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Top 100 Most Cited Studies in Obesity Research: A Bibliometric Analysis

Tauseef Ahmad

Abstract

Obesity represents a major global public health problem. In the past few decades the prevalence of obesity has increased worldwide. In 2016, an estimated 1.9 billion adults were overweight; of these more than 650 million were obese. There is an urgent need for potential solutions and deeper understanding of the risk factors responsible for obesity. A bibliometric analysis study was designed to provide a comprehensive overview of top 100 most cited studies on obesity indexed in Web of Science database. The online search was conducted on June 6, 2021 using the keywords “Obesity” OR “Obese” OR “Overweight” in title filed with no limitations on document types or languages. The top 100 cited studies were selected in descending order based on number of citations. The obtained data were imported in to Microsoft Excel 2019 to extract the basic information such as title, authors name, journal name, year of publication and total citations. In addition, the data were also imported in to HistCite™ for further citation analysis, and VOSviewer software for windows to plot the data for network visualization mapping. The initial search retrieved a total of 167,553 documents on obesity. Of the total retrieved documents, only top 100 most cited studies on obesity were included for further analysis. These studies were published from 1982 to 2017 in English language. Most of the studies were published as an article (n = 84). The highly cited study on obesity was “Establishing a standard definition for child overweight and obesity worldwide: international survey” published in BMJ-British Medical Journal (Impact Factor 39.890, Incites Journal Citation Reports, 2021) in 2000 cited 10,543 times. The average number of citations per study was 2,947.22 (ranging from 1,566 to 10,543 citations). Two studies had more than 10,000 citations. A total of 2,272 authors from 111 countries were involved. The most prolific author was Flegal KM authored 14 studies with 53,558 citations. The highly active country in obesity research was United States of America. The included studies were published in 33 journals. The most attractive journal was JAMA-Journal of the American Medical Association (Impact Factor 56.272) published 17 studies and cited globally 51,853 times. The most frequently used keywords were obesity (n = 87) and overweight (n = 22). The countries with highest total link strength was United States of America (n = 155), followed by England (n = 140), and Scotland (n = 130). Our results show that most number of highly cited studies were published in developed countries. The findings of this study can serve as a standard benchmark for researchers to provide the quality bibliographic references and insights into the future research trends and scientific cooperation in obesity research.

Keywords: Obesity, Overweight, bibliometric analysis

1. Introduction

Obesity represents a major public health challenge, in the past few decades the prevalence of obesity has increased worldwide and associated with serious adverse health outcomes [1, 2]. According to the statistics of World Health Organization, in 2016, an estimated 1.9 billion adults (18 years and older) were overweight, of these more than 650 million were obese. In 2019, 38 million children (under age of 5 years) were overweight or obese [3].

Obesity associated comorbidities including certain cancer, depression, fatty liver disease, hepatic steatosis, hyperlipidemia, hypertension, obstructive sleep apnea, orthopedic conditions, type 2 diabetes mellitus and social isolation [1, 4, 5]. There is an urgent need for potential solutions and deeper understanding of the risk factors responsible for obesity.

Bibliometric type studies are of great interest, conducted not only to present an overall overview of the published scientific literature but also critical and subjective summarization of the most influential scientific studies [6–8].

2. Aim

This study aimed to provide a comprehensive overview of top 100 most cited studies on obesity. The finding can serve as a standard benchmark for researchers and to provide the quality bibliographic references.

3. Methods

3.1 Study design

Bibliometric citation analysis study.

3.2 Searching strategy and database

On June 6, 2021 the online search was conducted on Web of Science, Core Collection database (Philadelphia, Pennsylvania, United State of America). The search keywords used were “Obesity” OR “Obese” OR “Overweight” in title filed with no limitations on documents types or languages. The top 100 cited studies were selected in descending order based on number of citations.

3.3 Data extraction

The obtained studies were imported in to Microsoft Excel 2019 to extract the basic information such as title, authors name, journal name, year of publication and total citations. In addition, the downloaded dataset were imported in to HistCite™ for further citation analysis.

3.4 Visualization network

Visualization network co-authorship countries and co-occurrence all keywords were plotted by using VOSviewer software version 1.6.15 (<https://www.vosviewer.com/>) for windows.

4. Ethical approval

This study did not involve any human or animal subjects, thus, ethical approval was not required.

