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Research Article

# The effect of body mass index and anxiety status on blood pressure in patients admitted to family medicine outpatient clinic

## Aile hekimliği polikliniğine başvuran hastalarda vücut kitle indeksi ve anksiyete durumunun kan basıncı üzerine etkisi

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## Abstract

**Introduction**: Hypertension is a global public health problem that is the leading cause of preventable death in the world and a disease which can cause many morbidities and mortality if not controlled or treated effectively. In many studies, it has been determined that anxiety and body mass index(BMI) are among the factors affecting hypertension. However, different results have been obtained in many studies in terms of the relationship between anxiety and hypertension. This study was carried out with the aim to evaluate the effect of body mass index and anxiety on blood pressure and the factors affecting blood pressure in patients who applied to outpatient clinic of family medicine at Dicle University Faculty of Medicine.

**Methods**: 403 patients aged between 18- 65 years, who applied to outpatient clinic of family medicine at Dicle University Faculty of Medicine between 01.04.2018 and 01.07.2018, were included in this cross-sectional study. The population of the study was the province where the study was carried out, and the sample size was calculated with a power of 80%. The patients' body mass index and anxiety scores from Beck anxiety scale were calculated and measurements of arterial blood pressure were performed. The relationship between BMI, Beck anxiety scores and blood pressure of patients were investigated.

**Results**: Of the participants, 50.1% were male, 49.9% were female and the average age was 34.11 in years. Of the patients, the mean BMI as 25.52 kg/m², the mean anxiety score as 7.40 and the arterial blood pressures as 117.80/75.54 mmHg were measured. It was found that arterial blood pressure raised significantly as the BMI group increased. While the relationship between the severity of anxiety and systolic blood pressure was significant, its relationship with diastolic blood pressure was not significant. There was a positive correlation between BMI, anxiety score and systolic and diastolic blood pressure.

**Conclusions**: According to the results of this study, it was found that the increase in BMI and Beck anxiety scores may be related with increase in arterial blood pressure. This result showed that common health problems in primary care such as anxiety, obesity and hypertension may be associated with each other, and it can be effectively fought against hypertension and its complications with the perspective of family medicine and biopsychosocial approach.

**Keywords**: Anxiety, Hypertension, Blood Pressure, Obesity, Body Mass Index

## Öz

**Giriş:** Hipertansiyon, kontrol altına alınmadığı takdirde veya etkin tedavi edilmediğinde birçok morbidite ve mortaliteye neden olabilen dünyada önlenebilir ölüm nedenleri arasında ilk sıralarda yer alan küresel bir halk sağlığı sorunudur. Birçok çalışmada hipertansiyonu etkileyen faktörler arasında anksiyete ve vücut kitle indeksinin yer aldığı belirlenmiştir. Bununla birlikte anksiyete ve hipertansiyon ilişkisi açısından birçok çalışmada farklı sonuçlar elde edilmiştir. Bu çalışma, Dicle Üniversitesi Tıp Fakültesi Aile Hekimliği polikliniğine başvuran hastalarda vücut kitle indeksi ve anksiyete durumunun kan basıncı üzerine etkisini ve kan basıncı üzerine etki eden faktörleri değerlendirmek amacıyla yapılmıştır.

**Yöntem**: Kesitsel tipte olan bu çalışmaya, Dicle Üniversitesi Tıp Fakültesi Aile Hekimliği Polikliniğine 01.04.2018 ve 01.07.2018 tarihleri arasında başvuran 18-65 yaş arası 403 hasta dahil edilmiştir. Çalışmanın evreni çalışmanın yürütüldüğü il, gücü %80 olacak şekilde örneklem hacmi hesaplanmıştır. Hastaların vücut kitle indeksleri ve Beck anksiyete ölçeğinden aldıkları anksiyete skorları hesaplanıp arteriyel kan basıncı ölçümleri yapıldı. Hastaların VKİ ve Beck anksiyete puanları ile kan basınçları arasındaki ilişki incelenmiştir.

**Bulgular**: Katılımcıların, %50.1'i erkek, %49.9'u kadın, yaş ortalaması 34.11'di. Hastaların vücut kitle indeksi(VKİ) ortalaması 25.52 kg/m², anksiyete skor ortalaması 7.40, arteriyel kan basınçları ortalama 117.80/75.54 mmHg olarak hesaplandı. VKİ grubu ilerledikçe kan basınçlarının anlamlı şekilde arttığı belirlendi. Anksiyete şiddeti ile sistolik kan basıncı arasındaki ilişki anlamlı iken, diastolik kan basıncı ile arasındaki ilişki anlamlı bulunmadı. VKİ ve anksiyete skorunun sistolik ve diastolik kan basıncı değerleriyle pozitif korelasyonu olduğu bulundu.

