



# Allergologia et immunopathologia

Sociedad Española de Inmunología Clínica,  
Alergología y Asma Pediátrica

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## ORIGINAL ARTICLE

# Bibliometric analysis of publications on house dust mites during 1980–2018



E. Demir<sup>a,\*</sup>, Ö.F. Akmeşe<sup>b</sup>, H. Erbay<sup>c</sup>, A. Taylan-Özkan<sup>d,e</sup>, K.Y. Mumcuoğlu<sup>f</sup>

<sup>a</sup> Hitit University, Faculty of Medicine, Department of Biostatistics, Çorum, Turkey

<sup>b</sup> Hitit University, Osmaniye Ömer Derindere Vocational School, Department of Computer Technologies, Çorum, Turkey

<sup>c</sup> Kırıkkale University, Faculty of Engineering, Department of Computer Engineering, Kırıkkale, Turkey

<sup>d</sup> Hitit University, Faculty of Medicine, Department of Medical Microbiology, Çorum, Turkey

<sup>e</sup> Department of Medical Microbiology and Clinical Microbiology, Faculty of Medicine, Near East University, Nicosia, Cyprus

<sup>f</sup> Hebrew University-Hadassah Medical School, Department of Microbiology and Molecular Genetics, The Kuvim Center for the Study of Infectious and Tropical Diseases, Jerusalem, Israel

Received 9 December 2019; accepted 29 January 2020

Available online 10 April 2020

## KEYWORDS

Dermatophagoides;  
House dust mites;  
Bibliometric analysis

## Abstract

**Background:** The global prevalence of allergic diseases has increased dramatically in recent years and are now recognized as significant chronic diseases worldwide. One of the most important allergens that causes allergic diseases is house dust mites.

**Objective:** This study aims to present a bibliometric overview of research published on dust mites between 1980 and 2018.

**Methods:** Articles published from 1980 to 2018 were analyzed using bibliometric methods. The keywords "Dust mite\*" and "Dermatophagoides" were used in the Web of Science (WoS). Simple linear regression analysis was used to estimate the number of future publications on this subject.

**Results:** A total of 4742 publications were found, 2552 (53.8%) of them were articles. Most of the articles were on subjects related to immunology (1274; 49.9%) and allergy (1229; 48.1%). *Clinical and Experimental Allergy* (222; 8.7%) was the journal with the most publications. The USA was the country that most contributed to the literature with 461 (18.1%) articles. The countries producing the most publications on this subject were developed countries. The most active author was W.R. Thomas (66; 2.5%). The most productive institution was the University of Western Australia (91; 3.6%). The most cited article was published in the *New England Journal of Medicine*.

\* Corresponding author.

E-mail address: [emredemir82@gmail.com](mailto:emredemir82@gmail.com) (E. Demir).

**Conclusion:** According to the findings, developed countries were the most productive in publishing on house dust mites. By planning multinational research rather than regional studies, it may be suggested that researchers in underdeveloped or developing countries could also conduct more research on this subject.

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## Introduction

The global prevalence of allergic diseases has increased dramatically in recent years and they are now recognized as significant chronic diseases worldwide.<sup>1</sup> There have been many studies in the literature showing that house dust mites play an important role in the development of allergic diseases such as asthma, allergic rhinitis, and atopic dermatitis.<sup>2-6</sup> In addition to genetic predisposition, exposure to household allergens such as house dust mites plays an essential role in triggering allergic diseases.

House dust mites are small arthropods mainly found in the home environment and which reproduce rapidly, especially in hot and humid environments. These mites feed on human skin scales and on microorganisms growing on it, while the allergens they produce are excreted with their feces. *Dermatophagoides pteronyssinus* and *Dermatophagoides farinae* are the most prevalent house dust mites worldwide.<sup>7</sup>

Bibliometrics is the statistical analysis of publications such as articles, books, reviews, congress abstracts and full texts of congresses, and evaluating a subject, institutions, countries, or a research area as a whole.<sup>8-10</sup> It is a quantitative analysis of academic literature based on metrics such as citation analysis. It is a statistical method used to examine the development of a special research topic or a direct research area. In addition to providing evidence of the impact of the publications' outputs, bibliometric researches identify emerging research areas, the most influential publications on a subject, and prominent journals.<sup>11,12</sup>

Many articles have been published on house dust mites and the allergies they cause, however, a bibliometric analysis of the articles on this subject could not be found in the literature. The aim of this study is to analyze the studies on house dust mites published between 1980 and 2018 with bibliometric methods and to reveal the international relations between the trend, most influential articles, journals, countries, and institutions in the world.

