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## Opinions of Medical Students about Cadavers and Cadaver Procurement in Medical Education

### Cadavers And Cadaver Procurement in Medical Education

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#### ABSTRACT

**Objective:** Although various learning methods are used in anatomy education, cadavers remain unquestionably important in medical education worldwide. Many medical schools face shortages of cadavers. The aim of this study was to investigate students' awareness of and attitudes toward cadavers and the process of cadaver procurement.

**Materials and Methods:** The survey was distributed to second- and third-year students at the Faculty of Medicine via digital media in 2023. A sixteen-question survey was administered to 140 students who participated in the study at the end of the academic period.

**Results:** Almost all medical students (91%) believed that cadavers should be included in anatomy education. Most students reported that they were not emotionally affected while working with cadavers and did not experience negative emotions such as anxiety or fear. When working with cadavers, women showed significantly more empathy than men ( $p<0.05$ ). Forty-six percent of students knew how to obtain cadavers, while 43% stated that it was important to know how the cadaver they worked with was obtained. In our study, 36% of students found it ethically acceptable to use abandoned bodies in anatomy education, and 67% found it acceptable from an educational perspective. It was concluded that students were not willing to encourage themselves, their family members, or their acquaintances to donate bodies.

**Conclusion:** The results of this survey may provide information that will contribute to further research and the implementation of educational programs aimed at increasing medical students' awareness of cadavers and cadaver procurement.

### Tıp Eğitiminde Kadavra ve Kadavra Temini Hakkında Tıp Öğrencilerinin Görüşleri

#### Tıp Eğitiminde Kadavra ve Kadavra Temini

#### Makale Bilgisi

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Kadavra,  
Kadavra temini,  
Diseksiyon,  
Anatomi eğitimi

#### ÖZET

**Amaç:** Anatomi eğitiminde farklı öğrenme yöntemleri kullanılmasına rağmen, kadavranın dünya genelinde tıp eğitiminde tartışmasız önemli bir yeri bulunmaktadır. Kadavraların anatomi eğitiminin önemine rağmen, birçok tıp fakültesinde yeterli kadavra bulunmamaktadır. Bu çalışmanın amacı, öğrencilerin kadavra ve kadavra temini konusundaki farkındalıklarını ve tutumlarını araştırmaktır.

**Gereç ve Yöntemler:** Anket, 2023 yılında Tıp Fakültesi Dönem II ve Dönem III öğrencilerine dijital ortam üzerinden ulaştırılmıştır. Çalışmaya katılan 140 öğrenciye eğitim döneminin sonunda on altı sorudan oluşan bir anket uygulanmıştır.

**Bulgular:** Tıp fakültesi öğrencilerinin neredeyse tamamı (%91) anatomi eğitimine kadavranın mutlaka olması gerektiğini düşünmektedir. Öğrencilerin çoğu, kadavralarla çalışırken duygusal olarak etkilenmediklerini, kaygı ve korku gibi olumsuz duygular yaşamadıklarını belirtmiştir. Kadavralarla çalışırken kadınlar erkeklerden anlamlı olarak daha fazla empati kurabilmektedir ( $p<0,05$ ). Öğrencilerin %46'sı kadavra temin yollarını bilmektedir. Öğrencilerin %43'ü çalıştıkları kadavranın hangi şekilde temin edildiğini bilmenin önemli olduğunu belirtmiştir. Çalışmamızda sahihsiz bedenlerin anatomi eğitiminde kullanılmasını etik açıdan doğru bulan %36, eğitim açısından doğru bulan %67 oranından öğrenci bulunmaktadır. Öğrencilerin beden bağışi için kendilerini, aile üyelerini veya çevrelerini teşvik etmeye istekli olmadıkları sonucuna varılmıştır.

**Sonuç:** Bu anketin sonuçları, tıp öğrencilerinin kadavra ve kadavra teminiyle ilgili farkındalıklarının artırmayı amaçlayan eğitim programlarının uygulanmasına katkıda bulunacak bilgiler sağlayabilir.

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## Introduction

In anatomy, cadaver dissection is an age-old but powerful learning tool for medical students. The regular use of the human body in medical education began in Europe during the Late Middle Ages and became widespread in the 18th and 19th centuries (1). From then to the present, dissection has maintained its value in the medical curriculum as a method of learning human anatomy (2). This learning approach provides students with a true three-dimensional view of human anatomy and reinforces the knowledge gained in lessons. Examining cadavers in anatomy education allows students to discover variations in real human material compared to textbooks and models (3). It also improves the manual dexterity required in almost every field of medical expertise (4).

Cadaveric dissection is a traditional method used in anatomy education. In addition to cadaver anatomy education, the development of technology has introduced new learning methods, such as computer-based programs and three-dimensional models, in anatomy courses (5). While it is relatively easy to provide training using technological advances, these materials are not real (6). Observing the human body in the dissection laboratory and seeing the organs and tissues in their actual locations underscores the importance of cadavers in anatomy education, despite technological advancements (7). Combining traditional methods with emerging technologies can enhance the understanding and retention of information. Therefore, courses that incorporate dissection, three-dimensional models, and imaging methods

together may be more effective. A multimodal education approach to anatomy is considered one of the best methods (8).

The cadaver impacts students not only by providing information about the human body but also in terms of shaping their attitudes and thoughts toward life and death. Confronting the cadaver allows students to face the concept of death and may provoke deep reflection on the subject (9, 10). A medical student's first encounter with a cadaver can be a period of intense emotions, such as anxiety and stress. Understanding the complex emotions students experience in dissection laboratories is essential for the development of their professional skills (9, 11). It is believed that prospective physicians form their first attitudes toward patients in their professional lives based on their experiences in dissection laboratories (11).

Despite the importance of cadaver anatomy education, many medical schools face challenges in providing an adequate cadaver supply due to factors such as financial and transportation difficulties, religious reasons, and sociocultural considerations. There are several options for procuring cadavers, including body donation programs, imported cadavers, bodies of criminals sentenced to death, or unclaimed bodies (12, 13). Additionally, practices vary greatly between developed and developing countries. In many developed countries, cadavers are sourced through body donation programs (14, 15). In developing countries such as Iran, South Africa, and Nigeria, unclaimed bodies or those of criminals sentenced to death are used as cadaver sources (13, 16). In Turkey, many

faculties rely primarily on unclaimed bodies, with additional sources including voluntary body donations or imports (17).

Despite the importance of cadaver procurement, there are relatively few survey studies in the literature on this topic compared to other surveys related to cadavers. The aim of our study is to examine the opinions of medical faculty students on cadavers and cadaver procurement, which serve as the primary educational resource in anatomy courses.

## Materials and Methods

The study was conducted with a total of 140 medical students (74 female, 66 male) who volunteered to participate in the survey from Term II (second year) and Term III (third year) students registered at Izmir Kâtip Celebi University Faculty of Medicine in Turkey. Approval for the study was granted by the Izmir Kâtip Çelebi University Noninvasive Clinical Research Ethics Committee (decision number 2023/180).

The survey was composed of two parts: demographic characteristics of the participants and their opinions about cadavers and cadaver procurement. Three answer options were provided: Yes, No, and Undecided. Participants were informed about the purpose of the survey, and their consent was obtained. The survey, consisting of sixteen questions, was administered to students at the end of their anatomy education period. Additionally, the researchers assured the students of the

confidentiality of their identity information before they participated in the survey. Survey data were collected digitally using the "Google Forms" application (Google, Inc., Mountain View, CA, USA).

The data were analyzed using IBM SPSS Statistics 25.0 (IBM Corp, Armonk, New York, USA). The number of units and percentage values were presented as descriptive statistics. For categorical variables, the exact method of the Chi-Square test was used for comparisons between groups. A p-value of <0.05 was considered statistically significant.

## Results

The demographic data of the students who participated in the survey are presented in Table 1. A total of 140 students, 74 female and 66 male, answered the survey (Table 1).

The answers given by the students to the survey questions regarding cadavers and cadaver procurement are shown in Table 2. Almost all of the students (91.4%) thought that cadavers should be included in anatomy education. Although most of the students had never seen a dead body before (73.6%), they were not emotionally affected (75%) and had no anxiety/fear (81.4%) while working with cadavers. Nearly half of the students knew how to obtain cadavers (46.4%) and thought that this knowledge was important (43.6%). Working with donated cadavers positively affected the majority of students (70.7%). While 67% of the students found it correct to use abandoned bodies as cadavers for educational purposes, only 36% found it

ethically correct. Most students thought that knowing that the cadaver donor was alive could emotionally affect them (80%), and a small proportion wanted to encourage people around them to donate (22.9%). While 39% of the students' experience in the anatomy laboratory increased their likelihood of becoming a cadaver donor, 34% answered negatively. Only 17% felt ready to become a cadaver donor.

A comparison of the answers given by the students according to gender is presented in Table 3. Compared with male students, female students showed more empathy when working with cadavers ( $p < 0.05$ ). Thirty-two percent of male students and 19% of female students found it ethically correct to use unclaimed bodies in medical education (Figure 1).

A comparison of the answers from students according to class is shown in Table 4. Compared to Term II students, Term III students did not feel emotionally affected while working with cadavers and stated that they did not empathize as much while working with cadavers ( $p < 0.05$ ).

## Discussion

The use of cadavers is the main method and an indispensable part of learning anatomy in many medical schools. It holds an important place in the beginning and continuation of medical students' education (18, 19). In fact, cadavers can be considered the first patients students encounter in their professional lives. Although cadavers are a necessary and effective tool, there are many difficulties in

their procurement, and the number of cadavers is insufficient in faculties. One of the underlying factors contributing to these difficulties is the lack of necessary information and awareness about issues related to cadaver procurement and body donation (20, 21). The aim of this study was to investigate students' knowledge and attitudes about cadavers. Therefore, we believe that this study can increase students' awareness of cadaver procurement.

In the current literature, medical students consider cadavers and cadaver dissection to be among the most effective methods for learning anatomy (22, 23). In one study, 91% of the students and 95% after dissection training stated that cadavers were necessary for anatomy education (24). In another study, almost all of the students (99%) stated that cadaver dissection has important educational value for anatomy (25). Similar findings have been reported in the literature (24, 25). In our study, 91% of the students stated that cadavers should be included in anatomy education. These findings suggest that, although cadaveric use is a traditional method, it still maintains its importance.

One of the difficulties students experience in anatomy laboratories is their first encounter with a cadaver. Previous studies have reported that students have negative reactions to dissection, such as anxiety, stress, and fear, and that these reactions improve over time (26-28). Bahsi et al. (7) determined that women felt more negative emotions, such as anxiety, excitement, and fear, than men during their first encounter with a cadaver, and that these negative

emotions decreased significantly after the fifth encounter. Chang et al. (9) observed that as the time spent in the dissection laboratory increased, students' stress and anxiety levels decreased. In our study, most of the students stated that they were not emotionally affected and had no anxiety/fear while working with cadavers. Negative feelings toward cadavers reported in the literature were not observed during dissection in our study, possibly because the survey was administered at the end of the training period, all at once. In addition, our study revealed that women were more empathetic than men when working with cadavers. We believe that this result is due to women's development of empathy skills.

In our study, 46.4% of the students knew how to procure cadavers, and 43.6% thought that it was important to know how to procure cadavers when working with cadavers. Although there is not enough knowledge about cadaver procurement, most students stated that working with donor cadavers had a positive impact on them. This may indicate that students have a positive attitude toward body donation. In the literature, there are different data regarding students' knowledge and awareness about how to procure cadavers (23, 29). Ciliberti et al. (23) stated that students have incomplete information about body donation programs. Mwachaka et al. (30) reported that only 13.9% of medical school students had heard of body donation programs. In contrast, Ganapaty et al. (29) reported that 87% of medical students were aware of voluntary body donation. The reason for the different results in the literature may be the existence of information and

awareness programs about body donation throughout medical education, and the variability of their contents between countries.

Although donation programs are recommended as a source of cadavers in anatomy education, abandoned bodies are mostly used in countries facing supply shortages. The use of abandoned bodies has led to ethical debates (31). In our study, although 36% of the students responded "yes," 31% answered "no," and 32% answered "undecided" to the question, "Do you think it is ethically correct to use unclaimed/unidentified bodies in medical education?", the answer to the question "Do you think the use of unclaimed/unidentified bodies in medical education is correct in terms of education?" was 67% in agreement. The majority of students may have thought that cadavers played an important role in anatomy education and found it appropriate to use abandoned bodies for educational purposes. Additionally, investigating students' thoughts on ethical issues related to cadaver procurement can contribute to ongoing ethical discussions in the literature, particularly in terms of student evaluations.

A study conducted in Iran reported that most students were reluctant to encourage their family members and friends to donate bodies. In that study, a contradiction was found between the desire to donate one's own body and the desire to encourage others (13). Similarly, in our study, it was determined that students were not willing to donate. Only 23% of the students answered "yes" to the question, "Would you like your family to be a body donor?" In our study, unlike Abbasi et

al.'s results, there was also reluctance among students to encourage people around them, whether they knew them or not. We believe that the reluctance to encourage body donation may be due to the inadequacy of donation programs and activities. When such activities increase, students may be more willing to promote awareness of and a sense of responsibility for cadaver donation in society.

