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Indian Research Output in Atopic Dermatitis Literature: A Bibliometric Study

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Abstract:
The present study examines the growth, development, research productivity, and citation impact of Indian research output in Atopic Dermatitis literature during the period 2016–2025 using bibliometric techniques. The study aims to evaluate publication trends, citation patterns, and India's relative contribution to global research in this field. A total of 891 Indian research publications were analysed using bibliometric indicators such as Citations per Publication (CPP), Activity Index (AI), Attractivity Index (AAI), Publication Efficiency Index (PEI), Annual Growth Rate (AGR), Exponential Growth Rate (EGR), Relative Growth Rate (RGR), Doubling Time (DT), and time-series analysis. The findings reveal that Indian research output increased substantially from 32 publications in 2016 to 162 publications in 2025, indicating growing research interest in Atopic Dermatitis. The publications received a total of 16,730 citations, with an average of 18.78 citations per publication. The highest citation impact of 71.78 CPP was recorded in 2017. The Activity Index increased from 60.58 in 2016 to 129.61 in 2025, reflecting India's increasing relative contribution to global research, while the highest Attractivity Index of 179.68 was observed in 2023. The highest Publication Efficiency Index of 2.06 was recorded in 2017. The Annual Growth Rate and Exponential Growth Rate reached their highest values of 70.15% and 1.70, respectively, in 2021. However, the Relative Growth Rate declined from 0.75 in 2017 to 0.20 in 2025, while the Doubling Time increased from 0.92 to 3.45 years, indicating a gradual moderation in cumulative publication growth. Time-series analysis projects approximately 248 publications in 2030 and 583 publications in 2050, assuming the continuation of the historical linear trend. The study concludes that Indian research output in Atopic Dermatitis literature has demonstrated substantial growth and increasing relative global participation, although citation impact and growth rates have fluctuated over time. The findings highlight the importance of strengthening research quality, scientific collaboration, and scholarly visibility to enhance India's contribution to global Atopic Dermatitis research.

Keywords: Atopic Dermatitis, Indian Research Output, Bibliometric Analysis, Citation Analysis, Activity Index, Attractivity Index, Publication Efficiency Index, Research Growth, Doubling Time, Time-Series Analysis.

1. Introduction

The advancement of medical knowledge is greatly aided by research and development, especially when it comes to comprehending the causes, diagnosis, treatment, and prevention of diseases. The

development of evidence-based healthcare procedures and better patient outcomes has been greatly aided by the on-going expansion of scientific literature. One of the key areas of medicine that treats conditions affecting the skin, hair, nails, and related structures is dermatology. Atopic dermatitis is one of many dermatological disorders that have become a significant public health concern due to its chronic nature, growing recognition, and significant impact on the quality of life of those who are affected. A considerable amount of research literature has been produced globally as a result of the increased scientific interest in atopic dermatitis, providing opportunity for rigorous evaluation of research output, scientific collaboration, and emerging research trends through bibliometric analysis.

Atopic dermatitis (AD), commonly known as atopic eczema, is a chronic, relapsing, inflammatory skin disorder characterized by intense itching, skin dryness, redness, and recurrent eczematous lesions. It affects individuals of all age groups, particularly infants and children, although the condition may persist into adulthood or develop later in life. Environmental factors such as climate, pollution, allergens, lifestyle changes, and urbanization may influence the occurrence and severity of the disease. In addition to physical symptoms, atopic dermatitis can produce considerable psychological, emotional, social, and economic burdens. Recent developments in medical research have significantly improved the understanding of the pathophysiology of atopic dermatitis. These developments have encouraged further scientific investigations and increased scholarly publications in this field.

The participation of Indian researchers in national and international scientific collaborations has also created opportunities for knowledge exchange, multidisciplinary investigation, and improved research visibility. However, the extent of India's contribution to global atopic dermatitis literature, the growth of publications over time, the leading research institutions, influential authors, preferred publication sources, and patterns of scientific collaboration require systematic examination. A bibliometric study can provide a comprehensive understanding of these aspects and identify the strengths, limitations, and future directions of Indian research in this field.