**Sonuç**: Bu çalışma sonucunda VKİ ve Beck anksiyete skorunun artışının kan basıncında artışla ilişkili olabileceği bulundu. Bu sonuç, birinci basamakta anksiyete, obezite ve hipertansiyon gibi sık karşılaşılan sağlık sorunlarının birbirine eşlik edebileceğini ve aile hekimliği bakış açısı ve biyopsikososyal yaklaşımla hipertansiyon ve komplikasyonlarıyla etkili mücadele edilebileceğini göstermiştir.

**Anahtar Kelimeler**: Anksiyete, Hipertansiyon, Kan Basıncı, Obezite, Vücut Kitle İndeksi

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## Key Points

1. Systolic blood pressures increased as the anxiety severity of the patients increased
2. Body mass index was associated with increased blood pressure
3. Anxiety symptoms were associated with a decrease in blood pressure

## Introduction

Cardiovascular diseases are responsible for one-third of deaths worldwide and are a leading and growing contributor to the global burden of disease [1]. Hypertension is a very common risk factor for cardiovascular diseases throughout the industrialized world [2]. Hypertension is becoming an increasingly common health problem due to the prevalence of factors such as obesity, physical inactivity and unhealthy diet, and increased longevity [3]. In many developing countries, especially in urban populations, the prevalence of hypertension is as high as in developed countries [4, 5].

Hypertension plays an important etiological role in the development of cerebrovascular diseases, ischemic heart diseases, cardiac and renal insufficiency. If hypertension is treated, a significant decrease in the risk of stroke and myocardium can be achieved [1]. If not treated or controlled effectively, hypertension leads to many complications such as heart failure, kidney failure, thrombotic or hemorrhagic cerebrovascular events, aortic dissection, and increases mortality rates. High arterial blood pressure increases the complications and mortality rates related to hypertension in a direct proportion [2]. Although it has been shown that the treatment of hypertension prevents cardiovascular diseases and increases life expectancy, the management of hypertension remains inadequate worldwide [6, 7]. In addition, hypertension often coexists with other cardiovascular risk factors such as obesity, tobacco use, diabetes, and hyperlipidemia, which constitute cardiovascular risks predisposing to hypertension. Across the globe, high morbidity and mortality results occur due to inadequate handling of these accompanying risk factors in patients with hypertension [8, 9].

Hypertension is a worldwide epidemic and in terms of showing the consequences of this epidemic it is remarkable that of the 8.5 million deaths that occurred in 2015, high blood pressure was closely linked, with 88% occurring in low- and middle-income countries. [10]. Despite such mortality, early diagnosis and treatment provide a significant decrease in morbidity and mortality. [11].

Anxiety has been defined as a future-oriented emotional state characterized by a feeling of unease and the lack of control of one's own emotional response . Although anxiety is a normal response to stressful situations, it significantly affects quality of life and functionality in some individuals. Along with epidemiological studies, it is seen that the age of anxiety accompanies the age of hypertension. Because of the prevalence of high blood pressure and anxiety in the population, clinicians frequently encounter individuals who both carry these comorbidities and are suspected of one or both conditions [12]. In this study, it was aimed to determine the body mass index ( BMI) and anxiety status of the patients who applied to the DİCLE University Faculty of Medicine Family Medicine Outpatient Clinic, and to investigate the effects of these measurements on the mean blood pressure values determined in the same patients.

## Methods

Patients between the ages of 18-65 who applied to Dicle University Medical Faculty Hospital Family Medicine Outpatient Clinic between 01.04.2018 and 01.07.2018 were determined as the population of this descriptive cross-sectional study. The population aged 18-65 in the province where the research institution is located was taken as the universe. When the sample volume was calculated with the “This Sample Size Calculator Software” (http://www.surveysystem.com/sscalc.htm ) prepared by The Survey System, with 80% power in the research, it was seen that the sample number should be at least 384 patients, 400 patients were planned to reach. Exclusion criteria were determined as having an abnormal weight problem due to an endocrine disorder, having a chronic disease other than obesity secondary to diseases, and having any psychiatric diagnosis, and this group of patients were not included in the study. Sociodemographic characteristics, body mass indexes, arterial blood pressures, anxiety states, the relationship between these parameters, and the effect of body mass index and anxiety status on blood pressure of the patients who applied to the outpatient clinic between these dates were investigated.

Study data were collected through a questionnaire, and verbal and written informed consent was obtained from each patient to participate in the study. Body mass index was calculated, and arterial blood pressure was measured by measuring the body weight and height of each participant who accepted to participate in the study. Blood pressure values were obtained by averaging the blood pressure measurements made from both arms, measured by the same physician for each participant in a quiet and calm room, in a rested and sitting position.

