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Covid-19 and Food & Nutrition: A Scientometric Assessment of Global Publications During 2020-21

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The study presents a scientometric analysis of 878 globally published publications on 'Covid-19 and Food & Nutrition' research with the aim to understand the status of research at the global, national, institutional and individual level. The data retrieved for the study was sourced from the Scopus database covering the period from 2020-21. The study provides an insight characteristics and performance of 'Covid-19 and Food & Nutrition' research, using scientometric indicators to evaluate the productivity and performance of the most productive countries, organisations, authors, journals and high-cited papers. The VOS viewer and Biblioshiny were used to visually display bibliometric network of countries, organisations, authors, high-cited papers, journals and keywords respectively.The USA tops as the most productive country in the subject. The study also provides a window to key institutions and authors in 'Covid-19 and Food & Nutrition'. Nutrients and Clinical Nutrition ESPEN were observed to be most productive journals. The results from this study may provide valuable information for researchers and policy-makers to identify present and future hotspots in 'Covid-19 and Food & Nutrition' research.

Keywords: *Covid-19, Food & Nutrition, Pandemic, Dietary Supplements, Scientometrics*

1 INTRODUCTION

Coronavirus Disease-2019 (COVID-19) is an infectious disease caused by

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"Severe Acute Respiratory Syndrome-Corona Virus-2 (SARS-CoV-2)". SARS-CoV-2 is the mostvirulent and its rate of transmission is also much higher than that of SRAS-CoV[1]. The first case of COVID-19 outbreak was reported in Wuhan, China on 31st December 2019 that spread rapidly, resulting in an epidemic throughout China, also to other countries. It brought about a pandemic with millions of mortalities all over the world. On 30thJanuary 2020, World Health Organisation (WHO) declared COVID-19 as pandemic as a Public Health Emergency of International Concern (PHEIC). The numbers have increased at an exponential level from there, so confining the pandemic statistics at this moment seems impractical. As of 3rd August 2021 at, 6:00 pm, a number of 198 778 175 confirmed cases are reported from 223 countries, areas or territories and a death toll of 4 235 559 have been confirmed globally [2].

Hippocrates once said '*let food be thy medicine and medicine be thy food'*. Fast forward to 2021, Covid-19 is still around and it's safe to say it still holds true after 2500 years. Food nutrients play a major role in immune system which helps to fight against infectious diseases. It is important to realise that during the Covid-19 outbreak the food and lifestyle have become a matter of life and death. The current measures to fight the spread of the disease are primarily aimed at preparing the body to produce antibodies against this virus. Certain food rich with vitamins and minerals playsa crucial role in management of COVID19 infections. Therefore in the present study we aim to shed light on role of dietary components and their efficacy against COVID19 disease.

11 LITERATURE REVIEW

Only one bibliometric study exists on this topic in this study, Muley and Medithi, Srujana presented a bibliometric assessment of research (93 records) on the role of nutrition in treating COVID-19, using Scopus database during 2020-21. The authors identify the active countries where the research was conducted, various types of documents wherein the research was published, the most prominent scientific subject areas under which these documents were published, top 10 authors in this research area, their affiliations, publications as per the number of authors, top funding agencies, month-wise analysis of publications and list of active journals which have published the documents. The study examines the content of papers published by listing the top 5 most cited articles and analysing them using word cloud. The present analysis reveals the current research trend of nutritional therapy to combat COVID-19 symptoms and provides potential hot spots for future research and some of the studies were referred [3-15].

Since no comprehensive bibliometric study exists on this topic, the authors decided to undertake the present bibliometric study at global level on the topic

'Covid-19 and Food & Nutrition' with the objective to analyse the literature characteristics, subject scatter and identification of significant keywords and the major players (countries, organisations, authors and journals) and also study their collaborative linkages.

2 METHODOLOGY

The authors performed a bibliometric search on the theme 'Covid-19 and Food & Nutrition' using a well-organised search strategy, which identified, retrieved and downloaded all relevant publications records from the Scopus database (https://www.scopus.com) on this theme. The search strategy using two set of keywords related to 'Covid-19' and 'Food & Nutrition'in field tags, 'Keyword' or 'Title' (Article Title) and limiting the search to 2020-1.8.21 period. The search yielded 878 records, which were further analysed using additional analytical provisions in the Scopus database.

