Prevalence and Awareness of Hypertension in Seven Distinct Geographic Regions of Turkey: The SEMT HT Study

Türkiye'nin Yedi Farklı Coğrafi Bölgesinde Hipertansiyon Sıklığı ve Farkındalığı: TEMD HT Çalışması

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Abstract

Objective: This study aimed to assess the prevalence, the level of awareness, and the factors that increase hypertension in Turkey. **Material and Methods:** A cross-sectional survey with a multi-stage probability sampling was conducted. A total of 9604 people were screened; of them, 9316 had a complete clinical examination. The ages, genders, personal and family histories of hypertension, diabetes, coronary artery diseases were recorded. Their systolic and diastolic blood pressures (BP), heights, weights, waist, and hip circumferences were measured. Hypertension was defined as taking medication for hypertension or BP ≥140/90 mmHg. **Results:** According to the JNC-7 criteria, 22.1% of the population had prehypertension, 36.5% had hypertension (15.3% stage 1 and 21.2% stage 2 hypertension), and 41.4% were normal population. Of the population, 30% had an awareness of hypertension. The prevalence of hypertension was higher in Mediterranean, Central Anatolia, and Black Sea Regions and lower in South-East Anatolia, Aegean Regions, while it was similar in Marmara and East Anatolia Regions when compared to the general population of Turkey. Though rural life, advancing age, increasing body mass index, and waist to height ratio >0.5 were the factors responsible for an increased prevalence of hypertension, smoking was found to decrease the prevalence. **Conclusion:** The data of the SEMT hypertension study indicated that more than one-third of the adult population was hypertensive in Turkey. Furthermore, only one-third of the hypertensive adult population showed awareness of their hypertension.

Keywords: Hypertension; prevalence; Turkey; risk factors; SEMT study; JNC-7

Özet

Amaç: Çalışmanın amacı, Türkiye'de hipertansiyon prevalansını, farkındalık düzeyini ve hipertansiyon prevalansını arttıran faktörleri değerlendirmekti. **Gereç ve Yöntemler:** Çok aşamalı olasılık örneklemesi ile kesitsel bir anket çalışması yapıldı. Toplam 9604 kişi tarandı, 9316'sının tam klinik muayenesi yapıldı. Yaş, cinsiyet, kişisel ve ailesel hipertansiyon, diyabet ve koroner arter hastalığı öyküleri kaydedildi. Sistolik ve diyastolik kan basınçları (KB), boy, vücut ağırlığı, bel ve kalça çevresi ölçümleri yapıldı. Hipertansiyon tanısı, hipertansiyon için bir ilaç almak veya KB ≥140/90 mmHg olarak tanımlandı. **Bulgular:** JNC-7'ye göre popülasyonun %22,1'inde prehipertansiyon, %36,5'inde hipertansiyon (%15,3'ünde evre 1 ve %21,2'sinde evre 2) ve %41,4'ünde normal tansiyon vardı. Hipertansiyon farkındalığı %30 idi. Hipertansiyon prevalansı Akdeniz, İç Anadolu ve Karadeniz Bölgelerinde daha yüksek, Güneydoğu Anadolu, Ege Bölgeleri'nde daha düşük, Marmara ve Doğu Anadolu Bölgeleri'nde ise Türkiye genel nüfusu ile benzer oranda bulundu. Kırsal yaşam, artan yaş, artan beden kitle indeksi ve bel/boy oranı >0,5 olması hipertansiyon prevalansını arttıran faktörler iken, sigara kullanımının düşük prevalans ile ilişkili olduğu bulundu. **Sonuç:** TEMD hipertansiyon çalışması verileri, Türkiye'de yetişkin nüfusun 1/3'ünden fazlasının hipertansif olduğunu göstermiştir. Dahası hipertansif yetişkin popülasyonun sadece 1/3'ünün hipertansiyonlarının farkında olmasıdır.

