

ORJİNAL ARAŞTIRMA ORIGINAL RESEARCH

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Analysis of Scientific Production Among Academics in Physical Medicine and Rehabilitation Departments of Medical Faculties in Türkiye Using H-Index and Bibliometric Parameters

Türkiye’de Tıp Fakültelerinde Fiziksel Tıp ve Rehabilitasyon Ana Bilim Dallarında Görevli Akademisyenlerin Bilimsel Üretimlerinin H-İndeks ve Bibliyometrik Parametreler ile Analizi

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ABSTRACT Objective: Bibliometric studies based on the evaluation of the numbers of publications and citations and h-index values provide information on scientific production. Our study aimed at evaluating the number of publications and citations and h-index values of academics serving in physical medicine and rehabilitation (PM&R) departments of medical faculties in Türkiye as determined from the Scopus database as well as the impact of gender, institution, and title on the former parameters. **Material and Methods:** Number of publications, citations and h-index values of PM&R specialists working at university hospitals in Türkiye, as identified from the higher education academic search website and websites of universities, were determined using the Scopus database. The data were analyzed using the SPSS 24.0 software package. **Results:** Of the 431 PM&R academics included in our study, 277 (64.3%) were female and 154 (35.7%) were male. The mean number of publications of academics was 32.48±39.61, the mean number of citations was 344.44±472.60, and the mean h-index value was 7.89±5.37. Of the physicians, 231 (53.6%) were professors, 103 (23.9%) were associate professors, and 97 (22.5%) were assistant professors. Professors were found to have significantly higher mean number of publications, citations and h-index value than others (p<0.001). There was no significant difference between the mean number of publications, citation numbers and h-index values of male and female PM&R academics (p=0.106, p=367, p=461, p=0.275). **Conclusion:** Our study is the first in Türkiye to analyze the number of publications, citations and h-index values of PM&R specialists in academic positions in medical faculties. Our study determined that there were more female academics than male academics, male academics had a higher mean number of publications and higher mean h-index value, but there was no significant difference between the genders.

ÖZET Amaç: Yayın sayıları, atıf sayıları ve h-İndeksler değerlendirilerek hazırlanan bibliyometrik çalışmalar, bilim alanındaki üretimi gösteren çalışmalardır. Çalışmamızda, ülkemizde tıp fakültelerinde, fiziksel tıp ve rehabilitasyon (FTR) ana bilim dallarında görev alan akademisyenlerin, Scopus veri tabanı kullanılarak belirlenen yayın, atıf sayıları, h-İndeksleri ile cinsiyet, çalıştıkları kurum ve unvanın bunlara etkilerinin değerlendirilmesi amaçlanmıştır. **Gereç ve Yöntemler:** Yükseköğretim akademik arama web sitesi ve kurumların web siteleri aracılığı ile belirlenen, ülkemizde üniversite hastanelerinde çalışan akademik kadroda bulunan FTR uzmanlarının yayın sayıları, atıf sayıları ve h-İndeksleri, Scopus veri tabanı kullanılarak belirlendi. Veriler SPSS 24.0 paket programı kullanılarak analiz edildi. **Bulgular:** Çalışmamızda değerlendirilen 431 FTR akademisyeninin 277’sinin (%64,3) kadın, 154’ünün (%35,7) erkek olduğu belirlendi. FTR alanındaki akademisyenlerin Scopus veri tabanındaki yayın sayısı ortalaması 32,48±39,61, atıf sayısı ortalaması 344,44±472,60 ve h-İndeks ortalaması 7,89±5,37 olarak belirlendi. Çalışmamıza dâhil edilen PM&R akademisyenlerinin 231’i (%53,6) profesör, 103’ü (%23,9) doçent ve 97’si (%22,5) doktor öğretim üyesi olarak görev yapmaktaydı. Profesörlerin yayın sayıları, atıf sayıları ve h-İndeks ortalamaları, doçent ve doktor öğretim üyelerinden anlamlı olarak yüksek bulundu (p<0,001). Erkek ve kadın FTR akademisyenlerinin yayın sayıları, atıf sayıları ve h-İndeks ortalamaları arasında anlamlı farklılık tespit edilmedi (p=0,106, p=367, p=461, p=0,275). **Sonuç:** Çalışmamız, ülkemizde tıp fakültelerinde akademik pozisyonlarda çalışan tüm FTR uzmanlarının bilimsel üretimlerini gösteren önemli bibliyometrik parametreler olan yayın sayısı, atıf sayısı ve h-İndekslerinin değerlendirildiği ilk çalışmadır. Çalışmamızda, kadın akademisyenlerin daha fazla sayıda olduğu, erkek akademisyenlerin yayın aktiviteleri ve h-İndeks ortalamalarının daha yüksek olduğu, ancak cinsiyetler arasında anlamlı farklılık bulunmadığı tespit edilmiştir.

