

Yoga Research Output in India: A Scientometric Study

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Abstract - This article presents the research output of Yoga in India using different Scientometric approach both quantitative and qualitative methods. Bibliographic data for the study has been collected from the Web of Science Core Collection online database of Thomson Scientific, USA. The strings 'Yoga and India' in the topic and address field are used for retrieving data. Researcher have published 525 publications with 6683 Global Citations Scores (H-Index: 45) were selected and 525 publications which were used for further data analysis. Prominent Authors were identified by name, subject domain and able to place their papers in high impact journals. Moreover it has identified Countries wise collaboration of the research. 8 papers are received more than 100 citations. India has collaborated with 32 countries.

Keywords: Scientometrics, Yoga, Web of Science

I. INTRODUCTION

Yoga is a wonderful system of Indian philosophy. The word "yoga" is derived from "Yuj" which means "addition or combination" (Amarjeet, Y., & Sohan, R. T. (2011)). Yoga is an astounding way to augment flexibility, acquire strength, and reduce stress. The physical and mental practices of yoga originated in India roughly 5,000 years ago. Yoga will help man in the performance of all his duties in harmony with the Law of Nature and the sentiments and conventions of the society, enable him to lead a successful life and to achieve satisfaction and peace by sharpening his intellect, cultivating constant awareness and strengthening the will, streamlining the mind and moralizing the behavior. As the functions of the mind and the body are interdependent, it is imperative that equal attention is paid both to the spiritual and the material aspects of man. Yoga provides all benefits in both the fields. Therefore Yoga is a well-balanced and perfect process for success and peace in life (Vethathiri Maharishi. (2007)).

Yoga is a practice originating in India which usually consists of physical exercises (stretches or asanas), breathing techniques and meditation or relaxation. It is taught in yoga classes, can be practiced by the individual or incorporated into stress management programmes. Yoga is claimed to have a range of physical, psychological and spiritual benefits (Pilkington, K., & CAM-Cancer Consortium. (2013)). Yoga-based interventions may prove to be an attractive option for the treatment of depression. The aim of this study is to systematically review the research evidence on the effectiveness of yoga (Pilkington, K., Kirkwood, G., Rampes, H., & Richardson, J. (2005)).

The 'bibliometric' term was coined by Alan Pritchard (1969) who described that bibliometrics was a simple statistical method of bibliography used to evaluate and quantify the growth of a subject. He also described the scope of the Librametry and defined Bibliometrics as the "statistical distribution of the processes relating to establish a theory for the structural aspects of a library". Eugene Garfield (1970) indicated that proper bibliometric analysis could identify the present focus of scientific research. Scientometrics is the developing science indicators. It also expedient the impact of science on society and comparing the output as well as the impact of science at National and International levels. Scientometric analysis is an important tool in analyzing any science and social science discipline. Scientometric is one of the tools for assess the research publications and use of statistical analysis to measure patterns of publications and citations, H-index, Impact Factor, Highly cited Papers, Highly cited references, dominant subject domain, most productive and cited authors, source etc.

II. OBJECTIVES OF THE STUDY

The main objective of this study was to use Scientometrics to analyze the Yoga Research Output:

1. To study the year wise distribution of publications;
2. To note the document wise distribution of publications;
3. To analyze the authorship pattern and examine the extent of research collaboration;
4. To illustrate journal wise distribution of publications;
5. To examine the country wise distribution of publications;
6. To assess the Institution wise research concentration;

III. METHODOLOGY

The study entitled "Yoga Research Output in India: A Scientometric Study" is a study encompassing records output with 525 and indexed in Web of Science online database. The present study analysis the research output of Researchers in the field of Yoga Research Output in India between the years of 1989 to 2018. The growth rates of output in terms of research productivity is analyze the study period. The authorship pattern and author productivity are examined to identify the pattern of research contribution in the field of Yoga Research Output in India. It is also analytical in nature in strengthening the empirical validity due to application of suitable statistical tools.

