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Bibliometric Analysis of Publications of University Institute of Pharmaceutical Sciences (UIPS), Panjab University, Chandigarh

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ABSTRACT

Panjab University in pharmacy discipline ranked 2nd in NIRF-2019 rankings. The University Institute of Pharmaceutical Sciences (UIPS) of Panjab University Chandigarh is a premier institute of pharmaceutical education and research in India. The present study attempts to analyze research output and publication trends of authors of the UIPS during 2009-2018. The study is based on the data extracted from Scopus database and mainly examines the year-wise research output, major subject-wise contributions, national and international collaborations, most preferred journals, types of publications, authorship pattern, highly cited paper, most prolific authors, keywords and citations pattern of the UIPS during the period of ten years. The study revealed that total 978 research publications have been published by the authors of the UIPS which received 15318 citations during the above said period. The highest collaborative publications (5.32%) were published with United States of America. O.P. Katare is the most prolific author publishing 145 research publications having 2057 citations. Total 88.65% research papers of the institute have been cited by other authors and 14 papers received more than 100 citations.

Keywords: Bibliometrics, Research Output, Panjab University, Pharmaceutical Sciences

1. INTRODUCTION

Panjab University Chandigarh has a “long tradition of pursuing excellence in teaching and research in science and technology, humanities, social sciences, performing arts and sports. The University supports excellence and innovation in academic programmes, promotes excellence in research, scholarship and teaching.”[1] The University has been recognized by the UGC as the "University with Potential for Excellence in Biomedical Sciences" with facilities for Stem Cell Research and Drug Development. (https://puchd.ac.in/)

1.1 University Institute of Pharmaceutical Sciences

Panjab University in pharmacy discipline ranked 2nd in 2019 in National Institutional Ranking Framework[2] (NIRF), Ministry of Human Resource Development, Government of India (https://www.nirfindia.org/2019/PharmacyRanking.html) and it is the University Institute of Pharmaceutical Sciences (UIPS) that deals with the pharmacy discipline in Panjab University Chandigarh. It is a premier institute of pharmaceutical education and research in India. The UIPS "has covered a long and glorious journey of 76 years starting from Lahore in 1944 and finally settling to the present campus in Chandigarh."[3] The elevation of the status from department to the level of an institute i.e. University Institute of Pharmaceutical Sciences (UIPS) took place in 1994. (https://pharma.puchd.ac.in/)

2. OBJECTIVES

The main objective of the present study is to analyze the research output and publication trends of authors of the UIPS. The specific objectives are as below:

- To study the growth of research publications of the UIPS.
- To analyze the major subject categories of the UIPS research publications.
- To examine the research collaborations of the UIPS at national and international level.
- To identify the authorship pattern and the most prolific authors of the UIPS research publications.
- To identify the most preferred journals for research publications of the UIPS.
- To analyze the citations received by research publications of the UIPS.
- To identify the type of research publications of the UIPS.
- To find out the highly cited research publications of the UIPS.

3. METHODOLOGY

This study was conducted to examine research output and publication behavior of the UIPS which is one of the best institutes in pharmaceutical research and teaching in India. The data for the present study is retrieved from Scopus[4] database, which is the largest abstracting and citation database of peer-reviewed scientific literature (https://www.scopus.com). The search started with

'affiliation' as 'University Institute of Pharmaceutical Sciences' and then it was limited to years 2009 to 2018. The final search string used is given below:

AFFILORG ("University Institute of Pharmaceutical Sciences" 60018483) AND PUBYEAR > 2008 AND PUBYEAR < 2019.

A total of 978 research publications were extracted from Scopus database using the above search string. The extracted data was entered in excel sheet for further examination.

