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# CITATION IMPACT OF PHARMACEUTICAL SCIENCES RESEARCH: A COMPARATIVE BIBLIOMETRIC ANALYSIS OF NIGERIAN AND INTERNATIONAL UNIVERSITIES

**Reuben Ejike Ozioko**
Dept. of Library and Information Science,
Michael Okpara University of Agriculture, Umudike
and
***Nkiruka Angela Ofoedu**
Festus Aghagbo Nwako Library,
Nnamdi Azikiwe University, Awka
Email: na.ofoedu@unizik.edu.ng

## ABSTRACT

*The study examined and compared the citation impact of pharmaceutical sciences research published by Nigerian universities with that of an international comparator group. A total of 6,919 articles retrieved from dimension database were analyzed using bibliometrics data. The bibliometric data comprises citation counts from 192 publications by Nigerian universities and 6727 publications from the international comparator. An independent samples t-test was conducted to determine if there was a significant difference in mean citation counts between the two groups. Result indicated that the mean citation count for Nigerian universities (M = 3.77, SD = 9.48) was slightly lower than that of the international comparator (M =4.46, SD = 19.29). However, the difference was not statistically significant, t_(6917) = 0.49, _p = 0.621. The effect size was negligible, d =0.04, suggesting no practically meaningful difference. Further, analysis of publication outlets revealed that out of the four core journals publishing Nigerian pharmaceutical sciences research, only one is indexed in the JCR core collections. The findings suggests that while the citation impact of Nigerian universities is comparable to the international standard, the visibility and global reach of the research may be limited by publication in non-JCR indexed journals. It is recommended that Nigerian universities and researchers prioritize publishing in high-impact, JCR-indexed journals to enhance international visibility and scholarly influence.*

**Keywords**: Citation Impact, Bibliometrics, Nigerian Universities, Pharmaceutical Sciences and Pharmaceutical Sciences Research

## Background to the Study

Health research is a major driver of economic development in countries around the world. Considering the importance of health research to the overall development of the economy, research efforts that yield high productivity in pharmaceutical sciences research are widely recommended. Nastannho (2024) stresses that it is essential to strengthen the research efforts of pharmaceutical scientists to perform high-quality innovative research that advances the knowledge base of pharmaceutical sciences, yielding scientific discoveries and

help generate evidence for new therapies to drive continuous improvement and ultimately solve unmet problems and health needs.

Considering the importance of pharmaceutical sciences research in the overall development of the economy, it is therefore, necessary for nations to pay serious attention to developmental issues relating to this sector. In developed nations, researchers are endowed with enormous opportunities to undertake innovative research. This has enabled researchers acquire the enhanced ability for collaboration within institutions and with others around the world (Holbrook & Sanberg, 2013 in Garba & Sa'idu, 2020). Developed countries pay great attention to health issues by providing adequate funding for healthcare facilities and the implementation of problem-solving research in order to improve the quality of life. For example, in Australia, the Association of Medical Research Institutes (2021) has proposed a national health and medical research strategy to ensure a coherent and consistent approach to the provision of funding support is adopted, for medical research and innovation. There is no doubt that knowledge from research sponsored by rich academic institutions and nations with strong innovation systems has a significant impact on their industrial sectors. Products from these industries are then exploited for the benefit of patients in these countries.

In developing countries like Nigeria, however, opportunities to undertake innovative research are rare and not adequately utilized. Lawal (2024) reported that proper environment for research is not yet available in Nigeria. This is as a result of inadequate funding, poor infrastructure, lack of political will to implement policies meant to enhance research and many more. Consequently, the zeal to undertake meaningful research in Nigerian research centres and institutions is dampened. These challenges equally affect medical research centres and institutions. Osaigbovo et al. (2025) affirmed that Nigerian health institutions have been plagued by weak departmental infrastructure, limited funding, inadequate research facilities, self-motivation driven by professional growth, yet undermined by workload and time pressures. This ugly situation has drastically impacted negatively on Nigerian pharmaceutical industries.

The Nigerian pharmaceutical industry is considered a critical component of the manufacturing sector and important contributor to the nation's Gross Domestic Product (GDP) (Atanda et al., 2025). Nigeria as one of the most populous countries in Africa has a land area of about 923,769 square kilometres with a population of around 226.184 million (Statista, 2024). Despite her large population and vast natural resources, Nigeria still wallows up in manmade squalor and misery in the midst of plenty. It is well known that many Nigerians suffer from outrageous burden of diseases, poverty and hunger. As described by the Pharmaceutical Manufacturers Group of the Manufacturers Association of Nigeria (PMG-MAN), the Nigerian pharmaceutical industry has the potentials to become a

giant in the production, distribution and sale of pharmaceutical products in Sub-Saharan Africa (Obukohwo, 2018) yet, the Nigerian health sector was ranked 163rd out of 191 members by the World Health Organization (WHO) in 2021 (World Health Organization (WHO), 2021). Up till date, Nigeria still relies on imported finished pharmaceutical products (Okereke et al., 2021). The local production of raw materials, pharmaceutical dosage formulations, or processing equipment has not been given adequate attention. Nigeria has been forced to rely on countries such as India and China for supplies due to lack of domestic production of key inputs. Currently, Nigeria is struggling with foreign exchange difficulties, contributing to the price of imported drugs increasing more than 300%. These challenges all constitute setbacks to the Nigeria's pharmaceutical manufacturing sector and have led to an overall decline in its manufacturing capacity.

The current status of Nigerian healthcare sector, where majority of its medicines are imported, is in direct contravention of the National Drug Policy which was formulated in 1990 and was revised 2005. The policy aimed at enhancing the provision of safe, effective and high-quality products at affordable prices through various relevant means. It was designed to ensure that within a decade of the amendment, the majority (70%) of nation's drug needs would be met through local production. In line with the achievement of this objective, the national drug policy also aims to promote the development of raw materials for manufacturing of pharmaceuticals and related products and seek to further promote pharmaceutical research. The persistence of import reliance therefore raises questions about the effectiveness of policy implementation and the capacity of national research system to support pharmaceutical self-sufficiency.

Addressing this requires empirical assessment of the research networks that underpins pharmaceutical development. A harmonized central overview of the vast body of literature on pharmaceutical research is key to enabling local manufacturers gain easy access to research-driven knowledge that can aid their production of drugs. Despite the growing number of research studies in pharmaceutical sciences in Nigeria universities, there is a dearth of comprehensive analysis that evaluates these studies.

Bibliometric analysis provides a valuable methodological approach for such evaluation. It helps detect the developmental status and research boundaries in a specific field. Bibliometric analysis is a research method in Library and Information Science that studies research publications, revealing patterns, trends, and impacts in science by analysing publications and citation data within a discipline (Oliveira et al., 2019). Through indicators such as citation analysis and citation impact, bibliometric analysis enables comparative evaluation of research impact and influence across institutions and countries.

Citation analysis is a broad field of bibliometrics that studies the citations to and from documents. Citation analysis is the study of the citation process in scientific research in the form of citation counts to determine the frequency of citations made to authors, journals, books and other forms of intellectual works (Anaehobi & Ofoedu, 2021). Citation analysis is useful in determining the impact of scholarly work by counting the number of times the work is cited. It provides information on how much impact a particular organisation, institution or author has had by showing which other authors found it relevant when writing their articles. Therefore, citation analysis is deemed important in assessing the impact of authors', institutions and countries research output. It remains a helpful tool for assessing academic influence. Research impact is measured by the number of citations a research publication has received over a given period of time.

The idea of measuring the impact of authors or their publications and institutions by the validity of the journals that publish their articles has always been a subject of interest in the library and information science profession. Several studies such as Zhou and Ma (2025); Alrawashdeh et al. (2024); Konu and Ozay (2024) and so many others have been conducted to evaluate the performance of institution(s) in terms of its contribution to knowledge through the citation impact of the journals in which they have published in. However, the performance of pharmaceutical sciences researchers in Nigerian universities as regards to their contribution to journal impact or quality is yet to be known.

In view of this, it is therefore necessary to examine the research impact of pharmaceutical sciences research output from universities in Nigeria. Given the strategic importance of Pharmaceutical Research & Development to Nigeria's health and economic development, a comparative bibliometric analysis of Nigerian universities against international counterparts is necessary. Such a comparison can reveal disparities in citation impact and identify areas requiring policy and institutional intervention. This study, therefore, undertake a comparative evaluation of research impact of pharmaceutical sciences research output from universities in Nigeria and that of international institutions. There exists a dearth of such studies for developing countries like Nigeria, hence the need for this study.