In the research, the sample volume was calculated with “This Sample Size Calculator Software” (http://www.surveysystem.com/sscalc.htm) prepared by The Survey System. We planned to reach 400 people. Patients between the ages of 18-65 who voluntarily agreed to participate in the study were included in the study. Having abnormal weight problems due to an endocrine disorder, having a chronic disease other than diseases secondary to obesity, having any psychiatric diagnosis were determined as exclusion criteria and this group of patients were not included in the study. Questionnaire application was chosen as the data collection tool for the research. The questionnaire consisted of 34 questions in total, including a sociodemographic data form and Beck anxiety scale questions.

The sociodemographic data form included questions about age, gender, marital status, educational status, occupation, smoking status and number of packs/years of smoking, chronic disease status secondary to obesity, number of antihypertensive drugs used, and presence of hypertension in the family. It consisted of 13 questions in total, including body mass index calculated by measured height and body weight, and systolic and diastolic blood pressure measurement values.

The Beck anxiety scale used in our study is a questionnaire used to measure the frequency of anxiety symptoms experienced by individuals. It was developed by Beck et al. [13] in 1988. The validity and reliability analysis of the scale was performed by Ulusoy et al. [14] in 1998. As a result of this analysis, the internal validity coefficient of the scale was found to be high (Cronbach's alpha= 0.93) [14].
In our study, the internal validity coefficient (Cronbach's alpha) value of the scale was calculated as 0.926.

### Ethical approval

Ethical approval was obtained from Dicle University Faculty of Medicine, Non-Interventional Clinical Research Ethics Committee with the date of 16.03.2018 and number 113. Written informed consent of the participants were taken prior to the study.

### Statistical Analysis

In our study, the data were analyzed with 95% confidence, using the Statistical Package for the Social Sciences (SPSS Inc., Chicago, IL, USA, version 24) The significance limit of all statistical tests used was set at 0.05. Kolmogorov-Smirnov and Shapiro Wilk tests were used for normality control. Parametric tests were used for normally distributed data, and non-parametric tests were used for those that did not. Non-parametric tests were used because the data did not show a normal distribution. Chi-square test was used for the analysis of categorical variables. Descriptive statistics were used for demographic characteristics used in the study. Spearman correlation analysis was performed to determine the relationship between the variables. The independent variables in predicting the presence of hypertension were analyzed by logistic regression analysis. The Hosmer-Lemeshow test was used for model fit.

## Results

A total of 403 patients participated in the study between 01.04.2018 and 01.07.2018. When the socio-demographic characteristics of the patients participating in the study were examined, it was seen that 202 (50.1%) were male and 201 (49.9%) were female. In terms of education level, 195 (48.4%) were university graduates, 74 (18.3%) were primary school graduates, and illiterate patients comprised 19 (4.7%) of all patients participating in the study. When the distribution of the participants according to their professions was examined, it was seen that 95 (23.6%) were civil servants, 65 (16.1%) were students, and 130 (32.2%) were not working in any job. The sociodemographic characteristics of the patients participating in the study are given in Table 1.

**Table 1.** Sociodemographic and medical characteristics of the participants

| Sociodemographic and medical characteristics | | N | % |
|---|---|---|---|
| **Gender** | Male | 202 | 50.1 |
| | Female | 201 | 49.9 |
| **Marital Status** | Married | 246 | 61.0 |
| | Single | 154 | 38.3 |
| | Widow(er) | 3 | 0.7 |
| **Education Level** | Illiterate | 19 | 4.7 |
| | Literate | 16 | 4.0 |
| | Primary School | 74 | 18.3 |
| | Middle School | 24 | 6.0 |
| | High School | 75 | 18.6 |
| | University | 195 | 48.4 |
| **Occupation** | Civil Servant | 95 | 23.6 |
| | Worker | 83 | 20.6 |
| | Self-employment | 20 | 5.0 |
| | Student | 65 | 16.1 |
| | Unemployed | 130 | 32.2 |
| | Other | 10 | 2.5 |
| **Smoking** | Smoker | 117 | 29.0 |
| | Non-smoker | 286 | 71.0 |
| **Number of antihypertensive drugs used** | 0 | 382 | 94.8 |
| | 1 | 13 | 3.2 |
| | 2 | 7 | 1.8 |
| | 3 | 1 | 0.2 |
| **Presence of individuals with a diagnosis of hypertension in the family** | Available | 205 | 50.9 |
| | Unavailable | 198 | 49.1 |
| **Total** | | **403** | **100** |

Frequency distribution of participants' sociodemographic characteristics and medical values

When the participants were examined according to their medical characteristics; In terms of smoking, 29.0% of the patients were smokers and 50.9% of them had at least one individual with a diagnosis of hypertension in their family. 94.8% of the patients participating in the study were not using any antihypertensive drugs. The distribution of the patients according to their medical characteristics is given in Table 2. In the study, in which patients between the ages of 18-65 participated, the mean age of the participants was 34.11±11.16, the mean age of male patients was 35.79±11.50, and for females, it was 32.42±10.56. The mean body mass index calculated by measuring the height and weight of the participants was calculated as 25.52±5.03 in kg/m². The mean of the scores of the patients from the Beck anxiety scale was7.40±9.21. The mean systolic blood pressure of the patients was 117.80±17.21 mmHg, and the mean of the diastolic blood pressure was 75.54±10.47 mmHg. Other parameters of the participants are given in Table 2.

