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Medicinal Plants Used In Traditional Treatment of Hypertension in Turkey

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Abstract
Since ancient times people have used plants because of their therapeutic effects. People have recorded the therapeutic effects of plants throughout history. Turkey has a rich traditional medicine and ethnobotanical culture. People have preserved this ethnobotanical culture by transferring them from generation to generation. Medicinal plants are playing an important role in health care programmes worldwide, especially in developing countries. In Turkey there are many plant species known with their blood pressure lowering effect. In this study 150 plant taxa, used against hypertension in Turkey were compiled. The study contains botanical names, families, local names, used parts and method of use of these plant species. According to this research commonly used medicinal plants are from Rosaceae (27 taxa), Lamiaceae (26 taxa), Asteraceae (15 taxa), Apiaceae (11 taxa), Polygonaceae (6 taxa), Loranthaceae (3 taxa) and Rhamnaceae (3 taxa) respectively.

Keywords: Hypertension, Traditional medicine, Ethnobotany, Medicinal plants, Turkey

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1. Introduction

Hypertension, also known as high or raised blood pressure, is a condition in which the blood vessels have persistently raised pressure (WHO). Optimal blood pressure is defined as a systolic blood pressure less than 120 mm Hg and a diastolic blood pressure less than 80 mm Hg. Hypertension is characterized by a confirmed elevation of systolic (≥ 140 mm Hg) or diastolic (≥ 90 mm Hg) blood pressure (He and Whelton, 1997). Hypertension increases the risk of heart attacks, strokes and kidney failure. Uncontrolled hypertension can also cause blindness, irregular heartbeat and heart failure. Based on office blood pressure, the global prevalence of hypertension was estimated to be 1.13 billion in 2015, with a prevalence of over 150 million in central and eastern Europe. The overall prevalence of hypertension in adults is around 30- 45%, with a global age standardized prevalence of 24 and 20% in men and women, respectively, in 2015. This high prevalence of hypertension is consistent across the world, irrespective of income status, i.e. in lower, middle, and higher income countries. Hypertension becomes progressively more common with advancing age, with a prevalence of >60% in people aged >60 years (Williams et al., 2018).

Turkey has a rich plant biodiversity and has ratio of endemism. Approximately twelve thousand plant species are growing in Turkey, and three thousand of them are endemic. (Güner et al., 2000, Özhatay et al. 2013, Özhatay et al., 2015, Özhatay et al., 2017) This rich plant biodiversity ensures that traditional medicine is widespread in Turkey. In the present study 151 plant taxa, used against hypertension in Turkey were obtained. The botanical names, families, local names, used parts and usage of these plant taxa are shown in Table 1.

Table 1- List of the medicinal plants used in traditional treatment of hypertension in Turkey.

Botanical name	Family	Local name	Plant part used	Preparation, administration and use	References
Achillea biebersteinii Afan.	Asteraceae	Ayvadana, Civamperçemi	Aerial parts	Inf.	(Tuzlacı 2016)
Achillea millefolium L. subsp. *pannonica* (Schelek) Hayek	Asteraceae	Civanperçemi, kurpotu, dişotu, ayvadana, ronağvaç, sporiş,	Flowers	Inf., O.Ad., drink one teacup two times a day for 5 days	(Kültür 2007)
Alchemilla sintenisii Rothm.	Rosaceae	Aslanpençesi, Fındık otu	Leaves	Inf. One cup of plant in the morning	(Tuzlacı 2016)
Alliaria petiolata (M.Bieb.) Cavara & Grande	Brassicaceae	Dida, Sarımsak otu	Aerial parts	Dec.	(Tuzlacı 2016)
Allium cepa L.	Liliaceae	Soğan	Bulbs	Inf., Drink one cup of the plant on an empty stomach in the morning	(Hayta 2014; Saday 2009; Öztürk et al. 2013; Tetik 2011; Tuzlacı 2016)
Allium macrochaetum Boiss. et Hausskn. subsp. *tuncelianum* Kollmann	Liliaceae	Dağ sarmısağı	Bulbs	Eaten	(Tuzlacı & Doğan 2010; Tuzlacı & Şenkardeş 2011; Doğan 2014; Tuzlacı 2016)
Allium sativum L.	Liliaceae	Sarımsak, sarmısak	Bulbs, Dried	O.Ad.; Eaten	(Polat et al. 2013; Güzel et al. 2015; Karaman et al. 2001; Akbulut & Bayramoğlu 2013; Han & Bulut 2015; Polat & Çakıroğlu 2018; Sezik et al. 2001; Eşen 2008; Tuzlacı & Tolon 2000; Tuzlacı & Sadıkoğlu 2007; Ezer & Arısan 2006; Saday 2009; Bulut 2008; Çakılcıoğlu et al. 2010; Tekin 2011; Onar 2006; Metin 2009; Öztürk 2006; Şenkardeş 2014; Tütenocaklı 2014; Polat 2010; Kültür 2007; Tuzlacı 2016; Ezer & Arısan 2006)
Allium scorodoprassum L. subsp. *rotundum* (L.) Stearn	Liliaceae	İt soğanı	Bulbs	Fresh, dried. Dec., Int.	(Altundağ & Ozturk 2011; Hayta 2014; Altundağ 2009; Tuzlacı 2016)
Allium tuncelianum	Liliaceae	Soğan	Bulbs	Fresh	(Ekşi 2012)
Anchusa azurea Mill.	Boraginaceae	Gelazun, Gelezun	Aerial parts, Roots	Dec., Aerial parts boiled. Drink one tea glass of the plant before the meal. Eaten as meal	(Polat et al. 2013; Akgul et al. 2018; Tuzlacı 2016)
Anethum graveolens L.	Apiaceae	Dereotu	Seeds	Dec., O. Ad, drink one teacup three times a day for 7-8 days	(Ugulu et al. 2009; Kaval et al. 2014; Bulut et al. 2008; Tuzlacı 2016)
Anthemis coelopoda var. *bourgaei* Boiss.	Asteraceae	Papatya	Aerial parts	Inf., Drink one cup of the plant on an empty stomach in the morning	(Tetik et al. 2013; Tetik 2011; Tuzlacı 2016)
Anthemis tinctoria L. var. *tinctoria*	Asteraceae	Papatya, Sarı papatya	Flowers	Dec.	(Doğan 2014; Tuzlacı 2016)
Apium nodiflorum (L.) Lag.	Apiaceae	Bendik	Aerial parts	Eaten	(Bulut et al. 2008; Demirci 2010; Tuzlacı 2016)
Arbutus unedo L.	Ericaceae	Kocayemiş, Dağ yemişi	Fruits	Eaten	(Kızılarslan 2008)
Artedia squamata L.	Apiaceae	Karabenek	Leaves	Inf., Int.	(Bulut et al. 2008; Doğan 2014; Tuzlacı 2016)
Artemisia absinthium L.	Asteraceae	Pelinotu, acıpelin, pelin, acı pelinotu	Leaves	Cutting into little pieces/ Ext., chewed once a day for 10 days. Dec., O.Ad., drink one teacup once a day for 5 days	(Özhatay et al. 2006; Kültür 2007; Tuzlacı 2016)
Arum elongatum Steven subsp. *detruncatum* (C.A. Meyer ex Schott) H. Riedl.	Araceae	Kardun, Kardu, Kardı	Leaves	Int., Compress Drink one cup of the plant on an empty stomach in the morning	(Polat et al. 2013; Polat & Çakıroğlu 2018; Tuzlacı 2016)