IV. DATA ANALYSIS AND INTERPRETATIONS

A. Year Wise Distribution of Publications

To analyze the year wise publication of research on yoga research output in India, the data has been presented in Table I. From the below table, we could clearly see that during the period 1989 - 2018 a total of 525 publications were published. In the present study the research output on Yoga Research Output in India is taken as a tool to evaluate the performance at various levels.

TABLE I SHOWS YEAR WISE DISTRIBUTION OF PUBLICATIONS

Year	No. of Publications	TLCS	TGCS
2016	65	12	122
2017	62	2	37
2015	51	22	129
2013	39	33	361
2011	33	25	396
2012	33	30	572
2014	33	19	312
2009	31	65	752
2010	27	25	367
2008	23	49	467
2005	16	53	856
2006	14	23	144
2007	14	38	509
2018	14	0	0
2004	9	22	199
1993	7	21	121
2001	6	8	147
2003	6	8	36
1991	5	9	59
1994	5	20	147
1995	5	6	54
2000	5	32	314
2002	5	21	170
1997	3	15	68
1998	3	0	13
1999	3	15	249
1989	2	2	31
1996	2	2	34
1992	1	0	17
Total	522	577	6683

The highest publication is 65 in 2016 with 122 Global Citation Scores followed by 62 papers in 2017 with 37 Global Citation Score and 51 papers in 2015 with 129 Global Citation Scores. It shows that even minimum numbers of records were scored higher global citations. The

study also reveals all these 525 publications have 6683 Citation scores it shows that there is a healthy trend in citing reference is found in yoga research output in India.

B. Document Wise Distribution of Publications

The study reveals that the major source of publications covered by Web of Science on Yoga Research Output in article (72%), while meeting abstract comprises (10.66%), letter comprises (6.47%), review comprises (4%), editorial material comprises (3.23%), article & proceedings paper comprises (1.7%), article and early access comprises (0.57%), correction comprises (0.57%), article and book chapter comprises (0.2%), book review comprises (0.2%), note comprises (0.2%) and poetry comprises (0.2%), article.

TABLE II SHOWS DOCUMENT WISE DISTRIBUTION OF PUBLICATIONS

S. No	Document Type	Records	Percent	TLCS	TGCS
1	Article	378	72	514	6148
2	Meeting Abstract	56	10.66	0	10
3	Letter	34	6.47	41	226
4	Review	21	4	8	184
5	Editorial Material	17	3.23	14	47
6	Article; Proceedings Paper	9	1.7	0	42
7	Article; Early Access	3	0.57	0	0
8	Correction	3	0.57	0	0
9	Article; Book Chapter	1	0.2	0	9
10	Book Review	1	0.2	0	0
11	Note	1	0.2	0	17
12	Poetry	1	0.2	0	0
	Total	525	100.00		

C. Ranking of Authors Based on Publications

Table III indicates ranking of authors by number of publications. Author "Nagendra H.R." published highest number of articles for the study period with 64 records and received 1180 citations, next author "Telles S" published with 52 records. "Orimo S" having highest Global Citation Scores of 1115 with just 20 publications. Thus the most-cited authors are distinguished from the most-published ones.

D. Country Wise Distribution of Publications

The table IV shows around 33 countries, the study tops first place goes to India with 283 (45.2%) publications followed by United States of America with 118 (18.8), and Japan 107 (17%) research publications respectively. India secured first rank having total Global Citation Score of 2772 with 283 publications.

TABLE III SHOWS RANKING OF AUTHORS (TOP 30)

