**A Bibliometric Analysis of Turkey’s Research Activity in the *Anatomy & Morphology* Category from the Web of Science Database**

**ABSTRACT**

**Objective:** The measurement of international publication activities is one of the essential indicators used to evaluate the scientific development level of countries. Although many studies are using the bibliometric method in the literature, it is seen that there are very few bibliometric studies in the field of anatomy. This study aimed to analyses the articles bibliometrically which conducted by researchers at institutions from Turkey and indexed in SCI-E of the WoS database in the category of *Anatomy & Morphology*.

**Methods:** According to 2019 data, journals in the *Anatomy & Morphology* category and indexed in the SCI-E were determined. Publications from Turkey that were published in these journals was determined. The full-texts of these articles were examined, and study types were defined. Also, VOSviewer software was used to create a collaboration and word co-occurrence network.

**Results:** It was determined that there were 48002 publications in 21 journals. It was found that 1461 publications (3.04%) which have at least one author from Turkey. The total number of citations was 11728 for these publications. The average number of citations was 8.02±11.95. The radiological studies have increased statistically more than both experimental animal and cadaveric studies by years.In addition, it has been determined that the total number of articles, especially the radiological studies, has increased significantly over the years.

**Conclusion:** The increase in the number of scientific studies in the field of anatomy is important in terms of the contribution of Turkey to literature in this area.

**Keywords:** Anatomy, Bibliometric analysis, Web of Science

**INTRODUCTION**

Anatomy, one of the oldest known medical sciences, is a discipline that forms the basis of medical education and an integral part of the medical curriculum [1]. It is thought that the first studies in the field of anatomy date back to the 19th century B.C. These studies started with animal dissections [2]. Undoubtedly, cadavers have been the essential teaching method in anatomy education in this long process. As a matter of fact, many scientists who have made significant contributions to anatomy owe these contributions to cadaveric studies [3]. On the other hand, with the development of medical imaging methods over time, radiological and clinical studies also have been added to cadaver dissection studies, which are still valuable and relevant [4].

Because of countless scientists contributed to the development of anatomy over this long period, the highly detailed knowledge of anatomy in today’s medical literature has emerged [1, 5]. For this reason, every study in the field of anatomy is exceptionally essential in terms of its contribution to the field.

Bibliometry (βιβλίο*: book, μέτρηση: measurement*) is a Greek origin word [6]. It is a kind of research approach used to measure and analyze the productivity of the literature in a particular area or journal. Today, many disciplines use bibliometric analysis to examine the impact of their field [7]. The bibliometric analysis includes features such as the article type, content of article, number of citations to the article, number of authors, the affiliation of authors, index, and category of the journals [7-9]. Although many studies are using the bibliometric method in the literature, it is seen that there are very few bibliometric studies in the field of anatomy [5, 10, 11].

The Web of Science (WoS) database is one of the widely used databases in bibliometric research. The most valid measure of the quality of scientific publications and the productivity of researchers at the international level are the number of articles published in journals in the WoS database and the number of citations of these articles. All these criteria can be interpreted as a quality indicator and used to evaluate institutions, academicians, and even countries [12]. On the other hand, the measurement of international publication activities is one of the essential indicators used to evaluate the scientific development level of countries. In the WoS database, there are articles indexed in the Science Citation Index Expanded (SCI-E) since 1980. In 2019, journals indexed in SCI-E were classified into 178 different categories. One of these categories is *Anatomy & Morphology* [13]. To the best of our knowledge, in the literature, there is no bibliometric study evaluated the *Anatomy & Morphology* category. We think that this study is the first study to examine the *Anatomy & Morphology* category in the WoS database studies on a country basis bibliometric.

This study aimed to assess the bibliometric characteristics of related articles in the *Anatomy & Morphology* category, which indexed in SCI-E of the WoS database by researchers from Turkish institutions.

**MATERIAL and METHODS**

According to 2019 data, in the WoS database, journals in the *Anatomy & Morphology* category and indexed in the SCI-E were determined using Clarivate Analytics’ Journal Citation Reports database. The names, abbreviated names, publication periods, and ISSN numbers of these journals were recorded (Table 1). The WoS database was searched for each journal with ISSN numbers by using the advanced search. Also, it has been taken into consideration that there may be changes in ISSN over the years, so another search also was done with the journal names. Articles published from January 1, 2020, onwards, it was excluded as any capture from that period forward would include incomplete bibliometric data for that year. In the WoS options, all categories such as Conference Proceedings Citation Index-Science, Arts and Humanities Citation Index, Social Sciences Citation Index, and Book Citation Index–Science were excluded, except for SCI-E. Afterward, meeting abstract, proceedings paper, early access, reprint, book series titles, and conference titles were excluded. Finally, in the Countries/Regions option, Turkey was chosen, and articles were determined. For each publication, all information relevant to the analysis was exported to Microsoft Excel and a bibliography manager (EndNote Desktop). Concretely this was: Author(s), Title, Source, Addresses, Times Cited, and Keywords. Since the document type in WoS is not detailed enough to evaluate the output of different types of papers, each article was separately examined while evaluating the document types. Therefore, the full texts of the articles were examined, and study types were defined as per the National Library of Medicine’s (NLM) MeSH database [14] and the evaluated journals. Also, VOSviewer software (version 1.6.15) was used to create a collaboration and word co-occurrence network [15].

