

**CITATION ANALYSIS OF DOCTORAL DISSERTATIONS IN
ANIMAL PHYSIOLOGY DIVISION SUBMITTED TO ICAR-
NATIONAL DAIRY RESEARCH INSTITUTE, KARNAL, HARYANA,
INDIA**

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Citation Analysis is a scientific method of measuring frequency and pattern of research information citations in research papers to establish linkage of one research document to another revealing their importance and properties. The present investigation aims to study the scientific literature use pattern through the Citation Analysis of doctoral dissertations. For this five doctoral dissertations having call numbers (P – 1541, P – 1535, P – 1507, P – 1506 and P – 1518) submitted to Animal Physiology Division, ICAR – NDRI, Karnal during the year 2017 were considered as base reference. The Citation Analysis of these five doctoral dissertations revealed that out of total 1628 citations, highest, i.e. 1477 numbers (90.72 %) were cited from journals, followed by 73 (4.48%) from subject matter books and rest 78 (4.80 %) from scientific magazines, conference proceedings, theses, etc. The results reveal that journals were the most consulted source of research information by the research scholars, study of authorship pattern shows that more than three authors were more acceptable to scholars with 875 (56.20%), study revealed that thesis call No. P-1541 had maximum numbers of citations i.e. 451 (27.70%), most frequently cited foreign journal is *Journal of Dairy Science* with 147 (33.79%) citations and the Indian Journal titled *Journal of Animal Science* an ICAR publication was highest cited with 7 (26.92%) citations during the study period. The study further highlights the information materials available and used by the researchers of the Animal Physiology Division of ICAR-National Dairy Research Institute (NDRI) for their research work and those which need to be added for a rich collection in the library.

Keywords: National Dairy Research Institute, Citation Analysis, Doctoral Dissertations, Doctoral Theses

INTRODUCTION

A scientific research paper does not stand alone; it embodies the vast literature available on the subject. Citation Analysis helps to study about the citation pattern of any given scientific document and the nature of literature embedding is specified by the use of appended reference lists. The list of citations given at the end of any research paper gives information about the previous published research papers consulted by the author before and during writing a particular research article. The number of listed references allots definite weightage to the particular paper. In other words, it exhibits the specific needs of the availability of relevant research documents required by the author in the form of books, journals, magazines, proceedings, theses, etc. In this study, five doctoral theses having call numbers (P – 1541, P – 1535, P – 1507, P – 1506 and P – 1518) submitted to the division of Animal Physiology, ICAR - NDRI, Karnal in the year 2017 were considered for data collection and analysis.

The National Dairy Research Institute as country's premier Dairy Research Institution has developed considerable expertise over the last five decades in different areas of Dairy Production, Processing, Management and Human Resource Development. Information generated at the Institute and the services offered have contributed to the growth of Dairy Industry as a whole and well-being of millions of milk producers and consumers of milk and milk products. Realizing the challenging need of global Dairy Trade, the Institute is continuously working to develop its R&D and HRD programmes to better serve the nation in terms of food security, employment generation, poverty alleviation and economic prosperity. The National Dairy

Research Institute as the premier Dairy Research Institution undertakes research, teaching and extension activities towards dairy development in the country. Being the National Institute, it conducts basic and applied research with the objective to enhance animal productivity and also to develop cost effective technologies for the benefit of the teeming millions. Further, the Institute provides high quality manpower to meet the human resource requirements for the overall dairy development in the country. The Institute also undertakes extension programmes for transferring the know-how from the laboratory to the farmers' fields.

The discipline of Animal Physiology functioned as a section of erstwhile Dairy Husbandry Division and subsequently of Dairy Cattle Nutrition Division till the end of the 6th Five Year Plan. In the year 1984, it received the status of an independent Division. Presently, the Division is focusing its research thrust in 3 main areas namely Growth and Reproductive Physiology, Lactation Physiology and Environmental and Stress Physiology.

REVIEW OF LITERATURE

Various studies have been carried out to investigate the use pattern of literature as revealed through citation analysis.

Shafi and Gazi (2001) analysed 100 Ph.D theses in Natural Sciences which have submitted to Kashmir University during 1980-2000. A total of 11,862 citations were analysed for bibliographic form, citation potential, journal ranking and obsolescence rate. The results show that journal articles are the most preferred source of information for scholars in natural sciences (68.08%).