S. No.	Author	Records	Percent	TLCs	TGCS	TLCR
1	Nagendra HR	64	12.2	138	1180	70
2	Telles S	52	9.8	145	741	92
3	Nagarathna R	44	8.3	92	934	75
4	Gangadhar BN	25	4.7	35	226	36
5	Varambally S	23	4.3	38	275	38
6	Agarwal BB	22	4.1	30	178	30
7	Hayashi Y	21	4.0	30	238	30
8	Matsuda R	21	4.0	30	238	30
9	Orimo S	20	3.8	76	1115	76
10	Raghuram N	18	3.4	27	323	28
11	Mooney K	16	3.0	13	57	21
12	Naveen KV	15	2.8	27	135	15
13	Manjunath NK	13	2.5	15	117	15
14	Signorile JF	13	2.5	10	49	21
15	Thirthalli J	13	2.5	29	165	12
16	Hankey A	12	2.3	6	54	7
17	Ni M	12	2.3	13	57	12
18	Yoshio M	12	2.3	5	200	5
19	Wakabayashi K	11	2.1	42	630	53
20	Gopinath KS	10	1.9	31	439	18
21	Subramanya P	10	1.9	10	45	23
22	Takahashi H	10	1.9	33	541	51
23	Uchihara T	10	1.9	36	573	54
24	Ajaikumar BS	9	1.7	10	177	15
25	Balkrishna A	9	1.7	2	38	18
26	Cohen L	9	1.7	3	70	10
27	Dwivedi N	9	1.7	6	12	8
28	Jagannathan A	9	1.7	10	78	8
29	Arun B	8	1.5	3	70	10
30	Gunawardhana N	8	1.5	3	137	4

E. Journal Wise Distribution of Publications

The study found that the total research output of the Yoga Research Output in India for the study period (1989 – 2018) published in 259 journals. The journal “Journal of Alternative and Complementary Medicine” topped with 24 publications with the Global Citation Score of 593; next “Indian Journal of Traditional Knowledge” has 20 publications with the Global Citation Score of 34 and

“Indian Journal of Psychiatry” with 16 publications with the Global Citation Score of 149. “Journal of Alternative and Complementary Medicine” has scored the highest Global Citation Score of 593 with 24 publications.

TABLE IV SHOWS COUNTRY WISE DISTRIBUTION OF PUBLICATIONS

S. No.	Country	Records	Percent	TLCs	TGCS
1	India	283	45.2	338	2772
2	USA	118	18.8	78	1538
3	Japan	107	17	135	2258
4	UK	18	2.8	21	337
5	Australia	12	1.9	3	139
6	Germany	10	1.5	4	254
7	Peoples R China	8	1.2	3	77
8	Canada	7	1.1	6	68
9	Iran	7	1.1	1	53
10	Spain	5	1	3	21
11	Brazil	4	0.6	2	55
12	Netherlands	4	0.6	3	119
13	Italy	3	0.5	0	35
14	Singapore	3	0.5	5	96
15	Taiwan	3	0.5	0	28
16	Colombia	2	0.3	0	9
17	Indonesia	2	0.3	0	5
18	Nepal	2	0.3	0	0
19	Saudi Arabia	2	0.3	0	11
20	South Korea	2	0.3	0	14
21	Thailand	2	0.3	0	0
22	Turkey	2	0.3	0	0
23	France	1	0.2	0	6
24	Iraq	1	0.2	0	23
25	Israel	1	0.2	0	0
26	Malaysia	1	0.2	0	1
27	Mexico	1	0.2	1	53
28	New Zealand	1	0.2	0	5
29	Oman	1	0.2	1	53
30	Russia	1	0.2	0	28
31	Sweden	1	0.2	0	0
32	Switzerland	1	0.2	0	4
33	Tunisia	1	0.2	1	53