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Ballota nigra L. subsp. *nigra*	Lamiaceae	Arıotu	Flowers, Leaves	Inf.	(Tetik et al. 2013; Tuzlacı 2016)
Bellis perennis L.	Asteraceae	Beyazpapatya	Flowers, Leaves	Inf., Dec.	(Kızılarslan 2008)
Berberis vulgaris L.	Berberidaceae	Kadın tuzluğu, Karamuk	Root, Leaves, Flower, Fruit	Crude, dried and Dec.	(Akgül et al. 2016)
Berberis crataegina DC.	Berberidaceae	Karamık	Fruits	The plant is eaten raw	(Eşen 2008; Saday 2009; Tuzlacı 2016)
Brassica nigra (L.) W.D.J. Koch	Brassicaceae	Eşek turpu	Leaves, stem	Inf.	(Güneş 2010)
Bryonia multiflora Boiss. & Heldr.	Cucurbitaceae	Juri ruvi, tırye ruvi	Fruits	The plant is eaten raw	(Mükemre et al. 2015)
Calendula officinalis L.	Asteraceae	Aynısafa	Aerial Parts	Dec. O. Ad, drink one teacup 2-3 times a day for 5-6 days	(Ugulu et al. 2009; Tuzlacı 2016)
Capsella bursa-pastoris Medik.	Brassicaceae	Çoban çantası	Leaves	Dec. O., drink one teacup 3 times a day for 8 days	(Ugulu et al. 2009)
Castanea sativa Mill.	Fagaceae	Anadolu kestanesi	Cortex	Inf.	(Saraç 2013; Kızılarslan 2008; Tuzlacı 2016)
Chaerophyllum bulbosum L.	Apiaceae	Handok	Rhizome, Leaves	Inf., Int.	(Bulut et al. 2008; Doğan 2014)
Celtis australis L.	Cannabaceae	Karaçıtlık, çitlenbik	Fruits, leaves	Dec., Int.	(Tuzlacı & Sadıkoğlu 2007; Tuzlacı 2016)
Ceratonia siliqua L.	Fabaceae	Cırnıp, Harnup, Keçiboynuzu	Fruits	Inf.	(Güneş 2010)
Cichorium intybus L.	Asteraceae	Kaniş	Aerial parts, latex, whole plant	Inf., Eaten as meal. Drink one glass 2–3 times a day for 8–12 weeks	(Kaval et al. 2014; Sargın et al. 2013; Tetik et al. 2013; Mükemre et al. 2015; Akgul et al. 2018; Tuzlacı 2016)
Cistus laurifolius L.	Cistaceae	Yavşancıl, tistüs, karakan yaprağı, karakan otu	Leaves	Dec., Inf.	(Oral 2007; Tuzlacı 2016)
Citrus x *limon*	Rutaceae	Limon	Fruits	The fruits are eaten raw	(Eşen 2008)
Cnicus benedictus L.	Asteraceae	Devedikeni, Şevketi bostan	Whole plant	Int., Dec., spice Drink one teacup 2–3 times a day for 3–4 weeks	(Sargın et al. 2013)
Cnicus benedictus L. var. benedictus	Asteraceae	Mübarek dikeni	Flowers, leaves	Dec., drink one cup of the plant on an empty stomach in the morning	(Cakilcioglu & Turkoglu 2010; Tuzlacı 2016)
Cornus mas L.	Cornaceae	Kızılcık	Fruits	Dec., O. Ad., drink one tea cup two times a day for a week	(Polat et al. 2011; Güneş 2010; Polat 2010; Tuzlacı 2016)
Cotinus coggygria Scop.	Anacardiaceae	Tetra, tetre, tetere, tetra otu	Leaves	Dec., O.Ad.	(Kültür 2007; Tuzlacı 2016)
Crataegus aronia (L.) Bosc ex DC. var. *aronia* (L.) Bosc ex DC.	Rosaceae	Zeğrur, Alıç	Leaves, flowers	Dec.	(Güzelşemme 2014; Gençay 2007; Tuzlacı 2016)
Crataegus monogyna Jacq. subsp. *monogyna*	Rosaceae	Yemişgen, alıç, arıç, yemişgen çalısı	Fruits, flowers	Dec., Int., 3,4 times a day	(Koçyiğit et al. 2006; Bulut et al. 2013; Fakir et al. 2009; Arı et al. 2015; Karaman et al. 2001; Eşen 2008; Saday 2009; Doğan 2014; Bulut 2008; Güzelşemme 2014; Tekin 2011; Metin 2009; Şahin 2014; Alparslan 2012; Güldaş 2009; Şenkardeş; Savran et al. 2009; Genç 2003; Genç 2006; Tuzlacı 2016)
Crataegus pentagyna Waldst. et Kit. ex Willd	Rosaceae	Alıç, Alişan çalısı	Flowers, Leaves	As cardiotonic; Inf.	(Koçyiğit et al. 2006, Arı et al. 2015; Tuzlacı 2016)

