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Bibliometric Analysis of Pakistan Journal of Pharmaceutical Sciences From 2005 To 2020

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Abstract

Background:

The major aim of this study is to evaluate the research productivity of Pakistan Journal of Pharmaceutical Sciences (PJPS) from 2005 to 2020. For the purpose, bibliometric analysis was performed.

Methodology:

From March to April 2021, the data was retrieved from Scopus, one of the largest databases in the world. journal. Later it was analyzed by MS Excel. Based on the Scopus database, this is the 1st bibliometric report about PJPS.

Results:

From 2005 to 2020, PJPS published 3301 articles. The per year publication and citation details are provided. In all publications (n=3301), 8066 authors, 6018 institutes or departments and 72 countries have contributed. Based on the number of publications, citations, and citations per documents (CPD), details about the top author, institute and country are provided. Infact, from 2005 to 2020, based on the number of publications University of Karachi and Pakistan topped the list (for each year). By Vosviewer analysis, we described the collaboration or co-authorship pattern for top author, university, and country. We also identified and analyzed the 100 most-cited articles in PJPS. Infact the detail co-words analysis of all 3301 research titles were performed. Total 9288 words were recorded. After co-words analysis it was found that various drugs and plants were tested in different pathological models. Their efficacy and mechanism of action were briefly discussed.

Conclusion: The citescore data for the last ten years are described. This suggests that PJPS holds a credible position in world ranking.

Key words: Bibliometrics, Scopus, Co-words Analysis and Pharmaceutical Science

1.0 Introduction and Literature Review

In 1988, The Journal of Pharmaceutical Sciences (PJPS) was launched by Faculty of Pharmacy, University of Karachi, Sindh, Pakistan. Initially it was a biannual journal, while its frequency changed as quarterly in 2005 and bi-monthly in 2013. PJPS is indexed in various global databases i.e. ASCI Database, AsiaNet, CAB Abstracts, CABI, Chemical Abstracts, EBSCO, EMBASE, EMRmedex, ESSCI, EVISA, GDPBM, MEDLINE/PubMed, SCImago, SCOPUS, Scribd, WebStatDomain and WorldCat, to name a few. PJPS publishes original research articles and reviews from all fields of pharmaceutical sciences.

Bibliometric analysis is commonly used to analyze and monitor the published scientific literature. It also helps to investigate the flow of knowledge, the growth in literature, and determine the future direction in different domains. Different bibliometric parameters can be used to measure the impact and popularity of a specific author, institute, country, or a specific journal (1-3). The present project is designed to perform the bibliometric analysis of PJPS.

Its worthy to note that Ishtiaq Ahmed et al., reported a 10-Year Bibliometric Study of PJPS from 2006 to 2015. While, Zameer Hussain Baladi reported bibiometric analysis of PJPS from 1998 to 2012 (4,5). However, in both studies the data was collected from the PJPS website (http://www.pjps.pk/). Scopus is covering PJPS since 2005. This motivated us and the present project is designed to perform the 1st (based on Scopus data) comprehensive bibliometric analysis of PJPS. The manuscript is divided in several sections.

1. In 1st section brief details about per year publications and citations are provided. Numerical details about all authors, institutes and countries are also provided. Infact, based on the number of publications, citations and citations per document, the top authors, institutes, and countries are described.
2. In 2nd section, the co-authorship network,
3. In 3rd section, details about the top 100 most cited documents,
4. In 4th section, the co-words analysis for all publications and
5. In 5th and last section, the journal metrics are described.

2.0 Material and Method

2.1 Scopus and VOSVeiwer Analysis

The data was retrieved from the Scopus database on 1st April 2021 using the name of the journal (PJPS). All published documents were analyzed for access type, year, author name, document type, key words, affiliations, and country. Later the results were exported in CSV format for further analysis. The publications were analyzed on VOSviewer. The software was developed by Van Eck and Waltman (2010)

for constructing and visualizing bibliometric networks. For more information, please see http://www.vosviewer.com/. We selected co-authorship, co-occurrence of words and citations for detail analysis.

3.0 Results and Discussion

3.1 Section-One: Analysis of publication outputs

Since 2005 to 2020, PJPS has completed research publications of 3297 documents, majorly comprising of articles (n=3183), reviews (n=109), notes (n=2), short surveys (n=2) and conference papers (n=1). For detail analysis we only focused on articles and reviews (n=3301). Nine (n=9) documents from the year 1995 are also included in the list. The highest documents are published in the year 2018 (n=431), followed by 2019 (n=401), 2017 (n=351), 2016 (n=338) and 2015 (n=335). The per year publications are described in figure 1. PJPS received total 17056 citations. The highest citations were recorded for the year 2020 (n=2759), followed by 2019 (n=2194), 2018 (n=2089), 2017 (n=1962) and 2016 (n=1722) as shown in figure 1.

In all publications (n=3301), 8066 authors, 6018 institutes or departments and 72 countries have contributed. For numerical representation, we designed the publication (table 1) and citations clubs (table 2). For example, ten authors have published between forty and fifty documents. Similarly, fourteen departments have contributed in twenty to twenty-nine publications. Furthermore, details about each author (supp table 1), institutes (supp table 2) and country (supp table 3) are also provided.

Based on the number of publications the top ten authors are Ahmad M. (n=59), Arayne M.S. (n=47), Sultana N. (n=47), Wang Y. (n=46), Haleem D.J. (n=45), Ahmad S. (n=44), Ahmed S. (n=44), Ali M. (n=44), Usmanghani K. (n=44) and Khan M.A. (n=44). Institutionally, the highest documents are published by Department Of Chemistry, Government College University, Lahore, Pakistan (n=47), followed by Department Of Pharmacology, Faculty Of Pharmacy And Pharmaceutical Sciences, University Of Karachi, Karachi, Pakistan (n=42), Department Of Pharmaceutics, Faculty Of Pharmacy And Pharmaceutical Sciences, University Of Karachi, Karachi, Pakistan (n=41), Institute Of Molecular Biology And Biotechnology, Bahauddin Zakariya University, Multan, Pakistan (n=29), Department Of Chemistry, Government College University, Faisalabad, Pakistan (n=29), Department Of Chemistry, University Of Karachi, Karachi, Pakistan (n=28), Department Of Pharmaceutics, Faculty Of Pharmacy, University Of Karachi, Karachi, Pakistan (n=27), University College Of Pharmacy, University Of The Punjab, Lahore, Pakistan (n=26), Department Of Chemistry, University Of Karachi, Karachi-75270, Pakistan (n=24) and Neurochemistry And Biochemical Neuropharmacology Research Unit, Department Of Biochemistry, University Of Karachi, Karachi, Pakistan (n=24). While, Pakistan (n=1619), published the highest number of documents in PJPS, followed by China (n=812), India (n=199), Saudi Arabia

(n=190), Malaysia (n=134), Egypt (n=124), Iran (n=99), Nigeria (n=69), Turkey (n=60) and Bangladesh (n=50).

