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A Collaboration Analysis Study of Food Chemistry Journal

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Abstract*—In recent years in Turkey, it is identified that article production has increased in the subject category of "Food Science Technology". Food Chemistry journal is determined to be the most preferred journal among Turkish authors. As a result of this determination, Food Chemistry journal was examined with bibliometric methods between the period of 2007-2012. This study focused on articles produced with collaboration. The co-authorship rate was found to be around 99% with a decrease in the number of articles with single author in years. Most of the co-authored studies originated from the same country with a percentage of 64.1; while 34,8% of them were participated by authors from 2 or more countries. The highest level of collaboration was determined to be between the PRC and the USA. At the same time the most productive authors of the journal was found and collaboration network was made between this productive authors. This study has made certain suggestions as a result of bibliometric examination of Food Chemistry journal.

***Index Terms*—Bibliometry, collaborative studies, co-authored publications.**

I. INTRODUCTION

One of the most common research topics in Turkey in recent years is the food safety. A study by the Ministry of Health carried out within a project has been effective on the issue, while the frequent publications of the media have prepared the ground for scientists to carry out special studies. As food safety is a topic that is related to various disciplines, it is a topic of research that allows for interdisciplinary studies along with cooperation among the institutions. In this respect, studies on food safety in Turkey have been evaluated in the light of the data obtained from the Web of Science. The evaluations concluded that Food Chemistry is the journal with the highest number of publications on the issue in Turkey.

This study has made certain suggestions as a result of bibliometric examination of the articles originating from Turkey published between 2007 and 2012 in the Food Chemistry journal, where the highest number of publications was made on "Food Science Technology".

A. Collaborative Studies

Accelerating learning through direct access to knowledge resources, increasing productivity, becoming more visible, receiving support from the budget and funds, progressing faster, enabling communication among people through creating a network and reducing isolation [1, 2, 3]; are triggering aspects, which affect the tendencies of scientists towards collaboration.

While collaborative studies exist in various forms, most of them were concluded without documentation [3, 4, 5, 6]. For the permanence of collaborative studies, documentation is essential; thus, the most common forms of collaborative studies are the co-authored studies. Findings show that the tendency towards co-authored studies increased in years [7]. While there were a few co-authored studies, a marked increase was observed starting from the second half of the 20th century [8, 9, 10, 11, 12, 13]. Co-authored studies have a lot of contributions to the scientific process. Both the research input and the products obtained, along with the variety in knowledge and skills of scientists and the reception of more citations by the co-authored studies are among the contributions [12, 14, 15, 16].

B. Literature Review

The increase in co-authored studies brought forward the need for the analysis of these publications. In this respect, with the aim of assessing and analyzing the scientific publications, bibliometric methods have been prominent, where mathematical and statistical methods are utilized. Bibliometric analysis on co-authored studies made use of different methods. Many studies on the analysis of co-authored studies are carried out through the evaluation of publications from selected country/countries of institution/institutions at the national/international dimensions. These evaluations are mostly made from the perspective of geopolitical regions, cultural relationships and language factors along with tendency towards receiving or making citations [12, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28].

There are also bibliometric analyses carried out in terms of titles. These titles are evaluated according to their tendencies towards collaboration as well as the subject field and countries that have tendencies towards collaboration [12, 20, 21,29, 30, 31]. Additionally, publishing houses are also known to have made detailed bibliometric analyses based on co-authored articles. For instance, a study, which was completed with the help of Elsevier in 2005, focused on the co-authored collaboration pattern of the Peoples Republic of China and their effects on the Elsevier journal [32]. On the other hand, it is also known that bibliometric collaboration analyses have been carried out upon the selection of certain journals to reach detailed conclusions [33, 34, 35].