**Purpose Of the Study**

The study generally sought to analyse selected journals that publish pharmaceutical sciences research output from universities in Nigeria to examine the impact and evaluate the difference in research impact of pharmaceutical sciences research output from universities in Nigeria and that of international institutions. Specifically, the study aimed to determine

1. The core journals that publish pharmaceutical sciences research publications from universities in Nigeria.

2. The Web of Science JCR impact factors of the core journals
3. Determine the mean citation of pharmaceutical sciences publications from universities in Nigeria in the core journals.
4. Determine the mean citation of publications of international comparator group in the core journals
5. To compare the difference in mean citation counts between pharmaceutical Sciences publications from universities in Nigeria and those from the international comparator group.

**Research Questions**

The following research questions have been formulated to guide the study

1. What are the core journals that publish pharmaceutical sciences research publications from universities in Nigeria.
2. What is the Web of Science JCR impact factors of the core journals
3. What is the mean citation count of Pharmaceutical Sciences publications from universities in Nigeria in the selected journals?
4. What is the mean citation count of publications from international comparator group in selected journals?
5. Is there a significant difference in mean citation count between pharmaceutical sciences publications from universities in Nigeria and those from the international comparator group?

**Hypotheses**

The following null hypothesis has been tested for this study at 0.05 level of significance;

$H_O$ There is no statistically significant difference in mean citation count of Pharmaceutical Science research in Universities in Nigeria and international comparator group pharmaceutical sciences research.

**Review Of Literature**

**Conceptual Framework**

The conceptual framework of the study is grounded in a set of interconnected concepts which include bibliometric analysis and citation analysis. These concepts serve as the building blocks for this study, providing a comprehensive framework for analysing the dynamics of a bibliometric study.

**Bibliometric analysis**

Bibliometrics analysis is a quantitative approach used in library and information sciences to describe publication patterns within a given fields or body of literature (Hyland &Jiang, 2021). It involves the application of statistical and mathematical techniques to measure the productivity, impact, and quality of research publication, authors, and institutions (Waltman, 2016). According to Belter (2018), bibliometrics is a science of science that deals with four major themes: productivity, collaboration, research topics and citation impact. It is a technique that is based on quantifying the level of research outputs, collaboration patterns and the impact of scientific research.

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The concept of bibliometrics dates back to the early 20th century when Hulme (1923) applied statistical methods to analyse bibliographic data, laying the groundwork for bibliometrics. In 1960's, Allan Pritchard introduced the term "statistical bibliography" or "bibliometrics" to describe the quantitative study of literature (Pritchard, 1969) and this marked the beginning of modern bibliometrics. Since then, bibliometrics has evolved to incorporate new methods, techniques, and data sources, including citation analysis, co-word analysis, co-authorship analysis and network analysis. Today, bibliometrics emerged to be a crucial tool for understanding the dynamics of scientific communication and evaluating performance.

Bibliometric is now commonly used by library and information science professionals and researchers of various disciplines in resolving different issues related to all aspects of their fields. It plays a significance role in understanding the dynamics of scientific communication, evaluating research performance, and informing research policy decisions. Kumar (2025) asserted that bibliometric analysis has become a crucial and indispensable tool used by researchers, academic institutions, and policy makers for literature review and academic benchmarking. Thus, bibliometric analysis is highly useful in analysing all aspects of literature, aiming to identify patterns of publication and scholarly communication, authorship, publication coverage and evaluation.

Bibliometric analysis is used in measuring the scientific output of publications, authors, journals, institutions and countries. It is used to examine how the intellectual, social, and conceptual structure of the relevant field has evolved over time based on the relationships and interactions between these items (Donthi et al., 2021). LIS researchers all over the world have conducted bibliometric studies to analyse the productivity, collaboration patterns, subject areas and citation impact of publications in various fields. Bibliometric approach provides researchers with important information about the intellectual and conceptual structure of a field. This analytical approach provides valuable insights into the dynamics of knowledge growth within the subject area under investigation. According to Walton and Noyons (2018), bibliometric analysis can yield valuable insight into:

i. Information about the number of publications produced by a research unit (scientific output)
ii. Information about the number of citations that publications have received (scientific impact)
iii. Information about co-authored publications, focusing on e.g. national cum international collaboration, university cum industry collaboration (Scientific collaboration)
iv. Information about the interdisciplinarity of publications, usually based on the fields that are cited by a publication (Interdisciplinary study)

v. Information about the gender of the authors of publications (Gender study)
vi. Information about the open access status of publications, distinguishing between gold open access, green open access, and no open access (Open access publishing)
vii. Information about researchers that change their affiliation (Mobility).

Bibliometric analysis is a very useful technique for analysing and evaluating research results properly. Bibliometrics has been widely used in research evaluation to assess the quality and impact of research publications and institutions. Bibliometric indicator such as publication counts, citation counts, h-index and impact factor, are used to evaluate research performance and compare institutions. It is employed in measuring national research performance in an international context or to describe the development of a particular research field. These indicators provide a quantitative measure of research output and impact, enabling policymakers and administrators to make informed decisions about research funding and resource allocation.

Bibliometrics can also help in knowledge management to identify and manage knowledge gaps. Bibliometrics is used to identify knowledge gabs, track research trends, and monitor the dissemination of knowledge. Bibliometrics techniques such as citation analysis and co-word analysis can be used to identify areas of research trends and weaknesses, and to track the dissemination of knowledge across research communities (Leung, et al., 2017). It enables researchers to track the progress of a field of science and identify trends in research topics across disciplines (Anna et al., 2021).

Bibliometric analysis is also helpful in library and information science in evaluating library services, policy refinement, resource allocation and even weeding. Bibliometric analysis helps librarians identify core journals, authors, and topics in specific fields, informing collection development decision (Udo-Anyanwu, 2018). Bibliometric indicators can be used to assess library performance, such as evaluating the impact of library collections on research output (Nicholas et al., 2015).

**Citation analysis**

Citation Analysis is one of the most commonly used bibliometric techniques. According to Library and Information Science Education Network (2022), citation analysis is a non-intrusive method of finding patterns in specific populations' use of research materials. It is one of the bibliometric research tools used in evaluating scholarly communication with the intent of finding or establishing links or relationships with other studies, researchers, scholars, institutions and corporations. When an author cites another author, a relationship is established. Citation analysis is therefore the study of the citation process in scholarly research, which involves examining citation networks or counting citations to understand the impact of publications of a specific group (authors, institutions,

countries, research area etc.) or relationships between different groups.

Citation analysis is an important quantitative technique used to analyse and evaluate the impact and influence of research publications, authors, and institutions. It has long been employed as a method for determining scholars, journals, departments impact on the field (Worrall & Ellan, 2023). This analysis aims to determine the frequency of citations made to authors, journals, books, institutions and other forms of intellectual works, ultimately evaluating their impact. Citation counts are based on the assumption that citation of a document implies the use of that document by the authors citing it and that references are selected based on the degree to which they contribute to the authors' own work (Agarwal et al., 2016). Citation, therefore, reflects the value (quality, significance, impact) of the article. This implies that influential scientists and important works are cited more frequently than others and that the cited article has content related to the article used.

Some scientist however, belief that citation count is not the best way to evaluate the value of a scientific work or a researcher. They are of the opinion that basic citing errors such as homographs, cronyism, negative citation, self-citation, ceremonial citation, length of articles, journal prestige and visibility affect the credibility of citation counts (Szomszor, et al., 2020; Thelwall, et al., 2023; Yeung, 2024; Willie, 2025). Some authors; Ruscio (2016); D'lppoliti (2018); McKiernan, et al. (2019); Galvez (2017) on the other hand, claim that these problems are relatively insignificant. They say that most of the citations found in articles and books are useful- honouring pioneers, identifying original publications and providing background information. Citations also substantiate claims and give credit to related works. D'lppoliti (2018) argued that citations indexes at the author level should be interpreted as reflecting a mix of both intellectual impact and social dynamics and that the use citation counts to rank authors does not lead to unambiguous measures of scientific impact.