There are studies reporting that participants' support for the idea of donating their bodies decreased significantly after the anatomy dissection laboratory (32, 33). Gebert et al. (34) reported that the percentage of students willing to volunteer for body donation decreased by 25% after cadaver dissection. After dissection, the thought of dissecting one's body may cause discomfort and anxiety. In this study, the number of students who said that their chances of donating their bodies increased as a result of their experiences in the anatomy laboratory was 39%. Agnihotri et al. (10) reported that mental and emotional preparation of students before entering the dissection laboratory reduced the anxiety that might occur after dissection. If the negative emotions that students experience after dissection are reduced by providing preliminary information before entering the dissection laboratory, their support for body donation can increase.

Although cadavers have an unquestionably important place in medical education, there is great difficulty in procuring cadavers, and there is general reluctance to voluntary body donation. Singh et al. (35) reported that only 33% of medical and nursing students were

willing to donate their bodies. Boduç et al. (36) reported that while the majority of students wanted to donate their organs, very few were willing to donate their bodies. In our study, only 17% of the students felt ready for cadaver donation. The reason for the reluctance to donate cadavers, which was observed in our study as well as in other studies, may be psychological obstacles arising from the idea of deteriorating the integrity of the person's body. We believe that these obstacles can be overcome by showing respect for cadavers in dissection laboratories through medical education, explaining the benefits of cadavers in education, and emphasizing the importance of body donation.

### **Conclusion**

Cadavers and cadaver dissections are among the most valuable tools and methods used in anatomy education. Although their educational value is widely accepted, there are significant challenges in their supply, and ethical debates continue in situations of limited availability. In our study, although medical school students did not have sufficient knowledge about how to procure cadavers, they demonstrated a positive attitude toward donor cadavers. However, both students and their families are reluctant to donate or encourage body donation. Students' knowledge and awareness can be enhanced by including more programs focused on cadaver use and cadaver donation in medical education. Future doctors can play an important role in increasing public awareness of cadavers and cadaver donation, particularly in terms of medical education and research.

## Limitations

The limitations of our study include the small sample size and the fact that only a single institution was evaluated. Additionally, since our survey was administered only at the end of the semester, we were unable to make a comparison regarding the students' situation before receiving anatomy education.

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**Table 1.** Demographic characteristics of medical students.

Demographic parameters	Total, n (%)
Gender	
Female	74 (52.9)
Male	66 (47.1)
Year	
Second-year students	109 (77.9)
Third-year students	31 (22.1)

**Table 2.** Distribution of answers to survey questions

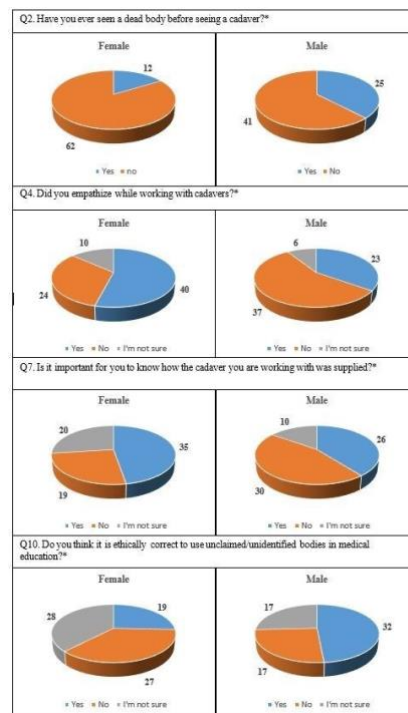
Questions	Yes n (%)	No n (%)	I'm not sure n (%)	Total n (%)
<b>Q1.</b> Is it necessary to have education with cadavers?	128 (91.4)	1 (0.7)	11 (7.9)	140 (100)
<b>Q2.</b> Have you ever seen a dead body before seeing a cadaver?	37 (26.4)	103 (73.6)	0 (0)	140 (100)
<b>Q3.</b> Do you feel emotionally affected when working with cadavers?	25 (17.9)	105 (75)	10 (7.1)	140 (100)
<b>Q4.</b> Did you empathize while working with cadavers?	63 (45)	61 (43.6)	16 (11.4)	140 (100)
<b>Q5.</b> Do you experience any anxiety or fear when working with cadavers?	22 (15.7)	114 (81.4)	4 (2.9)	140 (100)
<b>Q6.</b> Do you have information about ways to supply cadavers?	65 (46.4)	41 (29.3)	34 (24.3)	140 (100)
<b>Q7.</b> Is it important for you to know how the cadaver you are working with was supplied?	61 (43.6)	49 (35)	30 (21.4)	140 (100)
<b>Q8.</b> Does working with a cadaver that you know is a donor affect you positively?	99 (70.7)	24 (17.1)	17 (12.1)	140 (100)
<b>Q9.</b> Do you think the use of unclaimed/unidentified bodies in medical education is correct in terms of education?	94 (67.1)	18 (12.9)	28 (20)	140 (100)
<b>Q10.</b> Do you think it is ethically correct to use unclaimed/unidentified bodies in medical education?	51 (36.4)	44 (31.4)	45 (32.1)	140 (100)
<b>Q11.</b> Does knowing the body donor while he/she is alive affect you emotionally?	112 (80)	13 (9.3)	15 (10.7)	140 (100)
<b>Q12.</b> Would you like your family to be a body donor?	33 (23.6)	58 (41.4)	49 (35)	140 (100)
<b>Q13.</b> Would your family approve of you becoming a cadaver donor?	15 (10.7)	74 (52.9)	51 (36.4)	140 (100)
<b>Q14.</b> Would you encourage people you know or do not know to become cadaver donors?	32 (22.9)	45 (32.1)	63 (45)	140 (100)
<b>Q15.</b> Did your experience in the anatomy lab increase your willingness to donate your body?	55 (39.3)	48 (34.3)	37 (26.4)	140 (100)
<b>Q16.</b> Do you feel ready for a cadaver donation?	25 (17.9)	76 (54.3)	39 (27.9)	140 (100)



**Table 3.** Distribution of parameters based on sex of the participants.

	<i>p</i> *
Q1	0.441
Q2	0.007***
Q3	0.340
Q4	0.019***
Q5	0.307
Q6	0.409
Q7	0.035***
Q8	0.100
Q9	0.211
Q10	0.020***
Q11	0.113
Q12	0.191
Q13	0.199
Q14	0.791
Q15	0.886
Q16	0.054

\*:comparison by gender, Pearson's chi-squared test. \*\*\*=significant result ( $p < 0.05$ ).



**Figure 1.** Comparison of answers to questions 2, 4, 7, 10 by gender

**Table 4.** Distribution of parameters based on the class of the participants.

Questions	$p^*$
Q1	0.426
Q2	0.889
Q3	0.024***
Q4	0.020***
Q5	0.051
Q6	0.760
Q7	0.187
Q8	0.129
Q9	0.063
Q10	0.482
Q11	0.072
Q12	0.719
Q13	0.620
Q14	0.642
Q15	0.658
Q16	0.941

\*:comparison by gender, Pearson's chi-squared test. \*\*\*=significant result ( $p < 0.05$ ).

## Examination of Pelvis Diameters and Pelvis Types On 3D Computed Tomography Images

### Pelvis Types in Women in Different Age Groups

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Article Info	ABSTRACT
<b>Article History</b> <b>Received:</b> 13/05/2024 <b>Accepted:</b> 03/10/2024 <b>Published:</b> 31/12/2024	<b>Objective:</b> There are four main types of female pelvis: android, anthropoid, gynecoid, and platypelloid. The anatomical structure of certain pelvic types can make vaginal childbirth more difficult. Pelvic shape may also change slightly with age. Our study aimed to examine the distribution of pelvic types in women from two different age groups: young and old. <b>Materials and Methods:</b> We analyzed 3D images of 100 women—50 women aged 18-25 and 50 women aged 60-70—created using the RadiAnt DICOM Viewer program. Pelvic diameters were measured, and pelvic types were classified. <b>Results:</b> Our analysis showed a clear predominance of platypelloid and gynecoid pelvic types compared to the anthropoid and android types. In the 18-25 age group, the gynecoid type was the most common, accounting for 48%, while the android type was the least common at just 2%. In the 60-70 age group, the platypelloid type was most prevalent, at 70%, while the anthropoid type was not observed ( $p < 0.005$ ). <b>Conclusion:</b> The platypelloid type was the most common pelvic type in our study, followed by the gynecoid type. Notably, the gynecoid type was less common in women aged 60-70, suggesting that age may have a significant impact on changes in pelvic anatomy.
<b>Keywords:</b> Pelvis tipleri, Gynecoid, Platypelloid, Android, Anthropoid	

## Üç Boyutlu Bilgisayarlı Tomografi Görüntüleri Üzerinde Pelvis Çaplarının ve Pelvis Tiplerinin İncelenmesi

### Farklı Yaş Gruplarındaki Kadınlarda Pelvis Tipleri

Makale Bilgisi	ÖZET
<b>Makale Geçmişi</b> <b>Geliş Tarihi:</b> 13/05/2024 <b>Kabul Tarihi:</b> 03/10/2024 <b>Yayın Tarihi:</b> 31/12/2024	<b>Amaç:</b> Kadın pelvis'inin android, anthropoid, gynecoid ve platypelloid olmak üzere temelde dört farklı tipi vardır. Bu pelvis tiplerinden bazılarının anatomik yapısı normal vajinal doğumun gerçekleşmesini zorlaştırır. Pelvisin şekilsel özellikleri yaş ile beraber bir miktar değişiklik gösterebilir. Çalışmamızda genç ve yaşlı olmak üzere iki farklı yaş grubundaki kadınlarda pelvis tiplerinin incelenmesi amaçlanmıştır. <b>Gereç ve Yöntemler:</b> 18-25 yaş aralığındaki 50 kadın ve 60-70 yaş aralığındaki 50 kadın olmak üzere toplamda 100 kadının görüntülemeleri RadiAnt DICOM Viewer programı aracılığıyla 3 boyutlu hale getirilerek pelvis çapları ölçüldü ve pelvis tipleri belirlendi. <b>Bulgular:</b> Elde edilen pelvis tiplerini karşılaştırdığımızda platypelloid ve gynecoid pelvis tipi sayısı, anthropoid ve android pelvis tipi sayısına net bir üstünlük sağlamıştır. 18-25 yaş aralığında %48 oranla gynecoid tip en çok görülürken android tip %2 oranla en az görülmüştür. 60-70 yaş aralığında %70 oranla platypelloid tip en çok görülürken anthropoid tipe hiç rastlanmamıştır ( $p < 0.005$ ). <b>Sonuç:</b> Çalışmamızda en çok görülen pelvis tipi platypelloid tiptir. Gynecoid tip ikinci sıradadır. Araştırmamızda 60-70 yaş aralığındaki kadınlarda gynecoid pelvis tipi daha az yaygındır, bu da yaşın pelvis anatomideki değişiklikler üzerinde belirleyici bir etkiye sahip olabileceğini düşündürülebilir.
<b>Anahtar Kelimeler:</b> Pelvis tipleri, Gynecoid, Platypelloid, Android, Anthropoid	

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## **Introduction**

The pelvis is formed by the union of the right and left hip bones with the sacrum and coccyx at the back. The area above the linea arcuata is known as the pelvis major, while the area below it is referred to as the pelvis minor. The entrance to the pelvis minor, called the apertura pelvis superior (pelvic inlet), has different shapes depending on the type of pelvis.

The most commonly used classification for pelvic types is the one proposed by Caldwell and Moloy, which takes into account the dimensions and appearance of the apertura pelvis superior. According to Caldwell and Moloy's classification, there are four distinct types of pelvis: gynecoid, android, anthropoid, and platypelloid.

In the gynecoid type, the maximal transverse diameter of the apertura pelvis superior is wider, giving the pelvic inlet an oval shape. It is generally considered the most common pelvis type in women. Additionally, the distance between the spinae ischiadica is wider, which facilitates the passage of the baby through the birth canal. The android type resembles the male pelvis; thus, the apertura pelvis superior is triangular, and the pelvis minor is typically funnel-shaped. The anthropoid type is characterized by a long conjugata vera, with a decreased and narrowed maximal transverse diameter. The pelvis is usually deeper in this type. The platypelloid type features a shorter sagittal diameter and a longer maximal transverse diameter, with a shallower depth of the pelvis minor.

The purpose of our study; The aim of our study was to compare the distribution of pelvic types (gynecoid, android, anthropoid, and platypelloid) in women from two different age groups in our society: young adults (just before the pelvis is fully developed) and older adults.

## **Materials and Methods**

In this study, pelvic types were examined in women from two different age groups: 60-70 years old and 18-25 years old. The study was approved by the Ethics Committee of Izmir Katip Celebi University Faculty of Medicine, under the decision number 21.09.2023/0373, issued by the Non-Invasive Clinical Research Ethics Committee.