((TITLE ("COVID 19" OR "2019 novel coronavirus" OR "coronavirus 2019" OR "coronavirus disease 2019" OR "2019-novel CoV" OR "2019 ncov" OR covid 2019 OR covid19 OR "corona virus 2019" OR ncov-2019 OR ncov2019 OR "nCoV 2019" OR 2019-ncov OR covid-19 OR "Severe acute respiratory syndrome coronavirus 2" OR "SARS-CoV-2") OR KEY ("COVID 19" OR "2019 novel coronavirus" OR "coronavirus 2019" OR "coronavirus disease 2019" OR "2019-novel CoV" OR "2019 ncov" OR covid 2019 OR covid19 OR "corona virus 2019" OR ncov-2019 OR ncov2019 OR "nCoV 2019" OR 2019-ncov OR covid-19 OR "Severe acute respiratory syndrome coronavirus 2" OR "SARS-CoV-2") and Key (vitamin D deficiency)) or (TITLE ("COVID 19" OR "2019 novel coronavirus" OR "coronavirus 2019" OR "coronavirus disease 2019" OR "2019-novel CoV" OR "2019 ncov" OR covid 2019 OR covid19 OR "corona virus 2019" OR ncov-2019 OR ncov2019 OR "nCoV 2019" OR 2019-ncov OR covid-19 OR "Severe acute respiratory syndrome coronavirus 2" OR "SARS-CoV-2") OR KEY ("COVID 19" OR "2019 novel coronavirus" OR "coronavirus 2019" OR "coronavirus disease 2019" OR "2019-novel CoV" OR "2019 ncov" OR covid 2019 OR covid19 OR "corona virus 2019" OR ncov-2019 OR ncov2019 OR "nCoV 2019" OR 2019-ncov OR covid-19 OR "Severe acute respiratory syndrome coronavirus 2" OR "SARS-CoV-2") and Key (micronutrient* or nutrition or nutrient* or diet* or nutrition therapy or dietary suppl* or Food* or probiotics or prebiotics or synbiotics)))

3 ANALYSIS AND RESULTS

31 OVERALL OUTPUT

Scholars, globally, have published 878 publications (2020=463; 2021=415) on 'Covid-19 and Food & Nutrition' as reflected in indexed publications in Scopus database on 1.8.2021. These 878 publications received 11032 citations, averaging 12.56 citations per publication. Of the 878 global publications on this theme, 176 (20.04%) received external funding support from 100+ global research agencies and they together registered 2992 citations, averaging 17.0 citations per paper. The leading funding agencies providing support (along with their output) to research in this area are National Institute of Health, USA (38 papers), U. S. Department of Health & Human Sciences (25 papers), National Institute of Health Research (17 papers), Brazilian Agency for Scientific Research (10 papers), National Natural Science Foundations of China (9 papers each), etc. Of the 878 global publications, articles constituted the largest global share (46.81%), followed by reviews and letters (27.11% and 15.15%), editorials and notes (5.35% and 4.78%), book chapters and conference papers (0.46% and 0.23%) and short survey 0.11%).

32 TOP 10 COUNTRIES

101 countries unevenly participated in global research on 'Covid-19 and Food & Nutrition': 76 countries contributed 1-10 papers each, 11 countries 11-20 papers each, 10 countries 21-50 papers each and 4 countries 51-203 papers each. The top 10 countries individually contributed 28 to 203 paper each and together contributed 84.74% and 95.99% share in global publications and citations. Among top 10 countries, the largest contribution is made by USA (with 23.12% global share), followed by Italy and U.K. (16.17% and 12.64%), India (7.86%), China, Iran, Turkey, Spain. Australia and Poland (from 3.19% to 5.69%). Five out of top 10 countries registered citations per paper and relative citation index higher than their group average (14.23 and 1.13), Spain (21.2 and 1.69), China (20.5 and 1.63), Italy (17.32 and 1.38), U.K. (17.3 and 1.38) and Poland (14.71 and 1.17). The share of international collaborative papers of top 10 countries varied from 23.68% to 89.66%, with an average of 45.03% (Table 1).

