Original Investigation
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Bibliometric Analysis of All Theses on Echinococcosis in Türkiye

Türkiye'deki Ekinokokkozis Üzerine Yapılmış Tüm Tezlerin Bibliyometrik Analizi

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ABSTRACT

Objective: Türkiye is the country with the highest number of published articles on echinococcosis worldwide, it is expected that medical specialization, PhD and master's students in Türkiye would conduct theses on this topic. These theses can provide insights for future studies. Therefore, this study aims to evaluate the medical specialization, PhD, and master's theses related to echinococcosis conducted in Türkiye.

Methods: The relevant theses were accessed individually from the "detailed search" section of the National Thesis Center webpage of the Council of Higher Education by using the search terms "Ekinokok", "*Echinococcus*", or "Hidatik" without selecting a year range.

Results: A total of 202 theses (113 medical specialization theses, 42 PhD theses, and 47 master's theses) were included in the study. When examined on a provincial basis, it was found that the highest number of theses were conducted in Ankara (n=36). At the university level, İstanbul University had the most theses. Medical specialization theses were mostly conducted in the fields of general surgery and radiology, while PhD and master's theses were primarily conducted in the fields of parasitology and veterinary medicine. Most of the theses conducted in the internal and surgical sciences were retrospective in design, while those in the basic sciences were mainly diagnostic in nature. A moderate positive correlation was found between the number of theses and the years for medical theses (r=0.341, p=0.027), and a strong positive correlation was found for PhD theses (r=0.505, p=0.001), master's theses (r=0.619, p=0.000), and all theses combined (r=0.761, p=0.000).

Conclusion: It was observed that at least one thesis related to echinococcosis is conducted each year, with an increase in the number of PhD and master's theses in recent years.

Keywords: Academic dissertation, bibliometric analysis, echinococcosis

ÖZ

Amaç: Türkiye, dünyada ekinokokkozis üzerine en fazla makale yayımlanan ülke olup, Türkiye'deki tıpta uzmanlık, doktora ve yüksek lisans öğrencilerinin bu konuda tez çalışmaları yapması beklenmektedir. Bu tezler, gelecekteki çalışmalar için önemli bilgiler sunabilir. Bu nedenle, bu çalışmanın amacı, Türkiye'de ekinokokkozis ile ilgili olarak yürütülen tıpta uzmanlık, doktora ve yüksek lisans tezlerini değerlendirmektir.

Yöntemler: İlgili tezlere, Yükseköğretim Kurulu Ulusal Tez Merkezi web sayfasındaki "detaylı arama" bölümünden "Ekinokok", "*Echinococcus*" veya "Hidatik" anahtar kelimeleri kullanılarak herhangi bir yıl aralığı seçilmeksizin tek tek erişilmiştir.

Bulgular: Çalışmaya toplamda 202 tez (113 tıpta uzmanlık tezi, 42 doktora tezi ve 47 yüksek lisans tezi) dahil edilmiştir. İller bazında incelendiğinde, en fazla tezin Ankara'da (n=36) yapıldığı belirlenmiştir. Üniversite düzeyinde ise İstanbul Üniversitesi en çok tez yapılan kurum olarak öne çıkmıştır. Tıpta uzmanlık tezleri en çok genel cerrahi ve radyoloji alanlarında yapılırken, doktora ve yüksek lisans tezleri genellikle parazitoloji ve veterinerlik alanlarında gerçekleştirilmiştir. Dahili ve cerrahi bilimlerde yapılan tezlerin çoğu retrospektif tasarıma sahipken, temel bilimlerde yapılan tezler genellikle tanı odaklıdır. Tıbbi tezler ile yıllar arasında orta düzeyde pozitif bir korelasyon (r=0,341, p=0,027), doktora tezleri ile güçlü bir pozitif korelasyon (r=0,505, p=0,001), yüksek lisans tezleri ile (r=0,619, p=0,000) ve tüm tezler bir arada değerlendirildiğinde (r=0,761, p=0,000) güçlü bir pozitif korelasyon bulunmuştur.