The CT images of a total of 100 women were examined, including 50 women aged 18-25 years and 50 women aged 60-70 years, who had undergone CT scans of the lower abdomen between 01.01.2020 and 31.12.2023 at Izmir Katip Çelebi University Atatürk Training and Research Hospital. Women with images showing traffic accidents, pelvic fractures, previous surgeries that could disrupt pelvic structure, or congenital pelvic anomalies were excluded from the study. All images were obtained using a 128-detector CT scanner (GE Revolution) with a routine protocol for the lower abdomen. The acquisition parameters were 120 kV, with an axial slice thickness of 2.5 mm. Additionally, sagittal and coronal reconstructions with a slice thickness of 3 mm were available. All data were transferred to the RadiAnt DICOM Viewer program (Medixant, Poland) and converted into 3D. Diameters of the apertura pelvis superior were measured from the obtained images. These included the median

diameter (conjugata anatomica), transverse diameter, conjugata vera (the narrowest distance between the promontory and the symphysis pubis in the midline), both oblique diameters (right and left), and the posterior sagittal diameter (the distance between the promontory and the transverse diameter) (Figure 1). A total of 600 measurements were made in the study. Pelvic types were determined by calculating the Brim index from the obtained data (2). The Brim index is calculated by multiplying the ratio of the shortest distance in the sagittal plane to the widest distance in the transverse plane of the pelvic inlet by 100. Based on reference values for the Brim index, all pelvises were classified into the following types: Gynecoid type (85-100%), anthropoid type (>100%), and platypelloid type (<85%). The Android type is considered a modified anthropoid type and requires a clear distinction from the anthropoid type. The Brim index alone is insufficient to distinguish between these two types. Therefore, a special formula suggested by Nikola et al. was used to determine the Android type. This formula uses the following calculation:  $(\text{posterior sagittal diameter}/\text{conjugata vera}) \times 100$  was used (2). According to this formula, if the result is between 24% and 40%, the pelvis type is classified as Android.

#### *Inclusion and exclusion criteria*

**Inclusion Criteria:** Pelvic CT images of women aged 18-25 years and 60-70 years.

**Exclusion Criteria:** Women who have had a traffic accident, pelvic fractures, surgery that may disrupt the pelvic structure, or congenital pelvic anomalies; women under the age of 18;

pelvic CT images of women aged 25-60; and male pelvis CT images.

#### *Data collection tools*

This study was conducted using the PROBEL data recording procedures at Izmir Katip Çelebi University Atatürk Training and Research Hospital. Pelvic CT images, retrospectively obtained from the radiology archive between 2020 and 2023, were used in the study.

#### *Statistical analysis*

In order to ensure standardization, measurements for each parameter on computed tomography images were repeated three times and the average of all three measurements was used as data. The data obtained was saved in the Microsoft Office Excel program. Data analysis was done with SPSS 25.00 program. The Shapiro-Wilk test was used to check whether the measurement values were homogeneous (normally distributed) across the sample size. Descriptive statistical results such as mean, standard deviation and median of the measured morphometric distances were revealed. Spearman Correlation analysis was used to determine whether there was a correlation between measured distances and pelvis types. Comparisons between groups were made using the independent sample test or Mann Whitney U test, depending on whether the pelvis measurement values showed a normal distribution. Chi-square test, a statistical test, was used to compare the pelvis types of the young and old groups with

each other.

## Results

The ages of the women included in the study, the pelvic diameters obtained from measurements on 3D CT images, and the descriptive values of the calculated unit index (mean, median, standard deviation, minimum, and maximum values) are presented in Table 1. When both groups are evaluated together, the most common pelvis type is the platypelloid type, followed by the gynecoid type. The frequency distribution of pelvis types is provided in Table 2. The least common pelvis types are the anthropoid and android types. When evaluating pelvis type frequencies separately in the young and elderly groups, the gynecoid type is the most common in the young group (18–25 years old), with a prevalence of 48%, while the android type is the least common, at 2%. In contrast, in the elderly group (60–70 years old), the platypelloid type is the most common, with a prevalence of 70%, and the anthropoid type is not observed at all. Detailed results are shown in Table 3. According to the Chi-Square test, the differences in pelvis type distribution between the young and elderly groups are statistically significant,  $p < 0.005$  (Table 4).

Except for the right oblique diameter, the values of other pelvic diameters and brim index values showed a normal distribution. For group comparisons, the Whitney U test was used for the right oblique diameter, while the independent samples test was applied for the other pelvic diameters (Table 5). Significant differences between the young and elderly

groups were found in the right and left oblique diameters, posterior sagittal diameter, and transverse diameters ( $p < 0.005$ ). Additionally, the differences in calculated brim index values between the groups were also statistically significant ( $p < 0.005$ ). Further details are provided in Table 5.

## Discussion

In our study, we compared the prevalence of pelvic types in young adult and elderly women from the same society to identify generational differences. Studies in the literature have examined the frequency of pelvic types in women from different societies. The results of our study differ from those of Vučinić et al. (2). Their study measured pelvic CT images from 54 individuals of varying ages, while our study analyzed pelvic patterns in two distinct groups of women: young and elderly. Vučinić et al. reported that among the 54 individuals, 28 (52%) had a gynecoid pelvis, 11 (20%) had a platypelloid pelvis, 8 (15%) had an anthropoid pelvis, and 7 (13%) had an android pelvis. The order of frequency was gynecoid > platypelloid > anthropoid > android. In contrast, in our study of 100 women, 58% had a platypelloid pelvis, 38% had a gynecoid pelvis, 2% had an anthropoid pelvis, and 2% had an android pelvis. The frequency order in our study was platypelloid > gynecoid > anthropoid = android. When comparing results, the gynecoid pelvis was the most dominant type in their study, while it was the second most common type in ours. The notable differences in the frequencies of android and anthropoid pelvis types between the studies are significant. One possible explanation for these

differences could be the geographic and societal variations in the populations studied. In their study of 400 Nigerian women, Bukar M and colleagues reported that 361 women (90.3%) had a gynecoid pelvis, 36 women (9%) had an android pelvis, and 3 women (0.8%) had an anthropoid pelvis (3). They did not observe any instances of the platypelloid pelvis type. While the most common pelvis types in our study were platypelloid and gynecoid, Bukar et al. identified gynecoid and android as the most prevalent types. This discrepancy is likely attributable to genetic differences and variations in the geographical conditions of populations living in vastly different regions.

Ciftcioglu et al., in their study of pelvic radiographs from 284 women aged 15–49 (mean age = 30.32), found that the gynecoid pelvis was the most common type, with a prevalence of 64.1% (4). The gynecoid type was followed by the platypelloid type (16.5%), the anthropoid type (11.3%), and the android type (8.1%). In our study, the platypelloid pelvis was the most common type, followed by the gynecoid type. Comparing the results of Ciftcioglu's study with ours, although the rankings differ, both studies identified the platypelloid and gynecoid types as the two most common, while the anthropoid and android types were the least common. The higher average age in our study, along with the exclusion of middle-aged women (25–60 years old), may explain the differences between the results, even though both studies were conducted in the same country.

The table comparing the results of some studies in the literature with our study is provided below (Table 6) (1, 4–6). According to the sources in the table, the gynecoid pelvis is consistently the most common type, although the percentages vary. In the 1938 study by Caldwell and Moloy on white and black women, the platypelloid pelvis was the least common type, which contrasts significantly with the findings of our study. Details are shown in Figure 2. In our study, unlike the values reported in classical textbooks, the platypelloid pelvis was the most common type, while the gynecoid type, typically identified as the most frequent in classical references, ranked second. Comparing the results of three studies—Vural et al. in Istanbul, Ciftcioglu et al. in the Black Sea region, and our study in Izmir (4, 7)—the order of pelvis type prevalence is as follows: Vural et al. reported gynecoid, platypelloid, android, and anthropoid; Ciftcioglu et al. found gynecoid, platypelloid, anthropoid, and android; and in our study, platypelloid, gynecoid, anthropoid, and android were observed. In conclusion, when evaluating results from three different regions, the most common pelvis types among Turkish women are gynecoid and platypelloid. Differences in the results across regions may be partially explained by variations in the number of births among the women included in the studies.

Kolesova et al. published a study investigating how pelvic anatomy changes with gender and age (8). In their study, pelvic measurements of 211 women and 181 men were obtained using computed tomography pelvimetry. They observed that age-related changes in pelvic

dimensions are more pronounced in the apertura pelvis superior and apertura pelvis inferior (pelvic inlet and outlet). They reported that the transverse and sagittal diameters of female pelvises are larger than those of males; however, the age-related changes are similar for both sexes. With age, the transverse diameter of the apertura pelvis superior increases while the sagittal diameter decreases. Conversely, in the apertura pelvis inferior, the transverse diameter decreases, and the sagittal diameter increases. Kolesova et al. did not address the frequency of pelvic types in their study, making it impossible to compare their findings with ours in terms of pelvic typing (8). However, their age-related results may provide insights that help interpret the differences in pelvic types between the young and elderly women in our study.

In a study conducted at Monmouth University in New Jersey, Delprete H examined the pelvises of 182 women with an average age of 56.57 years, all of whom had completed bone development after the age of 24, using three different skeletal collections (Hamann-Todd, Terry, Coimbra) (9). Among the 182 pelvises, 108 (59.3%) were android, 23 (12.6%) were anthropoid, 26 (14.3%) were gynecoid, and 25 (13.7%) were platypelloid. Unlike our study, the android pelvis was the most common type in their results, with the frequency order being android > anthropoid > gynecoid > platypelloid. In contrast, in our study, the most common type among women aged 18–25 was the gynecoid pelvis (48%), followed by the platypelloid type (46%). In the 60–70 age group, the platypelloid type was the most

common (70%). The low prevalence of the anthropoid (2%) and android (2%) pelvis types in our study differentiates our findings from those of Delprete's study.

The study by Kolesova, O et al. was conducted on 172 women aged 18–69, divided into three groups: 18–25 years, 26–49 years, and 50–69 years (10). Contrary to expectations that pelvic sizes would be larger in younger women, the study found the opposite—narrow pelvises were more frequently observed in the younger age group. In the 26–49 age group, the prevalence of the gynecoid pelvis, which facilitates childbirth, was found to be 36%. The authors suggested that more detailed research is needed on pelvic type distribution and parameters in the 18–25 age group, given the growth trend where pelvic parameters change with age, with pelvic inlet dimensions increasing until age 25. In our study, the most common pelvis types in the 18–25 age group were gynecoid (48%) and platypelloid (46%).

In their study on 60 women in Nepal, Manandhar et al. found the prevalence of the gynecoid pelvis type to be 10% in the 25–45 age group and 36.66% in the 45–65 age group (11). In contrast, in our study, the gynecoid pelvis type was found in 48% of the 18–25 age group and 28% of the 60–70 age group.



## Conclusion

Although it is generally believed in the literature that the gynecoid pelvis is the most common type in women and the platypelloid type is the least common, various studies reveal significant differences in the frequency of pelvis types across societies. The least common anthropoid and android pelvis types in one society may be the most common in another. Therefore, this topic needs to be

examined and reinterpreted specifically for populations living in different geographical regions.

## Limitations

The unknown number of births among individuals included in our retrospective study is a limitation.

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**Ethics Approval:** The study was approved by the Ethics Committee of Izmir Katip Celebi University Faculty of Medicine, under the decision number 21.09.2023/0373, issued by the Non-Invasive Clinical Research Ethics Committee.