Shokeen and Kaushik (2004) in their study entitled “*Indian Journal of Plant Physiology: A Citation Analysis*”, covered the issues published between January to December 2002, issue number 1 to 4 of volume 7, 61 articles published in these issues, 1149 citations featuring 2770 authors during that period. 39% cited articles are three authored. The ratio of author self-citation to total citations was 1:16.65 and the ratio of author self-citation of total citation was 1:31.91. The average number of articles published in each issue was 15.25, which were higher than others.

Hadagali et al. (2009) examined the citation patterns of researchers in the field of Physics by analyzing the citations appended to 37 theses submitted to the Karnatak University, Dharwad during 1992-2006. The analysis was carried out to study the distribution of citations according to different bibliographic forms, authorship pattern, half-life period of journals. It was also determined applicability of Bradford’s Law of scattering to the citation data. The bibliographic form wise distribution of citations shows that journals were at the top with 80.54% contribution of citations, followed by books 10.95% and proceedings 3.17%. The authorship pattern shows that the number of citations with two authors is 34.5%, followed by single authored papers (about 30%).

Banateppanvar et al. (2013) carried out citation analysis of doctoral theses in Biotechnology submitted to Kuvempu University, Karnataka. The study reveals that journals are the most preferred sources of information used by the researchers in the field of Biotechnology accounting for 79.72% of total citations although citations from books, proceedings, theses, reports and patents are also found.

Veerabasavaiah and Namboori (2014) conducted a study using 42 doctoral theses submitted for the period from 2003 to 2012 at the Department of Education, Bangalore University, Bangalore. This study was performed to determine the use of different information sources by the doctoral students of the university. There were 6688 citations in 42 doctoral theses. The data were collected from the bibliographic section listed at the end of each thesis, which included the details of the articles referred to by the researchers for completing their thesis. The citations were collected in a catalogue card. The study revealed that journals were the most preferred sources of information in the field of education with (39.43%) citations.

Gohain and Saikia (2014) also studied citation analysis of Ph.D theses submitted to the department of chemical sciences, Tezpur University, Assam. The study was based on 10983 citations appended in the 30 Ph.D. theses of chemical sciences submitted to Tezpur University, Assam for the award of doctoral degree during 2008-2012. The main purpose of this study was to investigate authorship pattern of the citations, type and form of literature cited, and compile a rank list of core journals in chemical sciences. The study revealed that journals were the most preferred sources of information in the field of chemical sciences accounting for 78.83% of total citations, followed by books with 15.57 % citations.

Mahajan and Kumar’s (2016) study carried out to analyse 7490 citations appended in the 60 Ph.D. theses of Public Administration submitted to Panjab University, Chandigarh, for the award of doctoral degree during 2002-2012. The authors analysed several parameters such as authorship

pattern of the citations, form of literature cited, half-life of books and journals and compiled a rank list of journals in Public Administration. The study found that the highest number of citations to research work by single authors was higher in case of both books (2782, 87.02%) and journals (1785, 87.12%). Books comprised the highest citations (3197, 42.68%), followed by journals (2049, 27.36%).

Mahajan and Kumar (2017) carried out a study on the citations appended of History discipline Ph.D. dissertations to ascertain the types of documents frequently used in the research process, the most commonly consulted core journals and obsolescence rate of the journals and books. The authors analysed 8488 citations appended to the 36 Ph.D. theses of History discipline submitted to Panjab University, Chandigarh, for the award of doctoral degree during 2002-2012. The results obtained from the 8488 citations revealed that most frequently used documents were books, which accounted for 54.16 percent of the total citations and '*Economic & Political Weekly*' was found to be the most cited journal.

Tyagi and Kumar (2017) have analysed citation analysis of doctoral theses in political science submitted to Chaudhary Charan Singh University, Meerut, Uttar Pradesh. Their study is evidenced that this type of study will definitely help the libraries in selection of useful sources as there is an explosion of information and documents in the form of books and journals. The ranking of journals can be used by librarians and researchers to select the journals of greater importance in a particular subject area.