2. Need for the study

Atopic Dermatitis is a chronic inflammatory skin disease that has gained increasing attention in medical research. The growing volume of scientific publications highlights the need for a systematic evaluation of India's research contribution to this field. The present study aims to examine the growth and development of Indian research output in Atopic Dermatitis literature during 2016–2025 using bibliometric techniques. It focuses on publication trends, citation impact, research productivity, growth rates, and India's relative contribution to global research. The study also identifies patterns of scientific growth and estimates future research trends. The findings will be useful to researchers, academicians, medical professionals, and policymakers in understanding research performance, identifying research gaps, and promoting further scientific investigations in Atopic Dermatitis.

3. Objectives of the study

The main objective of the present study is to examine and evaluate the growth, development, research productivity, and citation impact of Indian scientific publications in Atopic Dermatitis literature during the period 2016–2025 through bibliometric techniques are

1. To analyse the year-wise citation distribution and citation impact of Indian research publications using Citations per Publication (CPP).

2. To measure India's relative research contribution to global Atopic Dermatitis literature through the Activity Index (AI), Attractivity Index (AAI).
3. To assess the relative citation attractiveness of Indian research output using the To evaluate the citation performance of Indian research output in relation to global publication productivity through the Publication Efficiency Index (PEI).
4. To determine the Annual Growth Rate (AGR) of Indian research publications in Atopic Dermatitis literature.
5. To examine the Exponential Growth Rate (EGR) of Indian research output during the study period.
6. To calculate the Relative Growth Rate (RGR) and Doubling Time (DT) of Indian research publications.

4. Methodology

The current study follows a bibliometric research approach to analyze the growth and citation characteristics of atopic dermatitis research. The data in the atopic dermatitis was obtained from the Scopus database for the period 2016–2025. A total of 891 publications were found and included in the analysis. The collected data were analysed with MS office Execl Spread sheet and presented the findings in the form of Tables and Graphs.

5. Review of literature

Dhar and Banerjee (2010) examined the clinical characteristics and management of atopic dermatitis among infants and children in India, highlighting its chronic inflammatory nature and the importance of appropriate treatment. Kanwar and De (2011) investigated the epidemiology and clinical features of atopic dermatitis in India and emphasized the need for further research on its prevalence, clinical manifestations, and management. Laughter et al. (2021) analysed the global burden of atopic dermatitis using Global Burden of Disease data from 1990 to 2017 and identified considerable geographical variations and a substantial nonfatal disease burden. Shin et al. (2023) examined the global, regional, and national burden of allergic disorders, including atopic dermatitis, across 204 countries and territories and highlighted variations in disease burden among different populations. Cao et al. (2024) investigated the global burden of paediatric atopic dermatitis and identified increasing numbers of affected children and geographical inequalities. A Global Burden of Disease-based study (2025) examined worldwide trends in atopic dermatitis from 1990 to 2021 and emphasized its continuing significance as a public health concern. A bibliometric study on atopic dermatitis and microbiota interactions (2025) analysed 1,196 publications published during 2009–2024 using VOSviewer, CiteSpace, and Biblioshiny, identifying publication growth, influential contributors, research collaborations, and emerging research trends. The reviewed studies indicate that previous research has mainly focused on the epidemiology, clinical characteristics, disease burden, and emerging scientific developments in atopic dermatitis. However, a focused bibliometric assessment of Indian research output remains important for understanding publication growth, citation impact, research productivity, and scholarly performance.

6. Analysis and interpretation

6.1 Year-wise distribution of Publication of Indian Research output in Atopic Dermatitis Literature

The table presents the year-wise distribution of Indian research publications in Atopic Dermatitis literature from 2016 to 2025. A total of 891 publications were recorded during the study period. In 2016, 32 publications were produced, accounting for 3.59% of the total output. The number increased gradually to 41 in 2019 and 67 in 2020. A considerable increase was observed in 2021, with 114 publications, representing 12.79% of the total. The output continued to rise, reaching 117 publications in 2022 and 125 in 2023. In 2024, publications increased to 161, accounting for 18.07%. The highest output was recorded in 2025, with 162 publications (18.18%). The cumulative percentage reached 49.72% by 2022 and 81.82% by 2024. Overall, the findings reveal a substantial upward trend in Indian Atopic Dermatitis research, particularly during the later years of the study period.

