Bosphorus Medical Journal
Boğaziçi Tıp Dergisi
Original Article

DOI: 10.14744/bmj.2025.94809

Bosphorus Med J 2025;12(3):65–72

Seasonal Changes of Gout Disease

Gut Hastalığının Mevsimsel Değişimleri

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ABSTRACT

Objectives: The aim of this study was to evaluate seasonal changes in patients diagnosed with gout.

Methods: The study included patients aged 18–65 years who presented at the Rheumatology Polyclinic between November 2021 and November 2023 and were diagnosed with gout, and an age-matched control group. The findings of the gout patients at the time of presentation and seasonal changes in gout attacks were retrospectively evaluated. Demographic, clinical, and laboratory data were retrieved from the hospital information system.

Results: A total of 170 individuals were analyzed. The gout patient group of 110 patients comprised 95 (86.3%) males and 15 (13.7%) females, with a mean age of 53.1 years. The control group of 60 healthy subjects comprised 35 (58.3%) males and 25 (41.7%) females, with a mean age of 55.1 years. The gout patients presented most frequently in spring, most often in the month of May. Of the gout patients, 40 (36.4%) presented with an attack. The attacks were seen most often in spring, in the month of April.

Conclusion: The study results showed that gout patients presented at hospital most often in spring, in the month of May, and that gout attacks occurred most often in spring, in the month of April. There is a need for further studies on the seasonality seen in gout disease.

Keywords: Gout; hyperuricemia; seasonality; uric acid.

ÖZET

Amaç: Bu çalışmanın amacı, gut tanısı almış hastalardaki mevsimsel değişiklikleri değerlendirmektir.

Yöntem: Çalışmaya Kasım 2021 ile Kasım 2023 arasında Romatoloji Polikliniğine başvuran ve gut tanısı alan 18–65 yaş aralığındaki hastalar ve yaşları eşleştirilmiş kontrol grubu dahil edildi. Gut hastalarının başvuru anındaki bulguları ve gut ataklarındaki mevsimsel değişiklikler retrospektif olarak değerlendirildi. Demografik, klinik ve laboratuvar verileri hastane bilgi sisteminden alındı.

Bulgular: Toplam 170 kişi analiz edildi. 110 hastadan oluşan gut hasta grubu 95 (%86,3) erkek ve 15 (%13,7) kadından oluşmakta olup yaş ortalaması 53,1 yıldı. 60 sağlıklı kişiden oluşan kontrol grubu ise 35 (%58,3) erkek ve 25 (%41,7) kadından oluşmakta olup yaş ortalaması 55,1 yıldı. Gut hastaları en sık ilkbaharda, en sık Mayıs ayında başvurdu. Gut hastalarının 40'ı (%36,4) bir atakla başvurdu. Atakların en sık ilkbaharda, Nisan ayında olduğu görüldü.

Sonuç: Çalışma sonuçları, gut hastalarının hastaneye en sık ilkbaharda, Mayıs ayında başvurduğunu ve gut ataklarının en sık ilkbaharda, Nisan ayında meydana geldiğini gösterdi. Gut hastalığında görülen mevsimsellik konusunda daha fazla çalışmaya ihtiyaç vardır.

Anahtar sözcükler: Gut; hiperürisemi; mevsimsellik; ürik asid.

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Cite this article as: Ünal Enginar A. Seasonal Changes of Gout Disease. Bosphorus Med J 2025;12(3):65-72.

Received: 31.05.2025
Revision: 20.09.2025
Accepted: 10.11.2025

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Gout is the most common reason for inflammatory arthritis in adults. The global prevalence is 1%–3% and the incidence is 0.1%–0.3%. It is seen more often in males and the frequency increases with age.[1] There may be comorbidities such as hypertension, hyperlipidemia, atherosclerosis, ischaemic heart disease, chronic kidney disease, and obesity accompanying gout disease.[1,2]

Hyperuricemia refers to an increase in serum urate concentration (>6.0mg/dL for females, >7.0mg/dL for males).[3] The generally accepted definition of hyperuricemia is established using serum urate >0.41mmol/L (6.8mg/dL), temperature difference, and pH values. However, monosodium urate crystals (MSU) can form at lower concentrations, especially in tissues with low temperature or acidic pH.[4] Although hyperuricemia is accepted as the main risk factor for gout patients, gout only develops in 25% of patients with hyperuricemia.[5] In up to 76% of patients with asymptomatic hyperuricemia, MSU crystal accumulation is not determined.[6] In some patients with hyperuricemia, MSU crystal accumulation occurs, and in some individuals with MSU crystal accumulation, clinical symptoms of gout emerge. The factors that contribute to the transition from hyperuricemia to clinically evident gout disease are less understood.[4]