Keywords: Physical medicine and rehabilitation;
bibliometrics; medical faculty; h-index

Anahtar Kelimeler: Fiziksel tıp ve rehabilitasyon;
bibliyometri; tıp fakültesi; h-İndeksi

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Bibliometric analyses, which were first published in 1987 by Garfield in *The Journal of the American Medical Association* in an article titled “100 Most Cited Articles,” provide information about the impact of scientific publications and producers of science.¹ Bibliometric parameters used in bibliometric analyses are used as an indicator of academic productivity and impact. These metrics include the impact factor, h-index, Eigenfactor score, e-index, m-index, number of publications, and number of citations.²

The Hirsch index (h-index), used in the academic world, is determined by how often a publication is cited and is defined as the number of papers (h) of a researcher cited at least h times.³ At the same time, the h-index is said to be one of the best bibliometric measures as it aims to determine both the quantity and quality of scientific output in the publications of a researcher. Developed by Jorge Hirsch in 2005, the index has been used as a reasonable indicator of academic output in rehabilitation medicine.⁴ On the other hand, studies have shown that the use of h-index is limited by the fact that it is affected by self-citation.⁵ However, a recent study noted that the h-index contributes to advancement, value increase, and grant support, independent of the criticisms and discussions about bibliometrics.⁶

The issue of gender inequalities in academic medicine has a long history. Despite an increase in the number of women in medical faculties, inequalities persist in advancement and leadership positions.⁷ In 2019, the Association of Academic Medical Colleges stated that 34.7% (n=3,083) of physical medicine and rehabilitation (PM&R) specialists were women.⁸ Again, in 2019, it was reported that 15.9% of 63 chair positions in PM&R departments in medical faculties in the United State (US) belonged to women.⁹

Some studies have shed light on gender inequality in the field of PM&R.¹⁰⁻¹³ Wagner et al. reported that female rehabilitation doctors in the US considered themselves less talented than their male colleagues were.¹⁰ They reported that being a woman was a disadvantage for academic advancement, leadership opportunities, and salaries. Hwang et al. noted that women were underrepresented in associate and

full professorship positions in PM&R in the US.¹¹ Silver et al. have reported that female doctors in the field of PM&R have not received recognition awards from PM&R societies for a long time.¹² The Association of Academic Physiatrists Women’s Task Force Report published in 2018 mentioned difficulties women experienced in several areas including leadership positions, recognition awards, being a journal editor, and conference participation.¹³

Previous studies in some countries have reported the impact of gender and academic titles on bibliometric parameters and h-index and the existence of a gender gap in academia.^{14,15} Our literature review found several studies conducted in different countries that investigated the h-index of PM&R specialists working as academics based on the Scopus database and bibliometric data, but there were none in Türkiye.

Our study aimed to analyze the number of publications, the total number of citations, the total number of cited publications, and the h-index, as extracted from the Scopus database, for all PM&R specialists holding academic titles in PM&R departments in Turkish medical faculties. In addition, the impact of the institution, title, and gender on the aforementioned parameters were to be analyzed.

