



Plants used in traditional treatment against diarrhea in Turkey

Seçil Karahüseyin^{1,2} , Aynur Sarı^{1*} 

¹Department of Pharmacognosy, İstanbul University, Faculty of Pharmacy, İstanbul, Turkey

²Department of Pharmacognosy, Çukurova University, Faculty of Pharmacy, Adana, Turkey

ORCID IDs of the authors: A.S. 0000-0001-8116-7053; S.K.0000-0002-3515-2974.

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ABSTRACT

Turkey is one of the richest countries in the world in terms of flora with its extraordinary plant diversity. Its flora consists of about 10,000 vascular plants and approximately one third of them (34.4 %) are endemic to the country. In recent years, the use of ethnobotanical information obtained from medicinal plant research has gained attention all around the world. For this reason, numerous ethnobotanical studies have recently been published and much has been written about medicinal plants in our country. This study deals with 133 taxa used in traditional treatments against diarrhea in Turkey and it aims to give information about scientific and local names of these taxa, families, used parts and usage in diarrhea.

Keywords: Diarrhea, medicinal plants, traditional treatment, Turkey

INTRODUCTION

Diarrhea is defined as loose stools, increased stool frequency, or urgency by patients. Although most patients use this term to describe changes in consistency (loose or watery stool), diarrhea can be considered as urgency or high stool frequency. In fact, with normal consistency, frequent defecation is often referred to as pseudodiarrhea; for this reason, an abnormal stool form and frequency should not be used to describe diarrhea. Most diarrheal episodes in developed countries are acute and self-limited and are usually caused by infections. In immunocompetent patients, acute contagious diarrhea typically resolves within 4 weeks (most often within 1 week). Therefore, chronic diarrhea is defined as that lasting longer than 4 weeks. It is estimated that 1%-5% of adults suffer from chronic diarrhea. In immunocompetent patients in developed countries, chronic diarrhea is not usually contagious (Lawrence et al. 2017).

Acute bloody diarrhea in children and adults is a difficult diagnostic problem. Acute bloody stools have different spectra between adults and children, but there are overlapping causes (infectious colitis and less frequently intussusception). Identification of patients with infectious causes is mandatory, so that they are suitably treated with antimicrobials and so that infection control measures can be fulfilled (Lori et al. 2009).

Detection of the cause of this disorder may be a problem, because there are many enteric pathogens that cause acute bloody diarrhea and several noninfectious gastrointestinal disorders; these are interpreted as loose, bloody stools, mostly diarrhea (Lori et al. 2009).

There is a battle between the host microbiology of normal flora and the exterminating microbes. Symptomatic infections for the host when invaded can alter the bowel barrier and absorptive functions, or can quickly cause a number of problems that can

Address for Correspondence :

Aynur Sarı, e-mail: aynur@istanbul.edu.tr

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lead to lethal dehydration, diarrhea, toxic megacolon or shock. Asymptomatic infections may go unnoticed, but they have durable results for children's growth and development. Most are acquired through contaminated food or water; however, only few pathogens (such as Shigella, Cryptosporidium, Giardia, rotaviruses, or noroviruses) can cause infection (Pawlowski et al. 2009).

Rotavirus is the leading cause of diarrhea hospitalization among children in the world. In 2003, a world-wide estimate of rotavirus-related deaths was published, based on a review of published literature on deaths from diarrhea and rotavirus hospitalizations in children from 1986 to 1999. Studies published between 1986 and 1999 showed that rotavirus causes ≈22% (range 17%-28%) of diarrheal hospitalizations in childhood. From 2000 to 2004, this rate increased to 39% (range 29%-45%). Application of this ratio to the recent World Health Organization estimates of diarrhea-related childhood deaths gave a predicted 611,000 (range 454,000-705,000) rotavirus-related deaths (Parashar et al. 2006).

In mass tourism, traveler's diarrhea is one of the most common health problems in long-distance journeys. Globally, there are 40 million cases per year. For this reason, travelers to risky areas should be informed in advance of what measures they should take in case of acute diarrhea and which medicines to include in the first aid kit (Jelinek et al. 2017).

The first choice of treatment of acute uncomplicated traveler's diarrhea - more than 90% of all cases - is the secretion inhibitor racecadotril. Usual practice, which recommends the antitility drug loperamide as the first option, should be rethought in favor of the last active ingredient racecadotril. Antibiotics should be used only in complicated cases. Generally, anticipation of a large number of passengers demanding antibiotic treatment should be impaired. Other therapeutic measures currently available for the treatment of acute diarrhea while traveling play a minor role (Jelinek et al. 2017).

Several studies have shown that antibiotics can reduce the rates of diarrhea in travelers to resource-limited countries. However, preventive antibiotic therapy is not recommended because of its side effects and so, if necessary, rapid-acting, single-dose antimicrobial therapy is used. In some studies, probiotics have shown benefit (Pawlowski et al. 2009).

There are a lot of kinds of diarrhea shown in this study and the drugs used for the treatment of diarrhea have many side effects. Medicinal plants have traditionally been used for the treatment of diarrhea for many decades.

In this study, we have compiled 133 taxa used in traditional treatments of diarrhea in Turkey. The aim is to give information about scientific and local names of these taxa, families, used parts and usage in diarrhea (Table 1).