TABLE V DISTRIBUTION OF YOGA RESEARCH OUTPUT IN JOURNAL PUBLICATIONS

S. No.	Journal	Records	Percent	TLCS	TGCS	TLCR
1	Journal of Alternative and Complementary Medicine	24	4.6	58	593	24
2	Indian Journal of Traditional Knowledge	20	3.8	4	34	9
3	Indian Journal of Psychiatry	16	3.0	24	149	14
4	Complementary Therapies in Medicine	15	2.9	23	227	33
5	Perceptual and Motor Skills	14	2.7	35	208	17
6	Surgical Endoscopy and other Interventional Techniques	13	2.5	25	124	11
7	Journal of Clinical and Diagnostic Research	12	2.3	2	8	5
8	Medicine and Science in Sports And Exercise	12	2.3	0	1	0
9	International Review of Psychiatry	10	1.9	3	18	24
10	Medical Science Monitor	9	1.7	16	63	19
11	Applied Psychophysiology and Biofeedback	8	1.5	51	209	10
12	Complementary Therapies in Clinical Practice	6	1.1	7	58	16
13	Journal of Clinical Oncology	6	1.1	2	69	6
14	Chromatographia	5	1.0	8	64	8
15	Evidence-Based Complementary and Alternative Medicine	5	1.0	2	43	12
16	Indian Journal of Palliative Care	5	1.0	0	0	8
17	Analytical Sciences	4	0.8	0	32	7
18	Archives of Surgery	4	0.8	4	20	3
19	Bmc Complementary and Alternative Medicine	4	0.8	0	51	5
20	Integrative Cancer Therapies	4	0.8	13	206	7
21	Journal of Acupuncture and Meridian Studies	4	0.8	1	3	1
22	Journal of Power Sources	4	0.8	3	69	4
23	Journal of Religion & Health	4	0.8	1	7	1
24	World Journal of Stem Cells	4	0.8	4	11	8
25	Acta Neuropathologica	3	0.6	14	236	11
26	Alternative Therapies in Health and Medicine	3	0.6	5	149	3
27	Clinical Eeg and Neuroscience	3	0.6	6	11	10
28	European Journal of Integrative Medicine	3	0.6	0	4	3
29	European Psychiatry	3	0.6	0	0	0
30	Indian Journal of Natural Products and Resources	3	0.6	2	2	1

TABLE VI INSTITUTION WISE DISTRIBUTION OF PUBLICATIONS (TOP 30)

S. No.	Institution	Records	Percent	TLCS	TGCS
1	Swami Vivekananda Yoga AnusandhanaSamsthana	40	7.6	12	252
2	NatlInstHlthSci	39	7.4	35	713403
3	NatlInst Mental Hlth&Neurosci	28	5.3	33	227
4	DrAgarwalsSurg& Yoga	22	4.2	30	178
5	Swami Vivekananda Yoga Res Fdn	22	4.2	63	387
6	Kanto Cent Hosp	19	3.6	62	873
7	Sir Ganga Ram Hosp	18	3.4	27	157
8	University Miami	17	3.2	13	58
9	Harvard University	12	2.3	26	451
10	Saga University	12	2.3	5	200
11	Patanjali Res Fdn	11	2.1	8	37

12	Vivekananda Yoga Res Fdn	11	2.1	11	177
13	HirosakiUniversity	10	1.9	35	554
14	KripaluCtr Yoga & Hlth	10	1.9	14	197
15	Niigata University	10	1.9	33	541
16	S VYASA University	10	1.9	4	7
17	SVYASA	10	1.9	18	143
18	Vivekananda Kendra Yoga Res Fdn	10	1.9	48	193
19	Tokyo Metropolitan InstNeurosci	9	1.7	35	565
20	NatlInst Mental Hlth & Neurosci NIMHANS	8	1.5	3	28
21	Swami Vivekananda Yoga AnusandhanaSamsthanaUniversity	8	1.5	8	56
22	Green Monkey Yoga	7	1.3	4	20
23	Morarji Desai NatlInst Yoga	7	1.3	23	181
24	PatanjaliYogpeeth	7	1.3	17	119
25	Univ Texas MD Anderson CancCtr	7	1.3	3	69
26	YokufukaiGeriatrHosp	7	1.3	37	498
27	NATL INST HYG SCI	6	1.1	10	62
28	SVYASA Yoga University	6	1.1	1	12
29	University Penn	6	1.1	10	151
30	Yoga Allergy Clin	6	1.1	2	57