Hyperuricemia is not the only risk factor for gout flare-ups. Temperature, pH, ion concentrations, proteins and various connective tissue conditions also affect MSU crystallisation in tissues. Other than hyperuricemia, MSU accumulation requires a pathological environment that has damaged biofibre integrity (e.g., osteoarthritis, surgery-related tissue damage).[7]

Seasonal changes have been determined in some rheumatological diseases. These changes may be related to humidity, temperature, hormonal factors, antibodies, inflammatory factors and preparation for immune response.[8] Acute gout arthritis attacks have been previously reported to be determined more often in spring.[9] In one study, acute gout attacks showed a yearly distribution and an increase in April, whereas there was no such seasonal distribution in pseudogout.[10] Environmental factors may play a role in the pathogenesis, onset and exacerbation of gout disease.[11]

The aim of this study was to evaluate seasonal changes in patients diagnosed with gout.

Methods

The study included patients aged 18–65 years who presented at the Rheumatology Polyclinic between November 2021 and November 2023 and were diagnosed with gout, and an age-matched control group. The demographic, clinical and laboratory data were collected retrospectively from the hospital information system. Patient data were evaluated, including age, gender, disease duration, drugs used, attacks, arthritis, uric acid, creatinine, full blood count, C-reactive protein and sedimentation. The patients were evaluated at the time of hospital presentation and the season when attacks occurred. Seasons were classified as winter (December–February), spring (March–May), summer (June–August) and autumn (September–November). Patients were excluded from the study if they were pregnant or breastfeeding, or had psoriasis, cancer or any other rheumatological disease. The study protocol was approved by the Ethics Committee of Necmettin Erbakan University (decision no: 2023/4710). This study complied with the Declaration of Helsinki and the Good Clinical Practice Guidelines.

Statistical Analysis

Data obtained in the study were analyzed statistically using SPSS for Windows version 22.0 (Statistical Package for Social Science) and SAS 9.4 software. Descriptive statistics were stated as mean±standard deviation values for the quantitative variables measured, and as number (n) and percentage (%) for qualitative variables. Conformity of the variables to normal distribution was assessed with the Kolmogorov–Smirnov test with examination of skewness and kurtosis values. As a result of the tests and the skewness coefficients, all the variables were seen to be between +2 and -2, so it was understood that the data showed normal distribution and parametric tests were used in the statistical analyses. In paired comparisons of variables with two categories, such as gender, the Independent Samples t-test was applied, and to determine differences between variables with 3 or more categories, variance analysis (F test) was used. Pearson correlation analysis was performed to determine relationships between quantitative variables. A value of $p<0.05$ was accepted as the level of statistical significance in all the analyses.

Results

The gout patient group of 110 patients comprised 95 (86.3%) males and 15 (13.7%) females with a mean age of 53.1 years. The control group of 60 healthy subjects comprised 35 (58.3%) males and 25 (41.7%) females with a mean age of 55.1 years. In the gout group, disease duration was determined to be a mean of 21.1 months.

A comorbid disease was present in 38 (34.5%) gout patients and in 19 (31.7%) of the control group. No significant difference was determined between the groups in respect of comorbidities.

The uric acid and creatinine values were significantly higher in the gout group ($p<0.0001$). The gout patients presented most frequently in spring, most often in the month of May ($p<0.0001$) (Table 1, Table 2, Fig. 1). Of the gout patients,