Table 1. List of the plants used in traditional treatment against diarrhea in Turkey

Botanical name	Family	Local name	Plant parts used	Preparation, administration and use	Reference
<i>Achillea aleppica</i> DC. subsp. <i>aleppica</i>	Asteraceae	Civanperçemi	Aerial parts	Dec., Int.	(Doğan 2014)
^a <i>Achillea wilhelmsii</i> C. Koch.	Asteraceae	Ayvadere, Kedicirnağı, Kedi Tırnağı, Tilki otu	Aerial parts	+Milk, Dec. or Inf., Int Crushed, Ext. Dec., Int. Inf., Int.	(Oral 2007) (Şenkardeş 2014) (Tuzlacı 2016)
<i>Ailanthus altissima</i> (P. Mill.) Swingle	Simaroubaceae	Ossuruk ağacı	Branches	Dec., Int.	(Güneş et al. 2017)
<i>Alchemilla</i> sp.	Rosaceae	Aslanpençesi, Dutya	Aerial parts, Flower	Inf., Int.	(Karagöz and Serteser 2017)
<i>Alhagi maurorum</i> Medik.	Fabaceae	Xirnuf	Fruit	Raw, Int.	(Dalar et al. 2018)
<i>Alhagi pseudoalhagi</i> (Bieb.) Desv.	Fabaceae	Hurnif, Çeti, Çoban çalısı	Fruit	Dried Fruits Eaten Crushed, Int.	(Korkut 2006; Gençay 2007) (Tuzlacı 2016)
<i>Allium sativum</i> L.	Liliaceae	Sarımsak	Bulb	+Yoghurt, Fac.	(Uysal 2008)
<i>Alyssum pateri</i> Nyár. subsp. <i>pateri</i>	Brassicaceae	Keselmahmut	Aerial parts	Dec., Int.	(Kaval et al. 2014; Tuzlacı 2016)
<i>Anacamptis pyramidalis</i> (L.) Rich.	Orchidaceae	Sahlep, Salep çiçeği	Root	Dec., Int.	(Doğan 2014; Tuzlacı 2016)
<i>Anthemis cretica</i> L. subsp. <i>pontica</i> (Willd.) Grierson	Asteraceae	Papatya	Capitulum	Inf., Int.	(Tütenocaklı 2014)
<i>Artemisia absinthium</i> L.	Asteraceae	Acı yavşan	Leaf	Take as a pill, Int.	(Yıldırım 2015)

Table 1. List of the plants used in traditional treatment against diarrhea in Turkey (continued)

Botanical name	Family	Local name	Plant parts used	Preparation, administration and use	Reference
<i>Arum conophalloides</i> Kotschy ex Schott	Araceae	Yılan bıçağı	Seed	Raw, Swallowed	(Güneş et al. 2017)
<i>Arum dioscoridis</i> SM.	Araceae	İlan purçulağı, Kabargan, Ölüm körü, Yılan purçulağı		Cooked, Int.	(Yıldırım 2015)
<i>Berberis crataegina</i> DC.	Berberidaceae	Karamuk, Karamık, Kızılıcık	Flowering and Fruity Branches Fruit	Dec., Int. Raw, Int.	(Özkan 2002; Tuzlacı 2016) (Yeşil and Akalın 2009; Vural 2008)
<i>Berberis vulgaris</i> L.	Berberidaceae	Karamuk, Kadıntuzluğu	Fruit	Raw, Int.	(Korkmaz and Karakuş 2013)
<i>Camellia sinensis</i> (L.) Kuntze	Theaceae	Siyah çay	Leaf	Inf., Int. Raw or Inf., Int.	(Saraç et al. 2013; Tuzlacı 2016) (Uysal 2008)
<i>Capparis spinosa</i> L. var. <i>aegyptia</i> (Lam.)Boiss.	Capparaceae	Gebere, Kebere	Gemma	Swallowed	(Kazan 2007)
<i>Cardiospermum helicacabum</i> L.	Sapindaceae	Balon sarmaşığı, Japon feneri	Young Shoots	Dec., Int.	(Güzel et al 2015)
<i>Celtis tournefortii</i> Lam.	Ulmaceae	Derdoğan	Fruit	Raw, Int.	(Doğan 2014; Tuzlacı 2016)
<i>Centaurea pterocaula</i> Trautv.	Asteraceae	Şermnik	Leaf	Dec., Int.	(Kaval et al. 2014)
<i>Centaurea solstitialis</i> L. subsp. <i>solstitialis</i>	Asteraceae	İshal dikeneni	Aerial parts	Inf., Int.	(Şenkardeş 2014; Tuzlacı 2016)
<i>Cerasus avium</i> (L.) Moench	Rosaceae	Kiraz	Stem and Branch Bark	Dec., Int.	(Kural 2012; Tuzlacı 2016)
<i>Ceratonía siliqua</i> L.	Fabaceae	Buynuz, Harıp, Harnup, Keçiboynuzu, Keçibuynuzu	Fruit	Raw, Int. Jam, Int. Mac., Int.	(Bulut 2006; Tuzlacı 2016; Gürdal and Kültür 2013; Yıldırım 2015)
<i>Ceterach officinarum</i> DC.	Aspleniaceae	Altın otu, Mayasıl otu	Aerial parts	Cooked, Int. Dec., Int.	(Güzel et al. 2015) (Bulut 2006; Tuzlacı 2016)
<i>Chenopodium foliosum</i> Aschers	Chenopodiaceae	Kedi üzümü, Kuş üzümü	Aerial parts	Inf., Int.	(Doğan 2014; Şenkardeş 2014; Tuzlacı and Şenkardeş 2011; Tuzlacı 2016)
<i>Cicer arietinum</i> L.	Fabaceae	Nohut	Seed	Cooked, Int.	(Uysal 2008; Tuzlacı 2016)
<i>Cistus creticus</i> L.	Cistaceae	Pamuk otu	Leaf	Dec., Int.	(Onar 2006; Tuzlacı 2016)
<i>Citrus limon</i> L.	Rutaceae	Limon, Limon ağacı	Fruit	Juice, Int.	(Sargın et al. 2013)
<i>Convolvulus arvensis</i> L.	Convolvulaceae	Basırık (Bağırsak) otu, Mahmude otu	Branches and Leaves	Dec., Int.	(Güneş et al. 2017)
<i>Cornus mas</i> L.	Cornaceae	Kızılıcık, Kiren, Zaye	Fruit	Raw, Int. Syrup, Int. Dec., Int. Inf., Int.	(Koçyiğit and Özhatay 2006; Ayan 2015; Tuzlacı 2016) (Polat 2010; Korkmaz and Karakurt 2014) (Karcı 2013) (Güler et al. 2015)