TABLE VII SHOWS HIGHLY CITED PAPERS

S. No.	Date / Author / Journal	LCS	GCS	LCR	CR
1	38Orimo S, Ozawa E, Nakade S, Sugimoto T, Mizusawa H I-123-metaiodobenzylguanidinemyocardialscintigraphy in Parkinson's disease, Journal of Neurology Neurosurgery and Psychiatry. 1999 Aug; 67(2), 189-194	15	246	0	37
2	78Orimo S, Amino T, Itoh Y, Takahashi A, Kojo T, <i>et al.</i> , Cardiac sympathetic denervation precedes neuronal loss in the sympathetic ganglia in Lewybody disease Acta Neuropathologica. 2005 Jun; 109(6), 583-588	9	148	4	30
3	103Orimo S, Takahashi A, Uchiyama T, Mori F, Kakita A, <i>et al.</i> , Degeneration of cardiac sympathetic nerve begins in the early disease process of Parkinson's disease Brain Pathology. 2007 Jan; 17(1), 24-30	4	134	6	35
4	43Nagakura T, Matsuda S, Shichijyo K, Sugimoto H, Hata K Dietary supplementation with fish oil rich in omega-3 polyunsaturated fatty acids in children with bronchial asthma European Respiratory Journal. 2000 Nov; 16(5), 861-865	0	133	0	18
5	149Danahauer SC, Mihalko SL, Russell GB, Campbell CR, Felder L, <i>et al.</i> , Restorative yoga for women with breast cancer: findings from a randomized pilot study Psycho-Oncology. 2009 Apr, 18(4), 360-368	5	123	3	39
6	192 Streeter CC, Whitfield TH, Owen L, Rein T, Karri SK, <i>et al.</i> , Effects of Yoga Versus Walking on Mood, Anxiety, and Brain GABA Levels: A Randomized Controlled MRS Study, Journal of Alternative and Complementary Medicine. 2010 Nov, 16(11), 1145-1152	10	118	0	35
7	71Amino T, Orimo S, Itoh Y, Takahashi A, Uchiyama T, <i>et al.</i> , Profound cardiac sympathetic denervation occurs in Parkinson disease Brain Pathology. 2005 Jan, 15(1), 29-34	10	108	4	39
8	145Raghavendra RM, Vadiraja HS, Nagarathna R, Nagendra HR, Rekha M, <i>et al.</i> , Effects of a Yoga Program on Cortisol Rhythm and Mood States in Early Breast Cancer Patients Undergoing Adjuvant Radiotherapy: A Randomized Controlled Trial, Integrative Cancer Therapies. 2009 Mar, 8(1), 37-46	8	108	4	71
9	110Banerjee B, Vadiraj HS, Ram A, Rao R, Jayapal M, <i>et al.</i> , Effects of an integrated yoga program in modulating psychological stress and Radiation Induced genotoxic stress in breast cancer patients undergoing radiotherapy, Integrative Cancer Therapies. 2007 Sep, 6(3), 242-250	5	95	0	47
10	146Satyapriya M, Nagendra HR, Nagarathna R, Padmalatha V Effect of integrated yoga on stress and heart rate variability in pregnant women International Journal of Gynecology & Obstetrics. 2009 Mar, 104(3), 218-222	10	93	4	24

F. Institution Wise Distribution of Publications

The table VI analysis indicates Institution-wise research productivity. It is noted that 713 institutions were contributed 525 of the total research productivity. It is noted that Swami Vivekananda Yoga Anusandhana Samsthana contributed the highest number of research publications with (40) at the same time it ranks first in terms of Global Citation Score 252 followed by National Institute Health Science with 39 Publications and received 403 citations.

G. Highly Cited Papers

Highly Cited paper is identified through papers are arranged in descending order according to Citations.

V. FINDINGS AND CONCLUSION

1. In this paper 525 articles were published. Moreover, the dynamics of collaboration among authors and researchers in this field have clearly increased.
2. The quantitative techniques revealed active contributors and useful information for scientific researchers in this field and characteristics of highly cited articles.
3. The study found that 8 papers are received 100 and above citations. The range of Citation is 1-246.
4. The study found that overall h-index 45 and Citations are 6683.
5. The great growth of publications and citations in Yoga Research increased evidently.
6. The study found that 232 papers are published in open access journals.
7. The study found that i10 index 164.
8. The study found 839 Self-Citations out of 6683.

This study aims to investigate the yoga research over a period of 30 years from 1989 – 2018 using publications data from the Web of Science database. The study reveals that 525 publications with 6683 Citation scores it shows that there is a healthy growth in citing reference is found in yoga research output in India. Among the 33 countries, India ranked first forming total Global Citation Score of 2772 with 283 publications. In open access journals the study published 232 papers. Yoga is an upcoming field in complementary and alternative system of healing. In recent years more studies are published on these concepts. This will likely be a promising direction for future yoga studies.

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