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Crataegus pontica C. KOCH	Rosaceae	Zeğrur, Alıç, Masmus, Kırmızı alıç	Fruits, leaves, flowers	Dec.	(Güzelşemme 2014)
Crataegus pseudoheterophylla Pojark.	Rosaceae	Alıç, Aluç	Flower, leaves	Inf.	(Doğan 2014; Tuzlacı 2016)
Crataegus tanacetifolia (Lam.)	Rosaceae	Alıç	Flowers	Inf., Int., drink one glass once a day	(Uzun & Kaya 2016; Mumcu 2010)
Crataegus x bornmuelleri Zabel	Rosaceae	Gıvica zar	Roots	Inf.	(Yeşil & Akalın 2009)
Convolvulus betonicifolius Mill. subsp. *peduncularis* (Boiss.) Paris	Convolvulaceae	Sarmaşık	Aerial parts,	Inf., drink one cup of the plant on an empty stomach in the morning	(Hayta 2014)
Cydonia oblonga Miller	Rosaceae	Ayva	Leaves	Int.	(Bulut et al. 2013; Tuzlacı 2016)
Dioscorea communis (L.) Caddick & Wilkin	Dioscoreaceae	Acı ot, vicirne, kabarcık, kapırcık	Roots, flower bark of mature fruit	Raw(uncooked), Aerial parts boiled.	(Sargın et al. 2013)
Diplotaenia cachrydifolia Boiss	Apiaceae	Siyabu	Aerial parts, roots	Dec., The plant is eaten raw	(Mükemre et al. 2015)
Dryopteris pallida (Bory) Fomin.	Dryopteridaceae	Eğrelti otu	Aerial parts	Dec.	(Oral 2007; Tuzlacı 2016)
Equisetum arvense L.	Equisetaceae	Giyagezık, Atkuyruğu	Aerial parts	Inf., Drink one glass of the plant on an empty stomach in the morning. Drink one glass 3 times a day for 4–8 weeks	(Kaval et al. 2014; Sargın et al. 2013; Güzel et al. 2015)
Erica arborea L.	Ericaceae	Süpürge otu	Aerial parts	-	(Kızılarslan 2008)
Erica manipuliflora Salisb.	Ericaceae	Funda, Püren	Flowers and leaves	Dec., Int.	(Tuzlacı & Sadıkoğlu 2007)
Fumaria officinalis L.	Fumariaceae	Şahtere otu	Aerial parts	Inf. O. Ad. Drink one teacup two times a day for 1–2 weeks	(Polat & Satıl 2011; Oral 2007; Polat 2010; Tuzlacı 2016)
Geum urbanum L.	Rosaceae	Bit otu, Yellice otu	Aerial parts	Inf.	(Doğan 2014; Tuzlacı 2016)
Glycyrrhyza glabra L.	Fabaceae	Meyan kökü	Roots	Inf.	(Akan et al. 2013)
Helianthus tuberosus L.	Asteraceae	Say erd, Say bin erd, Yer elması	Tuber	The plant is eaten raw	(Polat et al. 2013)
Helichrysum compactum Boiss.	Asteraceae	Altınotu	Leaves	Dec. (2–3 cups of tea daily)	(Kargıoğlu et al. 2010; Vural 2008)
Hibiscus esculentus L.	Malvaceae	Bamya	Flowers	-	(Uysal 2010)
Hibiscus sabdariffa L.	Malvacaceae	Habiskus, Medine gülü	Calyx	Inf.	(Akan 2015)
Hypericum perforatum L.	Hypericaceae	Kantaron, kantaron çayı, sarı kantaron, kantaryon, sarıcayüz, kantül, kesik otu, mide otu, kalp otu	Aerial parts	Dec., O.Ad.	(Akaydın et al. 2013; Bulut & Tuzlacı 2013; Özhatay et al. 2006; Kültür 2007; Tuzlacı 2016)
Juglans regia L.	Juglandaceae	Ceviz	Leaves	Dec., Int., drink one glass once a day	(Uzun & Kaya 2016; Kızılarslan 2008; Metin 2009; Tuzlacı 2016)
Juniperus foetidissima Willd.	Cupressaceae	Ardıç	Resins	Dec, resins chewed, Apply chewed gum 2–3 times a day for 1–2 weeks /chew 1/2 handful aday for 2–3 weeks.	(Hayta 2014; Sargın et al. 2015; Bulut 2008; Tuzlacı 2016)
Juniperus oxycedrus L.	Cupressaceae	Pardı üzümü, Andız meyvesi	Fruits	Dec, Inf.	(Oral 2007; Tuzlacı 2016)
Lactuca saligna L.	Asteraceae	Tehliska geva	Flowers	The plant is eaten raw	(Kaval et al. 2014; Tuzlacı 2016)
Laurocerasus officinalis Roemer	Rosaceae	Karayemiş, Taflan	Leaves	The plant is eaten raw	(Polat et al. 2015)