Table 1. List of the plants used in traditional treatment against diarrhea in Turkey (continued)

Botanical name	Family	Local name	Plant parts used	Preparation, administration and use	Reference
<i>Crataegus monogyna</i> Jacq. subsp. <i>monogyna</i>	Rosaceae	Alıç, Ekşi muşmula, Keçi alıcı, Kız elması, Kocakarı hurması	Fruit, Leaf, Flower	Eaten, Inf., Int.	(Sargin et al. 2013) (Furkan 2016)
<i>Cupressus sempervirens</i> L.	Cupressaceae	Mezarlık selvisi, Selvi	Cone	Dec., Int.	(Uysal 2008; Tuzlacı 2016)
<i>Cydonia oblonga</i> Miller	Rosaceae	Ayva	Leaf, Seed, Flower	Inf., Int., Dec., Int., Dec., Int., Inf., Int.	(Sargin et al. 2013) (Güneş et al. 2017; Uysal 2008; Metin 2009; Kayabaşı 2011; Deniz 2008; Kıncal 2018; Tuzlacı 2016) (Uysal 2008; Yüzbaşıoğlu 2010; Tuzlacı 2016) (Yıldırım 2015)
<i>Cyperus rotundus</i> L.	Cyperaceae	Topalak otu	Root	Crushed, Ext.	(Uysal 2008)
<i>Diospyros lotus</i> L.	Ebenaceae	Laz hurması, Kara hurma	Leaf	Inf., Int.	(Saraç et al. 2013; Tuzlacı 2016)
<i>Elaeagnus angustifolia</i> L.	Elaeagnaceae	İğde	Seed, Fruit, Leaf	Dec., Int., Eaten, Inf., Int.	(Altundağ 2009) (Güzel et al 2015; Korkmaz and Karakurt 2014) (Polat 2010)
<i>Erica manipuliflora</i> Salisb.	Ericaceae	Funda, Püren, Süpürge otu	Young Shoots	Dec., Int.	(Bulut 2006)
<i>Eriobotrya japonica</i> (Thunb.) Lindly	Rosaceae	Malta eriği, Muşmula	Leaf	Inf., Int., Dec., Int.	(Uysal 2008) (Tuzlacı 2016)
<i>Euphorbia denticulata</i> Lam.	Euphorbiaceae	Hekletis, Sütleğen otu	Latex	Int.	(Kaval et al. 2014; Tuzlacı 2016)
<i>Fagus orientalis</i> Lipsky	Fagaceae	Doğu kayını	Stem Bark	Dec., Int.	(Kural 2012)
<i>Ficus carica</i> L. subsp. <i>carica</i>	Moraceae	İncir	Leaf	Raw, Int., Dec., Int.	(Alkaç 2013) (Tuzlacı 2016)
<i>Glaucium leiocarpum</i> Boiss.	Papaveraceae	Gelincik	Flower	Inf., Int., Dec., Int.	(Doğan 2014) (Tuzlacı 2016)
<i>Gundelia tournefortii</i> L.	Asteraceae	Kenger	Root	Latex, Eaten	(Hayta et al. 2014; Çakılcıoğlu and Türkoğlu 2010)
<i>Helichrysum arenarium</i> (L.) Moench.	Asteraceae	Altın otu	Capitulum, Leaf	Inf., Int., 2015)	(Akan and Sade 2015)
<i>Helichrysum plicatum</i> DC. subsp. <i>plicatum</i>	Asteraceae	Arı Çiçeği, Ölmez Çiçek, Yayla Çiçeği	Aerial parts, Flowering Branches	Inf., Int., Inf., Int.	(Arısan 2010) (Altundağ 2009)
^b <i>Helleborus orientalis</i> L.	Ranunculaceae	Bohça, Bohça otu, Çöp otu, Çöpleme	Leaf, Rhizome	Eaten	(Kızılarşlan and Özhatay 2012)
<i>Hordeum vulgare</i> L.	Poaceae	Arpa	Spike, Whole plant	Inf., Int., Inf., Int.	(Sargin et al. 2013) (Korkmaz and Karakurt 2014)
<i>Hypericum cerastoides</i> (Spach) N. Robson	Hypericaceae	Kantaron, Küçük Kantaron	Aerial parts	Dec., Int.	(Kızılarşlan and Özhatay 2012; Tuzlacı 2016)
<i>Hypericum scabrum</i> L.	Hypericaceae	Mide otu, Yara otu	Aerial parts	Inf., Int.	(Doğan 2014; Tuzlacı 2016)