**Table 2.** Parameters of the participants

| Measurements | Mean | SD | Minimum | Maximum |
|---|---|---|---|---|
| **Age (year)** | 34.11 | 11.16 | 18 | 65 |
| **Smoking (packet/year)** | 4.27 | 9.55 | 0 | 60 |
| **Body mass index (kg/m²)** | 25.52 | 5.03 | 16.20 | 50.00 |
| **Anxiety score** | 7.40 | 9.21 | 0 | 58 |
| **Systolic blood pressure (mmHg)** | 117.80 | 17.21 | 80 | 200 |
| **Diastolic blood pressure (mmHg)** | 75.54 | 10.47 | 40 | 110 |

Frequency distribution of the patient's measurement values. SD: Standard Deviation

The body mass indexes according to the gender of the patients participating in the study, the mean male gender body mass index was 25.62±3.70 kg/m². A statistically significant difference was found between the body mass index results of male and female patients according to gender. In terms of body mass index groups by gender, 46.0% of the male were overweight and 10.9% were obese. The obese group constituted 19.9% of the female. A statistically significant relationship was found between BMI groups according to the gender of the participants (Table 3). According to the scores obtained from the Beck anxiety scale, the participants were classified according to their anxiety severity levels. 23.3% of the participants had mild anxiety and 5.2% had severe anxiety. When the mean scores of the participants from the Beck anxiety scale were evaluated according to gender, the mean anxiety score of the women was 10.22±10.03. A statistically significant difference was found between the anxiety scores of the patients participating in the study according to their gender. Considering the severity of anxiety according to the gender of the patients; it was seen that 76.7% of men had minimal anxiety and 21.4% of women had moderate and severe anxiety (Table 3). The distribution of patients according to body mass index groups and severity of anxiety is given in Table 3.

When the mean systolic blood pressure of the patients participating in the study was evaluated according to gender, the mean systolic blood pressure of the men was 118.93±16.12 mmHg. A statistically significant difference was found between the systolic blood pressures of the participants by gender (Table 4). When the diastolic blood pressures of the patients were examined according to their educational status, the mean diastolic blood pressure of the participants with less than high school education was 77.21±11.01 mmHg. A statistically significant difference was found between diastolic blood pressures according to the educational status of the patients participating in the study (Table 4). When the systolic blood pressures of the participants were examined according to the body mass index groups, the mean systolic blood pressure of the group with normal body mass index was 113.81±14.56 mmHg. This mean was calculated as 118.49±15.55 in the overweight group and 153.75±23.86 in the 3rd degree obese group. A statistically significant difference was found between the systolic pressures of the patients according to the body mass index groups (Table 4). When the diastolic blood pressures of the patients participating in the study were evaluated according to the body mass index groups; the mean diastolic blood pressure was 72.93±9.35 mmHg in the normal group, 76.54±10.17 in the overweight group and 93.75±10.60 in the 3rd degree obese group. A statistically significant difference was found between the diastolic blood pressures of the participants compared to the body mass index groups (Table 4). Considering the systolic blood pressures of the patients participating in the study according to the severity of anxiety; while the mean systolic blood pressure was 115.85±15.31 mmHg in those with minimal anxiety, it was found as 128.57±21.74 in those with severe anxiety. A statistically significant correlation was found between systolic blood pressures according to the anxiety severity of the participants (Table 4).

**Table 3.** BMI and anxiety severity group distributions of the participants by gender

| | **BMI groups n %** | | | | | | | **Anxiety severity n %** | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Gender** | **Low** | **Normal** | **Overweight** | **1st degree obese** | **2nd degree obese** | **3rd degree obese** | **p** | **Minimal** | **Mild** | **Moderate** | **Severe** | **p** |
| **Male** | 5<br>2.5% | 82<br>40.6% | 93<br>46.0% | 20<br>9.9% | 2<br>1.0% | 0 | **<0.011** | 155<br>76.7% | 33<br>16.3% | 9<br>4.5% | 5<br>2.5% | **<0.012** |
| **Female** | 14<br>7.0% | 104<br>51.7% | 43<br>21.4% | 24<br>11.9% | 8<br>4.0% | 8<br>4.0% | | 97<br>48.3% | 61<br>30.3% | 27<br>13.4% | 16<br>8.0% | |
| **Total** | **19<br>4.7%** | **186<br>46.2%** | **136<br>33.7%** | **44<br>10.9%** | **10<br>2.5%** | **8<br>2.0%** | **403<br>100%** | **252<br>62.5%** | **94<br>23.3%** | **36<br>9.0%** | **21<br>5.2%** | **403<br>100%** |

