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Changes in Epistaxis in Different Climatic Conditions: A Comparison Between the East Black Sea and Central Anatolia

ABSTRACT

Background: This study is the first to have been assessing epistaxis cases in respect of the geographic and seasonal variations in 2 distinct cities 900 km apart in 2 different regions of Turkey, whereas most studies in the literature about this entity had evaluated patients in the same residential area. The purpose of this study was to compare seasonal and regional variations in the presentations of patients with epistaxis in the regions of Central Anatolia, which has a continental climate, and the Eastern Black Sea, which has a marine climate.

Methods: This retrospective study was conducted in Karaman Training and Research Hospital and Trabzon Kanuni Training and Research Hospital throughout 2019, a total of 2141 cases (Central Anatolia: 1247; Eastern Black Sea: 894). The data of patients who presented with epistaxis were scanned retrospectively from patient records. Weather parameter data on the day of admission to hospital were obtained from the Regional Institutes of Meteorology.

Results: The number of cases (1247 vs. 894, $P < .001$) was significantly higher in the Central Anatolia than in the Eastern Black Sea, in which higher results of mean humidity, air pressure, rainfall, and wind speed were recorded. A weak positive correlation was determined between the number of cases and mean temperature ($r = 0.397$) and a weak negative correlation between the number of cases and air pressure ($r = -0.261$) and rainfall ($r = -0.288$).

Conclusion: The study results suggest that the meteorological parameters of mean temperature, rainfall, and air pressure could have a significant effect on epistaxis.

Keywords: Epistaxis, temperature, humidity, seasonal variation, meteorological factors

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INTRODUCTION

Epistaxis is one of the most common otolaryngological emergencies, occurring at some point in up to 60% of the general population, and accounting for 1 in 200 emergency department (ED) visits.[1] Nasal mucosa has a rich blood supply and therefore has the potential for bleeding. Injury or hyperemia in the nasal mucosa creates a predisposition for nose bleeding. In the etiology, there are local factors such as trauma and direct irritation as well as systemic diseases resulting in bleeding susceptibility and anticoagulant drug usage.[2]

Many different studies in the literature have examined the relationship between meteorological conditions and the incidence of epistaxis. While some studies have not shown any significant correlation between temperature and the number of patients with epistaxis,[3] many have reported increased rates of epistaxis cases during the winter,[4-6] and others have suggested that the incidence increases during the summer.[7]

This study was designed to compare epistaxis cases according to the seasonal and regional variations in Central Anatolia (CA), which has a continental climate, and the Eastern Black Sea (EBS), which has a marine climate.

MATERIALS AND METHODS

This retrospective clinical study included patients aged >2 years who presented with epistaxis at the Karaman Training and Research Hospital and Trabzon Kanuni Training and Research Hospital between January 2019 and December 2019. Approval for the study was obtained from the Ethics Committee of Trabzon Kanuni Training and Research Hospital (Decision date: July 1, 2020, IRB No.: 2020/31), and all procedures complied with the principles of the Declaration of Helsinki. Informed consent was not obtained because it was a retrospective and epidemiological study.

Trauma, septal deviation, surgery, benign or malignant tumors, arterial hypertension, granulomatous diseases, sinus disease, acute infection, chronic disease, bleeding disorder, hypertension, drug use, and pregnancy were the criteria for the exclusion from the study.

The epistaxis cases were compared according to the seasonal conditions in the CA and EBS regions of Turkey. Patient data were retrieved from the patient records in both hospitals. The weather parameters of the day when patients presented with epistaxis were recorded by the meteorological authorities of both provinces.

The seasons were defined as winter, including December, January, and February; spring, including March, April, and May; summer, including June, July, and August; and autumn, including September, October, and November.

Meteorological data were provided by the meteorological authority of each province. If patients presented with a second epistaxis attack within 2 weeks of the first attack, this was accepted as the same epistaxis event. When patients presented with a second epistaxis attack after more than 2 weeks, this was accepted as a new epistaxis case.

Comparisons of the epistaxis rates were made according to the mean temperature [MT: degrees Celsius (°C)], sunlight duration (SD: hours), mean humidity (MH: %), rainfall (kg/m^2), air pressure (AP: atmosphere bar), and wind speed (km/h) recorded by the Meteorology Department for the day of presentation.

Statistical Analysis

The data obtained were analyzed statistically using IBM Statistical Package for the Social Sciences Statistics for Windows, version 25.0 software (IBM Corp., Armonk, NY, USA).