## Author contributions

For the preparation of the article all authors have taken equal responsibility. All authors discussed the results and contributed to the final manuscript

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**Table 1.** Descriptive parameters

		Age	Diameters (cm)					Brim Index	
			Sagittal	Conjugata	Right_Oblik	Left Oblik	Transvers		Posterior Sagittal
N	Valid	100	100	100	100	100	100	100	
	Missing	0	0	0	0	0	0	0	
Mean		42.37	12.73	10.64	11.56	11.64	12.97	5.26	82.45
Median		42.00	12.73	10.67	11.57	11.60	12.95	5.22	83.83
Std. Deviation		22.82	1.19	1.22	0.85	0.76	0.95	0.78	10.75
Minimum		18.00	9.57	8.02	8.65	10.15	10.68	3.42	59.06
Maximum		69.00	16.25	14.14	13.62	13.60	15.26	7.37	111.43

**Table 2.** Pelvis types

	Pelvis types	Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Platypelloid pelvis	58	58	58	58
	Gynecoid pelvis	38	38	38	96
	Anthropoid pelvis	2	2	2	98
	Android pelvis	2	2	2	100
	Total	100	100	100	

**Table 3.** Pelvis types seen in young and old groups

Pelvis_Type * Grup Crosstabulation					
			Group		Total
			18-25	60-70	
Pelvis_Types	Platypelloid pelvis	Count	23 <sup>a</sup>	35 <sup>b</sup>	58
		% within Grup	46.00%	70.00%	58.00%
	Gynecoid pelvis	Count	24 <sup>a</sup>	14 <sup>b</sup>	38
		% within Grup	48.00%	28.00%	38.00%
	Anthropoid pelvis	Count	2 <sup>a</sup>	0 <sup>a</sup>	2
		% within Grup	4.00%	0.00%	2.00%
	Android pelvis	Count	1 <sup>a</sup>	1 <sup>a</sup>	2
		% within Grup	2.00%	2.00%	2.00%
Total	Count	50	50	100	
	% within Grup	100.00%	100.00%	100.00%	

**Table 4.** Chi-Square Tests results

	Value	df	Asymptotic Significance (2-sided)	Monte Carlo Sig. (2- sided)	Monte Carlo Sig. (2- sided)	Monte Carlo Sig. (1- sided)			
				Sig.	99% Confidence Interval	99% Confidence Interval	Sig.	99% Confidence Interval	
					Lower Bound	Upper Bound		Lower Bound	Upper Bound
Pearson Chi-Square	7.114 <sup>a</sup>	3	0.068	.038 <sup>b</sup>	0.033	0.043			
Likelihood Ratio	7.936	3	0.047	.055 <sup>b</sup>	0.049	0.06			
Fisher's Exact Test	6.936			.034 <sup>b</sup>	0.029	0.038			
Linear-by-Linear Association	4.737 <sup>c</sup>	1	0.03	.042 <sup>b</sup>	0.037	0.047	.020 <sup>b</sup>	0.016 0.023	
N of Valid Cases	100								

**Table 5.** Group statistics

		Group	N	Mean	Std. Deviation	Std. Mean Error	Sig.(2- tailed)
Brim_Index		18-25	50	86.34	9.84	1.39	<0,001*
		60-70	50	78.57	10.29	1.45	
Diameters (cm)	Sagittal	18-25	50	12.91	1.22	0.17	0,133
		60-70	50	12.55	1.14	0.16	
	Conjugata	18-25	50	10.88	1.09	0.15	0,053
		60-70	50	10.41	1.32	0.19	
	Left_Oblik	18-25	50	11.36	0.70	0.10	<0,001*
		60-70	50	11.93	0.72	0.10	
	Transvers	18-25	50	12.66	0.97	0.14	0,001*
		60-70	50	13.28	0.83	0.12	
	Posterior Sagittal	18-25	50	5.54	0.76	0.11	<0,001*
		60-70	50	4.98	0.71	0.10	
	Right_Oblik	18-25	50	11,36	0.70	0.10	<0,05 **
		60-70	50	11.75	0.94	0.13	

\* p<0.05 Independent sample test results

\*\*p<0.05 Mann-Whitney U test result

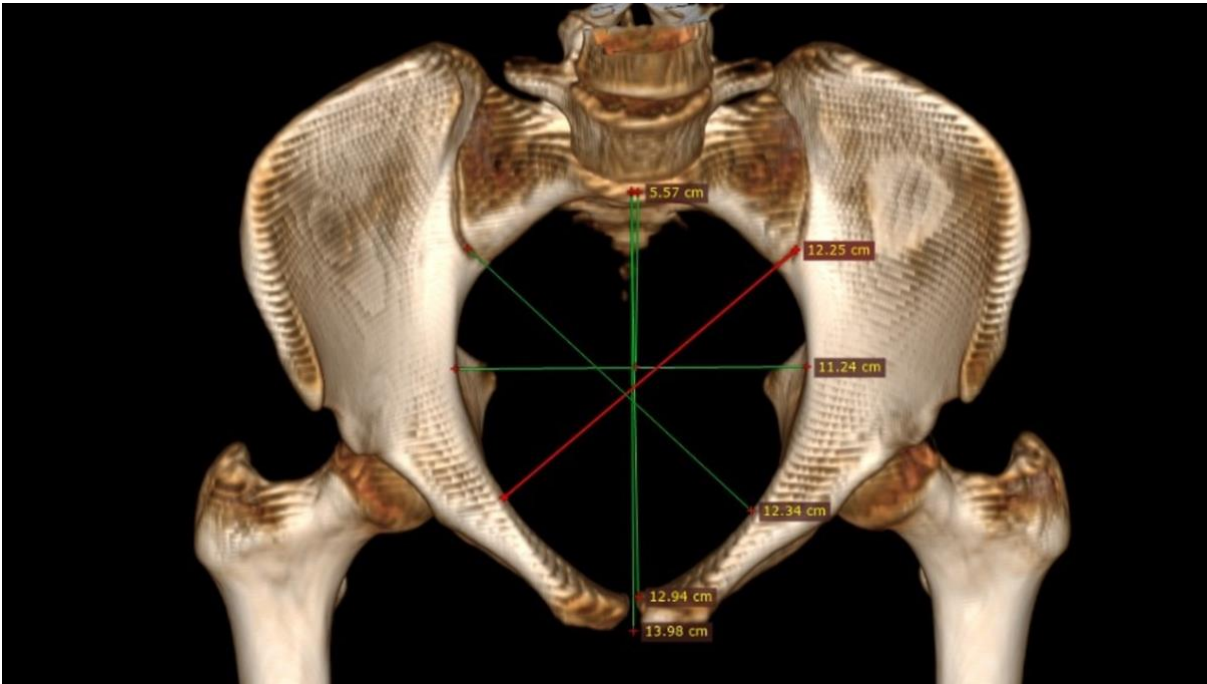


Figure 1. Measured distance and diameters.

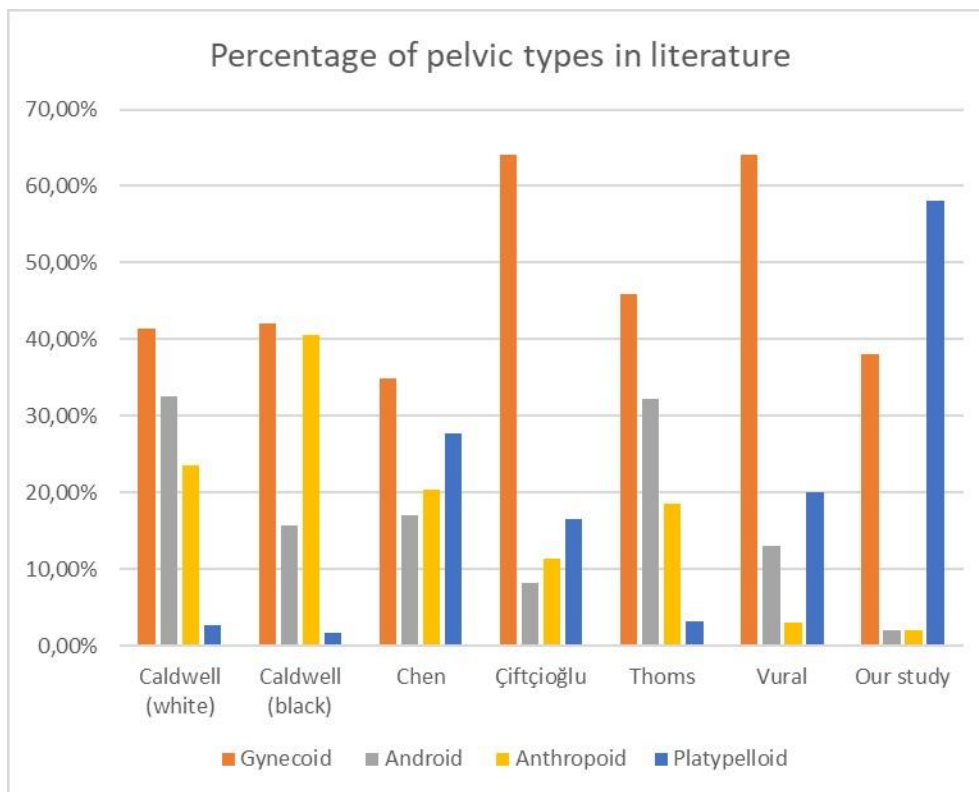








Figure 2. Percentage of the pelvis in literature.

## The Diagnosis Rate of Colorectal Carcinoma Through Cancer Screening Programs

### Colorectal Cancer Screening

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#### Article Info

#### ABSTRACT

##### Article History

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##### Keywords:

Colorectal cancer,  
KETEM,  
Risk factors.

**Objective:** This study aimed to assess the diagnosis rate of colorectal cancer through screening programs, examine the influence of personal and environmental risk factors on its development, and evaluate awareness of colorectal cancer screening programs.

**Materials and Methods:** Patients aged 50 and above, diagnosed with colorectal carcinoma at the Medical Oncology Outpatient Clinic of Izmir Katip Celebi University Atatürk Education and Research Hospital, were included in this study. Participants completed a survey to assess their knowledge of screening programs and risk factors. Clinical and demographic data were collected retrospectively from medical records.

**Results:** Among the 130 patients included, 23 (17.6%) were diagnosed through screening, while 107 (82.4%) were diagnosed without screening. The mean age of patients diagnosed through screening was significantly younger (58.7 years) than those diagnosed without screening (63.7 years). Screening-diagnosed patients were identified at earlier cancer stages, with a lower proportion presenting with advanced T stages (T1-T2: 5.9%; T3-T4: 94.1%). Metastasis was present in 44.6% of patients overall, with 8 cases in the screening group. Awareness of Early Diagnosis, Screening, and Training Centers (KETEMs) was reported by only 20.8% of participants. Patients aware of KETEMs were more likely to undergo screening (56.5%) than those unaware (43.5%,  $p < 0.001$ ).

**Conclusion:** Patients diagnosed through screening were younger and presented with less advanced disease. Familiarity with KETEMs was significantly associated with increased screening participation. Enhancing public awareness and education regarding colorectal cancer screening programs is essential to improve early detection and reduce mortality rates.

## Kolorektal Karsinom Tanısı Alan Hastalarda Kanser Tarama Programı ile Tanı Konulma Oranı

### Kolorektal Kanserde Tarama

#### Makale Bilgisi

#### ÖZET

##### Makale Geçmişi

Geliş Tarihi: 30/09/2024

Kabul Tarihi: 01/11/2024

Yayın Tarihi: 31/12/2024

##### Anahtar Kelimeler:

Kolorektal kanser,  
KETEM,  
Risk faktörleri.

**Amaç:** Kolorektal kanser tanısı almış hastalarda tarama programlarıyla tanı konulma oranını araştırmak, kişisel ve çevresel risk faktörlerinin kolorektal kanser gelişimine etkisini ve kolorektal kanser tarama programları farkındalıklarını incelemek amaçlanmıştır.

**Gereç ve Yöntemler:** Çalışmaya İKÇÜ Atatürk Eğitim Araştırma Hastanesi Tıbbi Onkoloji polikliniğinde, kolorektal karsinom tanısı almış 50 yaş üstü hastalar dahil edilmiştir. Hastalara tarama programları hakkındaki bilgilerini ve risk faktörlerini değerlendirmeye yönelik anket yönetilmiştir. Klinik-demografik veriler tıbbi onkoloji poliklinik dosya kayıtlarından elde edilmiştir.

**Bulgular:** Çalışmaya 130 hasta dahil edilmiştir. Taramayla tanı alan 23, taramayla tanı almayan 107 hasta saptanmıştır. Tarama ile tanı alanların yaş ortalaması 58,7, taramayla tanı almayanların yaş ortalaması 63,7 olup taramayla tanı alan hastalar daha erken yaşta tanı almıştır. Hastaların %2,4'ü T1, %3,5'i T2, %47,1'i T3, %47,1'i T4 evresinde tanı almıştır. Tarama ile tanı alan hastaların T evresi tarama ile tanı almayan hastalara göre düşük saptanmıştır. Tanı sırasında metastaz saptanan 58 kişiden 8'i taramayla tanı alan gruptadır. Hastaların %79,2'sinin KETEM hakkında bilgisi olmadığı saptanmıştır. KETEM hakkında bilgi sahibi olanların %56,5'i taramayla tanı almış, %13,1'i tarama programına katılmadan tanı almıştır. KETEM hakkında bilgi sahibi olmanın, tarama ile tanı almayla anlamlı bir ilişkisi olduğu bulunmuştur. Çalışmaya katılan hastaların tarama programıyla tanı konulma oranı %17,6'dır.

**Sonuç:** Bu çalışmada taramayla tanı almış hastaların daha erken yaşta, daha düşük T evresinde tanı aldıkları ve KETEM hakkında bilgisi olanların tarama programına katılmalarının daha yüksek olduğu saptanmıştır. Kolorektal kanserin daha erken evrede tespiti ve mortalitesinin azaltılması için tarama programlarına katılım çok önemlidir. Tarama programları hakkında toplumun bilinçlendirilmesi ve bilgi düzeylerinin artırılması için çalışmalar yapılması gerekmektedir.

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## **Introduction**

Colorectal cancer is the most prevalent cancer of the gastrointestinal system (1). According to the Turkish Statistical Institute (TUIK), it was the fourth leading cause of cancer-related deaths in 2017 (2). Its incidence begins to rise after the age of 40, peaking between ages 60 and 70 (3). Screening programs, combined with advancements in therapeutic and surgical approaches, have proven effective in reducing both the incidence and mortality rates of colorectal cancer (4).

