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Original Research

How Does Social Media Impact the Number of Citations? An Altmetric Analysis of the 50 Most-Cited MicroRNA Articles

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ABSTRACT

Objective: Altmetric analysis is web-based a metric analysis. Social media platforms affect medical literature over the last few years. The altmetric Attention Score (AAS) is an automatically calculated metric for monitoring social media. This study aimed to determine the correlation between AAS and the number of citations received from important articles published in the last 11 years with microRNAs.

Methods: MicroRNA as a search term was entered into the Web of Science database to identify all articles. The most 50 cited articles were analyzed by Topic, Journal Name, First Author, Publication Year, Citation, Average Citation Per Year (ACPY), Impact Factor (IF), Quartile (Q) Category, H Index, and AAS.

Results: Altmetric explorer identified 45.911 articles as being referred to online. Correlation analysis revealed that there was a weak correlation between AAS and the number of citations ($p<0.15$), while a very strong correlation was found between the number of citations and ACPY ($p<0.01$).

Conclusion: These results give some clues about the articles studied did not lose their currency. They are cited regularly each year so they are very popular in academia. This study provides a detailed list of 50 most cited microRNA articles and social media interest using the Altmetric.com database. miRNAs can be used in the diagnosis, prognosis, or treatment of various diseases.

Keywords: Social media, citation, Altmetric microRNAs

INTRODUCTION

MicroRNAs (miRNAs) are small, noncoding RNAs that are approximately 22 nucleotides in length. The biogenesis of miRNAs begins with the copying of DNA sequences into primary miRNAs, continues with transformation into precursor miRNAs, and is completed with the formation of mature miRNAs. miRNAs exert their effects through their target genes, which are messenger RNAs. In most cases, miRNAs interact with the 3′ untranslated region (UTR) of target messenger RNAs to suppress gene expression (1). MiRNAs have been reported to interact with other gene regions, including the 5′ UTR, coding sequence, and promoter (2). It has also been shown that miRNAs activate gene expression under certain conditions (3). Recent studies have suggested that miRNAs are shuttled between different subcellular compartments to control the rate of translation and transcription (4).

MiRNAs are involved in many cellular processes. These processes are proliferation, differentiation, apoptosis, and developmental process. Dysregulation of miRNAs leads to various diseases, such as cancer, cardiovascular diseases, and neurodegenerative disease (5-7). This dysregulation indicates that miRNAs can be used as potential markers in the diagnosis or prognosis of diseases. In addition, miRNAs are thought to be targets that can be used in the treatment of various diseases, including cancer. Understanding the roles of miRNAs in various biological processes has led to an increase in miRNA studies (8).

It is stated that each miRNA has hundreds of target genes. Various databases are used in the prediction of these target genes. Thus, the functional significance of miRNAs will be shown by the identification of possible target genes (9, 10).

MiRNAs can be secreted into extracellular fluids and transported to target cells through vesicles, such as exosomes, or by binding to proteins, including Argonautes. They can act as extracellular messengers because they can be taken up by new cells, where they potentially regulate gene expression. Extracellular or circulating miRNAs can be found in various body fluids, such as plasma and serum (11, 12). Extracellular miRNAs mediate cell-to-cell communication. Circulating miRNAs can be used as potential biomarkers for various diseases (13-15).

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Citation is one of the most important quality indicators of an article. However, the number of citations alone is not sufficient to determine the quality of the article. Impact factor (IF) is also used to measure the quality of a journal. IF is calculated by dividing the number of citations in the current year by the articles published in the journal during the previous two years (16). Another indicator used to measure journal quality is the H index (17, 18).

Many researchers use citation analysis to identify the most valuable studies in their field. The analyses that include the number of citations are referred to as bibliometric analyses. Bibliometric analyses were first applied by Eugene Garfield, the founder of Eugene Garfield Scientific Information Institute, in the 1970s (19).

The influence of social media platforms on medical literature has started to increase in recent years. Altmetric analyses are metric-based citation analyses. These analyses evaluate the effects of the number of citations received by academicians on social media (Facebook, Twitter, Wikipedia citations, Google+, mainstream media, RSS feeds, and videos) (20, 21). There are several sources used for altmetric analyses. One of them is Altmetric (altmetric.com). Altmetric Institution (Altmetric LLP, London, UK) uses different weighting values for various data sources to calculate the Altmetric attention score (AAS) (22).