5. Results

The initial search retrieved a total of 167,553 documents on obesity indexed in Web of Science database. Of the total retrieved documents, only top 100 most studies on obesity were included in this study. The included studies were published in English language. Most of the studies were published as an article ($n = 84$) followed by review ($n = 14$) and letter ($n = 1$). The average number of citations per study was 2,947.22, ranging from 1,566 to 10,543 citations.

The most cited study on obesity was “Establishing a standard definition for child overweight and obesity worldwide: international survey” published in BMJ-British Medical Journal in 2000 cited 10,543 times. Another study “Positional cloning of the mouse obese gene and its human homolog” published in Nature in 1994 was cited 10,214 times. A total of 10 studies were cited more than 5,000 times. Furthermore, 52 studies were cited at least 2,000 times, while the remaining studies were cited more than 1,500 times. The top 100 studies on obesity is presented in **Table 1**.

5.1 Most prolific authors

A total of 2,272 authors contributed to top 100 most cited studies. The most prolific author was Flegal KM authored 14 studies with 53,558 citations, followed by Carroll MD ($n = 10$, citations = 36,950), and Ogden CL ($n = 9$, citations = 34,784). Only nine authors authored at least five studies as shown in **Table 2**. In addition, only 22 authors contributed in at least three studies.

5.2 Most active countries

A total 111 countries were involved in top 100 most cited studies on obesity. The most active country was United States of America (studies contributed: 75, citations: 217,788), followed by United Kingdom (studies contributed: 18, citations: 57,015), Canada (studies contributed: 9, citations: 17,920), Japan (studies contributed: 9, citations: 26,695), France (studies contributed: 8, citations: 21,228), Sweden (studies contributed: 8, citations: 20,632), and Netherlands (studies contributed: 7, citations: 13,018) as shown in **Table 3**. Only 21 countries were involved at least in four studies.

5.3 Journals

The top 100 most cited studies were published in 33 journals. The most attractive journal was JAMA-Journal of the American Medical Association published 17 studies and cited globally 51,853 times as shown in **Table 4**. Only seven journals published at least 4 studies, six journals published two studies each, while the remaining journals published a single study each.

5.4 Commonly used keywords

A total of 366 keywords were used in the top 100 most cited studies. The most widely used keywords were obesity ($n = 87$) and overweight ($n = 22$) as shown in **Table 5**.

Rank	Study reference	LCS	LCS/t	GCS	GCS/t
1	Cole et al. [9]	5	0.28	10543	585.72
2	Zhang et al. [10]	14	0.58	10218	425.75
3	Alberti et al. [11]	0	0.00	7170	796.67
4	Ogden et al. [12]	7	0.58	6501	541.75
5	Weisberg et al. [13]	9	0.60	6360	424.00
6	Turnbaugh et al. [14]	9	0.75	6237	519.75
7	Ng et al. [15]	2	0.50	6092	1523.00
8	Turner et al. [16]	1	0.05	5585	279.25
9	Ogden et al. [17]	2	0.50	5530	1382.50
10	Hotamisligil et al. [18]	12	0.48	5305	212.20
11	Calle et al. [19]	2	0.13	4927	328.47
12	Considine et al. [20]	1	0.05	4888	222.18
13	Ley et al. [21]	4	0.33	4624	385.33
14	Flegal et al. [22]	9	0.56	4575	285.94
15	Flegal et al. [23]	5	0.63	4510	563.75
16	Xu et al. [24]	5	0.33	4501	300.07
17	Turnbaugh et al. [25]	2	0.22	4499	499.89
18	Pi-Sunyer et al. [26]	0	0.00	4046	202.30
19	Halaas et al. [27]	8	0.35	3846	167.22
20	DeFronzo et al. [28]	0	0.00	3653	135.30
21	Flegal et al. [29]	3	0.50	3653	608.83
22	Pelleymounter et al. [30]	7	0.30	3611	157.00
23	Yamauchi et al. [31]	3	0.18	3603	211.94
24	Arita et al. [32]	4	0.21	3588	188.84
25	Ley et al. [33]	7	0.54	3439	264.54
26	Steppan et al. [34]	4	0.24	3335	196.18
27	Furukawa et al. [35]	1	0.07	3314	236.71
28	Cani et al. [36]	3	0.27	3183	289.36
29	Must et al. [37]	3	0.16	3081	162.16
30	Hedley et al. [38]	8	0.57	3077	219.79
31	Kopelman [39]	3	0.17	3001	166.72
32	Maffei et al. [40]	3	0.13	2989	129.96
33	Black et al. [41]	1	0.20	2937	587.40
34	Sjostrom et al. [42]	0	0.00	2910	264.55
35	Hubert et al. [43]	6	0.17	2908	83.09
36	Frayling et al. [44]	0	0.00	2908	264.36
37	Haslam and James [45]	1	0.08	2900	223.08
38	Mokdad et al. [46]	2	0.13	2816	187.73
39	Whitaker et al. [47]	2	0.10	2766	131.71
40	Barlow [48]	0	0.00	2764	251.27
41	Lumeng et al. [49]	0	0.00	2762	251.09