Kaur and Rattan (2018) studied on Citation Analysis of Theses in Economics subject

submitted to Punjabi University, Patiala during 2000-2014. Their study is based on 9053 citations appended to 92 doctoral theses. The study reveals that the journals are the most cited sources with 49.39 per cent of the citations. The year-wise distribution of authorship pattern indicates that the trend is changing from single authored documents to multiple authored documents. Mustafa (2019) examined the citation analysis of 86 M.Ed. dissertations submitted in the Department of Education and Training, MANNU, Hyderabad during 2008-2010. The study shows that books and journals are most used sources for information and single authorship is in preference.

OBJECTIVES OF THE STUDY

The specific objectives of the present study are:

1. To identify the most cited sources of information consulted by the researches.
2. To identify the authorship pattern.
3. To identify the average number of references cited per thesis.
4. To determine the most frequently cited Indian, and foreign journals.
5. To examine the number of citations Indian Vs Foreign Journals.
6. To compare between Indian and Foreign Authors citations.

RESEARCH METHODOLOGY

As per the objectives of the study, the data was collected from the five theses submitted to Animal Physiology Division, ICAR - NDRI, Karnal during the period 2017. The citations were extracted from the references at the end of each dissertation. The total 1628 numbers of citations are embedded in these theses. Each reference of each thesis was analysed manually. Data was

collected by counting the references, categorised and tabulated in MS-Excel to analyse the data. Materials cited were categorized as books, journals, magazines, theses, websites, conference proceedings, annual reports, databases, patents etc.

SCOPE OF THE STUDY

The ICAR-National Dairy Research Institute (Deemed University) as the premier Dairy Research Institution undertakes research, teaching and extension activities towards dairy development in the country. The division of Animal Physiology was established as full fledged in the year 1984. The Division is focusing in 3 thrust areas namely Growth and Reproductive Physiology, Lactation Physiology and Environmental and stress Physiology. In, twelve different disciplines of animal and allied sciences ICAR-NDRI awarded the Ph.D degrees to the students. 98 students are enrolled per year in different disciplines. In the year 2017, in animal physiology division only 05 students were enrolled in Ph.D programme.

A Citation Analysis of Ph.D. theses in Animal Physiology submitted to the Animal Physiology

Division, ICAR - National Dairy Research Institute, Karnal, Haryana, India was considered to determine the use of information sources made by the Ph.D scholars from Animal Physiology Division. For the present study, five Ph.D. theses (P – 1541, P – 1535, P – 1507, P – 1506 and P – 1518) of Animal Physiology were selected.

ANALYSIS AND DISCUSSION

Most Cited Sources of Information Referred by the Researchers

In the NDRI Library different cited sources are available such as books, journals, magazines, theses, websites, conference proceedings, annual reports, databases, patents etc. The data presented in table - 1 shows that the citations included in the referred theses submitted to Animal Physiology Division of ICAR – NDRI were in the order of : maximum from journals 1477 (90.72%), second from books 73 (4.48%), third from magazines 23 (1.41%), fourth from theses 20 (1.23%) and fifth from conference proceedings 20 (1.23). It revealed that journals were the most consulted source of research information by the research scholars for their research work in the year 2017.

Table 1: Order of Different Sources of Literature Citation in Doctoral Theses of Plant Physiology Division, ICAR – NDRI During 2017

Theses	Jls.	Books	Magzs.	Theses	Web Sites	Conf. Procs.	Annual report	CAB	Bulletins	Patents	Total
P-1541	412	15	12	2	3	7	0	0	0	0	451
P-1535	293	13	2	1	0	1	1	6	0	0	317
P-1507	175	3	3	0	1	3	0	0	0	0	185
P-1506	258	20	6	4	0	5	0	0	0	0	293
P-1518	339	22	0	13	1	4	0	0	2	1	382
Total	1477	73	23	20	5	20	1	6	2	1	1628
%	90.72	4.48	1.41	1.23	0.31	1.23	0.06	0.37	0.12	0.06	100

Authorship Pattern of the Authors in cited Articles

The authorship pattern of the cited documents is presented in table - 2. The data analysis indicates that multi - authorship i.e. more than three authors were more acceptable to scholars with 875 (56.20%), with 256 (16.44%) by three authors, with 243 (15.61%) by two authors and with 183 (11.75%) by single authorship. The study indicate that single authorship pattern decreased while most of the authors wished to write research articles with multiple authorship pattern.