## Material and methods

Between 1980 and 2018, all publications indexed in the WoS (Web of Science Core Collection database maintained by Clarivate Analytics; access date: 1.08.2019) about dust mites were downloaded and analyzed by bibliometric methods. "Dust mite\* (or Dust mites)," and "*Dermatophagoides*" were used as search keywords. Documents were found only with keywords in the title. The WoS codes used for our search were as follows; *Title: ("Dust mite\*") OR Title: ("Dermatophagoides") Refined by:*

*Document Types: (Article) Timespan: 1980–2018. Indexes: SCI-Expanded, SSCI, A&HCI, CPCI-S, CPCI-SSH, BKCI-S, BKCI-SSH, ESCI. With this search method, all published articles from 1980–2018 containing the keywords "dust mite", "dust mites" and "Dermatophagoides" in the title of the articles were found in the WOS database. VOSviewer (Version 1.6.10) software was used for bibliometric network visualizations.<sup>13</sup> Simple linear regression analysis was used to estimate publication numbers to be published in the following years. In this study, in addition to bibliometric indicators, Price's Law analysis is also available. This law is widely used in analyzing the efficiency of a specific discipline or a particular country, to reflect an essential aspect of scientific production with exponential growth.<sup>14</sup> The correlations between Gross Domestic Product (GDP) Purchasing power parity (PPP) per capita and publication productivity of countries on the topic of dust mite were investigated with Spearman's rank correlation coefficient. Linear regression is one of the most widely used statistical techniques for predictive modeling and summarizes the relationships between two continuous variables. Mathematically, linear regression is defined by the following equation:  $y = bx + a + \varepsilon$ , where:  $x$ : represents an independent variable.  $y$ : refers to a dependent variable.  $a$ : is the Y-segment, which is the expected average value of  $y$  when all  $x$  variables are equal to 0.  $b$ : is the slope of a regression line with a rate of change of  $x$  for  $y$ .  $\varepsilon$ : the random error term, which is the difference between the actual value and the predicted value of a dependent variable.*

## Results

Our search revealed a total of 4742 publications. These publications were articles (2552, 53.8%), meeting abstracts (1720, 36.3%), letters (144, 3.0%), proceedings papers (110, 2.3%), reviews (98, 2.1%), editorial material (74, 1.6%) and others such as notes, corrections, news items, additions, reprints, book chapters, discussions, and items about an individual (98, 2.1%).

The language distribution of the articles was as follows; 2413 (94.6%) English, 68 (2.7%) German, 34 (1.3%) French, and 37 (1.3%) in other languages such as Russian, Spanish, Turkish, Italian, Japanese, Korean, and Chinese.

Most articles were published in Immunology (1274, 49.9%). The subjects of the publications were: Allergy (1229, 48.2%), Respiratory System (144, 5.6%), Biochemistry and Molecular Biology (137, 5.4%), Entomology (126, 4.9%), Veterinary Sciences (112, 4.4%), Dermatology (102, 4.0%), Medicine: General and Internal (94, 3.7%), Medical Research (84, 3.3%), and Pharmacology/Pharmacy (77, 3.0%).

Bibliometric analyses were performed with 2552 publications in this category. Overall, 2552 articles received 66,689 citations (52,844 times without self-citations). The h-index of the articles was 104, and the average citations per item 26.1.

### Development of publications

The distribution of dust mite publications by years is shown in Fig. 1. In this figure, the number of articles to be published during 2019–2022 was also estimated by regression analysis. It was predicted that 113 (95% confidence interval; 80–146) articles could be published in 2019, while in 2022, this number is expected to increase to 120 (86–154).

### Active countries and Price's Law

Studies on house dust mites and allergies were published in 87 countries. Fig. 2a shows 35 countries producing at least 10 publications, while Fig. 2b shows international cooperation between 31.

According to Price's Law, the total number of publications for the first countries obtained by taking the square root of the number of countries in our study should be half of the total publications. The total number of publications is 3222. When the square root of the number of 87 countries is taken, the number of publications in the first nine countries with the highest number of scientific publications was found to be 1934.

To assess whether the growth of scientific production in countries follows Price's law of exponential growth, we made a linear adjustment of the data obtained, according to the equation  $y = 1.9386x - 48.263$ , and another adjustment to an exponential curve, according to the equation  $y = 0.3913e^{0.0686x}$  (Fig. 3a).

### Active authors

The top five authors producing the highest number of publications were W.R. Thomas (66, 2.6%), L.G. Arlian (48, 1.9%), M.D. Chapman (44, 1.7%), G.A. Stewart (44, 1.7%), and T.A.E. Platts-Mills (42, 1.6%).