Rank	Study reference	LCS	LCS/t	GCS	GCS/t
42	Kahn et al. [50]	1	0.08	2747	228.92
43	Ogden et al. [51]	1	0.17	2704	450.67
44	Weyer et al. [52]	0	0.00	2694	158.47
45	Christakis and Fowler [53]	1	0.09	2687	244.27
46	Ogden et al. [54]	5	0.31	2660	166.25
47	Ozcan et al. [55]	1	0.07	2602	185.86
48	Despres and Lemieux [56]	0	0.00	2581	215.08
49	Hotamisligil et al. [57]	7	0.30	2580	112.17
50	Cani et al. [58]	2	0.20	2516	251.60
51	Hirosumi et al. [59]	2	0.13	2304	144.00
52	Huszar et al. [60]	1	0.05	2295	109.29
53	Calle and Kaaks [61]	0	0.00	2286	163.29
54	Swinburn et al. [62]	4	0.57	2196	313.71
55	Weiss et al. [63]	0	0.00	2178	155.57
56	Flegal et al. [64]	7	0.35	2166	108.30
57	Kuczmarski et al. [65]	11	0.46	2137	89.04
58	Montague et al. [66]	5	0.24	2081	99.10
59	Ezzati et al. [67]	0	0.00	2073	2073.00
60	Kahn and Flier [68]	3	0.17	2068	114.89
61	Gregor and Hotamisligil [69]	0	0.00	2026	289.43
62	Flegal et al. [70]	2	0.40	2021	404.20
63	Locke et al. [71]	0	0.00	1967	655.67
64	Luppino et al. [72]	0	0.00	1951	243.88
65	Wortsman et al. [73]	0	0.00	1934	107.44
66	Hotamisligil et al. [74]	5	0.23	1933	87.86
67	Flegal et al. [75]	2	0.15	1907	146.69
68	Yudkin et al. [76]	2	0.11	1873	98.58
69	Mokdad et al. [77]	2	0.12	1861	109.47
70	Popkin et al. [78]	1	0.17	1856	309.33
71	Yusuf et al. [79]	1	0.08	1841	141.62
72	Guh et al. [80]	0	0.00	1836	204.00
73	Everard et al. [81]	0	0.00	1836	367.20
74	Wang and Lobstein [82]	1	0.08	1832	152.67
75	Ebbeling et al. [83]	0	0.00	1823	113.94
76	Wang and Beydoun [84]	1	0.09	1821	165.55
77	Ridaura et al. [85]	0	0.00	1799	359.80
78	Kenchiah et al. [86]	4	0.25	1725	107.81
79	Afshin et al. [87]	0	0.00	1703	1703.00
80	Elchebly et al. [88]	0	0.00	1702	89.58
81	Dietz [89]	1	0.05	1701	85.05
82	Poirier et al. [90]	1	0.08	1687	140.58

Rank	Study reference	LCS	LCS/t	GCS	GCS/t
83	Van Gaal et al. [91]	0	0.00	1682	140.17
84	Newgard et al. [92]	1	0.11	1682	186.89
85	Turnbaugh et al. [93]	2	0.20	1674	167.40
86	Spiegelman and Flier [94]	2	0.12	1663	97.82
87	Kanda et al. [95]	3	0.25	1661	138.42
88	Uysal et al. [96]	7	0.33	1660	79.05
89	Hu et al. [97]	3	0.14	1659	75.41
90	Finkelstein et al. [98]	1	0.11	1645	182.78
91	Mozaffarian [99]	0	0.00	1640	820.00
92	Larsson et al. [100]	1	0.03	1633	48.03
93	Mokdad et al. [101]	2	0.11	1631	85.84
94	Visser et al. [102]	1	0.05	1615	85.00
95	Kissebah et al. [103]	1	0.03	1612	44.78
96	Wang et al. [104]	3	0.43	1610	230.00
97	Clement et al. [105]	1	0.05	1588	79.40
98	Puhl and Heuer [106]	0	0.00	1582	175.78
99	Flegal et al. [107]	0	0.00	1574	787.00
100	Turek et al. [108]	0	0.00	1566	120.46

Note: LCS: Local citation score; LCS/t: Local citation score per year; GCS: Global citation score; GCS/t: Global citation score per year.