The conformity of continuous variables to normal distribution was assessed with Q-Q and histogram plots. Continuous variables were stated as mean ± SD or median [interquartile range 25-75 (IQR)] values according to the normality of distribution and categorical variables as number (n) and percentage (%). Continuous variables were analyzed with the independent samples *t*-test if the distribution was normal and with the Mann–Whitney *U*-test if the data distribution was not normal. The chi-square test was applied to categorical variables. The number of cases was analyzed with the 1-sample chi-square test with the null hypothesis of equal probabilities (H0: $p1=p2=0.5$). Relationships between the number of cases and other variables were analyzed using Spearman's correlation coefficient. A value of $P < .05$ was accepted as statistically significant.

MAIN POINTS

- Epistaxis is one of the most frequently encountered otolaryngological emergencies all around the world.
- This study is the first to have assessed epistaxis cases in respect of the geographic and seasonal variations in 2 cities 900 km apart in 2 different regions of Turkey.
- The number of cases (1247 vs. 894) were significantly higher in the Central Anatolia region, where the mean air humidity, air pressure, and rainfall were significantly lower than in the Eastern Black Sea region.

RESULTS

A total of 2141 (CA: 1247; EBS: 894) epistaxis cases were evaluated during the study period. The median age of the patients was 18 years (IQR: 12-27; range: 2-67 years). Patient age was significantly higher in the EBS than in the CA ($P < .001$). Gender distribution was similar between the regions, with significantly more male cases (n = 1234; 57.6%) than female (n = 907; 42.4%) ($P < .001$).

Mean humidity ($P < .001$), air pressure ($P < .001$), rainfall ($P < .001$), and wind speed ($P < .001$) were found to be significantly higher in the EBS than in the CA, and sunlight duration was significantly higher in the CA than in the EBS ($P < .001$). The statistical analysis did not reach any significant difference between the regions in terms of mean temperature.

Cases were most common in spring both in the CA (28.2%) and in the EBS (34.2%). The fewest cases presented in winter in the CA (20.1%) and in autumn in the EBS (19.0%) (Figure 1). The percentages of case presentations were significantly higher in the winter and spring in the EBS and in the summer and autumn in the CA ($P < .001$).

Cases were most common in May (12.5%), September (11.0%), and July (10.7%) in the CA and in April (13.2%), March (12.5%), and February (10.5%) in the EBS. The lowest number of presentations were seen in December (5.1%), June (5.9%), and January (6.5%) in the CA and in December (5.0%), October (5.6%), and September (5.7%) in the EBS (Figure 2). The percentages for January, March, and April were significantly higher in the EBS, and the percentages for May, July, and September were significantly higher in the CA (Table 1).

There was determined to be a statistically significantly greater number of cases in the CA (n = 1247) than in the EBS (n = 894) ($P < .001$). The numbers of cases in summer (322 vs. 187, $P < .001$) and autumn (322 vs. 170, $P < .001$) were significantly higher in the CA than in the EBS. The number of cases in April (89 vs. 118, $P = .044$) was significantly lower in the CA than in the EBS. The numbers of cases in May (156 vs. 76, $P < .001$), July (134 vs. 62, $P < .001$), August (115 vs. 68, $P = .001$), September (137 vs. 51, $P < .001$), and October (94 vs. 50, $P < .001$) were determined to be statistically significantly higher in the CA than in the EBS (Table 2).

A negative correlation was determined between the number of cases and age ($r = -0.766$, $P < .001$) (Figure 3). A positive