Anahtar kelimeler: Hipertansiyon; prevalans; Türkiye; risk faktörleri; TEMD çalışması; JNC-7

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Introduction

Hypertension (HT) is a well-known modifiable risk factor for congestive heart failure, renal insufficiency, and coronary, cerebral, and peripheral vascular diseases (1). Epidemiological studies have shown that every 20 mmHg increase in systolic blood pressure (SBP) after the 4th decade in life is associated with a doubling of death rates for cerebral and coronary heart disease (2). At least 50% of cardiovascular diseases and 75% of cerebrovascular diseases are caused by HT. Moreover, randomized clinical studies have shown that these diseases can be easily prevented by controlling elevated blood pressure (3).

A high prevalence (25-55%) of hypertension has been reported in the adult population in most of the developed countries. Variation in rates of hypertension prevalence in different countries may result from different study protocols, environmental factors, and genetic susceptibilities (4). Adequate knowledge and epidemiological data regarding hypertension in developing populations are lacking. Modern dietary and lifestyle modifications, increased life duration, and rapid changes in social structure can lead to an increase in hypertension prevalence (5).

In Turkey, an Eastern Mediterranean developing country with a total population of about 83 million, 92.8% of people live in the cities and district centers. The Turkish population is relatively young, with a median age is 32.4 years; 23.1% of the population is under 15-years of age; 67.8% is between 15- 64 years, and 9.1% of the population is 65 years and older. In this relatively young population, the leading cause of death is cardiovascular disease (6).

Turkey has seven distinct geographic regions with different altitudes, weather conditions, lifestyles, dietary habits, and socioeconomic statuses that may play a key role in high hypertension prevalence. There is limited data about the nationwide or the regional distribution of hypertension in Turkey. We aimed to determine the prevalence of hypertension, the level of awareness, treatment, and control rates for hypertension, and the factors that increase the hypertension prevalence in the seven distinct areas of Turkey.

Material and Methods

Society of Endocrinology and Metabolism of Turkey (SEMT) hypertension (HT) Study, coordinated by the SEMT, was carried out in the seven geographic regions of Turkey. A multi-stage probability sampling was done. The study was approved by the Turkish Ministry of Health (Approval number 19.02.03/2088) and was conducted in accordance with the Declaration of Helsinki (DOH), 1964 on ethics and protection of human participants in medical research. We collected Household Verification Form (HVF) data from primary health care centers affiliated to Provincial Health Directorates. Men and non-pregnant women, who were between 20-83 years of age, were included in the study. At least three provinces of each geographic region of Turkey were randomly selected (Figure 1).

Initially, inhabitants of city centers, districts, and villages were planned by the stratified sampling method. Then cases were chosen with the random sampling method by using the HVF data. Age groups were classified as decades from the age of 20, up to the age of 80 and above.

Individual differences, such as gender, demographic, economic, social, and geographical situations were considered. The study protocol was given/explained about two weeks before in the regions where the study was to be conducted, and the participants were instructed to fast for 8-12 h before the collection of samples. About 100 participants were evaluated daily from 7 -10 a.m. in the health care centers. The waiting room of the participants was kept calm. Prior written informed consent from each of the participants was obtained. A total of 9604 people were screened; 9316 of them underwent clinical examination; 3383 of them underwent laboratory examination because of poor financial conditions. The numbers of participants from different regions were as follows: 1926 from the Mediterranean, 1964 from Central Anatolia, 1064 from South-East Anatolia, 661 from Aegean, 1270 from Marmara, 1199 from the Black Sea, and 1232 from East Anatolia Region.