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II. METHODOLOGY

Increasing attention on *food safety* in Turkey in recent years led to the enrichment in the relevant literature. Therefore, Web of Science was scanned with the aim of determining the number of Turkey originated publications at the WoS subject category and under the "Food Science Technology" title. It was concluded that there were 5704 publications originating from Turkey and these publications were examined in terms of journals. The results are displayed on Table1. Table 1 shows the five journals favored the most in Turkey originated publications and related topic along with the number and percentages of publications in these journals.

Table I. Favorite journals of Turkish authors

Name of the journal	Number of articles	Percentage of articles (%)
Food Chemistry	455	7,98
Journal of Food Engineering	397	6,96
Journal of Food Agricultural Environment	392	6,87
International Journal of Food Science and Technology	204	3.58
European Food Research And Technology	196	3,44

Table I displays that the number of articles originating from Turkey at the *Food Chemistry* journal was more in number when compared to those in other journals. It was closely followed by the *Journal Of Food Engineering* and the *Journal Of Food Agriculture Environment*. In this respect, articles in *Food Chemistry* by Turkish authors were analyzed bibliometricly in terms of co-authorship.

A. The Purpose of the Study and Research Questions

This study aims to make certain suggestions as a result of bibliometric examination of the articles originating from Turkey published between 2007 and 2012 in the Food and Chemistry journal, where the highest number of publications was made on "Food Science Technology". The journal was evaluated according to the increase in the number of publications and co-authored studies. Answers to the following questions were sought:

1. Is there any increase in the number of articles in years?
2. What is the progress in collaborative publications with co-authorship?
3. What is the distribution of co-authored articles according to the number of authors?
4. What is the distribution of the countries within the scope of journal publication?
5. What is the distribution of collaboration among countries publishing in the journal?
6. Are there any productive author groups?
7. How does Turkey rank in terms of publication production and collaborative studies?

B. Method of the Study

For the bibliometric analysis of the *Food Chemistry* journal, data were obtained from the WoS database. The indexed number of publications since 1980 were determined and the period between 2007 and 2012 were taken into consideration due to the high number of publications. The relevant data for 2007 – 2012 were obtained on 4.4.2013 from the WoS database. BIBEXCEL was used for the bibliometric analysis, while the electronic and abstract tables were produced on EXCEL. The maps were made on PAJEK. The study was concluded with the utilization of knowledge obtained from WoS database on the name of the author, address of the author, year of publication and type of document.

III. FINDINGS

A. Number of Articles per Year

Food Chemistry journal, having been published since July 1976, started to be scanned on SCI since 1980. The journal is published four times a year. The number of pages and publications accordingly increased in years and since 2007 the number of pages and the number of publications accordingly doubled. Fig.I displays the number of publications in WoS since 1980. Numerical values on Fig.I show that more than half of the indexed articles were published after 2007. Therefore, the analysis was limited to the period between 2007 and 2012.

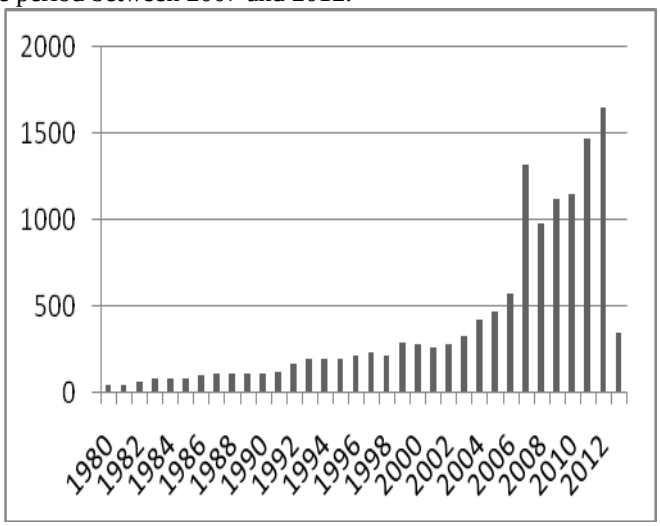

Fig I: Number of publications in the *Food Chemistry* journal since 1980

Types of publications such as articles, proceedings paper, notes and reviews were found. The types of publications indexed were analyzed after 1980. Among the types of publications, 95% were articles with 13,283 in number indexed since 1980 (21.03.2013).As 95% of the publications are articles; the types of publications in this study were limited to articles only.