Thus, the analysis of citation can help in understanding scholarly communication patterns and identify major contributors and contributions (Zhao & Logan, 2002 in Anaehobi & Ofoedu, 2021). According to Nwagwu (2025), citation analysis offers a way to evaluate references to identify the most cited or influential works and how ideas flow between different authors and topics. Data obtained from citation analysis allows us to identify the most productive authors, the most used sources, the impact of authors and publication, the age of literature, the most used document type and so on.

Citation analysis is an unobtrusive methodology that can often be carried out with readily available data. Citation analysis without the users' influence provides valuable data about users' information needs. It shows the information trends of specific user groups and the extent to which the library's collections meet users' information needs. This is of interest to libraries, particularly academic libraries since its efficiency depends on its ability to

select and make available important print and electronic information sources to support research in various fields of study. Some of the research problems that can be explored by analysing citations include evaluating library collections, research evaluation in terms of individual output, institution output or geographical output and investigating how the cognitive content and social structures of scientific theories developed (University of Illinois Library, (2021) in Onwumbiko & Okeke, 2023).

Citation analysis is also a technique which is based on the principle that articles citing the same references (bibliographic coupling) have much of their contents in common. This similarity between an article and its references is the cornerstone of citation analysis since this relationship is of great interest to scholars. Citation analysis uses bibliographic references and their counts to recognize the information that relates to a particular work. With citation analysis many different links can be established such as links between author, scholarly works, fields or even two or more nations (Ashikuzzaman, 2018).

**Theoretical Framework**

This study theoretical framework is anchored on Cohen's Rules. Cohen's Rule provides guideline for interpreting effect sizes. These two principles serve as the foundation for this study, guiding the analysis and interpretation of the data.

**Cohen's rule**

Cohen's rules, also known as Cohen's guideline or Cohen's d which was propounded by Jacob Cohen, a renowned American Statistician in 1962 are a set of statistical guidelines used to interpret the magnitude of effect size in research studies. These guidelines were revisited and published by Jacob Cohen in 1988 in his seminal paper titled "Statistical Power Analysis for the Behavioral Sciences" (2nd ed.).

Cohen's d is a statistical method used to calculate the effect size of a study. It a set of guidelines for interpreting the magnitude of effect size. Effect size is a statistical measure that quantifies the magnitude of the difference between two groups or the strength of the relationship between two variables. Cohen's d is a standardized measure that allows researchers to compare the magnitude of effects across different studies, even when the variables are measured differently (Hedges, 2024). Islam (2025, July 13) defined Cohen's d as a measure of the standardized difference between two groups, which can be used to estimate the effect size of a treatment of intervention. Cohen's d is simply the difference between two means divided by the standard deviation of the population.

For example: r

In calculating Cohen's d, the formular $d=(M1-M2)/\Delta$ is used

Where:

d= Cohen's d (effect size)

M1= Mean of group 1

M2= Mean of group 2

$\Delta$= Standard deviation of the population (or pooled standard deviation)

Note: When the standard deviation of the two groups is different. A pooled standard deviation can be used.

Cohen's rule propose that effect sizes can be categorized into three levels of magnitude.
Small effect size d=0.2
Medium effect size d= 0.5
Large effect size d= 0.8

These guidelines provide a framework for interpreting the practical significant of research findings. Cohen's rule and effect size can be used in bibliometric analysis to evaluate the research productivity of two groups. It is helpful in comparing the impact of research output between two groups. It can also be used in identifying areas where group B may need to improve to match the performance of group A.

While Cohen's rules and effect size are widely used in statistical analysis, they have been subjected to critique. Some researchers have argued that Cohen's rule is arbitrary and do not provide a clear guideline for interpreting effect sizes (Schafer, 2024). Others have argued that effect size measures, such as Cohen's d, are sensitive to outliers and may not provide an accurate estimate of the population effect size (Wilcox & Serang, 2016). Cohen's rules and effect size are rooted in statistical theory and provides a foundation for interpreting the magnitude of research findings. While these concepts have been subject to critique, they remain widely used in statistical analysis. This study will utilize Cohen's d to estimate the standardize difference in mean citation between pharmaceutical science publications from Nigeria universities and those from the comparators group, with the aim of determining the practical significance of the impact of Nigerian pharmaceutical science publications on citation metrics of selected journals.

**Empirical Studies**

This section discusses citation rate and mean citations of publications and impact metrics of journals that published them from the perspectives of some empirical work done in Nigeria and other developed and developing nations respectively. It reviews studies already carried out by researchers, highlighting their focus and findings. It equally identifies gap in literature.

Gupta and Gupta, (2014) analysed 76 highly cited publications in clinical pharmacology research output in India during 2000-2014 using bibliometric method. Indian Clinical Pharmacology research had 1.45% of world's research output of highly cited papers in clinical pharmacology research. India was ranked 10th highest country of the world's highly cited research output according to the Scopus database at 0.75% share of India's research output. These 76 highly cited publications received 14,059 citations with an average citation of 184.99 per article. The value of Major Contributor Index varied among the prolific institutions as well as the productive authors. This study and the present study adopted bibliometric research design and both used online database as data source. However, both studies differ in scope. The study analysed research productivity of an area (clinical pharmacology) of pharmaceutical sciences while the present study focused on general

pharmaceutical sciences research in Nigeria.

Ahmed et al. (2016) conducted Clinical Pharmacology Research in India: A Scientometric Assessment of Publication Output during 2005-2014. The paper examined 8,519 publications The result indicated mean citation of 6.75 per paper during 2005-2014, which decreased from 9.14 to 4.08 from 2005-2009 to 2010-2014. Nearly 61% of the Indian publications on clinical pharmacology registered citations from 0 to 605 citations and these citations witnessed highly skewed distribution. India's publication output in clinical pharmacology had 51 highly cited papers with each receiving 100 or more citations. These highly cited papers received a total of 8597 citations with average citation per paper of 168.57. This study and the present study adopted bibliometric research design and used online database as data source. However, they differ in scope.

Ishtiaq and Ullah (2018) carried out a bibliometric evaluation of articles published in Pakistan Journal of Pharmaceutical Sciences (PJPS) from 2006 to 2015. Bibliometrics was used to determines publication pattern and identifies research trends in a field. All articles published in PJPS during ten years were analysed using MS Excel. A total of 951 authors contributed 1172 articles to PJPS from 2006 to 2015. The average number of citations per article was 28.67% and the average length of the articles was 6.34 pages. This study and the review study adopted bibliometric research design but the review study used a journal (PJPS) website as data source. The two studies also differ in scope. The reviewed study analysed research publication of a Pakistan Journal of Pharmaceutical Sciences while the present study focused on Nigerian pharmaceutical sciences research.

Das et al (2019) studied highly cited research in pharmaceutical sciences of India during 1998-2017 with a view to understand the impact of highly cited articles in Indian Pharmaceutical research. The result revealed that India with 274 highly cited articles holds the 10th position with 2.51% of the world's share during 1998-2017. These 274 Highly Cited papers received 90,911 citations with an average of 331.79 citations per papers. There are 14 Indian institutions having more than 5 publications and Major Contributor Index value more than 0.5, which are considered more productive and have the potential to conduct research independently. The two studies also aimed at examining the citation rate of research publications using online databases as data source but their scopes differ. The reviewed study focused on Indian Pharmaceutical research while this study focused on Nigerian pharmaceutical science research.

Chaman et al., (2019) analysed the Indian publications output in Pharmacology and Pharmacy during 2004-2018 on several parameters including India's overall contribution, its growth pattern, citation impact. A total of 37,734 papers published in Web of Science Citation Database where analysed. The findings indicated India publication increased from 1045 papers in 2005 to 3,042 papers in 2014 and decreased

from 2,898 in 2015 to 1,817 in 2018. The study also indicated that the citation impact and quality of Indian research is low compared to select development and developing countries. This study and the present study adopted bibliometric research design and both used online database as data source. However, both studies differ in scope. The study analyzed Indian research output on Pharmacology and Pharmacy while this study focused on Nigerian pharmaceutical sciences research.