Table 1.
Top 100 most cited studies on obesity.

S. No.	Author	Studies	LCS	LCS/t	GCS	GCS/t
1	Flegal KM	14	67	5.461386	53558	6340.429
2	Carroll MD	10	47	4.171429	36950	5114.773
3	Ogden CL	9	40	3.821429	34784	5006.473
4	Hotamisligil GS	7	34	1.541382	18410	1110.571
5	Dietz WH	6	15	0.819507	22538	1238.22
6	Gordon JI	6	24	2.044017	22272	2196.711
7	Johnson CL	5	40	2.254762	14615	869.3149
8	Mokdad AH	5	8	0.856244	14103	3609.046
9	Spiegelman BM	5	29	1.265631	13140	585.4702
10	Kengne AP	4	2	0.5	11941	7372
11	Khang YH	4	2	0.5	11941	7372
12	Kit BK	4	8	1.566667	13908	2846.2
13	Ley RE	4	22	1.844017	18799	1669.511
14	Turnbaugh PJ	4	17	1.505556	17034	1572.372

Note: LCS: Local citation score; LCS/t: Local citation score per year; GCS: Global citation score; GCS/t: Global citation score per year.

Table 2.
Authors with at least 4 studies.

S. No.	Country	Number of studies	LCS	GCS
1	United States of America	75	207	217788
2	United Kingdom	18	32	57015
3	Canada	9	7	17920
4	Japan	9	13	26695
5	France	8	11	21228
6	Sweden	8	12	20632
7	Netherlands	7	3	13018
8	Belgium	6	5	12993
9	Finland	6	2	16579
10	Australia	5	6	14031
11	Italy	5	2	15488
12	Pakistan	5	3	14772
13	Switzerland	5	3	11196
14	Brazil	4	3	12805
15	Estonia	4	2	11835
16	Germany	4	2	11835
17	Norway	4	2	11835
18	Peoples Republic of China	4	2	11835
19	Saudi Arabia	4	2	11835
20	South Korea	4	2	11835

Note: LCS: Local citation score; GCS: Global citation score.

Table 3.
Country with at least 3 studies.

Journal name	Number of studies	LCS	LCS/t	GCS	GCS/t
JAMA-Journal of the American Medical Association (IF: 56.272, Q1)	17	65	5.400378	51853	6276.611
Nature (IF: 49.962, Q1)	14	52	3.120612	48524	3834.997
Lancet (IF: 79.321, Q1)	9	13	1.903846	27057	5484.994
Science (IF: 47.728, Q1)	9	33	1.430875	25272	1644.342
New England Journal of Medicine (IF: 91.245, Q1)	8	10	0.614935	23784	3157.565
Journal of Clinical Investigation (IF: 14.808, Q1)	7	28	1.725776	23246	1577.351
Circulation (IF: 29.690, Q1)	4	7	0.254762	13405	1840.336

Note: IF: Impact Factor, Incites Journal Citation Reports, 2021; Q: Quartile; LCS: Local citation score; LCS/t: Local citation score per year; GCS: Global citation score; GCS/t: Global citation score per year.

Table 4.
Journals published at least 4 studies.

5.5 Year of publication

The top 100 most cited on obesity were published from 1982 to 2017 as shown in **Figure 1**. The highest number of studies were published in 2006 (n = 9, citations = 29,552) and 2007 (n = 7, citations = 19,035) as presented in **Figures 1** and **2**.

S. No.	Word	Occurrence	LCS	GCS
1	Obesity	87	205	245145
2	Overweight	22	58	73740
3	Insulin	17	55	45751
4	Resistance	16	54	43149
5	Prevalence	12	62	46421
6	Adults	11	41	38279
7	Diabetes	10	13	32966
8	Trends	10	34	27357

Note: LCS: Local citation score; GCS: Global citation score.

Table 5.
The keywords used at least ten times.