Table 1. Profile of Top 10 Countries in Global Output in 'Covid-19 and Food & Nutrition'

S. No.	Country	TP	TC	CPP	H-Index	ICP	%ICP	RCI	% TP
1	United States	203	2811	13.85	25	88	43.35	1.10	23.12
2	Italy	142	2459	17.32	23	55	38.73	1.38	16.17
3	U.K.	111	1920	17.30	20	58	52.25	1.38	12.64
4	India	69	559	8.10	10	25	36.23	0.65	7.86
5	China	50	1025	20.50	14	24	48.00	1.63	5.69
6	Iran	44	245	5.57	9	15	34.09	0.44	5.01
7	Turkey	38	201	5.29	7	9	23.68	0.42	4.33
8	Spain	30	636	21.20	12	18	60.00	1.69	3.42
9	Australia	29	322	11.10	8	26	89.66	0.88	3.30
10	Poland	28	412	14.71	8	17	60.71	1.17	3.19
Total		744	10590	14.23	13.6	335	45.03	1.13	84.74
Global Total		878	11032	12.56					
Share of top 10 countries in global output		84.74	95.99						

TP=Total papers; TC=Total citations; CPP=Citations per paper; ICP=International collaborative papers; RCI=Relative citation index

321 COLLABORATIVE LINKAGES AMONG TOP 10 COUNTRIES

The total collaborative linkages among top 10 countries on 'Covid-19 and Food & Nutrition' varied each from 10 to 74 and individual country-to-country linkages varied from 1 to 18. The top 3 countries depicting the largest collaborative linkages (74, 56 and 46) comes from the USA, Italy and U.K. The largest country-to-country collaborative linkages (18) are made by USA–Italy, followed by USA–U.K. (15 linkages), USA-India (9 linkages), etc. (Table 2). A collaborative network chart covering the top 10 countries is presented in Figure 1 using Biblioshiny. The countries with the same colour belong to a single cluster. The thickness of links between the countries and the distance between them represents the degree of their research collaboration. The bigger the diameter of a network node and its font size, the bigger its weight in research collaboration. USA dominates in the green cluster, followed by the Italy in red cluster respectively.

Table 2.Size of Collaborative Linkages among Top 10 Countries

S.No	Name of the country	Collaborative linkages with othertop 10 countries	Total collaborative linkages
1	United States	2(18), 3(15), 4(9), 5(7), 6(4), 7(1), 8(5), 9(6), 10(9)	74(9)
2	Italy	1(18), 3(7), 4(2), 5(3), 6(2), 7(5), 8(11), 9(3), 10(5)	56(9)
3	U.K.	1(15), 2(7), 4(3), 5(3), 6(3), 7(1), 8(3), 9(6), 10(5)	46(9)
4	India	1(9), 2(2), 3(3), 5(1), 6(2), 9(2), 10(1)	20(7)
5	China	1(7), 2(3), 3(3), 4(1), 8(2), 7(2), 8(2), 9(3), 10(2)	25(9)
6	Iran	1(4), 2(2), 3(3), 4(2), 5(2), 10(2)	15(6)
7	Turkey	1(1), 2(5), 3(1), 5(2), 8(2), 10(2)	13(6)
8	Spain	1(3), 3(2), 5(2), 7(2), 10(1)	10(5)
9	Australia	1(3), 2(3), 3(6), 4(2), 5(3), 10(2)	19(6)
10	Poland	1(9), 2(6), 3(5), 4(1), 5(2), 6(2), 7(2), 8(1), 9(2)	30(9)

Figure 1.Collaboration Network of Top 10 Countries

33 SUBJECT-WISE DISTRIBUTION OF PUBLICATIONS

On classifying 878 publications on 'Covid-19 and Food & Nutrition' according to Scopus database classification, it was observed that Medicine account for the largest share (72.32%) in the total output, followed by Nursing (26.31%), Biochemistry, Genetics & Molecular Biology (18.11%), Agricultural & Biological Sciences (14.01%), Pharmacology, Toxicology & Pharmaceutics complications (8.09%), Immunology & Microbiology (7.63%) and Environment Science (3.19%). In terms of impact, publications on Nursing registered the highest citation impact per paper (26.31) and Environment Science the least (6.07).

331 SIGNIFICANT KEYWORDS

The 46 significant keywords (with frequency of appearance varying from 33 to 869) have been identified from the literature, which throw light on the trends of research on his theme. The largest frequency of occurrence (869) was reported by keyword Covid-19, followed by pandemic (458), Vitamin D (420), Vitamin D Defiency (385), etc (Table 3). The overlay visualization helped to understand the evolution of research. The co-occurrence of top 46 keywords using the VOSviewer tool was investigated over the entire analysed period. After being analysed, there were 4 clusters formed. Cluster 1 in red color represents 20 items followed by cluster 2 in green colour with 12 items, cluster 3 in blue colour with 8 items and cluster 4 in yellow colour with 6 items respectively, which shows the relationship between one topic and another. The more often a keyword appears, the greater the size of the letters and frames as shown in Figure 2.

