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Research Article

Gender disparity in academic radiology in Turkey: Where are we now?

Türkiye'de akademik radyolojide cinsiyet eşit(siz)liği: Nerede duruyoruz?

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Abstract

Aim: The study aims to summarize the gender distribution in academic radiology departments in Turkey and analyze the relationships between gender and academic rank, research productivity, and leadership positions.

Material and Methods: In this cross-sectional study, the Council of Higher Education academic search database was used to identify academic radiologists in Turkey. Each radiologist's gender, academic rank, years of active research, and research productivity metrics (number of publications and citations, h-index) were recorded from the Scopus database. The m-index, which is calculated by dividing the h-index by the number of years of active research, was also recorded. An Internet search was conducted to identify the leadership positions of academic radiology departments and radiology societies.

Results: Overall, 653 academics (professor n=292; associate professors n=211; assistant professors n=150) were identified from the database; 642 academics with reliable research productivity parameters were enrolled in the study. There were fewer female academics (n=245) than male peers ($\chi 2$ =35.988, $p<0.001$). Regarding academic ranking, men were higher in all groups, and female representation decreased as academic rank increased. Overall number of publications ($p<0.001$), number of citations ($p<0.001$), h-index ($p<0.001$), and active years of research ($p<0.001$) of female academics were significantly lower than male counterparts. The m-index did not differ significantly between male and female academics ($p=0.492$). There was no difference between genders in terms of m-index at the professor and assistant professor levels. The m-index of women at the associate professor level was higher than that of men ($p=0.046$). Women's representation in leadership positions in academic departments was significantly lower than that of men ($\chi 2$ =18,325, $p<0.001$), and current presidential positions in seven radiology societies in Turkey were held by men.

Conclusion: Women academic radiologists are underrepresented in Turkey, especially at senior academic levels and leadership positions.

Keywords: Gender, Radiology, Academic Rank, Leadership, Disparity

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Öz

Amaç: Çalışma, Türkiye'deki akademik radyoloji bölümlerinde cinsiyet dağılımını özetlemeyi ve cinsiyet ile akademik derece, araştırma verimliliği ve liderlik pozisyonları arasındaki ilişkileri analiz etmeyi amaçlamaktadır.

Gereç ve Yöntemler: Bu kesitsel çalışmada, Türkiye'deki akademik radyologları belirlemek için Yükseköğretim Kurulu akademik araştırma veri tabanı kullanılarak veritabanında yer alan her radyoloğun cinsiyeti, akademik derecesi, aktif araştırma yılı ve araştırma üretkenliği parametreleri (yayın ve alıntı sayısı, h-indeksi) Scopus veri tabanından kaydedildi. Ayrıca h-indeksinin aktif araştırma yapılan yıl sayısına bölünmesiyle hesaplanan m-indeksi de kaydedildi. Akademik radyoloji bölümlerinin ve radyoloji topluluklarının liderlik pozisyonlarını belirlemek için internet araştırması yapıldı.

Bulgular: Toplamda 653 akademisyen (profesör n=292; doçent n=211; doktor öğretim üyesi n=150) veri tabanından belirlendi. Araştırma verimliliği parametrelerine güvenilir bir şekilde erişilebilen 642 akademisyen çalışmaya dahil edildi. Kadın akademisyenlerin sayısı (n=245) erkeklere göre daha azdı ($\chi2$ =35,988, p<0,001). Akademik derecelendirmeye göre yapılan gruplarda erkekler daha yüksekti ve akademik derece arttıkça kadınların temsili azaldı. Kadın akademisyenlerin toplam yayın sayısı (p<0,001), atıf sayısı (p<0,001), h-indeksi (p<0,001) ve aktif araştırma yılları (p<0,001) erkek akademisyenlere göre düşüktü. M-indeksi kadın ve erkek akademisyenler arasında anlamlı farklılık göstermedi (p=0,492). Profesör ve doktor öğretim üyesi düzeyinde m-indeksi açısından cinsiyetler arasında fark yoktu. Doçent düzeyindeki kadınların m-indeksi erkeklere göre daha yüksekti (p=0,046). Akademik bölümlerdeki liderlik pozisyonlarında kadınların temsili erkeklere göre anlamlı derecede düşüktü ($\chi2$ =18,325, p<0,001) ve Türkiye'deki yedi radyoloji derneğindeki mevcut başkanlık pozisyonlarının erkekler tarafından yürütüldüğü tespit edildi.