Table 2: Order of Authorship Pattern in Doctoral Theses of Animal Physiology Division, ICAR – NDRI During 2017

Authorship Pattern	P-1541	P-1531	P-1507	P-1506	P-1518	Total	%
Single Author	57	17	15	32	62	183	11.75
Two Authors	76	49	23	41	54	243	15.61
Three Authors	71	60	16	52	57	256	16.44
>Three Authors	64	39	28	64	55	875	56.20
Total	60	43	28	49	46	1557	100

Average Number of References Cited per Thesis by the students

Analysed data is presented in table – 3 which reveals that thesis call No. P-1541 had maximum numbers of citations out of total 1628 i.e. 451 (27.70%), followed by P-1518 with 382

Table 3: Average Number of References Cited per Thesis in Doctoral Theses of Plant Physiology Division, ICAR – NDRI During 2017

Thesis	No. of Citations	% of Total
P-1541	451	27.70
P-1535	317	19.50
P-1507	185	11.40
P-1506	293	17.90
P-1518	382	23.50
Total	1628	100.00

(23.50%), P-1535 having 317 (19.50%), P-1506 having 293 (17.90%) and P-1507 cited least 185 citations i.e. 11.40%. The average number of citations was found to be 326.

Cited Foreign Journals by the students of Animal Physiology Division

Foreign Journal Citation Analysis presented in table – 4 reveals that total 1477 citations were cited from foreign journals by the different research scholars in their doctoral theses during the period of study. The analysis also indicates that 12 journals were the most frequently cited by the researchers. *The Journal of Dairy Science* acquired top position with 147 (33.79%) citations. *The Journal of Animal Science* with 53 (12.18%) citations was at the second position, *The Journal of Theriogenology* with 46 (10.57%) citations was at the third position, *The Journal of Endocrinology* with 46 (10.57%) citations at the fourth position, *The Journal of Biology of Reproduction* with 30 (6.90%) citations at the fifth position. It is also interesting to note that according to frequency of citations, the Journals listed in table – 4 at serial number 1 to 4 can be considered as core journals. The research scholar - wise and journal – wise citations are also presented in table – 4.

Cited Indian Journals by the students of Animal Physiology Division

The study reveals that the Indian Journals citations were lesser in comparison with the Foreign Journals citations in all the five theses considered for the study. Among the Indian Journals, the *Journal of Animal Science* an ICAR publication was at the top rank with 7 (26.92%) citations. *The Indian Journal of Animal Research of Agricultural Research Communication Centre, Karnal* was at the second

Table 4: Most frequently Cited Foreign Journals in Doctoral Theses of Animal Physiology Division, ICAR – NDRI During 2017

Sl. No.	Title of Journal	P-1541	P-1535	P-1507	P-1506	P-1518	Total	%
1	Jr. of Dairy Science	39	4	9	66	29	147	33.79
2	Jr. of Animal Science	18	3	3	17	12	53	12.18
3	Theriogenology	7	12	14	9	4	46	10.57
4	Endocrinology	6	16	7	2	2	33	7.59
5	Biology of Reproduction	0	6	24	0	0	30	6.90
6	Jr. Pineal Research	28	0	0	0	0	28	6.44
7	Animal Reproduction Sc.	3	6	7	6	1	23	5.29
8	Jr. of Endocrinology	0	7	5	5	1	18	4.14
9	Cell	9	5	0	0	0	14	3.22
10	Small Ruminant Res.	4	0	1	2	4	11	2.53
11	Int. of Sports Medicine	0	8	0	0	0	8	1.84
12	Nature	0	2	0	4	0	6	1.38
	Total						435	100.00

Table 5: Most frequently Cited Indian Journals in Doctoral Theses of Plant Physiology Division, ICAR – NDRI During 2017

Title of Journal	P-1541	P-1535	P-1507	P-1506	P-1518	Total	%
Indian Jr. Animal Sc.	3	1	0	0	3	7	26.92
Indian Jr. of Animal Research	0	0	0	1	5	6	23.08
Indian Jr. of Dairy Sc.	2	2	0	0	1	5	19.23
Indian Jr. Animal Nutrition	2	0	0	0	1	3	11.54
Indian Vet Journal	0	0	0	0	3	3	11.54
Indian Jr. of Production & Management	0	2	0	0	0	2	7.69
Total							100.00

position with 6 (23.08%) citations, the *Indian Journal of Dairy Science* of Indian Dairy Association publication was at the third position

with 5 (19.23 %) citations during the period of study. It can be concluded that the referred journals fall in the category of core Indian Journals.