Sonuç: Her yıl ekinokokkozis ile ilgili en az bir tez çalışması yapıldığı ve son yıllarda doktora ve yüksek lisans tezlerinin sayısında artış olduğu gözlenmiştir.

Anahtar Kelimeler: Akademik tez, bibliyometrik analiz, ekinokokkozis

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Türkiye PARAZİTOLOJİ Dergisi

INTRODUCTION

Echinococcosis, a chronic and neglected zoonosis characterized by the formation of cysts, is caused by the larval stages of parasites belonging to the genus *Echinococcus* and affects both humans and animals. Over the past two decades, despite the concerted efforts of scientists worldwide to minimize *Echinococcus* helminth infections, the disease continues to result in a significant number of human cases globally. Increased tourism and travel mobility have contributed to the spread of echinococcosis even in developed countries. The disease are classified as alveolar echinococcosis caused by *E. multilocularis* and cystic echinococcosis caused by *E. granulosus*. Notably, cystic echinococcosis accounts for over 95% of all echinococcosis cases, the most common larval form is the hydatid cyst, and cases are most commonly localized in the liver (1). However, cases of infection have also been reported in the spleen, kidneys, peritoneal cavity, skin, muscles, and, rarely, the heart, spine, brain, and ovaries (2). In Türkiye, the prevalence of *E. granulosus* in stray dogs exceeds 10%, particularly in the Central Anatolia and Eastern Anatolia Regions. Moreover, the number of human cases has increased steadily each year from 2008 to 2019 (3). Therefore, alongside proper washing of fresh fruits and vegetables, reducing the number of stray dogs is of critical importance in preventive strategies (4).

These parasites cause significant health problems and economic losses for both humans and animals. The World Health Organization reports that over 1 million individuals are affected by echinococcosis annually worldwide, with the disease being highly prevalent in endemic regions such as Central Asia, Mediterranean countries, East Africa, South America, and Western China (2). Echinococcosis is estimated to cause approximately 19,300 deaths and result in the loss of 871,000 disability-adjusted life years globally each year, with hepatic echinococcosis accounting for 60-75% of these cases (5,6). Türkiye has emerged as the leading country in echinococcosis research globally, contributing 531 articles, which account for 20.3% of the total 2,605 publications worldwide (7). Another study highlights that between 2000 and 2019, the top five countries with the most publications on echinococcosis were Türkiye, China, Iran, Germany, and the United States (2). Although Turkish researchers have received the highest total number of citations in this field, their average citation values are not particularly high (2). Original research articles and bibliometric analyses like this article will contribute to increasing the number of citations. Bibliometric analysis, a method that quantitatively evaluates studies and provides in-depth knowledge about a specific research area, systematically examines a large body of work using mathematical and statistical approaches. This method also evaluates the co-citations, authors, journals, institutions, countries, and keyword trends of articles across different research domains, offering researchers a comprehensive literature review and helping measure and assess productivity in the field. As a result, it aids in identifying potential future research areas (1,8,9).

In the literature, we did not encounter any bibliometric analysis of theses on echinococcosis conducted in Türkiye. Given that Türkiye is the country with the highest number of publications on echinococcosis worldwide, it is expected that medical specialization, PhD, and master's students in Türkiye would conduct theses on this topic. These thesis studies can provide valuable insights for future research. Therefore, this study aims to evaluate the Medical Specialization, PhD, and Master's theses on echinococcosis conducted in Türkiye.

METHODS

Data Collection

This descriptive study was conducted between June 1, 2024, and June 31, 2024. The relevant theses were accessed individually through the "detailed search" section of the National Thesis Center website of the Council of Higher Education, using the search terms "Ekinokok" or "*Echinococcus*" or "Hidatik" without restricting the search to a specific time period (10). Theses in which echinococcosis was not the primary focus, or in which echinococcosis was studied alongside multiple other factors, were excluded from the study. Theses specifically addressing the diagnosis, treatment, or prevalence of echinococcosis, as well as those involving patients diagnosed with hydatid cyst, were included in the analysis. The titles, page numbers, topics, authors' names and sexes; supervisors' names, titles, and sexes; university names, and the characteristics of the provinces where the studies were conducted were recorded. The study did not require ethical committee approval as the data used were publicly available.