Citation analysis is considered an invaluable technique for literature review. Furthermore, it also makes it possible to recognize information from previous research and provides clues for the subject's development which could be a possible indicator in research pattern (6,7).

Based on citations, the top ten authors are Arayne M.S. (n=592), Sultana N. (n=587), Shoaib M.H. (n=429), Ahmad M. (n=330), Yousuf R.I. (n=329), Haleem D.J. (n=325), Qadir M.I. (n=286), Ahmed M. (n=285), Bakht J. (n=272) and Khan R.A. (n=266). Institutionally the highest citations were recorded for Similarly, the top ten universities or organizations are United States Environmental Protection Agency (n= 68), The Dow Chemical Company (n= 41), National Institute for Public Health and the Environment (n= 37), Gradient Corporation (n= 30), Imperial College London (n= 29), University of Massachusetts Amherst (n= 28), DuPont (n= 27), University of Nebraska Medical Center (n= 27), National Institute of Environmental Health Sciences NIEHS (n= 25) and ILSI Health and Environmental Sciences Institute (n= 24). While, based on citations, the top ten countries are Pakistan (n=7711), India (n=2136), China (n=1813), Iran (n=1506), Saudi Arabia (n=904), Egypt (n=871), Malaysia (n=689), Turkey (n=605), Bangladesh (n=508) and Nigeria (n=490).

We also calculated citations per documents (CPD) for those authors, institutes and countries which have published atleast five publications. The top ten authors in this series are Israili Z.H. (n=33), Lyoussi B. (n=33), Abo-Salem O.M. (n=24), Nwafor P.A. (n=21), Okokon J.E. (n=21), Ali M.S. (n=20), Bachar S.C. (n=20), Zia-ul-Haq M. (n=19), Azhar I.(n=17) and Ansari A. (n=15). Institutionally the highest CPD was noted for Department Of Pharmaceutics, Faculty Of Pharmacy, University Of Karachi, Karachi-75270, Pakistan (n=45), followed by Department Of Microbiology, University Of Karachi, Karachi-75270, Pakistan (n=26), Department Of Pharmacology, Faculty Of Pharmacy, University Of Karachi, Pakistan (n=24), School Of Materials Science And Engineering, Central South University Of Forestry And Technology, Changsha, China (n=18), Department Of Chemistry, University Of Karachi, Karachi-75270, Pakistan (n=17), Department Of Pharmaceutical Technology, University Of Dhaka, Dhaka-1000, Bangladesh (n=14), Department Of Chemistry And Biochemistry, University Of Agriculture, Faisalabad, Pakistan (n=13), Faculty Of Pharmacy, Bahauddin Zakariya University, Multan, Pakistan (n=13), Department Of Pharmaceutical Chemistry, Research Institute Of Pharmaceutical Sciences, Faculty Of Pharmacy, University Of Karachi, Karachi-75270, Pakistan (n=13) and Department Of Physiology, University Of Karachi, Karachi-75270, Pakistan (n=12). In countries category, the highest CPD was recorded for Morocco (n=23), followed by France (n=17), Iran (n=15), Nepal (n=13), Japan (n=12), Tunisia (n=11), India (n=11), Thailand (n=11), Bangladesh (n=10) and South Africa (n=10).

We can conclude that University of Karachi and Pakistan published the highest number of publications for each year in PJPS. Similarly, the details about top authors for each year in presented in table. 3.

3.2 Section-Two: Co-authorship network by Vosviewer

To describe the scientific collaboration between the authors, institutions and countries in a particular research field or a journal, co-author analysis is performed. For the purpose, based on the number of publications we selected the top authors, university and country i.e. Arayne, M.S. (n=47), University of Karachi (n=578) and Pakistan (n=1629), respectively.

1. Arayne, M.S. collaborated with 42 authors as shown in figure. 2. Mostly he co-authored publications with Sultana, N. (n=45), Siddiqui, F.A. (n=8), Hussain, F. (n=5), Mirza, A.Z. (n=3), Zuberi, M.H. (n=3), Afzal, M. (n=2), Akhtar, M. (n=2), Bahadur, S.S. (n=2), Farooq, A. (n=2), Haroon, U. (n=2), Khan, A. (n=2), Qureshi, F. (n=2), Shafi, N. (n=2), Siddiqi, T.A. (n=2) and Zaman, M.K. (n=2).
2. In 578 publications of University, 1095 authors contributed. The data for authors with atleast five publications are presented in figure. 3. Similarly, 77 universities published atleast two documents with University of Karachi. While, 779 departmental addresses from twenty (n=20) countries are noted in all documents. Departmental collaboration or interconnectivity is described in figure. 4.
   Its worthy to note that University of Karachi also collaborated with other universities. The highest collaborating documents were found for Federal Urdu University of Arts (n=86), followed by Dow University of Health Sciences Pakistan (n=84), Jinnah Sindh Medical University (n=40), Hamdard University (n=37), Ziauddin University (n=33), Jinnah University for Women (n=32), Government College University Lahore (n=16), Islamia University (n=14), Baqai Medical University (n=14), PCSIR Laboratories (n=13), King Saud bin Abdulaziz University for Health Sciences (n=13) and Bahauddin Zakariya University (n=11), to name a few.
3. Pakistan collaborated with 44 countries in 1629 publications. The data is presented in figure 5. Based on the number of publications, the highest collaboration was recoded with Saudi Arabia (n=62), Malaysia (n=44), China (n=39), United Kingdom (n=27), United States (n=15), Australia (n=10), Germany (n=8), Japan (n=8), United Arab Emirates (n=8), Iran (n=7), Turkey (n=7) and Austria (n=6).

3.3 Section-Three: The top one hundred (n=100) most cited documents

It's important to note that we presented citations clubs for all documents (n=3301) in table 4. For example, sixty-two documents received atleast ten citations. While nine hundred and ten documents received zero (n=0) citations. In this section we analyze the 100 most-cited articles in PJPS. The number

of citations received by these 100 articles ranged from 27 to 356. The cumulative total citations were 5077, while the average citations were found to be 50.77. The adjusted citation count (i.e., citation count per year since publication) ranged from 2.1 to 32.36 (average=5.32). The title of document, year of publication, volume, issue, page start, page end and citations for each document (total 100) is described in supplementary table 5. Based on the number of citations, we divided all documents (n=100) in various citations clubs. For example, one document received atleast three hundred (n=300), two documents received atleast two hundred (n=200), three documents received atleast one hundred (n=100), seventeen documents received atleast fifty (n=50), twenty documents received atleast forty (n=40), thirty-six document received atleast thirty (n=30) and twenty documents received atleast twenty (n=20) citations.