Table 3. List of Significant Keywords appearing in Literature on "Covid-19 and Food & Nutrition"

S.No.	Keywords	TP	S.No	Keywords	TP	S.No	Keywords	TP
1	Covid-19	869	17	Vitamins	96	33	Malnutrition	54
2	Pandemic	458	18	Zinc	96	34	Food Intake	53
3	Vitamin D	420	19	Nutritional Status	87	35	Oxidation Stress	53
4	Vitamin D Deficiency	385	20	Diet Supplementation	86	36	Probiotic Agents	52
5	Dietary Supplements	297	21	Diabetes Mellitus	84	37	Drug Therapy	50
6	Virus Pneumonia	265	22	Hypertension	84	38	Lifestyle	50
7	Vitamin Supplementation	176	23	Interleuk 6	83	39	Feeding Behavior	49
8	Risk Factors	173	24	Nutrition	83	40	Selenium	44
9	Virology	128	25	Cytokine Storm	81	41	Non-Insulin Dependent Diabetes Mellitus	42
10	Obesity	126	26	Immune System	79	42	Omega 3 Fatty Acids	42
11	Comorbidity	114	27	Colecalciferol	74	43	Antioxidants	36
12	Inflammation	113	28	Diet Therapy	70	44	Calcium	35
13	Ascorbic Acid	112	29	Immunomodulation	64	45	Nutritional Supplements	34
14	Dietary Intake	103	30	Respiratory Tract Infection	64	46	Magnesium	33
15	Metabolism	103	31	Cardiovascular Disease	56			
16	25 Hydroxyvitamin D	98	32	Anti-Viral Activity	54	TP=Total papers		

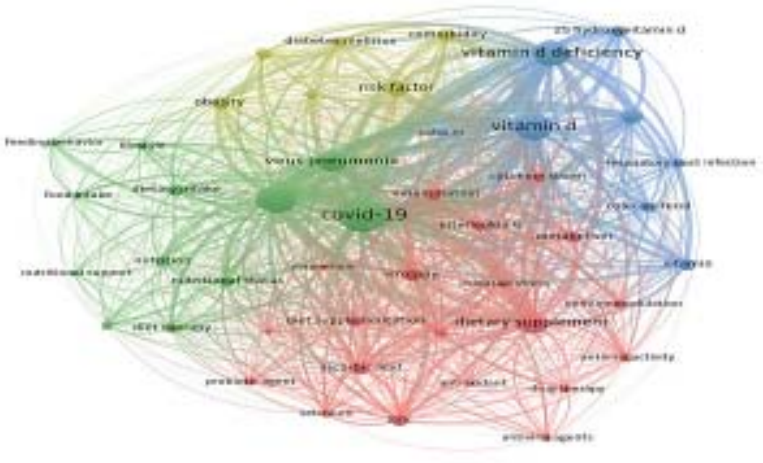

Figure 2. Keyword network Visualization Map

34 PROFILE OF TOP 15 ORGANISATIONS

In all 367 organisations participated unevenly in global research on 'Covid-19 and Food & Nutrition': 319 organisations contributed 1-5 paper each, 38 organisations 6-10 papers each and 10 organisations 11-19 papers each. The top 15 organisations individually contributed 9 to 19 papers and together contributed 20.05% (176 papers) and 20.86% (2301 citations) respectively share in global publications and citations. On further analysis, it was observed that: (i) Five organisations contributed papers higher than their group average (11.73) and (ii) Six organisations registered citation per paper and relative citation index above their group average (13.07 and 1.04). Table 3 lists the top 7 most productive and 5 most impactful organisations (Table 4). A collaborative networks chart of top 15 organisations is presented in Figure 3 by using Biblioshiny. The more the number of publications the larger the hub size in the visualization network chart. The collaborative network is divided into 6 clusters.

Table 4. Profile of Top 5 Most Productive and Most Impactful Organisations on 'Covid-19 and Food & Nutrition'

S.No	Name of the Organization	TP	TC	CPP	HI	ICP	% ICP	RCI
Top 7 Most Productive Organizations								
1	Sapienza University of Rome, Italy	19	299	15.74	8	7	36.84	1.25
2	Harvard Medical School, USA	16	141	8.81	7	5	31.25	0.70
3	Trinity College, Dublin, Ireland	13	348	26.77	6	10	76.92	2.13
4	University of Liverpool, U.K.	13	328	25.23	6	10	76.92	2.01
5	Shahid Beheshti University of Medical Sciences, Iran	12	81	6.75	5	4	33.33	0.54
Top 7 Most Impactful Organizations								
1	Universita degli Studi di Milan, Italy	11	414	37.64	5	3	27.27	3.00
2	Trinity College, Dublin, Ireland	13	348	26.77	6	10	76.92	2.13
3	University of Liverpool, U.K.	13	328	25.23	6	10	76.92	2.01
4	Universita degli Studi di Pavia, Italy	9	157	17.44	6	4	44.44	1.39
5	Universita degli Studi di Napoli Federico 11, Italy	11	191	17.36	5	6	54.55	1.38