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^b <i>Inula viscosa</i> (L.) Aiton	Asteraceae	Khişkeş, Mıcvce, Yerce, Zimbit	Leaf	Eaten	(Güzel et al. 2015)
<i>Juglans regia</i> L.	Juglandaceae	Ceviz	Seed Leaf Fruit Bark	Inf., Int. Dec., Int. Dec., Int.	(Aktan 2011) (Şenkardeş 2014; Tuzlacı 2016) (Sargın et al. 2013)
<i>Juniperus drupacea</i> L.	Cupressaceae	Andız	Tar	+Water, Int.	(Orhan 2011)
<i>Juniperus oxycedrus</i> L.	Cupressaceae	Ardıç	Leaf, Branches		(Orhan 2011)
<i>Jurinella moschus</i> (Habl.) Bobrov subsp. <i>pinnatisecta</i> (Boiss.) Danin and P.H.Davis	Asteraceae	Gazangulpu, Kazankulpu	Whole plant	Dec., Int.	(Altundağ 2009)
<i>Lysimachia vulgaris</i> (L.) Pohl	Primulaceae	Giya baluk	Leaf	Dec., Int.	(Dalar et al. 2018)
<i>Malva neglecta</i> Wallr.	Malvaceae	Ebegümece, Ebemkömece	Aerial parts	Dec., Int.	(Altundağ 2009)
<i>Matricaria chamomilla</i> L. var. <i>recutita</i> (L.) Grierson	Asteraceae	Papatya	Aerial parts (Without Flower)	Inf., Int.	(Sargın et al. 2013)
<i>Melissa officinalis</i> L.	Lamiaceae	Oğul otu	Leaf and Young Shoots	Inf., Int.	(Bulut 2006; Tuzlacı 2016)
<i>Mentha longifolia</i> (L.) Hudson subsp. <i>longifolia</i>	Lamiaceae	Bung, Pung, Yarpız, Yarpuz	Leaf	Inf., Int.	(Altundağ 2009; Tuzlacı 2016)
<i>Mentha x piperita</i> L.	Lamiaceae	Bünk, Mentol nane, Kedi nanesi, Tıbbi nane	Aerial parts	Dec., Int.	(Akan and Sade 2015)
<i>Mespilus germanica</i> L.	Rosaceae	Beşbiyık, Döngel, Muşmula, Töngel	Leaf Fruit	Inf., Int. Dec., Int. Eaten	(Karcı 2013) (Onar 2006; Tuzlacı 2016) (Bulut 2006; Kural 2012; Güler et al. 2015; Tuzlacı 2016)
<i>Morus alba</i> L.	Moraceae	Akdut, Beyaz dut, Dut	Leaf	Inf., Int.	(Sargın et al. 2013)
<i>Musa sapientum</i> L.	Musaceae	Muz	Fruit	Eaten	(Uysal 2008; Tuzlacı 2016)
<i>Myrtus communis</i> L.	Myrtaceae	Mersin, Murt	Leaf	Dec., Int. Inf., Int.	(Güneş et al. 2017) (Tuzlacı 2016)
<i>Olea europaea</i> L. var. <i>sylvestris</i> (Mill.) Lehr.	Oleaceae	Zeytin	Leaf and Stem Bark	Inf., Int.	(Bulut 2006)
<i>Opuntia ficus-indica</i> (L.) Mill.	Cactaceae	Frenk inciri, Kaynana dili, Tin sabır	Fruit	Eaten	(Güzel et al 2015; Güler et al. 2015)
<i>Orchis coriophora</i> L.	Orchidaceae	Sahlep	Root	Dec., Int.	(Doğan 2014; Tuzlacı 2016)
<i>Orchis palustris</i> Jacq.	Orchidaceae	Sahlep	Root	Dec., Int.	(Doğan 2014; Tuzlacı 2016)
<i>Orchis punctulata</i> Steven ex Lindley	Orchidaceae	Sahlep	Root	Dec., Int.	(Doğan 2014; Tuzlacı 2016)
<i>Origanum onites</i> L.	Lamiaceae	Beyaz kekik, Deli kekik, Eşek kekiği, Güve otu, Karakekik, Kekik	Aerial parts Leaf	Cooked with +Monk's pepper, Thyme, Flour, Water, Ext. Inf. or Dec., Int. Aromatic Water, Int. Inf., Int.	(Uysal 2008) (Gürdal and Kültür 2013; Tuzlacı 2016) (Tütenocaklı 2014)