Mousavi et al. (2013) investigated scientific output on rational use of drugs in Iran using a bibliometric analysis of publications. A systematic search was conducted for finding all papers (English and Persian) using Pubmed, Web of Science, Google Scholar, CINAHL, Proquest, International Pharmaceutical Abstract and Persian databases including SID, Iran Medex and MagIran. Retrieved articles were categorized by research topics and year of publication. Impact Factor of the journals, citation analysis of first authors, most cited topics and average citations per item were analyzed. A total of 466 articles were included in the review. Number of publications increased dramatically after 2001(more than 10 times). Evaluation of prescribing pattern (15%), self-medication (11.3%) and adverse drug reaction (9.1%) were among the most studied topics. From the total of 165 journals, 60 of them had Impact factors and 125 articles were published in these journals. Antimicrobial resistance and adverse drug reaction were the most cited topic. The study also revealed that publication of articles on rational use of drugs research in Iran has undergone an important increase during last decade. This study and the reviewed study adopted bibliometric research design and both used online database as source data but the two studies differ in scope. The review study focused on scientific output on rational use of drugs in Iran while the present study focused on Nigerian pharmaceutical sciences research.

Sadik (2018) investigated "Research contributions on oral cancer in India during the period 2010 to 2017 using bibliometric method". The data for the study were retrieved from the Web of Science database. The study reported that the USA produced 31.34% of global publications on oral cancer. All India Institute of Medical Science has a TLCS of 490 and TGCS 3980. The most productive journals were colloids and surface B-Bio interfaces with 1180 articles and impact factor of 3.887. The study indicated that Indian oral cancer research is continuously increasing. Both studies adopted bibliometric research design and both used online database as source data but the two studies differ in scope. The study covered scientific output of oral cancer in India.

Baladi et al. (2018) conducted a bibliometric analysis to track the development of pharmaceutical care research worldwide during the past two decades. The pharmaceutical care publications were retrieved from the Web of Science Core Collection (WoSCC). Countries, institutions, authors, journals, references, and keywords in this field were visually analyzed by using VOSviewer (version 1.6.17) and CiteSpace (Version 5.8.R3). A total of 3,597 publications

(3,177 articles and 420 reviews) were obtained. The result revealed that the annual yields grew more than three times in the past two decades, from 54 records in 2002 to 379 papers in 2021. The United States played the leading role in this research from multiple aspects, including publication ($n$ = 1,208), citations ($n$ = 28,759), funding agencies, and collaboration worldwide. The University of Sydney in Australia was the most contributed institution with the greatest number of publications ($n$ = 112) in pharmaceutical care research. Hersberger KE from the University of Basel was the most productive author ($n$ = 40). Chen TF from the University of Sydney was the author who owed the highest H-index of 19 and most citations ($n$ = 1,501). They both significantly impacted this field. American Journal of Health System Pharmacy produced the most publications, while Pharmacotherapy had the highest IF (IF2020 = 4.705) in this field. Clusters networks of co-cited references and keywords suggested that clinical pharmacy is an essential theme in pharmaceutical care. The study indicated that Indian oral cancer research is continuously increasing. Both studies adopted bibliometric research design and both used online database as data source but the two studies differ in scope. The study covered pharmaceutical care research worldwide.

Okagbue (2024) carried out a study on comparison of Geopolitical, regional and funding differences of universities in Nigeria, based on citations per paper, using web of science and Scopus. The paper investigated the quality of papers published by the top 76 universities in Nigeria. Result indicated that southwest has the highest mean citation (23), the northwest has the highest publication counts while the northwest has the lowest publication counts. The southern region has greater representation (43) in the top 76 universities in Nigeria than the Northen region (33). The southern region has a higher mean citation and publication counts than the northern region in both databases. Federal universities have higher mean citation and publications counts than state and private universities. Based on Scopus and Web of Science, the mean citation was 5.90 and 6.15 respectively. The result also revealed that no significant mean differences were detected among universities across the six geopolitical regions. The two studies adopted bibliometric research design the review study however, used web of Science and Scopus as data source while this study explore dimension database. The scope of the two studies also differs.

**Research Method**

The study employed a bibliometric research design. The population of the study consists of 6919 articles published in four purposively selected journals of pharmaceutical sciences produced within 2016 to 2025 as indexed in Dimension database. No sampling was done as the number is manageable.

**Database selection**: Dimension database was purposively selected because it can efficiently handle large volumes of data, making them suitable for big data analysis. Moreover, it is an open access database and allow users to define and categorize data

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into different dimensions without subscription, enabling flexibility reporting and analysis.

**Search Strategy**: The search strategy involved two phases. In the phases filtration and extraction technique was applied. Open access articles in the field of Pharmacology and Pharmaceutical Sciences (3214) were used.

**Phase one:** Phase one involves selection of core journals of pharmaceutical sciences research affiliated with universities in Nigeria. In selecting the journals, search was conducted using the keywords: ("Pharmaceutical Sciences" OR "Pharmacy Research") AND ("Nigeria") AND ("University"). Since the researcher was using the free version of Dimension database, the search was limited to universities in Nigeria through researchers' names and institutions in the filter. A total of 76 journals that published 311 pharmaceutical sciences articles from Nigerian universities was retrieved from the Source Title. Four core journals were selected from the journal rank list. The search was limited to the four core journals from the "Source Title" in the filter. This yielded a total of 192 articles.

**Phase two**: Here, search was conducted using the keywords: ("Pharmaceutical Sciences" OR "Pharmacy Research") AND ("Universities"). The search was limited to the four core journals. The journals yielded a total of 6919 articles which was used for the study.

**Overview of the collected data**

**Table 1a:** Pharmaceutical sciences publications in the four selected journals

| Pharmaceutical Sciences Journals | Journal position in Dimension database | Number of Publications | % of publications |
|---|---|---|---|
| Journal of pharmaceutical research International | 1 | 5916 | 85.50 |
| Research and Evidence-based Complementary and Alternative Medicine | 6 | 781 | 11.29 |
| Tropical Journal of pharmaceutical research | 50 | 133 | 1.92 |
| Journal of Pharmacy and Bioresource | 68 | 89 | 1.29 |
| Total | As at 10th July | 6919 | 100 |

**Table 1b**: Pharmaceutical sciences publication from universities in Nigeria

| Core journals that published articles from universities in Nigeria | Journal position in Dimension database | Number of Publications | % of publications |
|---|---|---|---|
| Journal of pharmaceutical research International | 1 | 122 | 63.54 |
| Journal of Pharmacy and Bioresource | 2 | 41 | 21.35 |
| Tropical Journal of pharmaceutical research | 3 | 25 | 13.02 |
| Research and Evidence-based Complementary and Alternative Medicine | 4 | 4 | 2.08 |
| Total | As at 10th July | 192 | 100 |

The percentage of pharmaceutical sciences publications from universities in Nigeria in the selected journals accounted for 2.77% of the overall 6919 publications. The variables related to international/global comparator group were derived by

subtraction the figures in Table 1b from those in Table 1a, since Table 1b is a subset of Table 1a.

**Data Analysis**: Data analysis was conducted using both descriptive and inferential statistics. Descriptive analysis was used to determine the annual distribution of citation counts, as well as to identify the most productive journals. Inferential analysis using Cohen's d was conducted to address research question 4 which is to examine the difference in mean citation count between pharmaceutical sciences publications from universities in Nigeria and those from the international comparator group?

**Results And Discussions**

Research Question 1: What are the core journals that publish pharmaceutical sciences research publications from universities in Nigeria

Table 1c: The core journals that publish pharmaceutical sciences research publications from universities in Nigeria.

| S/N | Journals | Number of publications | Number of Citation |
|---|---|---|---|
| 1 | Journal of Pharmaceutical Research International | 122 | 424 |
| 2 | Journal of Pharmacy and Bioresource | 41 | 69 |
| 3 | Tropical Journal of Pharmaceutical Research | 25 | 63 |
| 4 | Evidence Base Complementary & Alternative Medicine | 4 | 168 |
| 5 | Nigerian Journal of Pharmaceutical Research | 4 | 37 |
| 7 | Journal of Complementary & Alternative Medical Research | 4 | 7 |
| 8 | Journal of Medical Plant Research | 4 | 2 |
| 9 | Journal of Pharmacognosy & Phytotherapy | 4 | 15 |
| 10 | Natural Product Communications | 4 | 3 |
| 11 | GSC Biological & Pharmaceutical Sciences | 3 | 56 |
| 12 | Journal of Advances in Medical & Pharmaceutical Sciences | 3 | 87 |
| 13 | Frontiers in Pharmacology | 3 | 8 |
| 14 | International Journal of Biochemistry Research & Review | 3 | 0 |
| 15 | Asian Journal of Biochemistry Genetics & Molecular Biology | 3 | 6 |
| 16 | Nigerian Journal of Biochemistry & Molecular Biology | 3 | 5 |
| 17 | Pharmacy Practice | 3 | 3 |
| 18 | Toxicology Reports | 3 | 21 |
| 19 | Bayero Journal of Pure and Applied Sciences | 3 | 2 |
| 20 | Dutse Journal of Pure and Applied Sciences | 2 | 10 |
| 21 | Journal of Experimental and Chemical Anatomy | 2 | 45 |
| 22 | Journal of Applied Sciences & Environmental Management | 2 | 2 |
| 23 | Scientia Africana | 2 | 11 |
| 24 | Journal of Drug Delivery & Therapeutics | 2 | 17 |
| 25 | International Journal of Basic & Clinical Pharmacy | 2 | 15 |
| 26 | Pharmaceutical Biology | 2 | 20 |