Sonuç: Türkiye'de akademide kadın radyologların özellikle üst düzey akademik pozisyonlarda ve yönetici pozisyonunda erkeklere kıyasla daha az temsil edilmektedir.

Anahtar kelimeler: Cinsiyet eşitsizliği, radyoloji, akademik derece

Introduction

It can be assumed that the most universal and oldest factor of inequality is gender. Gender disparity regarding career development and leadership positions is evident in the field of academic medicine, as in most fields. Although the ratio of female and male students in medical schools in Turkey has been almost equal for more than a decade (1), fewer women continue to be academics, and women are still underrepresented in senior academic ranks and leadership positions. Although 36.8% of academics in the faculties of medicine in Turkey are women, only a few of the deans of medicine are women (2). The data shows the "glass ceiling effect," which refers to invisible barriers preventing women from rising to leadership positions. The underrepresentation of women in academia should be a concern because the identified gender disparity also leads to a lack of female faculty members serving as mentors and role models for younger colleagues.

Radiology seems to be a medical field with less gender inequality, especially when compared to surgical disciplines (3). However, many studies across different radiology subspecialties have shown that there is a significant gender disparity in academic rankings, faculty leadership, and scholarly productivity (4-6). Research productivity is considered essential for advancement in academic medicine and is measured by the number of publications and citations. The Hirsh index (h-index) was developed to calculate and measure a researcher's impact and is widely accepted as an objective criterion (Hirsh-2005). The index enables measurement of both the quality and quantity of research output and is defined as the number of publications (h) with a citation number equal to or greater than h. It is shown that a higher h-index is associated with higher academic rank and a greater chance of funding (7,8). The m-index is calculated by dividing the h-index by the number of years of active research, defined as the years since the date of first publication. The m-index attempts to correct the fact that the h-index is highly influenced by the age and career span of the researcher.

To our knowledge, no study has been conducted to date investigating gender disparity among academic radiologists in Turkey. This study aims to summarize the gender distribution in academic radiology departments in Turkey and analyze the relationships between gender, academic rank, research productivity, and leadership positions.

Material and Methods

Institutional review board was not required for this cross-sectional study because all data was publicly available. Radiologists with academic degrees were identified, and institutional affiliations were recorded using the Council of Higher Education academic search database (9). Academic rank was stratified as professor, associate professor, and assistant professor. Each radiologist's self-identified gender and academic rank were determined by cross-referencing official institutional websites. To identify the head of department, an Internet search was conducted for all institutions, and institutional websites that had not been updated in the last six months were excluded from the study. Afterwards, the Scopus database (Elsevier) was queried for all radiologists' numbers of publications and citations, and h-index. Years of active research were calculated and recorded as the first and last years of publications of an author according to the Scopus database. The m-index was also calculated and recorded. Since the h-index can vary up to 9.9 units between different databases (10), a single database was used to standardize the data, and the Scopus database was chosen because the journal coverage rate was higher (11). Finally, an Internet search was conducted to identify Turkish radiology societies to assess leadership positions. Seven societies, including Turkish Society of Radiology, Turkish Society of Thoracic Radiology, Turkish Society of Pediatric Radiology, Turkish Society of Interventional Radiology, Turkish Society of Neuroradiology, Turkish Society of Magnetic Resonance, and Turkish Society of Interventional Oncology were included in the study. Current presidents of the societies were recorded. All data were collected between December 2023-February 2024.