TP=Total papers; TC=Total citations; CPP=Citations per paper; ICP=International collaborative papers; RCI=Relative citation index

Table 5. Profile of Top 15Organisations on 'Covid-19 and Food & Nutrition'

S.No	Name of the Organisation	TP	TC	CPP	HI	ICP	%ICP	RCI
1	Sapienza University of Rome, Italy	19	299	15.74	8	7	36.84	1.25
2	Harvard Medical School, USA	16	141	8.81	7	5	31.25	0.70
3	Trinity College, Dublin, Ireland	13	348	26.77	6	10	76.92	2.13
4	University of Liverpool, U.K.	13	328	25.23	6	10	76.92	2.01
5	Shahid Beheshti University of Medical Sciences, Iran	12	81	6.75	5	4	33.33	0.54
6	Universita degli Studi di Napoli Federico 11, Italy	11	191	17.36	5	6	54.55	1.38
7	University of Birmingham, U.K.	11	68	6.18	5	6	54.55	0.49
8	Tehran University of Medical Sciences, Iran	11	66	6.00	5	2	18.18	0.48
9	Universita degli Studi di Milan, Italy	11	414	37.64	5	3	27.27	3.00
10	University Hospital of Ghent, Belgium	11	30	2.73	3	2	18.18	0.22
11	King Saud University, Saudi Arabia	10	41	4.10	4	5	50.00	0.33
12	Brigham & Women's Hospital, USA	10	65	6.50	5	0	0.00	0.52
13	University of Ghent, Belgium	10	46	4.60	3	2	20.00	0.37
14	Universita degli Studi di Pavia, Italy	9	157	17.44	6	4	44.44	1.39
15	Research Foundation – Flanders Belgium	9	26	2.89	2	1	11.11	0.23
		176	2301	13.07	5	67	38.07	1.04
		878	11032	12.56				
		20.05	20.86					

Figure 3. Collaboration Network of Top 15 Organization

35 PROFILE OF TOP 15 AUTHORS

474 authors participated unevenly in global research on 'Covid-19 and Food & Nutrition': 283 authors contributed 1 paper each, 121 authors 2 papers each, 59 authors 3 papers each, 11 authors 4-5 papers each and 14 authors 6-9 papers each. The top 15 authors individually contributed 5 to 9 papers each and together contributed 11.5% (101) and 16.01% (1766) shares in global publications and citations. On further analysis, it was observed that: (i) Six authors contributed papers higher than their group average (6.73) and (ii) Five authors registered citation per paper and relative citation index above their group average (17.49 and 1.41). Table 3 lists the top 7 most productive and 5 most impactful organizations (Table 6).

Table 6. Profile of Top 6 Most Productive and Most Impactful Authorson 'COVID-19 and Food & Nutrition'

S.No	Name of the Author	Affiliation of the Author	TP	TC	CPP	HI	ICP	%ICP	RCI
Top 7 Most Productive Authors									
1	J.R. Delanghe	University Hospital of Ghent, Belgium	9	26	2.89	2	0	0.00	0.23
2	R.A. Kenny	Trinity College Dublin, Ireland	9	26	2.89	5	8	88.89	0.23
3	M.M. Speeckaert	University Hospital of Ghent, Belgium	9	26	2.89	2	0	0.00	0.23
4	A. Giustina	Universita Vita-Salute San Raffaele, Italy	7	56	8.00	5	2	28.57	0.64
5	E. Laird	Trinity College Dublin, Ireland	7	245	35.00	4	7	100.00	2.79
6	S. Subramanian	Trinity College Dublin, Ireland	7	187	26.71	4	7	100.00	2.13
7	R. Caccialanza	Fondazione IRCCS Policlinica San Matteo, Italy	6	130	21.67	4	0	0.00	1.73
Top 7 Most Impactful Authors									
1	W.B.Grant	Nutrition & Health Research Center, USA	6	674	112.33	3	2	33.33	8.94
2	E. Laird	Trinity College Dublin, Ireland	7	245	35.00	4	7	100.00	2.79
3	S. Subramanian	Trinity College Dublin, Ireland	7	187	26.71	4	7	100.00	2.13
4	A.R. Martineau	Barts & The London School of Medicine & Dentistry,, U.K.	6	153	25.50	4	2	33.33	2.03
5	R. Caccialanza	Fondazione IRCCS Policlinica San Matteo, Italy	6	130	21.67	4	0	0.00	1.73
6	M.F.Holick	Boston University School of Medicine, USA	6	104	17.33	4	0	0.00	1.38
7	A. Giustina	Universita Vita-Salute San Raffaele, Italy	7	56	8.00	5	2	28.57	0.64