4. REVIEW OF LITERATURE

A number of bibliometric and scientometric studies have been conducted to access the research output and publication behavior of research institutions and universities. Kumar (2019)[5] studied research output of Guru Jambheshwar University of Science and Technology for the time period from 1999-2018. Siwach and Parmar[6] (2018) conducted bibliometric study of CCS Haryana Agricultural University (CCSHAU) for the period of from 2001-15. Thakur and Siwach[7] (2018) examined zoology research in Haryana during 2006-2015 based on Indian Citation Index. Pradhan and Ramesh[8] (2017) conducted a scientometric study of IIT Madras and IIT Bombay during 2006-2015.

Khanna et al[9] (2017) investigated research output of Physics and Astronomy of Guru Nanak Dev University during 2006-2015. Singh[10] (2016) conducted bibliometrics study to access the research output of chemistry of Panjab University during 2008-2015. Siwach and Kumar[11] (2015) conducted bibliometrics studies to assess the research output of Maharshi Dayanand University, Rohtak during 2000-2013. Bansal et at[12] (2015) examined research output of mathematics of Panjab Univeristy during 2005-2014. Vashishtha[13] (2011) investigated the contribution and impact of research output of PEC University of Technology during 1996-2009.

5. DATA ANALYSIS

5.1 Year wise publications

Table 1 shows the year wise growth of research publications of the UIPS along with Panjab University Chandigarh for the period of ten year from 2009 to 2018. During the above said period, the authors of the UIPS published total 978 research publications which received 15318 citations. On the other hand, the University in total, i.e., Panjab University Chandigarh published total 8958 research publications which received total 139829 citations during the same period of 10 years.

Publication share and citation share of the UIPS are 10.92% and 10.95% respectively in the total University research output.

Cumulative research publication growth of the UIPS is also assessed for two equal intervals of 5 years i.e. 2009-13 and 2014-2018 as shown in the above said table 1. It is found that a total 477 research publications published in first five year interval 2009-2013 with an ACCP of 22.21. During the second interval from 2014-18 a total 501 research publications were published with an ACCP of 9.43. The publications also witnessed 5.03% growth rate during these intervals.

It was also revealed that the average publication per year of the UIPS is 97.8. Maximum research publications were 126 published by the institute in 2016 followed by 121 in 2017 and 107 in 2011 and minimum 76 research publications published in the year 2014. Highest ACPP calculated for the year 2009 is 30.74 followed by 24.80 (2011) and 21.87 (2010) and lowest ACPP is 1.78 (2018).

Table 1: Year wise publication of UIPS

Publication Year	Panjab University Overall Output		University Institute of Pharmacy Science Output				
	TP	TC	TP	TC	ACPP	PS	CS
2009	525	13148	88	2705	30.74	16.76	20.57
2010	591	16812	101	2209	21.87	17.09	13.14
2011	754	18204	107	2654	24.80	14.19	14.58
2012	772	23588	87	1410	16.21	11.27	5.98
2013	854	18223	94	1617	17.20	11.01	8.87
2014	976	15995	76	1115	14.67	7.79	6.97
2015	932	13161	79	1503	19.03	8.48	11.42
2016	1203	10560	126	1280	10.16	10.47	12.12
2017	1091	6848	121	649	5.36	11.09	9.48
2018	1260	3290	99	176	1.78	7.86	5.35
2009-13	3496	89975	477	10595	22.21	13.64	11.78
2014-18	5462	49854	501	4723	9.43	9.17	9.47
2009-18	8958	139829	978	15318	15.66	10.92	10.95

TP=Total Publications, TC=Total Citation, ACPP=Average Citation per Paper, PS=Publication Share, CS=Citation Share

5.2 Subject Wise Contribution

The 10 major subjects of the UIPS publications are shown in table 2. 'Pharmacology, Toxicology and Pharmaceutics', a major subject of the institute that stood first with maximum 664 research publications which received 10431 citations. 'Biochemistry, Genetics and Molecular Biology' subject category is at the second position with 256 research publications and 4757 citations. Third in this category is 'Chemistry' under which is published 224 research publications and received 3194 citations. 'Medicine' stood fourth with 211 research publications and received 3093 citations. The highest ACPP is for 'Neuroscience' (26.62) followed by 'Physics and Astronomy' (20.38) and 'Chemical Engineering' (18.60). The table also reveals the highest h-index, 47 for the subject 'Pharmacology, Toxicology and Pharmaceutics' followed by 37 for 'Biochemistry, Genetics and Molecular Biology'.