Statistical Analysis

The data were analyzed using IBM SPSS 21 software. Descriptive statistics were presented as counts, percentages, medians, and 25^{th}-75^{th} percentile values. Continuous variables with skewness and kurtosis levels between ±2 were assumed to follow a normal distribution. Data were analyzed using descriptive statistics, the chi-square test for categorical variables, and Kruskal-Wallis, ANOVA, and Pearson correlation analysis for continuous variables. A p-value of <0.05 was considered statistically significant in the results.

RESULTS

According to the research results, 293 theses were retrieved. Theses that contained the search terms in the abstract but did not focus on echinococcosis as their primary topic were excluded, resulting in a total of 202 theses being analyzed (113 medical specialization theses, 42 PhD theses, and 47 master's theses).

According to available records, the earliest thesis on echinococcosis dates back to 1976 and was prepared by the department of general surgery as a medical specialization study. The distribution of theses by year is presented in Figure 1.

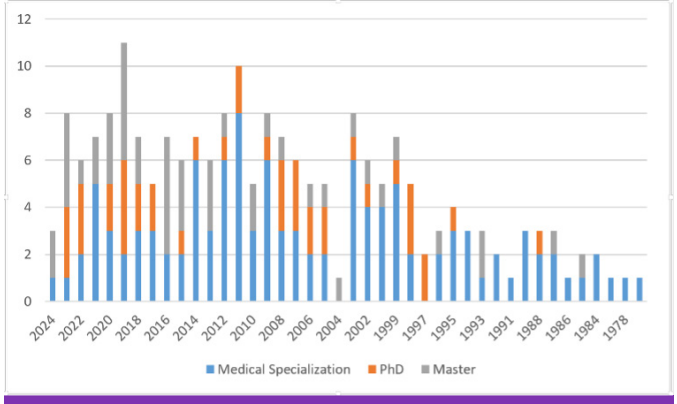

Figure 1. Distribution of theses by year

Table 1. Characteristics of theses

	Medical specialization	PhD	Master	p	Cramer's V	X^2
Title of the consultant						
Professor	54 (47.8%)*	32 (76.2%)	27 (57.4%)	**0.005**	**0.201**	**15.077**
Associate professor	20 (17.7%)*	7 (16.7%)	15 (31.9%)			
Assistant professor/medical specialist	25 (34.5%)*	2 (7.1%)	4 (10.6%)			
City						
Metropolitan	103 (91.2%)*	32 (76.2%)	36 (76.6%)	**0.015**	**0.203**	**8.336**
Small city	10 (8.8%)	10 (23.8%)	11 (23.4%)			
Experimental/hospital/field						
Experimental	21 (18.6%)	10 (23.8%)	3 (6.4%)	**0.000**	**0.363**	**53.368**
Hospital	85 (75.2%)	13 (31.0%)	20 (42.6%)			
Field	7 (6.2%)	19 (45.2%)	24 (51.1%)			
Who the research is conducted on						
Experimental animal/animal	11 (9.7%)	18 (42.9%)	19 (40.4%)	**0.000**	**0.372**	**27.931**
Human/strain/animal and human together	102 (90.3%)	24 (57.1%)	28 (59.6%)			

*: Kruskal-Wallis

Figure 2. Distribution of all theses by province*
** It was prepared using the website https://paintmaps.com.*

