shehri, D., & Chrousos, G. (2013). Relative metabolic stability, but disrupted circadian cortisol secretion during the fasting month of ramadan. *PLoS ONE*, 8, e60917. <https://doi.org/10.1371/journal.pone.0060917>
- Bayani, A. A., Esmaeili, R., & Ganji, G. (2020). The Impact of fasting on the psychological well-being of muslim graduate students. *Journal of Religion and Health*, 59, 3270–3275. <https://doi.org/10.1007/S10943-018-00740-3>
- Beshyah, W. S., & Beshyah, S. A. (2019). Bibliometric analysis of the literature on Ramadan fasting and diabetes in the past three decades (1989–2018). *Diabetes Research and Clinical Practice*, 151, 313–322. <https://doi.org/10.1016/j.diabres.2019.03.023>
- Bragazzi, N. L. (2014). Ramadan fasting and chronic kidney disease: A systematic review. *Journal of Research in Medical Sciences*, 19, 665–676.
- Bragazzi, N. L., Briki, W., Khabbache, H., Rammouz, I., Mnadla, S., Demaj, T., & Zouhir, M. (2015). Ramadan fasting and infectious diseases: A systematic review. *Journal of Infection in Developing Countries*, 9, 1186–1194. <https://doi.org/10.3855/jidc.5815>
- Chtourou, H., Briki, W., Hammouda, O., Aloui, A., Souissi, N., & Chaouachi, A. (2014). The effect of the time-of-day of training during Ramadan on soccer players' chronotype and mood states. *Sport Sciences for Health*, 10, 143–147. <https://doi.org/10.1007/S11332-014-0185-X>
- Damiani, G., Watad, A., Bridgewood, C., Pigatto, P. D. M., Pacifico, A., Malagoli, P., Bragazzi, N. L., & Adawi, M. (2019). The impact of ramadan fasting on the reduction of PASI score, in moderate-to-severe psoriatic patients: A real-life multicenter study. *Nutrients*, 11, 277. <https://doi.org/10.3390/nu11020277>
- Develioglu, O. N., Kucur, M., Ipek, H. D., Celebi, S., Can, G., & Kulekci, M. (2013). Effects of ramadan fasting on serum immunoglobulin g and m, and salivary immunoglobulin concentrations. *Journal of International Medical Research*, 41, 463–472. <https://doi.org/10.1177/0300060513476424>
- El MekkaouiKaoutar, A. S., Ihssane, M., Adil, I., & Dafr-Allah, B. (2013). Effect of Ramadan fasting on acute upper gastrointestinal bleeding. *Journal of Research in Medical Sciences*, 18, 230–233.
- Falagas, M. E., Pitsouni, E. I., Malietzis, G. A., & Pappas, G. (2008). Comparison of PubMed, Scopus, Web of Science, and Google Scholar: Strengths and weaknesses. *The FASEB Journal*, 22, 338–342. <https://doi.org/10.1096/fj.07-9492LSF>
- Faris, M. A. I. E., Kacimi, S., Al-Kurd, R. A., Fararjeh, M. A., Bustanji, Y. K., Mohammad, M. K., & Salem, M. L. (2012). Intermittent fasting during Ramadan attenuates proinflammatory cytokines and immune cells in healthy subjects. *Nutrition Research*, 32, 947–955. <https://doi.org/10.1016/j.nutres.2012.06.021>
- Haouari, M., Haouari-Oukerro, F., Sfaxi, A., Ben Rayana, M. C. H., Kâabachi, N., & Mbazâa, A. (2008). How ramadan fasting affects caloric consumption, body weight, and circadian evolution of cortisol serum levels in young, healthy male volunteers. *Hormone and Metabolic Research*, 40, 575–577. <https://doi.org/10.1055/s-2008-1065321>
- Hassanein, M., Al-Arouj, M., Hamdy, O., Bebakar, W. M. W., Jabbar, A., Al-Madani, A., Hanif, W., Lessan, N., Basit, A., Tayeb, K., Omar, M. A. K., Abdallah, K., Al Twaim, A., Buyukbese, M. A., El-Sayed, A. A., & Ben-Nakhi, A. (2017). Diabetes and Ramadan: Practical guidelines. *Diabetes Research and Clinical Practice*, 126, 303–316. <https://doi.org/10.1016/j.diabres.2017.03.003>
- Husain, S., Zafar, M., & Ullah, R. (2020). Ramadan and public health: A bibliometric analysis of top cited articles from 2004 to 2019. *Journal of Infection and Public Health*, 13, 275–280. <https://doi.org/10.1016/j.jiph.2019.11.006>
- Karamat, M. A., Syed, A., & Hanif, W. (2010). Review of diabetes management and guidelines during Ramadan. *Journal of the Royal Society of Medicine*, 103, 139–147. <https://doi.org/10.1258/jrsm.2010.090254>
- Khparde Professor, V., & Pawar, S. (2013). Authorship Pattern and Degree of Collaboration in Information Technology. *Journal of Computer Science & Information Technology*, 1, 46–54.