Table 2: Subject Distribution of Publications

S. No.	Subject Category	TP	TC	ACPP	h-index
1	Pharmacology, Toxicology and Pharmaceutics	664	10431	15.71	47
2	Biochemistry, Genetics and Molecular Biology	256	4757	18.58	37
3	Chemistry	224	3194	14.26	27
4	Medicine	211	3093	14.66	29
5	Neuroscience	80	2130	26.62	28
6	Chemical Engineering	65	1209	18.60	19
7	Agricultural and Biological Sciences	63	1068	16.95	18
8	Physics and Astronomy	49	999	20.38	16
9	Materials Science	48	777	16.19	15
10	Engineering	43	440	10.23	11
TP=Total Publication, TC=Total Citation, ACPP=Average Citation per Paper					

5.3 National and International Collaborations

The UIPS is actively collaborating with different prestigious institutions in India as well as in abroad. At national level, top 10 collaborating institutions with which authors of the institute has published research publications during 2009-2018 are listed in table 3. It is revealed that the institute has published maximum 43 research publications with Central University of Rajasthan

having ACPP of 11.51. This is followed by I.S.F. College of Pharmacy, Punjab with 36 research publications with ACPP of 17.75, and Postgraduate Institute of Medical Education and Research Chandigarh with 34 research publications respectively. Next institutions are Punjabi University Patiala and National Institute of Pharmaceutical Education and Research, Mohali with which 21 research publications each published in collaboration with the UIPS.

The table also reveals the highest h-index 13 of Central University of Rajasthan and I.S.F. College of Pharmacy each. Next in the line are National Institute of Pharmaceutical Education and Research, Mohali (11), Postgraduate Institute of Medical Education and Research and Dr. H.S Gaur Vishwavidyalaya Sagar (9 each).

Table 3: Top Ten National Collaborating Institutions

S. No.	Affiliation	State	TP	TC	ACPP	h-index
1	Central University of Rajasthan	Rajasthan	43	495	11.51	13
2	I.S.F. College of Pharmacy	Punjab	36	639	17.75	13
3	Postgraduate Institute of Medical Education and Research	Chandigarh	34	257	7.56	9
4	Punjabi University Patiala	Punjab	21	131	6.24	6
5	National Institute of Pharmaceutical Education and Research, Mohali	Punjab	21	277	13.19	11
6	Punjab Technical University	Punjab	15	151	10.07	8
7	Guru Nanak Dev University	Punjab	14	102	7.29	6
8	Institute of Nano Science and Technology, Mohali	Punjab	14	136	9.71	7
9	Maharshi Dayanand University	Haryana	13	252	19.38	6
10	Dr. H.S Gaur Vishwavidyalaya Sagar	Madhya Pradesh	13	333	25.62	9
TP=Total Publications, TC=Total Citation, ACPP=Average Citation per Paper						

The international level collaboration of the UIPS during 2009-2018 are indicated in table 4. The institute published maximum 52 research publications in collaboration with United States which received total 1271 citations and have h-index of 20. The next collaborating countries are Germany with which the institute has published total 18 collaborating research publications, United Kingdom (17 papers), Australia (13 papers) and Malaysia (10 papers).