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| | | | |
|---|---|---|---|
| 27 | Journal of Research in Pharmacy | 2 | 5 |
| 28 | Pharmacognosy Journal | 2 | 2 |
| 29 | International Journal of Pharmacy Practice | 2 | 30 |
| 30 | Future Journal of Pharmaceutical Science | 2 | 11 |
| 31 | 46 journals with one publication each | 46 | |
| | | 311 | 1803 |

It could be observed from table 1c that pharmaceutical sciences research affiliated with universities in Nigeria yielded a total of 311 articles and 1803 citations. Four core journals could be identified from the list. They are Journal of Pharmaceutical Research International (122 publications, 424 citations), Journal of Pharmacy and Bioresource (41 publications, 69 citations), Tropical Journal of Pharmaceutical Research (24 publications, 63 citations) and Evidence Base Complementary & Alternative Medicine (4 publications, 168 citations).

Research Question 2: What is the Web of Science JCR impact factors of the core journals

Table 2: The Web of Science JCR impact factors of the core journals

| | WoS JCR impact factors | Year indexed | Quartile |
|---|---|---|---|
| Journal of Pharmaceutical Research International | Not available | - | - |
| Journal of Pharmacy and Bioresource | Not available | - | - |
| Tropical Journal of Pharmaceutical Research | Not available | - | - |
| Evidence Base Complementary & Alternative Medicine | 4.8 | 2025 | Q1 |

Where Q1= top 25% in the category, Q2 = 25-50%, Q3 = 50-75%, Q4 =Bottom 25%

It could be observed from table 2 that among the four core journals, only Evidence Base Complementary & Alternative Medicine was indexed in the Web of Science Core Collection with an impact factor of 4.8, placing it in Quartile Q1 in the Pharmacology and Pharmacy category. The journal's inclusion in JCR indicates it meets Clarivate's selection criteria for citation tracking and has sufficient international visibility to be included in Web of Science Core Collection. The remaining three core journals- Journal of Pharmaceutical Research International, Journal of Pharmacy and Bioresource and Tropical Journal of Pharmaceutical Research were not listed in 2025 JCR.

Research Question 3: What is the mean citation count of Pharmaceutical Sciences publications from universities in Nigeria in them selected journals?

Table 2a: Annual mean citation of publications of Pharmaceutical Science researchers in Nigeria universities in the selected journals.

| Year | Number of Publication | Number of Citation | Mean Citation |
|---|---|---|---|

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| | | | |
|---|---|---|---|
| 2016 | 8 | 2 | 0.25 |
| 2017 | 11 | 2 | 0.18 |
| 2018 | 13 | 9 | 0.69 |
| 2019 | 7 | 16 | 2.29 |
| 2020 | 20 | 31 | 1.55 |
| 2021 | 71 | 59 | 0.83 |
| 2022 | 23 | 77 | 3.35 |
| 2023 | 8 | 82 | 10.25 |
| 2024 | 8 | 176 | 22 |
| 2025 | 23 | 196 | 8.52 |
| Total | 192 | 724 | 3.77 |

Table 2a shows the yearly mean citations for pharmaceutical sciences research from universities in Nigeria from 2016 t0 2025. Overall, 192 publications received 724 citations yielding an overall mean of 3.77 citations per paper. There was a general upward trend in mean citation over time. Mean citations were lowest (0.18) in the year 2017 followed by 2016 with 0.25 mean citation. From 2018 to 2021, mean citation remained below 2.00 per paper, ranging from 0.69 to 2.29 mean citation. A notable increase began in 2022 with mean citation of 3.35. The year 2024 has the highest mean citation (22). This is followed by 2023 with mean citation of 10.25. The most recent year (2025) was next with mean citation of 8.52.

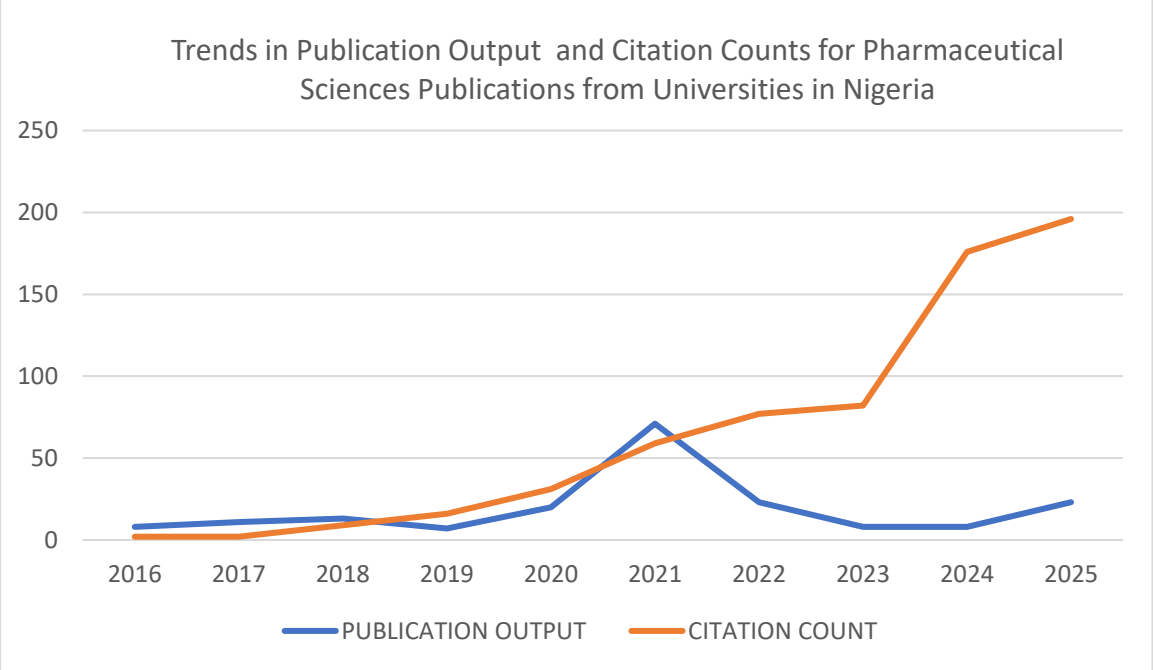



Chart 1: The line graph illustrates the annual trends in both publication output and citation counts of pharmaceutical sciences research in universities in Nigeria.

Publication counts increased to pick peak in 2021 and then decline sharply through 2024, while citation counts showed a steady, cumulative increase over the same period, with the steepest rise occurring from 2022 to 2025. The divergence of the two lines suggests an increasing citation impact for Nigerian pharmaceutical science research. Specifically, although fewer papers were published in the later years, the papers published earlier in the period, particularly around 2020 to 2021, appeared to have gained greater visibility and influence over time. The continue rise in citations despite declining output may indicate that research from this period is being more frequently referenced, reflecting growing recognition and cumulative impact within the field.