3.3.1 To identify the top contributors and

Similarly, in all publications (n=100) 370 authors, 184 departments and 27 countries have significantly contributed. The publications and citation details of all authors, departments and countries are presented in supplementary tables 6, 7 and 8, respectively. In authors list, Arayne M.S. and Sultana N. are the top researchers with five publications. However, the highest citations were recorded for Ebrahimzadeh M.A. (n=529). Institutionally, the highest number documents (n=4) are published by Department of Chemistry, University of Karachi, Karachi-75270, Pakistan, while the highest citations were found for Pharmaceutical Sciences Research Center, School Of Pharmacy, Mazandaran University Of Medical Sciences, 48189, Sari, Iran (n=529). In countries list, the Pakistan has contributed in highest (n=38) number of documents. Similarly, Pakistan also has the highest citations (n=1722). Other countries in the list with number of publications (NoP) and Ciations (C) are India (Nop=17 & C= 800), Iran (Nop=9 & C= 855), Egypt (Nop=7 & C= 293) Saudi Arabia (Nop=5 & C= 168), Bangladesh (Nop=4 & C= 163), Malaysia (Nop=4 & C= 125), Turkey (Nop=4 & C= 313), Thailand (Nop=3 & C= 126), Algeria (Nop=2 & C= 72), France (Nop=2 & C= 99), Morocco (Nop=2 & C= 115), Nigeria (Nop=2 & C= 90), United Kingdom (Nop=2& C= 105), United States (Nop=2 & C= 115), Argentina (Nop=1 & C= 32), China (Nop=1 & C= 31), Germany (Nop=1 & C= 50), Iraq (Nop=1 & C= 27), Italy (Nop=1 & C= 27), Japan (Nop=1 & C= 60), Jordan (Nop=1 & C= 29), Nepal (Nop=1 & C= 29), Serbia (Nop=1 & C= 29), South Africa (Nop=1 & C= 110), Spain (Nop=1 & C= 32) and Tunisia (Nop=1 & C= 58).

3.3.2 To understand what key research themes were addressed in these publications. The technical words in the titles of these 100 articles were manually analyzed and visualized by VOSviewer.

The list of plant studied

In 2003, Menrad et al., reported that the global market of medicinal plants or functional foods is US$33 billion, which enormously increased to US$168 billion (Vicentini et al., 2016). Food plants, and spices are also easily and often commercially available through the world (8,9).

The 100 articles involved different medicinal plants or spices. Infact the publications covered citrus species peels and tissues, h. officinalis l. var. angustifolius, v. odorata, b. hyrcana and c. speciosum, salvia species., berberis vulgaris, genus ajuga, black pepper, bay leaf, aniseed and coriander, garlic (allium sativum) , tamarindus indica linn., croton zambesicus, ficus carica latex, silymarin, umbelliferae fruits, emblica officinalis and coriandrum sativum , boesenbergia pandurata and piper sarmentosum , menthol, tectona grandis, thespesia lampas dalz and gibs, artemisia vulgaris, propolis extract, thai medicinal plants, glycyrrhiza glabra l. (liquorice), thespesia populnea , thymoquinone supplementation , peganum harmala seeds, peganum harmala seeds, bunium persicum , allium sativum (garlic, some indigenous plants., glycyrrhiza glabra, nigella sativa ,andrographis paniculata , salacia chinensis , allium cepa, four plant species used in folk medicine in the mediterranean basin, turkish karstic caves , grape fruit , mentha longifolia , echinacea purpurea l., garlic (allium sativum) , prunella vulgaris l, coccinia cordifolia l. and catharanthus roseus l., ajwa, polygonatum verticillatum, parkia speciosa hassk , thai mango seed extract, zataria multiflora , morus alba linn. (mulberry) leaves, proniosomes , thymus capitatus from jordan, hunteria umbellata (k. schum) and juniperus procera.

Drugs

In 100 articles, the authors also focused on various drugs. They discussed various simple, fast, and precise methods for the separation and quantification of various drugs in bulk and pharmaceutical dosage. They also described the formulation and evaluation of drugs delivery and release systems. Some of the studied drugs are ibuprofen, pioglitazone and glimepiride, carvedilol, ofloxacin, thymoquinone supplementation, sex steroid hormones, qadirvirtide, atenolol and amlodipine, metformin, captopril, proniosomes as drug carriers, ketoprofen, tenofovir disoproxil fumarate in tablets.

Chemicals

The authors also studied various chemicals and their mechanism of action i.e., silymarin, coumarin, new chalcones containing 1, 4 - dioxane ring system, 5-substituted-1,3,4-oxadiazole-2yl-n-(2-methoxy-5-chlorophenyl)- 2-sulfanyl acetamide, and citral (a component of lemongrass).

Heavy metals

The authors also focused on understanding the toxicity of various heavy metals, and nanoparticles for example zinc and NiO nanoparticles.

The list of their pharmacological potential

Another noticeable point is mostly the articles evaluated wider aspects of effects of the medicinal plants and functional food. For example, the oxidative stress (OS), antimicrobial potential, nanoparticles toxicity, antidiabetic, renal OS, biochemical characterizations, antiinflammatory, analgesic and antipyretic activities, melastatin-8 (trpm8) ion channels, hypolipidemic, protein glycation, renal oxidative damage, hyperlipidemic, cytotoxicity, hepatotoxicity in rats, cognitive performance, cardioprotective effects,

hypoglycemic activity, urease, anxiolytic effects, stz-induced diabetes, antihepatotoxic activity, apoptosis, cisplatin-induced nephrotoxicity in rats, nephro-protective, glucose induced hyperglycemic , antiangiogenic, immunomodulatory activity, in vivo antitumorigenic activity, nasal carriage, non-pregnant rat uterus in oestrus, zinc and endocrine system, phytotoxic and insecticidal activities were briefly described.

Diseases or pathologies

The 100 articles also focused on numerous diseases, for example obesity, nephropathy, wound, liver dysfunction, traumatic brain injury, hypertension, cancer, cardiovascular disease, and tardive dyskinesia.

Phytochemicals

Some important metabolites and phytochemicals are also mentioned at least in the 100 articles, including alkaloids, essential oil flavonoids and tannin etc.…

The interconnectivity between different keywords is presented in Figure. 6.

3.4 Section-Four: Co-words analysis for all publications

To explore the main research focus or trends in publications, we performed the co-words analysis. It analyses the frequency of co-occurrence of keywords in research documents and shows a link between the topics to which they refer. It also describes the interaction between different fields in scientific research (5,6).

1. Fangkun Zhao, Bei Shi, Ruixin Liu, Wenkai Zhou, Dong Shi and Jinsong Zhang. Theme trends and knowledge structure on choroidal neovascularization: a quantitative and co-word analysis. BMC Ophthalmology (2018) 18:86
2. Juan J. Nájera-Sánchez. A Systematic Review of Sustainable Banking through a Co-Word Analysis. Sustainability 2020, 12, 278.