MATERIAL AND METHODS

After getting approval from the Non-interventional Ethics Committee of Dokuz Eylül University Faculty of Medicine (date: November 03, 2021, no: 2021/31-11), the academic search engine of the Council of Higher Education (<https://akademik.yok.gov.tr/AkademikArama/>) and public official websites of public and private universities were screened on November 15, 2021 to identify PM&R specialist doctors still working at a higher educational institution. This resulted in a list of all the PM&R experts holding academic titles at universities in Türkiye. Various data relating to the PM&R specialists included in the data analysis were recorded in line with other studies in the literature, including their academic titles-classified as professors, associate professors, assistant professors, and lecturers-gender, and whether they were heads of department at the time of the screening.^{16,17} Missing gender data were identified via Google and LinkedIn

(Microsoft, United States of America).¹⁸ Lecturers, retired faculty members, research assistants, and research fellows whose academic positions could not be determined exactly were excluded from the study. The h-index, number of publications, and number of citations of each faculty member were recorded using the Scopus database as referenced in similar studies.¹⁶⁻¹⁹ This study was conducted in accordance with the principles of the Declaration of Helsinki.

The clinics where academics worked were classified as clinics located in metropolitan provinces and clinics located in the west and east of the capital Ankara. The types of institutions were classified as universities of health sciences, other public universities, and private universities.

STATISTICAL ANALYSIS

The SPSS 24.0 (IBM, United States of America) statistical package was used for statistical analysis. Frequency data were expressed as number and percentage (n, %), continuous variables as mean \pm SD, median (minimum-maximum). The chi-square test was used in the analysis of frequency data. In the analysis of continuous data, the Kolmogorov-Smirnov test was used to determine whether the data were normally distributed. The test showed that the data were not normally distributed. The Kruskal-Wallis test and the Mann-Whitney U test were used for data analysis. A p-value less than 0.05 was accepted as a significant difference.

RESULTS

The mean number of publications of 431 PM&R specialists included in the analysis, as detected from the Scopus database, was 32.48 \pm 39.61, with the median value being 26 (1-617); the mean number of citations being 344.44 \pm 472.60, with the median value being

213 (0-4412); and the mean h-index value being 7.89 \pm 5.39, with its median value being 7 (0-29).

Of the PM&R experts included in our study, 231 (53.6%) were professors, 103 (23.9%) were associate professors, and 97 (22.5%) were assistant professors.

Of the PM&R specialists who met the inclusion criteria and worked in higher educational institutions, 277 (64.3%) were female and 154 (35.7%) were male. Of the female academics, 157 (56.7%) were professors, 67 (24.2%) were associate professors, 53 (19.1%) were assistant professors. Of the male academics, 74 (48.1%) were professors, 36 (23.4%) were associate professors, and 44 (28.6%) were assistant professors.

Although there were more female professors, associate professors, and assistant professors than their male counterparts, there was no statistically significant difference (p=0.070, chi-square test) (Table 1). Fifty (18.1%) of the female academics and 34 (22.1%) of the male academics were heads of department (p=0.312, chi-square test).

The types and locations of the institutions where the academics served are given in Table 2.

The mean number of publications and citations and mean h-index value of professors were found to be significantly higher than those of associate professors (p<0.001, p<0.001, p<0.001, respectively, Mann-Whitney U test) and assistant professors (p<0.001, p<0.001, p<0.001, respectively, Mann-Whitney U test) (Table 3).

The mean number of publications and citations and the mean h-index value of associate professors were found to be significantly higher than those of assistant professors (p=0.002, p=0.063, p<0.001, respectively, Mann-Whitney U test) (Table 3).

TABLE 1: Distribution of academic titles by gender.

	Female	Male	Total
Professor	157 (36.4%)	74 (17.2%)	231 (53.6%)
Associate professors	67 (15.5%)	36 (8.4%)	103 (23.9%)
Assistant professors	53 (12.3%)	44 (10.2%)	97 (22.5%)
Total	277 (64.3%)	154 (35.7%)	431 (100%)

Chi-squared test; p<0.001.

TABLE 2: Types and locations of institutions where academics worked.

	Professor (n,%)	Associate professors (n, %)	Assistant professors (n, %)	p value
Locations of the Institutes				
Metropolitan cities	144 (62.3%)	54 (52.4%)	28 (28.9%)	0.001
Non-metropolitan cities	87 (37.7%)	49 (47.6%)	69 (71.1%)	
Clinics located in the west of Ankara	191 (82.7%)	77 (74.8%)	58 (59.8%)	0.001
Clinics located in the east of Ankara	40 (17.3%)	77 (25.2%)	58 (40.2%)	
Institution type				
University of health sciences	48 (20.8%)	17 (16.5%)	4 (4.1%)	0.005
Other public universities	150 (64.9%)	72 (69.9%)	74 (76.3%)	
Private universities	33 (14.3%)	14 (13.6%)	19 (19.6%)	

p<0.05; bold character statistically different.