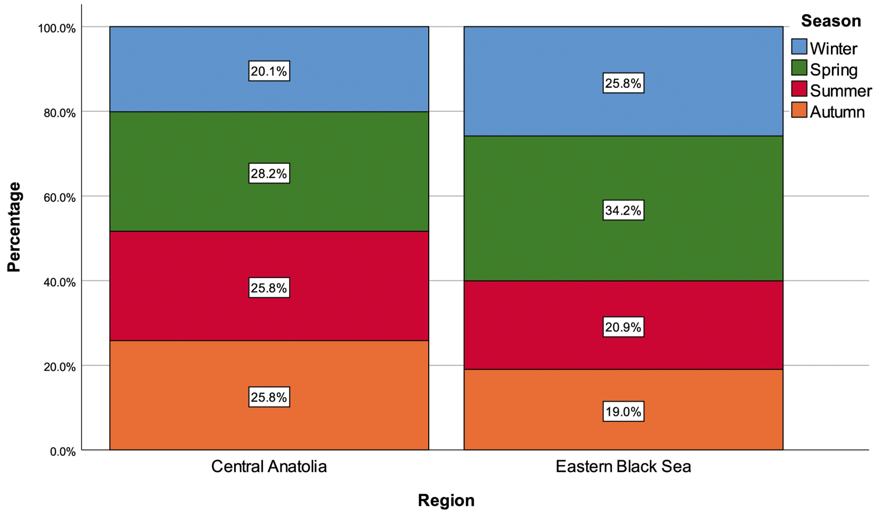

Figure 1. Distribution of cases with regard to seasons and regions.

correlation at a low level was determined between the number of cases and mean temperature (r = 0.397, P=.030) (Figure 4). A negative correlation at a low level was determined between the number of cases and air pressure (r=−0.261, P=.042) and between the number of cases and rainfall (r=−0.288, P=.047) (Table 3).

DISCUSSION

Epistaxis is one of the most frequent otolaryngological emergency encountered in the ED. Of the general population, 60% will experience epistaxis at least once during their lifetime, and a higher prevalence has been reported in patients aged <10 years and >35 years.[8] Although there are conflicting results in the available studies in literature, the frequency of epistaxis has been observed to be increased in the cooler months of the year. When seasonal and climatic variations of epistaxis are examined in the scientific literature, from a study of 15 523 patients admitting hospitals with epistaxis in 114 ear–nose–throat services in Germany in 2016, Seidel DU et al[5] reported a marked seasonal variation with the lowest levels in summer, an increase in autumn and winter, and cases peaked in February, March, and April.

Using data from the US Medicare database, a retrospective study of 4120 epistaxis cases by Chaaban et al[6] (2012) reported 40% fewer epistaxis cases admitted to ED in the summer compared to the winter months. The highest rates were seen between November and March, and the lowest rates between June and September. The variation according to the season was determined to be greater in northern states than in southern states of the USA.

Comelli et al[4] reported the results of 5404 cases in a retrospective study conducted in the ED of a university hospital in Italy from 2003 to 2012. There was reported to be seasonal variation

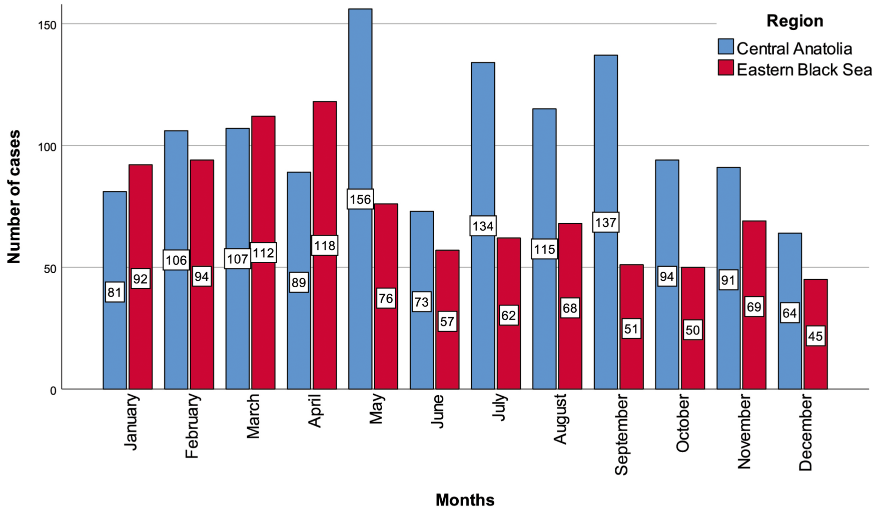

Figure 2. Number of cases with regard to months and regions.