Medical histories, including hypertension and other measurements, such as blood pressures, height, weight, waist circumference (WC), and hip circumference (HC) of
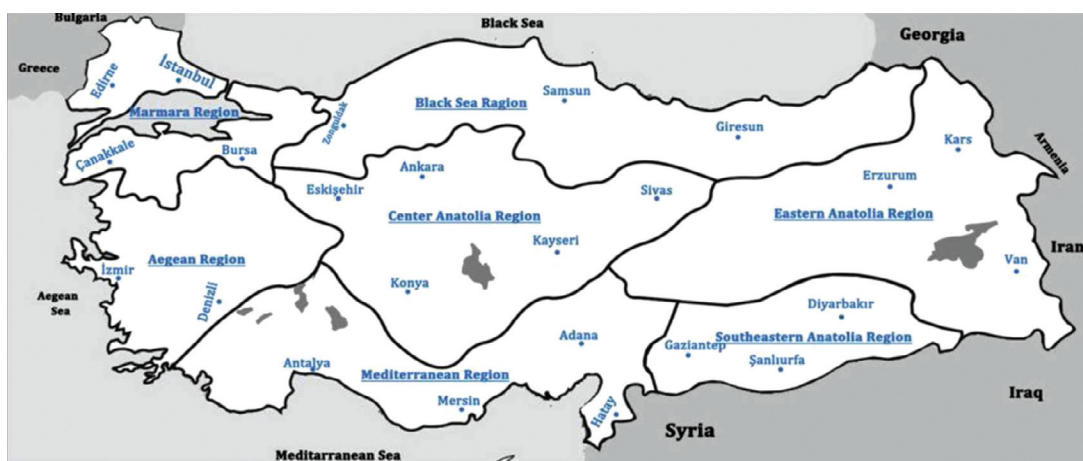
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Figure 1. The provinces selected from each geographic region in Turkey.

the participants were taken by the specifically trained physicians. While measuring their height and weight, the participants were asked to remove items such as shoes and outer clothing that would constitute significant weight. Body mass index (BMI) was determined as weight (in kg/m^2; kg being weight, m being height). A participant was considered as underweight if their BMI was below 18.5 kg/m^2; normal if BMI was between 18.5-24.9 kg/m^2; overweight if between 25-29.9 kg/m^2; obese if between 30-39.9 kg/m^2; morbidly obese if ≥40 kg/m^2 (7). WC was measured between iliac processes and umbilicus, and HC was measured at the level of the largest protrusion of the hips. The standard abdominal obesity criterion was WC ≥100 cm for men and ≥90 cm for women. Other criteria for abdominal obesity for both genders include waist to hip ratio (WHR) >0.9 for men and >0.85 for women; and waist to height ratio (WHtR) >0.5 (8).

Systolic blood pressure (SBP) and Diastolic blood pressure (DBP) were measured with standard sphygmomanometers, twice with at least 15-min interval after a rest of 30-min in sitting position, and the mean of the two measurements was taken. None of the participants were permitted to take alcohol, tea, coffee, and smoke 30-min before the measurement. HT was defined as ≥140/90 mmHg for SBP and DBP, respectively. The Korotkoff phases 1 and 5 were utilized for SBP and DBP, respectively. The classification of hypertension was done under the JNC-7 criteria (9).

Statistical Analysis: SPSS version 13.0 (IBM, Illinois, Chicago, USA) was used for statistical analysis. The Chi-square test was employed to determine the differences in categorical variables between the groups. Student's t-test for parametric data and Mann-Whitney U test for nonparametric data were used to evaluate the differences of continuous variables among different independent groups. In order to determine the probability of socio-demographic and anthropometric variables associated with hypertension, the multiple logistic regression tests with the center and backward stepwise procedures were applied. The odds ratios with 95% confidence intervals from binary logistic regression were used for each model. Two-tailed p-values of <0.05 were considered as statistically significant.

