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ORIGINAL ARTICLE

Academic Productivity of Cardiologists Working as Faculty Members in Universities in Turkey: A Bibliometric Analysis Study

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Abstract

Introduction: Bibliometric studies are important for the evaluation of academic productivity. The aim was to investigate the academic productivity of cardiologists working as university faculty members in Turkey in terms of the number of publications, number of citations, and h-indices, and to examine the relationship of these metrics with academic title and gender.

Methods: Cardiologists working as a professor, associate professors, assistant professors, and lecturers in cardiology departments in universities in Turkey were determined using the Council of Higher Education Academic Search platform. A number of publications and citations, and h-indices of the cardiologists were obtained from the Scopus database.

Results: Data from 760 cardiologists were analyzed in the study. Eighty-four percent of the cardiologists were male (n=639). Of the cardiologists, 51.1% were professors (n=388), 21.6% were associate professors (n=164), 23.4% were assistant professors (n=178), and 3.9% were lecturers (n=30). Associate professor ratio in women (12.4%) was about half of that in men (23.3%). There were significant differences among the titles with regard to the total number of publications and citations, and the h-indices (all $p<0.001$). The median number of publications and citations, and h-index was highest among professors, while they were followed by associate professors in all three variables. There was no significant difference between the assistant professors and lecturers in terms of all metrics ($p>0.05$). In comparisons by gender, the number of publications and citations, and the h-indices was significantly higher in male associate and assistant professors than in female counterparts ($p<0.05$).

Discussion and Conclusion: Academic productivity of cardiologists working in cardiology departments at universities in Turkey is presented using the metrics of number of publications and citations, and h-indices. It was determined that academic productivity increases as the title increases. Most of the cardiologists were male. The academic productivity of male cardiologists among associate and assistant professors was higher than their female counterparts.

Keywords: Academic performance; bibliometrics; cardiology; gender.

Bibliometric studies are important for the evaluation of academic productivity[1,2]. In general, academic productivity is evaluated by the number of publications and citations[3-6]. However, these two metrics have some limitations. A researcher may have many publications. However, these publications may receive few citations for several reasons such as language of the paper, journal impact factor, open-access policy of the journal, international coop-

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eration, country of the origin of the paper, and statistical power of the paper of the interest[7-10]. In this case, it can be interpreted that this person's publications are not influential. On the other hand, another researcher may have few but important publications are cited widely, such as guidelines. Due to the small number of publications, this researcher can be interpreted as having low academic productivity. To eliminate these limitations, the h-index was introduced by Jorge Hirsch as a tool for measuring the quantity and quality of an individual's research productivity[11]. Although there are different metrics, the h-index is one of the most widely used and accepted metrics[3,4].

Academic productivity metrics are important for decisions about assignment, reassignment, and promotion[12]. There are many studies evaluating the academic productivity of academics working in various fields of medicine[12-16]. In general, as the title increases, academic productivity also increases[17]. To the best of our knowledge, there was no study evaluating the academic productivity of cardiologists working in the cardiology departments in the universities in Turkey according to title and gender. Although the representation of women in the academic medical community has increased in the past 50 years, gender inequality remains a significant problem[18,19]. It is not known whether there are similar gender differences in the field of cardiology in our country.

The aim of this study was to investigate the academic productivity of cardiologists working in cardiology departments in all the state and foundation universities in Turkey with academic titles as professor, associate professor, assistant professor, and lecturer with regard to the number of publications, the number of citations, and the h-indices, and to examine the relationship of these metrics with academic title and gender.