Altmetric analyses are known to be very fast compared with traditional citation-based metrics analysis (23). While traditional citation-based metrics are only available for a few years after publishing, altmetric data sources can be updated in a real-time feed (e.g., Twitter and Wikipedia) or daily basis (e.g., Facebook and Google+) (24).

As far as we know, there is no study showing the relationship between the number of citations received by miRNA studies and AAS. Our study aims to show the correlation between the number of citations and the AAS using Web of Science (WoS), a data analysis tool, of the remarkable miRNA articles published in the last 11 years.

Therefore, in the context of the growing demand for the World Wide Web and social media, this study aims to analyze and visualize the knowledge structure of articles in the field of miRNA with a high AAS to explore current issues, active researchers, and journals.

Main Points:

- The term "miRNA" was searched on the Web of Science citation indexing database and the research platform and the articles published in the last 11 years were evaluated.
- This is the first study to evaluate the online attention received by the articles published in the microRNA field.
- Correlation analysis reveals strong correlation between citation and average cite per year (ACPY).
- Articles about miRNAs did not lose their currency, they are cited regularly each year so they are very popular in academia.
- The use of circulating miRNAs as minimal invasive biomarkers for diagnosis, prognosis or treatment monitoring has been explored mainly for cancer and cardiovascular diseases.

METHODS

Database

The citation data were obtained from the WoS database produced by Thomson Reuters. Search results from WoS encompassed entries from the WoS Core Collection, comprising Science Citation Index Expanded, Social Sciences Citation Index, Arts & Humanities Citation Index, Book Citation Index– Science, Book Citation Index –Social Sciences & Humanities, Conference Proceedings Citation Index-Science, Conference Proceedings Citation Index- Social Science & Humanities, and Emerging Sources Citation Index.

Search Terms and Methods

The WoS database was searched using the terms miRNA and microRNA with the Boolean operator OR. We reviewed articles on miRNA published in the last 11 years using publication and citation information from the WoS database.

The publication timeframe analyzed encompassed January 2009 to December 2019. The articles provided with full text in English are listed according to the citation numbers. The 50 most-cited articles were selected as previously described by Paladugu et al (25). In these articles, the title of the study, the first author, and the publication year as well as the study subjects were evaluated with AAS. AAS is based on three main factors: the volume, the sources, and the authors. The results obtained from the different sources are shown in altmetric donut colors. The amount of each color in the donut varies according to the sources of research output taken. The use of AAS and Altmetric donuts together is extremely useful to demonstrate an interest in the relevant research topic (22).

Statistical Analysis

WoS data tools were used to perform certain elements of result analysis, for example, generating journal citation reports.

Categorical variables were defined using percentages, and continuous variables were defined using median and interquartile ranges. Data were not normally distributed. Spearman rank correlation coefficient was used to assess the correlation between AASs, citations, average citation per year (ACPYs), postpublication year numbers, journal H indexes, and IFs. Spearman correlation test was interpreted according to r level: $r < 0.19$ was interpreted as very weak, $r = 0.2–0.39$ was interpreted as weak, $r = 0.4–0.59$ was interpreted as moderate, $r = 0.6–0.79$ was interpreted as strong, and $r > 0.8$ was interpreted as very strong. $P < .01$ was considered statistically significant. The statistical analysis was performed using the Statistical Package for the Social Sciences, version 21(IBM SPSS Corp.; Armonk, NY, USA).

RESULTS

Database and Publication Distribution

The number of articles published on miRNAs in the WoS Core Collection database (2009-2019) was 45.911. The first miRNA article was published in 2009. A total of 88% of all miRNA literature (40.401 publications) were published between 2009 and 2012, whereas 12% of the miRNA literature (5.510 publications) were published between 2013 and 2015. The most-cited miRNA publications were in 2009 with 67% publications (30.729) (Table 1).

Table 1. Top 50 cited primary miRNA publications.