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<i>Paliurus spina-christi</i> Miller	Rhamnaceae	Çaltı	Fruit	Inf., Int.	(Bulut and Tuzlacı 2009)
<i>Papaver somniferum</i> L.var. <i>somniferum</i>	Papaveraceae	Afyon, Afyon çiçeği, Haşhaş, Haşhaş kozağı, Yeleğen mavi	Fruit Bark	Dec., Int.	(Sargın et al. 2013; Tuzlacı 2016)
^a <i>Parietaria judaica</i> L.	Urticaceae	Duvar reyhanı, Yapışık ot	Aerial parts	Inf., Int. Eaten	(Tuzlacı and Şenkardes 2011)
^b <i>Phlomis pungens</i> Willd.var. <i>hirta</i> Velen	Lamiaceae	Ayıkulağı, Calba	Aerial parts	Eaten	(Vural 2008)
^b <i>Pinus brutia</i> Ten.	Pinaceae	Çam, Kızılçam	Dried Stem Bark and Mastic	Crushed, Int.	(Güneş et al. 2017)
<i>Pinus nigra</i> Aiton subsp. <i>pallasiana</i> (Lamb.) Holmboe	Pinaceae	Çam gıdısı, Karaçam	Tar	Ext.	(Arısan 2010)
<i>Pinus pinea</i> L.	Pinaceae	Fıstık çamı	Branches	Dec., Int.	(Kökçü 2015)
<i>Pistacia eurycarpa</i> Yalt.	Anacardiaceae	Menengeç	Fruit	Eaten	(Doğan 2014; Tuzlacı 2016)
<i>Pistacia terebinthus</i> L.	Anacardiaceae	Menengiç	Fruit		(Akan and Sade 2015)
<i>Pistacia vera</i> L.	Anacardiaceae	Kaliki-fıstığı	Fruit Bark	Dec., Int.	(Dağlı 2015)
<i>Plantago lanceolata</i> L.	Plantaginaceae	Sinir otu, Sinirli ot	Seed	Int. Dec., Int.	(Genç and Özhatay 2006) (Kolaç 2018)
<i>Plantago major</i> L. subsp. <i>major</i>	Plantaginaceae	Damar otu, Kara kabarcık, Siğilli ot, Sinir otu, Sinirli ot	Flower Seed	Dec., Int. Dec., Int. +Yoghurt, Int.	(Genç and Özhatay 2006) (Karataş 2007) (Kızıllarslan and Özhatay 2012)
<i>Platanus orientalis</i> L.	Platanaceae	Çınar, Kavak	Fruit Leaf Stem Bark	Dec., Int. Inf., Int. Dec., Int. Dec., Int.	(Bulut and Tuzlacı 2009; Kökçü 2015; Tuzlacı 2016) (Koçyiğit and Özhatay 2006) (Vural 2008) (Polat 2010)
<i>Populus tremula</i> L.	Salicaceae	Bodur kavak	Stem Bark	Dec., Int.	(Doğan 2014; Tuzlacı 2016)
<i>Potentilla recta</i> L.	Rosaceae	Acı hayıt, Beşparmak otu	Root	Dec., Int.	(Deniz 2008)
<i>Potentilla reptans</i> L.	Rosaceae	Beşparmak otu	Leaf	Dec., Int.	(Yılmaz 2011; Öztürk 2006; Tuzlacı 2016)
<i>Prosopis farcta</i> (Banks and Sol.) J.F.Macbr.	Fabaceae	Çeti, Hışhaş	Fruit Root	Eaten Dec., Int.	(Gençay 2007; Tuzlacı 2016) (Balos and Akan 2007)
<i>Prunus cerasus</i> L.	Rosaceae	Vişne	Fruit	Juice, Int. Eaten	(Korkmaz and Karakurt 2014) (Metin 2009)
<i>Prunus divaricata</i> Ledeb.	Rosaceae	Dağ eriği, Gakka, Kuş eriği	Fruit	Juice, Int.	(Korkmaz and Karakurt 2014)
<i>Prunus x domestica</i> L.	Rosaceae	Erik	Fruit	Boiled with Turkish Coffee, Int.	(Kolaç 2018)

Table 1. List of the plants used in traditional treatment against diarrhea in Turkey (continued)