Comparison of body mass index and anxiety level by gender ; Pearson chi-square test was used

**Table 4.** Sociodemographic data of the participants, mean systolic and diastolic blood pressure according to BMI groups and anxiety severity groups

| | | Systolic blood pressure (mmHg) | | | Diastolic blood pressure (mmHg) | | |
|---|---|---|---|---|---|---|---|
| | | Mean | SD | P | Mean | SD | P |
| **Gender** | **Male** | 118.93 | 16.12 | **0.012** | 76.06 | 10.12 | 0.150 |
| | **Female** | 116.66 | 18.20 | | 75.02 | 10.82 | |
| **Education level** | **Below high school** | 120.67 | 19.19 | 0.051 | 77.21 | 11.01 | **0.010** |
| | **High school and university** | 116.38 | 15.99 | | 74.72 | 10.12 | |
| **Smoking** | **Smoker** | 118.33 | 15.39 | 0.324 | 75.81 | 9.71 | 0.590 |
| | **Non-smoker** | 117.58 | 17.92 | | 75.43 | 10.78 | |
| **Hypertension in the Family** | **Yes** | 119.14 | 19.06 | 0.281 | 76.41 | 11.25 | 0.150 |
| | **No** | 116.41 | 14.97 | | 74.64 | 9.55 | |
| **BMI group** | **Low** | 111.05 | 11.00 | **<0.013** | 72.89 | 7.69 | **<0.001** |
| | **Normal** | 113.81 | 14.56 | | 72.93 | 9.35 | |
| | **Overweight** | 118.49 | 15.55 | | 76.54 | 10.17 | |
| | **1st degree obese** | 125.00 | 19.94 | | 79.65 | 11.43 | |
| | **2nd degree obese** | 135.00 | 22.23 | | 83.00 | 10.59 | |
| | **3rd degree obese** | 153.75 | 23.86 | | 93.75 | 10.60 | |
| **Anxiety severity** | **Minimal** | 115.85 | 15.31 | **0.032** | 74.62 | 9.68 | 0.100 |
| | **Mild** | 120.53 | 19.65 | | 76.80 | 11.61 | |
| | **Moderate** | 118.05 | 17.53 | | 76.11 | 10.76 | |
| | **Severe** | 128.57 | 21.74 | | 80.00 | 12.64 | |

SD: Standard Deviation. Comparison of the mean blood pressure scores and the descriptive characteristics of the patient's' systolic and diastolic values. Student t and ANOVA test was used.

While a positive correlation was found between the body mass index and systolic and diastolic blood pressures of the patients participating in the study, a positive correlation was found between the scores obtained from the Beck anxiety scale and systolic and diastolic blood pressures. The correlation analysis between the anxiety scale score and body mass index, and systolic and diastolic blood pressures are given in Table 5.

**Table 5.** The relationship between the participants' BMI, anxiety score, systolic and diastolic blood pressures

| | | BMI | Anxiety score | Systolic blood pressure | Diastolic blood pressure |
|---|---|---|---|---|---|
| **BMI** | **R** | 1.00 | | | |
| | **p** | | | | |
| **Anxiety score** | **R** | -0.40 | 1.00 | | |
| | **p** | 0.423 | | | |
| **Systolic blood pressure** | **R** | **0.294** | **0.11** | 1.00 | |
| | **p** | **<0.010** | **0.023** | | |
| **Diastolic blood pressure** | **R** | **0.282** | **0.114** | **0.874** | 1.00 |
| | **p** | **<0.010** | **0.013** | **<0.010** | |

R:Correlation Coefficient, p:coefficient of significance, correlation analysis was used

When advanced logistic analysis was performed to evaluate the effects of some sociodemographic data and measurement results on hypertension situations of the patients participating in the study, a statistically significant difference was found between the groups regarding age, presence of anxiety, body mass index higher than 25 kg/m² and the presence of hypertension (Table 6).

**Table 6.** The effect of various factors of the participants on the frequency of hypertension

| | B | SE | p | OR (CI) |
|---|---|---|---|---|
| **Age** | 0.06 | 0.01 | **<0.010** | 1.07 (1.04-1.09) |
| **Gender ( male=1)** | 0.13 | 0.32 | 0.663 | 1.14 (0.61-2.15) |
| **Education level (below high school=1)** | 0.42 | 0.32 | 0.192 | 1.52 (0.80-2.86) |
| **Smoking (smoker=1)** | 0.19 | 0.32 | 0.554 | 1.21 (0.64-2.30) |
| **HT in the family (available=1)** | 0.09 | 0.29 | 0.753 | 1.09 (0.61-1.94) |
| **Anxiety status (available=1)** | -0.92 | 0.31 | **<0.010** | 0.39 (0.21-0.72) |
| **BMI (≥25 kg/m²=1)** | -0.87 | 0.32 | **<0.010** | 0.41 (0.22-0.78) |

B: Regression Coefficient, SE: Standard Error, OR :Odd Ratio , CI : Confidence Interval, logistic regression analysis was used.