Based on the number of times of appearance Scopus provides the list of top 160 most appeared keywords. We manually analyzed and groups them in the following four (n=4) categories.

1. **General words**

   In this category the following words with number of times of appearance are added. These words represent different subjects (rats, mice, humans), cell & tissues, blood, age (young, adult, aged) and type of study. The exact words are described below.

   Controlled study (n=1657), nonhuman (n=1392), male (n=1280), human (n=1260), humans (n=1179), animals (n=1117), chemistry (n=1053), unclassified drug (n=1011), drug effect (n=895), female (n=886), animal (n=881), animal experiment (n=707), rat (n=586), adult (n=569), animal model (n=455), rats (n=447), procedures (n=418), blood (n=400), middle aged (n=383), animal tissue (n=333), mouse (n=307), rats, wistar (n=276), mice (n=258), aged (n=245), wistar rat (n=220), young adult (n=202), randomized controlled trial (n=194), solvent

(n=189), chemistry, pharmaceutical (n=187), disease models, animal (n=166), adolescent (n=137), rabbits (n=134), animal cell (n=129), hydrogen-ion concentration (n=127), rats, sprague-dawley (n=127), reproducibility of results (n=107), body weight (n=103), reproducibility (n=96), review (n=95), child (n=92), comparative study (n=323), human cell (n=144) , sprague dawley rat (n=113), and administration, oral (n=136).

2. **Plants**

   Those words are added in this class, which represented plants. For example, plant extracts (n=797), isolation and purification (n=467), medicinal plant (n=366), plants, medicinal (n=268), plant leaf (n=255), phytotherapy (n=247), plant leaves (n=182), phytochemistry (n=149), fruit (n=115), plant medicinal product (n=107), plant root (n=104) and plant extract (n=876).

3. **Drugs**

   Metabolism (n=615), drug effects (n=345), dose response (n=304), drug screening (n=302), dose-response relationship, drug (n=286), time factors (n=277), drug formulation (n=215), treatment outcome (n=211), solubility (n=197), drug efficacy (n=181), tablets (n=180), drug structure (n= 168), alcohol (n=164), tablet (n=161), drug stability (n=155), time factor (n=152), drug synthesis (n=149), drug determination (n=139), herbaceous agent (n=135), hypoglycemic agents (n=134), glucose (n=133), drug isolation (n=129), acetic acid ethyl ester (n=124), synthesis (n=124), chloroform (n=123), ic50 (n=123), biological marker (n=122), drug solubility (n=119), phenol derivative (n=117), oral drug administration (n=115), drug release (n=114), concentration response (n=109), drug mechanism (n=108), chemically induced (n=106), drug evaluation, preclinical (n=106), flavonoids (n=106), kinetics (n=103), hexane (n=102), blood glucose (n=101), ascorbic acid (n=100), drug compounding (n=96), pharmaceutics (n=95), particle size (n=94), chemical structure (n=92) and methanol (n=251).

4. **Pharmacological Potential**

   The plants or various drugs were tested to understand their;

   1. antimicrobial activity (n=114), microbiology (n=145), microbial sensitivity test (n=190), antibacterial activity (n=245), anti-bacterial agents (n=369), bacillus subtilis (n=99), bacteria (n=106), bacterial strain (n=110), escherichia coli (n=205), klebsiella pneumoniae (n=93), pseudomonas aeruginosa (=147) and staphylococcus aureus (n=203), antifungal activity (n=113) and antifungal agent (n=114).
   2. antiinfective agent (n=440) and anti-infective agents (n=106)
   3. oxidative stress (n=152), antioxidant (n=357), antioxidant activity (n=325), antioxidants (n=318) and DPPH radical scavenging assay (n=98)
   4. analgesic agent (n=94)

5. antidiabetic agent (n=136)
6. enzyme activity (n=114) and alanine aminotransferase (n=95)
7. antiinflammatory activity (n=117), antiinflammatory agent (n=113), anti-inflammatory agents (n=91) and
8. anti-inflammatory agents, non-steroidal (n=93).
9. antineoplastic agent (n=170)
10. genetics (n=169)
11. glucose blood level (n=136),
12. growth, development and aging (n=160)
13. Similarly, various instrumental techniques were applied to understand the biological potential and mechanism of actions in different physiology (n=178), pathophysiology (n=131), pathology (n=260) and histopathology (n=102). For example, Ultraviolet Spectrophotometry (n=99), Chromatography, High Pressure Liquid (n=197), Disk Diffusion (n=103), High Performance Liquid Chromatography (n=256), Infrared Spectroscopy (n=130) and Spectrophotometry, Ultraviolet (n=95).

For further detail description we analyzed all research titles (n=3301). Total 9288 technical words were noted. After a careful analysis, it was observed that the publications focused on various chemicals/drugs or plants. The effect of different doses was studied in different biological studies and experimental models. The major subjects studied were humans, rats, mice and rabbits etc... The authors explored and discussed various acute and chronic pathologies. The terms used are described below. The number of times of appearance of each word (total=9288) in represented in supplementary table 9.

Acute bacterial conjunctivitis, acute cerebral infarction, acute coronary artery syndrome, acute coronary syndrome, acute endotoxemia, acute enteritis, acute hepatic injury, acute hypotensive activity, acute ischemic stroke, acute kidney injury, acute leukemia, acute myocardial infarction, acute pancreatitis, acute pulmonary embolism, acute secretory otitis medium, acute spinal injury, acute swimming exercise, acute toxicity, acute vulvo vaginal candidiasis, adult asthmatic patient,
advanced breast cancer, advanced colorectal cancer patient, advanced glycation endproducts formation, advanced head, advanced hepatocellular carcinoma, advanced lung adenocarcinoma, advanced lung cancer, advanced maternal age,

allergic asthma, allergic rhinitis, alzheimer, ameliorating brittle fracture, ameliorating oxidative stress, anaesthesia management, anemia, anesthesia, angiogenesis,

anti, anti-acetylcholinesterase, anti-allergic effect, anti alzheimers agent, anti-angiogenesis, anti-arrhythmic drug, anti-arthritis, anti-avian influenza virus, anti-bacterial, anti bph capsule, anti-cancer