Table 1. Summary of Age, Sex, and Climate Characteristics and Distribution of the Cases by Seasons and Months in Both Regions

	Region		
	Central Anatolia (n = 1247)	**Eastern Black Sea (n = 894)**	***P***
Age	16 (10-24)	19 (14-29)	**<.001†**
Sex			
Female	519 (41.6%)	388 (43.4%)	.411§
Male	728 (58.4%)	506 (56.6%)	
Mean temperature (°C)	17 (7-21)	13 (10-20)	.226†
Mean humidity (%)	57 (42-73)	73 (69-80)	**<.001†**
Air pressure (mb)	899.43 ± 4.61	1017.04 ± 6.99	**<.001‡**
Sunlight duration (hours)	9 (5-11)	3 (2.8-4)	**<.001†**
Rainfall (kg/m²)	0 (0-0)	45 (30-50)	**<.001†**
Wind speed (km/h)	1 (1-2)	9 (8-12)	**<.001†**
Season			
Winter	251 (20.1%)[a]	231 (25.8%)[b]	**<.001§**
Spring	352 (28.2%)[a]	306 (34.2%)[b]	
Summer	322 (25.8%)[a]	187 (20.9%)[b]	
Autumn	322 (25.8%)[a]	170 (19.0%)[b]	
Month			
January	81 (6.5%)[a]	92 (10.3%)[b]	**<.001§**
February	106 (8.5%)	94 (10.5%)	
March	107 (8.6%)[a]	112 (12.5%)[b]	
April	89 (7.1%)[a]	118 (13.2%)[b]	
May	156 (12.5%)[a]	76 (8.5%)[b]	
June	73 (5.9%)	57 (6.4%)	
July	134 (10.7%)[a]	62 (6.9%)[b]	
August	115 (9.2%)	68 (7.6%)	
September	137 (11.0%)[a]	51 (5.7%)[b]	
October	94 (7.5%)	50 (5.6%)	
November	91 (7.3%)	69 (7.7%)	
December	64 (5.1%)	45 (5.0%)	

Data are given as mean ± SD or median (first quartile-third quartile) for continuous variables according to normality of distribution and as frequency (column percentage) for categorical variables.
†Mann–Whitney *U*-test. ‡Independent samples *t*-test. §Chi-square test. [a, b] denote statistically significant difference between groups for the category.

in epistaxis cases, with peak numbers reported in January, and a strong negative correlation was determined between the number of epistaxis cases per day and the mean temperature on the day of presentation.

Similarly, Kemal et al[7] reported a positive correlation between epistaxis rates and temperature and a negative correlation between epistaxis incidences and humidity, air pressure, and rainfall in their prospective study consisting of 310 cases. On the other hand, no correlation was determined between wind speed and sunlight duration.

Table 2. Number of Cases According to Regions and Time

	Region		
	Central Anatolia	**Eastern Black Sea**	***P***
Total number of cases	1247 (58.2%)	894 (41.8%)	**<.001**
Season			
Winter	251 (52.1%)	231 (47.9%)	.362
Spring	352 (53.5%)	306 (46.5%)	.073
Summer	322 (63.3%)	187 (36.7%)	**<.001**
Autumn	322 (65.4%)	170 (34.6%)	**<.001**
Months			
January	81 (46.8%)	92 (53.2%)	.403
February	106 (53.0%)	94 (47.0%)	.396
March	107 (48.9%)	112 (51.1%)	.735
April	89 (43.0%)	118 (57.0%)	**.044**
May	156 (67.2%)	76 (32.8%)	**<.001**
June	73 (56.2%)	57 (43.8%)	.161
July	134 (68.4%)	62 (31.6%)	**<.001**
August	115 (62.8%)	68 (37.2%)	**.001**
September	137 (72.9%)	51 (27.1%)	**<.001**
October	94 (65.3%)	50 (34.7%)	**<.001**
November	91 (56.9%)	69 (43.1%)	.082
December	64 (58.7%)	45 (41.3%)	.069

Data are given as frequency (row percentage). *P*-values were obtained with the 1-sample chi-square test under the null hypothesis of equal probabilities. Bold *P*-values are statistically significant.

In a study by Akdoğan MV et al[9] 1130 children admitted to the tertiary hospital due to epistaxis between 2009 and 2014 were recruited. A positive correlation was observed between the frequency of epistaxis and the mean daily temperature, as well as the maximum and minimum daily temperature. On the other hand, negative correlation was seen between the frequency of epistaxis and mean daily humidity, the difference between maximum and minimum daily humidity, particulate matter <10 μm diameter and sulfur dioxide levels ($P < .05$). The results showed that there was a significant difference in the frequency of epistaxis when the seasons were compared ($P < .01$), the incidence was high in summer and low in winter. According to these results, the frequency of epistaxis in children was found to be higher in summer months and in low humidity environments.