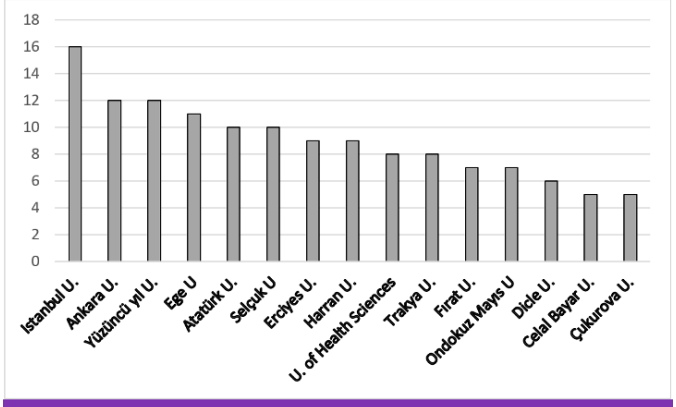

Figure 3. Distribution of theses according to the centers where they were conducted
U: University

A total of 113 supervisors (60.8%) were professors, 42 (22.6%) were associate professors, 19 (10.2%) were assistant professors, and 12 (6.4%) were specialist doctors. The characteristics of the theses are presented in Table 1.

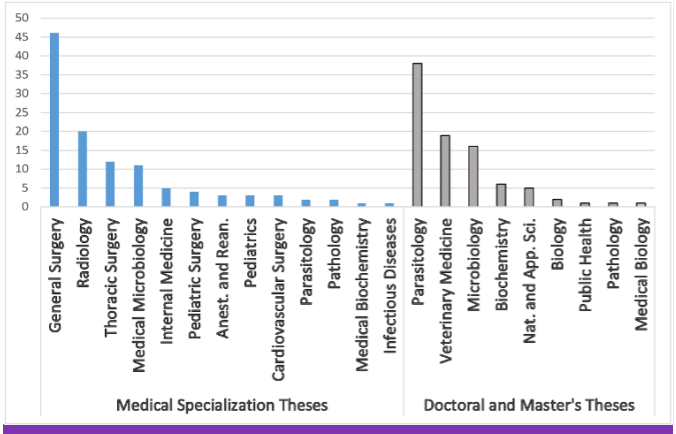

Figure 4. Distribution of theses by department
Anest. and Rean.: Anesthesia and Reanimation, Nat. and App. Sci.: Natural and Applied Science

On a provincial basis, the highest number of theses was conducted in Ankara (n=36) (Figure 2), followed by İstanbul (n=20), İzmir (n=17), and Konya (n=16). The most master's theses were conducted in Van (n=6), the most PhD theses in İzmir (n=6) and Ankara (n=6), and the most medical specialization theses in Ankara (n=28) (Supplement 1).

In studies on echinococcosis, İstanbul University ranks first with 16 theses, followed by Ankara University and Van Yüzüncü Yıl University with 12 theses each, and Ege University with 11 theses (Figure 3). The highest number of medical specialization theses were conducted at İstanbul University (n=10); the most PhD theses were conducted at Ege University (n=5) and Ankara University (n=5); and the most master's theses were conducted at Van Yüzüncü Yıl University (n=6) and Erciyes University (n=5) (Supplement 2).

It is observed that the highest number of medical specialization theses were conducted in general surgery and radiology, while the majority of PhD and master's theses were completed in the

Table 2. Distribution of medical specialization theses according to internal, surgical and basic sciences