Results

The mean systolic blood pressure (SBP) was 134.3±27.62 (males, 133.33±25.91; females, 134.85±28.53) mmHg, and the mean diastolic blood pressure (DBP) was 81.78±15.46 (males, 81.48±15.04; females, 81.95±15.7) mmHg. Normal blood pressure was recorded in 41.4% (42.4% of males, 40.8% of females) of the participants; 22.1% (23.1% of male, 21.5% of female) participants reported prehypertension, while 15.3% (14.5% of males, 15.7% of females) of the participants had stage 1 and 21.2% of the participants (19.9% of male, 22% of female) had stage 2 hypertension according to JNC-7 (Figure 2). Though the percentage of patients taking
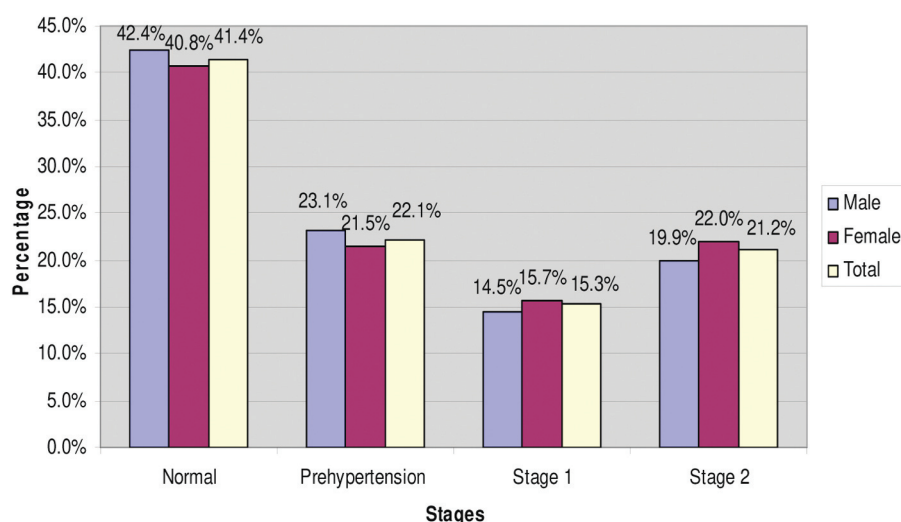
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Figure 2. The distribution of HT types with respect to gender.

antihypertensive treatment was 57.3%, the rate of hypertension control was only 31.5%.

The prevalence of hypertension was 40.6% in Mediterranean Region, 41.4% in Central Anatolia, 23.2% in South-East Anatolia, 27.2% in Aegean Region, 33.8% in Marmara Region, 44.9% in the Black Sea Region, and 33.3% in East Anatolia, giving a total prevalence of 36.5% in Turkey (Table 1). The hypertension prevalence was higher in the populations of Mediterranean, Central Anatolia, and the Black Sea Regions, lower in South-East Anatolia and Aegean Regions (all p<0.001), and similar in Marmara and East Anatolia Regions when compared to the general population of Turkey.

The awareness of hypertension was 21.4% in the Mediterranean, 25.9% in Central Anatolia, 35.5% in South-East Anatolia, 44.8% in Aegean, 49.3% in Marmara, 26.8% in the Black Sea, and 27.6% in East Anatolia, giving a total of 30% in Turkey (Figure 3). Hypertension was more common in the altitudes <200 m and >1000 m when compared with altitudes between 200-1000 m (50.4% and 50.3% vs. 34.2%, respectively, both p<0.001). Hypertension prevalence was higher (53.9%) in rural areas than in urban areas (45.1%) with p<0.001.

When different age groups were compared with the 20-29 age group, the hypertension prevalence up to the age of 79 registered an increase from 19% to 78% with the advancing age, but the rate decreased marginally for the group with age >79 yrs (all p<0.001) (Figure 4). The mean SBP value after the age of 30 and DBP after the age of

Table 1. Distribution of normotensive, prehypertensive, and stage-wise hypertensive participants with respect to the seven geographic regions of Turkey.