Materials and Methods

This study was approved by the Non-Interventional Research Ethics Committee of Dokuz Eylül University on October 27, 2021, with the decision number: 2021/30-28. The process of obtaining the data was carried out between October 28, 2021, and November 2, 2021. The data were obtained using the Council of Higher Education Academic Search platform (YÖK Akademik, https://akademik.yok.gov.tr/AkademikArama/). First, registered faculty members in the basic field of "Health Sciences" and "Cardiology" were determined using the advanced search function. Among these faculty members, residents, and fellows and those who did not work in the "Department of Cardiology" were excluded. Since there was a possibility that some faculty members have profiles not including major research field in the Council of Higher Education Information System (YÖKSİS), all universities with a medical faculty were manually screened. During this screening, the filter of "Faculty of Medicine>Department of Internal Medical Sciences" was applied, and faculty members working in the "Department of Cardiology," which were not included in the previous list, were identified. In the screening process, 821 faculty members were reached. Although 40 of them stated "cardiology" as their specialty, they were not working in the cardiology department, and seven of them were working in the Turkish Republic of Northern Cyprus. These 47 faculty members were excluded from the study. The profiles of the remaining 774 faculty members were screened in the Scopus database. Despite a notable increase in bibliographic data sources and metrics available over the last decade, the Web of Science and Scopus databases are still the two main and most comprehensive sources of publication search[20]. However, the Scopus database was considered to be more suitable for evaluating research results as it has a more comprehensive content compared to the Web of Science [20]. For this reason, the Scopus database was preferred as the search source in this study. Data on the total number of publications, the total number of citations, and the h-indices were obtained from the Scopus database. In the screening process, 13 people with a common profile due to same name-surname and one person having uncertain data due to the name similarity of a researcher from a different academic field were excluded from the study. Profile information with the highest h-index of researchers with multiple profiles due to institution and/or surname change was included in the study. As a result, the data obtained from the profiles of 760 faculty members were analyzed. The details of obtaining the data were presented in the flowchart (Fig. 1).

Statistical Analysis

IBM SPSS Statistics for Windows (Version 25.0. Armonk, NY: IBM Corp) was used for the statistical analysis. The normality of data was evaluated by the Kolmogorov–Smirnov test. Non-normally distributed continuous variables were reported as median (Q1 quartile-Q3 quartile) values. Categorical variables were presented with numbers and percentages and compared using the Chi-square (χ^2) test. The Mann–Whitney U-test was used to compare differences between two independent groups when the variable was continuous. The Kruskal–Wallis H test was employed to analyze the data of three or more independent groups'

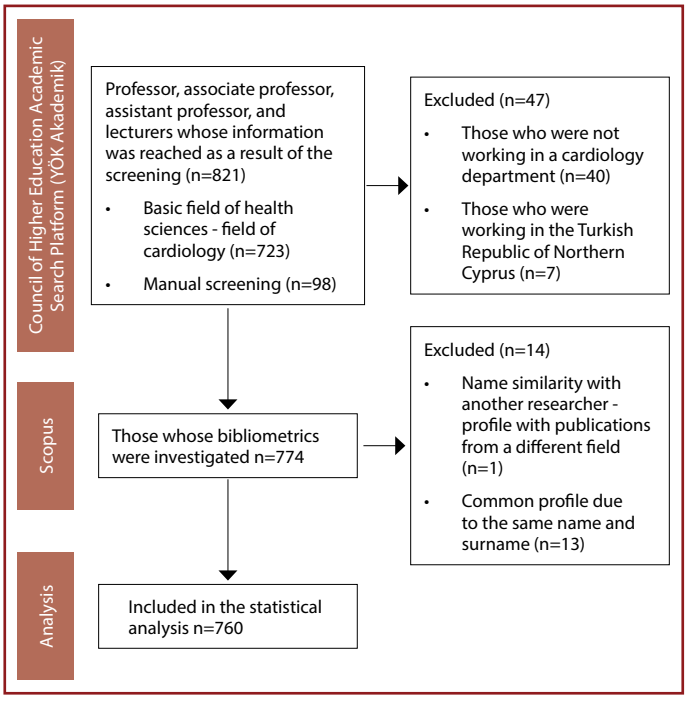

Figure 1. Study of flowchart.

measurements, and Dunn's test was used for pairwise comparisons. The results were assessed at p<0.05 significance level. Adjusted p-values were presented for pairwise comparisons.

Results

In the study, the data of 760 cardiologists were analyzed. Eighty-four percent of the cardiologists were male (n=639). Of the cardiologists, 51.1% were professors (n=388), 23.4% were assistant professors (n=178), 21.6% were associate professors (n=164), and 3.9% were lecturers (n=30). A statistically significant difference was found when the distribution of academic titles by gender was evaluated (p=0.037). About 58.7% of women were professors, and 49.6% of men were professors. Associate professor ratio in women (12.4%) was about half of that in men (23.3%). About 23.5% of men and 23.1% of women were assistant professors. About 5.8% of women and 3.6% of men were lecturers. Title comparisons by gender are presented in Table 1.