Table 4: Top Ten Collaborating Country

S. No.	Country	TP	TC	ACPP	h-index
1	United States	52	1271	24.44	20
2	Germany	18	267	14.83	7
3	United Kingdom	17	227	13.35	6
4	Australia	13	161	12.38	7
5	Malaysia	10	148	14.80	5
6	Saudi Arabia	6	69	11.50	3
7	Trinidad and Tobago	6	29	4.83	4
8	Canada	5	231	46.20	4
9	China	5	233	46.60	5
10	France	5	29	5.80	2
TP=Total Publication, TC=Total Citation, ACPP=Average Citation per Paper					

5.4 Top Journals Preferred for Publication

The authors of the UIPS have chosen over 160 sources at national and international level for publishing a total 978 research publications during 2009-2018. The top ten journals are listed in table 5. The most preferred journal is "Medicinal Chemistry Research" in which 32 research publications have been published. The next most preferred journal by the authors of the UIPS is "AAPS Pharmscitech" where 27 research publications appeared. Next in the line are "International Journal of Pharmaceutics" (24 papers) and "European Journal of Medicinal Chemistry" (18 papers), both are published by Elsevier/Netherlands. The highest 38.57 Average Citation per Paper (ACPP) is calculated for the research publications published in the journal titled "Colloids and Surfaces B Biointerfaces". This is followed by "Pharmacological Reports" (ACPP 37.13), "European Journal of Pharmacology" (ACPP 28.38), "International Journal of Pharmaceutics" (ACPP 25.54) and "European Journal of Medicinal Chemistry" (ACPP 25.06).

SNIP, SJR, Impact Factor (JCR-2018) and h-index of the UIPS publications are also shown in table 5. The highest IF among these top ten journals is that of "European Journal of Medicinal Chemistry" (IF= 4.816), followed by "Colloids and Surfaces B Biointerfaces" (IF= 3.997) and "International Journal of Pharmaceutics" (IF= 3.862). These three journals also have the top SJR value among the journals listed in the table. Among these top ten journals, five are published by

Elsevier; two are published in Springer Nature and one each by Scientific Publishers, Begell House and American Association of Pharmaceutical Scientists.

Table 5: Top Ten Journals for Publication

S. No.	Source Title	Publisher /Country	TP	TC	ACPP	SNIP	SJR	IF (JCR 2018)	h-index (UIPS Pub.)
1	Medicinal Chemistry Research	Springer Nature/United Kingdom	32	405	12.66	0.83	0.35	1.607	9
2	AAPS Pharmscitech	American Association of Pharmaceutical Scientists/USA	27	287	10.63	1.26	0.80	2.666	10
3	International Journal of Pharmaceutics	Elsevier/Netherlands	24	613	25.54	1.62	1.38	3.862	15
4	European Journal of Medicinal Chemistry	Elsevier/Netherlands	18	451	25.06	1.88	1.21	4.816	13
5	Inflammopharmacology	Springer Nature/United Kingdom	17	154	9.06	0.88	0.79	3.304	7
6	European Journal of Pharmacology	Elsevier/Netherlands	16	454	28.38	1.09	1.07	3.04	12
7	Pharmacological Reports	Elsevier/Netherlands	16	594	37.13	0.95	0.76	2.787	10
8	Indian Journal of Experimental Biology	Scientific Publishers/India	15	175	11.67	0.87	0.45	1.475	9
9	Colloids and Surfaces B Biointerfaces	Elsevier/Netherlands	14	540	38.57	1.59	1.25	3.997	11
10	Critical Reviews in Therapeutic Drug Carrier Systems	Begell House/United States	12	249	20.75	0.84	0.92	2.414	7

TP=Total Publications, TC=Total Citation, ACPP=Average Citation per Paper, SNIP=Source Normalized Impact per Paper, SJR=SCImago Journal Rank, IF-Impact Factor

5.5 Most Prolific Authors

The 10 most prolific authors of the UIPS are shown in the table 6. O.P. Katare secured first position in the list by publishing highest (145) research publications which received 2147 citations. B. Singh is the second most productive author who published 142 research publications receiving 2069 citations. At third position is A. Kumar who published 133 research publications which received 3240 citations and fourth is K. Chopra with 99 research publications receiving 2145

citations. The average productivity per author of the 10 most prolific authors is 87.60 and the above mentioned four authors have published research publication more than the average productivity. Next in the line are G. Sharma (68), R. Chadha (63), I.P. Kaur (61), A. Kuhad (53) etc.