### Active institutions

The top 10 organizations that contributed most to the literature were: University of Western Australia (91, 3.6%), University of Virginia (69, 2.7%), University of Amsterdam (59, 2.3%), Imperial College of London (56, 2.2%), University of Sydney (53, 2.1%), Wright State University Dayton (50, 2.0%), University of Copenhagen (48, 1.9%), Karolinska Institutet (47, 1.8%), Yonsei University (45, 1.8%), and University of London (43, 1.7%).

### Active journals and Price's Law

Overall, 2552 articles have been published in 520 journals. The journals which published at least 15 articles on dust mites and the first 25 journals with the highest number of

publications are shown in Table 1, while the citation visualization map between these journals is given in Fig. 4.

According to Price's Law, the total number of publications for the first journals obtained by taking the square root of the number of journals in our study should be half of the total publications. The total number of publications is 1415. When the square root of the number of 25 journals is taken, the number of publications in the first five journals with the highest number of scientific publications was found to be 799.

To assess whether the growth of the number of publications in journals follows Price's law of exponential growth, we made a linear adjustment of the data obtained, according to the equation  $y = 5.865x - 24.754$ , and another adjustment to an exponential curve, according to the equation  $y = 10.983e^{0.0915x}$ .

### Top cited articles

Table 2 shows the first 20 articles with the most citations.

### Co-citation

A total of 35,647 citations were mentioned in the references of the articles. The researchers with the first four most cited studies were: R. Sporik (1990), M.D. Chapman (1980), E.R. Tovey (1981) and T.A.E. Platts-Mills (1992).<sup>2,15-17</sup>

### Keyword analysis

A total of 3314 different keywords were used in 4742 articles. As a result of the keyword analysis, 80 keywords that were used in at least 10 different articles are shown in Table 3. The clustering analysis between these keywords is given in the network visualization map (Fig. 5). In addition, the network visualization map for the trend keywords obtained according to the topicality of the publications is shown in Fig. 6.

### Correlation analysis

There was a moderate, positive, statistically significant correlation between the number of publications and GDP PPP ( $r = 0.682$ ,  $p < 0.001$ ).

### Discussion

When the number of publications is evaluated by years, it is seen that there is a linear increase in the number of publications, with a significant increase since 2014. According to the regression analysis, it is predicted that 120 articles will be published on this subject in 2022.

When the number of publications in a given country is evaluated, it can be seen that countries with high economic power such as the USA, Japan, England, Australia, and China have published the highest number of publications about dust mites. This is consistent with the literature showing that academic productivity has a significant correlation with economic power.<sup>8,11,12</sup> In addition, Rossi et al. (2015) stated that the socio-economic burden of allergic rhinitis, which

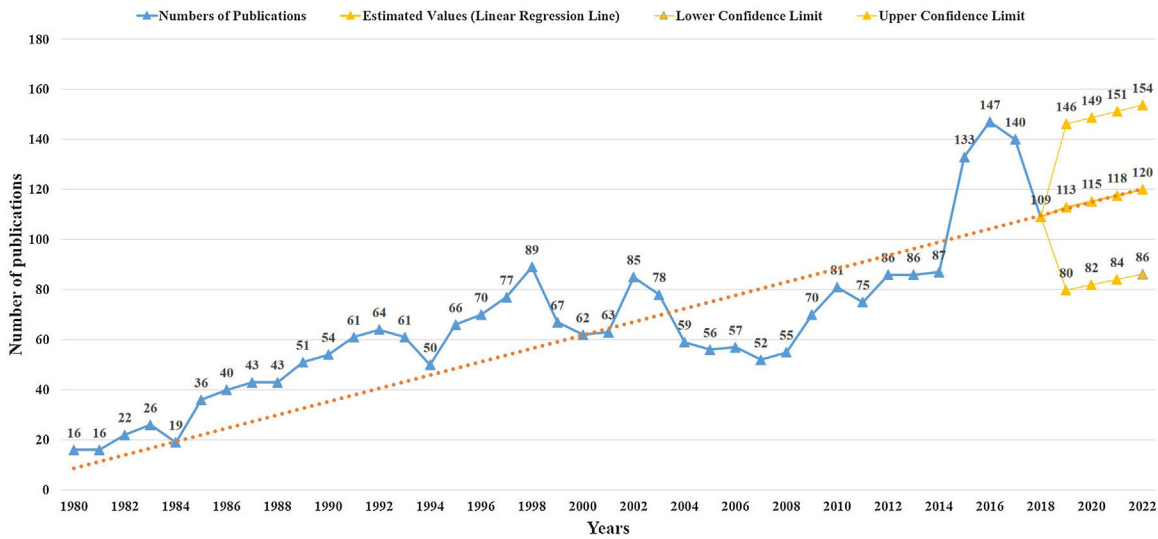


Figure 1 Number of publications by year on dust mites.