Analyzes were performed using the SPSS 23.0 (IBM, Armonk, NY) software program. Descriptive statistics for continuous variables were obtained, and normality was evaluated. Descriptive statistics (percentage and frequency), one sample chi-square test was used to evaluate the difference in gender distributions in academic rank and leadership distribution. Cramer's V coefficient was calculated to evaluate the relationship between academic rank and gender. Independent samples t-test was used to test the difference between gender means. A p value of < 0.05 was accepted as significant.

Results

Gender distribution of academics

A total of 653 academics (professor n=292; associate professors n=211; assistant professors n=150) from 127 different institutions and 52 cities were identified from the Council of Higher Education academic search database. Reliable research productivity parameters were unavailable for 11 academics from 10 different institutions (female n=3; professor n=1, associate professor n=2, assistant professor n=8). A total of 642 academic radiologists were enrolled in the study (Fig 1). Academic title distribution by gender is shown in Table 1. Regarding overall distribution, there were fewer women (n=245) than men (n=397), and this difference was significant ($\chi 2 = 35.988$, $p<0.001$). It was examined whether there was a relationship between the academics' gender and academic ranks, and there was a statistically significant difference between these two variables ($\chi 2 = 8.691$, $p=0.013$); however, a weak relationship was found ($V=0.116$). Figure 2 shows gender ratios in academic rankings and that female representation decreases as academic rank increases. In terms of academic ranking, men were higher in all three groups. However, this difference is statistically significant only for professors ($p<0.05$). The difference between gender ratios for associate and assistant professor groups is not statistically significant ($p>0.05$).

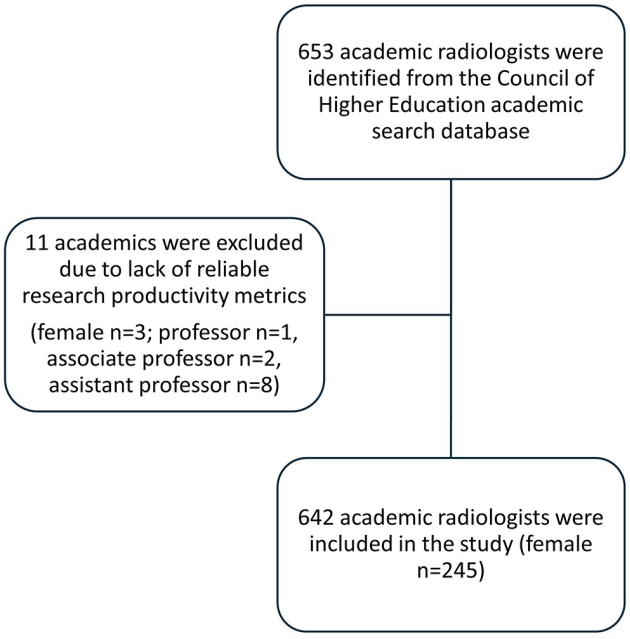


Figure 1. Flowchart shows the selection of the study sample.

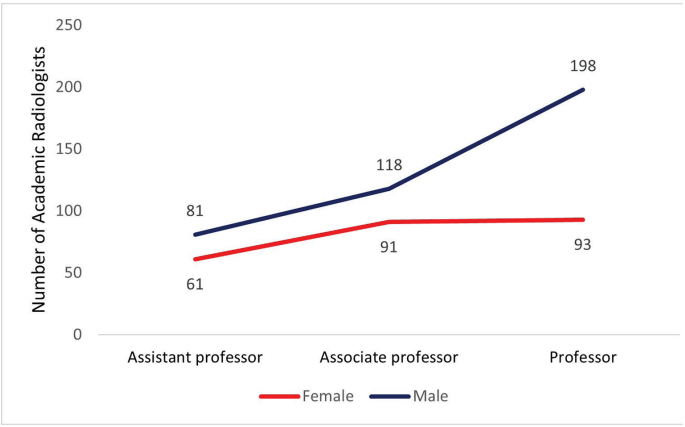


Figure 2. Line plot shows changes in gender representation by academic rank.