activity, anti-candida, anti-cholinesterase potential, anti-coagulant, anti-dermatitis, anti-diabetic, anti-estrogenic potential, anti-fatigue activity, anti-fungal, anti glycationand anti oxidation property, anti-hepatitis drug use effect, anti-hepatotoxic effect, anti-hiv, anti-hyperglycemic activity, anti-hypertensive drug, anti-infectious treatment, anti -inflammation, anti-leishmanial agent, anti-lipid peroxidation, anti-malarial drug, anti-metastatic potential, anti-microbial activity, anti-mutagenic activity, anti-mycobacterial activity, anti-myelosuppressant, anti-nociceptive agent, anti-osteoporosis drug, anti-oxidant, anti-parkinsonian agent, anti-proliferative, anti-pyretic activity, anti-stress, anti tb drug, anti-thyroid drug, anti-tubercular drug, anti-tumor potential, anti-tumorigenesis, anti-tyrosinase, anti-ulcer activity, anti-ultraviolet activity, anti-acetylcholine esterase potential, antiacid capacity, anti-aggressive activity, antiaging, antianxiety, anti-atherosclerotic effect, antibacterial, antibiofilm, anticancer, anticataleptic activity, anticholinergic drug atropine, anticholinesterase activity, anticoagulant, anticoccidial effect, anticonvulsant, antidepressant, anti-desm abunius l, antidiabetic activity, antidiarrheal potential, antidote, anti-dyslipidemic potential, antiemetic drug, anti-epcam antibody, antiepileptic drug valproic acid, antiepileptogenic activity, anti-erythmic effect, antifertility agent, antifouling coating, antifungal, antiglycation, antiglycation activity, antigrowth capacity, antihepatotoxic activity, anti-hyperglycaemic activity, anti-inflammatory, antileishmanial, antimalarial activity, antimicrobial activity, antineoplastic activity, anti-nephrolithiatic activity, antinociceptive activity, antioxidant, antiplatelet aggregation agent, antiproliferative activity, antiprotozoal activity, antipyretic activity, antipyretic potential, anti-quorum sensing, antiseptic drug, antispasmodic activity, antithrombotic drug use effect, antitubercular activity, antitumor, antitussive compound iasp n glc, anti-tyrosinase activity, antiulcer, anti-urease, anti-urolithiatic plant, antiviral activity, anxiolytic effect, apoptosis, atopic dermatitis, atrial fibrillation,

Autoimmune thyroid disorder, autologous blood transfusion drainage, autologous bone marrow stem cell, autophagy, autosomal recessive non syndromic hearing loss, Different bacterial strains, Bio-containing words or phrases, bipolar disorder, bipolar hemiarthroplasty replacement, blood problems, bone, brachial plexus block, brain, breast, bronchial asthma, bronchodilator, cancer, cardiac damage, cell apoptosis, central nerve cell damage, central nervous system, cerebrovascular disease, cervical cancer, cognitive behavior or pathologies, colon cancer, colorectal cancer, coronary artery disease, cytoprotective activity, dementia, dengue, depression, diabetes, dna damage, encephalitis, encephalopathy, endometriosis, endometrium regeneration, endophthalmitis, focal cerebral infarct volume, focal cerebral ischemia, fungal keratitis, fungal pathogen, gastric cancer, genetic, glioblastoma cell line, glioma, gonadotrophin, gouty arthritis, hcv, heart failure, hematological, hemorrhage, hemsleya sinesis, hepatic damage, hepatitis, hepatocellular carcinoma, hepatocytotoxicity, hepg2 cancer cell line, histology, hiv,

human, human acute promyelocytic leukemia cell, human artificial immune system, human bite, human bladder cancer, human blood, human body organ, human brain micro vascular endothelial cell, human breast adenocarcinoma cell line, human breast cancer cell line, human breast carcinoma cell line, human breast epithelial cell, human cancer cell line, human cell culture, human cheek skin sebum, human coronary artery endothelial cell, human dectin, human drug free plasma, human erythrocyte, human esophageal cancer cell line ec9706 proliferation, human amma globulin, human gastric cancer cell line, human glial cell line, human gm csfr, human guanidinoacetate n methyl transferase, human interferon, human liver, human lung adenocarcinoma tissue, human lung cancer xenograft, human lymphocyte, human male infertility, human neuroblastoma cell, human ovarian cancer cell, human pappilomavirus, human pathogenic microbe, human plasma, human platelet aggregation, human pulmonary artery smooth muscle cell proliferation, human serum, human skin, human sperm function, human sperm parameter, human sputum sample, human t cell, human triple negative breast cancer cell, human tumor cell line, human umbilical vein endothelial cell, human urinary kalllikrein, human urine, human urine sample, human whole blood,

Hyperlipidemia, hypersensitivity, hypertension, hyperuricemia, hypocholesterolemic, hypocholestrolic effect, hypoglycemic, hypogonadism, hypolipidemic, hypolocomotive effect, hypoxia, immune system, induced pathological models, infant pneumonia treatment, infantile eczema, infarct size, infection, inflammation, influenza, intervertebral drg rf puncture way, intervertebral foramen type, intestinal absorption, intestine ischemia reperfusion injury, intra articular & intravenous administration, intracerebral hemorrhage, intravenous analgesia, intravenous bolus injection, intravenous dexmedetomidine, intravenous infusion, intravenous iodinated contrast medium, ischemia reperfusion, ischemic heart disease, ischemic stroke, leishmania, leukemia cell, lumbar disc herniation, lumbar disc protrusion, lung, metabolic disorder, metastasis, meteorological cardiovascular disease, microbial, mitochondrial dysfunction, molecular analysis, multiple myeloma, multiple myeloma monoclonal antibody, multiple organ toxicity, multiple sclerosis, mutagenic breeding, mutagenic effect, myocardial dysfunction, myocardial fibrosis, myocardial infarction, myopathy, nasal carriage, nausea, neoadjuvant chemoradiotherapy, neonatal diarrhea, neonatal hypoxia ischemia, neonatal infection, neonatal jaundice, neonatal mortality, nephro damages, neuro modesl or pathologies, new anti-tubercular agent, obesity, obsessive compulsive disorder, obstetric, orthodontic treatment, orthopaedic footwear, orthopaedic surgery, osteoarthris patient, osteoarthritis, osteoporosis, osteosarcoma cell, ototoxicity, ovaries, pancreas, pediatric problems, pediatric diarrhea, pneumonia, prostate cancer, pulmonary issues, radiochemical & clinical evaluation, radiolabeling, radiotherapy, renal pathologies, respiratory problems, rheumatoid arthritis, sciatic nerve injury, seizure, sepsis, serotonergic activity, skin, small cell neuroendocrine carcinoma, spinal cord injury, trauma, tumor, vascular dementia or problems and wound.

3.5 Section-Five: Overall ranking and conclusion

In table 5, the per year number of publications, citations, CPD, citations (for 4-years), number of documents (for 4-years), ranking, total journals in pharmaceutical category, and % ranking is described. The highest citescore was noted for the year 2012 (2.4), followed by 2011 (2.1) and 2013 (1.9). This indicates a significant growth. However significant measures are needed to maintain or improve the overall ranking and citation metrics.

Conflict of Interest:

The authors declare no conflict of interest.