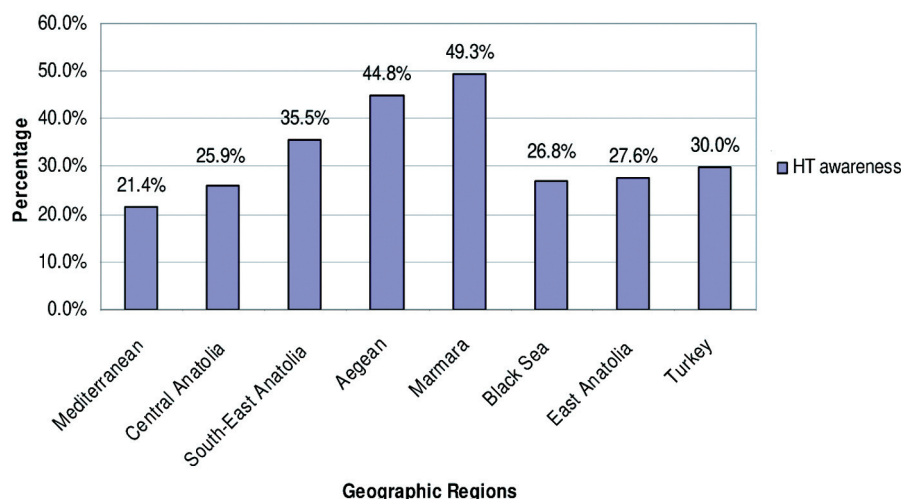|	Normal	Prehypertension	Stage 1	Stage 2	Total
Mediterranean	686 (35.6%)	458 (23.8%)	314 (16.3%)	468 (24.3%)	1926
Central	693 (35.3%)	457 (23.3%)	326 (16.6%)	488 (24.8%)	1964
South-East	630 (59.2%)	187 (17.6%)	117 (11%)	130 (12.2%)	1064
Aegean	361 (54.6%)	120 (18.2%)	77 (11.6%)	103 (15.6%)	661
Marmara	544 (42.8%)	296 (23.3%)	197 (15.5%)	233 (18.3%)	1270
Black Sea	406 (33.9%)	254 (21.2%)	204 (17%)	335 (27.9%)	1199
East	537 (43.6%)	285 (23.1%)	190 (15.4%)	220 (17.9%)	1232
Total	3857 (41.4%)	2057 (22.1%)	1425 (15.3%)	1977 (21.2%)	9316

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Figure 3. Hypertension awareness with respect to the seven geographic regions.

40 was recorded higher in women than in men across all age groups. After 80 years of age, SBP and DBP values became higher among men than women (Figure 5). The hypertension prevalence increased with the rise in BMI from 28% to 73% (Figure 6).

The logistic regression analysis revealed that participants living in the rural area had 1.2 times higher risk of hypertension as compared with the participants living in an urban area. When compared with the age group of 20-29 years, participants in age group 30-39 years had 1.3 times higher risk, 40-49 years of age had two times risk, 50-59 years of age group had four times, 60-69 years of age group had 6.8 times, 70-79 years of age group had 9.7 times, and finally the groups with age ≥80 years of age were 6.4 times more likely to develop hypertension. Smokers were 0.7 times less likely to suffer from HT (p<0.001) than the nonsmokers. Compared with standard reference, overweight participants were twice, obese participants were 3.2 times higher, and morbid obese participants were six times more likely to develop HT. Participants with waist/height ratio >0.5 were 1.3 times more prone to develop HT than those with a ratio of <0.5 (Table 2).

Discussion

Several national and regional studies about the epidemiology of hypertension in Turkey have been reported. The hypertension prevalence was estimated to be 33.7% in
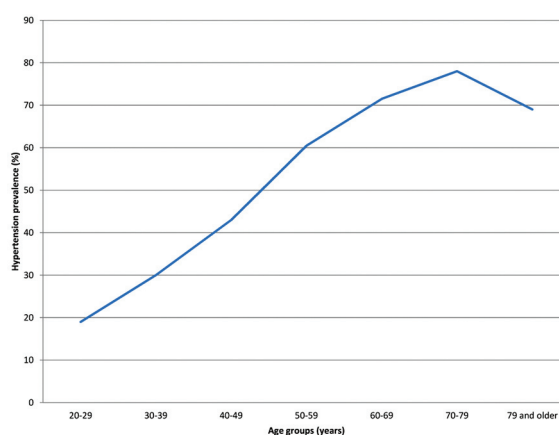

Figure 4. Prevalence of hypertension in Turkey by different age groups.

the TEKHARF study conducted by the Turkish Cardiology Association in the 1990 (10). The PatenT study documented the prevalence of general hypertension in Turkey as 31.8% in 2003 (11). The hypertension incidence in Turkey (HinT) study conducted in the population of the PatenT study in 2007 recorded the prevalence of hypertension to be 44.1% (12). The 2013 TURDEP II study showed that the hypertension prevalence was 31.4%, and the frequency of hypertension decreased by 11% in Turkey from that observed in the 2002 TURDEP I study (13).