Table 2b: Frequency of citation counts of Nigerian pharmaceutical sciences publications

**Citation Counts of Nigerian Universities Pharmaceutical Sciences Research (GROUP A)**

| | | Frequency | Percent | Valid Percent | Cumulative Percent |
|---|---|---|---|---|---|
| Valid | 0 | 56 | 29.2 | 29.2 | 29.2 |
| | 1 | 41 | 21.4 | 21.4 | 50.5 |
| | 2 | 25 | 13.0 | 13.0 | 63.5 |
| | 3 | 17 | 8.9 | 8.9 | 72.4 |
| | 4 | 12 | 6.3 | 6.3 | 78.6 |
| | 5 | 11 | 5.7 | 5.7 | 84.4 |
| | 6 | 5 | 2.6 | 2.6 | 87.0 |
| | 7 | 5 | 2.6 | 2.6 | 89.6 |
| | 8 | 2 | 1.0 | 1.0 | 90.6 |
| | 9 | 4 | 2.1 | 2.1 | 92.7 |
| | 10 | 2 | 1.0 | 1.0 | 93.8 |
| | 11 | 2 | 1.0 | 1.0 | 94.8 |
| | 13 | 2 | 1.0 | 1.0 | 95.8 |
| | 14 | 1 | .5 | .5 | 96.4 |
| | 15 | 1 | .5 | .5 | 96.9 |
| | 18 | 1 | .5 | .5 | 97.4 |
| | 22 | 1 | .5 | .5 | 97.9 |
| | 32 | 1 | .5 | .5 | 98.4 |
| | 37 | 1 | .5 | .5 | 99.0 |
| | 49 | 1 | .5 | .5 | 99.5 |
| | 107 | 1 | .5 | .5 | 100.0 |
| | Total | 192 | 100.0 | 100.0 | |

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Table 2c: Descriptive statistics of Citation Count of Nigerian Pharmaceutical Sciences Research

**Descriptive Statistics**

| | N Statistic | Minimum Statistic | Maximum Statistic | Sum Statistic | Mean Statistic | Std. Deviation Statistic |
|---|---|---|---|---|---|---|
| CITATION COUNT | 192 | 0 | 107 | 724 | 3.77 | 9.479 |
| Valid N (listwise) | 192 | | | | | |

Table 2c shows the descriptive statistics of citation count of across 192 publications of pharmaceutical sciences research from universities in Nigerian. The data indicated that 192 articles accumulated a total of 724 citations, yielding a mean citation of 3.77 and standard deviation of 9.479.

Research Question 3: What is the mean citation count of publications from international comparator group in selected journals?

Table 3a: the mean citation of publications of pharmaceutical sciences research of the comparator group

| Year | Total Publication | Total Citation | Mean Citation |
|---|---|---|---|
| 2016 | 143 | 28 | 0.20 |
| 2017 | 177 | 185 | 1.05 |
| 2018 | 231 | 411 | 1.78 |
| 2019 | 341 | 850 | 2.49 |
| 2020 | 705 | 1822 | 2.58 |
| 2021 | 3940 | 3101 | 0.79 |
| 2022 | 899 | 4662 | 5.19 |
| 2023 | 103 | 5632 | 54.68 |
| 2024 | 138 | 6441 | 46.67 |
| 2025 | 50 | 6865 | 137.3 |
| Total | 6727 | 29,997 | 4.45 |

Table 3a shows the yearly mean citations for pharmaceutical sciences publications of international comparator group from 2016 to 2025. Overall, 6727 publications received 29,997 citations yielding an overall mean of 4.46 citations per paper. There was a general upward trend in mean citation over time. Mean citations were lowest (0.20) in the year 2016 followed by 2021 with mean citation of 0.79. From 2016 to 2021, mean citation remained below 2.60 per paper, ranging from 0.20 to 2.58 mean citation. A notable increase began in 2022 with mean citation of 5.19. The most recent year, 2025 has the highest mean citation of 137.3. This is followed by 2023 with mean citation of 54.68. The year 2024 was next with mean citation of 46.67.

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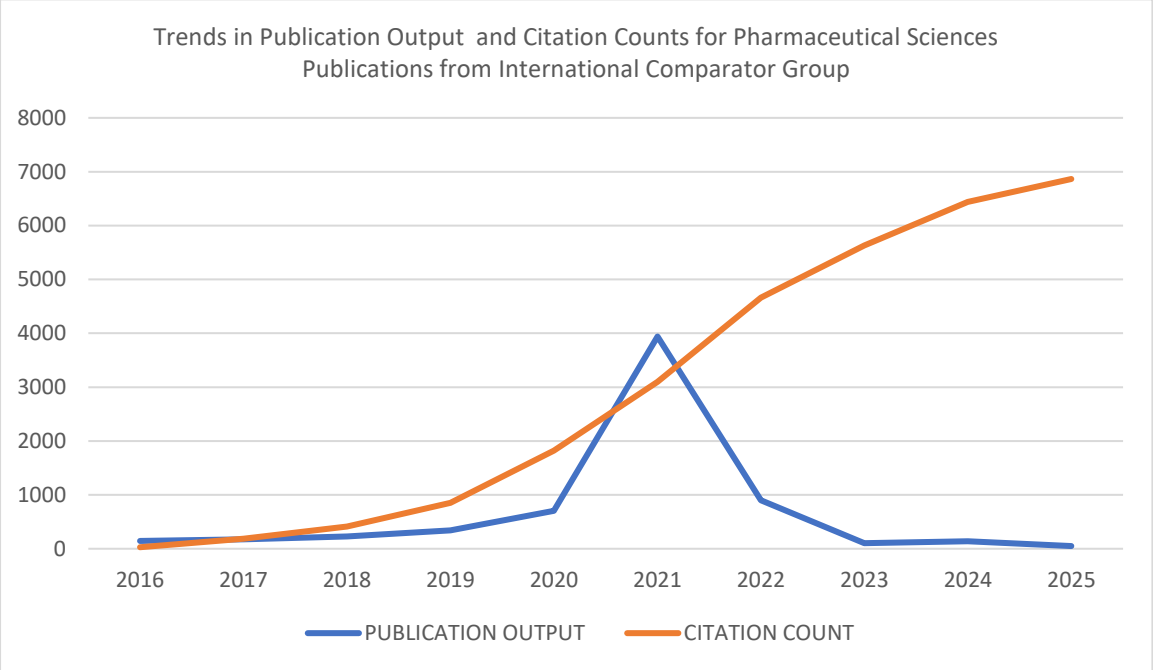



Chart 2: The line graph illustrates the annual trends in both publication output and citation counts of pharmaceutical sciences research of international comparator group.

Publication counts increased to pick peak in 2021 and then decline sharply through 2023, while citation counts showed a steady, cumulative increase over the period, with the steepest rise occurring from 2021 to 2025. In 2021, output surpasses citation count reaching 3940 before declining steeply to 899 in 2022. The divergence of the two lines in the current years suggests an increasing citation impact for pharmaceutical science research of the international comparator group in recent time. The papers published earlier in the period, particularly around 2023 to 2025, appeared to have gained greater visibility and influence over time.

Table 3b: Frequency of citation counts of pharmaceutical sciences publications of the international comparator group

**Citation Count of Pharmaceutical Sciences Research (GROUP B)**

| | | Frequency | Percent | Valid Percent | Cumulative Percent |
|---|---|---|---|---|---|
| Valid | 0 | 1611 | 23.3 | 23.3 | 23.3 |
| | 1 | 4030 | 58.2 | 58.2 | 81.5 |
| | 2 | 436 | 6.3 | 6.3 | 87.8 |
| | 3 | 90 | 1.3 | 1.3 | 89.1 |