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B. Collaborative studies

Articles published between 2007 and 2012 were analyzed in terms of articles with single authors or multiple authors. The data obtained are displayed on Table II. Articles with multiple authors were categorized as articles with 2 authors, 3 authors, 4 authors and more. Table II displays the articles produced per year, cumulative number of articles and collaboration coefficient.

Table II: Distribution of articles with multiple authors

Years	Single	Multiple authors			Total	Cum.	Collab. Coeff.
		2	3	4≥			
2007	2,1	13,4	25,9	58,6	1317	1317	0,979
2008	1,4	12,2	23,3	63,1	977	2294	0,986
2009	1,2	11,3	20,2	67,4	1119	3413	0,988
2010	1,2	10,7	17,5	70,6	1151	4564	0,988
2011	1,1	8,8	17,0	73,1	1467	6031	0,989
2012	0,9	9,9	15,1	74,1	1654	7685	0,991

Table II shows that the percentage of articles with single authors decreased after 2007. The number of articles with two or three authors also decreased while the number of articles with four or more authors increased. As the number of articles with a single author is rather low, the collaboration coefficient is valued close to 1.

Collaborative publications with multiple authors have been produced with the participation of authors from the same country or authors from different countries. The published articles between 2007 and 2012 were analyzed in terms of the addresses of the authors and the results are displayed on Table III. On Table III[1], the countries with most number of articles in Food Chemistry were listed according to years. As Table III displays, the country with the most number of studies in PRC with 1253 articles and it is followed by Spain and the USA:

Table III: Countries with the most number of publications in Food Chemistry journal.

Country	% of articles per year						Total
	07	08	09	10	11	12	
PRC	12	13	15	15	20	25	53 12
Spain	18	13	14	13	22	21	90 3
USA	14	11	13	21	17	24	68 3
Italy	18	14	14	13	22	19	53 8
India	27	14	13	17	12	17	36 5
Japan	21	12	16	14	20	19	35 5
France	14	12	16	20	17	21	33 2
Taiwan	20	12	14	16	17	23	32 7
S. Korea	10	9	12	18	24	27	32 0
Brazil	18	11	14	14	20	24	30 3
Canada	11	14	16	14	22	23	26 7
Turkey	34	13	15	12	12	15	26 2

It was mentioned above that almost 99% of the articles published in the journal had multiple authors. Collaborative publications with multiple authors have been produced with the participation of authors from the same country or authors from different countries. Table IV lists the articles published in Food Chemistry between 2007 and 2012 in terms of being single or multinational.

Table IV: Distribution of articles with multiple authors according to the number of countries.

Single country (%)			Two countries (%)	Three countries (%)	Four ≥ countries (%)
Total (S. A.+M. A.)	Multiple A.	Single A.			
65,2	64,1	1,1	29,6	3,8	1,4

Collaborative co-authorship was observed to occur with single country participation with a value of 64,1% as Table IV displays. Therefore, it was observed that there was very little international collaboration in co-authored articles. In thisrespect, articles with the participation of more than one country were evaluated to determine the countries with more international collaboration. The results are displayed on Figure3.

Fig. III displays the stronger collaboration with darker colors. The highest level of collaboration in co-authored articles in terms of international collaboration was between the USA and PRC.

Fig.III displays the network of collaboration among the countries. Table V displays the collaboration matrix among the countries. Countries with the most number of articles published in collaboration were PRC and the USA with 122 articles. Others were Portugal and Spain with 39 articles, the USA and the South Korea as well as the PRC and Canada with 38 articles.