	Internal medicine sciences	Surgical medical sciences	Basic medical sciences
Title of the consultant			
Professor	13 (56.5%)	30 (47.6%)	11 (84.6%)
Associate professor	4 (17.45)	14 (22.2%)	2 (15.4%)
Assistant professor/ medical specialist	6 (26.1%)	19 (30.2%)	0 (0.0%)
Council of higher education/ministry of health			
Council of higher education	24 (82.8%)	59 (84.3%)	14 (100.0%)
Ministry of health	5 (17.2%)	11 (15.7%)	0 (0.0%)
Experimental/hospital/field			
Experimental	1 (3.4%)	16 (22.9%)	4 (28.6%)
Hospital	27 (93.1%)	53 (75.7%)	5 (35.7%)
Field	1 (3.4%)	1 (1.4%)	5 (35.7%)
Who the research is conducted on			
Experimental animal	0 (0.0%)	8 (11.4%)	0 (0.0%)
Animal	0 (0.0%)	2 (2.9%)	1 (7.1%)
Human	28 (96.6%)	54 (77.1%)	9 (64.3%)
Strain	1 (3.4%)	6 (8.6%)	2 (14.3%)
Human and animal	0 (0.0%)	0 (0.0%)	2 (14.3%)
Aim			
Risk factor	2 (6.9%)	3 (4.3%)	2 (14.3%)
Treatment	7 (24.1%)	22 (31.4%)	1 (7.1%)
Diagnosis	9 (31.0%)	6 (8.6%)	10 (71.4%)
Method comparison	1 (3.4%)	0 (0.0%)	1 (7.1%)
Retrospective	10 (34.5%)	39 (55.7%)	0 (0.0%)
Method used			
Biochemical	2 (6.9%)	4 (6.0%)	1 (7.1%)
Serological	2 (6.9%)	0 (0.0%)	9 (64.3%)
Radiological	8 (27.6%)	3 (4.5%)	0 (0.0%)
Microscopic	0 (0.0%)	2 (3.0%)	0 (0.0%)
Molecular	0 (0.0%)	1 (1.5%)	3 (21.4%)
Method research	7 (24.1%)	17 (25.4%)	1 (7.1%)
Macroscopic	0 (0.0%)	1 (1.5%)	0 (0.0%)
Retrospective	10 (34.5%)	39 (35.5%)	0 (0.0%)
City			
Metropolitan	27 (93.1%)	65 (92.9%)	11 (78.6%)
Small city	2 (1.8%)	5 (4.4%)	3 (21.4%)
Region			
Marmara	6 (20.7%)	13 (18.6%)	3 (21.4%)
Aegean	3 (10.3%)	4 (5.7%)	3 (21.4%)
Central Anatolia	14 (48.3%)	24 (34.3%)	6 (42.9%)
Eastern Anatolia	1 (3.4%)	9 (12.9%)	1 (7.1%)
Black Sea	1 (3.4%)	2 (1.8%)	0 (0.0%)
Southeastern Anatolia	3 (10.3%)	13 (18.6%)	1 (7.1%)
Mediterranean	1 (3.4%)	5 (7.1%)	0 (0.0%)

departments of parasitology and Veterinary Medicine (Figure 4).

Most of the theses in internal medicine and surgical sciences are retrospectively designed, while in basic sciences, the majority of theses focus on diagnostics (Table 2).

A moderate positive correlation was found between the number of theses over the years and medical theses (r=0.341, p=0.027), a strong positive correlation with PhD theses (r=0.505, p=0.001), a strong positive correlation with master's theses (r=0.619, p=0.000), and a strong positive correlation with the total number of theses (r=0.761, p=0.000).

DISCUSSION

Türkiye is the leading country in the world in terms of the number of publications on echinococcosis, followed by China, Germany, and the United States (7). In a country where extensive research is conducted on echinococcosis, it is expected that a high number of theses would also be produced on the same topic. In this study, a bibliometric analysis was conducted using data from the National Thesis Center to examine theses on echinococcosis. Since the first thesis on echinococcosis in 1976, it has been observed that at least one thesis has been completed on this subject each year. Particularly in recent years, there has been a noticeable increase in the number of PhD and master's theses.

When examining the sex of the researchers conducting the theses, a balanced distribution is observed in PhD and master's theses, while male dominance is more pronounced in medical specialization theses. This sex disparity in medical specialization theses seems to be primarily due to the surgical disciplines. Additionally, when considering the sex of thesis advisors, male dominance is evident in medical specialization, PhD, and master's theses. This may be related to the higher number of professors compared to associate professors in Türkiye, or it could be due to professors perceiving themselves as more competent in this field. Medical specialization theses are mostly designed in hospitals, whereas approximately half of the PhD and master's theses are conducted in the field.