S.No	Name of the author	Affiliation of the author	TP	TC	CPP	HI	ICP	%ICP	RCI
1	J.R. Delanghe	University Hospital of Ghent, Belgium	9	26	2.89	2	0	0.00	0.23
2	R.A. Kenny	Trinity College Dublin, Ireland	9	26	2.89	5	8	88.89	0.23
3	M.M. Speeckaert	University Hospital of Ghent, Belgium	9	26	2.89	2	0	0.00	0.23
4	A. Giustina	Universita Vita-Salute San Raffaele, Italy	7	56	8.00	5	2	28.57	0.64
5	E. Laird	Trinity College Dublin, Ireland	7	245	35.00	4	7	100.00	2.79
6	S. Subramanian	Trinity College Dublin, Ireland	7	187	26.71	4	7	100.00	2.13
7	R. Caccialanza	Fondazione IRCCS Policlinica San Matteo, Italy	6	130	21.67	4	0	0.00	1.73
8	E. Cereda	Fondazione IRCCS Policlinica San Matteo, Italy	6	29	4.83	4	4	66.67	0.38
9	L. Ferder	CONICET, Argentina	6	29	4.83	4	4	66.67	0.38
10	W.B.Grant	Nutrition & Health Research Center, USA	6	674	112.33	3	2	33.33	8.94
11	M.F.Holick.	Boston University School of Medicine, USA	6	104	17.33	4	0	0.00	1.38
12	F.Inserra	CONICET, Argentina	6	29	4.83	4	4	66.67	0.38
13	W.Manucha	CONICET, Argentina	6	29	4.83	4	4	66.67	0.38
14	A.R. Martineau	Barts & The London School of Medicine & Dentistry,, U.K.	6	153	25.50	4	2	33.33	2.03
15	M. Hewison	University of BIrgham, U.K.	5	23	4.60	2	3	60.00	0.37
			101	1766	17.49	3.67	47	46.53	1.39
			878	11032	12.56				
			11.50	16.01					

A collaborative networks visualization chart of the top 15 most authors is presented in Figure 4. The thickness of the box is proportional to its number of collaborative publications. The bigger the box size and its font size, the more the number of collaborative publications. The chart suggests there has been active collaboration amongst the most productive authors are grouped into 7 clusters. The cluster 1 has five authors followed by cluster 2 with 3 authors, cluster (3 and 4) has 2 authors each and cluster (5 to 7) has one author each.

Figure 4. Collaboration Network of Top 15 Authors

36 PROFILE OF TOP 15 JOURNALS

Of the total 878 global publications on 'Covid-19 and Food & Nutrition', 871 publications are published in 212 journals, 5 in book series and 1 each in trade journal and in conference proceeding. Of the 212 journals participated unevenly in global research on 'Covid-19 and Food & Nutrition': 185 journals contributed 1-5 papers each, 20 journals 6-10 papers each, 6 journals 11-20 3 papers each and 1 journal 86 papers. Top 15 journals that published the most papers are presented in Table 8, and these 15 journals contributed 26.41% (230) of total publications in this research field.

On further analysis it was found that (i) the top 5 most productive journals include Nutrients (86 papers), Clinical Nutrition Espen (17 papers), International Journal of Environmental Research & Public Health (16 papers), Journal of Medical Virology and Medical Hypotheses (12 papers each); and (ii) the top five journals in terms of citation impact per paper are: *Journal of Medical Virology (52.42), Diabetes & Metabolic Syndromes. Clinical Research & Reviews (44.89), Clinical Nutrition (39.86), Nutrients(30.13) and Irish Medical Journal (22.38).* Figure 5 represents a co-citation network visualization chart of the top most 15 journals. The chart was generated using the VOSviewer tool and divided into 7 clusters. Cluster 1 has 4 sources followed by cluster 2

and 3 has 3 sources each, cluster 4 has 2 sources and cluster (5 to 7) has 1 source each.