## Discussion

In our study, 403 patients between the ages of 18-65 who applied to the Dicle University Faculty of Medicine Family Medicine outpatient clinic within a three-month period were evaluated. It is thought that the measurements and questionnaires made by the same physician in a quiet and calm environment with standard measurement techniques and face-to-face interviews accurately reflect the arterial blood pressure levels of the participants and the affecting factors. The mean score of the patients from the anxiety scale was 7.40±9.21. Considering the severity of anxiety, 23.3% had mild anxiety and 5.2% had severe anxiety. While the mean body mass index of the patients was calculated as 25.52 kg/m², 33.7% of the patients were overweight and 15.4% were obese. The mean systolic and diastolic blood pressures of the patients were measured as 117.80 and 75.54 mmHg, respectively. 52 patients were included in a study conducted in Ankara in 2012, in which the frequency of anxiety disorders in patients with a diagnosis of hypertension was investigated [15]. In this study, 36.5% of the participants were male and their average age was 57.33 years, which is higher than the average of our study. While the average score of the participants from the Beck anxiety scale was 14.61, 36.5% had mild anxiety and 13.5% had severe anxiety. The mean systolic and diastolic blood pressures measured in this study were calculated as 137.50 and 79.38 mmHg, respectively. Although the number of participants was not high, Aydogan et al. [15] emphasized the prevalence of hypertension and anxiety. Unlike our study, the higher anxiety scores and higher percentage of severe anxiety in this study can be explained by the higher average age and the presence of comorbidities in the participants included in the study. The reason for the higher mean systolic and diastolic blood pressures in this study compared to the mean arterial blood pressures measured in our study can be explained by the inclusion of only patients with a diagnosis of hypertension, unlike our study.

While a statistically significant difference was found between the systolic blood pressure averages according to gender, higher in males, in the patients participating in our study, there was no statistically significant difference between the diastolic blood pressure averages. Paterniti et al. [16] examined the differences in arterial blood pressure according to gender. The mean systolic blood pressure was significantly higher in men; similar findings were obtained in our study. However, while there was no significant difference in diastolic blood pressure by gender in our study, a significant difference was found in this study, with the mean diastolic blood pressure of men approximately 4.4 mmHg higher than that of female participants. In another study evaluating 13,557 participants aged 15-20, men were found to have higher systolic blood pressure, similar to our study [17]. In a study conducted by Tanyeri et al. [18] in Samsun, the mean systolic and diastolic blood pressures of women were found to be 140/80 mmHg and 88/50 mmHg, respectively. In this study, contrary to our study, both systolic and diastolic blood pressures were statistically significantly higher in women than in men. Akman et al. [19] in an internal medicine polyclinic observed that systolic and diastolic blood pressures did not differ according to gender, unlike the findings of our study.

When the education level of the patients participating in our study was grouped as below high school and graduation from high school or higher, systolic blood pressure was found to be approximately 4 mmHg higher in the lower-high school group compared to the other group, but no statistically significant difference was found. When evaluated in terms of diastolic blood pressure; a statistically significant difference was found between the two groups, which was higher in the group below high school. Raikkonen et al. [20] found that the duration of education in years did not affect the incidence of hypertension. Paterniti et al. [16] determined that the duration of education was not related to the blood pressure value. Tasci et al. [21] found that the prevalence of hypertension decreased as the education level increased. The reason for the different results of the effect of education status on blood pressure in studies in different regions can be considered as the existence of factors such as the content of education, taking health-related courses, and health literacy apart from the education period.

When the systolic and diastolic blood pressures of the patients participating in our study were evaluated according to the body mass index group, it was determined that both systolic and diastolic blood pressure averages went up as the body mass index group increased. While the mean systolic and diastolic blood pressures of the normal weight group were 113.81 mmHg and 72.93 mmHg, respectively, these mean values were calculated as 153.75 mmHg and 93.75 mmHg in the 3rd degree obese group. In our study, a statistically significant difference was found in terms of systolic and diastolic blood pressure averages according to body mass index groups. In addition, a positive correlation was found between body mass index values and both systolic and diastolic blood pressures.

In a prospective study conducted on 1166 male patients aged 23-80 years, patients with blood pressure levels below 140/90 mmHg at first were included in the study [22]. In this study, in which the blood pressure and other measurements of the patients were repeated with 5 and 10 years follow-up, it was shown that body mass index was a statistically significant predictor of the increase in diastolic blood pressure.