Rank	Title	Publication Year	First Author	Citation	Average Citation per Year	Altmetric Attention Score
1.	MicroRNAs: Target Recognition and Regulatory Functions	2009	Bartel DP	11131	1011.91	41
2.	Most mammalian mRNAs are conserved targets of microRNAs	2009	Friedman RC	4302	391.09	10
3.	Origins and Mechanisms of miRNAs and siRNAs	2009	Carthew RW	2657	241.55	30
4.	Mammalian microRNAs predominantly act to decrease target mRNA levels	2010	Guo H	2334	233.40	27
5.	The widespread regulation of microRNA biogenesis, function and decay	2010	Krol J	2317	231.70	6
6.	Non-coding RNAs in human disease	2011	Esteller M	2023	224.78	39
7.	Causes and consequences of microRNA dysregulation in cancer	2009	Croce CM	1937	176.09	21
8.	Circular RNAs are a large class of animal RNAs with regulatory potency	2013	Memczak S	1861	265.86	171
9.	Natural RNA circles function as efficient microRNA sponges	2013	Hansen TB	1853	264.71	104
10.	Regulation of microRNA biogenesis	2014	Ha M	1785	297.50	33
11.	Argonaute2 complexes carry a population of circulating microRNAs independent of vesicles in human plasma	2011	Arroyo JD	1606	178.44	18
12.	Regulation of mRNA Translation and Stability by microRNAs	2010	Fabian MR	1472	147.20	22
13.	Predicting effective microRNA target sites in mammalian mRNAs	2015	Agarwal V	1419	283.80	15
14.	MicroRNAs in Cancer	2009	Garzon R	1407	127.91	9
15.	MicroRNAs are transported in plasma and delivered to recipient cells by high-density lipoproteins	2011	Vickers KC	1376	152.89	20
16.	A Long Noncoding RNA Controls Muscle Differentiation by Functioning as a Competing Endogenous RNA	2011	Cesana M	1295	143.89	42
17.	Therapeutic microRNA Delivery Suppresses Tumorigenesis in a Murine Liver Cancer Model	2009	Kota J	1190	108.18	38
18.	The MicroRNA Spectrum in 12 Body Fluids	2010	Weber JA	1152	115.20	9
19.	Argonaute HITS-CLIP decodes microRNA-mRNA interaction maps	2009	Chi SW	1093	99.36	37
20.	miRWalk - Database: Prediction of possible miRNA binding sites by "walking" the genes of three genomes	2011	Dweep H	993	110.33	6
21.	Secretory Mechanisms and Intercellular Transfer of MicroRNAs in Living Cells	2010	Kosaka N	980	98.00	23
22.	miR-145 and miR-143 regulate smooth muscle cell fate and plasticity	2009	Cordes KR	939	85.36	18
23.	MicroRNAs in Stress Signaling and Human Disease	2012	Mendell JT	931	116.38	9
24.	Characterization of extracellular circulating microRNA	2011	Turchinovich A	930	103.33	13
25.	Targeting microRNAs in cancer: rationale, strategies and challenges	2010	Garzon R	887	88.70	20
26.	miR-9, a MYC/MYCN-activated microRNA, regulates E-cadherin and cancer metastasis	2010	Ma L	849	84.90	11
27.	NON-CODING RNA MicroRNAs and their targets: recognition, regulation and an emerging reciprocal relationship	2012	Pasquinelli AE	842	105.25	7
28.	MicroRNA dysregulation in cancer: diagnostics, monitoring and therapeutics. A comprehensive review	2012	Iorio MV	841	105.13	44
29.	Differential expression of microRNAs in plasma of patients with colorectal cancer: a potential marker for colorectal cancer screening	2009	Ng EK	826	75.09	9

Table 1. Top 50 cited primary miRNA publications. (Continue)