TABLE 3: Number of publications, number of citations, and h-index value in the field of physical medicine and rehabilitation by academic title and gender, as determined from the Scopus database.

	Female			Male			Total		
	Number of publication	Number of citation	H-index	Number of publication	Number of citation	H-index	Number of publication	Number of citation	H-index
Professor	41.35±26.27*	502.30±500.54*	10.36±4.64*	57.08±71.01	664.68±611.31	12.55±4.89	46.38±46.07 [^]	554.32±542.50 [^]	11.06±4.82 [^]
	37 (1-188)	386 (0-4412)	11 (0-24)	43.50 (12-617)	545.50 (108-3894)	12 (5-29)	40 (1-617)	438 (0-4412)	11 (0-29)
Associate professors	20.95±15.24**	155.80±184.28**	5.71±3.41**	32.72±38.54	185.11±295.08	6.33±3.63	25.06±26.30'	166.04±228.14	5.93±3.49'
	18 (1-87)	92 (0-1159)	5 (0-19)	22 (3-241)	36 (4-1748)	6 (1-22)	21 (1-241)	96 (0-1748)	6 (0-22)
Assistant professors	6.24±5.40	30.73±53.91	2.15±1.75	8.50±7.22	38.04±46.01	2.70±1.65	7.26±6.36	34.05±50.36	2.40±1.72
	4 (1-20)	12 (0-270)	2 (0-7)	6 (1-30)	25 (0-263)	3 (0-8)	5 (1-30)	17 (0-270)	2 (0-8)
Total	29.70±25.54	328.26±437.87	7.67±5.14	37.50±56.51	373.53±529.65	8.28±5.82	32.48±39.61	344.44±472.60	7.89±5.37
	25 (1-188)	209 (0-4412)	7 (0-24)	27 (1-617)	226 (0-3894)	7 (0-29)	26 (1-617)	213 (0-4412)	7 (0-29)

*:p<0.05 Mann-Whitney U test between female and male academics in professorship positions; **:p>0.05 Mann-Whitney U test between female and male academics in associate professorship positions; †:p<0.05 Mann-Whitney U test between professors and associate professors; [^]:p<0.05 Mann-Whitney U test between professors and assistant professors; †':p<0.05 Mann-Whitney U test between associate professors and assistant professors.

According to the Scopus database, the mean number of publications of female PM&R specialists was 29.70±25.54, the mean number of citations was 328.26±437.87, and the mean h-index value was 7.67±5.14. For male PM&R specialists, the mean number of publications was 37.50±56.51, the mean number of citations was 373.53±529.65, and the mean h-index value was 8.28±5.82 according to the Scopus database. No significant difference was found between male and female PM&R specialists in terms of mean number of publications, mean number of citations, and mean h-index value (p>0.05 Mann-Whitney U test) (Table 3).

According to the Scopus database, mean number of publications (p=0.015, Mann-Whitney U test), mean number of citations (p=0.049, Mann-Whitney U test),

and mean h-index value (p=0.046, Mann-Whitney U test) of male PM&R specialists in professorship positions were found to be significantly higher than those of female PM&R specialists in professorship positions (Table 3).

There was no significant difference between the mean number of publications and citations and the mean h-index values of male and female PM&R specialists in associate professorship (p=0.086, p=0.590, p=0.405, Mann-Whitney U test) positions and assistant professorship positions (p=0.091, p=0.473, p=0.479, Mann-Whitney U test) (Table 3).

A significant difference was found between genders in terms of working in metropolitan provinces and in the west of the capital Ankara (p<0.001). A higher

proportion of female academics were found to work in the west of Ankara and in metropolitan cities.

A significant difference was found between academics with different titles in terms of working in metropolitan provinces and in the west of the capital Ankara ($p<0.001$). A higher proportion of professors were found to work in the west of Ankara and in metropolitan cities.

A statistically significant difference was found when we grouped the institutions as universities of health sciences, which constituted the majority of public universities, other public universities, and private universities and evaluated them in connection with title ($p=0.005$).