The highest 24.36 ACPP is registered by A. Kumar followed by A. Kuhad with ACPP 22.53. Next the list are I.P. Kaur (22.36), K. Chopra (21.67), B. Singh (14.57) etc. The h-index for the most 10 prolific authors of the UIPS is also shown in table 6. It was found that the highest 27 h-index for research publications published by K. Chopra which is followed by A. Kumar (26), O.P. Katare and B. Singh with 24 each. Next in the list are I.P. Kaur (22), A. Kuhad (19). G. Sharma and R. Chadha have same h-index for their research publication i.e. 16 each.

Table 6: Most Prolific Authors

S. No.	Author	TP	TC	ACPP	h-index
1	O.P. Katare	145	2157	14.88	24
2	B. Singh	142	2069	14.57	24
3	K. Chopra	99	2145	21.67	27
4	A. Kumar	133	3240	24.36	26
5	G. Sharma	68	799	11.75	16
6	R. Chadha	63	789	12.52	16
7	I.P. Kaur	61	1364	22.36	22
8	A. Kuhad	53	1194	22.53	19
9	M. Kumar	49	539	11.00	11
10	S. Beg	47	515	10.96	15
TP=Total Publicaton, TC=Total Citation, ACPP=Average Citation per Paper					

5.6 Type of Publications

The authors of the UIPS have contributed to various types of research publications during 2009-18 as listed in table 7. From the total 978 research publications 819 (83.74%) are Articles which received 12131 citation, 115 (11.76%) are Reviews, 25 (2.56%) are Book Chapters, 7(0.72%) are Conference Papers, 3 (0.31%) each are Editorials, Letters and Short Survey.

Table 7: Publication Types

S. No.	Document Type	TP	TC	ACPP
1	Article	819	12131	14.81
2	Review	115	3005	26.13
3	Book Chapter	25	31	1.24
4	Conference Paper	7	68	9.71
5	Editorial	3	0	0.00
6	Letter	3	1	0.33
7	Short Survey	3	34	11.33
8	Erratum	1	0	0.00
9	Article in Press	1	0	0.00
10	Retracted	1	59	59.00
	Total	**978**	**15329**	**15.67**
TP=Total Publications, TC=Total Citation, ACPP=Average Citation per Paper				