Table 1. Clinical characteristics of patients gout and control group

	Group		
	Gut Patients (n=110)	Control (n=60)	p
Age (years)			0.47381
Mean (SD)	53.1 (13.02)	55.1 (10.12)	
Median (Range)	58.0 (27.0, 74.0)	57.0 (33.0, 76.0)	
Disease duration(months)			
Mean (SD)	21.1 (24.73)		
Median (Range)	12.0 (0.0, 120.0)		
Comorbidity, n (%)			0.7040
No	72 (65.5)	41 (68.3)	
Yes	38 (34.5)	19 (31.7)	
Chronic renal failure, n (%)			0.1180
No	99 (90.0)	58 (96.7)	
Yes	11 (10.0)	2 (3.3)	
Hypertension (%)			0.0001
No	87 (79.1)	60 (100.0)	
Yes	23 (20.9)	0 (0.0)	
Diabetes Mellitus n (%)			0.0028
No	107 (97.3)	51 (85.0)	
Yes	3 (2.7)	9 (15.0)	
Coronary artery disease n (%)			0.0051
No	100 (90.9)	45 (75.0)	
Yes	10 (9.1)	15 (25.0)	
Stroke n (%)			0.1968
No	107 (97.3)	60 (100.0)	
Yes	3 (2.7)	0 (0.0)	
Proteinuria n (%)			0.4589
No	109 (99.1)	60 (100.0)	
Yes	1 (0.9)	0 (0.0)	
Pace maker n (%)			0.4589
No	109 (99.1)	60 (100.0)	
Yes	1 (0.9)	0 (0.0)	
Down Syndrome n (%)			0.1968
No	107 (97.3)	60 (100.0)	
Yes	3 (2.7)	0 (0.0)	
Drug, n (%)			
allopurinol	2 (2.8)		
allopurinol, colchicine	33 (46.5)		
allopurinol, colchicine, steroid	13 (18.3)		
colchicine	18 (25.4)		
febuxostat, colchicine	5 (7.0)		
Months, n (%)			0.3614
April	9 (8.2)	6 (10.0)	
August	9 (8.2)	3 (5.0)	
December	6 (5.5)	7 (11.7)	
February	11 (10.0)	2 (3.3)	
January	11 (10.0)	8 (13.3)	
July	4 (3.6)	6 (10.0)	

Table 1. Clinical characteristics of patients gout and control group (Cont.)

	Group		p
	Gut Patients (n=110)	Control (n=60)	
June	8 (7.3)	3 (5.0)	
March	11 (10.0)	7 (11.7)	
May	13 (11.8)	3 (5.0)	
November	8 (7.3)	7 (11.7)	
October	10 (9.1)	5 (8.3)	
September	10 (9.1)	3 (5.0)	
Season, n (%)			0.9617
Spring	33 (30.0)	16 (26.7)	
Summer	21 (19.1)	12 (20.0)	
Autumn	28 (25.5)	15 (25.0)	
Winter	28 (25.5)	17 (28.3)	
NLR			0.0633
Mean (SD)	2.2 (1.75)	2.0 (1.97)	
Median (Range)	1.9 (0.9, 16.2)	1.7 (0.8, 16.0)	
PLR			0.2558
Mean (SD)	110.6 (46.26)	124.2 (73.17)	
Median (Range)	101.1 (38.6, 339.0)	103.9 (57.3, 581.0)	
Uric acid mg/dl			<.0001
Mean (SD)	7.7 (2.06)	4.7 (1.32)	
Median (Range)	7.7 (3.1, 15.4)	4.5 (2.3, 7.3)	
Creatinine mg/dl			<.0001
Mean (SD)	1.1 (0.24)	0.8 (0.19)	
Median (Range)	1.0 (0.4, 1.8)	0.7 (0.5, 1.4)	
Erythrocyte sedimentation rate(ESR)mm/h			0.4419
Mean (SD)	17.7 (15.59)	14.5 (10.24)	
Median (Range)	13.0 (1.0, 82.0)	11.0 (1.0, 47.0)	
C- Reactive protein(CRP)mg/dl			0.1008
Mean (SD)	9.1 (16.70)	3.2 (2.23)	
Median (Range)	3.1 (0.6, 120.0)	2.7 (0.4, 9.0)	

NLR: Neutrophil-lymphocyte ratio; PLR: Platelet-lymphocyte ratio.

40 (36.4%) presented with an attack. The attacks were seen most often in spring, in the month of April (p<0.89) (Table 3, Fig. 2).

Discussion

The development of gout disease is generally the result of several factors such as diet, and hereditary and environmental factors. Although genetics and diet are important factors, environmental factors have been reported to play an important role in the onset and flare-ups of gout disease.[11,12]

In my study, hospital admissions of gout patients were most common in spring, and the most common month was May. A total of 36.4% of gout patients presented with an attack. It was observed that attacks were most common in spring and April.

A study in Sweden reported that serum uric acid showed seasonal differences, and that uric acid values increased significantly and reached a peak in the summer months (June–August).[13] In another study that examined serum urate in 54,536 blood samples, higher levels were seen in autumn.[14] It can be hypothesised that the seasonal char-

Table 2. Comparison of uric acid levels according to seasons

Season	Gut Patients (n=33)	Control (n=16)	p
Spring			
Uric acid			<0.0001[1]
Mean (SD)	7.9 (2.24)	4.6 (1.30)	
Median (Range)	8.2 (3.7, 14.3)	4.5 (2.3, 7.2)	
Summer	(n=21)	(n=12)	
Uric acid			<0.0001[1]
Mean (SD)	8.7 (2.27)	4.7 (1.47)	
Median (Range)	8.3 (5.6, 15.4)	4.4 (2.5, 7.0)	
Autumn	(n=28)	(n=15)	
Uric acid			0.0005[1]
Mean (SD)	6.9 (1.98)	4.8 (1.08)	
Median (Range)	6.8 (3.1, 11.7)	5.0 (2.4, 6.5)	
Winter	(n=28)	(n=17)	
Uric acid			<0.0001[1]
Mean (SD)	7.3 (1.34)	4.7 (1.52)	
Median (Range)	7.5 (4.6, 9.5)	4.4 (2.3, 7.3)	

[1]Kruskal-Wallis p-value.