| | | | | |
|---|---|---|---|---|
| 4 | 20 | .3 | .3 | 89.4 |
| 5 | 1 | .0 | .0 | 89.4 |
| 6 | 1 | .0 | .0 | 89.4 |
| 7 | 20 | .3 | .3 | 89.7 |
| 8 | 10 | .1 | .1 | 89.9 |
| 9 | 16 | .2 | .2 | 90.1 |
| 10 | 34 | .5 | .5 | 90.6 |
| 11 | 20 | .3 | .3 | 90.9 |
| 12 | 23 | .3 | .3 | 91.2 |
| 13 | 42 | .6 | .6 | 91.8 |
| 14 | 30 | .4 | .4 | 92.3 |
| 15 | 34 | .5 | .5 | 92.8 |
| 16 | 31 | .4 | .4 | 93.2 |
| 17 | 26 | .4 | .4 | 93.6 |
| 18 | 20 | .3 | .3 | 93.9 |
| 19 | 22 | .3 | .3 | 94.2 |
| 20 | 27 | .4 | .4 | 94.6 |
| 21 | 24 | .3 | .3 | 94.9 |
| 22 | 25 | .4 | .4 | 95.3 |
| 23 | 15 | .2 | .2 | 95.5 |
| 24 | 14 | .2 | .2 | 95.7 |
| 25 | 10 | .1 | .1 | 95.9 |
| 26 | 9 | .1 | .1 | 96.0 |
| 27 | 8 | .1 | .1 | 96.1 |
| 28 | 10 | .1 | .1 | 96.2 |
| 29 | 12 | .2 | .2 | 96.4 |
| 30 | 19 | .3 | .3 | 96.7 |
| 31 | 8 | .1 | .1 | 96.8 |
| 32 | 7 | .1 | .1 | 96.9 |
| 33 | 9 | .1 | .1 | 97.0 |
| 34 | 10 | .1 | .1 | 97.2 |
| 35 | 10 | .1 | .1 | 97.3 |
| 36 | 8 | .1 | .1 | 97.4 |
| 37 | 6 | .1 | .1 | 97.5 |
| 38 | 6 | .1 | .1 | 97.6 |
| 39 | 6 | .1 | .1 | 97.7 |
| 40 | 5 | .1 | .1 | 97.8 |
| 41 | 5 | .1 | .1 | 97.8 |
| 42 | 8 | .1 | .1 | 98.0 |
| 43 | 5 | .1 | .1 | 98.0 |
| 44 | 5 | .1 | .1 | 98.1 |
| 45 | 3 | .0 | .0 | 98.2 |

| | | | | |
|---|---|---|---|---|
| 46 | 7 | .1 | .1 | 98.3 |
| 47 | 3 | .0 | .0 | 98.3 |
| 48 | 4 | .1 | .1 | 98.4 |
| 49 | 7 | .1 | .1 | 98.5 |
| 50 | 7 | .1 | .1 | 98.6 |
| 51 | 3 | .0 | .0 | 98.6 |
| 52 | 3 | .0 | .0 | 98.6 |
| 53 | 4 | .1 | .1 | 98.7 |
| 54 | 1 | .0 | .0 | 98.7 |
| 55 | 3 | .0 | .0 | 98.8 |
| 56 | 1 | .0 | .0 | 98.8 |
| 58 | 1 | .0 | .0 | 98.8 |
| 59 | 2 | .0 | .0 | 98.8 |
| 60 | 3 | .0 | .0 | 98.9 |
| 61 | 1 | .0 | .0 | 98.9 |
| 62 | 3 | .0 | .0 | 98.9 |
| 63 | 1 | .0 | .0 | 98.9 |
| 64 | 2 | .0 | .0 | 99.0 |
| 65 | 3 | .0 | .0 | 99.0 |
| 66 | 2 | .0 | .0 | 99.0 |
| 67 | 2 | .0 | .0 | 99.1 |
| 70 | 1 | .0 | .0 | 99.1 |
| 71 | 1 | .0 | .0 | 99.1 |
| 72 | 1 | .0 | .0 | 99.1 |
| 73 | 1 | .0 | .0 | 99.1 |
| 74 | 1 | .0 | .0 | 99.1 |
| 75 | 2 | .0 | .0 | 99.2 |
| 76 | 4 | .1 | .1 | 99.2 |
| 77 | 2 | .0 | .0 | 99.2 |
| 78 | 3 | .0 | .0 | 99.3 |
| 79 | 1 | .0 | .0 | 99.3 |
| 81 | 3 | .0 | .0 | 99.3 |
| 82 | 2 | .0 | .0 | 99.4 |
| 84 | 2 | .0 | .0 | 99.4 |
| 85 | 1 | .0 | .0 | 99.4 |
| 86 | 1 | .0 | .0 | 99.4 |
| 89 | 1 | .0 | .0 | 99.5 |
| 91 | 1 | .0 | .0 | 99.5 |
| 95 | 1 | .0 | .0 | 99.5 |
| 97 | 1 | .0 | .0 | 99.5 |
| 99 | 1 | .0 | .0 | 99.6 |
| 101 | 1 | .0 | .0 | 99.6 |

| | | | | | |
|---|---|---|---|---|---|
| | 109 | 1 | .0 | .0 | 99.6 |
| | 110 | 1 | .0 | .0 | 99.6 |
| | 111 | 1 | .0 | .0 | 99.6 |
| | 113 | 1 | .0 | .0 | 99.6 |
| | 115 | 1 | .0 | .0 | 99.6 |
| | 116 | 1 | .0 | .0 | 99.7 |
| | 118 | 1 | .0 | .0 | 99.7 |
| | 121 | 1 | .0 | .0 | 99.7 |
| | 123 | 1 | .0 | .0 | 99.7 |
| | 128 | 1 | .0 | .0 | 99.7 |
| | 133 | 1 | .0 | .0 | 99.7 |
| | 138 | 1 | .0 | .0 | 99.8 |
| | 139 | 1 | .0 | .0 | 99.8 |
| | 145 | 1 | .0 | .0 | 99.8 |
| | 147 | 1 | .0 | .0 | 99.8 |
| | 153 | 1 | .0 | .0 | 99.8 |
| | 159 | 1 | .0 | .0 | 99.8 |
| | 160 | 1 | .0 | .0 | 99.9 |
| | 201 | 1 | .0 | .0 | 99.9 |
| | 214 | 1 | .0 | .0 | 99.9 |
| | 219 | 1 | .0 | .0 | 99.9 |
| | 243 | 1 | .0 | .0 | 99.9 |
| | 282 | 1 | .0 | .0 | 99.9 |
| | 296 | 1 | .0 | .0 | 99.9 |
| | 300 | 1 | .0 | .0 | 100.0 |
| | 409 | 1 | .0 | .0 | 100.0 |
| | 616 | 1 | .0 | .0 | 100.0 |
| | 752 | 1 | .0 | .0 | 100.0 |
| | Total | 6727 | 100.0 | 100.0 | |

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Table3c: Descriptive statistics of Citation Count of Pharmaceutical Sciences Research of the Comparator Group

**Descriptive Statistics**

| | Statistic | Minimum Statistic | Maximum Statistic | Sum Statistic | Mean Statistic | Std. Deviation Statistic | Std. Error |
|---|---|---|---|---|---|---|---|
| CITATION COUNTS | 6727 | 0 | 752 | 29997 | 4.46 | 19.29 | .029 |
| Valid N (listwise) | 6727 | | | | | | |

Table 3c shows the descriptive statistics of citation count across 6727 publications in pharmaceutical sciences research of the international comparator group. The data indicated that the 6727 articles accumulated a total of 29,997 citations, yielding a mean citation of approximately 4.46.and standard deviation of 19.29.

Research Question 5: Is there a significant difference in mean citation count between pharmaceutical sciences publications from universities in Nigeria and those from the international comparator group in selected journals?

To determine the difference in mean citation counts of Pharmaceutical Science research of Nigeria Universities and international comparator group pharmaceutical sciences research, Cohen's d was used.

Given: Group A (The Nigerian universities):
$M_1 = 3.77$, $n_1 = 192$, $SD_1 = 9.479$
Group B (The international comparator group):
$M_2 = 4.46$, $n_2 = 6727$, $SD_2 = 19.29$,
The pooled standard deviation was computed using the formular:

$$SDpooled = \frac{\sqrt{(n_1 - 1)SD_1{}^2 + (n_2 - 1)SD_2{}^2}}{n_1 + n_2 - 2}$$

yielded a Pooled Standard Deviation of 19.08
Cohen's d was calculated using the formular:
$d=(M_1-M_2)/SD$,
$d=3.77- 4.46/19.08= -0.69/19.08= -0.036$
If we use |d| for effect size magnitude
$|d| = 0.036$
Cohen's d = -0.036

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This means Group A (Nigerian universities pharmaceutical sciences research output) mean is slightly lower than Group B (International comparator group research output)

**Effect size magnitude**

By Cohen's conventions: $0.20 \leq |d| < 0.50$ = small effect, $0.50 \leq |d| < 0.80$ = medium effect, $|d| \geq 0.80$ = large effect

Therefore d = 0.036 is a negligible/very small effect size.