Table 1. Distribution of gender by academic degree

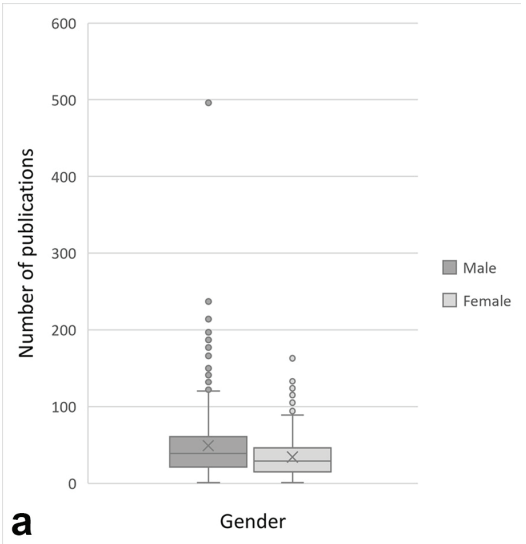
	Professor (%)	Associate professor (%)	Assistant professor (%)	Total (%)
Female	93 (32)	91 (43.5)	61 (43)	245 (38)
Male	198 (68)	118 (56.5)	81 (57)	397 (62)
Total	291	209	142	642

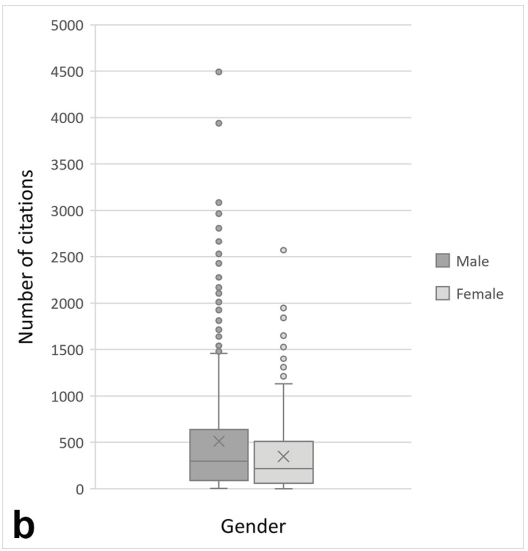
Academic productivity by gender

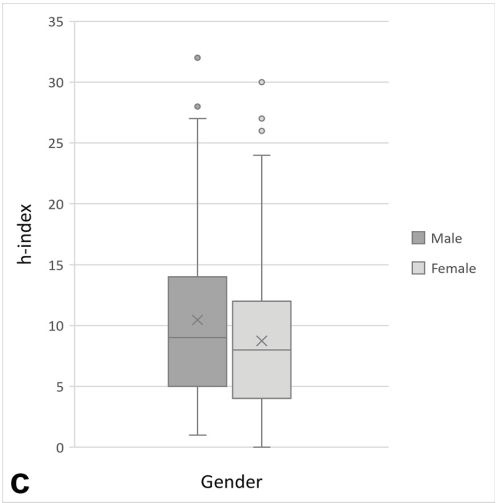
A total of 642 academics' (female n=245) research productivity metrics are summarized in Table 2. Overall number of publications (p<0.001), number of citations (p<0.001), h-index (p<0.001), and active years of research (p<0.001) of female academics were significantly lower than men (Fig 3). m-index did not differ for male (mean=0.61, range 0.07-2) and female (mean=0.60, range 0-2.25) academics (p=0.492). At the professor level, similar to the overall results, female academics' research productivity parameters were significantly lower than that of men, except for m-index (p=0.136). At the associate professor level, the m-index of female academics was significantly higher than that of men (p=0.046). Apart from this, there was no difference between men and women in terms of research productivity metrics at the associate and assistant professor levels.