Key risk factors for colorectal cancer include age, genetic predisposition, and dietary habits. It is most commonly observed in individuals aged 50 and older. A family history of colorectal cancer in first- or second-degree relatives and the presence of polyps further elevate the risk (5). Additional contributors include smoking, physical inactivity, obesity, a low-fiber diet, and excessive red meat consumption (6).

The early symptoms of colorectal cancer are often nonspecific. Common signs include changes in bowel habits, rectal bleeding, weight loss, anorexia, iron deficiency, and anemia (7). While early-stage colorectal cancer is primarily treated surgically, radiotherapy and chemotherapy may also be necessary depending on disease progression (8).

In Turkey, colorectal cancer screening involves fecal occult blood tests performed every two years for individuals aged 50 to 70 through Cancer Early Diagnosis, Screening, and Education Centers (KETEMs) and Family Health Centers. Additionally, colonoscopy is

recommended every 10 years for individuals over the age of 50 (9). Advanced diagnostic techniques, such as computed tomography, fecal DNA testing, and capsule endoscopy, are also employed when necessary (10).

This study aimed to evaluate whether patients diagnosed with colorectal cancer at the Medical Oncology Clinic of Atatürk Education and Research Hospital, Izmir Katip Celebi University, had prior exposure to KETEM services or participation in screening programs. Furthermore, it assessed the influence of personal and environmental risk factors on colorectal cancer development and examined patients' awareness of colorectal cancer screening programs.

## **Materials and Methods**

Ethics approval for this non-interventional study was obtained from the Clinical Research Ethics Committee of Izmir Katip Celebi University. Data were analyzed retrospectively. The study included patients aged 50 and older who were diagnosed with colorectal carcinoma at the Medical Oncology Outpatient Clinic of Izmir Katip Celebi University Atatürk Education and Research Hospital and were receiving treatment and/or follow-up care. Participants who agreed to take part in the study completed a 14-question survey designed to evaluate their knowledge of screening programs and associated risk factors. Clinical and demographic data were extracted from outpatient medical records.

A total of 144 patients volunteered to participate in the survey. Fourteen patients

were excluded due to incomplete clinical or demographic data or a diagnosis under the age of 50, resulting in a final sample size of 130 participants.

Data analysis was conducted using IBM SPSS Statistics Standard Concurrent User V26 (IBM Corp., Armonk, New York, USA). Descriptive statistics included sample size (n), percentage (%), mean  $\pm$  standard deviation (mean  $\pm$  sd), median (M), minimum (min), and maximum (max) values. The Shapiro-Wilk test was used to evaluate the normality of numerical variables, and Levene's test assessed the homogeneity of variances. Since the data did not follow a normal distribution, nonparametric tests were applied. The Mann-Whitney U test was used to compare single-measure numerical variables (e.g., mean ages). Categorical variables were analyzed using Fisher's Exact test and Chi-Square test. Frequency tables and crosstabs were generated for descriptive purposes. Statistical significance was set at  $p < 0.05$ .

Fisher's Exact test was used to compare educational status and the presence of family and personal histories of cancer between patients diagnosed through screening and those diagnosed without screening. Additionally, Fisher's Exact test was employed to compare T stage between the two groups, while Pearson's Chi-Square test was applied to assess differences in lymph node metastasis and distant metastasis at diagnosis.

## Results

The study included 130 patients. Table 1

summarizes the patient characteristics, while Table 2 compares these characteristics based on screening status.

The mean age of patients diagnosed through screening (n = 23) was 58.7 years, significantly lower than the mean age of 63.7 years for those diagnosed without screening (n = 107;  $p = 0.007$ ).

Regarding reasons for hospital admission, 48 patients (36.9%) presented with abdominal pain and swelling, 33 (25.4%) with constipation, 14 (10.8%) with rectal bleeding, 11 (8.5%) with fatigue and weight loss, 8 (6.2%) with diarrhea, and 4 (3.1%) for other reasons (e.g., rectal discharge, polyps, ulcers). Additionally, 12 patients (9.2%) were diagnosed during routine check-ups without complaints.

Participants were grouped into five educational levels: 64.6% (n = 84) completed primary school, 11.5% (n = 15) secondary school, 12.3% (n = 16) high school, 10.8% (n = 14) university, and 0.8% (n = 1) postgraduate studies. Educational levels did not differ significantly between screening and non-screening groups ( $p = 0.083$ ).

### *Cancer staging*

T and N stages were classified based on AJCC criteria. Excluding patients with metastasis or undetermined staging, 2.4% of participants were at T1, 3.5% at T2, 47.1% at T3, and 47.1% at T4. Among screening-diagnosed patients, lower T stages were observed ( $p = 0.003$ ).

- T1: 0% (non-screened) vs. 8.7% (screened)
- T2: 2.8% (non-screened) vs. 0% (screened)



- T3: 37.8% (non-screened) vs. 52.2% (screened)
- T4: 59.4% (non-screened) vs. 13% (screened).

Lymph node involvement (N stage) was assessed in 85 participants. Among them, 40% (n = 34) were at N0, 37.6% (n = 32) at N1, and 22.4% (n = 19) at N2. Although no significant difference in lymph node metastasis was observed between groups (p = 0.066), screening-diagnosed patients showed fewer cases of advanced N staging.

Metastasis was identified in 44.6% (n = 58) of all participants at diagnosis, with 8 cases in the screening group. Although the proportion of metastasis was lower among screened patients, the difference was not statistically significant (p = 0.296).

#### *Risk factors and lifestyle*

- Smoking: 63.8% (n = 83) were non-smokers, and 36.2% (n = 47) were smokers.
- Alcohol: 83.8% (n = 109) did not consume alcohol, while 16.2% (n = 21) did.
- Ulcerative colitis: Present in 6.2% (n = 8).
- Fatty food consumption: 41.5% (n = 54) consumed high-fat diets.
- Polyps: 11.5% (n = 15) had a history of polyps.

The mean body mass index (BMI) was 25.68 kg/m<sup>2</sup>.

#### *Family and personal history*

- Family history of cancer was reported by 21.7% (n = 5) of screened patients and 14% (n = 15) of non-screened patients (p = 0.350).
- Concomitant cancers were found in 4.3% (n

= 1) of screened patients and 5.6% (n = 6) of non-screened patients (p = 1.000).

#### *Screening participation*

Of the 130 patients, 36.9% (n = 48) participated in screening programs, while 63.1% (n = 82) did not. Among screened patients, 25.4% (n = 33) underwent colonoscopy only, 4.6% (n = 6) had a fecal occult blood test (FOBT) only, and 6.9% (n = 9) had both tests.

#### *Awareness of KETEM*

Participants were divided into those informed (20.8%, n = 27) and unaware (79.2%, n = 103) of KETEM. Among informed participants, 56.5% were diagnosed through screening, compared to 43.5% of uninformed participants. Awareness of KETEM was significantly associated with screening participation (p < 0.001).

Overall, 17.6% (n = 23) of participants were diagnosed through the screening program, with a screening diagnosis rate of 47.9% among those who participated.

#### **Discussion**

Colorectal cancer ranks as the fourth leading cause of cancer-related deaths globally (2). Reducing mortality rates requires the implementation of effective screening programs, advancements in treatment, and improved surgical techniques.

A study by Kilickap et al. focused on patients aged 18 years and older, while our study targeted a more specific cohort of individuals aged 50 years and above. Despite this difference, the mean age of participants was

comparable, with 58.7 years in our study and 56 years in theirs. Additionally, 15.3% of our patients reported a family history of colorectal cancer, slightly higher than the 12% reported in Kilickap et al.'s study. Participation in screening programs was also higher in our study (36.9%) compared to theirs (20%), likely due to the inclusion of fecal occult blood test (FOBT) alongside colonoscopy (11).

In a study by Izbul and Muderriszade, 52.3% of patients were aged between 60 and 80 years, with a mean age of 65.2 years (12). Consistent with these findings, our study reported a mean age of 58.7 years for patients diagnosed through screening and 63.7 years for those diagnosed without screening.

Altun H.'s thesis study, which included 60 patients aged 36 to 80, reported a mean age of 62.5 years, similar to our results (13). However, Altun H.'s study reported no significant relationship between educational level and participation in screening programs ( $p = 0.391$ ). In contrast, other studies, such as those by Swan et al. and Frederiksen et al., found significant associations between higher educational attainment and participation in screening programs, particularly colonoscopy (14, 15). Our study did not observe such a relationship ( $p = 0.083$ ).

Regarding presenting symptoms, Turan et al. identified rectal bleeding (62.6%), constipation (51.2%), and abdominal pain (47.2%) as the most common reasons for seeking medical attention (16). Similarly, our study reported abdominal pain and swelling (36.9%), constipation (25.4%), and rectal bleeding (10.8%) as the top three symptoms, although the relative frequencies differed.

Family history of colorectal cancer was present in 15.3% of our patients, consistent with findings by Turan et al. (13.8%) and Altun H. (10%) (13, 16). A history of other cancers was reported by 5.4% of our patients, lower than the 10.5% reported by Turan et al.

The male-to-female ratio in our study was 1.3, aligning with Izbul and Muderriszade's findings (1.2) but differing slightly from Ozkan et al.'s ratio of 1.7, which highlights a higher prevalence of colorectal cancer among men (12, 17).

Screening methods in our study were predominantly colonoscopy (25.4%) and FOBT (4.6%), with 6.9% of patients undergoing both. These findings align with Izbul and Muderriszade's study, where colonoscopy was the primary diagnostic tool (76%) (12). Ozkan et al. reported that increased adoption of screening tests has contributed to declining colorectal cancer incidence in Turkey and the USA over the past two decades (17).

In Diyarbakirlioglu et al.'s study, 72.2% of patients had no metastasis, compared to 55.4% in our cohort. This difference may reflect variations in study populations and access to early detection programs (18).

Altug et al. reported a screening participation rate of only 0.3% in the general population, significantly lower than the 36.9% in our study (19). This disparity likely arises from differences in study focus; our research specifically targeted patients already diagnosed with colorectal cancer, many of whom underwent screening.

Altun H. found that 43.3% of patients did not participate in screening due to a lack of

information (13). Similarly, 79.2% of our participants were unaware of KETEM, emphasizing the need for better public education. Awareness of KETEM was significantly associated with screening participation ( $p < 0.001$ ).

Internationally, awareness and participation in screening programs are higher, with rates exceeding 65% in the USA, leading to lower colorectal cancer mortality (20, 21). In Turkey, participation rates range between 20% and 30%, as reported by the Ministry of Health (22). Our study's rate of 36.9% indicates progress but underscores the need for further improvement.

Dietary habits were also explored. Aune et al.'s meta-analysis demonstrated that high-fiber diets reduce colorectal cancer risk (24). In our study, 41.5% of participants consumed high-fat diets, and the mean BMI of 25.67 indicated that most were overweight, consistent with findings by Altun H. (13).

Lastly, Jess et al. highlighted the increased risk of colorectal cancer among patients with ulcerative colitis, estimating a 1.6% risk over 14 years (25). Our study reported a higher prevalence of ulcerative colitis (6.2%) among participants, likely reflecting our focus on a colorectal cancer cohort.

## Conclusion

Colorectal cancer risk factors include being over 50 years old, consuming a high-fat diet, smoking, alcohol use, obesity, a family history of colorectal cancer, and a personal history of polyps or ulcerative colitis. High-risk individuals should undergo regular screening

and monitoring through primary care physicians or KETEM centers to facilitate early detection.

Our findings demonstrate that patients diagnosed through screening were younger and presented with a lower T stage, emphasizing the critical role of screening tests in detecting colorectal cancer at earlier stages and reducing mortality rates.

Furthermore, our study revealed a significant association between awareness of KETEM and participation in screening programs. These results highlight the importance of raising public awareness and enhancing education about the benefits of colorectal cancer screening programs to improve early diagnosis and survival outcomes.

## Limitations

A key limitation of our study is the inability to include all patients diagnosed with colorectal cancer who were treated at the Medical Oncology Outpatient Clinic of Izmir Katip Celebi University Ataturk Education and Research Hospital. This may have resulted in a selection bias and limited the generalizability of our findings.

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**Ethics Approval:** Ethics approval for this non-interventional study was obtained from the Clinical Research Ethics Committee of Izmir Katip Celebi University.