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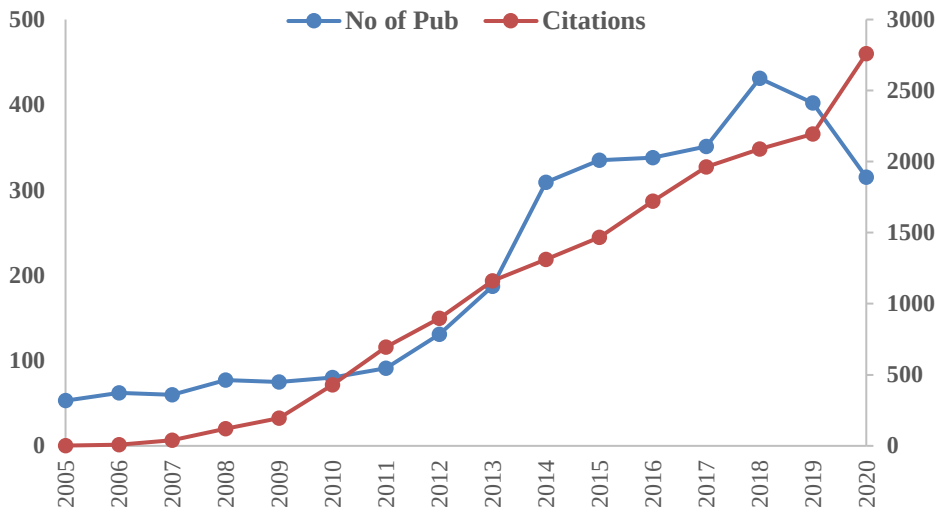

Figure 1: The per year publications and citations details.

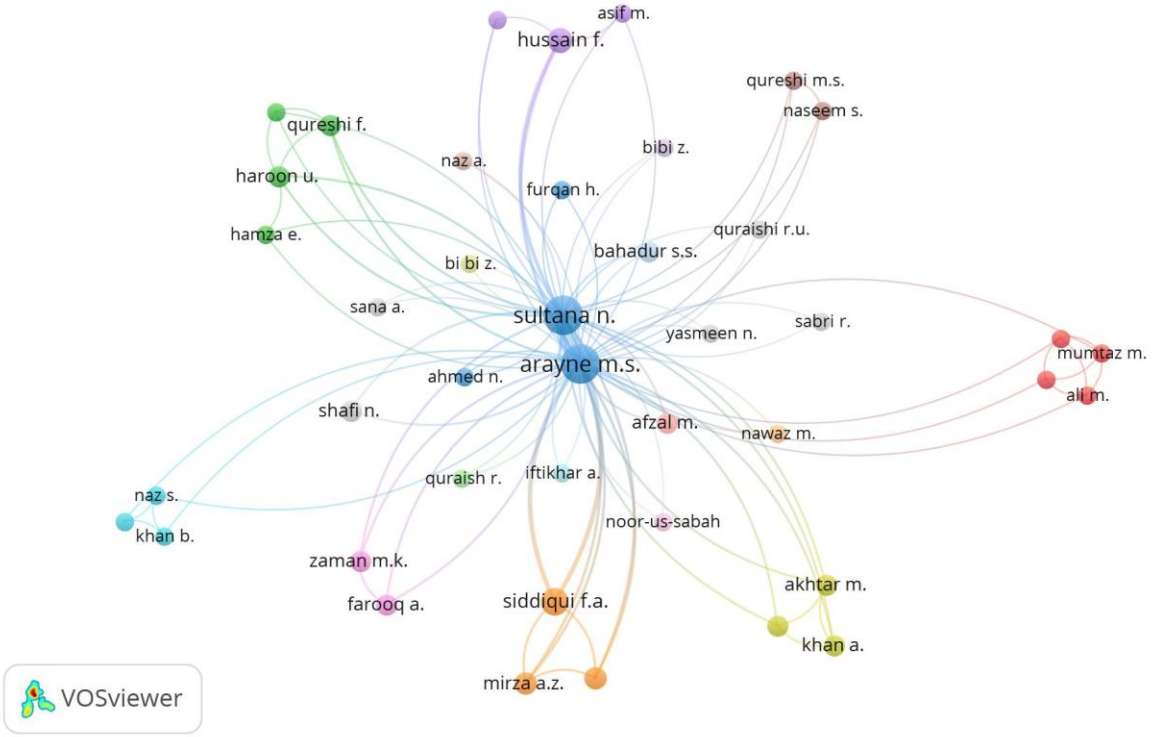

Figure 2: The co-authorship network for authors

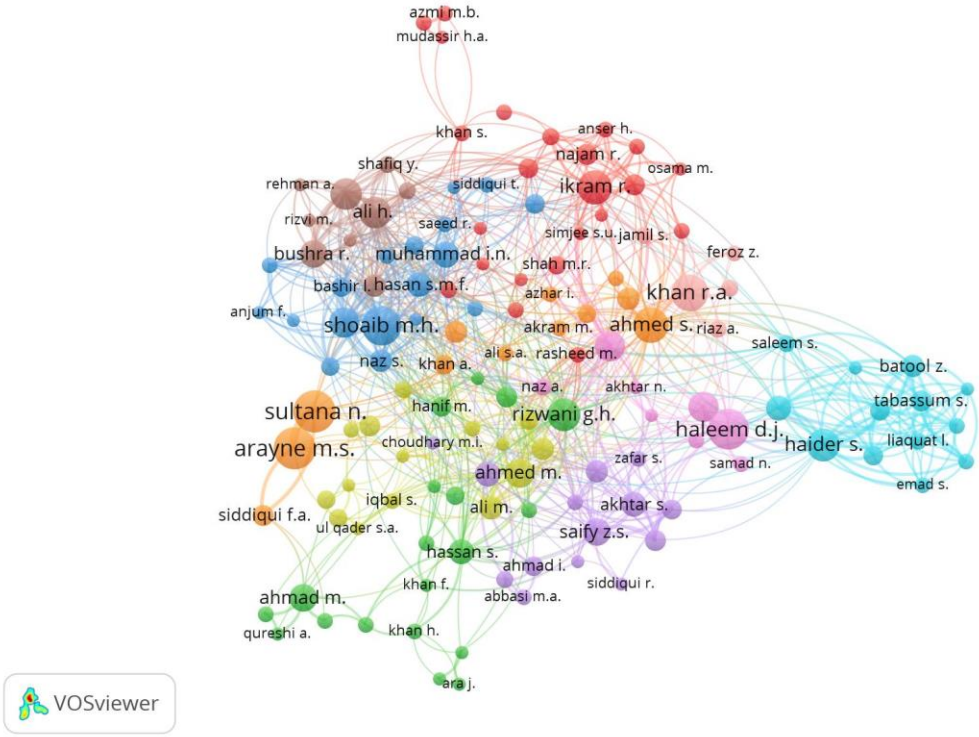

Figure 3: The co-authorship network for authors in different departments or institutes