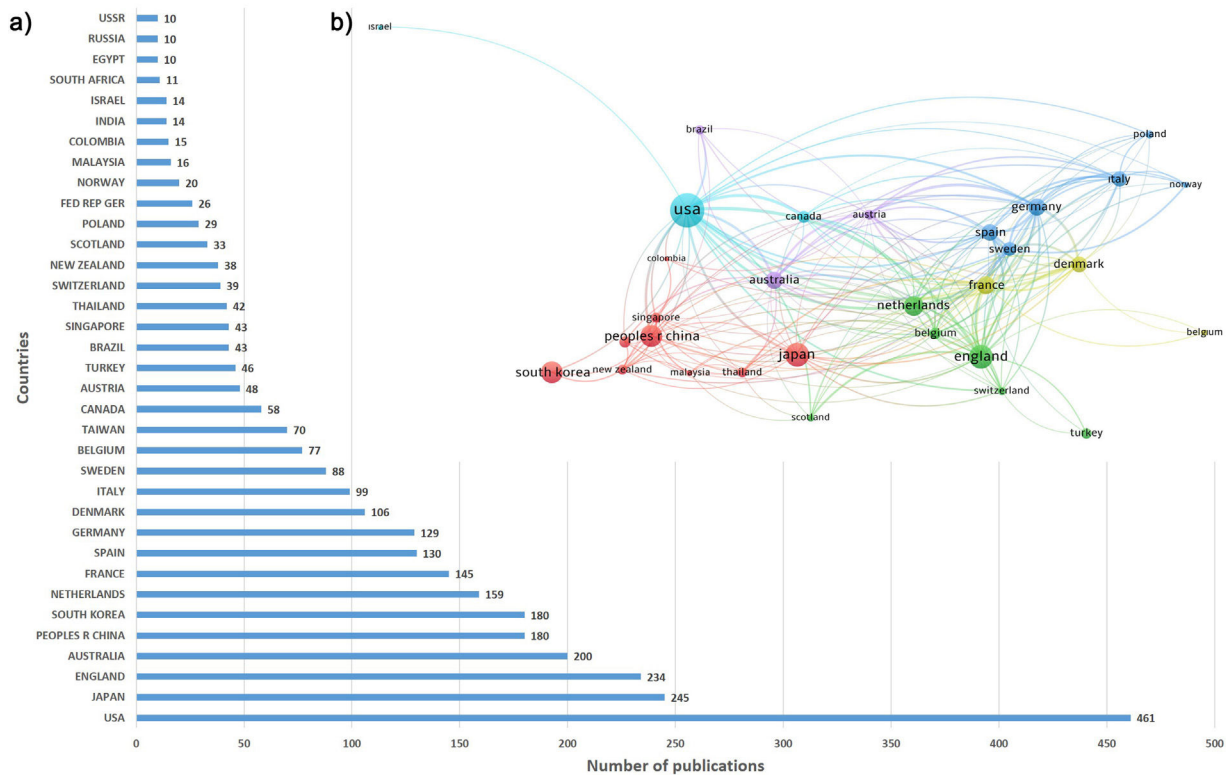
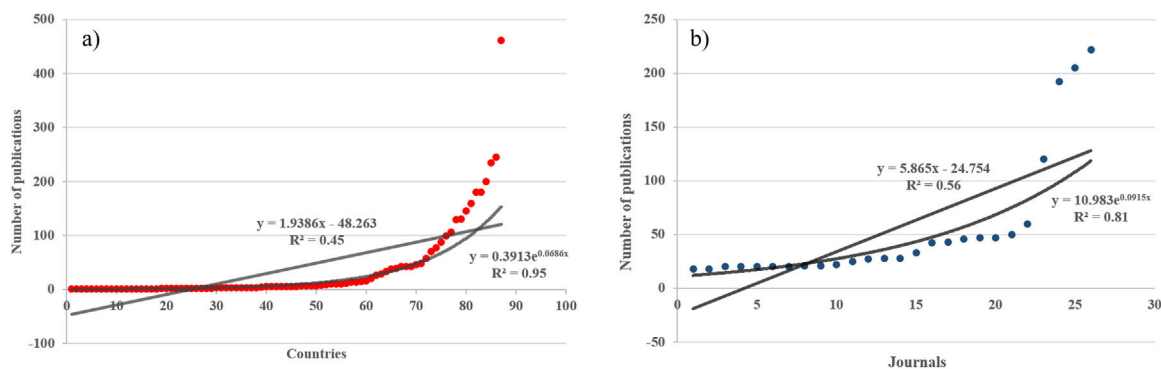