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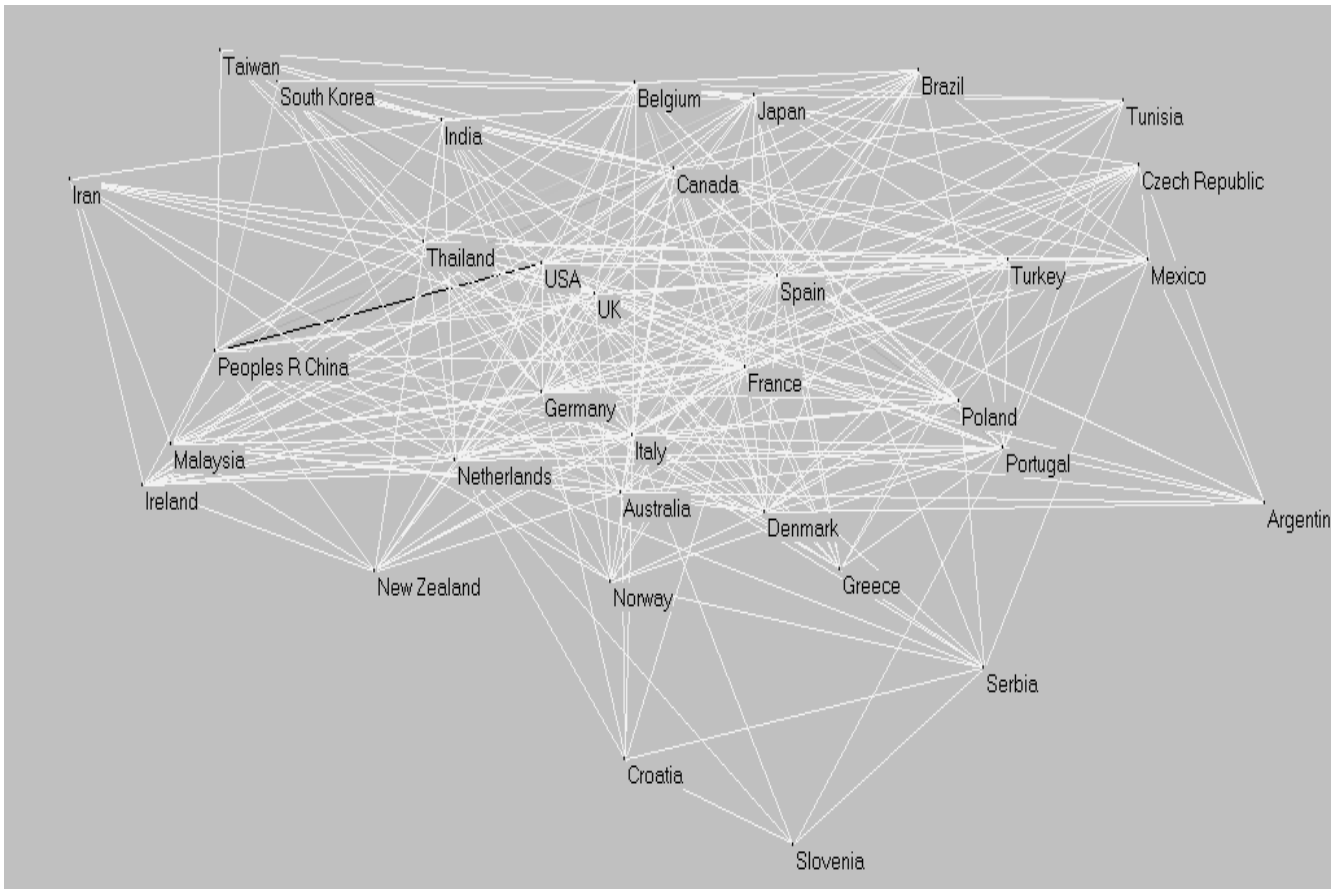

Fig III: International collaboration network in the *Food Chemistry* journal

C. o-authorship

Looking at the publications in Food Chemistry between 2007 and 2012, it is possible to say that most of the authors contributed to the journal with more than one article. Articles with co-authors increase the contribution of authors to the journal. Various authors, on the other hand, are scanned to have a single article. This affects the number of authors per article and the number of articles per author. The numbers are displayed on Table VI.