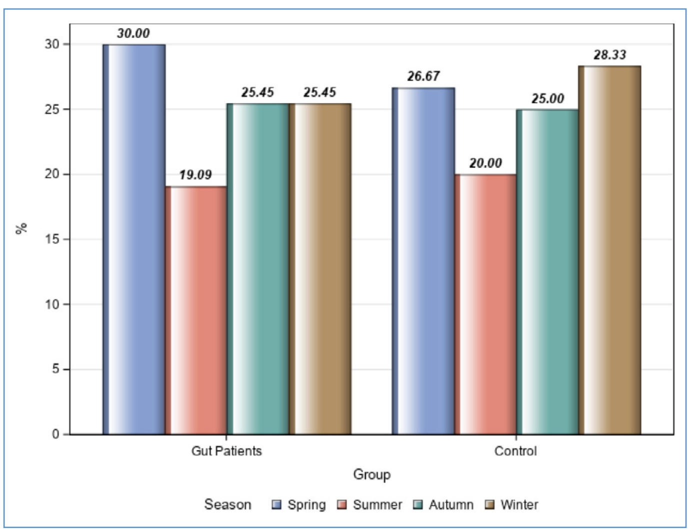

Figure 1. Seasonal distribution of hospital admissions.

acteristics of uric acid can cause periodic changes in gout disease. Another study in the USA showed that hospital admissions for acute gout arthritis reached a peak in autumn.[15] A retrospective medical file study in Italy reported that the majority of gout attacks occurred in the summer months.[16] Another two studies conducted in northern hemisphere countries also showed the highest incidence of gout disease in the summer months.[17,18] In a study conducted in South Korea, gout attacks were observed to be more frequent in spring, in the month of March.[19] Another study examined the frequency of Google Trend searches for gout and determined that most were at the end of spring and beginning of summer.[20] A similar study in South Korea reported that the searches on Google Trend for the terms gout and uric acid were most frequent in summer and had the lowest frequency in winter. The most cases of gout were seen in July and the fewest in February.[21]

In a meta-analysis by Park et al.,[22] it was seen that gout attacks were associated with increases in daily temperatures, and this was most common in the spring months.

Both environmental temperature and humidity may play a role in gout attacks, and it has been shown that most attacks occur in conditions of high temperature and low humidity.[23]

A study in Japan showed seasonal differences in new prescriptions for drugs that lower urate levels in the treatment of gout or asymptomatic hyperuricemia, and there were seen to be higher rates recorded in summer and autumn than in winter.[24]

Guo et al.[25] determined that the intestinal microbiota of gout patients was different from that of healthy individuals. Bacteroidales caccae and xylanisolvens were increased in gout patients, while Faecalibacterium prausnitzii and Bifidobacterium pseudocatenulatum were decreased. The intestinal microbiota is known to be involved in the metabolism of purine and uric acid. When it is considered that 30% of uric acid is excreted through the intestinal tract, the microbiota of gout patients plays an important role in pathogenesis.[25,26] Bacteroidales concentrations have been reported to be highest in the spring and summer months, and the loading values to be highest in spring.[27] In a previous study, significantly higher cortisol levels were determined in saliva in winter and autumn than in spring and summer.[28] Walker et al.[29] reported that plasma cortisol and the sensitivity of tissues to glucocorticoids were determined to be higher in winter. A study that included 27,478 children and 36,644 adults found that neutrophil and leukocyte counts and C-reactive protein (CRP) levels were higher in winter and spring than in summer and autumn.[30]

The fact that intestinal microbiota, especially Bacteroidales, are higher in spring, cortisol levels in saliva and plasma are lower in spring, and CRP levels and neutrophil counts are higher in spring may lead to both higher rates of gout attacks and hospital admissions for gout disease in spring, as seen in the current study.