**Author contributions**

**Concept:** BA, BC, IK, KD, ENC, BBK.

**Design:** BA, BC, IK, KD, ENC, BBK.

**Supervision:** BA, BC, IK, KD, ENC, BBK.

**Resources:** BA, BC, IK, KD, ENC, BBK.

**Data Collection and Processing:** BA, BC, IK, KD, ENC, BBK..

**Analysis and Interpretation:** BA, BC, IK, KD, ENC, BBK.

**Literature Search:** BA, BC, IK, KD, ENC, BBK.

**Writing Manuscript:** BA, BC, IK, KD, ENC, BBK.

**Critical Review:** BA, BC, IK, KD, ENC, BBK.

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**Table 1.** Patient Characteristics

<b>Variables</b>	<b>Statistics</b>
<b>Cause of presentation, n (%)</b>	
No complaints/Check-up	12 (9.2)
Constipation	33 (25.4)
Abdominal Pain/Swelling	48 (36.9)
Bleeding	14 (10.8)
Diarrhea	8 (6.2)
Fatigue/Weight Loss	11 (8.5)
Other	4 (3.1)
<b>Smoking status, n (%)</b>	
Non-smoker	83 (63.8)
Smoker	47 (36.2)
<b>Alcohol, n (%)</b>	
No alcohol use	109 (83.8)
Alcohol use	21 (16.2)
<b>Ulcerative Colitis, n (%)</b>	
Yes	8 (6.2)
No	122 (93.8)
<b>Fatty Food Consumption, n (%)</b>	
Yes	54 (41.5)
No	76 (58.5)
<b>History of Polyps, n (%)</b>	
No	115 (88.5)
Yes	15 (11.5)
<b>BMI, (kg/m<sup>2</sup>)</b>	
$\bar{x} \pm sd$	25.67 ± 4.70
<i>M</i> (min-max)	25.29 (16.05-44.44)
<b>Participation in Screening, n (%)</b>	
No screening	82 (63.1)
Underwent screening	48 (36.9)
<b>Screening Test, n (%)</b>	
Colonoscopy	33 (25.4)
Fecal occult blood test (FOBT)	6 (4.6)
Colonoscopy and FOBT	9 (6.9)
None	82 (63.1)

$\bar{x}$ : Mean, *sd*: Standard deviation, *M*: Median, %: Percentage

**Table 2.** Comparison of Patient Characteristics by Screening Groups

	Groups		Test Statistics	
	Diagnosed without screening	Diagnosed through screening	Test Value	p value
<b>Age at Diagnosis, years</b>				
<i>x</i> ± <i>sd</i>	63.69±8.28	58.65±5.54	<i>z</i> =2.712	<b>0.007</b>
<i>M</i> ( <i>min-max</i> )	63 (50-82)	59 (51-69)		
<b>Educational Level, n (%)</b>				
Primary School	74 (69.2)	10 (43.5)	$\chi^2=7.422$	0.083
Secondary School	11 (10.3)	4 (17.4)		
High School	10 (9.3)	6 (26.1)		
Undergraduate	11 (10.3)	3 (13)		
Graduate	1 (0.9)	0 (0)		
<b>T Stage, n (%)</b>				
T1	0 (0)	2 (11.8)	$\chi^2=15.156$	<b>0.003</b>
T2	3 (4.4)	0 (0)		
T3	28 (41.2)	12 (70.6)		
T4	37 (54.4)	3 (17.6)		
<b>N Stage, n (%)</b>				
N0	23 (33.8)	11 (64.7)	$\chi^2=5.433$	0.066
N1	28 (41.2)	4 (23.5)		
N2	17 (25)	2 (11.8)		
<b>Metastasis, n (%)</b>				
No	57 (53.3)	15 (65.2)	$\chi^2=1.093$	0.296
Yes	50 (46.7)	8 (34.8)		
<b>Family History of Cancer, n (%)</b>				
Yes	15 (14)	5 (21.7)	$\chi^2=0.867$	0.350
No	92 (86)	18 (78.3)		
<b>Concomitant Cancer, n (%)</b>				
Yes	6 (5.6)	1 (4.3)	$\chi^2=0.603$	1.000
No	101 (94.4)	22 (95.7)		
<b>Informed about KETEM, n (%)</b>				
No	93 (86.9)	10 (43.5)	$\chi^2=47.738$	<b>0.0001</b>
Yes	14 (13.1)	13 (56.5)		

*x*: Mean *sd*: Standard deviation, *M*: Median, %: Percentage,  $\chi^2$ : Chi square test value, *z*: Mann-Whitney U test

# Investigation of Sleep Quality and The Relationship with Symptom Severity in Irritable Bowel Syndrome

## Sleep Quality in Irritable Bowel Syndrome

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### Article Info

### ABSTRACT

#### Article History

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#### Keywords:

Irritable bowel syndrome,  
Sleep quality,  
IBS symptom severity scale,  
Pittsburgh sleep quality index

**Objective:** This study aims to analyze sleep quality and its association with symptom severity in irritable bowel syndrome (IBS).

**Materials and Methods:** A total of 100 subjects, including 50 IBS patients and 50 healthy controls followed at our center between November 2023 and April 2024, were recruited for the study. All participants were assessed using the Pittsburgh Sleep Quality Index (PSQI), and the results were compared between groups. Additionally, the symptom severity of the IBS group was evaluated using the IBS Symptom Severity Scale (IBS-SSS), and its correlation with the PSQI score was analyzed.

**Results:** Of the participants, 18 (24%) were male, and the median age was 40.5 years (range: 28–52). The total PSQI score was significantly higher in the IBS group compared to controls (7.5 vs. 4,  $p < 0.001$ ). A positive correlation was identified between the total PSQI score and IBS-SSS ( $r = 0.501$ ,  $p < 0.001$ ).

**Conclusion:** IBS is a functional bowel disorder that negatively impacts sleep quality. Moreover, the severity of IBS symptoms is associated with poorer sleep quality.

## İrritabl Barsak Sendromunda Uyku Kalitesinin ve Semptom Şiddeti ile İlişkisinin Araştırılması

### İrritabl Barsak Sendromunda Uyku Kalitesi

### Makale Bilgisi

### ÖZET

#### Makale Geçmişi

Geliş Tarihi: 13/11/2024

Kabul Tarihi: 18/12/2024

Yayın Tarihi: 31/12/2024

#### Anahtar Kelimeler:

İrritabl barsak sendromu,  
Uyku kalitesi,  
İBS semptom şiddet puanlama sistemi,  
Pittsburgh uyku kalitesi indeksi

**Amaç:** Bu çalışma, İBS'de uyku kalitesini ve bunun semptom şiddeti ile ilişkisini analiz etmeyi amaçlamaktadır. **Gereç ve Yöntemler:** Kasım 2023 ve Nisan 2024 tarihleri arasında merkezimizde takip edilen 50 İBS hastası ve 50 sağlıklı kontrol ile birlikte toplam 100 katılımcı çalışmaya dahil edilmiştir. Tüm katılımcılar Pittsburgh Uyku Kalitesi İndeksi (PSQI) ile değerlendirilmiş ve gruplar arasında karşılaştırılmıştır. Ayrıca, İBS grubunun semptom şiddeti İBS Semptom Şiddeti Ölçeği (IBS-SSS) ile değerlendirilmiş ve PSQI skoru ile korelasyonu analiz edilmiştir.

**Bulgular:** Hastaların 18'i (%24) erkekti ve ortalama yaş 40,5 (28-52) yılıdır. Toplam PSQI puanı İBS grubunda daha yüksekti (7,5 vs 4,  $p < 0,001$ ). Toplam PSQI puanı ile IBS-SSS arasında pozitif bir korelasyon tespit edilmiştir ( $r = 0.501$ ,  $p < 0.001$ ).

**Sonuç:** İBS, uyku kalitesini olumsuz etkileyen fonksiyonel bir bağırsak hastalığıdır. Ayrıca, İBS semptomlarının şiddetinin uyku kalitesindeki düşüşle ilişkili olduğu bulunmuştur.

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## Introduction

Irritable bowel syndrome (IBS) is one of the most common types of gastrointestinal disorders, with a prevalence of 10–20% (1). IBS can present with a range of symptoms, including diarrhea, constipation, abdominal discomfort, and pain, significantly reducing the quality of life (2). The diagnosis of IBS is made by excluding other pathological disorders in the presence of characteristic symptoms, as there is no definitive diagnostic test (3).

Although the exact underlying pathology of IBS remains unclear, recent studies have identified the presence of subclinical inflammation in the gastrointestinal tract (4). Additionally, pathological variations in neurotransmitter levels in patients with IBS have been shown to disrupt communication within the gut-brain axis (5). In this context, the impact of IBS on sleep quality has been a focus of interest in previous research. However, the number of studies exploring this relationship is limited, and there is insufficient data on the association between sleep quality and symptom severity (6, 7).

In the present study, we aimed to investigate sleep quality and its relationship with symptom severity in patients with IBS.

## Materials and Methods

### *Study population*

This prospective study was conducted in the Gastroenterology Unit of Yenimahalle Teaching and Training Hospital. The study was approved by the Medical and Health Research Ethics Committee of the same institution

(Approval date: November 2023; Approval number: E-62). Written informed consent was obtained from all participants prior to their inclusion in the study.

All adult patients diagnosed with IBS between November 2023 and April 2024 were included. Demographic data, smoking status, exercise habits, and the presence of a sleep partner were recorded for each patient during outpatient clinic visits. The diagnosis of IBS was based on the Rome IV diagnostic criteria, as recommended by the guidelines (8). Additionally, IBS subtypes were identified using the Rome IV criteria. During the diagnostic process, organic pathologies that could be considered in the differential diagnosis of IBS were excluded through anamnesis, laboratory tests, and clinical examinations. For cases with uncertain diagnoses, further colonoscopic evaluations were performed, and patients with underlying pathological findings were excluded from the study.

The following exclusion criteria were applied:

- i) Age <18 years;
- ii) History of malignancy;
- iii) Hyperthyroidism or hypothyroidism;
- iv) Chronic respiratory, liver, or kidney diseases;
- v) Autoimmune diseases;
- vi) History of celiac disease or inflammatory bowel disease;
- vii) History of severe anxiety or depression.

The control group consisted of hospital staff without any diagnosed diseases and not receiving any treatments. The control group was also evaluated using the same exclusion criteria.

### *Sleep disturbance and symptom severity evaluation*

Both groups were assessed for sleep quality using the Pittsburgh Sleep Quality Index (PSQI), a validated diagnostic tool widely used to evaluate sleep quality in various diseases (9). To assess the symptom severity of IBS, the IBS Symptom Severity Scale (IBS-SSS) was utilized. The IBS-SSS is a questionnaire comprising five evaluation items:

- i) Severity of abdominal pain;
- ii) Number of days with pain over a 10-day period;
- iii) Severity of abdominal distension;
- iv) Satisfaction with bowel habits;
- v) Impact of IBS on quality of life.

### *Statistical analysis*

Statistical analyses were performed using IBM SPSS Statistics for Windows, version 25.0 (IBM Corp., Armonk, NY, USA). The Kolmogorov–Smirnov test was applied to assess the normality of the distribution of continuous variables. As all continuous variables were non-normally distributed, they were presented as median (interquartile range) and compared using the Mann–Whitney U test. Categorical variables were presented as frequency (percentage) and compared using the Chi-square test. Spearman’s correlation test was employed to analyze the relationship between the IBS-SSS score and the total PSQI score. A two-tailed p value of <0.05 was considered statistically significant.

## **Results**

Table 1 presents the demographic characteristics and clinical data of IBS patients. The most common IBS subtype was diarrhea-dominant (n = 22, 44%), followed by constipation-dominant (n = 15, 30%). Regular exercise habits were reported by 22% (n = 11) of IBS patients. Sixteen (32%) patients were smokers, and two-thirds (n = 33, 66%) had a sleep partner. The median IBS-SSS value was 320 (interquartile range: 207.5–368.75).

Table 2 summarizes the comparison of PSQI parameters between IBS patients and the control group. The subjective sleep quality score (p = 0.004), sleep latency score (p < 0.001), sleep disturbances score (p < 0.001), use of sleep medication score (p = 0.007), daytime dysfunction score (p < 0.001), and total PSQI score (p < 0.001) were significantly higher in the IBS group compared to the control group. In contrast, the habitual sleep efficiency score (p = 0.001) was significantly higher in the control group. The sleep duration score did not differ significantly between the groups (p = 0.079).

The correlation between the IBS-SSS and the total PSQI score is illustrated in Figure 1. A positive correlation was observed between the IBS-SSS and the total PSQI score (r = 0.501, p < 0.001).

## **Discussion**

In the current study, we found that the sleep quality of patients with IBS was poorer than that of the control group, and sleep quality was correlated with symptom severity.

IBS is a functional bowel disorder that affects

individuals of both sexes across all age groups and significantly impacts quality of life (10, 11). Although the etiology of IBS is not fully understood, recent studies have identified several underlying pathophysiological changes (12, 13). Examination of intestinal pathology specimens from IBS patients has revealed evidence of subclinical inflammatory changes (14, 15). Furthermore, pathophysiological changes mediated by immune, neural, and endocrine effects of gut microbiota-derived signals have been shown to influence the brain (16, 17). This communication pathway, known as the gut-brain axis, is supported by studies demonstrating differences in the intestinal flora of IBS patients compared to healthy individuals (16, 18). With the recognition of gut-brain axis interactions in IBS, recent research has focused on whether these interactions affect sleep quality.