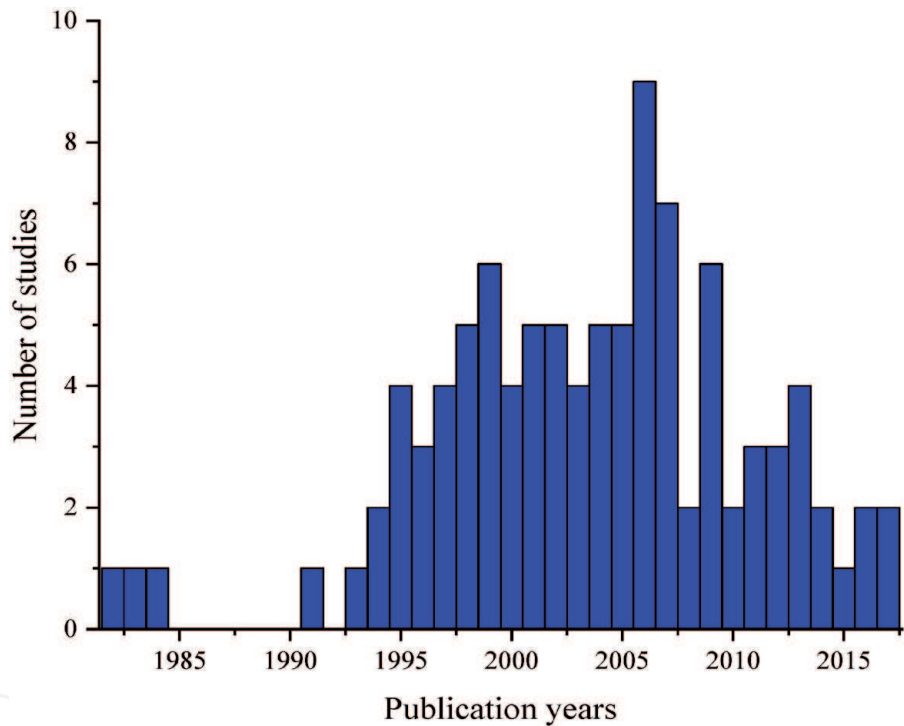


Figure 1.
Publication years of top 100 most cited studies in obesity research.

5.6 Co-authorship countries network visualization

The minimum number of studies for a country was fixed at 3. Of the total countries, only 38 countries were plotted based on total link strength (TLS) as shown in **Figure 3**. The countries with highest TLS were United States of America (155), England (140), and Scotland (130).

5.7 Co-occurrence all keywords network visualization

Of the total keywords, only 69 were plotted as shown in **Figure 4**. The keyword body-mass index has the highest TLS 117, followed by overweight (65), adipose-tissue (56), prevalence (53), weight (52), and obesity (49).