Table 7. Profile of 15 Top Journals on 'Covid-19 and Food & Nutrition'

S.No	Name of the Journal	TP	TC	CPP
1	Nutrients	86	2591	30.13
2	Clinical Nutrition Espen	17	43	2.53
3	International Journal of Environmental Research & Public Health	16	85	5.31
4	Journal of Medical Virology	12	629	52.42
5	Medical Hypotheses	12	190	15.83
6	Nutrition	12	162	13.50
7	Frontiers in Immunology	11	205	18.64
8	Diabetes & Metabolic Syndromes. Clinical Research and Review	9	404	44.89
9	Trials	9	41	4.56
10	Clinical Medicine. Journal of the Royal College of Physicians	8	92	11.50
11	Endocrine	8	66	8.25
12	International Journal of Research in Pharmaceutical Sciences	8	10	1.25
13	Irish Medical Journal	8	179	22.38
14	Appetite	7	23	3.29
15	Clinical Nutrition	7	279	39.86
Total of top 15 journals		230	4999	21.73
Global total		871		
Share of top 15 journals in global total		26.41		

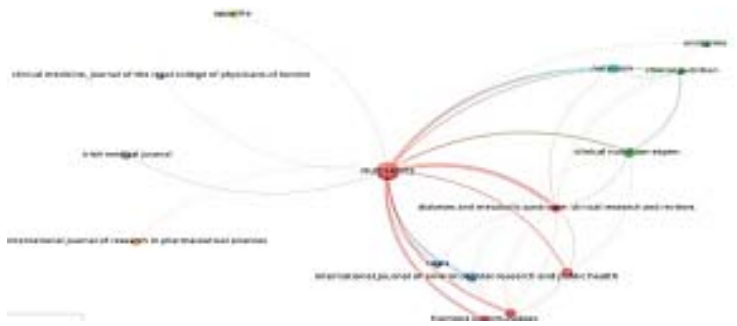

Figure 5. Bibliometric network chart of most productive Journals

37 HIGH CITED PAPERS

Out of 878 publications on 'Covid-19 and Food & Nutrition', only 30 (2.42) publications (assumed as highly cited here) received 70 to 624 citations since their publication and together received 4906 citations, averaging 163.53

citations per paper. Amongst 30 high-cited publications, 13 papers received 70 to 99 citations, 10 papers 105-172 citations, 5 papers 209-350 citations and 2 papers 572-624 citations.

Among 30 high-cited papers, the largest number of contribution (10 papers) come from Italy, followed by U.K. (7 papers), USA (6 papers), Ireland and Spain (3 papers), China, Germany, Russia Federation and Israel (2 papers), and 15 other countries with 1 paper each.

These 30 high-cited papers (18 articles, 6 reviews, 3 editorials, 2 each as notes and letters) witnessed the participation of 102 organizations and 190 authors and consist of 4 non-collaborative paper and 26 collaborative papers (14 national collaborative and 12 international collaborative)

The 30 high-cited publications in this area are published in 21 journals, with 9 papers in Nutrients, 2 papers each in Diabetes & Metabolic Syndromes. Clinical Research & Review and Alimentary Pharmacology & Therapeutics, and 1 paper each in 18 other journals: The BMJ, Aging Clinical & Experimental Research, Clinical Nutrition, FEBS Journal, Foods, International Journal of Molecular Sciences, Irish Medical Journal, JAMA Network Open, Journal of Infection & Public Health, Journal of Medical Virology, Journal of Transnational Medicine, Lancet Diabetes & Endocrinology, Metabolism: Clinical & Experimental, Nutrition, Medical Hypotheses, PLOS One and Signal Transduction & Targeted Therapy. Figure 6 shows the co-citation network of visualization by using VOSviewer tool. Minimum number of 24 citations of papers of the 878 papers, 100 meets the threshold and some of the 100 high-cited papers in the citation network are not connected to each other. The largest set of connected papers consists and hence a set of 69 references instead of all. The network chart is divided into 13 clusters. Cluster 1 with 10 references followed by cluster 2 with 7 references, cluster 3 and 4 with 6 references each, clusters 5 to 11 with 5 references, cluster 12 with 3 references and cluster 13 with 2 references each respectively.