Gender distribution of leadership positions

Updated head of department data was available for 83 institutions; 22 (26.5%) were women (Fig 4). Women's representation in leadership positions in academic departments was significantly lower than men's ($\chi 2$ =18,325, p<0,001). Current presidential positions in seven radiology societies were held by men. The current president of the Turkish Society of Radiology is a man, and there have been nine presidents since 1999, only one of whom is a woman. Past leadership position information was not available for other societies.







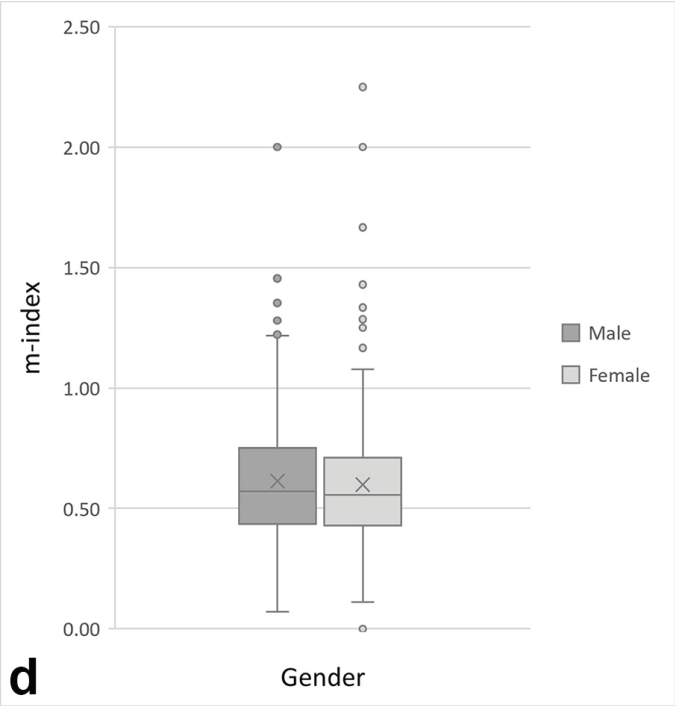
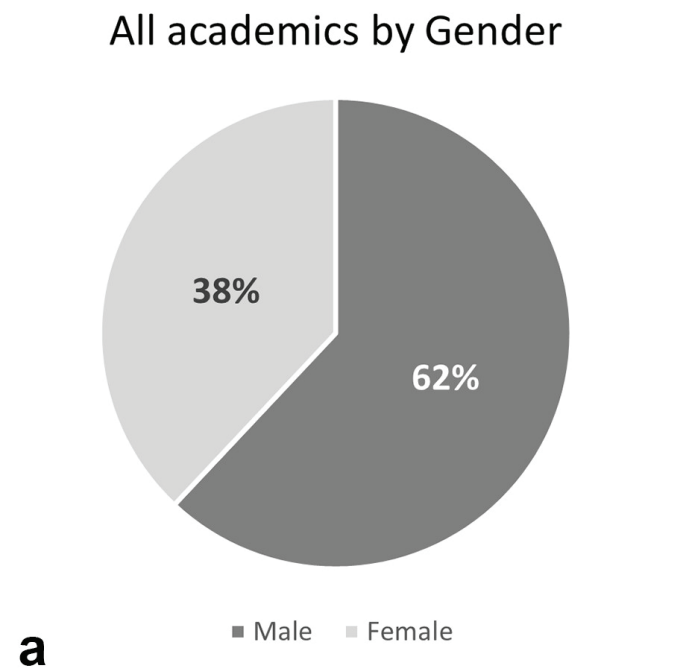


Figure 3. Box-and-whisker plots show research productivity metrics of all academics by gender. Plots show results for number of publications **(a),** number of citations **(b), h-index (c),** and m-index **(d).** Dots outside whiskers show outliers.