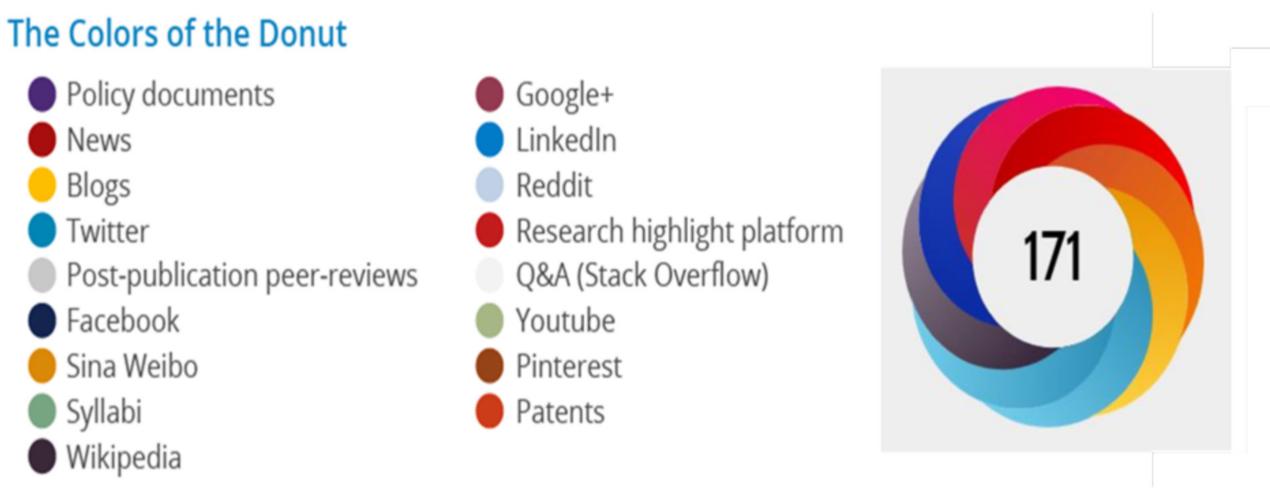
Rank	Title	Publication Year	First Author	Citation	Average Citation per Year	Altmetric Attention Score
30.	miRecords: an integrated resource for microRNA–target interactions	2009	Xiao F	814	74.00	5
31.	Plasma MicroRNA Profiling Reveals Loss of Endothelial MiR–126 and Other MicroRNAs in Type 2 Diabetes	2010	Zampetaki A	806	80.60	10
32.	Unidirectional transfer of microRNA–loaded exosomes from T cells to antigen–presenting cells	2011	Mittelbrunn M	803	89.22	3
33.	Functional delivery of viral miRNAs via exosomes	2010	Pegtel DM	802	80.20	33
34.	miRDeep2 accurately identifies known and hundreds of novel microRNA genes in seven animal clades	2012	Friedlaender MR	796	99.50	16
35.	Circulating microRNAs, potential biomarkers for drug–induced liver injury	2009	Wang K	792	72.00	15
36.	Modulation of microRNA processing by p53	2009	Suzuki HI	787	71.55	17
37.	starBase v2.0: decoding miRNA–ceRNA, miRNA–ncRNA and protein–RNA interaction networks from large–scale CLIP–Seq data	2014	Li JH	775	129.17	7
38.	MicroRNA profiling: approaches and considerations	2012	Pritchard CC	768	96.00	32
39.	Circulating microRNA in body fluid: a new potential biomarker for cancer diagnosis and prognosis	2010	Kosaka N	761	76.10	13
40.	Downregulation of miRNA–200c Links Breast Cancer Stem Cells with Normal Stem Cells	2009	Shimono Y	761	69.18	9
41.	MicroRNAs in body fluids–the mix of hormones and biomarkers	2011	Cortez MA	743	82.56	31
42.	MicroRNA control of signal transduction	2010	Inui	740	74.00	4
43.	Highly Efficient miRNA–Mediated Reprogramming of Mouse and Human Somatic Cells to Pluripotency	2011	Anokye–Danso F	739	82.11	36
44.	MicroRNA biogenesis pathways in cancer	2015	Lin S	711	142.20	19
45.	MiR–33 Contributes to the Regulation of Cholesterol Homeostasis	2010	Rayner KJ	710	71.00	22
46.	Exosomal MicroRNA: A Diagnostic Marker for Lung Cancer	2009	Rabinowits G	706	64.18	13
47.	Analysis of circulating microRNA biomarkers in plasma and serum using quantitative reverse transcription–PCR (qRT–PCR)	2010	Kroh EM	704	70.40	7
48.	Induced Pluripotent Stem Cells and Embryonic Stem Cells Are Distinguished by Gene Expression Signatures	2009	Chin MH	697	63.36	19
49.	MicroRNA Control in the Immune System: Basic Principles	2009	Xiao C	690	62.73	6
50.	Circulating microRNA: a novel potential biomarker for early diagnosis of acute myocardial infarction in humans	2010	Wang GK	682	68.20	6