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Lavandula stoechas L. subsp. *stoechas*	Lamiaceae	Karabaş otu, Karabaş	Flowering branches	Inf. O. Ad. drink one teacup two times a day for 1–2 weeks	(Polat & Satıl 2011; Sargın 2015; Güzel et al. 2015; Uysal et al. 2012; Tuzlacı & Sadıkoğlu 2007; Güzelşemme 2014; Onar 2006; Tuzlacı 2016)
Laser trilobum (L.) Borkh	Apiaceae	Sıraotu	Fruits	Eaten raw or cooked, Dec.	(Güneş et al. 2017; Güneş 2010)
Lecokia cretica (Lam.) DC.	Apiaceae	Baldıran	Seeds	Crushed. Int	(Bulut et al. 2008; Tuzlacı & Sadıkoğlu 2007; Demirci & Özhatay 2012; Tuzlacı 2016)
Linum aroanium Boiss. & Orph.	Linaceae	Keten	Seeds	Grinded seeds/mixed with yogurt and eaten Roasted and grinded seeds/boiled and drunk as coffee	(Güzel et al. 2015; Güzelşemme 2014)
Linum hirsutum L. subsp. *pseudoanatolicum* P.H. Davis	Linaceae	Siyerek, Keten	Seeds	Crushed seeds are eaten	(Deniz 2008; Tuzlacı 2016)
Linum usitatissimum L.	Linaceae	Keten	Seeds	Dec.	(Güzelşemme 2014; Akan 2015)
Lippia trphylla (L'Her.) O. Kuntze	Verbenaceae	Limon otu, Limonlu melisa, Ağaç lavanta	Leaves, flowers	Dec.	(Güzelşemme 2014)
Malus sylvestris Miller subsp. *mitis* (Wallr.) Mansf.	Rosaceae	Bodur elma, Taar elması	Fruits	Eaten, 2-3 fruits x1	(Tuzlacı & Şenkardeş 2011; Şenkardeş 2014; Tuzlacı 2016)
Malus sylvestris Miller subsp. *orientalis* (A. Uglitzkich) Browicz var. *orientalis*	Rosaceae	Sev, Yabani elma	Fruits	Fruits are eaten raw	(Doğan 2014)
Malva neglecta Wallr.	Malvaceae	Gömeç, Ebegümeci	Roots, stem	Dec.	(Güneş 2010; Demirci 2010; Tuzlacı 2016)
Malva sylvestris L.	Malvaceae	Gömeç, Ebegümeci	Roots, stem	Dec.	(Güneş 2010; Tuzlacı 2016)
Melisa officinalis L.	Lamiaceae	Melisa, oğulotu	Leaves, flowers	Dec.	(Uysal et al. 2010; Oral 2007;Onar 2006)
Melissa officinalis L. subsp. *altissima* (Sm.) Arcangeli	Lamiaceae	Oğulotu, Saçkıran	Aerial parts,	Dec.	(Kızılarslan 2008)
Mentha pulegium L.	Lamiaceae	Narpuz, yarpuz	Aromatic water	Int.	(Gürdal & Kültür 2013)
Mentha spicata L. subsp. *tomentosa* (Briq.) Harley	Lamiaceae	Yarpuz	Leaves	Inf.	(Erdoğan 2011)
Mespilus germanica L.	Rosaceae	Döngel, Muşmula	Fruits, leaves	The plant is eaten raw, Dec.	(Polat et al. 2015; Tuzlacı & Alparslan 2013; Kızılarslan 2008; Tuzlacı 2016)
Musa acuminata Colla	Musaceae	Muz	Fruits	Fruits are eaten by chewing. Eat 3-4 pieces a day for 2-3 weeks.	(Sargın 2015)
Nasturtium officinale R. Br	Brassicaceae	Kiji, Qije, Tujik	Aerial parts	Int., Drink one tea glass of the plant before the meal	(Polat et al. 2013; Polat & Çakıroğlu 2018; Demirci 2010; Tuzlacı 2016)
Olea europaea L. var. *europaea*	Oleaceae	Zeytin	Leaves	Inf., Int.	(Bulut & Tuzlacı 2013; Sargın et al. 2013; Sargın 2015; Güzel et al. 2015; Sağıroğlu et al. 2013; Gürdal & Kültür 2013; Bulut 2008; Onar 2006; Metin 2009; Tuzlacı 2016)
Olea europaea L. var. *sylvestris* (Miller) Lehr.	Oleaceae	Yabani zeytin	Leaves	Inf.	(Fakir et al. 2009; Öztürk et al. 2013; Tuzlacı 2016)
Origanum onites L.	Lamiaceae	Kırkbaş kekik, Tokalı kekik, Arı kekiği	Aerial parts	Inf, Aerial parts crushed	(Sargın et al. 2013; Gürdal & Kültür 2013; Tuzlacı & Erol 1999; Tuzlacı & Sadıkoğlu 2007; Tuzlacı 2016)
Origanum vulgare L.	Lamiaceae	Kekik	Leaves	Dec., Drink one tea glass of the plant two times a day	(Hayta 2014)
Origanum vulgare L. subsp. *gracile* (C. Koch) letswaart	Lamiaceae	Eşek kekiği	Aerial parts	Dec., Inf., Int.	(Altundağ & Ozturk 2011; Altundağ 2009; Tuzlacı 2016)
Paliurus spina-christi Miller	Rhamnaceae	Karaçalı, Dikenli çalı	Fruits, leaves, aerial parts	Inf.	(Kızılarslan 2008; Tuzlacı 2016)
Papaver bracteatum Lindl	Papaveraceae	Haşhaş	Seeds	The seeds are eaten raw.	(Mükemre et al. 2015)
Peganum harmala L.	Zygophyllaceae	Üzerlik	Seeds	Dec., Inf.	(Oral 2007; Tuzlacı 2016)