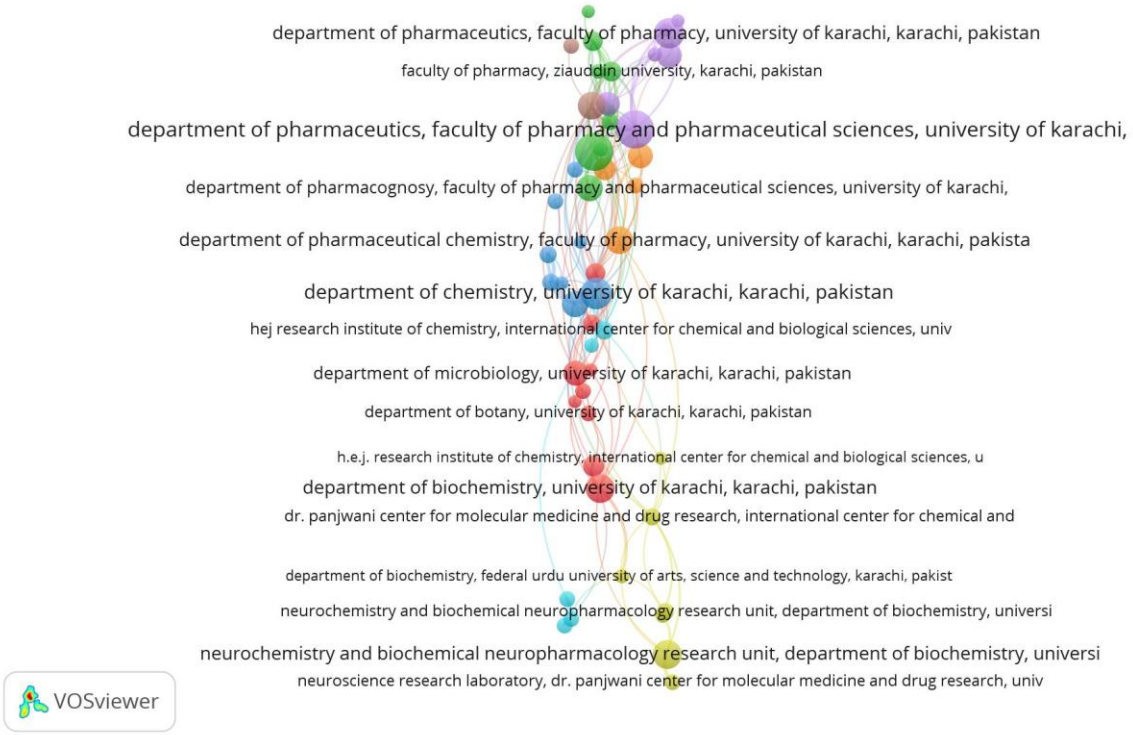

Figure 4: The institutional co-authorship network.

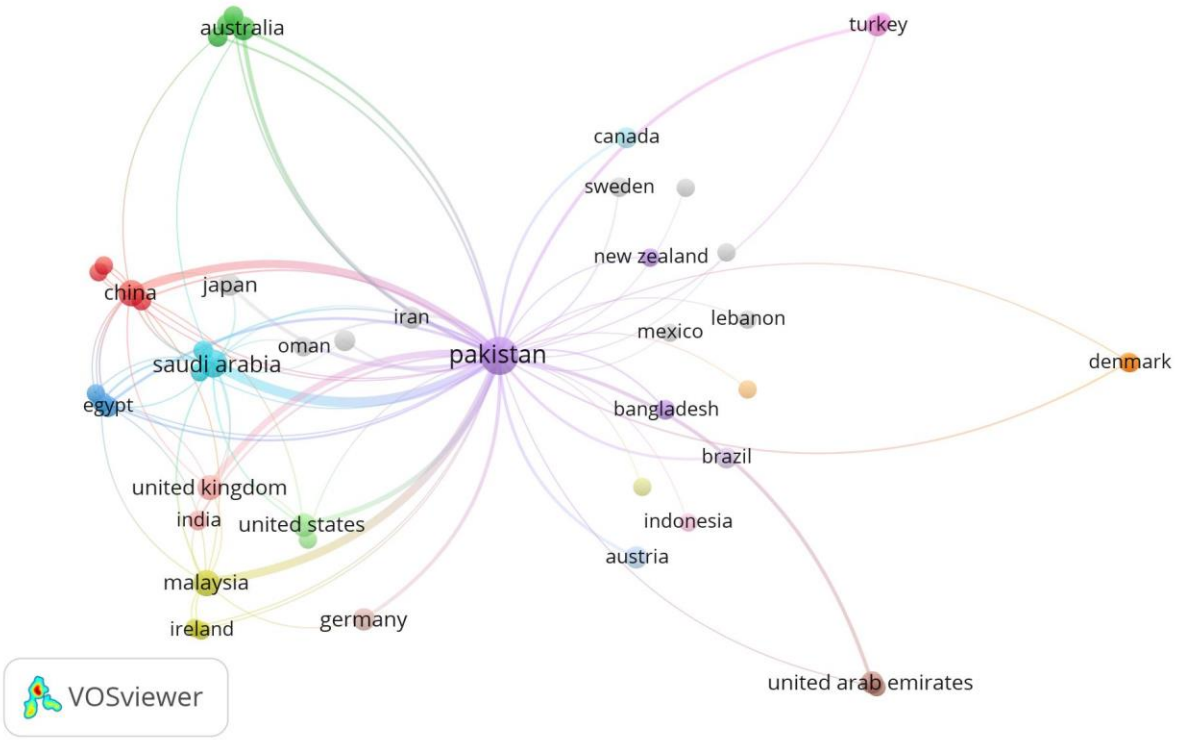

Figure 5: The countries co-authorship network.