Table 1: Year-wise distribution of Publication of Indian Research output in Atopic Dermatitis Literature

S. No	Year	Publication	Publications %	Cumulative	Cumulative %
1	2016	32	3.59	32	3.59
2	2017	36	4.04	68	7.63
3	2018	36	4.04	104	11.67
4	2019	41	4.60	145	16.27
5	2020	67	7.52	212	23.79
6	2021	114	12.79	326	36.59
7	2022	117	13.13	443	49.72
8	2023	125	14.03	568	63.75
9	2024	161	18.07	729	81.82
10	2025	162	18.18	891	100
	Total	**891**	**100**		

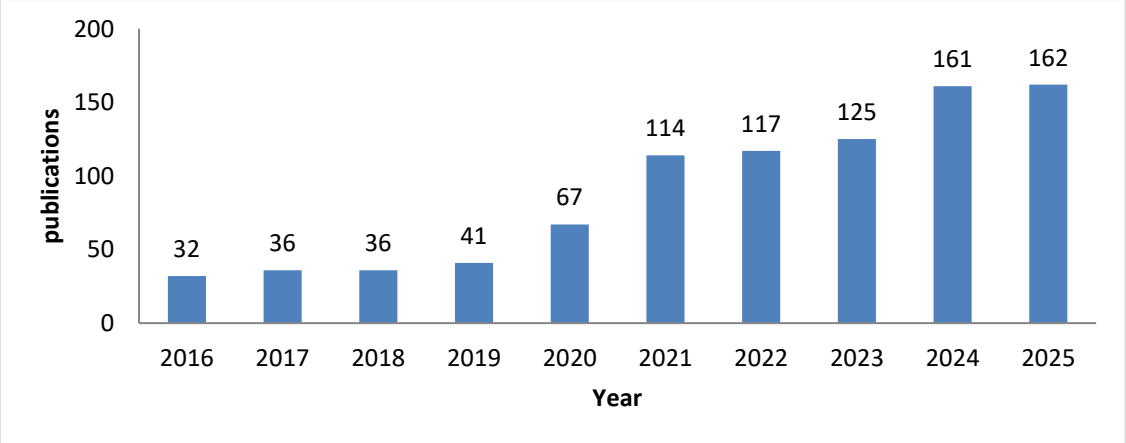


Figure 1: Year-wise distribution of Publication of Indian Atopic Dermatitis Literature

6.2 Year-wise distribution of Citations of Indian Research output in Atopic Dermatitis Literature

The table presents the year-wise distribution of citations received by Indian research publications in Atopic Dermatitis literature from 2016 to 2025. A total of 891 publications received 16,730 citations, with an overall average of 18.78 citations per publication (CPP). In 2016, 32 publications received 807 citations, averaging 25.22 citations per publication. The highest CPP of 71.78 was recorded in 2017, with 36 publications receiving 2,584 citations. In 2019, 41 publications received 2,028 citations, yielding a CPP of 49.46. Although publication output increased in subsequent years, CPP generally declined. In 2023, 125 publications received 2,489 citations, while 2024 recorded 978 citations for 161 publications. The lowest CPP of 2.27 occurred in 2025, with 162 publications receiving 367 citations. This may partly reflect the shorter time available for recent publications to accumulate citations. Overall, Indian research demonstrates substantial scholarly impact, particularly among publications from earlier years.