Table 3. Clinical features of gout attacks

	Attack		p
	No (n=70)	Yes (n=40)	
Age (years)			0.3004
Mean (SD)	54.1 (12.87)	51.3 (13.25)	
Median (Range)	58.0 (31.0, 74.0)	52.0 (27.0, 74.0)	
Disease duration (months)			0.2120
Mean (SD)	20.1 (20.33)	23.0 (31.19)	
Median (Range)	12.0 (0.0, 72.0)	10.5 (0.0, 120.0)	
Months, n (%)			0.6479
April	3 (4.3)	6 (15.0)	
August	5 (7.1)	4 (10.0)	
December	3 (4.3)	3 (7.5)	
February	7 (10.0)	4 (10.0)	
January	8 (11.4)	3 (7.5)	
July	3 (4.3)	1 (2.5)	
June	4 (5.7)	4 (10.0)	
March	7 (10.0)	4 (10.0)	
May	11 (15.7)	2 (5.0)	
November	6 (8.6)	2 (5.0)	
October	7 (10.0)	3 (7.5)	
September	6 (8.6)	4 (10.0)	
Season, n (%)			0.8957
Spring	21 (30.0)	12 (30.0)	
Summer	12 (17.1)	9 (22.5)	
Autumn	19 (27.1)	9 (22.5)	
Winter	18 (25.7)	10 (25.0)	
NLR			0.8230
Mean (SD)	2.3 (1.98)	2.2 (1.30)	
Median (Range)	1.9 (0.9, 16.2)	1.8 (1.1, 8.7)	
PLR			0.3247
Mean (SD)	108.2 (47.29)	114.6 (44.70)	
Median (Range)	99.5 (38.6, 339.0)	102.1 (56.8, 323.0)	
Uric acid mg/dl			<0.0001
Mean (SD)	7.1 (2.03)	8.6 (1.80)	
Median (Range)	7.1 (3.1, 14.3)	8.5 (5.3, 15.4)	
Creatinine mg/dl			0.9183
Mean (SD)	1.1 (0.23)	1.0 (0.25)	
Median (Range)	1.0 (0.7, 1.7)	1.0 (0.4, 1.8)	
ESR mm/h			0.0071
Mean (SD)	14.9 (14.33)	22.4 (16.69)	
Median (Range)	11.5 (1.0, 73.0)	20.5 (2.0, 82.0)	
CRP mg/dl			<.0001
Mean (SD)	5.9 (10.40)	14.5 (23.05)	
Median (Range)	2.2 (0.6, 63.0)	7.9 (0.6, 120.0)	

NLR: Neutrophil-lymphocyte ratio; PLR: Platelet-lymphocyte ratio; ESR: Erythrocyte sedimentation rate mm/h; CRP: C- Reactive protein mg/dl.

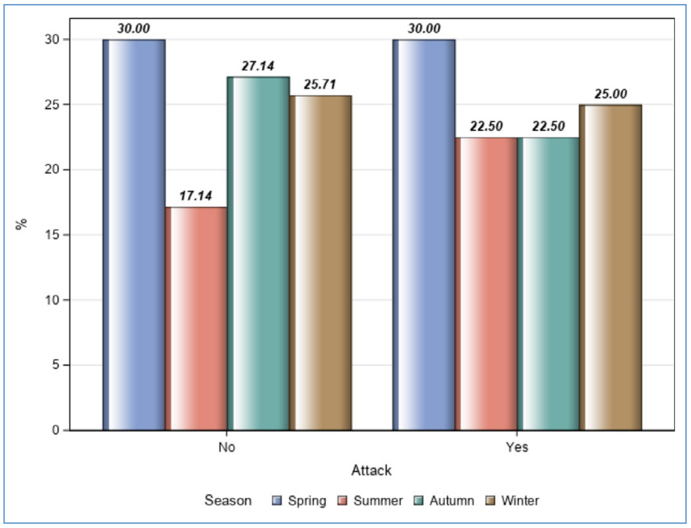

Figure 2. Seasonal distribution of gout attacks.

Limitations of this study could be said to be the single-centre, retrospective design, the relatively low number of patients and the lack of parameters such as air temperature changes, humidity, body mass index and diet.

Conclusion

In conclusion, the results of this study demonstrated that gout attacks and associated hospital admissions are seasonal in Türkiye. However, the effect of this on the pathogenesis, clinical condition or disease course is not fully known. Therefore, there is a need for further studies on this subject.

Disclosures

Ethics Committee Approval: The study was approved by Necmettin Erbakan University Ethics Committee (No: 2023/4710, Date: 15.12.2023).

Conflict of Interest: The author declare that there is no conflict of interest.

Financial Disclosure: The author declare no financial or non-financial competing interests.

Use of AI for Writing Assistance: Not declared.

Peer-review: Externally peer-reviewed.

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