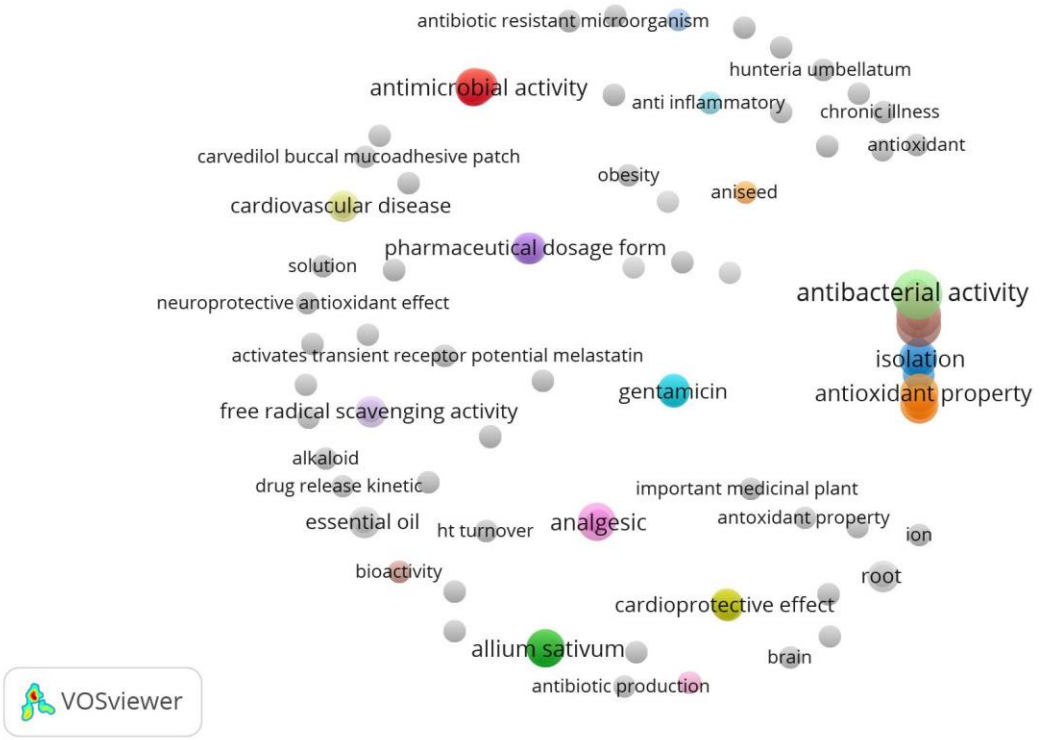

Figure 6: Interconnectivity between different keywords.

Table 1: **The publication clubs (PC) for authors, institutes and countries. NoA=Number of authors, NoI=Number of institutes and NoC=Number of Countries**

Table 2: **The citations clubs (CC) for authors, institutes and countries. NoA=Number of authors, NoI=Number of institutes and NoC=Number of Countries**

Table 3: **The list of top authors, university and country for each year. Ranking is based on the total number of publications**

Table 4: **The citation breakup or clubs for all publications (n=3301).**

Table 5: **The number of publications, citations, CPD, citations (for 4-years), number of documents (for 4-years), ranking, total journals in pharmaceutical category, and % ranking. Data is for the years 2011 to 2020.**

PC	NoA	PC	NoI	PC	NoC
55-60	1	40-45	3	1600-1620	1
40-50	10	20-29	14	800-820	1
30-40	17	15-19	12	100-199	4
20-29	32	11 to 14	16	50-99	4
11 to 19	104	5 to 10	102	30-39	6
10	29	2 to 4	659	10 to 19	10
9	39	1	5212	5 to 8	14
8	52	**Total**	**6018**	4	2
7	73			3	8
6	86			2	7
5	155			1	15
4	231			**Total**	**72**
3	443				
2	1052				
1	5742				
Total	**8066**				

Table 1: The publication clubs (PC) for authors, institutes and countries. NoA=Number of authors, NoI=Number of institutes and NoC=Number of Countries

CC	NoA	CC	NoI	CC	NOC
500-599	3	500-550	1	7500-8000	1
400-450	1	400-420	1	2000-2200	1
300-399	5	300-360	2	1800-1850	1
200-299	20	200-250	5	1500-1510	1
100-199	53	100-199	18	900-910	1
51-99	171	51-99	50	800-899	1
30-50	352	20 to 50	388	600-699	2
11 to 29	1266	11 to 19	474	500-510	1
5 to 10	1630	5 to 10	1078	400-499	1
1 to 4	2891	1 to 4	2370	200-299	4
0	1674	0	1631	100-199	9
Total	**8066**	**Total**	**6018**	51-99	6
				20-49	15
				11 to 15	4
				1 to 9	21
				0	3
				Total	**72**

Table 2: The citations clubs (CC) for authors, institutes and countries. NoA=Number of authors, NoI=Number of institutes and NoC=Number of Countries

Year	Top Authors	NoP	Top University	NoP	Top Country	NoP
1995	23 Authors have	1	University of Karachi	5	Pakistan	7
2005	Arayne, M.S.	12	University of Karachi	25	Pakistan	39
2006	Arayne, M.S. and Sultana, N.	16	University of Karachi	22	Pakistan	30
2007	Arayne, M.S. and Sultana, N.	16	University of Karachi	26	Pakistan	35
2008	Haleem, D.J.	5	University of Karachi	11	Pakistan	23
2009	Abo-Salem, O.M. and Anandan, R.	3	University of Karachi	13	Pakistan	19
2010	Sualeh, M.	4	University of Karachi	11	Pakistan	19
2011	Khan, R.A.	4	University of Karachi	17	Pakistan	46
2012	Jan, S.U. and Khan, H.	7	University of Karachi	26	Pakistan	76
2013	Jan, S.U.	5	University of Karachi	36	Pakistan	101
2014	Rizwani, G.H.	7	University of Karachi	47	Pakistan	136
2015	Ali, M. and Usmanghani, K.	6	University of Karachi	34	Pakistan	121
2016	Usmanghani, K.	15	University of Karachi	33	Pakistan	157
2017	Haider, S.	10	University of Karachi	56	Pakistan	180
2018	Ali, H., Bushra, R. and Zafar, F.	11	University of Karachi	73	Pakistan	222
2019	Ikram, R.	14	University of Karachi	82	Pakistan	235
2020	Ikram, R.	10	University of Karachi	53	Pakistan	169

Table 3: The list of top authors, university and country for each year. Ranking is based on the total number of publications (NoP).

CC	No of Docs
300-350	1
200-260	2
100-199	3
50-99	17
40-49	20
30-39	35
20-29	128
11 to 19	257
10	62
9	59
8	99
7	99
6	113
5	162
4	184
3	250
2	365
1	535
0	910
Total	**3301**

Table 4: The citation breakup or clubs for all publications (n=3301).

Year	NoD	Citations	CPD	Citations (4-years)	Docs (4-Years)	CiteScore	Ranking	Total Journals	% Ranking (Rounded off)
2011	90	695	7.7	682	321	2.1	54	169	32
2012	131	898	6.9	918	376	2.4	52	178	29
2013	187	1162	6.2	928	428	1.9	74	179	41
2014	308	1312	4.3	918	716	1.3	87	179	49
2015	335	1468	4.4	1179	961	1.2	91	181	50
2016	338	1722	5.1	1415	1084	1.3	93	168	55
2017	351	1962	5.6	1838	1207	1.5	93	178	52
2018	431	2089	4.8	1728	1455	1.2	95	163	58
2019	401	2194	5.5	1489	1522	1	100	169	59

Table 5: The number of publications, citations, CPD, citations (for 4-years), number of documents (for 4-years), ranking, total journals in pharmaceutical category, and % ranking. Data is for the years 2011 to 2020.