In this study, the top 50 most-cited miRNA publications were mentioned. According to the information obtained from the WoS Database, miRNA publications are listed according to the number of citations they receive. The publication "miRNAs: Target Recognition and Regulatory Functions" is the most-cited article (11.131), whereas "Circulating miRNAs: A new potential biomarker publication for early detection of acute myocardial infarction in humans" is the least-cited article (682). The first article with the most citations was published by Bartel DP in 2009 (26), and the least-cited article was published by Wang GK (27) in 2010 (Table 1).

The publication with the highest number of ACPYs was published by Bartel DP in 2009 (1011.91) (26). The publication with the lowest number of ACPYs was published by Xiao C in 2009 (62.73) (28). (Table 1).

The publication with the highest AAS (171) was "Circular RNAs, a large animal RNA with regulatory potential," published by Memczak S in 2013 (29). The publication with the lowest AAS (3), "One-Way miRNAs-loaded exosomes are transferred from T cells to antigen-presenting cells" was authored by Mittelbrunn M in 2011 (30) (Table 1). The publication years of these articles, first author,

Figure 1. Altmetric donut shows the article with the highest Altimetric Attention score



Tablo 2. The rank of 50 research categories featuring miRNA publications most frequently, with the the number of publications per research category, and the percentage of overall publication.

Rank	Category	No. Works	%Total Works
1.	Review articles	32	64
2.	Original research articles	14	28
3.	Guidelines and advisory documents	2	4
4.	Editorial material	1	2
5.	Validation study	1	2
Total		50	100

number of citations, ACPYs, and AASs are summarized in Table 1. The colors of the donut show the rate at which the term miRNA appeared on various social media platforms (Research Highlight Platform QA, News, Patents, LinkedIn, and Twitter) (Figure 1).

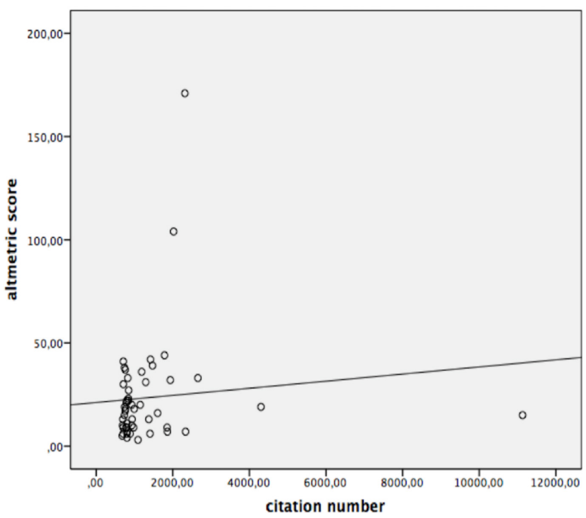
Document Type

MiRNA publications comprised various document types, including review articles, original research articles, guidelines and advisory documents, editorial material, and validation study. The top 50 most-cited miRNA publications consist of 64% review articles (32 publications), 28% original research articles (14 publications), and 4% guidelines and recommendations (2 publications). The remaining publications comprise 2% editorial material (1 publication) and 2% validation studies (1 publication). Table 2 presents the document types in the top 50 most-cited miRNA publications and the numbers and percentage values of these documents.