*Statistical Analysis*

Descriptive statistics are given as mean±standard deviation for numerical variables and number and percentage values for categorical variables. The relations between numeric variables were tested by using the Pearson correlation coefficient, and study designs were compared with years using Tamhane Post Hoc Tests. SPSS for Windows version 22.0 package software was used for statistical analysis, and p<0.05 was considered statistically significant.

**RESULTS**

The journals listed in the *Anatomy & Morphology* category of the WoS database and all the publications, publications remaining after exclusion criteria, and publications from Turkey that were published in these journals, are shown in Table 2. It was determined that there were 48002 publications in these 21 journals. It was found that 1461 publications (3.04%) which have at least one author from Turkey and published in 20 different journals (Fig. 1). In one of the journals (*Adv Anat Embryol Cell Biol*), there is no publication from Turkey. When examined with the VOSviewer software, it was determined that there was a total of 25979 different words in the titles and abstracts of 1461 publications (Fig. 2). The colors used in Fig. 2 indicate words within the same topic cluster and distinguishing three colored clusters. In spite of the WoS database started indexing SCI-E journals since 1980, it was seen that most of these journals started to be indexed in the following years. Although we examine the 40 years between 1980-2019, our results obtained belong to the articles published in 1983-2019. However, in the first year (1983), only one document was published, and this is the same for 1986, 1989, and 1990. Besides, it was determined that there was no publication in 1984, 1985, 1987, and 1988. The distribution of all publications by years is shown in Fig. 3. The articles were found to be published most in 2019 (n: 138, 9.45%). Furthermore, it was determined that financial support was received from various institutions for 232 out of 1461 publications (15.88%). These supports were mostly given by TUBITAK (in 25 publications).

While, the maximum number of publications (n: 431/1461, 29.50%) from Turkey were published in *Surg Radiol Anat*, the journal with the highest rate of publications from Turkey was *Folia Morph* (n: 149/841, 17.72%) when the journals were evaluated separately.

When the institutions according to the affiliations of authors were examined, it was determined that there are nearly 200 institutions. The 25 institutions with the highest number of publications are shown in Table 3. Additionally, Fig. 4 presents these publications’ collaboration map of universities in Turkey.

While, all author(s) were from Turkey in 1275 out of 1461 publications (87.27%), the authors from Turkey were collaborating with the researchers from 46 different countries in 186 out of 1461 publications (12.73%). The USA was leading these countries with 69 publications. The collaboration map of the publications between Turkey and other countries are shown in Fig. 5.

The total number of citations was 11728 for all publications. The average number of citations was 8.02±11.95 (min: 0, max: 127). At least one citation was made to 1179 out of 1461 publications (80.70%). When the number of citations was examined by years (Fig. 6), it was seen that most citations were made in 2019. The H-index of 1461 publications was 41. The 25 most cited publications are shown in Table 4 [16-40]. It was seen that 11 of these 25 publications (44%); in other words, the vast majority of them were published in the *Surg Radiol Anat*.

The study types and the average number of citations according to the study types are given in Table 5. It was determined that 1233 of them (84.39%) were original articles, and 184 of them (12.59%) were case reports. It was found that the most cited publications type was review. On the other hand, sub-types of the original articles and the case reports are detected and given in Table 6. Additionally, the three study types with the highest number of publications were compared by years, a statistically significant difference was found (Table 7). Accordingly, the radiological studies have increased statistically more than both experimental animal and cadaveric studies by years (Tamhane post hoc test: p=0.001 and p=0.001). Furthermore, experimental animal studies have also increased statistically more than cadaveric studies by years (Tamhane post hoc test: p=0.001). While cadaver studies have decreased in recent years, experimental animal studies and especially radiological studies have increased (Fig. 7). It was determined that there was a very strong positive correlation between the number of publications and the years (p=0.001, r=0.939). While it was found that there were very strong positive correlations between experimental animal studies and years (p=0.001, r=0.838) and radiological studies and years (p=0.001, r=0.906), there was no correlation between cadaveric studies and years (p=0.199).

**DISCUSSION**

Bibliometric studies allow us to measure the productivity and effectiveness of a field in the literature [7]. The number of publications of any institutions or countries in the WoS database and the number of citations of these publications can be interpreted as a quality indicator [12]. Although there are numerous articles that evaluated the bibliometry for different specialties and subspecialties, we were unable to find a study about bibliometric analysis of the *Anatomy & Morphology* category in the WoS database in the literature.

On the other hand, Tellioglu et al. [41] reported that most of the publications of Turkish Anatomists were published in *Surg Radiol Anat* between 2000-2014, with a rate of 27%. Similarly, Gürses et al. [42] examined the publication rates of oral and poster presentations in 2007 and 2008 national anatomy congresses in Turkey and determined that the most preferred journal is *Surg Radiol Anat*. In this study, it was seen that the most preferred journal was *Surg Radiol Anat*, similar to these two studies [41, 42].