Table VI: Co-authorship analysis in Food Chemistry

	Basic Results
Total papers	7685
Total number of authors	21.584
Total number of co-authors	35.623
Mean paper per author	0.36
Mean authors per paper	4.64

The total 7685 articles published between 2007 and 2012 were produced by a total of 21,584 authors. 3462 of these authors had 2 articles, while 15,320 of them had only one article published. The articles were evaluated in terms of the names of the authors and it was concluded that certain authors were quite productive. Authors with 20 or more articles were displayed on Fig. IV in terms of their collaboration networks. The size of the rings in Fig. 4 reflects the number of co-authored articles. The darker color of the links between the authors is parallel to the number of articles produced. The most productive author was determined to be Benjakul, S. Moreovr, the level of collaboration between Benjakul - Vissesanguan, Valenteao - Andrade, Yang – Zhao, Yang – Jiang and Decker - McClements were observed to be rather high.

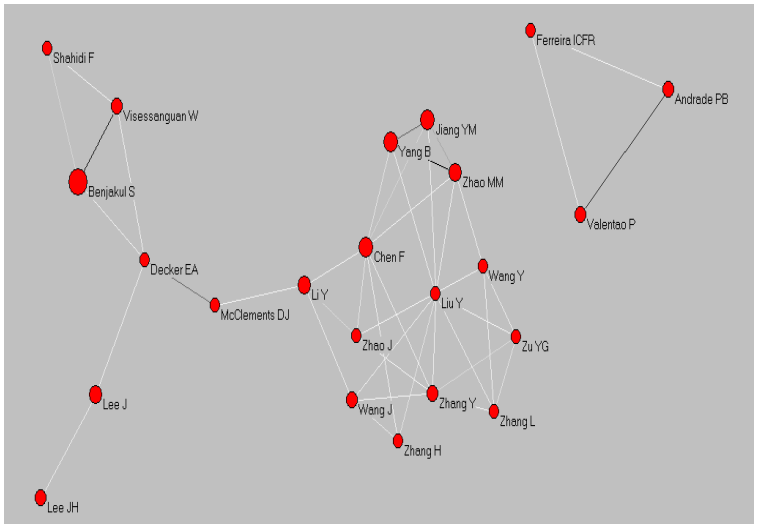

Fig IV: Collaboration among the authors

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Fig.IV presents that the number of articles published by certain authors were more than those of others. The most productive authors could easily be marked on Fig.IV Benjakul, S. is the most productive author with 80 articles, and he is followed by Yang, B with 49 articles.

IV. Conclusion And Suggestions

The number of studies on food safety has increased in number in Turkey recently. Turkey was determined to have 5704 publications published under the WoS subject category of "Food Science Technology" title. Turkish authors were found to favor the Food Chemistry journal.

Bibliometric studies on scientific journals are essential for observing the progress of the journal as well as using the observations for future decisions. In this study Food Chemistry was analyzed and the data obtained were evaluated in terms of collaboration among authors and countries.