Research Categories

MiRNA publications were classified according to research categories and subgroups in the WoS database. These publications consist of 48% cancer and diseases (24 publications), 44% regulation

Figure 2. Shows the correlation between the number of citations and average citations per year



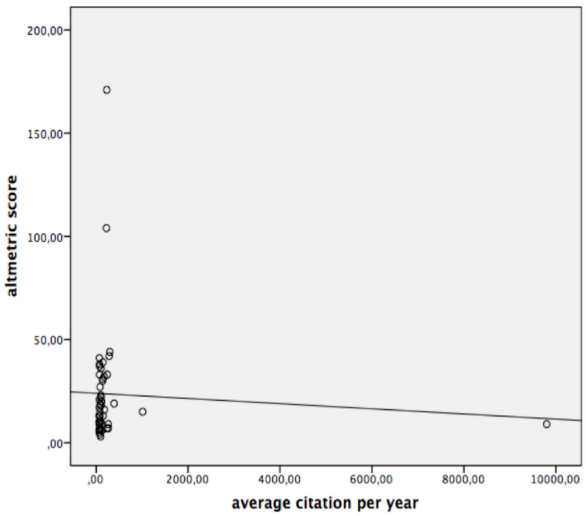


Table 3. Top-50 cited articles were classified according to research categories and subgroup

Rank	Main Subject	Subgroup
1.	Gene Expression Regulation	miRNA target recognition
2.	Gene Expression Regulation	miRNA target recognition
3.	Cancer and Disease	siRNA and mRNA biogenesis pathway
4.	Gene Expression Regulation	mRNA of protein-coding genes repression
5.	Gene Expression Regulation	protein-miRNA interactions
6.	Cancer and Disease	miRNAs and ncRNAs role of in cancer
7.	Gene Expression Regulation	miRNA-based therapies
8.	Gene Expression Regulation	CDR1 functions to bind miR-7
9.	Gene Expression Regulation	Circular RNA sponge for miR-7
10.	Gene Expression Regulation	Regulation of microRNA biogenesis
11.	Cancer and Disease	Ago2-miRNA complexes
12.	Gene Expression Regulation	MicroRNAs RNA- BindingProteins
13.	Gene Expression Regulation	miRNA target recognition
14.	Cancer and Disease	miRNA cancer biogenesis
15.	Diagnostic Biomarkers	HDL-miRNAs transports complexes
16.	Gene Expression Regulation	Myogenic Regulatory Factor miR-133
17.	Cancer and Disease	Expression of miR-26a by HCC cells
18.	Biomarkers	miRNAs in body fluids as biomarkers
19.	Gene Expression Regulation	Ago HITS-CLIP and miR-124 complexes
20.	Gene Expression Regulation	miRNA binding sites-miRWalk
21.	Cancer and Disease	Communication pathway by secretory miRNAs
22.	Gene Expression Regulation	miR-145 and miR-143 regulate smooth muscle cell
23.	Cancer and Disease	Stress signaling pathways
24.	Gene Expression Regulation	Extracellular circulating miRNA
25.	Cancer and Disease	miRNA target recognition
26.	Cancer and Disease	miR-9 metastasis
27.	Gene Expression Regulation	miRNA target gene recognition
28.	Cancer and Disease	miRNA diagnostics, monitoring and therapeutics
29.	Cancer and Disease	Diagnostic biomarker
30.	Gene Expression Regulation	microRNA-target interactions
31.	Cancer and Disease	miR-126 and other microRNAs in type 2 diabetes
32.	Cancer and Disease	Immunology/microRNA T cells to antigen-presenting
33.	Cancer and Disease	miRNA intercellular transfer
34.	Gene Expression Regulation	miRDeep2 Algorithm
35.	Biomarkers	miR122-miR192 circulating- drug-induced liver injury
36.	Gene Expression Regulation	Tumor Suppressor Protein p53
37.	Gene Expression Regulation	Protein-RNA interaction networks
38.	Gene Expression Regulation	miRNA profiling
39.	Cancer and Disease	Diagnostic biomarker
40.	Cancer and Disease	miRNA-200c links diseases
41.	Cancer and Disease	Diagnostic biomarker
42.	Gene Expression Regulation	Signal Transduction Network
43.	Cellular Reprogramming	miR302/367-mediated reprogramming
44.	Cancer and Disease	miRNA biogenesis pathway
45.	Cancer and Disease	miR-33 links liver and cellular cholesterol
46.	Cancer and Disease	Diagnostic marker for lung cancer
47.	Cancer and Disease	Diagnostic biomarker
48.	Gene Expression	IPSC and ESC are distinguished
49.	Cancer and Disease	Immune system regulatory
50.	Cancer and Disease	miR-1, miR-133a, miR-499 and miR-208a diagnostic biomarker for AMI