Table 2: Year-wise distribution of Citations of Indian Research output in Atopic Dermatitis Literature

S. No	Year	Publication	Citations	CPP
1	2016	32	807	25.22
2	2017	36	2584	71.78
3	2018	36	1250	34.72
4	2019	41	2028	49.46
5	2020	67	1821	27.18
6	2021	114	2279	19.99
7	2022	117	2127	18.18
8	2023	125	2489	19.91
9	2024	161	978	6.07
10	2025	162	367	2.27
	Total	**891**	**16730**	**18.78**

6.3 Activity Index of India in Atopic Dermatitis Literature

The Activity Index (AI) of India in Atopic Dermatitis literature indicates the relative research activity of India compared with global publication trends from 2016 to 2025. The AI increased from 60.58 in 2016 to 129.61 in 2025, reflecting a substantial rise in India's research activity. From 2016 to 2019, the index remained below 100, indicating relatively lower activity than the global average. In 2020, it increased to 81.95, followed by a rise above 100 in 2021 (109.64). The index continued to increase to 110.03 in 2022 and 114.36 in 2023. It reached 128.95 in 2024 and peaked at 129.61 in 2025. India's annual publications increased from 32 in 2016 to 162 in 2025, while global publications rose from 1,994 to 4,718. Overall, the findings demonstrate India's growing emphasis on atopic dermatitis research, particularly since 2021, with its relative research activity exceeding the global average in the later years.

$$AI = \{ (\frac{c_i}{c_o})/(\frac{w_i}{w_o}) \} \text{ X } 100$$

Where,

C_i = Country's publication output in the specific year

C_o = Country's total publication output

W_i = World's publication output in the specific year

W_o = World's total publication output

Table 3: Activity Index of India in Atopic Dermatitis Literature

S.No	Year	Global Publications	Indian Publication	AI
1	2016	1994	32	60.58
2	2017	2171	36	62.59
3	2018	2315	36	58.70
4	2019	2571	41	60.20
5	2020	3086	67	81.95
6	2021	3925	114	109.64
7	2022	4014	117	110.03
8	2023	4126	125	114.36
9	2024	4713	161	128.95
10	2025	4718	162	129.61
	Total	**33633**	**891**	

6.4 Attractivity Index of India in Atopic Dermatitis Literature

The Attractivity Index (AAI) of India in Atopic Dermatitis literature measures the relative citation impact of Indian research compared with global citation trends from 2016 to 2025. The index fluctuated considerably, increasing from 45.72 in 2016 to 134.56 in 2017, before declining to 59.69 in 2018. It rose to 96.35 in 2019 but decreased to 78.32 in 2020. In 2021, the index reached 98.73, followed by an increase to 125.72 in 2022. The highest AAI of 179.68 was recorded in 2023, indicating strong relative citation performance. Subsequently, the index declined to 116.20 in 2024 and increased to 125.11 in 2025. Indian publications received 16,730 citations out of the reported global total of 658,303 citations. The findings suggest that Indian research attracted comparatively greater citation attention in 2017 and from 2022 to 2025, particularly in 2023. However, the lower index values in several years indicate fluctuations in citation performance over the study period. Overall, India's citation attractiveness demonstrates a positive relative performance in the later years, although citation counts for recent publications may be affected by the shorter time available to accumulate citations.

$AAI = \{ (\frac{c_{ij}}{c_{io}})/(\frac{c_{oj}}{c_{oo}}) \} \text{ X } 100$

C_{ij} - Citations of country i in the year j

C_{ij} - Citations of country i in the year j

C_{oj} - Citations of world in the year j

C_{oo} - Total citations of world

Table 4: Attractivity Index of India in Atopic Dermatitis Literature

S. No	Year	Global Citations	Indian Citations	AAI
1	2016	69454	807	45.72
2	2017	75562	2584	134.56

3	2018	82400	1250	59.69
4	2019	82823	2028	96.35
5	2020	91491	1821	78.32
6	2021	90833	2279	98.73
7	2022	66572	2127	125.72
8	2023	54507	2489	179.68
9	2024	33118	978	116.20
10	2025	11543	367	125.11
	Total	**658303**	**16730**	

6.5 Publication Efficiency Index of India in Atopic Dermatitis Literature

The Publication Efficiency Index (PEI) of India in Atopic Dermatitis literature evaluates India's citation performance in relation to its publication output compared with global research. The index increased from 0.72 in 2016 to 2.06 in 2017, indicating improved citation efficiency. It declined to 0.98 in 2018, rose to 1.54 in 2019, and decreased to 0.92 in 2020. In 2021, the index further declined to 0.86 before increasing to 1.10 in 2022 and 1.51 in 2023. It subsequently fell to 0.86 in 2024 and rose slightly to 0.93 in 2025. The highest PEI of 2.06 was recorded in 2017, while the lowest value of 0.72 occurred in 2016. During the study period, India produced 891 publications and received 16,730 citations, compared with 33,633 global publications and 658,303 citations. Overall, the results reveal fluctuations in India's publication efficiency, with values exceeding 1.00 in 2017, 2019, 2022, and 2023. These findings suggest that Indian research achieved relatively stronger citation performance per publication in those years, whereas the values below 1.00 in the remaining years indicate comparatively lower performance under the index's calculation method.