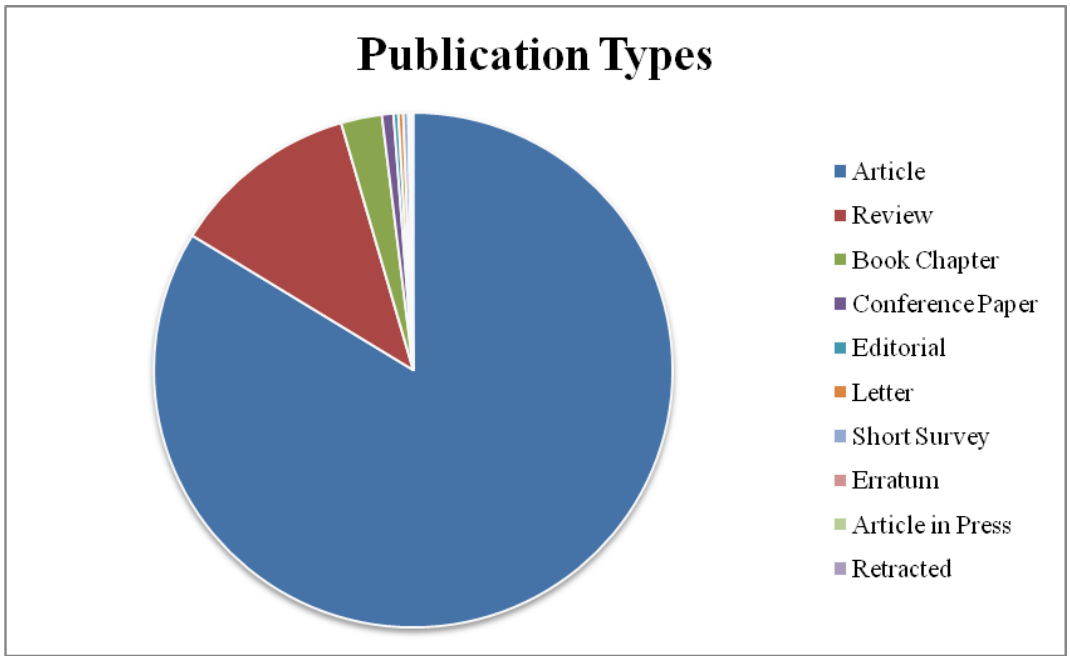

Figure 1: Publication Types

5.7 Authorship Pattern

The authorship pattern for publication of the UIPS during period 2009-2018 is shown year wise in the table 8. It is noticed in the table that the highest 240 research publications which accounts for one-fourth of the total publications are having three authors. Nearly another one-fourth

of the publications (23.62%) have more than 5 authors while 18% of research publications are two authored and 17.38% research publications are four authored. Single author research publications accounts for only 1.12% of the total publications and rest 967 (98.88%) research publications have more than two authors. Thus, it is indicated that collaborative research is a prevalent trend in the UIPS.

Table 8: Authorship Pattern

Year	One Author	Two Authors	Three Authors	Four Authors	Five Authors	> Five Authors	Total
2009	1	25	30	20	6	6	88
2010	2	15	27	29	11	17	101
2011	0	21	38	15	21	12	107
2012	2	16	23	19	16	11	87
2013	2	25	26	18	11	12	94
2014	1	21	16	13	11	14	76
2015	0	15	13	12	18	21	79
2016	0	15	21	18	23	49	126
2017	2	12	26	15	14	52	121
2018	1	11	20	11	19	37	99
Total	**11**	**176**	**240**	**170**	**150**	**231**	**978**
%	1.12	18.00	24.54	17.38	15.34	23.62	100.00

Figure 2: Author Keywords

5.8 Author Keywords

The author keywords were analysed and Tagxedo[14] (www.tagxedo.com) was used for creating cloud cluster of the author keywords and it is shown in figure 2. It is observed that total 4738 keywords are given by the authors of the UIPS for 978 Research publications from 2009-2018. The average keywords per research publication stand almost 5 for total 978 publications. The highlighted prominent keywords are oxidative, stress, nanoparticles, bioavailability, antioxidant, docking, lipid, acid drug, docking, alzheimer etc.

5.9 Citation Profile

The citation profile of research publications of the UIPS during 2009-2018 is exhibited in table 9. It is observed that 11.35% of the research publications of institute shown in table didn't received any citation and rest 88.65% research publications received citations. It is also noticed that 14 research publications (1.43%) received more than 100 citations followed by 43 research publications (4.40%) receiving 51-100 citations, 26 research publications (2.66%) receiving 41-50 citations and 50 research publications (5.11%) receiving 31-40 citations. Next in the sequence are 103 research publications (10.53%) receiving 21-30 citations and 172 research publications (17.56%) receiving 11-20 citations. The maximum 459 research publications i.e. 46.93% of the total publications of the UIPS received 1-10 citations.

Table 9: Citation Profile of Publications

No. of citations	TP	% of TP	Citations	% of Citations
0-0	111	11.35	0	0
1-10	459	46.93	2152	14.05
11-20	172	17.59	2576	16.82
21-30	103	10.53	2595	16.94
31-40	50	5.11	1777	11.60
41-50	26	2.66	1200	7.83
51-100	43	4.40	2956	19.30
>100	14	1.43	2062	13.46
Total	**978**	**100.00**	**15318**	**100.00**