Although the highest number of theses were completed at İstanbul University, the majority of theses on echinococcosis have been conducted in Ankara. The higher number of theses conducted in Ankara compared to other provinces can be attributed to several key factors. First, Ankara is home to long-established higher education institutions such as Hacettepe University, Ankara University, and Gazi University, which host numerous academic departments. These universities actively conduct research in fields directly related to echinococcosis, including medicine, veterinary sciences, and basic sciences. Additionally, as the capital city, Ankara's proximity to major public health institutions such as the Ministry of Health and the Ministry of Agriculture and Forestry provides strong research infrastructure and increased opportunities for institutional collaboration. Moreover, the presence and activity of multiple veterinary faculties and departments of parasitology in these universities contribute to the concentration of theses on zoonotic diseases. The combination of these factors may have positioned Ankara as the leading province in the production of theses on echinococcosis. The highest number of medical specialization theses were completed in Ankara, PhD theses in Ankara and İzmir, and master's theses in Van. The locations where theses or research are conducted may not always correlate with disease

prevalence. This simply indicates that there are more researchers interested in echinococcosis at these centers.

The primary treatment approach for the clinical diagnosis of hepatic echinococcosis is a combination of surgical intervention and the use of albendazole; however, the rapid progression of the disease limits the number of patients who can benefit from surgery. Therefore, it is crucial to focus on developing effective drugs and vaccines to control echinococcosis and improve early diagnosis. Such advancements will significantly impact future treatment methods for echinococcosis, which remains a global health concern (7).

Imaging techniques play a critical role in the diagnosis, community screening, and follow-up processes of echinococcosis in humans. Ultrasound and X-rays are widely used for diagnosing liver and lung lesions associated with cystic echinococcosis and alveolar echinococcosis, respectively. To confirm the diagnosis, serological tests with varying levels of sensitivity and specificity can assist in detecting antigens or antibodies in both definitive and intermediate hosts. Current approaches to echinococcosis treatment involve a combination of surgical intervention and pharmacotherapy, along with long-term follow-up of cases (2). When analyzing medical specialization theses by department, the majority of these theses were conducted in general surgery. Given that echinococcosis most commonly affects the liver and can be treated both medically and surgically, it falls within the scope of general surgery. On the other hand, radiology is the department most frequently consulted by general surgery doctors for both the diagnosis and treatment of echinococcosis in their patients. Therefore, it is natural that a large number of theses on echinococcosis have been conducted in both departments. Furthermore, in PhD and master's theses, the department with the most theses is parasitology, which is expected given that echinococcosis is caused by a parasitic agent.

We believe that academic theses conducted on echinococcosis, a zoonotic disease of public health importance, may have indirect impacts in various areas such as early diagnosis, preventive measures, treatment options, and raising public awareness. The fact that these theses are predominantly carried out within disciplines such as surgery and parasitology supports both clinical applications and laboratory-based diagnostic processes, while those conducted in the field of veterinary medicine contribute to the public health perspective within the One Health framework. Moreover, the concentration of theses in major metropolitan areas and well-established universities suggests that the academic expertise in these centers may influence the development of health policies. These data can provide an academic foundation for planning regional or national strategies in the fight against echinococcosis in Türkiye.

It is observed that theses in internal medicine and surgical disciplines are predominantly designed retrospectively, whereas those in basic sciences are more focused on diagnostics. When retrospective studies are excluded, internal medicine disciplines tend to use radiological methods, surgical disciplines primarily focus on methodological research, and basic sciences predominantly employ serological methods. The predominance of retrospective study designs in theses conducted within internal medicine and surgical departments may be explained by the ease of access to patient data stored in hospital information management systems, as well as the challenges researchers face in conducting prospective studies due to heavy clinical workloads. Additionally, one of the reasons why clinical disciplines produce more theses can be attributed to the high number of cystic echinococcosis cases. In contrast, the emphasis on diagnostic approaches in theses from basic science disciplines can be associated with the widespread availability of laboratory infrastructure, a strong culture of experimental research, and greater opportunities for fieldwork in these departments. When retrospective studies are excluded, the prevalence of radiological methods in internal medicine theses, methodological research in surgical theses, and serological techniques in basic science theses reflects the variations shaped by each discipline's research traditions, methodological frameworks, and available technical resources.