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Petroselinum crispum (Miller) A. W. Hill	Apiaceae	Maydanoz	Leaves and petioles	Inf. O.Ad., Dec.	(Güzel et al. 2015; Karaman et al. 2001; Güler et al. 2013; Uzun & Kaya 2016; Bulut et al. 2008; Yazıcıoğlu & Tuzlacı 1995; Tuzlacı 2016)
Physalis alkekengi L.	Solanaceae	Güney feneri, Patlangaç, Fener çiçeği	Fruits	Eaten	(Saraç 2013; Tuzlacı 2016)
Plantago major L.	Plantaginaceae	Damar otu	Leaves	Inf.	(Akbulut & Bayramoğlu 2013)
Plantago major L. subsp. *major*	Plantaginaceae	Balazagva, Damarliot Damarotu, Kirksinirotu	Leaves	Dec., Int., before breakfast	(Kızılarslan & Özhatay 2012; Kızılarslan 2008; Tuzlacı 2016)
Portulaca oleracea L.	Portulaceae	Semiz otu	Aerial parts	The plant is eaten raw	(Eşen 2008)
Prangos ferulacea (L.) Lindl.	Apiaceae	Eşek çakşırı	Leaves	Inf., Internal	(Bulut et al. 2008; Doğan 2014; Özgen et al. 2012)
Prunus cerasus L.	Rosaceae	Vişne	Fruits	Eaten raw	(Tekin 2011; Karagöz 2013;)
Prunus cocomilia Ten.	Rosaceae	Ekşi erik, Dağ eriği	Fruits	Fresh eaten	(Simsek 2004)
Prunus divaricata Ledeb.	Rosaceae	Deli erik	Fruits	Fresh O. Ad. eaten	Polat & Satıl 2011
Prunus divaricata Ledeb. subsp. *divaricata*	Rosaceae	Deli erik, Yabani erik, dağ eriği	Fruits	Fruits are crashed, dried, maserated, filtered, raw	(Sargın et al. 2015; Sargın 2015)
Punica granatum L.	Punicaceae	Nar	Flowers Fruits	Dec. Fresh eaten	(Uysal et al. 2010; Kılıç & Bağcı 2013; Uzun & Kaya 2016; Güneş 2010; Güzelşemme 2014; Öztürk et al. 2013; Onar 2006; Akan 2015; Tuzlacı 2016)
Pyrus elaeagnifolia Pallas subsp. *elaeagnifolia* Pallas	Rosaceae	Ahlat	Fruit	Inf. as tea(4 cups a day) Fruits of the plant part are eaten directly.	(Arı et al. 2015)
Quercus brantii Lindley	Fagaceae	Meşe, Palamut, Çılo	Fruits	Eaten raw	(Gençay 2007)
Quercus ithaburensis Decne subsp. *macrolepis* (Kotschy) Hedge & Yalt	Fagaceae	Palamut, Pilemit	Fruits	Eaten raw	(Gençay 2007)
Rheum ribes L.	Polygonaceae	Işgın	Root, shoots	Dec, Int.	(Altundağ & Ozturk 2011; Korkmaz & Karakuş 2015; Altundağ 2009; Tekin 2011; Gençay 2007; Tuzlacı 2016)
Rhus coriaria L.	Anacardiaceae	Sumak	Matured fruits	Dec., Inf. Drink one cup of the plant on an empty stomach in the morning	(Polat et al. 2015; Hayta 2014; Polat et al. 2013; Polat & Çakıroğlu 2018)
Rosa canina L.	Rosaceae	Kuşburnu	Fruits	Dec., Int.	(Güler et al. 2013; Tuzlacı & Erol 1999; Şahin 2014; Savran et al. 2009; Akan 2015; Mumcu 2010;101)
Rosmarinus officinalis L.	Lamiaceae	Kuş dili	Aerial parts	Dec., O.Ad., drink one teacup two times a day for 5–10 days	(Özhatay et al. 2006; Güneş 2010; Kızılarslan 2008; Onar 2006; Metin 2009; Kültür 2007; Tuzlacı 2016)
Rubus canescens DC. var. *canescens*	Rosaceae	Böğürtlen, karamuk	Roots, fruits, aerial parts	Dec.	(Kızılarslan 2008; Tuzlacı 2016)
Rubus canescens DC. var. *glabrescens* (Godron) Davis & Meikle	Rosaceae	Böğürtlen	Shoots, roots, fruit	Dec., Int	(Altundağ & Ozturk 2011)
Rubus sanctus Schreb.	Rosaceae	Böğürtlen	Fruits	Eaten	(Tuzlacı & Sadıkoğlu 2007; Kızılarslan 2008)
Rumex acetosella L.	Polygonaceae	Kuzukulağı	Aerial parts, leaves	The plant is eaten raw.	(Polat et al. 2015; Polat et al. 2013; Polat & Çakıroğlu 2018; Güneş 2010)
Rumex crispus L.	Polygonaceae	Ekşimek, Labada	Leaves	The plant is eaten raw.	(Güneş 2010)
Rumex tuberosus L.	Polygonaceae	Kislek	Stem, leaves	Drink one tea glass of the plant before the meal	(Uysal et al. 2010; Polat et al. 2013; Polat & Çakıroğlu 2018; Onar 2006)
Rumex tuberosus L. subsp. *horizontalis* (Koch) Rech.	Polygonaceae	Trisog, Evelik, yumru köklü kuzukulağı	Stem, leaves	Inf.	(Öztürk et al. 2013)