Consistent with our study, it was concluded that body mass index was associated with increased blood pressure. According to the results of a study planned as a 3-year prospective study by Markovitz et al. [23], it was determined that the increase in body mass index was significantly associated with the increase in systolic and diastolic blood pressures. According to the results of a prospective study conducted by Raikkonen et al. [20], it was determined that the participants diagnosed with hypertension had statistically significantly higher body mass index values at the beginning. According to the results of these studies, the significant relationship between body mass index and arterial blood pressure supports the finding of our study in this direction.
Similar to our study, in a cross-sectional study, the relationship between body mass index, physical activity and high blood pressure in adolescents was examined [17]. According to the results of this study, it was found that having a high body mass index value for both genders was associated with higher arterial blood pressure, independent of other variables. As a result of the study performed by Paterniti et al. [16] in an elderly population in France, it was determined that systolic and diastolic blood pressures were correlated with body mass index in a statistically significant way. The positive correlation result of our study between body mass index and blood pressure is also compatible with these studies. Finding a significant relationship between body mass index and blood pressure in these two studies, one of which was performed in adolescents and one in the elderly population, supports that body mass index is an important determinant of hypertension regardless of age, and that having a healthy weight, which is one of the non-pharmacological treatments, has a positive effect on blood pressure.

In a study conducted in three countries in Africa and Asia, the relationship between body mass index and blood pressure was investigated [24]. In this study carried out in Indonesia, Ethiopia and Vietnam, it was determined that the mean blood pressure values increased as the body mass index

increased. In addition, the risk of hypertension was found to be significantly higher in the overweight and obese groups. In addition to these findings consistent with the results of our study, a positive correlation was found between body mass index and systolic and diastolic blood pressure values in all three populations in this study, similar to our study, with the correlation coefficient varying between 0.23 and 0.27. Unlike in this study, the prevalence of hypertension was found to be higher in the groups with the lowest and highest body mass index in men in the Ethiopian population than in the other groups. While hypertension is more common in the high body mass index group, it is consistent with our study. The high blood pressure in the lean group compared to the other groups can be attributed to malnutrition.

Considering the studies conducted in our country on the relationship between body mass index and arterial blood pressure, Tanyeri et al. [18] found a significant relationship between body mass index and mean systolic and diastolic blood pressure. The mean systolic and diastolic blood pressures of the normal and obese groups were calculated as 120.9/77.4 and 142.8/90.2 mmHg, respectively. These results support the findings of our study. In addition, according to this study, 43.7% of obese individuals were found to be hypertensive, and 86.3% of individuals with hypertension were found to be obese. As a result of a study conducted by Hekimsoy et al. [25] on 58 female patients who applied with the complaint of being overweight, a positive correlation was found between body mass index and hypertension, as in our study.

Similarly, in the study conducted by Hatemi et al. [26], in which participants from four geographical regions and 11 cities were evaluated, a positive and linear correlation was found between body mass index and blood pressure values. Likewise, a significant relationship was found between body mass index and hypertension in the studies conducted by Nazlican et al. [27] and Tasci et al. [21]. As a result of the studies conducted by Akman et al. [19] and Aladag et al. [28], it was determined that an increase in body mass index significantly increased the risk of hypertension. In a study on the prevalence of obesity in the province of Tokat, systolic and diastolic blood pressure values were found to be significantly higher in obese and overweight patients compared to the normal group [29]. All these results support the findings of our study showing the effect of body mass index on blood pressure. As a result of these studies carried out both in our country and abroad, it can be concluded that a decrease in body mass index will positively affect blood pressure not only in hypertensive individuals, but also in individuals prone to hypertension, regardless of factors such as the patient's age, gender, and geography.

Anxiety score and correlation analysis of systolic and diastolic blood pressures of the patients participating in our study revealed a positive correlation. The effects of anxiety and depression on blood pressure were investigated in an 11-year study in which 36530 participants aged 20-78 were included [30]. In this study, it was determined that anxiety symptoms were associated with a decrease in blood pressure, and both the presence of high anxiety symptoms at baseline and the increase in symptoms at follow-up predicted a significant decrease in blood pressure. However, in this study, different questionnaires were used to measure anxiety at the beginning of the study and at follow-up. Although a positive correlation was found between anxiety and blood pressure in our study, in this study, on the contrary, it was shown that anxiety was associated with low blood pressure.

In a study investigating the factors affecting blood pressure changes, 1166 male patients were included in a study with 5- and 10-year follow-ups [22]. In this study, no significant relationship was found between the patient's psychological state and blood pressure, including anxiety. One of the limitations of this study is that the questions measuring psychological state are not sensitive enough. However, in this study, unlike our study, it was shown that anxiety did not have any effect on blood pressure. Raikkönen et al. [20] investigated the effect of psychological risks on hypertension in middle-aged women and found that the increase in anxiety score and symptoms did not have a statistically significant effect on blood pressure when other variables were excluded.