Table 10: Highly Cited Ten Papers

S. No	Authors	Title	Year	Source title	Publisher	Citation
1	A. Kumar, A. Singh and Ekavali	A review on Alzheimer's disease pathophysiology and its management: An update	2015	Pharmacological Reports	Elsevier	356
2	S.K. Kulkarni and A. Dhir	Berberine: A plant alkaloid with therapeutic potential for central nervous system disorders	2010	Phytotherapy Research	John Wiley and Sons Ltd	178
3	V. Kakkar et al	Exploring solid lipid nanoparticles to enhance the oral bioavailability of curcumin	2011	Molecular Nutrition and Food Research	John Wiley and Sons Ltd	165
4	A.M. Reilly et al	Report on the sixth blind test of organic crystal structure prediction methods	2016	Acta Crystallographica Section B	International Union of Crystallography	154
5	M.K. Bhutani, M. Bishnoi and S.K. Kulkarni	Anti-depressant like effect of curcumin and its combination with piperine in unpredictable chronic stress-induced behavioral, biochemical and neurochemical changes	2009	Pharmacology Biochemistry and Behavior	Elsevier Inc.	145
6	K.S. Bora and A. Sharma	The genus Artemisia: A comprehensive review	2011	Pharmaceutical Biology	Taylor and Francis Ltd	138
7	S. Aggarwal et al	An overview on 5α-reductase inhibitors	2010	Steroids	Elsevier Inc.	138
8	B. Singh et al	Self-emulsifying drug delivery systems (SEDDS): Formulation development, characterization, and applications	2009	Critical Reviews in Therapeutic Drug Carrier Systems	Begell House Inc.	128
9	A. Kuhadand and K. Chopra	Attenuation of diabetic nephropathy by tocotrienol: Involvement of NFkB signaling pathway	2009	Life Sciences	Elsevier Inc.	128
10	A. Kuhad et al	Suppression of NF-κβ signaling pathway by tocotrienol can prevent diabetes associated cognitive deficits	2009	Pharmacology Biochemistry and Behavior	Elsevier Inc.	110
Total citations received by ten highly cited papers						**1640**

5.10 Highly Cited Papers

The top ten highly cited research publications of the UIPS have been listed in table 10. These research publications appeared in nine journals. It is found that the above top ten research publications received total 1640 citations with an average of 164 citations per research publication. Only three research publications received more citations than the average citations. Highest 356 citations were received by research publication titled “A review on Alzheimer's disease pathophysiology and its management: An update” by A. Kumar, A. Singh and Ekavali which was published in “Pharmacological Reports” by Elsevier in 2015. This is followed by 178 citations

received by research publication titled, '"Berberine: A plant alkaloid with therapeutic potential for central nervous system disorders" by S.K. Kulkarni and A. Dhir appearing in the "Phytotherapy Research" published by John Wiley and Sons Ltd in 2010. All the top ten cited papers were multi-authored publications.

6. SUMMARY AND CONCLUSION

The present study examined the publications of the UIPS for the period from 2009 to 2018. In this period of 10 years, the authors of the UIPS published total 978 research publications which received total 15318 citations with an average citation per paper of 15.66. Publication share and citation share of the institute are 10.92% and 10.95% respectively among its parent University, i.e. Panjab University Chandigarh. The maximum research publications (68%) fall under the Scopus Subject Category 'Pharmacology, Toxicology and Pharmaceutics'. The UIPS has collaborated with many institutions at national and international level. At national level, the institute has published maximum research publication (43) in collaboration with Central University of Rajasthan and at international level the highest collaborated publications (5.32%) are with United Stated of America. It was also found that approximately 20% of the total research publications appeared in the ten journals and maximum research work of the institute is published in the journal named "Medicinal Chemistry Research". Among the various types of publications, articles constitute 83.74% of the total publications. O.P. Katare is the most prolific author with highest 145 research publications receiving 2057 citations. Analysis of authorship pattern indicated collaborative research as 98.88% publications had two or more authors and almost one-fourth publications were three-authored. The publications of UIPS have been cited by others as 88.65% research publications of the UIPS received citations and 14 research publications of the UIPS have received more than 100 citations during this period of 10 years from 2009-2018. The Paper titled "A review on Alzheimer's disease pathophysiology and its management: An update" by A. Kumar, A. Singh, Ekavali published in 2015 received highest 356 citations.

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