Botanical name	Family	Local name	Plant part used	Preparation, administration and use	References
Rumex scutatus L.	Polygonaceae	Kuzukulağı, Tırşok	Leaves, aerial parts	The plant is eaten raw., Dec.	(Tetik et al. 2013; Bulut et al. 2016; Tetik 2011; Özgen et al. 2012; Tuzlacı 2016)
Salvia sclarea L.	Lamiaceae	Paskulak, Adaçayı	Flowering branches	Dec.	(Korkmaz & Karakuş 2015)
Sambucus ebulus L.	Caprifoliaceae	Sultan otu	Leaves	Dec.	(Uysal et al. 2010; Kızılarslan 2008; Onar 2006)
Satureja cuneifolia Ten.	Lamiaceae	Kekik	Aerial parts	Dec., Inf.	(Oral 2007)
Satureja hortensis L.	Lamiaceae	Kekik	Leaves	Inf., Drink one cup of the plant on an empty stomach in the morning	(Hayta 2014; Polat et al. 2013; Tuzlacı 2016)
Satureja spicigera (C. Koch) Boiss.	Lamiaceae	Kekik, zımpara	Leaves	Inf.	(Polat et al. 2015)
Sideritis lanata L.	Lamiaceae	Karabaş otu	Aerial parts	Inf.	(Şenkardeş 2014)
Sorbus aria L.	Rosaceae	Kuş üzümü	Fruits	O.Ad.	(Akgül et al. 2016)
Sorbus aucuparia L.	Rosaceae	Üvez elması, Alıç	Fruits	Fresh O. Ad. eaten	Polat & Satıl 2011
Stachys cretica L. subsp. *mersinaea* (Boiss.) Rech	Lamiaceae	Boncuk şabla deli çayı, rize çayı	Aerial part	Inf., Int	(Özdemir & Alpınar 2015; Tuzlacı 2016)
Styrax officinalis L.	Styracaceae	Günlük	Seeds	Seeds eaten raw	(Güneş et al. 2017; Güneş 2010)
Taraxacum hybernum Stev.	Asteraceae	Karahindiba	Flowers, leaves	The plant is eaten raw	(Tetik et al. 2013; Tetik 2011)
Teucrium parviflorum Schreber	Lamiaceae	Dağ kekiği	Aerial parts	Dec.	(Doğan 2014)
Teucrium polium L.	Lamiaceae	Acı yavşan	Aerial parts	Daily 1-2 cups of infusion are drunk as tea.	(Akaydın et al. 2013; Sargın 2015; Tetik et al. 2013; Mükemre et al. 2015; Polat & Çakıroğlu 2018; Karagöz 2013; Tetik 2011; Tuzlacı 2016)
Thymus fallax Fisch. & Mey.	Lamiaceae	Kekik	Aerial parts	Inf., Dec., Int.	(Altundağ & Ozturk 2011; Altundağ 2009)
Thymus kotschyanus Boiss. & Hohen. subsp. *glabrescens* Boiss.	Lamiaceae	Kekik, Catri	Aerial parts	Inf., Dec., Int.	(Altundağ & Ozturk 2011; Mükemre et al. 2015; Altundağ 2009)
Thymus longicaulis C. Presl. subsp. *longicaulis*	Lamiaceae	Kekik	Aerial parts	Inf., a glass per day for 1 week	(Kızılarslan 2008; Kartal & Güneş 2017)
Thymus migricus Klokov & Des.-Shost.	Lamiaceae	Kekik	Aerial parts	Inf., Dec., Int.	(Altundağ & Ozturk 2011; Altundağ 2009)
Thymus praecox Opiz. subsp. *grossheimii* (Ronniger) Jalas var. *grossheimii*	Lamiaceae	Kekik	Aerial parts	Inf., Dec., Int.	(Altundağ & Ozturk 2011; Altundağ 2009)
Thymus transcaucasicus Ronniger	Lamiaceae	Kek otu, catıra	Whole plant	Inf.	(Altundağ & Ozturk 2011; Altundağ 2009; Güneş & Özhatay 2011; Tuzlacı 2016)
Thymus sipyleus Boiss.subsp. *rosulans* (Borbás) Jalas	Lamiaceae	Kekik	Aerial parts	Inf., Int.	(Tuzlacı & Şenkardeş 2011;)
Thymus zygioides Griseb. var. *lycaonicus* (Celak.) Ronniger	Lamiaceae	Kekik	Aerial parts	Inf.	(Deniz 2008; Tuzlacı 2016)
Tribulus terrestris L.	Zygophyllaceae	Demirci dikeni	Aerial parts	Dec., drink one cup of the plant on an empty stomach in the morning	(Hayta 2014; Onar 2006; Tuzlacı 2016)
Tripleuospermum oreades (Boiss.) Rech var. *oreades*	Asteraceae	Papatya, Oşoş	Aerial parts	Dec.	(Özgen et al. 2012)
Urtica dioica L.	Urticaceae	Isırgan, ısırganotu, büyük ısırgan	Aerial parts	Dec., O.Ad.	(Altundağ & Ozturk 2011; Kılıç & Bağcı 2013; Uzun & Kaya 2016; Özhatay et al. 2006; Güneş 2010; Altundağ 2009; Tuzlacı et al. 2010; Özgen et al. 2012; Mumcu 2010; Kültür 2007; Tuzlacı 2016)