A study of 350 subjects by Jin Min et al[10] in Seoul, Korea, revealed that the highest incidence of patients with nosebleeds was in March, January, April, and February. These months are winter and spring seasons, respectively, with lower air temperature and higher relative humidity and wind speed. When we look at the months with the lowest incidence of epistaxis, it was found in the autumn season, in October and August. This can be explained by high air temperature and relative humidity and low wind speed. They showed that patients presenting with epistaxis were correlated with meteorological factors associated with low minimum temperature and high mean wind speed. In addition, they suggested that low temperature and relative humidity increased the frequency of epistaxis statistically.

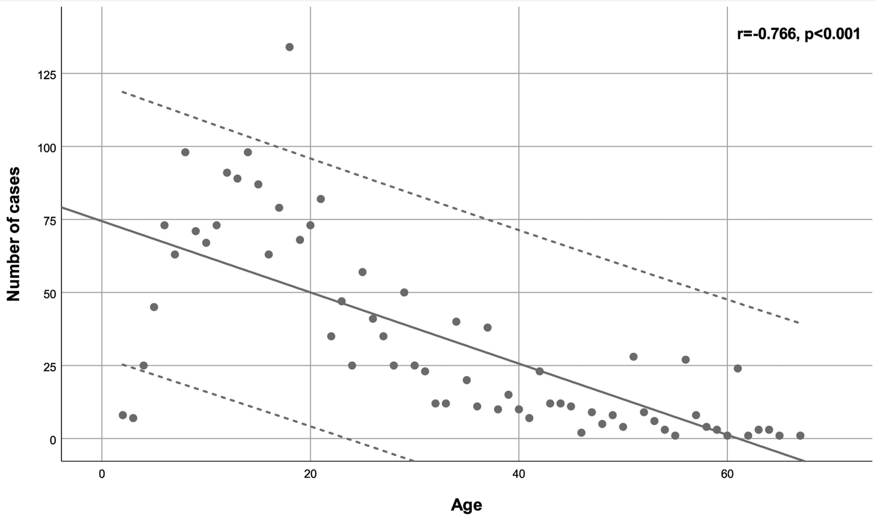

Figure 3. Scatter plot of the number of cases and age.

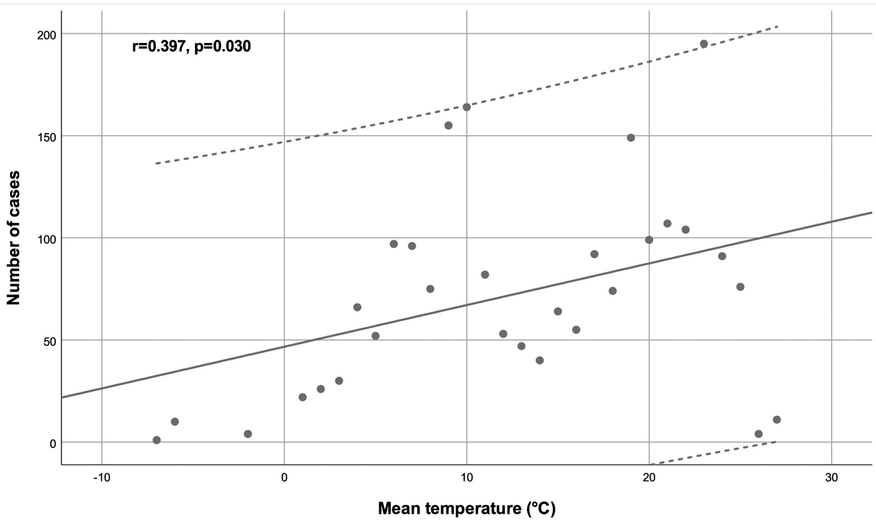

Figure 4. Scatter plot of the number of cases and mean temperature.

In a study of epistaxis of 476 cases in a maritime city in Eastern Canada where summers are generally relatively humid and winters are rather dry and cold, there was a significant seasonal variation; most cases of epistaxis occurred in winter ($P < .001$). There was a negative correlation between mean daily humidity and epistaxis. In addition, the highest number of cases was reported in winter, and a negative correlation was found between epistaxis and mean daily humidity.[11]

Table 3. Correlations Between Age, Climate Characteristics, and Number of Cases

	r	*P*
Age	−0.776	**<.001**
Mean temperature (°C)	0.397	**.030**
Mean humidity (%)	0.170	.158
Air pressure (mb)	−0.261	**.042**
Sunlight duration (hours)	0.303	.077
Rainfall (kg/m^2)	−0.288	**.047**
Wind speed (km/h)	0.354	.106

r, Spearman's correlation coefficient. Bold *P*-values are statistically significant.