Figure 2 a. Bar chart for the productivity of worldwide countries on dust mites. b. Network visualization map for an international collaboration of worldwide countries on dust mites. Footnote: The size of the circle shows a large number of publications; the colors indicate the cluster, and the thickness of the lines indicates the strength of the relationship.

amounts to billions of Euros in terms of health expenditure costs in Europe, is higher in health expenditures in Europe than in major diseases such as diabetes and cardiovascular diseases.<sup>18</sup>

When cooperation between countries is evaluated, it is generally thought that a regional geographical position has an effect on cooperation (Fig. 2).

The journals producing the most publications on the subject were: Clinical and Experimental Allergy, Journal of Allergy and Clinical Immunology, Allergy, and International Archives of Allergy and Immunology. According to the average number of citations per publication, the most cited journals were: Clinical and Experimental Allergy, Journal of Allergy and Clinical Immunology, Journal of Immunology,



**Figure 3** Network visualization map for citation analysis of active journals on dust mites. *Footnote:* The size of the circle shows a large number of citations. In the indicator given at the bottom left of the figure, the number of average citations increases from blue to red (blue-green-yellow-red). The thickness of the lines indicates the amount of citation relationship between journals. Featured journals based on the average number of citations per article; Clinical and Experimental Allergy, Journal of Allergy and Clinical Immunology, Journal of Immunology, American Journal of Respiratory and Critical Care Medicine, and Clinical Allergy.

**Table 1** Top 25 journals with the highest number of articles on dust mites.

Journals	RC	%	C
Clinical and Experimental Allergy	222	8.699	9246
Journal of Allergy and Clinical Immunology	205	8.033	13,362
Allergy	192	7.524	5023
International Archives of Allergy and Immunology	120	4.702	2248
Annals of Allergy Asthma Immunology	60	2.351	1029
Allergologie	50	1.959	113
International Archives of Allergy and Applied Immunology	47	1.842	3491
Journal of Immunology	47	1.842	1428
Annals of Allergy	46	1.803	724
Journal of Medical Entomology	43	1.685	599
Plos One	42	1.646	528
Veterinary Dermatology	33	1.293	517
Experimental and Applied Acarology	28	1.097	210
Pediatric Allergy and Immunology	28	1.097	786
Asian Pacific Journal of Allergy and Immunology	27	1.058	180
Journal of Investigational Allergology and Clinical Immunology	25	0.980	440
Allergologia et Immunopathologia	22	0.862	273
Clinical Allergy	21	0.823	906
Journal of Investigational Allergology Clinical Immunology	21	0.823	193
American Journal of Respiratory and Critical Care Medicine	20	0.784	1622
American Journal of Respiratory Cell and Molecular Biology	20	0.784	703
American Journal of Rhinology Allergy	20	0.784	187
Experimental Applied Acarology	20	0.784	409
Journal of Asthma	20	0.784	169
Allergy Asthma Immunology Research	18	0.705	134
Molecular Immunology	18	0.705	573

RC: record count C: number of citations.