Botanical name	Family	Local name	Plant parts used	Preparation, administration and use	Reference
<i>Prunus persica</i> (L.) Batsch.	Rosaceae	Şeftali	Fruit Flower	Eaten Inf., Int.	(Korkmaz and Karakuş 2013; Metin 2009; Kolaç 2018) (Kolaç 2018)
<i>Prunus spinosa</i> L.	Rosaceae	Dağ eriği	Fruit	Eaten	(Eşen 2008)
^a <i>Punica granatum</i> L.	Punicaceae	Hennar, Hınar, Nar	Fruit Seed Fruit Bark	Juice, Int. Cooked in Cinder, Ext. Eaten Crushed, Int.	(Gençay 2007) (Uysal 2008) (Güzel et al 2015) (Balos and Akan 2007)
<i>Pyrus amygdaliformis</i> Vill. subsp. <i>amygdaliformis</i>	Rosaceae	Ahlat, Çakal armudu, Çördük armudu, Deli armut, Yaban armudu	Leaf Fruit	Dec., Int. Eaten	(Uysal 2008) (Deniz 2008; Tuzlacı 2016)
<i>Pyrus elaeagnifolia</i> Pall. subsp. <i>elaeagnifolia</i>	Rosaceae	Dağ armudu, Yabani armut	Fruit	Eaten	(Tuzlacı and Şenkardes 2011; Tsetsekos 2006; Güldaş 2009; Keskin 2011)
<i>Pyrus elaeagnifolia</i> Pall. subsp. <i>kotschyana</i> (Boiss.) Browicz.	Rosaceae	Ahlat, Ahlet, Deli armut, Taş armut	Immature Fruit Flower	Raw, Eaten Inf., Int.	(Korkmaz and Karakurt 2014; Tuzlacı 2016) (Yıldırım 2015)
<i>Pyrus syriaca</i> Boiss. var. <i>syriaca</i>	Rosaceae	Çakal armut, Dağ armudu, Yaban armudu	Fruit	Eaten	(Furkan 2016; Tuzlacı 2016)
<i>Quercus coccifera</i> L.	Fagaceae	Kermes meşesi, Piyınar	Gall	Dec., Int.	(Metin 2009; Çilden 2011)
<i>Quercus ithaburensis</i> subsp. <i>macrolepis</i> (Kotschy) Hedge and Yalt.	Fagaceae	Meşe palamudu	Gall	Eaten	(Akan and Sade 2015; Tuzlacı 2016)
<i>Rhus coriaria</i> L.	Anacardiaceae	Sımak, Sumak	Fruit Seed Leaf	Eaten Inf., Int. Dec., Int. Dec., Int. Mac., Int.	(Güldaş 2009) (Balos and Akan 2007) (Metin 2009) (Metin 2009) (Furkan 2016)
<i>Rosa canina</i> L.	Rosaceae	İtburnu, İtgülü, Kuşburnu, Öküzgözü	Fruit	Dec., Int. Inf., Int. Eaten Marmalade, Int.	(Sargin et al. 2013; Karataş 2007) (Güneş et al. 2017) (Karagöz and Serteser 2017) (Karagöz and Serteser 2017; Keskin 2011; Tuzlacı 2016)
<i>Rosa damascena</i> Mill.	Rosaceae	Gül	Flower	Inf., Int.	(Güler et al. 2015; Tuzlacı 2016)
^a <i>Rubus canescens</i> DC. var. <i>glabratus</i> (Gordon) Davis and Meikle	Rosaceae	Böğürtlen, Kapına, Karamık	Root	Dec., Int. Eaten	(Genç and Özhatay 2006; Tuzlacı 2016) (Kayabaşı 2011)
<i>Rubus sanctus</i> Schreb.	Rosaceae	Böğürtlen	Root	Dec., Int.	(Uysal 2008)
<i>Rumex acetosella</i> L.	Polygonaceae	Ekşilik, Kuzukulağı	Leaf	Eaten	(Güler et al. 2015)

Table 1. List of the plants used in traditional treatment against diarrhea in Turkey (continued)

Botanical name	Family	Local name	Plant parts used	Preparation, administration and use	Reference
<i>Rumex crispus</i> L.	Polygonaceae	Ekşi ot, Gırgırcır, Labada	Root Leaf Seed	Dec., Int. Inf., Int. Eaten	(Oral 2007) (Oral 2007) (Kökçü 2015)
<i>Rumex patientia</i> L.	Polygonaceae	Ebelik, Kalmuk çayı, Labada, Tırşika karan, Yılıkulak	Leaf Root	Dec., Int. Inf., Int.	(Uysal 2008) (Yeşil and Akalın 2009)
<i>Salvia tomentosa</i> Mill.	Lamiaceae	Boğaç otu, Boşçapula, Ellik otu, Sancı otu, Şabıla, Şalpa, Yakı otu	Aerial parts	Inf., Int.	(Sargin et al. 2013)
<i>Sanguisorba minor</i> Scop. subsp. <i>magnolii</i> (Spach) Briq.	Rosaceae	Amel otu, Çayır düğmesi, Kara gömdürme, Kelek otu	Aerial parts	Raw, Eaten	(Furkan 2016)
<i>Scolymus hispanicus</i> L.	Asteraceae	Altın diken, Sarıdiken	Leaf, Capitulum	Dec. Int.	(Metin 2009)
<i>Secale cereale</i> L.	Poaceae	Çavdar	Seed	Inf., Int.	(Yıldırım 2015)
<i>Sideritis tmolea</i> PH. Davis	Lamiaceae	Sarı çiçekli yakı otu	Aerial parts with Flower	Inf., Int.	(Sargin et al. 2013)
<i>Silene vulgaris</i> (Moench) Garcke. var. <i>vulgaris</i>	Caryophyllaceae	Cırvınık	Aerial parts	Dec., Int.	(Doğan 2014; Tuzlacı 2016)
<i>Solanum nigrum</i> L.	Solanaceae	Köpek sirkeni	Fruit	Cooked with +Thyme, Monk's pepper, Flour, Water, Ext.	(Uysal 2008)
<i>Solanum tuberosum</i> L.	Solanaceae	Gumpir, Kitola, Kumpir, Patates, Patati	Tuber	Cooked, Int.	(Uysal 2008; Korkmaz and Karakuş 2013; Karakurt 2014; Ayandın 2010; Saday 2009; Yıldırım 2015; Tuzlacı 2016; Kıncal 2018; Kolaç 2018)
<i>Sorbus aucuparia</i> L.	Rosaceae	Kuş üvezi	Fruit	Jam	(Kural 2012)
<i>Sorbus domestica</i> L.	Rosaceae	Hüvez	Fruit	Eaten	(Kökçü 2015)
^b <i>Taraxacum androssovii</i> Schischk.	Asteraceae	Acıgıcı, Hapşuruk otu, Zeze	Capitulum	Dec., Int.	(Altundağ 2009)
<i>Taraxacum farinosum</i> Hausskn. and Bornm. ex Hand.-Mazz.	Asteraceae	Hindiba, Karahindiba	Leaf	Inf., Int.	(Güneş et al. 2017)
^b <i>Taraxacum fedtschenkoi</i> Hand.-Mazz.	Asteraceae	Acıgıcı, Hapşuruk otu, Zeze	Capitulum	Dec., Int.	(Altundağ 2009)
^b <i>Taraxacum macrolepium</i> Schischk.	Asteraceae	Acıgıcı, Hapşuruk otu, Zeze	Capitulum	Dec., Int.	(Altundağ 2009)
<i>Teucrium chamaedrys</i> L. subsp. <i>chamaedrys</i>	Lamiaceae	Bodur Mahmut, Bodurca Mahmut, Cüce Mahmut	Aerial parts Leaf	Dec., Int. Inf., Int. Dec., Int.	(Oral 2007) (Oral 2007) (Alkaç 2013)