- Kul, S., Savaş, E., Öztürk, Z. A., & Karadağ, G. (2014). Does ramadan fasting alter body weight and blood lipids and fasting blood glucose in a healthy population? A meta-analysis. *Journal of Religion and Health, 53*, 929–942. <https://doi.org/10.1007/s10943-013-9687-0>
- Memari, A. H., Kordi, R., Panahi, N., Nikookar, L. R., Abdollahi, M., & Akbarnejad, A. (2011). Effect of ramadan fasting on body composition and physical performance in female athletes. *Asian Journal of Sports Medicine, 2*, 161–166. <https://doi.org/10.5812/ASJSM.34754>
- Mikhailov, O. V., & evich. (2014). A new version of the Hirsh index: The j-index. *Herald of the Russian Academy of Sciences, 84*, 217–220. <https://doi.org/10.1134/S1019331614030101>
- Roky, R., Chapotot, F., Hakkou, F., Benchekroun, M. T., & Buguet, A. (2001). Sleep during Ramadan intermittent fasting. *Journal of Sleep Research, 10*, 319–327. <https://doi.org/10.1046/j.1365-2869.2001.00269.x>
- Rouhani, M. H., & Azadbakht, L. (2014). Is Ramadan fasting related to health outcomes? A review on the related evidence. *Journal of Research in Medical Sciences, 19*, 987–992.
- Roy, A. S., & Bandyopadhyay, A. (2015). Effect of Ramadan intermittent fasting on selective fitness profile parameters in young untrained Muslim men. *BMJ Open Sport and Exercise Medicine, 1*, e000020. <https://doi.org/10.1136/bmjsem-2015-000020>
- Sadeghpour, S., Keshteli, A. H., Daneshpajouhnejad, P., Jahangiri, P., & Adibi, P. (2012). Ramadan fasting and digestive disorders: SEPAHAN systematic review no. 7. *Journal of Research in Medical Sciences, 17*, S150–S158.
- Salti, I., Bénard, E., Detournay, B., Bianchi-Biscay, M., Le Brigand, C., Voinet, C., & Jabbar, A. (2004). A population-based study of diabetes and its characteristics during the fasting month of ramadan in 13 countries: Results of the epidemiology of diabetes and ramadan 1422/2001 (EPIDIAR) study. *Diabetes Care, 27*, 2306–2311. <https://doi.org/10.2337/diacare.27.10.2306>
- Santha kumar, R., & Kaliyaperumal, K. (2015). A scientometric analysis of mobile technology publications. *Scientometrics, 105*, 921–939. <https://doi.org/10.1007/s11192-015-1710-7>
- Steel, Z., Marnane, C., Iranpour, C., Chey, T., Jackson, J. W., Patel, V., & Silove, D. (2014). The global prevalence of common mental disorders: A systematic review and meta-analysis 1980–2013. *International Journal of Epidemiology, 43*, 476–493. <https://doi.org/10.1093/IJE/DYU038>
- Tian, H. H., Aziz, A. R., Png, W., Wahid, M. F., Yeo, D., & Png, A. L. C. (2011). Effects of fasting during ramadan month on cognitive function in muslim athletes. *Asian Journal of Sports Medicine, 2*, 145. <https://doi.org/10.5812/ASJSM.34753>
- van Eck, N. J., & Waltman, L. (2010). Software survey: VOSviewer, a computer program for bibliometric mapping. *Scientometrics, 84*, 523. <https://doi.org/10.1007/S11192-009-0146-3>
- Van Ewijk, R. J. G., Painter, R. C., & Roseboom, T. J. (2013). Associations of prenatal exposure to ramadan with small stature and thinness in adulthood: Results from a large indonesian population-based study. *American Journal of Epidemiology, 177*, 729–736. <https://doi.org/10.1093/aje/kwt023>
- Zerguini, Y., Dvorak, J., Maughan, R. J., Leiper, J. B., Bartagi, Z., Kirkendall, D. T., Al-Riyami, M., & Junge, A. (2008). Influence of Ramadan fasting on physiological and performance variables in football players: Summary of the F-MARC 2006 Ramadan fasting study. *Journal of Sports Sciences, 26*, S3–S6. <https://doi.org/10.1080/02640410802614944>
- Zouari, H., Latiri, I., Mahjoub, M., Boussarsar, M., Benzarti, M., Abdelghani, A., & Ben Saad, H. (2018). The Effects of Ramadan Intermittent Fasting (RIF) on Spirometric Data of Stable COPD Patients: A Pilot Study. *American Journal of Men's Health, 12*, 359–369. <https://doi.org/10.1177/1557988317734131>

Publisher's Note Springer Nature remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.