Botanical name	Family	Local name	Plant part used	Preparation, administration and use	References
Valeriana dioscoridis Sm.	Valerianaceae	Pisi otu, Pisik otu, Kedi otu	Flowers	Inf.	(Demirci 2010; Tuzlacı 2016)
Vicia ervilia Rafin L.	Fabaceae	Burçak	Seeds	Powdered, Int.	(Uğurlu et al. 2008)
Viscum album L. subsp. *abietis* (Wiesb.) Abromeit.	Loranthaceae	Ökse otu	Fruits	Int. Capsicum plaster, (Fr) ext., Drink one glass a day for 3-5 weeks	(Özdemir & Alpınar 2015; Sargın et al. 2015; Güneş et al. 2017; Güneş 2010; Tuzlacı 2016)
Viscum album L. subsp. *album*	Loranthaceae	Ökseotu, burç, çekim	Fruits, leaves, branches	O.Ad., drink one teacup two times a day for 5–9 days; Dec., Int.	(Tetik et al. 2013; Cakilcioglu et al. 2011; Fakir et al. 2009; Sağıroğlu et al. 2013; Kızılarslan & Özhatay 2012; Özdemir & Alpınar 2015; Ezer & Arısan 2006; Oral 2007; Doğan 2014; Kızılarslan 2008; Onar 2006; Öztürk 2006; Akan 2015; Genç 2003; Kültür 2007; Genç 2006; Tuzlacı 2016)
Viscum album L. subsp. *austriacum* (Wiesb.) Vollman	Loranthaceae	Çampurçu, Öksüotu	Leaves	Leaves are cut into pieces. Daily 1–2 cups of decoction are drunk.	(Ugulu et al. 2009; Sargın et al. 2013; Ezer & Arısan 2006; Deniz 2008; Ozkan & Koyuncu 2005; Yeşilyurt 2017)
Zea mays L.	Poaceae	Mısır	Stylus	Drink one tea glass of the plant three times a day	(Hayta 2014)
Ziziphora taurica Bieb. subsp. *taurica*	Lamiaceae	Merze	Aerial parts	Inf., Int.	(Altundağ & Ozturk 2011; Altundağ 2009; Tuzlacı 2016)
Zizyphus jujuba Miller	Rhamnaceae	Hırnap, Hünnap	Fruits	Dec.	(Güneş 2010; Tuzlacı 2016)

O.Ad., Oral administration; Ext., External use; Int., Internal use; Inf., Infusion; Dec., Decoction;

2. Materials and Methods

This study is prepared by searching ethnobotanical studies accomplished in Turkey and by searching MSc and PhD theses at the Higher Education Council (Theses Center), with selecting plants used against hypertension. Also local plant names checked from different important sources in Turkish folk medicine (Tuzlacı 2016; Baytop 1994, Güner et al. 2012). Current plant names and families checked from www.plantlist.com.

In this study 150 ethnobotanical articles and some phytochemical articles were compiled. In 106 different records, data for the using medicinal plants against hypertension were founded and their used parts, uses were explained in details in Table 1. Mostly used plant families and plant parts showed in diagrams (Fig. 1-2).

3. Results and Discussion

This study, prepared by screening of ethnobotanical researches, that revealed 157 plant taxa, which were used for treatment of hypertension. These plant species are mostly from families Rosaceae, Lamiaceae, Asteraceae, Apiaceae, Polygonaceae, Loranthaceae and Rhamnaceae (Figure 1). Respectively mainly used taxa are *Allium sativum* L. (in 23 studies), *Crataegus monogyna* Jacq. subsp. *monogyna* (in 19 studies), *Viscum album* L. subsp. *album* (in 17 studies), *Urtica dioica* L. (in 11 studies), *Olea europaea* L. var. *europaea*, (in 10 studies), *Punica granatum* L. (in 9 studies), *Lavandula stoechas* L. subsp. *stoechas* (in 8 studies), *Rosa canina* L. (in 8 studies), *Teucrium polium* L. (in 8 studies), *Petroselinum crispum* (Miller) A. W. Hill. (in 7 studies) and *Rosmarinus officinalis* L. (in 7 studies). Mainly used plant parts are; leaves: %32, fruits: %27, flowers: %16, seeds: %10, root: %9 bulb: %3 and stem: %3 (Figure 2).

Clinical studies supports the antihypertensive effects of garlic (*Allium sativum* L.) (Ashraf et al. 2013), hawthorn (*Crataegus* sp.) (Chang et al. 2012), mistletoe (*Viscum album* L.) (Poruthukaren et al. 2014), stinging nettle (*Urtica dioica* L.) (Qayyum er al. 2016) and olive (Somova et al. 2003). For example in leaves of *Crataegus monogyna* and *Crataegus laevigata* the major constituents are flavonoids (hyperoside, rutin, quercetine, vitexin, vitexin-2≤ rhamnoside, acetylvitexin-2≤ rhamnoside) and related proanthocyanidins. In the inflorescence, flavonol glycosides, mainly in the form of hyperoside, spiraeoside and rutin, are present. Hawthorn leaf with flower have positive inotropic, positive chronotropic and dromotropic; negative bathmotropic effect and increases coronary blood flow (Demirezer et al 2017).