HCC: Hepato Cellular Carcinoma, AMI: Acute Myocardial Infarction, IPSC: Induced Pluripotent Stem Cells, and ESC: Embryonic Stem Cells

Table 4. Journals with top–50 articles, ranked according to the number of articles, Impact Factory, Quartile Category and H Index

Journal name	Number of articles	Impact Factory	Quartile Category	H Index
Cell	7	36,216	Q1	705
Nature	6	43,070	Q1	1096
Nature Reviews Genetics	5	43,704	Q1	320
Nucleic Acids Research	4	11,147	Q1	452
Proceedings of the National Academy of Sciences of The United States of America	3	9,580	Q1	699
Nature Revıews Molecular Cell Biology	2	43,351	Q1	386
Cell Stem Cell	2	21,464	Q1	212
Nature Cell Biology	2	17,728	Q1	337
Annual Review of Biochemistry	1	26,922	Q1	268
Elife	1	7,551	Q1	93
Annual Review of Medıcıne	1	10,091	Q1	148
Clinical Chemistry	1	6,891	Q1	201
Journal of Biomedical Informatics	1	2,950	Q1	83
Journal of Biological Chemistry	1	4,106	Q1	477
Nature Reviews Drug Discovery	1	57,618	Q1	289
Genome Research	1	9,944	Q1	269
Embo Molecular Medicine	1	10,624	Q1	90
Gut	1	17,943	Q1	262
Circulation Research	1	15,862	Q1	306
Nature Communications	1	11.878	Q1	248
Cancer Science	1	4.751	Q1	129
Nature Reviews Clinical Oncology	1	34.106	Q1	127
Nature Reviews Cancer	1	51.848	Q1	396
Science	1	41.037	Q1	1058
Clinical Lung Cancer	1	4.117	Q1	52
Methods	1	3.782	Q1	132
European Heart Journal	1	23.239	Q1	265

gene expression (22 publications), 6% biomarkers (3 publications), and 2% cellular reprogramming (1 publication) (Table 3).

Journal

MiRNA articles were classified according to the number of articles published in various journals. We saw that 7 articles were published in Cell journal, 19 articles in Nature and Nature Review Genetics, 4 articles in Nucleic Acid Research, and 3 articles in the United States National Academy of Sciences Papers. The remaining 17 articles were published in various declaration journals. The IF values of the journals varied between 2.9 and 57.6. Journal of Biomedical Informatics had the lowest IF, whereas Nature Reviews Drugs Discovery had the highest IF. All miRNA publications were published in the Quartile (Q) 1 category. It was observed that the journal with the highest H index was Nature (1.096), and the journal with the lowest H index was Clinical Lung Cancer (52). The journal name, number of articles, IF, Q category, and H index are presented in Table 4.

Correlation Analyses

Correlation analyses revealed a weak correlation both between AAS and the number of citations ($r = 0.207$, $p < .15$) and between

AAS and ACPY (r =.241, p <.09). In addition, a strong correlation was observed between the number of citations and ACPY (r = 0.866, p <.01). Correlation analysis is shown in Figure 2.

DISCUSSION

With the increase in the number of social network users worldwide, social media has an extremely important place in the dissemination of scientific and interdisciplinary information (31). Healthcare professionals use social media to share medical information about patients and to connect with colleagues around the world (32). To our knowledge, this is the first review to evaluate the online attention received by articles published in the miRNA field.

To understand the functions of miRNAs in physiological and pathological processes, miRNAs biogenesis must be known. The biogenesis and the functions of miRNAs are mentioned in 8 articles. In addition, miRNAs perform their functions through their target genes. The identification of target genes of miRNAs was reported in 9 articles. Various databases are used to determine target genes. One of these databases, mirWalk, determines the binding sites of miRNAs using information about genes known in humans, mice, and rats (33) and identifies not only the matches present that are complementary to 3′ UTRs but also other known regions of the gene.