**Statistical significance: p-value from the t-test**

For t = 0.494, df =6917, two tailed test *p=0.621,* d=-0.036

Welch's independent sample t-test was conducted to compare citation counts between Nigerian universities and international comparator group

t = -0.79, degree of freedom (df) =6917, two-tailed test: p=0.621,

The Decision Rule

- If Sig. ≤ 0.05'n Reject $H_O$. (Result is statistically significant at the 5% level.
- If sig. ≥ 0.05'n Fail to reject $H_O$ (Result not statistically significant. The effect could easily be due to chance)

  Significant Value (p-value): 0.621 > 0.05, thus the null hypothesis is retained. Thus, there was no statistically significant difference in citation counts between the two groups, t (6917) = 0.49, p =0.621. The effect size was negligible, |d| = 0.036

**Discussion Of Findings**

The finding revealed that research in pharmaceutical sciences affiliated with universities in Nigeria yielded a total of 311 articles across 76 journals, accumulating 1,803 citations. Based on the ranking in the Dimension database, four journals emerged as the leading outlets for this body of literature and are therefore designated as the core journals for Nigerian university-affiliated pharmaceutical research. The core journals are Journal of Pharmaceutical Research International (122 publications, 424 citations), Journal of Pharmacy and Bioresource (41 publications, 69 citations), Tropical Journal of Pharmaceutical Research (24 publications, 62 citations) and Evidence-Based Complementary and Alternative Medicine (4 publications, 168 citations). Collectively these core journals yielded 191 articles, accounting for 61.4% of the total output from Nigerian universities in pharmaceutical sciences.

The concentration of more than 60% of the Nigerian university publications in just four journals underscores the dependency of Nigerian pharmaceutical researchers on a limited set of publication venues. This has both advantage and risk. On one hand, publishing in a small core can enhance visibility and build a recognizable research identity. On the other hand, overreliance on few outlets may limit disciplinary breadth and expose researchers to risks associated with changes in journal policies or indexing status. Journal of Pharmacy and Bioresource and Tropical Journal of Pharmaceutical Research are regional journals. Their strong presence among the core indicates a continued reliance on

regional outlets. Overreliance on regional journals limit global visibility especially if the journals have limited indexing in major databases such as Web of Science and Scopus.

The findings also revealed that only Evidence-Based Complementary and Alternative Medicine was indexed in the Web of Science Core Collection in 2025. The journal had an impact factor of 4.8, placing it in Quartile 1 (Q1= top 25% of the journals in the category) in the pharmacology and Pharmacy category. The three other journals (JPRI, JPB, and TJPR) were not listed in the 2025 JCR and therefore had no assigned impact factor. Despite this, they accounted for the vast majority (187, 97.9%) of publications. However, their average citation rates, 3.48, 1.68 and 2.52 respectively were substantially lower than that of the single JCR-indexed journal. For instance, EBCAM, published only 4 articles of Nigerian pharmaceutical sciences researchers but recorded 168 citations. It is an international journal indexed in major databases. Despite low output, it achieved the highest citation density with an average of 42 citation per article.

The high volume of Nigerian pharmaceutical sciences article in journals not indexed in the Web of Science Core Collection can reduce the likelihood of citation and international collaboration which enhance the journal's visibility and accessibility to the global research community and allows its publications to contribute to citation-based metrics used in academic evaluation. Furthermore, the absence of JCR across the majority of utilized journals is consistent with many findings related to field of pharmaceutical sciences. For example, Asubiaro (2023) revealed that majority of biomedical journals published in Sub-Sahara Africa are not indexed in Web of Science. The lower proportion of impact factor indexed journals observed here relative to Mousavi et al. (2013) observation in Rational use of Drugs in Iran that 36.4% of the journals that publish their articles had an impact factor, may reflect differences in the scope of the datasets.

Interestingly, The Nigerian pharmaceutical sciences research has a moderate overall citation impact, with a mean of 3.77 citations per paper. The highest mean citation in 2024 (22), followed by 2023 (10.25) and 2025 (8.52). The publication counts increased to peak in 2021 and then declined sharply through 2024. In contrast, citation counts showed a steady, cumulative increase over the same period, with the steepest rise occurring from 2022 to 2025. Consequently, the year 2024 recorded the highest mean citation of 23 followed by 2023 (10.25) and 2025 (8.52). The divergence suggests an increasing citation impact for Nigerian pharmaceutical science research despite reduces output in later years. The continued rise in citations despite declining output may indicate growing recognition and a cumulative impact effect, whereby older papers continued to be referenced. Across the 10-year period, 6727 publications from the international comparator group received 29,997 citations, yielding an overall mean of 4.45 citations per paper. There was a

general upward trend in mean citations over time with a substantial rise from in 2023(54.68), 2024(46.67) and 2025(137.30). This suggest that more recent publications from international comparator group are achieving significantly greater visibility and influence within a shorter time frame. The observed mean of the groups is modest when compare to field normalized benchmarks for pharmacology and pharmacy. Journals in the pharmaceutical sciences category commonly report 5-year CiteScores ranging from 6.9 to 7.9. The large standard deviation relative to the mean is consistent with the pattern, indicating that impact is concentrated in a small subset of highly cited publications (Tobias, 2021).

The independent samples Welch's t-test found no statistically significant difference in mean citation counts between Nigerian university publications and international comparative group pharmaceutical sciences research, t_(6917) =0.49, p= 0.49. The effect size was negligible, d = 0.04, falling well below Cohen's threshold for small effect. This indicate that while there may be a slight numerical difference in means, it has no practical significance.

The finding suggests that research output from universities in Nigeria published in the selected pharmaceutical sciences journals performs at a level comparable to the broader field. It aligns with SCImago and Nature Index data showing that Nigeria maintains a measurable presence in pharmacology and pharmaceutical sciences within Africa. The result also resonates with Okangbue et al. (2024), who reported no substantial median difference across universities in Nigerian, implying that internal variation may be as pronounced as external.

The descriptive statistics show that Nigerian pharmaceutical sciences research has a moderate overall citation impact, with a mean of 3.77 citations per paper. Older papers from 2016-2017 demonstrate that the research can achieve double-digits mean citations given time. The low mean citations for recent years (2021-2025) do not necessarily indicate low quality. In pharmaceutical sciences, it takes 2 to 4 years for a paper to reach peak citation rate therefore the downward trend (2.08 - 0.13) in mean citations for the recent years (2021-2025) is largely attributable to citation lag rather than declining research quality.

The mean citation of publications of global pharmaceutical sciences researchers in the top ranked journals?
The overall mean citation of 4.35 suggests moderate visibility for pharmaceutical sciences research. The observed mean is modest when compare to field normalized benchmarks for pharmacology and pharmacy. Journals in the pharmaceutical sciences category commonly report 5-year Cite Scores ranging from 6.9 to 7.9. The large standard deviation relative to the mean is consistent with the pattern, indicating that impact is concentrated in a small subset of highly cited publications (Tobias, 2021).

The higher mean citation for publications from 2021 onward is attributable to citation lag. In biomedical and pharmaceutical

sciences, citations typically peak 3-5 years after publication, and it is common for recent articles to show low mean counts simply due to limited exposure time. The difference in mean citation counts of Pharmaceutical Science research of Nigeria Universities and global pharmaceutical sciences research.

The independent samples Welch's t-test found no statistically significant difference in mean citation counts between Nigerian university publications and international comparative group pharmaceutical sciences research, $t(243) = 1.15$, $p = 0.251$, $d = 0.06$. the effect size was negligible, $d = 0.06$, falling well below Cohen's threshold for small effect. This indicate that while there may be a slight numerical difference in means, it has no practical significance.

The finding suggests that research output from universities in Nigeria published in the selected pharmaceutical sciences journals performs at a level comparable to the broader field. It aligns with SCImago and Nature Index data showing that Nigeria maintains a measurable presence in pharmacology and pharmaceutical sciences within Africa. The result also resonates with Okangbue et al. (2024), who reported no substantial median difference across universities in Nigerian, implying that internal variation may be as pronounced as external.

## Conclusion

The study concluded that pharmaceutical sciences research in universities in Nigeria demonstrates citation performance comparable to global benchmarks. However, efforts are needed to increase publication in internationally recognized, high impact-global journals to further enhance global visibility and scholarly influence.

## Recommendations

1. Researchers should focus on quality and novelty rather than volume alone, since global impact is driven by a small proportion of highly cited works. The department should identify and support research with potential for high impact through mentorship, collaboration, and access to high-impact journals.
2. Universities should provide training and incentives for researchers to publish in journals indexed in Scopus, Web of Science, and PubMed to increase the visibility and discoverability of research outputs, making findings more accessible to industry stakeholders and potential collaborators.

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