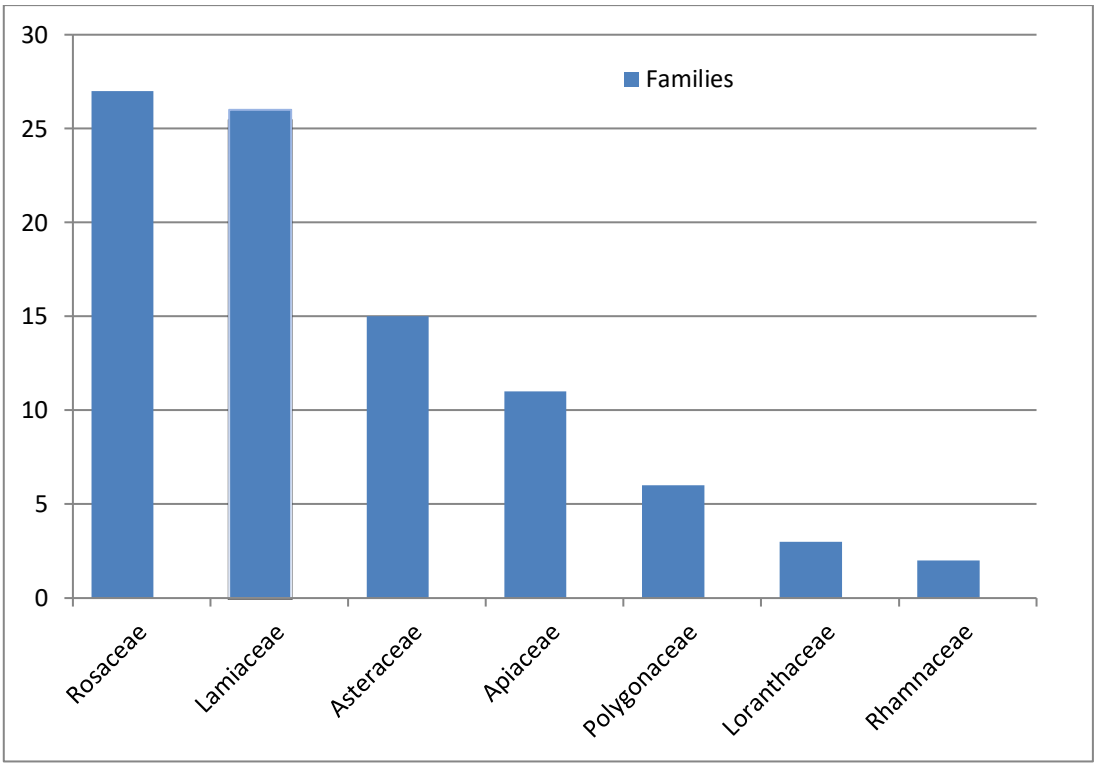

Fig. 1- The plant families used in traditional treatment of hypertension in Turkey

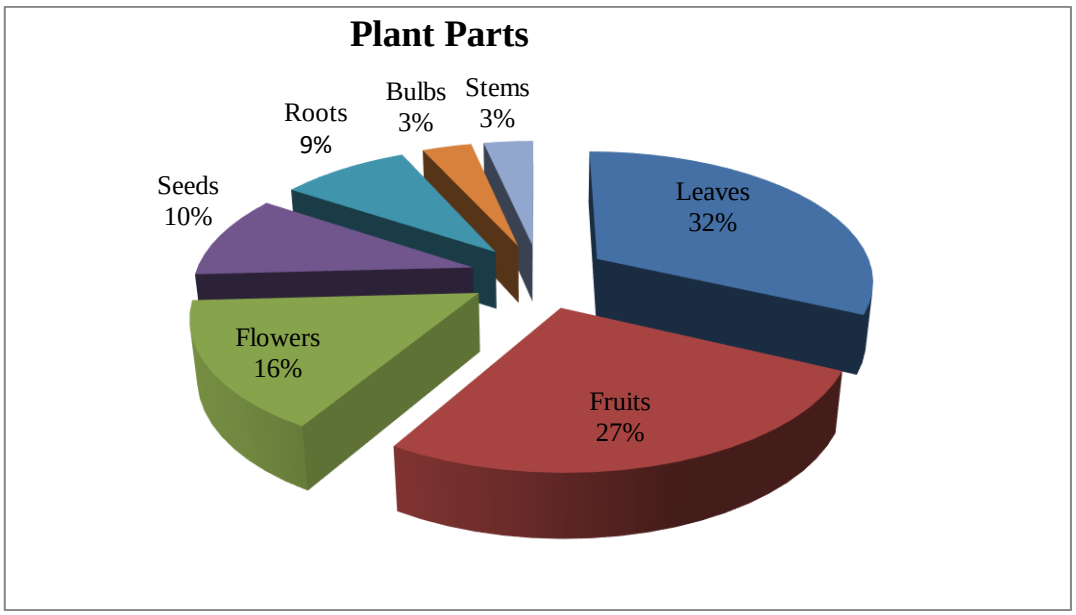

Fig. 2- The plant parts used in traditional treatment of hypertension in Turkey

We hope this study, which contains medicinal plants traditionally used in the treatment of hypertension in Turkey, will contribute to the development of conventional drugs originate from plant sources, that can be useful in the treatment of hypertension.

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