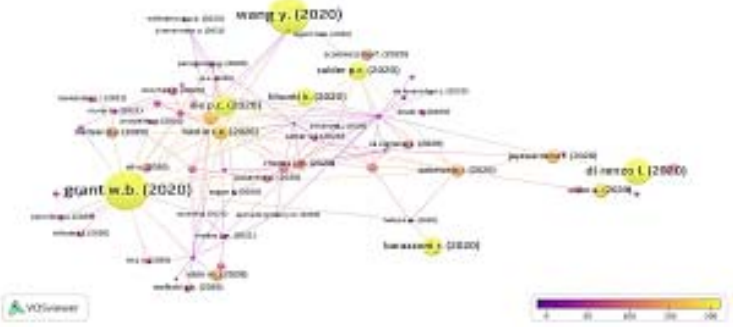

Figure6.Co-citation Network Visualization Chart of Top 69 Highly Cited Papers

4 SUMMARY AND CONCLUSION

878 publications were published on 'Covid-19 and Food & Nutrition' as covered in Scopus database till 1.8.2021. These 878 global publications registered 11032 citations, averaging 12.56 citations per publication. Only 74 out of 878 global publications received extramural funding support from 100+ research agencies and they these funded papers together received 2992 citations, averaging 17.0 citations per paper.

101 countries unevenly participated in 878 global publications on 'Covid-19 and Food & Nutrition', of which the top 10 countries together contributed 84.74% and 95.99% share in global publications and citations. USA contributed the largest global share (23.12%), followed by Italy and U.K. (16.17% and 12.64%), India (7.86%), etc. Among top 10 countries, only five countries namely Spain (21.2 and 1.69), China (20.5 and 1.63), Italy (17.32 and 1.38), U.K. (17.3 and 1.38) and Poland (14.71 and 1.17) registered citations per paper and relative citation index higher than their group average (14.23 and 1.13)

Medicine, among various broad subjects, accounted for the largest share (72.32%) in total output on 'Covid-19 and Food & Nutrition', followed by Nursing (26.31%), Biochemistry, Genetics & Molecular Biology (18.11%), Agricultural & Biological Sciences (14.01%), Pharmacology, Toxicology & Pharmaceutics complications (8.09%), Immunology & Microbiology (7.63%) and Environment Science (3.19%).

In all, 367 organisations and 474 authors participated unevenly in global research on 'Covid-19 and Food & Nutrition', of which the top 15 organisations and authors together contributed 11.50% and 19.48% and 20.86% and 16.01% share respectively in global publications and citations.

The top 5 most productive organisations were: Sapienza University of Rome, Italy (19 papers), Harvard Medical School, USA (16 papers), Trinity College, Dublin, Ireland and University of Liverpool, U.K. (13 papers each) and Shahid Beheshti University of Medical Sciences, Iran (12 papers). The top 5 most impactful organizations in terms of citations per paper and relative citation index were: Universita degli Studi di Milan, Italy (37.64 and 3.0), Trinity College, Dublin, Ireland (26.77 and 2.13), University of Liverpool, U.K. (25.23 and 2.01), Universita degli Studi di Pavia, Italy (17.44 and 1.39) and Universita degli Studi di Napoli Federico 11, Italy (17.36 and 1.38).

The top 5 most productive authors were: J.R. Delanghe (Belgium), R.A. Kenny (Ireland) and M.M. Speeckaert (Belgium) (9 papers each), A. Giustina (Italy) and E. Laird (Ireland) (7 papers each). The top 5 most impactful authors were: W.B.Grant (USA) (112.33 and 8.94), E. Laird (Ireland) (35.0 and 2.79), S. Subramanian (26.71 and 2.13), A.R. Martineau (U.K.) (25.5 and 2.03) and R. Caccialanza (Italy) (21.67 and 1.73).

The top 5 most productive journals were: Nutrients (86 papers), Clinical Nutrition Espen (17 papers), International Journal of Environmental Research & Public Health(16 papers), Journal of Medical Virology and Medical Hypotheses (12 papers each). The top 5 most impactful journals in terms of citation per paper were: Journal of Medical Virology (52.42), Diabetes & Metabolic Syndromes. Clinical Research & Reviews (44.89), Clinical Nutrition (39.86), Nutrients (30.13) and Irish Medical Journal (22.38).

Only 30 out of 878 total papers received 70 to 624 citations which together registered 4906 citations, averaging 163.53 citations per paper. Among 30 comparatively high-cited papers, Italy contributed the largest number (10) of papers, followed by U.K. (7 papers), USA (6 papers), etc. The 30 high cited papers witnessed the participation of 93 organisations and 165 authors and consist of 1 non-collaborative paper and 13 collaborative papers (10 national and 3 international).

The 30 high-cited publications in this area were published in 21 journals, with 9 papers in Nutrients, 2 papers each in Diabetes & Metabolic Syndromes. Clinical Research and Review and Alimentary Pharmacology & Therapeutics, etc.

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