Our study compared the publication activities of the academics working at private and public universities and found that the number of publications and citations and the h-index parameters were significantly higher for academics working at public universities ($p<0.001$, $p=0.001$, $p=0.001$) (Table 4).

When universities of health sciences and other universities, where the academic PM&R experts included in the study worked, were compared in terms of number of publications, number of citations, and h-index, no significant difference was found ($p=0.055$, $p=0.551$, $p=0.168$, Mann-Whitney U test) (Table 4). Our study found the number of publications and ci-

tations were significantly higher for academics working in metropolitan cities than they were for those working in other cities ($p=0.001$, $p=0.031$, Mann-Whitney U test) (Table 5).

In our study, no significant relationship was found between the total number of publications and citations and the h-index values between the academicians who are the head of the department and other academicians ($p=0.842$, $p=0.226$, $p=0.185$, Mann-Whitney U test) (Table 5). A significant relation was found between academic titles and being the head of a department ($p=0.001$). It was found that 26% of the academics in professorship positions were acting as heads of department (Table 6).

DISCUSSION

Gender gaps have become an increasingly important issue in academic medicine. Although there are now more female academics than there were earlier, it is reported that they have lower rates of publication and that their academic advancement is slower than that of male academics.²⁰ Again, Reed et al. stated that because leadership positions in clinics were preferably awarded to academics with higher publication rates, female academics were less likely to become heads of clinics.²¹ In PM&R, women are relatively better represented than they are in other fields.¹⁰ However, there remain differences between male and female

TABLE 4: Number of publications, number of citations, and h-index value in the field of physical medicine and rehabilitation by institution.

	Public universities	Private universities	p value	Universities of health sciences	Other universities	p value
Number of publication	34.48±42.17	21.45±16.52	0.001>	38.86±31.25	31.27±41.48	0.055
Number of citation	365.83±499.20	226.16±255.49	0.001	323.28±273.54	348.47±501.84	0.551
H-index	8.20±5.51	6.13±4.32	0.001	8.57±4.25	7.75±5.58	0.168

$p<0.05$; Mann-Whitney U test; bold character statistically different.

TABLE 5: Number of publications, number of citations, and h-index value in the field of physical medicine and rehabilitation by academics who were heads of department and working in metropolitan cities.

	Academics who were heads of department	Other academics	p value	Academics working in metropolitan cities	Academics working in other cities	p value
Number of publication	45.63±25.25	46.65±51.48	0.842	38.15±49.21	26.24±23.70	0.001
Number of citation	640.40±680.37	524.12±483.73	0.226	390.69±527.90	293.45±398.05	0.031
H-index	11.80±4.99	10.81±4.75	0.185	8.34±5.17	7.39±5.60	0.070

$p<0.05$; Mann-Whitney U test; bold character statistically different.

TABLE 6: The relationship between being the head of the department according to the academic title.

	Academics who were		p value
	heads of department	Other academics	
Professor	60 (26%)	171 (74%)	0.001
Associate professors	14 (13.6%)	89 (86.4%)	
Assistant professors	10 (10.3%)	87 (89.7%)	
Total	84 (19.5%)	347 (80.5%)	

p<0.05; Mann-Whitney U test; bold character statistically different.

physiatrists in terms of number of publications, citation rates, and h-index parameters. This study, as previously stated in the literature, aimed at determining gender differences among PM&R academics in Türkiye and correlations between institutions, publication activity, and leadership positions.¹⁸

In this study, we analyzed the bibliographic data relating to specialist doctors working as academics in PM&R departments of medical faculties in Türkiye and related factors. We found that there were 431 PM&R specialists working in academic institutions in Türkiye; more female academics in professorship, associate professorship, and assistant professorship positions than their male counterparts; and no significant difference in the distribution of academic titles of PM&R specialists by gender. There were more female heads of department than their male counterparts but without any significant difference. There was no significant difference between male and female PM&R specialists in terms of mean number of publications and citations and the mean h-index values. Gender and academic titles had an impact on bibliographic parameters.