In the study conducted by Petekkaya [10], it was reported that the articles in the anatomy field showed a significant increase, especially between 1997-2010. In the present study, it was determined that there was a great positive relationship between the years and the number of publications annually. Many reasons, such as an increase in the number of academicians, the number of medical faculties, and changes in the academic promotion criteria in Turkey in the anatomy field, maybe the reasons for this situation.

Although it is considered as the most reliable database, it is known that document types are not sufficient in WoS database [43]. As a matter of fact, when the journals in the *Anatomy & Morphology* category are examined in the WoS database, it is determined that there is no study design as a case report. On the other hand, it is seen that some studies published as an original article in journals in the *Anatomy & Morphology* category, they are scanned as reviews in the WoS database [44, 45]. The criteria of the WoS database in this regard are as follows; any article containing more than 100 references and articles whose titles contain the word “review” or “overview” are coded as a review [46]. For this reason, the full texts of 1461 publications were examined in order to obtain the more precise information and to classify the publications in detail. These publications were classified according to both study types, which were defined by the National Library of Medicine’s (NLM) MeSH database [14] and categories in the journals evaluated.

It is known that the reviews had higher average numbers of citations than original articles [46], as determined in this study. Notwithstanding, it is noteworthy that there are very few numbers of reviews in the field of anatomy (1.03%). Kramer et al. [47] reported this rate as 13.2% in the bibliometric analysis of traumatic dental injuries in the primary dentition. Hafez et al. [48] stated this rate as 6.8% in the bibliometric analysis of six major psychiatry journals. On the other hand, the rate of the case reports was found as 33.6% in the study of Kramer et al. [47] and as 4.8% in the study of Hafez et al. [48]. In this study, the rate of case reports was found to be 12.59%. Differences in these rates suggest that the distribution of study designs varies for different areas.

Petekkaya [10] reported that the majority of the top 100 most cited articles in the anatomy field consisted of experimental studies. In this study, contrary to Petekkaya [10], it was found that most of the studies were radiological anatomy studies. Undoubtedly, there are many reasons for this situation. The probable reason for this situation is the increase in radiological anatomy studies, especially in recent years. Additionally, in recent years the importance and place of cadavers in the field of medicine have become a subject of discussion [4]. The number of cadaver studies has not increased, maybe due to the number of people donating their bodies is very low in many countries, including Turkey, while the development of technology has led to an increase in radiologic studies. Although cadaver studies are examined by years, it is observed that there is no correlation. However, it is seen that the highest number of studies was between 2004-2010 and gradually decreased in the following years. Despite the increase in radiologic and experimental animal studies, we think that this decline in cadaver studies is alarming.

On the other hand, in Turkey, the establishment of the universities that have the highest number of publications in *Anatomy & Morphology* category generally is known to be older than other universities. In addition, it has been observed that these universities have more publication requirements for academic assignment criteria [49]. The first two universities, Ankara University and Hacettepe University, with the highest number of publications of this field are the most prominent examples of this situation.

**Limitations**

Although the articles in the WoS database published before 2019 was scanned, the journals that were not active in 2019 could not be included in the study due to the inaccessibility of current data about these journals. Another limitation of this study is that the scanned 21 journals in the *Anatomy & Morphology* category in the Web of Science database published not only anatomical studies but also studies from the other fields. In fact, there were publications in the field of pathology and zoology in the first 25 articles with the most citations. The reason for this is that the types of articles accepted by some of these journals were from different scientific fields. Despite this limitation, we believe that the findings obtained in this study will be very useful in the field of anatomy.

**CONCLUSIONS**

A large amount of the articles conducted by researchers at institutions from Turkey and indexed in SCI-E of the WoS database in the category of *Anatomy & Morphology* were published in *Surg Radiol Anat*. In addition, it has been determined that the total number of articles, especially the radiological studies, has increased significantly over the years. The increase in the number of scientific studies in the field of anatomy is important in terms of the contribution of Turkey to literature in this area. With this study to examine the articles originated from Turkey in the anatomy field and determination of research trends of authors is thought to be guiding the work to be done in this area.

**Conflict of interest**

The authors declare that they have no conflicts of interest.

**Main points:**

It has been found that the total number of articles in the field of *Anatomy & Morphology*, especially radiological studies, has increased significantly over the years.

With this study to examine the articles originated from Turkey in the anatomy field and determination of research trends of authors is thought to be guiding the work to be done in this area.

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**FIGURE LEGENDS**

**Fig. 1.** Distribution of publications from Turkey by the journals

**Fig. 2.** Word co-occurrence network built using words present in titles and abstracts of publications

**Fig. 3.** Distribution of published articles by the years

**Fig. 4.** Collaboration map of universities in Turkey

**Fig. 5.** Collaboration map in the publications with Turkey and other countries

**Fig. 6.** Distribution of citations by years

**Fig. 7.** Distribution of the radiological, experimental animal and cadaveric studies by years