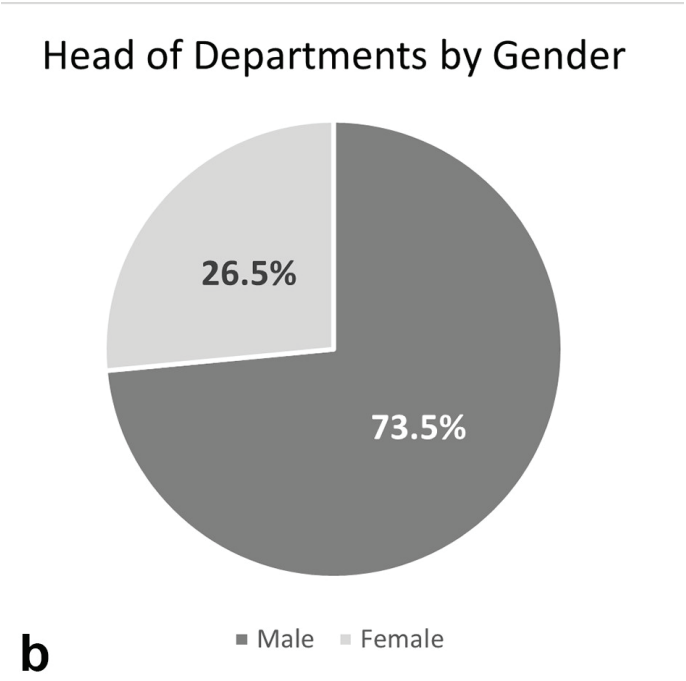


Figure 4. Pie charts show gender distribution of all academics **(a)** and head of departments **(b)** by gender. Note that women's representation in academia is not at parity with their representation in leadership positions.

Discussion

The main result of this study is that among academic radiologists in Turkey, men disproportionately outnumber women in terms of senior-level faculty members and leadership positions in academic departments and radiology societies. In terms of academic productivity parameters, although male academics appeared to be more productive than female academics, the m-index was similar for both genders.

Gender disparity in academia in general, and of course in Turkey, is not news. However, compared to other developed EU countries, it was reported that "unexpectedly" more female academics are at senior academic levels in Turkey, and the total rate of female academics in medical faculties in Turkey is 36.8% (2). This study showed that the rate of female academic radiologists was 38%, similar to the average of medical schools in Turkey. Goswami et al., in their research including 5086 academics from 129 radiology departments in the United States, reported that the rate of female academics at the professor, associate professor, and assistant professor levels were 26.1%, 35%, and 37.4%, respectively (12). Additionally, Vernuccio et al. reported data from Italy for professor, associate professor, and assistant professor levels of 11.2%, 31.6%, and 34.7%, respectively (13). In this study, the rate of female academic radiologists at all three

Table 2. Research productivity parameters by academic degree and gender

	Number of academics	Number of publications - mean (range)	Number of citations - mean (range)	h-index - mean (range)	Years of research - mean (range)	m-index - mean (range)
All academics						
Male	397	48.3 (1-496)	512.8 (2-4492)	10.5 (1-32)	16.9 (1-35)	0.61 (0.07-2)
Female	245	34.1 (1-163)	348 (0-2571)	8.7 (0-30)	14.9 (1-34)	0.60 (0-2.25)
p value	<0.001	<0.001	<0.001	<0.001	<0.001	0.492
Professor						
Male	198	70.8 (9-496)	875.7 (55-4492)	15.2 (5-32)	22.6 (5-35)	0.70 (0.17-2)
Female	93	57.8 (15-163)	662.4 (118-2571)	13.5 (5-30)	21.1 (10-34)	0.65 (0.33-1.29)
p value	<0.001	<0.001	0.003	0.011	0.04	0.136
Associate professor						
Male	118	33.9 (5-138)	208 (10-991)	7.2 (2-16)	13.3 (4-27)	0.57 (0.14-1.22)
Female	91	29.8 (5-124)	225 (10-931)	7.5 (2-16)	12.7 (4-26)	0.65 (0.17-2.25)
p value	>0.05	0.149	0.514	0.636	0.406	0.046
Assistant professor						
Male	81	13.8 (1-44)	69.4 (2-590)	3.5 (1-13)	8.2 (1-26)	0.47 (0.07-1.18)
Female	61	12.1 (1-41)	52.3 (0-463)	3.3 (0-10)	8.6 (1-18)	0.44 (0-1.67)
p value	>0.05	0.287	0.298	0.637	0.684	0.479

academic levels was higher than in the aforementioned studies: 32% at the professor level, 43.5% at the associate professor level, and 43% at the assistant professor level. Although the high participation of female academics in the academic workforce is promising, this does not mean that the country has achieved gender equality in the academic world.