Several studies have shown that sleep disturbances are more common, and sleep quality is poorer, in IBS patients compared to the general population (19, 20). Our findings align with the literature, demonstrating poorer sleep quality in the IBS group. Notably, our study showed that six of the seven primary components of the PSQI—excluding sleep duration—were significantly worse in IBS patients. However, no significant differences were observed in sleep duration between the two groups. Interestingly, Patel et al. found that sleep duration was higher in IBS patients but that they felt less rested (21). Based on these findings, it can be suggested that while sleep duration in IBS patients is not negatively affected, the restorative quality of sleep is

diminished.

Although various studies have explored the impact of IBS on sleep quality, there is limited research examining the association between IBS symptom severity and sleep quality (22). In the present study, we demonstrated a positive correlation between PSQI scores and IBS-SSS scores. These findings suggest that an increase in IBS symptom severity is associated with a greater negative impact on sleep quality. However, it is important to note that some studies have reported that a decrease in sleep quality may exacerbate IBS-related symptoms (6, 23). This suggests an interactive relationship between sleep quality and symptom severity. Consequently, it is not possible to draw definitive conclusions about the causality of this relationship based on our study data alone. Further multicenter studies with larger sample sizes are needed to elucidate this interaction.

## Conclusion

In conclusion, we found that patients with IBS have impaired sleep quality compared to healthy controls, and symptom severity is associated with worse PSQI scores.

## Limitations

The main limitation of this study is that sleep quality was not assessed using polysomnography. Additionally, the impact of treatment on symptom severity, and consequently on sleep quality, could not be evaluated. Lastly, the study's relatively small sample size and single-center design may limit the generalizability of the findings.

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**Ethics Approval:** The study was approved by the Medical and Health Research Ethics Committee of the same institution (Approval date: November 2023; Approval number: E-62).

**Author contributions**

**Concept:** İ.E.G, Y.M.B.

**Design:** İ.E.G.

**Supervision:** İ.E.G.

**Resources:** İ.E.G.

**Data Collection and Processing:** İ.E.G.

**Analysis and Interpretation:** İ.E.G, Y.M.B.

**Literature Search:** İ.E.G.

**Writing Manuscript:** İ.E.G, Y.M.B.

**Critical Review:** İ.E.G, Y.M.B.

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**Table 1.** Demographic characteristics of subjects with IBS

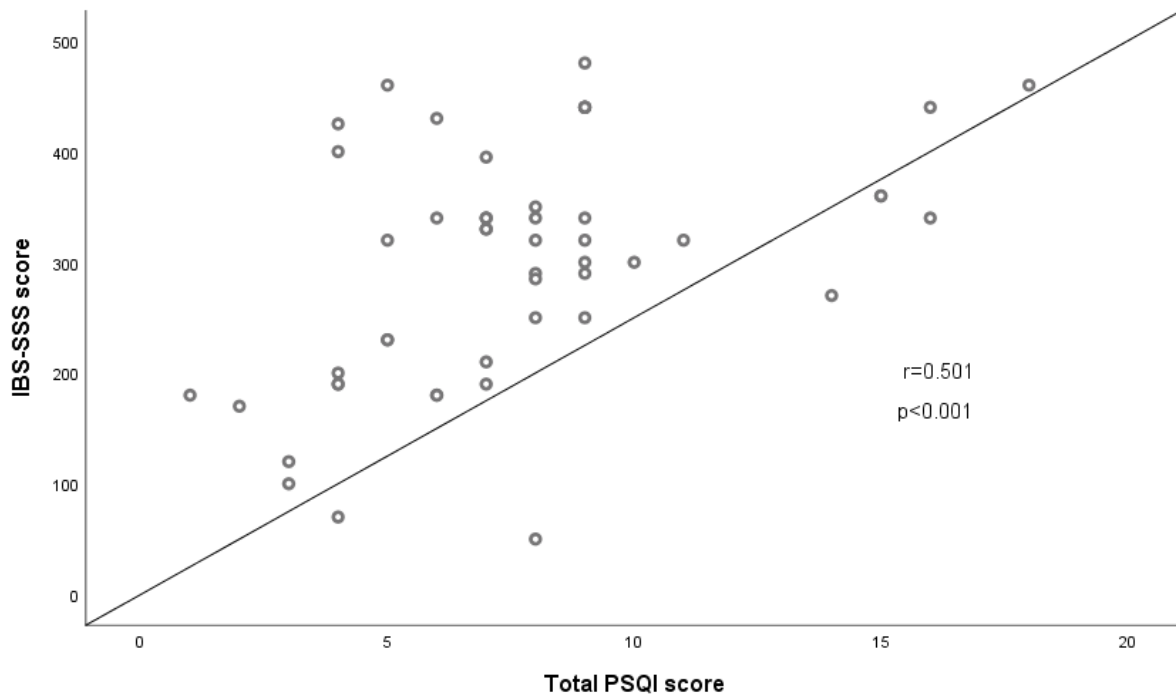
IBS Type	
IBS-D, n (%)	22 (44)
IBS-C, n (%)	15 (30)
IBS-Mixed, n (%)	13 (26)
Regular exercise habit, n (%)	11 (22)
Smoking habit, n (%)	16 (32)
Sleeping partner, n (%)	33 (66)
IBS-SSS	320 (207.5-368.75)

Data are presented as median (interquartile range) or frequency (percentages). IBS: irritable bowel syndrome, IBS-D; diarrhea dominant, IBS-C: constipation dominant, IBS-SSS: IBS symptom severity scale

**Table 2.** Pittsburgh Sleep Quality Index (PSQI) scores comparison between groups

	IBS (n=50)	Control (n=50)	P value
Age, years	40.5 (28-52)	39 (27.75-49.25)	0.868
Sex, male, n (%)	12 (24)	16 (32)	0.373
Subjective Sleep Quality	1 (1-2)	1 (1-1)	<b>0.004</b>
Sleep Latency	1 (1-2)	1 (0-1)	<b>&lt;0.001</b>
Duration of Sleep	1 (0-2)	1 (1-1)	0.079
Habitual Sleep Efficiency	0 (0-1)	1 (0-1)	<b>0.001</b>
Sleep Disturbances	1 (1-2)	1 (0-1)	<b>&lt;0.001</b>
Sleep Medication usage	0 (0-1)	0 (0-0)	<b>0.007</b>
Dysfunction in Daytime	1 (1-2)	1 (0-1)	<b>&lt;0.001</b>
Total PSQI score	7.5 (5-9)	4 (3-4.25)	<b>&lt;0.001</b>

Data are presented as median (interquartile range) or frequency (percentages). Significant p values are shown in bold. PSQI: Pittsburgh Sleep Quality Index



**Figure 1.** Correlation graph between IBS-SSS score and total PSQI score.

## Definition of Clinical Risk Factors for Differential Thyroid Cancers in Patients with Nodular Goiter

### Clinical Risk Factors in Thyroid Cancer

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#### Article Info

#### ABSTRACT

##### Article History

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##### Keywords:

Nodular goiter,  
Thyroid cancer,  
Risk factors

**Objective:** This study aimed to evaluate the clinical, radiological, and laboratory risk factors for differentiated thyroid cancers in patients with nodular thyroid disease and to investigate the relationship between these findings and the cytopathological features of the nodules.

**Materials and Methods:** Demographic data, laboratory and imaging findings, and fine-needle aspiration pathology results of 323 patients with incidentally detected thyroid nodules during clinical or radiological examination at the Endocrinology Clinic were retrospectively evaluated and recorded.

**Results:** Fine-needle aspiration biopsy of the dominant nodules revealed that 309 (95.6%) patients had benign nodules, while 14 (4.33%) had malignant nodules. Among patients with benign nodules, microcalcifications were detected in 274 (88.7%) cases, and macrocalcifications were observed in 18 (5.8%). In the malignant group, irregular nodule margins were noted in 1 (7.1%) patient, and multinodular goiter was present in 8 (57.1%). On thyroid ultrasound imaging, 8 (57.1%) patients with malignant nodules exhibited hypoechoic nodules, and 4 (28.6%) displayed microcalcifications. The internal structure of malignant dominant nodules was heterogeneous in 10 (71.4%) cases.

**Conclusion:** This study examined the relationship between histological results and various nodule characteristics, including echogenicity, diameter, calcification type, edge irregularity, autoimmunity, thyroid hormone levels, and cystic content. No significant associations were identified in the analyses, including the presence of microcalcifications ( $p = 0.074$ ). Broad-spectrum prospective studies with larger patient cohorts are needed to provide further insights and contribute to the existing literature.

## Nodüler Guatrlı Hastalarda Diferansiye Tiroid Kanseri için Klinik Risk Faktörlerinin Tanımlanması

### Tiroid Kanseri için Klinik Risk Faktörleri

#### Makale Bilgisi

#### ÖZET

##### Makale Geçmişi

Geliş Tarihi: 14/02/2024

Kabul Tarihi: 18/12/2024

Yayın Tarihi: 31/12/2024

##### Anahtar Kelimeler:

Nodüler guatr,  
Tiroid kanseri,  
Risk faktörleri

**Amaç:** Çalışmamızda, nodüler tiroid hastalarda diferansiye tiroid kanseri için klinik, radyolojik ve laboratuvar risk faktörlerinin değerlendirilmesi ve bu bulguların nodüllerin sitopatolojik özellikleri ile ilişkisinin saptanması amaçlanmıştır.

**Gereç ve Yöntemler:** Endokrinoloji Polikliniğine başvuran, muayene ile veya radyolojik tetkik sırasında tesadüfi olarak tiroid nodülü saptanan 323 hastanın demografik verileri, laboratuvar ve görüntüleme bulguları, ince iğne aspirasyon patoloji sonuçları retrospektif olarak değerlendirildi ve kaydedildi.

**Bulgular:** Olguların dominant nodüllerinden yapılan ince iğne aspirasyon biyopsisi sonucunda 309(%95,6) hastanın benign, 14(%4,33) hastanın ise malign nodüle sahip olduğu saptanmıştır. Benign nodüle sahip olguların 274'ünde(%88,7) mikrokalsifikasyon, 18'inde(%5,8) makrokalsifikasyon saptandı. Malign nodüllü olguların 1 (%7,1) inde nodül sınırları düzensiz, hastaların 8(%57,1) inde multinodüler guatr tespit edildi. Tiroid ultrason görüntülemesinde 82(%57,1) hastanın nodülleri hipoekoik iken 4(%28,6) hastada mikrokalsifikasyon mevcuttu. Malign dominant nodülün iç yapısı 10(%71,4) olguda heterojen izlendi.

**Sonuç:** Histolojik sonuçlarla nodüllerin yapısı, ekojenitesi, çapı, kalsifikasyon içeriği, kenar düzensizliği, eşlik eden otoimmünite, tiroid hormon düzeyi, kistik içeriği arasında ilişki araştırılmış ancak yapılan analizlerde ilişki saptanmamıştır. Mikrokalsifikasyon varlığı açısından tüm gruplarda anlamlı fark izlenmemiştir ( $p=0.074$ ). Bu konuda literatüre katkı amaçlı daha çok hasta içeren geniş spektrumlu prospektif çalışmaların dizayn edilmesine ihtiyaç vardır.

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## Introduction

Thyroid diseases are increasingly prevalent worldwide, including in our country. Thyroid nodules are typically benign and clinically asymptomatic lesions, observed in approximately 65% of the population, largely due to advancements in diagnostic imaging methods (1). Nodular thyroid disease is a condition of the endocrine system characterized by the presence of one or more nodules within the thyroid gland, with iodine deficiency being the most common cause (2). Thyroid cancer is detected in 7–15% of all thyroid nodules (3). However, it affects only 0.1% of the population, accounting for less than 1% of all cancers (2).

Thyroid nodules are often diagnosed incidentally during physical examinations or radiologic evaluations and are usually asymptomatic. While thyroid function tests, scintigraphy, and ultrasonography provide valuable information in the clinical and diagnostic approach to thyroid nodules, these methods alone cannot reliably differentiate between benign and malignant lesions. Fine-needle aspiration biopsy (FNAB), when combined with other diagnostic tools, offers more accurate insights into the pathology of thyroid nodules. FNAB is particularly significant for the early detection of malignant nodules and for avoiding unnecessary surgical procedures for benign nodules (3).

In this study, we aimed to evaluate the clinical, radiologic, and laboratory risk factors for differentiated thyroid cancers in patients with nodular goiter and to investigate the relationship between these findings and the cytopathologic features of the nodules.

## Materials and Methods

The records of 323 male and female patients aged 18–80 years, who were admitted to the Endocrinology and Metabolic Diseases Outpatient Clinic and incidentally diagnosed with thyroid nodules during examination or radiologic evaluation, were retrospectively analyzed and recorded.