MiRNAs whose target genes have been identified can be used for therapeutic purposes (34). Identification of miRNAs involved in the regulation of cellular processes will enable the functional significance of miRNAs to be determined. It has been reported that miR-26a acts as a proliferation inhibitor in hepatocellular carcinoma (35). A total of two miRNAs—miR-143 and miR-145—have been shown to play a role in the differentiation of smooth muscle cells and the regulation of plasticity (36). Moreover, it is stated that miRNAs play a balancing role in the regulation of cholesterol homeostasis. It has been reported that miR-33 is involved in both high-density lipoprotein biogenesis and the regulation of cellular cholesterol efflux in the liver (37). It has been shown in one study that miRNAs are involved in the formation of the immune response against autoimmune diseases and cancer (28). The functions of miRNAs in pluripotency have been described in two articles. In these studies, embryonic and pluripotent stem cells can be distinguished from each other owing to differences in gene expressions (38).

miRNAs can be used as biomarkers for a variety of diseases. The presence of miRNAs in body fluids has been reported in 12 separate articles. It is estimated that miRNAs found in body fluids can be used to evaluate and monitor various pathophysiological conditions (39). It has further been stated that miRNAs especially found in the blood of patients with cancer can be used as a new diagnostic criterion (40). The miRNAs whose expression changes in cancer disease have been mentioned in seven articles. It has been stated that the upregulation of miR-92 can be used as a biomarker in the plasma of patients with colorectal cancer (41). miRNAs may also play a role in preventing cancer metastasis. miR-9 has been shown to inhibit breast cancer metastasis (42). In addition, it has been stated that the upregulation of miR-208a in plasma can be used as a biomarker for early detection of myocardial damage (27).

It is extremely important to identify new miRNAs responsible for the emergence of human diseases. Various algorithms are used to identify new miRNAs. miRDeep2 is an algorithm used to identify canonical and noncanonical miRNAs (43). In determining the functions of miRNAs, their relationships with other noncoding RNAs and proteins need to be evaluated. One of the noncoding RNAs, competing endogenous RNAs, regulate the distribution of miRNA molecules on their targets (44). The other is small nucleolar RNAs that provide cellular homeostasis (45). It has been reported in two articles that noncoding RNAs are responsible for the occurrence of human diseases. For this purpose, a database called starBase is used to show the interaction of noncoding RNAs with miRNA and other proteins. Using this database, the functions of noncoding RNAs and the coordination of the networks they organize can be elucidated (46).

Correlation analyses revealed a weak correlation both between AAS and the number of citations (r = 0.207, p <.15) and between AAS and ACPY (r = 0.241, p <.09). These results show that the authors do not prefer to share their articles on social media. Although some articles received enormous citations, it was found that they were not common enough on social media. Although Bartel DP's publication had 11.131 citations, the AAS of this article was found to be 41. If these articles are shared on social platforms, they can be more enlightening or can attract the attention of different researchers. Because miRNA studies have been evaluated by a limited number of experts working in this field, it can be expected that the AASs of these studies are low. It has been stated that altmetric citations do not always reflect the impact value of highly cited articles (47). In a cross-sectional study conducted in the general medical journal, high-impact original research articles published in the full text were analyzed. In this study, it was shown that there is a weak correlation between AAS and the number of citations (48). It has also been reported that there is a moderate correlation between articles published in the cardiovascular field (49). It has been shown that there is a weak correlation between studies conducted in the field of radiology (50). Our results appear to be consistent with the literature. In addition, in our study, we observed a strong correlation between the number of citations and ACPY (r = 0.866, p <.01). These results give clues that the articles reviewed do not lose their validity. In addition, it has been observed that these publications are regularly cited every year. This shows that the subject of miRNA is still up to date and popular on the academic platform.

This study shows the impact of social media on the 50 most-cited miRNA articles. It has shown that miRNAs in circulation can be used, especially in the diagnosis, prognosis, and treatment of cancer and cardiovascular diseases.

The limitations of this study are that the altmetric analysis performed covers a certain period. Because altmetric analyses are constantly updated, fluctuations may be seen in the results of the analysis over time. In addition, it is necessary to reach the full text of the articles in order to make a few metric calculations. The full text of only 57% of the miRNA articles (26.055 publications) selected in our study (45.911 publications) can be accessed. We think that this situation may change with the increase in open access opportunities.

Ethics Committee Approval: N/A

Informed Consent: N/A

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