Table 1. List of the plants used in traditional treatment against diarrhea in Turkey (continued)

Botanical name	Family	Local name	Plant parts used	Preparation, administration and use	Reference
<i>Teucrium polium</i> L.	Lamiaceae	Acı Yavşan, Egzama otu, Kırmızı ballıbababa, Mayasıl otu, Meryemkot, Oğlan otu	Aerial parts Leaf and Flower Leaf	Dec., Int. Inf., Int. Boiled with Molasses, Ext. Inf., Int. Inf., Int.	(Han and Bulut 2015) (Akan and Sade 2015; Tuzlacı 2016) (Metin 2009) (Bulut 2006) (Tetik et al. 2013)
<i>Tribulus terrestris</i> L.	Zygophyllaceae	Çakır diken, Çoban çökerten, Demir diken, Deve çökerten	Fruit	Dec., Int. Inf., Int.	(Doğan 2014; Tuzlacı 2016) (Tetik et al. 2013)
<i>Trifolium pratense</i> L.	Fabaceae	Yonca	Aerial Parts	Dec., Int.	(Hayta et al. 2014; Tuzlacı 2016)
<i>Triticum</i> sp.	Poaceae	Buğday	Seed	Flour, Int.	(Günbatan et al. 2016)
<i>Urtica dioica</i> L.	Urticaceae	Isırgan otu	Leaf with Seed	Dec., Int.	(Uysal 2008)
<i>Vaccinium arctostaphylos</i> L.	Ericaceae	Ayı üzümü, Lifos, Likarba	Leaf	Dec., Int.	(Kural 2012)
<i>Viburnum lantana</i> L.	Caprifoliaceae	Germeşo, Germişek	Fruit	Dec., Int.	(Altundağ 2009; Tuzlacı 2016)
<i>Vicia faba</i> L.	Fabaceae	Bakla, Pakla	Seed	Eaten	(Yıldırım 2015)
^b <i>Viscum album</i> L.	Loranthaceae	Ökse otu	Leaf	Dec., Int.	(Saraç et al. 2013)
^a <i>Vitex agnus-castus</i> L.	Verbenaceae	Hayıt	Seed Branches	Dec., Int. Swallowed, Int. Crushed, Int. Poultice, Ext.	(Sargin et al. 2013) (Polat 2010; Tuzlacı 2016) (Uysal 2008) (Gürdal and Kültür 2013)
<i>Vitis vinifera</i> L.	Vitaceae	Üzüm, Asma, Tevek	Fruit	Juice, Int.	(Furkan 2016)

Int: Internal, Dec: Decoction, Ext: External, Fac: Fruits are crushed, Inf: Infusion, Mac: Maceration

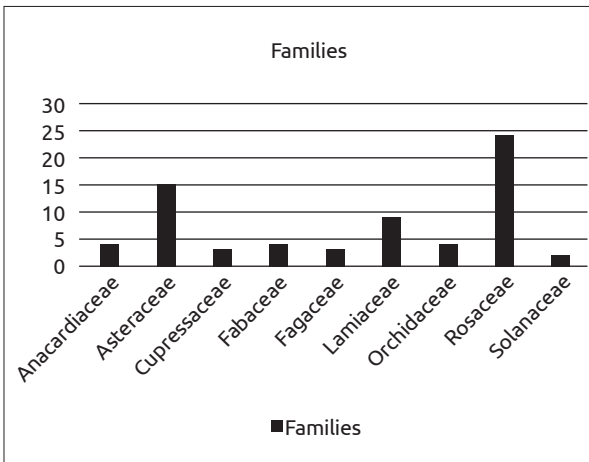


Figure 1. Graph of main families used in traditional treatment against diarrhea in Turkey

MATERIALS AND METHODS

In this study, a thesis search was carried out at the National Higher Education Center alongside an analysis of ethnobotanical studies conducted in various parts of Turkey with selecting regional plants used for the treatment of diarrhea.