The effects of psychological, biological and health behavior determinants on changes in blood pressure in female patients were investigated by Markowitz et al. [23]. According to this study, a significant correlation was found between high anxiety scores and increased symptoms during follow-up, and systolic and diastolic blood pressures. This study supports the positive correlation result that we found in our study.

In a cohort study evaluating whether symptoms of anxiety and depression are risk factors for hypertension, participants who were not initially diagnosed with hypertension were followed for 7-16 years [31]. As a result of this study, it was shown that high anxiety is an important determinant of hypertension. In a prospective study by Shinn et al. [32], it was shown that anxiety or depression did not have a statistical significance in the development of hypertension.

In the study conducted by Paterniti et al. [16], a significant relationship was found between anxiety and increases in systolic and diastolic blood pressure, independent of other variables. In this study, the relationship with high blood pressure in the group with the highest anxiety severity was found to be stronger than the other groups. As the reason for this, although it is not a psychiatric diagnosis criterion, it can be thought that only pathological anxiety is associated with hypertension.

There are few studies examining the effect of anxiety on blood pressure in our country. According to the results of the study by Aydogan et al. [15] examining anxiety disorder in hypertension patients, no significant correlation was found between the score obtained from the anxiety scale and blood pressure levels.

In various studies, the effect of anxiety severity on blood pressure has revealed different results. In some studies, it has been found that anxiety reduces blood pressure, in others it does not change, and in some other studies it increases blood pressure [15, 16, 30]. It is expected that the findings obtained in this study will contribute to the literature at this point. One of the reasons for this may be that the same scales were not used in the studies. The fact that only female or only male patients were included in some prospective studies with a large number of participants also leaves the analysis of two common comorbidities incomplete. In the light of the publications in the literature discussed above, while there are studies supporting the conclusion that anxiety has a positive correlation with blood pressure, there are also studies with results inconsistent with our study.

When the effects of factors belonging to the patients included in our study on blood pressure were evaluated by logistic analysis, a significant relationship was found between age, presence of anxiety, body mass index and hypertension. In the advanced logistic analysis of the study conducted by Tasci et al., a significant relationship was found between age and body mass index and blood pressure, in line with our results [21]. In this study, similar to our study; it was determined that gender, smoking status, education level and presence of hypertension in the family did not have a significant effect on high blood pressure.

## Limitations

Our research has some limitations and strengths. This descriptive and cross-sectional study was applied to patients who applied to the Family Medicine outpatient clinic of Dicle University Medical Faculty Hospital, which is a tertiary public hospital, within a period of 3 months. In this respect, it cannot be generalized for the whole country or the entire region. While there are many studies in the literature examining the effect of body mass index on arterial blood pressure, both in our country and abroad, studies examining the effect of anxiety on blood pressure are very few, especially in our country. This is the original aspect of our study and one of its strong characteristics. Another strong characteristic of our research is that the measurements and questionnaires were made by the same physician in a quiet and calm environment, using standard measurement techniques and face-to-face interviews, and accurately reflecting the arterial blood pressure levels of the participants and the affecting factors.

## Conclusion

A significant correlation was found between the body mass index group of the participants and their systolic and diastolic blood pressures. Significant increases were observed in systolic and diastolic blood pressures from the thin group to the 3rd degree obese group.

While a significant correlation was found between the systolic blood pressure averages according to the anxiety severity of the patients, no significant correlation was found between the diastolic blood pressures. It was determined that systolic blood pressures increased as the anxiety severity of the patients increased. A difference of approximately 5 mmHg was found between the severe and minimal anxiety groups in terms of mean diastolic blood pressure.

It should be known by the physicians who provide services in this step that common health problems such as anxiety, obesity and hypertension can accompany each other in the primary health care system. It should not be forgotten that even slight decreases in body mass index are important in regulating blood pressure in both hypertensive individuals and those inclined to hypertensive. Since studies on the effect of anxiety on arterial blood pressure are few in number in our country and anxiety is common in the population, studies focusing on this subject should be increased. Similar studies can be applied in different centers and on larger samples, and generalizations can be made by comparing the results obtained with these results.

**Conflict of interest**: The authors have no conflict of interest in this study

| Author Contributions | | Author Initials |
|---|---|---|
| SCD | Study Conception and Design | OA, AY, VDP |
| AD | Acquisition of Data | OA, AD, MK |
| AID | Analysis and Interpretation of Data | AD, VDP, MK |
| DM | Drafting of Manuscript | OA, AY, VDP |
| CR | Critical Revision | AY, AD, MK |

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