The current study presents the latest update about the prevalence of hypertension and represents Turkey's seven geographical regions in detail. It has reported hypertension in approximately 21 million adult indi-
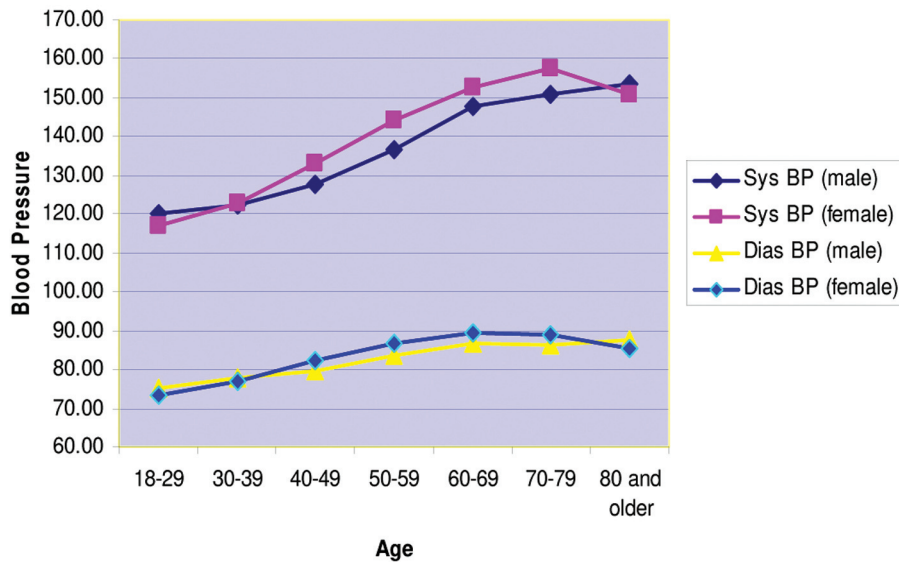
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Figure 5. The mean systolic and diastolic BP with respect to age and gender.

viduals over 20 years of age in Turkey and showed that only 30% of them became aware of the situation. The awareness rate was highest (49.3%) in the Marmara region and lowest (21.4%) in the Mediterranean Region. This rate is worse than that of the PatenT study, which documented approximately 15 million hypertensive adults, with 40% of the adults with HT awareness. These data indicate a rising trend of HT prevalence in Turkey and a declining trend in awareness level about HT. Several studies have reported awareness levels ranging from 26% to 60.2% (11).

In this study, the hypertension prevalence was found higher in the Mediterranean, Central Anatolia, and Black Sea regions and lower in South-East Anatolia and Aegean Regions. Different altitudes, weather conditions, lifestyles, dietary habits, and socioeconomic statuses of the regions may explain this difference. Importantly, it was noticed that the higher the unawareness in the region, the higher was the prevalence of hypertension.

Hypertension was more common in the altitudes <200 m and >1000 m when compared with altitudes between 200-1000 m. Chronic hypoxia at high altitudes leads to elevated blood pressure by the activation of the sympathetic nervous system in the healthy subjects (14). Studies also showed that factors such as decreased basal nitric
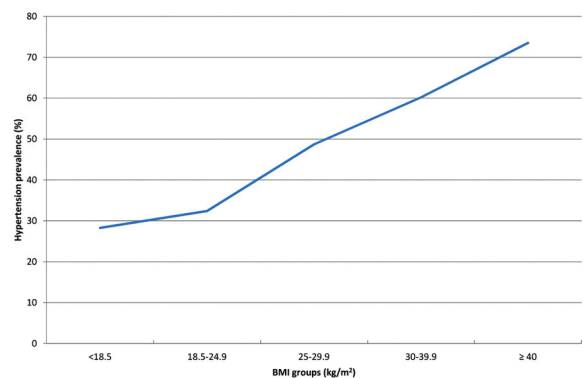

Figure 6. Prevalence of hypertension in Turkey by Body Mass Index (BMI).

oxide (NO) production, and increased NO consumption caused by increased blood viscosity, and increased blood hemoglobin might cause increased blood pressure with chronic hypoxia (15,16). A meta-analysis indicated that every 100 m increase in altitude led to a 2% increase in the prevalence of hypertension (17). The current study also found high hypertension prevalence in the regions with altitudes <200 m. Despite abundant information on prevalence at high altitude, there is little information about the effect of low altitude on blood pressure. Fiori et al. reported that hypertension was more frequent in low altitudes than in middle altitude in the subjects from Central Asia (18). High blood pressure levels in low altitude re-

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Table 2. Multiple logistic regression of hypertension prevalence.