The parameters frequently used in academic evaluation include the number of publications and citations and h-index parameters. Pfirmann et al. found the h-index to be closely correlated with factors such as career achievement, obtaining leadership positions, and receiving grants.²² Pagel et al. stated that an increase in h-index, number of publications, and total number of citations was correlated with a higher academic title.¹⁵ Similarly, statistical evaluations in our study found that as the academic title progressed, the number of publications and citations and h-index parameters increased significantly in parallel.

Our study analyzed publication activities for female and male PM&R specialists and found that the average number of publications and citations and average h-index of female PM&R specialists were lower than those of male PM&R specialists, albeit with no statistically significant difference. Yang et al. evaluated 1,045 PM&R academics working in the US and Canada in 2019 and stated that male academics were more likely to have a higher h-index.¹⁸ In addition, they found the median value of the h-index to be 5 for male academics and 4 for female academics, which they interpreted as comparable, and they stated that women were not at all inferior to men in academic performance. Bastian et al. found that there was no significant difference between the h-index values of men and women in the field of orthopedics.²³ The results obtained by Chauvin et al. indicated the same in the field of psychiatry.²⁴ Our findings are consistent with the literature in this regard. Considering that female academics focus on their family roles in their late 20s and 30s, it can be hypothesized that they achieve equality by spending more time on academic activities than male academics do when they are not away from work.

It is stated in the literature that women progress more slowly in academic levels and have a lower rate of publications.^{20,21} Yang et al. reported that male academics in the US and Canada were significantly over-represented (73.08%) in all leadership positions in the field of PM&R.¹⁸ In our study, however, no significant relationship was found between gender and clinical leadership (position as heads of department). This can be explained by the fact that male academics in the field of PM&R constitute 62.49% of the total number in the US and Canada, and a lower percentage, exactly 35.7% of the total number in Türkiye. In the literature, it has been reported that women are at a disadvantage because leadership positions are often awarded to academics with higher rates of publications.²¹ It is positive that women frequently represent leadership positions in PM&R in Türkiye and that leadership positions do not vary significantly on the basis of gender. It can be argued that clinics have a great responsibility-providing equal opportunities of leadership to women and men.

Our study examined the number of publications and citations and h-index parameters in connection with the institutions where the academics worked and found no significant difference between universities of health sciences, which are the type of university with the highest number of academics, other public universities, and private universities. Similar rates of publications can be attributed to the fact that universities are multidisciplinary in structure and are highly research-oriented. When the publication activities of academics in private and public universities were compared in our study, it was observed that the number pertaining to publications, citations, and h-index parameters were significantly higher for academics in public universities. This can be explained by the fact that public universities have a more favorable environment for academic development and do not nurture commercial concerns. De la Flor-Martínez et al. stated that, in dentistry departments, public universities had higher rates of publication and higher h-index values than private universities in Spain, while Gast et al. stated that among cosmetic surgeons, those who completed their resident programs at private universities had lower h-index values than those who completed the resident program at public universities.^{25,26} Our study is similar to extant studies in the literature in that regard and suggests that studies be conducted to reveal differences in publication activities between those who get their PM&R specialization from private universities and those from public universities in Türkiye.

STUDY LIMITATIONS

Our study has some limitations. The websites from which we extracted data may contain inaccurate or incomplete data. In addition, the surnames of female academics may change after marriage. Therefore, publications were checked on the public websites of institutions as well as on the Scopus database to determine the number of publications, h-index values, or academic parameters before and after surname change.

CONCLUSION

In conclusion, our study is the first to analyze the number of academics working in PM&R departments in medical faculties in Türkiye, their gender distribution, academic titles, leadership positions, number of publications, number of citations, and h-index values in the Scopus database. Our study found that there were 431 PM&R specialists with academic positions at university hospitals in Türkiye, there were more female professors, associate professors, and assistant professors specialized in PM&R than their male counterparts, but there was no significant difference between genders. It was found that male academics had higher number of publications and citations and h-index values than female academics but that there was no significant difference between genders. The number of publications and citations and h-index values were found to have an impact on the academic titles of PM&R specialists and on the institutions they worked for.

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Conflict of Interest

No conflicts of interest between the authors and / or family members of the scientific and medical committee members or members of the potential conflicts of interest, counseling, expertise, working conditions, share holding and similar situations in any firm.

Authorship Contributions

This study is entirely author's own work and no other author contribution.

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