Patient characteristics such as gender, age, comorbidities, and autoimmunity status were documented. Laboratory tests included the evaluation of sT3, sT4, TSH, and thyroid autoantibodies (anti-TPO, anti-Tg). Serum levels of sT3 (2.8–7.1 pmol/L), sT4 (12–22 pmol/L), and TSH (0.35–5.0  $\mu$ U/mL) were measured using the electrochemiluminescence method in the Biochemistry Laboratory. Patients with a TSH level  $<0.35$   $\mu$ U/mL and elevated sT3 and sT4 levels were classified as having overt hyperthyroidism, while those with normal sT3 and sT4 levels were classified as having subclinical hyperthyroidism. Patients with a TSH level  $>5$   $\mu$ U/mL were classified as having overt hypothyroidism if sT3 and sT4 levels were low, and as having subclinical hypothyroidism if sT3 and sT4 levels were within normal limits. Patients with TSH and sT4 levels within normal reference ranges were considered euthyroid.

Thyroid ultrasonography (USG) was performed using a GE-Logic 9 USG device equipped with a 12 MHz multifrequency linear probe in the Radiology or Endocrinology and Metabolic Diseases Ultrasonography Unit. Sonographic features of each nodule were recorded during



the examination.

Fine-needle aspiration biopsies (FNABs) were performed under USG guidance by specialist physicians in the Radiology Unit using 0.70 × 32 mm (25-gauge) needles, with patients positioned supine and without anesthesia. Nodules larger than 1 cm in size or smaller nodules with suspicious ultrasonographic features were biopsied. Each nodule underwent 2–4 aspirations, and biopsy materials were evaluated in the hospital's pathology laboratory.

Statistical analyses were performed using the SPSS 20.0 software package. Descriptive statistics were used for demographic data. The Student's t-test and one-way ANOVA with post-hoc tests were employed to compare continuous variables, while the Chi-square test was used for categorical variables. A p value <0.05 was considered statistically significant.

This study was approved by the local Ethics Committee and conducted in accordance with the Declaration of Helsinki. The authors declare no conflict of interest.

## Results

Among the 323 patients included in the study, 283 (87.6%) were female, and 40 (12.4%) were male. The mean age of all patients was  $48.16 \pm 12.96$  years (range: 17–84). Laboratory analysis showed a mean FT3 value of  $3.17 \pm 0.63$  pmol/L (range: 0.9–5.93), a mean FT4 value of  $1.11 \pm 0.19$  pmol/L (range: 0.41–2.13), and a mean TSH value of  $2.51 \pm 7.24$   $\mu$ IU/mL. Patients with TSH levels <0.35  $\mu$ IU/mL were classified as hyperthyroid, with a

total of 48 (14.9%) cases in this group. TSH levels >5  $\mu$ IU/mL were considered indicative of hypothyroidism, with 26 (8%) cases in this group. The remaining 249 (77.1%) patients, whose TSH and thyroid hormone levels fell within reference ranges, were classified as euthyroid (Table 1).

Thyroid ultrasound (USG) of the 323 patients revealed multinodular goiter (MNG) in 198 (61.3%) cases and a solitary nodule in 125 (38.7%) cases. The mean diameter of the dominant nodule was 19.14 mm (range: 6–70 mm). Autoimmune thyroiditis was not detected in 274 (84.8%) cases but was present in 49 (15.2%) cases. The borders of the nodules were regular in 283 (87.6%) cases and irregular in 40 (12.4%) cases. Regarding echogenicity, 167 (51.7%) nodules were isoechoic, 139 (43%) were hypoechoic, and 17 (5.3%) were hyperechoic. Microcalcifications were present in 39 (12.1%) nodules, while the remaining 284 (87.9%) nodules lacked microcalcifications. Macrocalcifications were observed in 19 (5.9%) nodules. Cystic content was detected in 91 (28.2%) nodules, with one case (0.3%) exhibiting purely cystic content.

Fine-needle aspiration biopsy (FNAB) of the dominant nodules revealed 309 (95.6%) benign cases and 14 (4.33%) malignant cases. The mean age of patients with benign nodules was 48.08 years, with 270 (87.4%) females and 39 (12.6%) males. Among these patients, 240 (77.7%) were euthyroid, 25 (8.1%) were hypothyroid, and 44 (14.2%) were hyperthyroid. MNG was found in 190 (61.5%) cases, while solitary nodules were observed in 119 (38.5%) cases. The dominant nodule was

located in the isthmus in 6 (1.9%) cases, the right lobe in 185 (59.9%) cases, and the left lobe in 118 (38.2%) cases. Autoimmune thyroiditis accompanied 48 (15.5%) cases of benign nodular goiter. Among benign nodules, 161 (52.1%) were isoechoic, 131 (42.4%) were hypoechoic, and 17 (5.5%) were hyperechoic. Microcalcifications were present in 35 (11.3%) cases, while macrocalcifications were detected in 18 (5.8%) cases. Cystic content was identified in 88 (28.5%) benign nodules, with heterogeneous internal structures observed in 176 (57%) cases and homogeneous structures in 133 (43%) cases. In the malignant group, the mean age of the 14 patients was 49.92 years, with 13 (92.9%) females and 1 (7.1%) male. Among these patients, 9 (64.3%) were euthyroid, 1 (7.1%) was hypothyroid, and 4 (28.6%) were hyperthyroid. MNG was found in 8 (57.1%) cases, and solitary nodules in 6 (42.9%) cases. The dominant nodule was located in the right lobe in 10 (71.4%) cases and the left lobe in 4 (28.6%) cases. Autoimmune thyroiditis accompanied 1 (7.1%) case with malignant nodular goiter. Regarding nodule borders, 13 (92.9%) had regular borders, while 1 (7.1%) had irregular borders. Among malignant nodules, 6 (42.9%) were isoechoic, 8 (57.1%) were hypoechoic, and none were hyperechoic. Microcalcifications were present in 4 (28.6%) cases, while macrocalcifications were observed in 1 (7.1%) case. Cystic content was identified in 3 (21.4%) malignant nodules, and the internal structure was heterogeneous in 10 (71.4%) cases and homogeneous in 4 (28.6%) cases (Tables 2 and 3).

FNAB results revealed 5 (1.54%) cases with follicular lesions, 10 (3.09%) with suspicious cytology, and 7 (2.16%) with malignant cytology. In 301 (93.18%) cases, FNAB reported benign results; cases with insufficient material were excluded from the study (Table 4).

Among the 323 patients, 25 (7.73%) underwent surgery. Pathological examination of the surgical material revealed malignancy in 14 (4.33%) cases and benign results in 11 (3.40%) cases. Of the malignant cases, 12 (3.71%) were papillary thyroid carcinomas, and 2 (0.61%) were follicular thyroid carcinomas.

The relationship between histological results and nodule characteristics, including structure, echogenicity, diameter, calcification content, edge irregularity, autoimmunity, TSH level, and cystic content, was analyzed. However, no significant associations were found, including the presence of microcalcifications ( $p = 0.074$ ).

## Discussion

Nodular thyroid disease is the most common endocrine pathology and continues to rise rapidly. Studies have shown that 4–7% of thyroid nodules can be detected by careful physical examination in the general population (4). The introduction of thyroid ultrasonography (USG) into clinical practice has enabled the detection of nodules that were previously undetectable during physical examination. It has been reported that the prevalence of thyroid nodules in the general population ranges from 30–50%, with 5–6.5%

of these nodules being malignant when evaluated by USG (5). In our study, the frequency of malignancy among all thyroid nodules was found to be 4.33%, consistent with the literature.

Although factors such as medical history, age, gender, radiation exposure, and family history are useful in evaluating thyroid nodules, there are no definitive ultrasonographic or scintigraphic markers for distinguishing malignant thyroid nodules. Fine-needle aspiration biopsy (FNAB) is crucial due to its simplicity, low complication rate, cost-effectiveness, and ability to provide cellular-level information. By distinguishing benign from malignant nodules, FNAB helps prevent unnecessary surgical interventions and guides surgical techniques.

Similar to nodular thyroid diseases, thyroid cancers are 3–4 times more common in females than males (6). In our study, 283 cases (87.6%) were female, and 40 cases (12.4%) were male, with a female-to-male ratio of 7:1. Of the 14 cancer cases, 13 (92.9%) were female, and 1 (7.1%) was male. Studies by El-Gammal et al. and Witczak et al. similarly found malignant nodules to be more common in female patients (7, 8). However, other studies have suggested that malignant thyroid nodules are more prevalent in males and individuals over 45 years of age (9). In our study, while malignant nodules were more common in females, no significant correlation was observed with age.

In our patient group, no correlation was found between nodule size and TSH levels or between elevated TSH levels and malignancy. Most patients, regardless of whether they had

benign or malignant nodules, were euthyroid, consistent with the literature (10).

FNAB results were categorized as benign (e.g., regressive changes, nodular hyperplasia, colloidal goiter), suspicious, or malignant (e.g., papillary carcinoma, follicular carcinoma). In a 2020 study by Al-Hakami et al., papillary thyroid carcinoma accounted for 85% of all thyroid malignancies, a finding consistent with our study (11). Nodules with suspicious cytology carry a high risk of malignancy (12, 13). For example, Hamad Ahmed et al. reported malignancy in 33.3% of 81 suspicious specimens, 21% of which were compatible with papillary carcinoma (14). Similarly, Maighan A. Seagrove-Guffey et al. found a 33% malignancy rate in patients with suspicious cytology in a study of 893 patients (15). In our study, 12 cases were diagnosed with papillary carcinoma and 2 with follicular carcinoma among nodules classified as malignant or suspicious. In addition, malignancy was found in 50% of operated cases with suspicious cytology, a rate similar to the literature. Suspicious nodules should therefore be surgically removed.

The increasing use of USG has made it essential for radiologists and clinicians to identify features suggestive of malignancy in thyroid nodules. Many USG findings, such as nodule size, internal structure (solid/cystic), echogenicity, vascularity, margins, hypoechoic halos, and the presence of microcalcifications, have been studied to differentiate benign from malignant nodules. These studies aim to determine which nodules should undergo further evaluation via biopsy, thus reducing unnecessary procedures for

benign nodules.

Most studies have not demonstrated a significant relationship between nodule size and malignancy. However, nodule size remains important for clinicians in deciding on follow-up, biopsy, or surgery. Nodules  $\geq 10$  mm require careful evaluation, and nodules with an anteroposterior-to-transverse diameter ratio  $>1$  are considered more likely to be malignant (16). In our study, there was no statistically significant association between nodule size and malignancy ( $p = 0.24$ ).

Hypoechoogenicity is considered more suggestive of malignancy compared to iso- or hyperechogenicity. Jeh et al. reported high rates of hypoechoogenicity in papillary cancers (72%) but lower rates in follicular cancers (35%), attributing this to lower intra-nodular colloid levels in follicular cancers (17). In our study, 42.4% of benign nodules and 57.1% of malignant nodules were hypoechoic, while no hyperechoic nodules were found in the malignant group. However, no statistically significant relationship was observed between echogenicity and malignancy ( $p = 0.43$ ).

Numerous studies have established a strong association between microcalcifications and malignancy. For instance, Serdal Uğurlu et al. identified microcalcifications as a critical predictor of malignancy in a study of 1004

cases (10). Similarly, Carlo Capelli et al. reported higher microcalcification rates in malignant nodules compared to benign ones (18). In our study, microcalcifications were found in 28.6% of malignant nodules and 11.3% of benign nodules. Although this difference did not reach statistical significance ( $p = 0.074$ ), one-way regression analysis indicated that the presence of microcalcifications increased the likelihood of malignancy 3.285-fold ( $p = 0.059$ , CI 0.955–11.303). While not statistically significant, this finding may still hold clinical relevance.

## Conclusion

In conclusion, the relationship between histological results and nodule structure, echogenicity, diameter, calcification content, margin irregularity, autoimmunity, thyroid hormone levels, and cystic content was investigated, but no significant associations were found. Broad-spectrum prospective studies with larger patient cohorts are required to further contribute to the literature.

## Limitations

The main limitation of our study is its relatively small sample size. Additionally, as a retrospective file review, the study had access to limited patient data. Larger prospective studies are needed to provide more robust and meaningful subgroup analyses.

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## Author contributions

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**Resources:** İ.E.G.

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**Analysis and Interpretation:** T.C, S.E, B.A.

**Literature Search:** T.C, S.E, B.A.

**Writing Manuscript:** L.C, S.E.

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**Table 1.** Laboratory results

Laboratory Result	Figure
Euthyroid	249 (77.1%)
Hypothyroidism	26 (8%)
Hypertrophy	48 (14.9%)

**Table 2.** Distribution of nodules

Conclusion	Figure
Benign	309 (95.6%)
Malignant	14 (4.33%)

**Table 3.** Distribution of benign and malignant nodules according to USG features

Result	Hypothyroid	Irregular outlines	Microcalcification
Benign	25(8.1%)	39 (12.6%)	35 (11.3%)
Malignant	1(7.1%)	1 (7.1%)	4 (28.6%)

**Table 4.** Distribution of FNAB results

FNAB result	Figure
Benign	301(93.18%)
Suspicious	10 (3.09%)
Malignant	7 (2.16%)
Follicular lesion	5 (1.54%)