	Odds ratio	%95 CI
Rural	1.244*	1.113-1.390
Age		
20-29	1	
30-39	1.346*	1.146-1.581
40-49	2.048*	1.742-2.407
50-59	3.964*	3.329-4.721
60-69	6.844*	5.603-8.361
70-79	9.719*	7.558-12.497
≥80	6.415*	3.788-10.864
Female	0.962	0.866-1.069
DM history	1.199	0.997-1.441
Smoke	0.683*	0.605-0.772
BMI		
<18.5 (underweight)	0.710	0,492-1.123
18.5-24.9 (normal)	1	
25-29.9 (overweight)	1.4360	0.974-2.095
30-39.9 (obese)	2.264*	1.541-3.327
≥40 (morbid obese)	4.241*	2.610-6.890
Waist/Height (>0.5)	1.326*	1.147-1.532
Altitude		
<200 m	1.093	0.875-1.366
200-1000 m	1	
>1000 m	1.091	0.873-1.363

*p<0.001

gions may be due to high sea salt exposure and excessive consumption of dried fish, although the exact cause is unknown (19).

Findings in our study showed similarities to those in developing countries such as China and India, where the hypertension prevalence was found higher in rural areas than in urban areas (20,21). There is a lack of effective public health measures in rural areas in developing countries, and most of the people live without social insurance. Hypertension is also associated with several individual indicators, such as education, occupation, and socioeconomic status, and regional and national economic conditions, but these relationships remain complex and unexplored. Possible reasons for these associations are lower birth weight and heavier job stress in lower socioeconomic status groups. On the other hand, higher awareness, better medical care, better prevention, and monitoring could reduce the prevalence

of hypertension in higher socioeconomic status groups (20,21). In developed countries such as Europe and the USA, hypertension prevalence was found higher in urban areas due to their lifestyles, eating habits, higher job strains (22-24) than in developing countries. The PatenT study showed that hypertension prevalence was not significantly different between the rural and urban populations (32.9% versus 31.1%) in Turkey (11).

In this study, the hypertension prevalence was higher in females than in males. The findings from previous nationwide surveys in Turkey (TEKHARF, HinT, and PatenT) have suggested that women show a higher prevalence of hypertension (10-12) than men. The monitoring of trends and determinants in Cardiovascular diseases (MONICA) study by WHO indicated that the problem of high blood pressure was almost universally more common in women than in men, especially in older age groups (25). In all 22 country populations, women in the 35-44 age group had lower SBP than men. In contrast, after this age group, SBP in women started to increase with age, and 34 of 41 study groups reported higher SBP values in women aged 55-64 years than men (25).

In the current study, although univariate analysis showed a relationship between increased hypertension prevalence with increasing BMI, WC, WHR, and WHtR, the multiple logistic regression analysis indicated that BMI and WHtR were the main determinants of hypertension prevalence. Although BMI, WC, and WHR are widely used as obesity indices for hypertension, diabetes, and other cardiovascular diseases, some authors have reported that BMI was a strong predictor of CVD mortality for whites, and also WC, WHR, or WHtR might be a better predictor for MetS or other CVD risks in different populations (26-29). WHtR was investigated in the NDNS and Health Survey for England, and it was found that both men and women with normal BMI but WHtR ≥0.5 had increased cardiometabolic risk factors, not only when they were compared to those with normal BMI and WHtR<0.5, but also with those with overweight BMI and WHtR<0.5 (30,31). Sayeed et al. highlighted the role of WHtR as an important predictor for hypertension (32). The hypertension rate was sig-

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nificantly higher in the upper quintiles of BMI, WHR, and WHtR, and BMI, WHR, and WHtR significantly correlated with SBP and DBP. Logistic regression analysis, which considers hypertension as a dependent variable, showed a higher odds ratio with WHtR than BMI and WHR (32,33).