It was found that there was an increase in the number of articles published in the journal between 2007 and 2012. The highest increase rate was observed for the year 2007. The co-authorship rate was found to be around 99% with a decrease in the number of articles with single author in years. The analysis concluded that co-authored publications are produced by four or more authors with a percentage of 59 within the mentioned period. 7,685 articles were published by 21,584 authors, most of whom participated in the production of articles as co-authors. 15,320 authors out of the total number of authors contributed to the journal with a single article. The most productive author of the journal was found to be Benjakul, S with 80 articles. Most of the co-authored studies originated from the same country with a percentage of 64.1; while 34,8% of them were participated by authors from 2 or more countries. The highest level of collaboration was determined to be between the PRC and the USA with 122 articles followed by Portugal and Spain along with the USA and the South Korea with 39 articles, the PRC and Canada with 38 articles. The first five countries with the highest number of publications were PRC, Spain, the USA, Italy and India. Turkey ranked 12th in the sequence. Countries, with which Turkey collaborates, were found to be the USA, the UK, Canada and Australia. Therefore, the following suggestions are presented:

- The journal could share the periodical statistics with its authors to ensure communication among authors.
- By categorizing articles published within a certain period according to their topics, the names and contact info of the authors interested in the same topic could be shared among each other.
- Articles with most number of citations, including their authors' names and contact information could be effective to establish communication among authors.
- Congress, conferences and symposiums in the subject field could be held, where the contributing authors could be gathered, which would increase scientific collaboration.
- In the event that the authors are open for communication, means of one-to-one communication could be established among the authors.

Authors, working on the same topic in different countries, could therefore be introduced to each other. Articles, which are produced within the international collaboration, receive more citations when compared to other publications. In this respect, the number of citations to the journal would increase accordingly. This would reflect the importance of bibliometric studies on the journal.

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Table V: Number of articles published with international collaboration

	USA	PRC	Spain	France	Italy	UK	Canada	Germany	Japan	S. Korea	Belgium	Thailand	Portugal	Netherlands	Brazil	Tunisia	Australia	Greece	Taiwan	Poland	Turkey	India	Denmark	Switzerland
USA		122	15	6	11	6	12	5	10	38	2	15	1	3	10	1	3	1	31	3	**10**	17	2	1
PRC	122		3	1	5	14	38	14	33	12	2	2		7			20		3				6	3
Spain	15	3		16	23	30	1	9	1		6		39	12	8	5	3	4		9	**1**	1	4	
France	6	1	16		11	11	7	9	1		18	1	4	4	5	28	1	4		3	**3**	1	3	6
Italy	11	5	23	11		17	3	11		2	10	1	5	3	3	6	5	9		1		3	2	3
UK	6	14	30	11	17		1	8	1		5	9	5	3	5			7	1		**5**	2	1	8
Canada	12	38	1	7	3	1		4	5	6		11	1	1	2	7	4	6	4	5	**4**	1	1	
Germany	5	14	9	9	11	8	4		3	1	2			1	7			3	2	1	**2**	1		7
Japan	10	33	1	1		1	5	3		6		29			2	1		1	5		**1**	6		
S. Korea	38	12			2		6	1	6		1	7		1						4	**1**	3		
Belgium	2	2	6	18	10	5		2		1			1	4	5	14				2			4	4
Thailand	15	2		1	1	9	11		29	7				1			5		1	2	**1**	1	2	
Portugal	1		39	4	5	5	1				1			2	10	2	1	3			**1**		1	1
Netherlands	3	7	12	4	3	3	1	1		1	4	1	2							2	**1**	1	1	1
Brazil	10		8	5	3	5	2	7	2		5		10				1						1	
Tunisia	1		5	28	6		7		1		14		2					1						
Australia	3	20	3	1	5		4					5	1		1						**2**	2		
Greece	1		4	4	9	7	6	3	1				3			1					**6**			
Taiwan	31	3				1	4	2	5			1										3		
Poland	3		9	3	1		5	1		4	2	2		2									1	1
Turkey	**10**		**1**	**3**		**5**	**4**	**2**	**1**	**1**		**1**	**1**	**1**			**2**	**6**					**2**	
India	17		1	1	3	2	1	1	6	3		1		1			2		3					
Denmark	2	6	4	3	2	1	1				4	2	1	1	1					1	**2**			2
Switzerland	1	3		6	3	8		7			4		1	1						1			2	