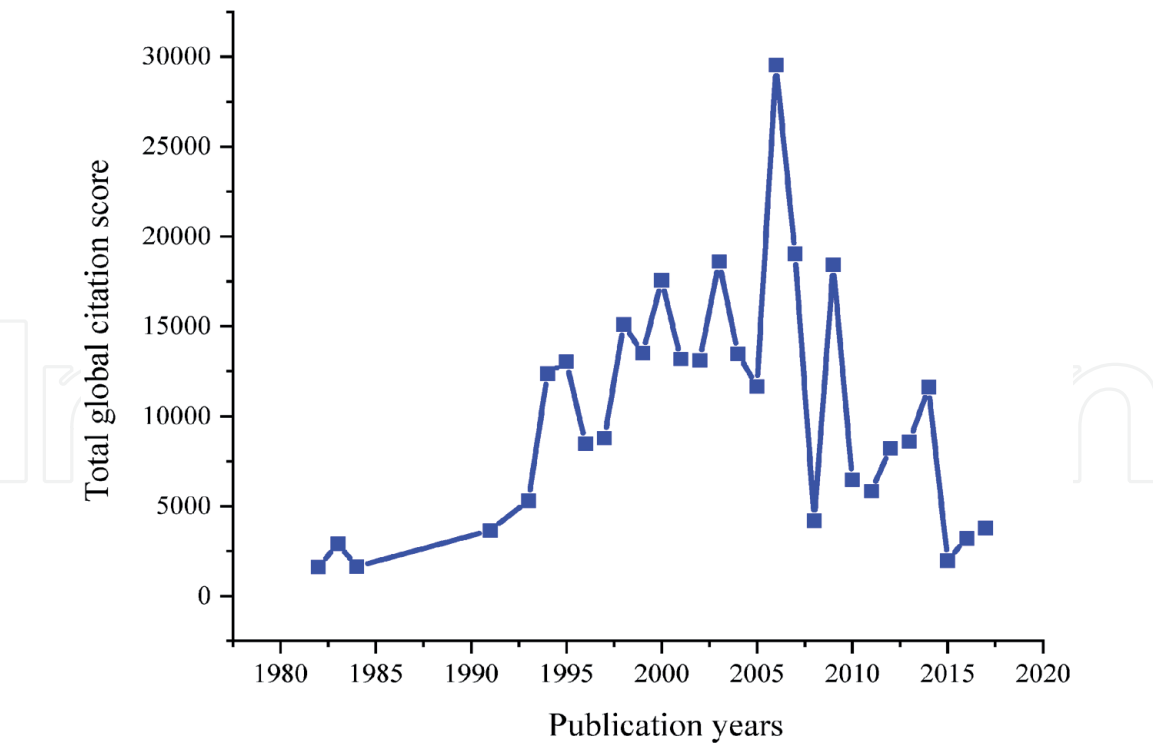


Figure 2.
Total global citation score per year of top 100 most cited studies in obesity research.

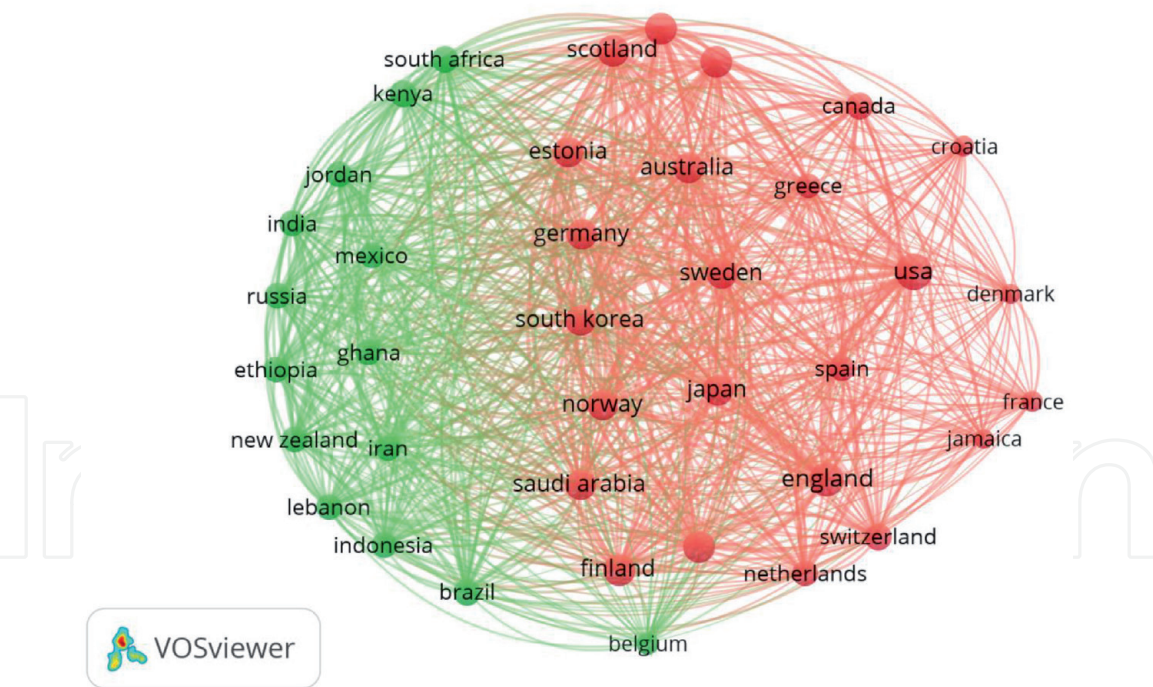


Figure 3.
Co-authorship countries network visualization. Two clusters are formed; red color represents cluster 1 (24 items), and green color represents cluster 2 (14 items).

6. Discussion

In recent years, bibliometric type studies have been increased significantly, these studies not only recognize the most influential studies in certain area but also determine the research shift and other important insights into the bibliometric parameters.