$PEI = [(\frac{TNCi}{TNCt})/(\frac{TNPi}{TNPt})]$

TNCi = Total number of citations in country I

TNCt = Total number of citations in all countries

TNPi = Total number of publications in country I

TNPt = Total number of publications in all countries

PEI = 1 the impact of the research publications is at par with the world

PEI > 1 the impact of the research publications of the country is more than the world.

PEI < 1 the impact of the research publications of the country is less than the world

Table 5: Publication Efficiency Index of India in Atopic Dermatitis Literature

S. No	Year	Indian Citations	Global Citations	Indian Publication	Global Publications	PEI
1	2016	807	69454	32	1994	0.72
2	2017	2584	75562	36	2171	2.06
3	2018	1250	82400	36	2315	0.98
4	2019	2028	82823	41	2571	1.54
5	2020	1821	91491	67	3086	0.92
6	2021	2279	90833	114	3925	0.86
7	2022	2127	66572	117	4014	1.10

8	2023	2489	54507	125	4126	1.51
9	2024	978	33118	161	4713	0.86
10	2025	367	11543	162	4718	0.93
	Total	**16730**	**658303**	**891**	**33633**	**0.96**

6.6 Annual Growth Rate (AGR) of Indian Research Output in Atopic Dermatitis Literature

The table presents the Annual Growth Rate (AGR) of Indian research output in Atopic Dermatitis literature from 2016 to 2025. A total of 891 publications were recorded during the study period, indicating increasing research interest. In 2016, 32 publications were produced, rising to 36 in 2017, with an AGR of 12.50%. In 2018, the output remained unchanged, resulting in zero growth. The growth rate increased to 13.89% in 2019 and 63.41% in 2020. The highest AGR of 70.15% was recorded in 2021, with 114 publications. Subsequently, growth slowed to 2.63% in 2022 and increased to 6.84% in 2023. In 2024, publications reached 161, registering 28.80% growth. In 2025, output increased slightly to 162, with an AGR of 0.62%. Overall, Indian Atopic Dermatitis research demonstrated a substantial upward trend, despite fluctuations in annual growth rates. The annual growth rate of publications was calculated from the following formula

$$\text{AGR} = \frac{\text{End value} - \text{First value}}{\text{First value}} \times 100$$

Table 6: Annual Growth Rate (AGR) of Indian Research Output in Atopic Dermatitis Literature

S. No	Year	Publications	AGR
1	2016	32	
2	2017	36	12.50
3	2018	36	0.00
4	2019	41	13.89
5	2020	67	63.41
6	2021	114	70.15
7	2022	117	2.63
8	2023	125	6.84
9	2024	161	28.80
10	2025	162	0.62
	Total	**891**	

6.7 Exponential Growth Rate (EGR) of Indian Research Output in Atopic Dermatitis Literature

The table presents the Exponential Growth Rate (EGR) of Indian research output in Atopic Dermatitis literature from 2016 to 2025. A total of 891 publications were recorded during the study period, indicating an overall increase in research activity. The EGR was 1.13 in 2017 and declined to 1.00 in 2018, when publication output remained unchanged at 36. It increased to 1.14 in 2019 and rose significantly to 1.63 in 2020. The highest EGR of 1.70 was recorded in 2021, with 114 publications. Subsequently, the rate declined to 1.03 in 2022 before increasing to 1.07 in 2023 and 1.29 in 2024. In 2025, the EGR decreased to 1.01, with 162 publications. Overall, the findings indicate sustained growth

in Indian Atopic Dermatitis research, although the pace of growth fluctuated across the years. The formula for calculating the exponential growth is given below:

$N_{(t)} = N_{(0)}(1 + r)^t$

Where,

$\mathbf{N_{(t)}}$ = the population when the time elapsed is "t" years

$\mathbf{N_{(0)}}$ = the initial publications

r = the growth rate

t = the number of years

e = the natural base of logarithms whose value is 2.711828

Table 7: Exponential Growth Rate (EGR) of Indian Research Output in Atopic Dermatitis Literature

S. No	Year	Publications	EGR
1	2016	32	
2	2017	36	1.13
3	2018	36	1.00
4	2019	41	1.14
5	2020	67	1.63
6	2021	114	1.70
7	2022	117	1.03
8	2023	125	1.07
9	2024	161	1.29
10	2025	162	1.01
	Total	**891**	

6.8 Relative Growth Rate (RGR) and Doubling Time (DT) of Indian Research Output in Atopic Dermatitis Literature

The table presents the Relative Growth Rate (RGR) and Doubling Time (DT) of Indian research output in Atopic Dermatitis literature from 2016 to 2025. A total of 891 publications were recorded during the study period. The highest RGR of 0.75 was observed in 2017, with a corresponding doubling time of 0.92 years, indicating rapid growth in the early stage. In 2018, the RGR declined to 0.42, while the doubling time increased to 1.63 years. The RGR fluctuated between 0.31 and 0.43 from 2019 to 2022, reflecting variations in publication growth. In 2023 and 2024, the RGR was 0.25, with doubling times of 2.79 and 2.78 years, respectively. The lowest RGR of 0.20 and the longest doubling time of 3.45 years were recorded in 2025. Overall, the findings indicate that Indian Atopic Dermatitis research output increased steadily, while its relative growth rate gradually declined and the time required for publications to double generally increased. The mean Relative Growth rate (R) over the specific period of interval can be calculated from the following formula.

$$R = \frac{W_2 - W_1}{T_2 - T_1}$$

Whereas,

R = Mean relative growth rate over the specific period of interval
W_1 = Log of initial number of publications
W_2 = Log of final number of publications after a specific period of interval
$T_2 - T_1$ = the unit difference between the initial time and final time.
Doubling Time (DT) = $\frac{0.693}{R}$
Where,
R = Relative Growth Rate

Table 8: Relative Growth Rate (RGR) and Doubling Time (DT) of Indian Research Output in Atopic Dermatitis Literature

S. No	Year	Publication	Cumulative	W1	W2	RGR (W2-W1)	DT (0.693/RGR)
1	2016	32	32		3.47		
2	2017	36	68	3.47	4.22	0.75	0.92
3	2018	36	104	4.22	4.64	0.42	1.63
4	2019	41	145	4.64	4.98	0.33	2.09
5	2020	67	212	4.98	5.36	0.38	1.82
6	2021	114	326	5.36	5.79	0.43	1.61
7	2022	117	443	5.79	6.09	0.31	2.26
8	2023	125	568	6.09	6.34	0.25	2.79
9	2024	161	729	6.34	6.59	0.25	2.78
10	2025	162	891	6.59	6.79	0.20	3.45
	Total	**891**					

6.9 Time series analysis of Indian Research Output in Atopic Dermatitis Literature

The table and graph present the time-series analysis and projected future growth of Indian research output in Atopic Dermatitis literature. During 2016–2025, a total of 891 publications were recorded, increasing from 32 publications in 2016 to 162 in 2025. Based on this linear projection, the estimated number of publications is 248.30 in 2030, 332.08 in 2035, 415.87 in 2040, 499.66 in 2045, and 583.45 in 2050. The graph illustrates a steady upward trajectory, suggesting continued growth in Indian research on Atopic Dermatitis. These estimates are projections based on the historical linear trend and assume that the general pattern continues. Straight Line equation Yc = a + bX