There were statistically significant differences among the titles in terms of the total number of publications, the total number of citations, and the h-index (all p-values were <0.001) (Table 2). As expected, the median number of publications, citations, and h-indices was highest among professors followed by associate professors in all three variables (Fig. 2). In the post hoc comparison, professors had a significantly greater number of publications and citations and h-indices than associate professors, assistant professors, and lecturers (all p-values were<0.001). Associate professors had significantly higher numbers in all three metrics than the assistant professors and lecturers (all p-values were<0.001). On the other hand, there was no significant difference between the assistant professors and lecturers with respect to the number of publications, citations, and h-indices (all p-values were>0.05). Details are presented in Table 2.

In comparisons by gender, the number of publications, citations, and h-indices median values was significantly higher in male associate professors than in female counterparts (p=0.038, p=0.003, and p=0.001; respectively). The number of publications, number of citations, and h-indices median values of the male assistant professors were also significantly higher than those of the females (p=0.019; p=0.030, and p=0.032; respectively). There was no statistically significant difference in the number of publications, the number of citations, and h-indices between male and female in professors and lecturers (p>0.05). The number of publications, citations, and h-index comparisons by gender is presented in Table 3.

Discussion

Bibliometric studies are important in terms of evaluating academic productivity and revealing the current state of the field of science[1-6]. Although the number of publications and citations is generally used to evaluate academic

Table 1. Comparison of titles according to sex

	Title				Total, n (%)	p*
	Prof., n (%)	Assoc. Prof., n (%)	Assist. Prof., n (%)	Lecturer, n (%)		
Sex						
Male	317 (49.6)	149 (23.3)	150 (23.5)	23 (3.6)	639 (100)	**p=0.037**
Female	71 (58.7)	15 (12.4)	28 (23.1)	7 (5.8)	121 (100)	
Total	388 (51.1)	164 (21.6)	178 (23.4)	30 (3.9)	760 (100)	

*Chi-square test; Prof.: Professor; Assoc. Prof.: Associate professor; Assist. Prof.: Assistant professor.

Table 2. Comparison of medians of publication, citation, and h-index according to titles

Variable	Title	Median (Q1-Q3)	p*	Post hoc comparisons
Total publication	Prof.	57.0 (40.3–87.0)	**p<0.001**	Prof.>Assoc. Prof. (p<0.001)
	Assoc. Prof.	42.5 (31.0–61.0)		Prof.>Assist. Prof. (p<0.001)
	Assist. Prof.	15.0 (7.8–29.0)		Prof.>Lecturer (p<0.001)
	Lecturer	15.0 (6.8–28.8)		Assoc. Prof.>Assist. Prof. (p<0.001)
				Assoc. Prof.>Lecturer (p<0.001)
Total citation	Prof.	582.5 (352.0–1221.5)	**p<0.001**	Prof.>Assoc. Prof. (p<0.001)
	Assoc. Prof.	247.5 (151.5–410.5)		Prof.>Assist. Prof. (p<0.001)
	Assist. Prof.	53.0 (23.5–134.5)		Prof.>Lecturer (p<0.001)
	Lecturer	39.5 (16.8–132.0)		Assoc. Prof.>Assist. Prof. (p<0.001)
				Assoc. Prof.>Lecturer (p<0.001)
h-index	Prof.	13.0 (10.0–16.0)	**p<0.001**	Prof.>Assoc. Prof. (p<0.001)
	Assoc. Prof.	9.0 (7.0–11.0)		Prof.>Assist. Prof. (p<0.001)
	Assist. Prof.	4.0 (2.0–6.0)		Prof.>Lecturer (p<0.001)
	Lecturer	3.0 (2.0–7.0)		Assoc. Prof.>Assist. Prof. (p<0.001)
				Assoc. Prof.>Lecturer (p<0.001)

*Kruskal–Wallis test; Q1: Quartile 1; Q3: Quartile 3; Prof.: Professor; Assoc. Prof.: Associate professor; Assist. Prof.: Assistant professor.