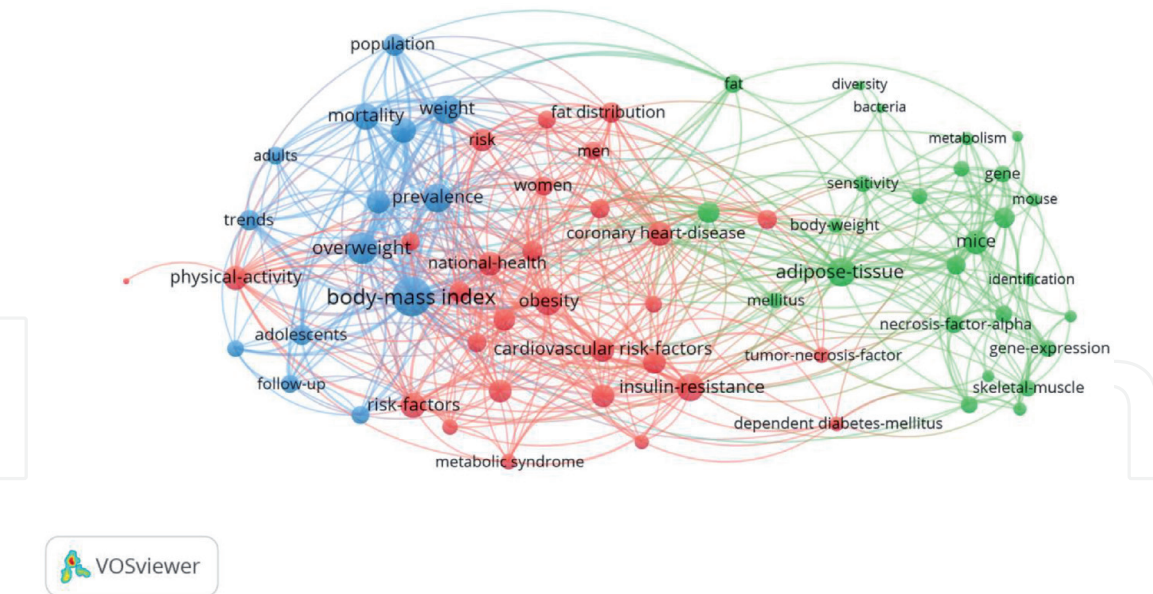


Figure 4. Co-occurrence all keywords network visualization. Three clusters are formed; red color represents cluster 1 (29 items), green color represents cluster 2 (26 items), and blue color represents cluster 3 (14 items).

Globally, obesity is a major public health problem and the prevalence has increased in the past few decades. Therefore, this study was undertaken to recognize the most influential studies in obesity research and provide essential bibliographic information. To the best of our knowledge this is the first bibliometric analysis on top 100 most cited studies on obesity indexed in Web of Science database. The highly cited study in obesity research received a total of 10,543 citations. The study published in a highly rated journal in medicine had an impact factor of 39.890 and placed in quartile 1 (Q1) category. The study entitled “Establishing a standard definition for child overweight and obesity worldwide: international survey” provides cut off points for body mass index in childhood of six large nationally representative cross sectional growth studies [9].

Another study received a total of 10,218 citations. The study titled “Positional cloning of the mouse obese gene and its human homologue” discusses the potential role of obese gene and these genes may function as part of a signaling pathway from adipose tissue that acts to regulate the size of the body fat depot [10].

The top 100 most cited were published in 33 journals. The most attractive and core journals in obesity research were JAMA-Journal of the American Medical Association (n = 17), and Nature (n = 14) had an impact factor of 56.272, and 49.962 respectively. A total of 31 studies were published in these two journals with a total citations of 100,377, thus representing the quality of work and aiming of the authors for high impact factor journals. Influential studies on obesity were published in higher impact factor journals. Furthermore, studies published in higher impact factor journals are more likely to be cited by the scientific community. The impact factor shows importance and quality of a journal [109]. The top three authors based on number of studies in obesity research were Flegal KM (n = 14, citations = 53,558), followed by Carroll MD (n = 10, citations = 36,950), and Ogden CL (n = 9, citations = 34,784). In our study, the leading country was United States of America contributed in a total of 75 studies with a total citations of 217,788. The finding is in line with studies in other research areas [110–113].

7. Conclusion

This study provides a comprehensive information of the most cited studies in obesity research. Majority of the most cited studies were published by

developed countries in higher impact factor journals. The current study might be helpful to researchers for insights into the future research trends and scientific cooperation.

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