Since $\sum X = 0$

$a=\sum Y/N=891/10=89.1$

$b=\sum XY/\sum X^2=16.75758$

Estimated Future growth in 2030 (2030-2020.5=9.5) = 89.1 + (16.75758*9.5) = 248.297
Estimated Future growth in 2035 (2035-2020.5=14.5) = 89.1 + (16.75758*14.5) =332.0849
Estimated Future growth in 2040 (2040-2020.5=19.5) = 89.1 + (16.75758*19.5) =415.8728
Estimated Future growth in 2045 (2045-2020.5=24.5) = 89.1 + (16.75758*24.5) =499.6607
Estimated Future growth in 2050 (2050-2020.5=29.5) = 89.1 + (16.75758*29.5) =583.4486

Table 9: Time series analysis of Indian Research Output in Atopic Dermatitis Literature

S. No	Year	Publications Y	X	X^2	XY
1	2016	32	-4.5	20.25	-144
2	2017	36	-3.5	12.25	-126
3	2018	36	-2.5	6.25	-90
4	2019	41	-1.5	2.25	-61.5
5	2020	67	-0.5	0.25	-33.5
6	2021	114	0.5	0.25	57
7	2022	117	1.5	2.25	175.5
8	2023	125	2.5	6.25	312.5
9	2024	161	3.5	12.25	563.5
10	2025	162	4.5	20.25	729
	Total	**891**	**0**	**82.5**	**1382.5**

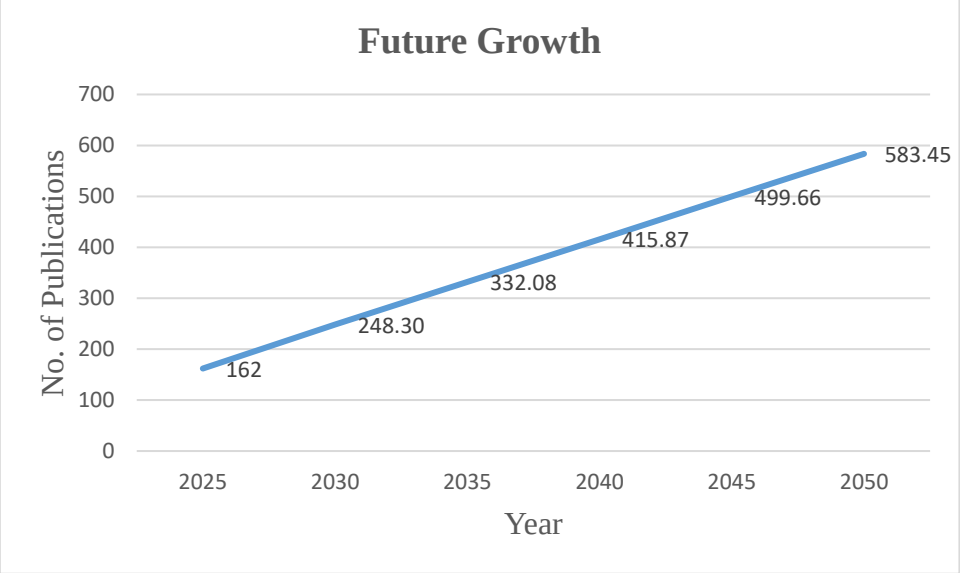


Figure 2: Future Growth of Indian Research Output in Atopic Dermatitis Literature

7. CONCLUSION

The present bibliometric study reveals substantial growth in Indian research output in Atopic Dermatitis literature during 2016–2025. A total of 891 publications received 16,730 citations, indicating increasing research productivity and scholarly attention. The significant rise in publications, particularly during 2021–2025, demonstrates India's growing participation in Atopic Dermatitis research. The Activity Index reflects an increasing relative contribution to global research, while the Attractivity Index and Publication Efficiency Index reveal variations in citation impact and research performance. The Annual Growth Rate and Exponential Growth Rate indicate rapid expansion in research output, particularly in 2021. However, the declining Relative Growth Rate and increasing Doubling Time suggest a gradual moderation in cumulative publication growth. Time-series analysis projects continued growth in Indian research publications in the coming decades. Overall, the study highlights the expanding contribution of Indian researchers to Atopic Dermatitis literature and emphasizes the need to strengthen research

quality, scientific collaboration, citation visibility, and innovative research activities to enhance India's position in the global scientific community.

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