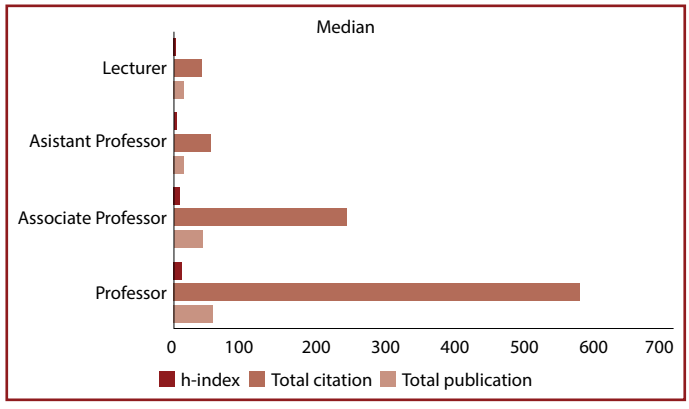

Figure 2. Number of publications, citations, and h-indices according to the academic title.

productivity, the h-index, which aims to eliminate the limitations of the other two metrics, is also widely used[3,4,11]. In this study, the academic productivity of cardiologists working as a faculty member in the cardiology departments in universities in Turkey was investigated in terms of the number of publications, number of citations, and the h-index, and the relationship of these metrics with title and gender was examined. In general, as the title increases, the academic productivity of the individuals also increases. A recent meta-analysis involving the data of 14,567 academic physicians revealed that the mean of the h-indices was 5.2 for assistant professors, 11.2 for associate professors, and 20.8 for professors[17]. In our study, the median of the h-indices was 3 for lecturers, 4 for assistant professors, 9 for associate professors, and 13 for professors. In our study, in concordance with the meta-analysis results, it was determined that the h-index increased significantly as the title increased. However, there was no significant difference between the assistant professors and lecturers with regard to the h-index, number of citations, and number of publications.

Gender differences remain a significant problem in the academic medicine community[18,19]. In a systematic review and meta-analysis that included data from 10,665 physicians, the proportion of women was 24.9%, and women had a lower h-index than men in most medical specialties and all academic titles[18]. In our study, only 16% of the cardiologists were women. When the female representation rates were analyzed by title distribution, 18.3% of professors, 9.1% of associate professors, 15.7% of assistant professors, and 23.3% of lecturers were women. The number of publications, number of citations, and the h-indices were found significantly lower in female associate and assistant professors compared to their male counterparts. On the other hand, there was no difference in terms of these metrics between male and female in professors and lecturers. The gender difference observed in assistant and associate professorship, which are the most critical steps of academic progress, is quite remarkable in this study.

Another study investigating the academic productivity of 1040 Canadian cardiologists from 17 universities found that 80% of cardiologists were male[21]. The h-indices of male associate and assistant professors were found to be higher than females similar to our study. Women had a

Table 3. Comparison of publication, citation, and h-index medians of titles by sex

Variable	Title	Male Median (Q1–Q3)	Female Median (Q1–Q3)	Total Median (Q1–Q3)	p*
Total publication	Prof.	58.0 (41.0–88.0)	50.0 (28.0–78.0)	57.0 (40.3–87.0)	p=0.054
	Assoc. Prof.	44.0 (31.5–63.5)	36.0 (27.0–42.0)	42.5 (31.0–61.0)	**p=0.038**
	Assist. Prof.	16.0 (8.0–31.0)	9.5 (3.3–20.5)	15.0 (7.8–29.0)	**p=0.019**
	Lecturer	16.0 (6.0–31.0)	14.0 (7.0–19.0)	15.0 (6.8–28.8)	p=0.641
Total citation	Prof.	597.0 (354.5–1230.5)	519.0 (335.0–1022.0)	582.5 (352–1221.5)	p=0.482
	Assoc. Prof.	278.0 (158.5–422.0)	145.0 (91.0–231.0)	247.5 (151.5–410.5)	**p=0.003**
	Assist. Prof.	58.5 (26.0–134.5)	29 (7.5–129.8)	53.0 (23.5–134.5)	**p=0.030**
	Lecturer	38.0 (19.0–195.0)	41.0 (10.0–111.0)	39.5 (16.8–132.0)	p=0.572
h-index	Prof.	13.0 (10.0–16.0)	12.0 (9.0–16.0)	13.0 (10–16)	p=0.304
	Assoc. Prof.	9.0 (7.0–11.0)	7.0 (5.0–8.0)	9.0 (7.0–11.0)	**p=0.001**
	Assist. Prof.	4.0 (3.0–7.0)	3.0 (1.0–6.0)	4.0 (2.0–6.0)	**p=0.032**
	Lecturer	3.0 (2.0–7.0)	4.0 (2.0–6.0)	3.0 (2.0–7.0)	p=0.901

*Mann–Whitney U-test; Q1: Quartile 1; Q3: Quartile 3; Prof.: Professor; Assoc. Prof.: Associate professor; Assist. Prof.: Assistant professor.

lower median h-index, but women having a professor title had a higher median h-index[21]. Another study evaluated gender differences among a cohort of 3810 cardiologists working at faculties in the United States[22]. The female ratio of that study sample was found to be 16.5%. Ratio of female cardiologists working as faculty members in the United States was similar to our country. In addition, it was shown that women had fewer publications and were less likely to become professors compared to men[22].