Gender inequality in the academic world is a complex issue due to contextual differences that include temporal, cultural, and social diversity. But there also seem to be some common problems. The study showed that female radiology residents across countries were more likely to perceive gender-based barriers to research participation during their residency programs compared to male residents (14). The most cited key obstacle is the lack of mentorship and support from seniors in accordance with previous literature (15,16). Presumably, the lack of female role models may be a discouraging factor for young Turkish female radiologists who want to pursue academic careers, as this study shows women are underrepresented, especially at the professor level.

In this study, male academics had generally higher research productivity metrics than females; however, this difference disappeared when the year of active research was taken into account. In addition, women's academic productivity was higher at the associate professor level, according to the m-index. These results may indicate that women's participation in academic radiology is increasing in new generations, in line with the literature (17). However, it is also worth considering whether there are any obstacles to women's advancement to higher academic levels. In this study, the male-to-female ratio at the professor level was more than 2:1. In most academic institutions in Turkey, there are standardized criteria for academic promotion. Therefore, it can be suggested that the reason why women cannot achieve higher academic degrees may not be because men are given priority in promotions. Instead, the major possible reason is that women are in a more difficult situation in terms of life-work balance. The choice between academic career and family is still an issue for women not only in Turkey but around the world. A recently published meta-analysis showed that increased family responsibilities are one of the most frequently cited possible causes of the gender gap in academic productivity (18). Also, studies indicated that female academics with children spend more time on domestic activities and parenting compared to their male peers with children (19-21). There are also inevitable differences between men and women that arise from the nature of having children, such as pregnancy, childbirth, and breastfeeding, which result in career interruptions. Although the m-index considers years of active research, studies have shown that family responsibilities and career interruptions disproportionately affect female academics, and the m-index cannot reflect these factors (22).

As in this study, gender inequality is becoming more evident, especially regarding higher academic degrees and leadership positions (23,24). This study showed that men (62%) outnumber women (38%) as faculty at academic

radiology departments. Furthermore, only one-fourth of department chairs are women, and no radiology society has a female president. In par with this result, women hold only 15% of leadership positions in radiology in the United States, according to a 2014 workforce survey from the American College of Radiology (25). It can be assumed that female academics are relatively younger and, therefore less likely to achieve these positions, or this difference may result from the larger male cohort. However, studies indicate that this is not the reality, and most female academics cannot reach leadership positions and higher academic degrees as easily as their male counterparts (26,27).

This study has several limitations. First, rarely multiple profiles of an author were found in the Scopus database. Mostly because women changed their surnames due to marital reasons, and this may be disproportionately affected female academics' metrics. When this was the case, the highest h-index was recorded. Second, there is a possibility that a publication may be mistakenly attributed to an author with a similar or identical name. The institutional information in the academics' recent publication was cross-checked to reduce this error. Third, the database has the potential of not being up-to-date. Finally, although the h-index is a widely used measure of research productivity, it can be misleading due to self-citations, and it does not consider the order of the authors, such that one gets the same citation credit for being a middle author as the first author.

In conclusion, women are underrepresented in academic radiology in Turkey, especially at senior academic levels and leadership positions in academic radiology departments and radiology societies. Narrowing the gender gap in the field of academic radiology in Turkey may be possible by increasing awareness on this issue and identifying possible causes. Further studies are needed to identify causes of gender disparity and to reduce modifiable factors that influence them.

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