This study includes only theses published in the National Thesis Center database. Since the electronic submission of theses was not mandatory prior to 2018, some theses prepared before this date may not be included in the database, which may have limited the scope of the study. Additionally, as the research is limited to theses prepared in Türkiye, the possibility of international comparison is restricted. Future studies are recommended to analyze additional dimensions such as sample size, findings, and contributions to the literature. Comparative studies involving international databases (e.g., ProQuest, Open Access Theses and Dissertations) could help assess Türkiye's scientific contribution on a global scale. Examining the changes over time in the methods used in echinococcosis theses (e.g., laboratory techniques, epidemiological models, experimental studies) may reveal scientific development trends. Analyzing the relationship between theses and health policies may be useful to measure the practical impact of the academic knowledge produced. Moreover, the distribution of thesis advisors by academic titles and affiliated institutions could be investigated to better understand the relationship between academic productivity and fields of specialization.

CONCLUSION

In conclusion, it has been determined that the number of theses increases each year, field studies are more frequently included in PhD and master's theses, the highest number of theses are conducted in Ankara, clinical disciplines produce more theses, and retrospective studies are the most commonly conducted in medical specialization theses.

*Ethics

Ethics Committee Approval: The study did not require ethical committee approval as the data used were publicly available.

Informed Consent: N/A.

Footnotes

*Authorship Contributions

Concept: İ.D., Design: İ.D., H.G., Data Collection or Processing: İ.D., H.G., Analysis or Interpretation: İ.D., H.G., Literature Search: İ.D., H.G., Writing: İ.D., H.G.

Conflict of Interest: No conflict of interest was declared by the authors.