In contrast to the abovementioned articles supporting correlations with weather parameters, in a retrospective study published in 2005 by Bray et al[3] of 1373 cases of spontaneous epistaxis cases at a tertiary-level referral hospital in London from 1997 to 2002, no correlation was determined between monthly mean temperature and the epistaxis incidence and no seasonal variation was observed.

The current study is the first to have evaluated the geographic and seasonal variations of epistaxis cases in 2 provinces of 2 different regions of Turkey. The results showed that mean humidity, air pressure, rainfall, and wind speed values were statistically significantly higher in the EBS than in the CA ($P <$

.001), and sunlight duration was significantly higher in the CA than in the EBS ($P < .001$). No statistically significant difference was determined between the 2 regions in respect of mean temperature. There was seen to be a significantly greater number of cases in CA than in the EBS (1247 vs. 894; $P < .001$). Contrary to common literature knowledge that the peak of epistaxis cases is mostly seen in cooler months, in the current study, epistaxis cases were most common in spring in both the CA and EBS regions. The highest numbers of cases were presented in May, September and July in the CA and in April, March, and February in the EBS. The fewest cases were seen in winter in the CA and in autumn in the EBS. The percentages of cases were significantly higher in winter and spring in the EBS and in summer and autumn in the CA ($P < .001$). As a low negative correlation was determined between the number of cases and air pressure, rainfall and humidity, it was not surprising that the number of cases increased significantly in summer and autumn because rainfall and air pressure were significantly lower in the CA region all year round. From the results of this study, a low negative correlation was determined between the number of epistaxis cases and reported mean air pressure, air temperature, and rainfall.

As previously mentioned, there are few studies in the literature that have examined the relationship between regional meteorological variance and epistaxis, especially in 2 different provinces. Sowerby et al[12] conducted a similar study in Canada, in which 4315 epistaxis cases admitted to the ED in Edmonton and Calgary, 2 cities 300 km apart in Alberta, were retrospectively reviewed over 3 years. A negative correlation reached statistical significance between mean monthly temperature and epistaxis and statistical analysis was performed between daily temperature and epistaxis. Seasonal variation was reported to be observed in Edmonton but not in Calgary. Similar to our current study, no correlation was found between humidity and epistaxis.

Limitations

A strong aspect of this study was the large number of cases included from 2 distinct cities. Another strength was the use of all real-time local meteorological data on the days of the presentation of the cases. However, there were also several limitations to this study. The diagnosis of epistaxis was based solely on International Classification of Diseases codes, and there was no information available about the bleeding site or intensity. It was also likely that the weather conditions over several days could have affected the occurrence of epistaxis, but it was not possible to examine if the effect of the meteorological factors was limited to a single day or continued for several days.

CONCLUSION

This is the first study to have examined the geographical and seasonal variations of epistaxis cases of 2 meteorologically distinct provinces from 2 different regions of Turkey. Most emergency medicine practitioners and otorhinolaryngologists believe that meteorological factors play an important role in the rates of epistaxis cases. The results of this clinical study provide evidence to support this. The number of epistaxis cases were significantly higher in the CA region, where the mean air humidity, air pressure, and rainfall are significantly lower than in the EBS region. However, there was no significant difference in mean air temperature between the 2 regions; a low positive correlation was determined between the number of cases and mean temperature. In addition, a low negative correlation was determined between the number of cases and air pressure and between the number of cases and rainfall. Therefore, it can be suggested that mean temperature, mean rainfall, and air pressure could be important meteorological parameters associated with the occurrence of epistaxis.

Ethics Committee Approval: This study was approved by Ethics Committee of Trabzon Kanuni Training and Research Hospital (Approval No: 2020/31, Date: 01.07.2020).

Informed Consent: N/A.

Peer-review: Externally peer-reviewed.

Author Contributions: Concept – E.S., F.Y.; Design – E.S., İ.Ç.; Supervision – E.S., F.Y.; Materials – F.Y., B.D.K., İ.Ç.; Data Collection and/or Processing – F.Y., İ.Ç., E.S., B.D.K.; Analysis and/or Interpretation – F.Y., A.S.; Literature Review – F.Y., A.S., E.S.; Writing – A.S., E.S., F.Y.; Critical Review – E.S., A.S.

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