RESULTS AND DISCUSSION

Plants have always been an important source for not only nutrition but also therapeutic use against a considerable number of human diseases. Recent phytochemical studies on medicinal plants have supported the effectiveness of folkloric medicines. Since ancient times, plants have been used for curing various diseases and infections (Singh et al. 2017).

Turkey has an extraordinary plant diversity and varies by region. Its flora consists of about 10,000 vascular plants and approximately one third of its flora (34.4 %) is endemic to the country (Demirci and Özhatay 2012; Gürdal and Kültür 2013). Recently, the use of ethnobotanical information obtained from medicinal plant research has gained attention all around the world. For this reason, numerous ethnobotanical studies have recently been published and much has been written about medicinal plants in our country (Gürdal and Kültür 2013). Since these medicinal plants have been used in folk medicine by the public for many years, the information about how to use these plants in the treatment of illnesses has been passed down for generations.

In this study, we compiled 133 plant species used in folk medicine for the treatment of diarrhea in Turkey from the ethnobo-

tanical studies and the theses published at the National Higher Education Center between the years of 2002-2018.

Accordingly, this study reveals that *Achillea wilhelmsii* C. Koch., *Parietaria judaica* L., *Punica granatum* L., *Rubus canescens* DC. var. *glabratus* (Godron) Davis and Meikle, *Vitex agnus-castus* L, shown as *a* in the table, are used for the treatment against diarrhea in both humans and animals.

Moreover, some species such as *Helleborus orientalis* L., *Inula viscosa*(L.) Aiton, *Phlomis pungens* Willd. var. *hirta* Velen, *Pinus brutia* Ten., *Taraxacum androssovii* Schischk., *Taraxacum fedtschenkoi* Hand.-Mazz., *Taraxacum macrolepium* Schischk., *Viscum album* L. which are marked as *b* in the Table 1 are only used for the treatment of diarrhea in animals.

In Figure 1, there is a graph of the main families used in the treatment of diarrhea in Turkey. The plants used for the treatment of diarrhea are mainly from Rosaceae, Asteraceae, Lamiaceae, Fabaceae, Anacardiaceae, Orchidaceae, Cupressaceae, Fagaceae and Solanaceae families (Figure 1). The plants of these families mainly take bioactive molecule groups in their different parts such as fruit, seed, root, aerial parts (Bilaloğlu and Harmanar 1999).

Phytomedicines have a significant role, both as traditional home remedies and as galenic preparations, in the symptomatic treatment of diarrhea. Three groups of preparations are particularly important: tannin-containing herbs, pectins, and a special strain of live dried yeast (Schulz et al. 2004).

Since diarrhea may occur because of fungal, bacterial, viral, and non-infectious causes and many of the plants reported in this study contain pharmaceutically bioactive compounds, including flavones, flavonoids, phenolic acids, tannins, anthocyanin compounds, volatile oil, minerals, vitamins, and polysaccharides (Bilaloğlu and Harmandar 1999). In these molecule groups, tannins especially are medicinally significant because of their astringent properties. Inwardly tannins are administered in cases of diarrhea, intestinal catarrh and as an antidote in cases of heavy metal poisoning (Adhikari and Kundu 2017). They can provide short-term healing and anti-inflammatory effects on the gut wall, though they are likely to rapidly reduce in transit through the tract unless they are in a slowly dispersing solid form. Effects on the bowel, can be significant if the symptom is a reflex consequence of irritation in the gastric or upper enteric passages. The use of tannins is not to be recommended as a long-term solution. Because when they are used as long-term therapy, they can cause constipation, iron deficiency anemia and malnutrition. Therefore long-term therapy with high doses of tannins is to be avoided (Bone and Mills 2013). In this study, *Potentilla*, *Quercus*, *Camellia*, *Vaccinium* and *Alchemilla* sp. are known as plant remedies traditionally used for tannin constituents (Schulz et al. 2004; Bone and Mills 2013).

For centuries, physicians have used preparations containing flavonoids as basic physiologically active components and lay healers attempt to treat human diseases (Cushnie and Lamb 2005). Up till today, plant-derived flavonoids have showed nu-

merous biological activities, including antiallergic, antibacterial, antidiabetic, antiinflammatory, antiviral, anti-proliferative, antimutagenic, antithrombotic, anticarcinogenic, hepatoprotective, oestrogenic, insecticidal, and antioxidant activities (Cushnie and Lamb 2005; Orhan et al. 2010). Flavonoid containing poultices, infusions, spices and balms have been used in many cultures based on ethnomedicinal use for centuries (Cushnie and Lamb 2011). As stated above, there are many kinds of diarrhea and some are caused by infections. In this way, flavonoids in terms of having antimicrobial activities might show a strong ability to cure the pathogenesis. As a result, flavonoids can also be used as a drug to treat diarrhea.

Consequently, these compounds should be investigated in order to determine the main component which is effective against diarrhea and produce natural-based and effective drugs used for this common disease with fewer side effects than chemical drugs. We assume that this study would lead to the development and optimization of new antidiarrheal drugs with no side effects.

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