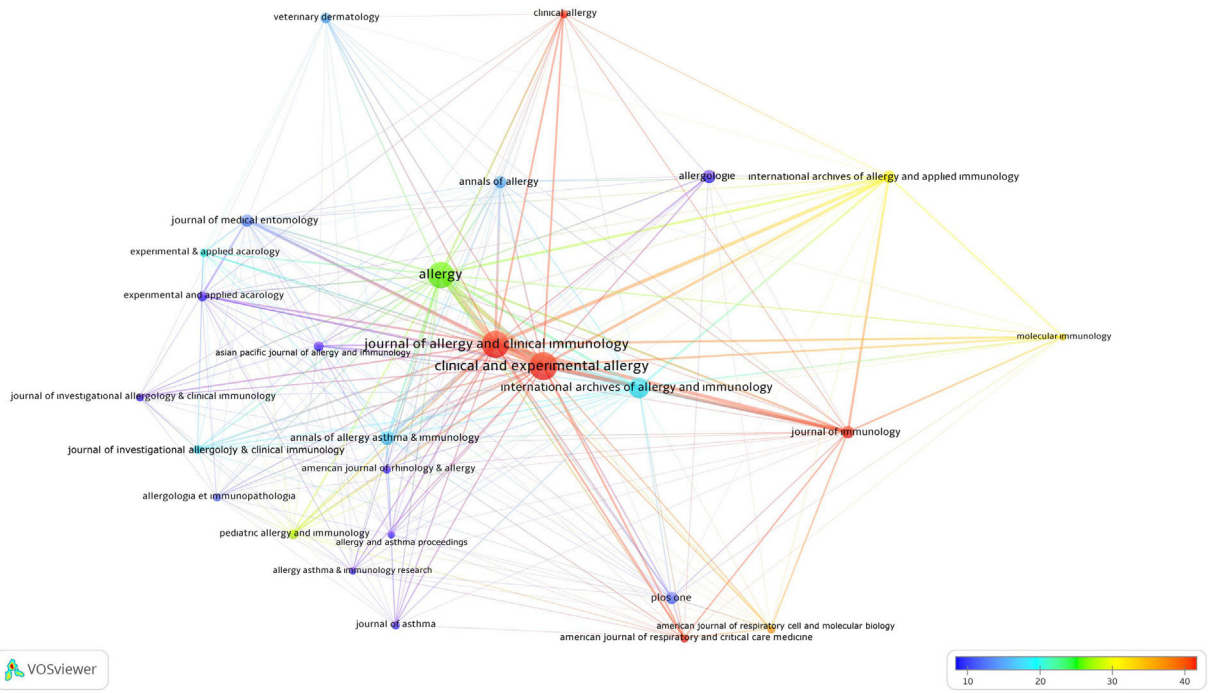
American Journal of Respiratory and Critical Care Medicine, and Clinical Allergy.

According to the results of the Price's Law and curve-fitting analyses, we can conclude that the analyzed database is compatible with a more exponential fit than the linear one and that the assumptions of Price's Law are fulfilled. In their studies, López-Muñoz et al. used Price's law as a bibliometric indicator of production.<sup>14,19-23</sup> In our study, Price's Law was calculated, and similar findings were obtained with these

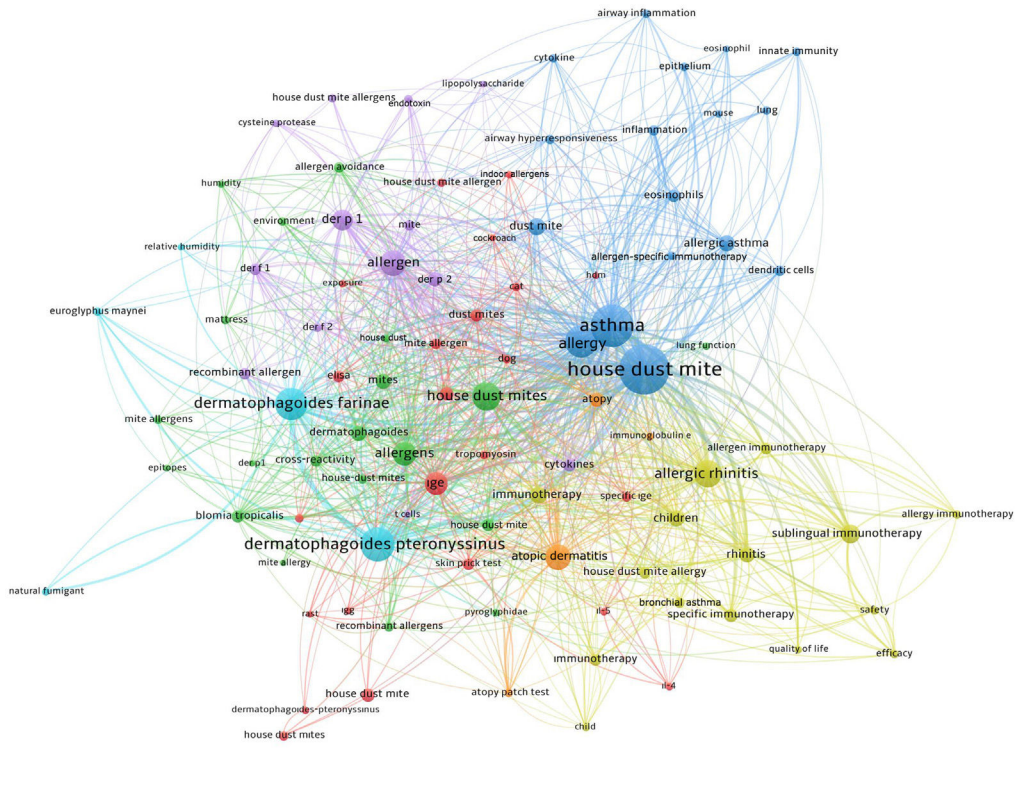
studies. In addition to these studies, we focused on the most cited topics and keyword analyses.