We found that the prevalence of smoking was lower in the hypertensive group than in the normotensive group, and smoking was found to affect hypertension prevalence inversely by multiple logistic regression analysis. Although smoking can cause an acute rise in blood pressure levels in normotensive and hypertensive individuals, epidemiological studies using standard office measurements reported that blood pressure levels were lower or equal in regular daily smokers than nonsmokers (34-37). When the researchers used ambulatory blood pressure monitoring (ABPM), Mikkelsen et al. reported that smokers reported lower mean daytime systolic BP measurements; Green et al. reported lower daytime diastolic BP measurements (36,38). Mikkelsen et al. suggested that this situation might lead to an adaptive change in the sympathetic nervous system against nicotine use for many years (38). They also emphasized that smoking might help reduce stress, which is associated with rising blood pressure. However, this result can lead to a misleading evaluation of the effects of smoking on health. It is well known that chronic smoking has a negative effect on endothelial function and arterial stiffness, resulting in cardiovascular diseases (39). Our study evaluated the current smoking status without indicating life-course-adjusted cigarette smoking. Morillo et al. showed that smokers with or without antihypertensive medication had significantly higher daytime SBP and DBP values (34). This finding was also corroborated by other studies conducted on normotensive and hypertensive patients (40-44). A lower smoking rate in hypertensive patients than in normotensive individuals in our study may be associated with the patients' reluctance to take extra risks due to smoking.

Conclusion

To sum up, the SEMT hypertension study indicated the prevalence of hypertension in more than one-third of the adult population in Turkey. Also, only one-third of the hypertensive adults showed awareness of their hypertension. Living in a rural area, older age increased BMI and waist to height ratio >0.5 were factors leading to a higher prevalence of hypertension, while the smoking rate was lower in hypertensive patients. This was the first study evaluating the characteristics of hypertension in 7 regions of Turkey. Significant differences were observed among the regions in terms of the prevalence and awareness about hypertension.

Overall, the data of the SEMT hypertension study has indicated that in the adult Turkish population, the prevalence of hypertension was high, but the awareness levels and treatment rates of hypertension were low, despite regional differences. It is suggested to conduct nationwide awareness programs on the risk factors of hypertension and the application of practical physical examination methods in primary health care centers for the prevention, early diagnosis, and control of hypertension.

Abbreviations

ABMP: Ambulatory blood pressure monitoring
BP: Blood Pressure
BMI: Body Mass Index
DM: Diabetes Mellitus
DBP: Diastolic blood pressure
HC: hip circumference
HT: Hypertension
JNC-7: Seventh report of the Joint National Committee (USA)
MONICA: Monitoring of trends and determinants in cardiovascular diseases
SEMT: Society of Endocrinology and Metabolism of Turkey
SBP: Systolic blood pressure
TURDEP-II: The Turkish Epidemiology Survey of Diabetes, Hypertension, Obesity and Endocrine Diseases
WC: waist circumference
WHtR: Waist to height ratio

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Conflict of Interest

No conflicts of interest between the authors and/or family members of the scientific and medical committee members or members of the potential conflicts of interest, counseling, expertise, working conditions, share holding and similar situations in any firm.

Authorship Contributions

Idea/Concept: Fahri Bayram, Tevfik Sabuncu, Aydın Vedia Gedik, Demet Çorapçıoğlu, Ahmet Kaya; Design: Fahri Bayram, Tevfik Sabuncu, Özgür Demir; Control/Supervision: Aydın Vedia Gedik, Demet Çorapçıoğlu, Ahmet Kaya; Data Collection and/or Processing: Fahri Bayram, Tevfik Sabuncu, Özgür Demir; Analysis and/or Interpretation: Fahri Bayram, Tevfik Sabuncu, Özgür Demir, Mehmet Ali Eren; Literature Review: Fahri Bayram, Tevfik Sabuncu, Özgür Demir, Mehmet Ali Eren; Writing the Article: Fahri Bayram, Tevfik Sabuncu, Özgür Demir, Mehmet Ali Eren; Critical Review: Fahri Bayram, Tevfik Sabuncu; References and Fundings: Tevfik Sabuncu, Özgür Demir, Mehmet Ali Eren; Materials: Fahri Bayram, Tevfik Sabuncu.

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