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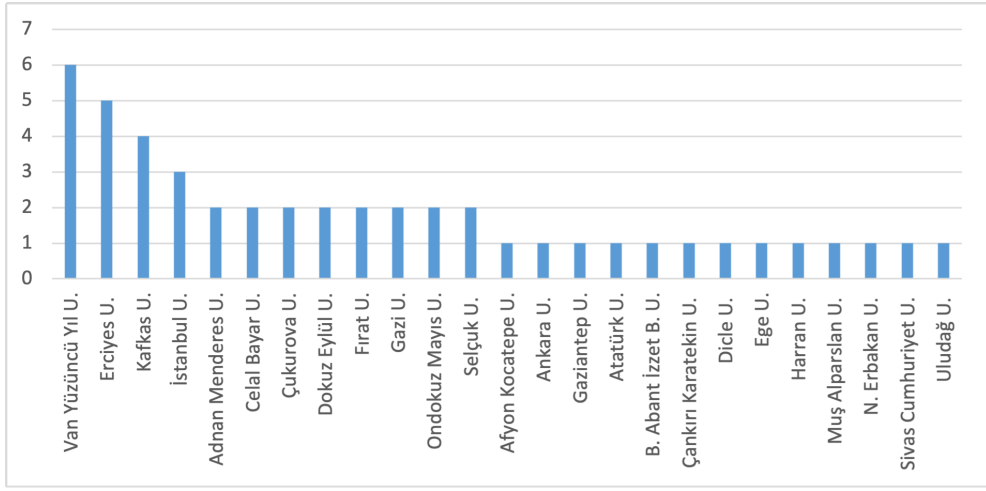
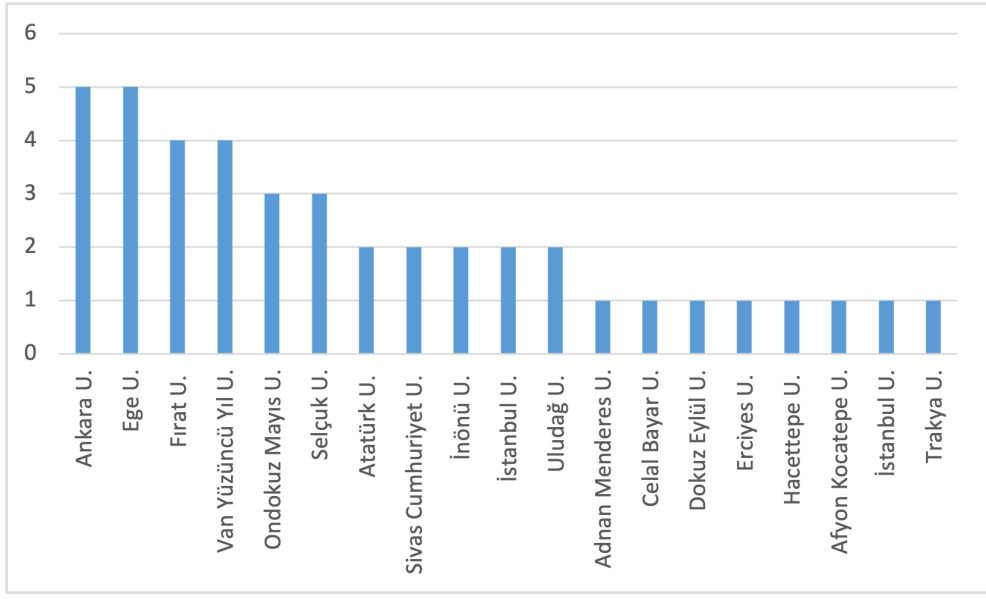
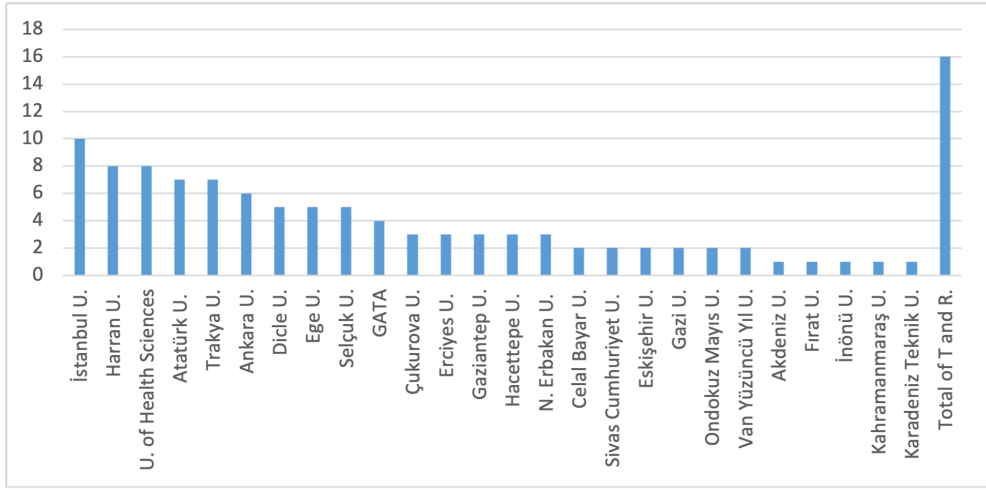
Supplement 1. Distribution of master's theses by province

Supplement 1. Distribution of PhD theses by province

Supplement 1. Distribution of medical specialization theses by province







Supplement 2. Distribution of master's theses by universities

Distribution of PhD theses by universities.

Distribution of medical specialization theses by universities.

B. Abant İzzet B. U.: Bolu Abant İzzet Baysal University, N. Erbakan U.: Necmettin Erbakan University, GATA: Gülhane Military Medical Academy, N. Erbakan U.: Necmettin Erbakan University, Kahramanmaraş U.: Kahramanmaraş Sütçü İmam University, Total of T and R.: Total of Training and Research Hospitals