Lopez et al. found a significant relationship between GDP and publication productivity in bibliometric articles in the field of health.<sup>24,25</sup> As a result of the correlation analysis performed in our study, a significant relationship was found between GDP, PPP, and publication productivity.

The most cited article (Sporik et al., 1990) was published in the *New England Journal of Medicine*, entitled "Exposure



**Figure 4** Cluster map for keyword analysis on dust mites. *Footnote:* The size of the circles indicates that the keyword is used frequently. The thickness of the lines indicates that keywords are commonly used together in similar studies.



**Figure 5** Trend map for keyword analysis on dust mites. *Footnote:* Indicator shows current publications from blue to red. Keywords in red indicate more recent articles published in recent years.

**Table 2** Top 20 most cited articles according to total citations on dust mites.

No	Article	Author	Journal	PY	TC	AC
1	Exposure to house-dust mite allergen (Der-p-1) and the development of asthma in childhood – a prospective-study	Sporik et al.	New England Journal of Medicine	1990	1309	43.6
2	House dust mite allergen induces asthma via Toll-like receptor 4 triggering of airway structural cells	Hammad et al.	Nature Medicine	2009	657	59.7
3	Dust mite allergens and asthma – report of a 2nd international workshop	Platts-Mills, TAE et al.	Journal of Allergy and Clinical Immunology	1992	504	18
4	Early exposure to house-dust mite and cat allergens and development of childhood asthma: a cohort study	Lau et al.	Lancet	2000	481	24.0
5	Dust mite allergens and asthma – a worldwide problem	Platts-Mills et al.	Journal of Allergy and Clinical Immunology	1989	480	15.4
6	Sequence-analysis of cdna coding for a major house dust mite allergen, Der-p-1 homology with cysteine proteases	Chua et al.	Journal of Experimental Medicine	1988	455	14.2
7	The relative risks of sensitivity to grass-pollen, house dust mite and cat dander in the development of childhood asthma	Sears et al.	Clinical and Experimental Allergy	1989	428	13.8
8	Conventional and monocyte-derived CD11b(+) dendritic cells initiate and maintain T helper 2 cell-mediated immunity to house dust mite allergen	Plantinga et al.	Immunity	2013	394	56.2
9	Immunotherapy with a standardized <i>Dermatophagoides pteronyssinus</i> extract 6. Specific immunotherapy prevents the onset of new sensitizations in children	DesRoches et al.	Journal of Allergy and Clinical Immunology	1997	394	17.1
10	Prevention of new sensitizations in asthmatic children monosensitized to house dust mite by specific immunotherapy. A six-year follow-up study.	Pajno et al.	Clinical and Experimental Allergy	2001	393	20.6
11	Purification and characterization of the major allergen from <i>Dermatophagoides pteronyssinus</i> -antigen-p1	Chapman & Platts-Mills	Journal of Immunology	1980	380	9.5
12	A 2-site monoclonal-antibody ELISA for the quantification of the major <i>Dermatophagoides</i> spp allergens, Der p-1 and Der f-1	Luczynska et al.	Journal of Immunological Methods	1989	374	12.0
13	House dust mite allergens – a major risk factor for childhood asthma in Australia	Peat et al.	American Journal of Respiratory and Critical Care Medicine	1996	365	15.2
14	Inflammatory dendritic cells-not basophils-are necessary and sufficient for induction of TH2 immunity to inhaled house dust mite allergen	Hammad et al.	Journal of Experimental Medicine	2010	352	35.2
15	Dust-free bedrooms in the treatment of asthmatic-children with house dust or house dust mite allergy – a controlled trial	Murray & Ferguson	Pediatrics	1983	324	8.7
16	The distribution of dust mite allergen in the houses of patients with asthma	Tovey et al.	American Review of Respiratory Disease	1981	273	7
17	T-cell activation-inducing epitopes of the house dust mite allergen Der-p-1 – proliferation and lymphokine production patterns by der-p-i-specific cd4+ t-cell clones	Yssel et al.	Journal of Immunology	1992	261	9.3

Table 2 (Continued)

No	Article	Author	Journal	PY	TC	AC
18	Continuous exposure to house dust mite elicits chronic airway inflammation and structural remodeling	Johnson et al.	American Journal of Respiratory and Critical Care Medicine	2004	245	15.3
19	Antigenic and structural-analysis of group-ii allergens (der-f-ii and der-p-ii) from house dust mites (dermatophagoides spp)	Heymann et al.	Journal of Allergy and Clinical Immunology	1989	245	7.9
20	Seasonal-variation in dust mite and grass-pollen allergens in dust from the houses of patients with asthma	Platts-Mills et al.	Journal of Allergy and Clinical Immunology	1987	240	7.2

PY: publication year, TC: total citations, AC: average citations per year.