Table 6: Number of Citations in Indian and Foreign Journals in Doctoral Theses of Plant Physiology Division, ICAR – NDRI during 2017

Journals	P-1541	P-1535	P-1507	P-1506	P-1518	Total
Indian Journals	15	9	1	6	21	52
Foreign Journals	397	284	174	252	318	1425
	412	293	175	258	339	1477

The data presented in table - 6 evidenced that maximum citations were cited from foreign Journals by all the five research scholars. It also revealed that research scholars preferred to consult the foreign journals in comparison to Indian Journals. They also believed that the scientific information embodied in foreign journals fulfill their needs of research work in a better way and hence considered these journals in the category of core journals. The share rating of foreign journals was at 96.47 % compared to 3.5 % of Indian Journals. The maximum citations from Indian Journals were 52. Thesis P-1518 cited maximum 21 (40.38%) citations, followed by thesis P-1541 with 15 (28.84%) citations. Thesis P-1541 cited maximum references from foreign journals i.e. 397 (27.85%), while thesis P-1518 was at the second position with citation of 318 (22.31%) from the foreign journals.

Citations of Indian and Foreign Authors

The data presented in table-7 exhibited that all the five Ph D research scholars made meticulous efforts to consult and cite relevant research information published by both the Indian and Foreign authors. However, a big gap was observed between the number of citations of Indian and Foreign authors. The citations of Indian authors was 229 (14.06%) as against 1399 (85.93%) of Foreign authors which reveals that more inclination of Indian research scholars for consultation towards the Foreign authors.

RECOMMENDATION AND SUGGESTIONS

In the present study it was observed that citations were not given in a standard format. The researchers did not use any uniform pattern/sequence while citing the research materials. It was also observed at some places year, publishers and place were missed. Hence, while citing the work of others, the researchers should cite the complete bibliographic information in a standard format. This kind of study will definitely help the libraries in selection of useful sources as there is an explosion of information and documents in the form of books, journals, conference proceedings, online databases etc. The ranking of journals can be used by librarians and researchers to select the journals of greater importance in a particular subject area. This type of studies are useful for the selection and deselection of reading materials in least budget of the institute.

CONCLUSION

Citation Analysis of the five doctoral theses submitted to the Plant Physiology Division of ICAR – NDRI, Karnal, India, during the year 2017 revealed that : (i) journals were the most consulted source (90.72 %) of research information by the research scholars, (ii) preferred (56.20 %) authorship pattern in research papers was for more than three authors, (iii) the average number of citations per Ph D thesis was 326 ranging from 185 to 451, (iv) twelve foreign journals were

Table 7: Citations of Indian and Foreign Authors in Doctoral Theses of Plant Physiology Division, ICAR – NDRI During 2017

Author	P-1541	P-1535	P-1507	P-1506	P-1518	Total
Indian Author	67	35	13	27	87	229
Foreign Author	384	282	172	266	295	1399
	451	317	185	293	382	1628

the most frequently cited journals by the researchers with citation ranging from 6 to 147. Among these *Journal of Dairy Science* with 147 (33.79%) citation, *Journal of Animal Science* with 53 (12.18%) citations, *Journal of Theriogenology* with 46 (10.57%) citation and journal of Endocrinology with 46 (10.57%) citations were considered in the core journal category, (v) the Indian Journals citations were lesser in comparison to Foreign Journals, the Indian Journal of Animal Science with 7 (26.92%) citations, Indian Journal of Animal Research with 6 (23.08%), Indian Journal of Dairy Science with 5 (19.23 %) fell in the category of core Indian Journals, (vi) research scholars preferred to consult foreign journals with share rating of 96.47 % in comparison to Indian Journals giving share rating of 3.5 %, and (vii) citation in Ph D theses by all the five scholars was of both, the Indian and foreign authors, however, a wide gap existed between Indian 229 (14.06 %) and foreign 1399 (85.93%) authors.

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