Asghar et al.[23] examined gender differences in 11,529 articles in six leading cardiology journals. As a result of the study, it was determined that 16.5% of the first authors and 9.1% of the senior authors were women. Although the rate of women among the first and senior authors was low, it has been determined that this rate has increased over the years in the cardiology literature[23]. Our study was important in terms of determining the academic productivity in the cardiology community in Turkey. In our country, the number of female faculty members in cardiology departments was found to be less than the number of male counterparts in accordance with the world literature, and academic productivity of female associate and assistant professors was found to be lower than their male counterparts. This finding could be explained by the fact that women get stuck between their academic duties and their duties in the family and cultural expectations. Due to traditional gender roles, women take on a disproportionate responsibility for family life. Pregnancy and childbearing demand time, especially in the early part of their career[24,25]. We found that those female professor cardiologists had similar academic productivity as their male counterparts. An explanation for this finding may be that as women get older and their responsibilities in their family and children decrease, they devote more time to academic productivity[26]. We also found that there was no gender difference in academic productivity among lecturers. The fact that the title of lecturer at universities considered as the first step of the academic career, there is no obligation to have a new publication to be reassigned, and the intense work burden both in the cardiology clinic and in educational activities as the youngest faculty member may explain the low and similar academic productivity in men and women. Since our explanations about gender differences are hypothetical, more detailed research is highly warranted to determine the exact causes of gender differences in the field of cardiology in both Turkey and worldwide.

This study has some limitations. The major limitation of the study is related to the databases used in the study. Even though some faculty members have gained associate professorship title, they are not seen as associate professors in the Council of Higher Education Academic Search platform (YÖK Akademik) if they are not assigned to associate professor positions. For this reason, in our study, it may have been a cardiologist who was evaluated as an assistant professor or lecturer, although his/her title was an associate professor. Another point is that some faculty members who have determined their field of specialization as cardiology work in departments other than cardiology. These people may be cardiologists and work in another department. However, since the main aim of our study was to examine faculty members working in cardiology departments, these individuals were excluded from the study. In

addition, cardiologists working in institutions such as private hospitals were not included in the study. For these reasons, the generalizability of the results of our study to all cardiologists in Turkey is limited. The Scopus database automatically creates researcher profiles. For this reason, the profile information of some researchers may be missing or excessive (such as the addition of publications by another researcher). More than 1 researcher profile may exist in cases such as changing the working institution or surname. In such cases, although the profile with the highest h-index was included in our study, some data of these researchers may have been lost. Especially in the marriage/divorce of female faculty members, changes in surnames cause losses in profile information. It is recommended that cardiologists update their Scopus profile information to eliminate all these problems and keep a decent resume record. In addition, there are limitations in the metrics examined in our study. For example, the h-index increases over time, and it is not surprising that it is low for the faculty members early in their careers. Other limitations of the h-index are that it may be higher due to self-citation, all authors do not contribute equally for a publication, and publication effort complexity is not included in the calculation[27].

Conclusion

In this study, the academic productivity of cardiologists working at universities in Turkey is presented objectively using the metrics of the number of publications, number of citations, and h-indices. In general, it has been revealed that as the title increases, the academic productivity increases, and the academic productivity of the women who are associate and assistant professors is lower than their male counterparts. In future studies, the underlying causes of the differences identified in this study should be examined. We think that gender inequalities can be overcome by encouraging women in every field and by facilitating the difficulties of social life along with unloading extra responsibilities.

Ethics Committee Approval: Non-Interventional Research Ethics Committee of Dokuz Eylül University approved this study (data: 27.10.2021,approved number: 2021/30-28).

Peer-review: Externally peer-reviewed.

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Conflict of Interest: None declared.

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