Table 3 The first 80 trend keywords on dust mites.

Keyword	O	Keyword	O	Keyword	O	Keyword	O
House dust mite	632	Eosinophils	39	Allergen-specific immunotherapy	15	IL-4	12
Asthma	295	Atopy	36	Airway inflammation	14	Indoor allergens	12
Allergen	205	Mite allergen	36	Der f 2	14	Lung function	12
Dermatophagoides pteronyssinus	205	Der p 2	35	Dog	14	Mouse	12
Allergy	173	Specific immunotherapy	33	Endotoxin	14	Natural fumigant	12
Dermatophagoides farinae	170	Sensitization	31	Epithelium	14	Pyroglyphidae	12
Allergic rhinitis	123	House dust mite allergens	28	Safety	14	Exposure	11
Atopic dermatitis	107	Blomia tropicalis	27	Allergy immunotherapy	13	Humidity	11
IgE	87	Cross-reactivity	25	Atopy patch test	13	IgG	11
Der p 1	86	ELISA	25	Cat	13	IL-5	11
Immunotherapy	78	House dust mite allergy	25	Efficacy	13	Immunoglobulin e	11
Dust mite	77	Skin prick test	24	Environment	13	Quality of life	11
Mites	64	Allergen immunotherapy	23	Euroglyphus maynei	13	Cockroach	10
Sublingual immunotherapy	60	Der f 1	23	Innate immunity	13	Epitopes	10
Allergic asthma	46	Allergen avoidance	20	Lung	13	House dust mites	10
Children	44	Bronchial asthma	19	Mattress	13	Lipopolysaccharide	10
Cytokines	43	Dendritic cells	19	Tropomyosin	13	Mite allergy	10
Rhinitis	43	Inflammation	19	Tyrophagus putrescentiae	13	RAST	10
Dermatophagoides	41	Airway hyperresponsiveness	17	Child	12	Relative humidity	10
Recombinant allergen	41	Specific IgE	16	Cysteine protease	12	T cells	10

O: number of occurrences.

to house-dust mite allergen (Der-p 1) and the development of asthma in childhood – a prospective-study”.<sup>2</sup> According to the average number of citations, the most effective article (Hammad et al., 2009) was the study

entitled “House dust mite allergen induces asthma via toll-like receptor 4 triggering of airway structural cells”, published in *Nature Medicine*.<sup>3</sup> The next most cited article was that of Plantinga et al., 2013 with the title



“Conventional and monocyte-derived CD11b+ dendritic cells initiate and maintain T helper 2 cell-mediated immunity to house dust mite allergen” published in the journal *Immunity*.<sup>26</sup>

The most commonly used keywords in the articles were: asthma, allergen, *Dermatophagoides pteronyssinus*, allergy, *Dermatophagoides farinae*, allergic rhinitis, atopic dermatitis, IgE, Der-p 1, and immunotherapy. The keyword analysis also revealed that there were no keywords that were significantly related to probiotics. Domínguez et al. (2016) stated that probiotics had beneficial therapeutic effects in allergic rhinitis, but no positive effect was found in the prevention of asthma and respiratory diseases.<sup>27</sup> Fassio (2018) stated that the use of probiotics in the treatment of allergic diseases was very promising due to increasing evidence of immunomodulatory effects. He also stated that the role of probiotics was known in the treatment and prevention of some allergic conditions such as atopic dermatitis, whereas the efficacy of probiotics in patients with an increasing number of respiratory allergies has not been proven yet.<sup>28</sup>

The limitations of the study were that the first publication in the Web of Science database starts in 1980, although the first publication on the role of house dust mites in the development of allergies was from 1964.<sup>29</sup> In addition, databases such as PubMed and Scopus are not included in our study. Since only journals with high impact factors are indexed in the WoS database, not all journals were included in this study. In some bibliometric studies, it has been reported that the use of a large number of databases raises the problem of including more than one publication in the analysis. Doğan (2019), Demir (2020), Muslu (2018), and Ozsoy (2018) used only the WoS for the literature review in their bibliometric study and stated that the WoS database is more reliable than other databases such as Scopus and Medline.<sup>30–33</sup>

## Conclusions

This study provides a holistic review of articles on dust mites, one of the most common triggers behind allergic rhinitis and asthma. According to the findings, developed countries were the most productive in publications on house dust mites and allergies. By planning multinational research rather than regional studies, it could help researchers in underdeveloped or developing countries to conduct more research on this subject.

## Conflict of interest

The authors declare that there is no conflict of interest

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