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Memorial functional foods: a new concept from Bavi tribe

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Abstract

The use of functional foods (FFs) for maintaining health and preventing or treating illnesses—in recent years—has been dramatically increased in the literature. There are available valuable examples of FFs in ethno medicine from different tribes. Ethnic FFs can be valuable resources for developing FFs science, e.g., introducing memorial FFs as an interdisciplinary ethnopharmacological concept. In this paper, ethnic FFs from Bavi tribe (Kohgiluyeh va Boyerahmad province of Iran) have been studied, and their medical potentials are reported. Data gathering was done by interview with Bavi tribe local healers using a questionnaire. Plant materials were collected and identified, and Bavi FFs were prepared according to local procedures. Information of 21 Bavi tribe FFs was collected which are including 20 different plant species. The results showed that most FFs are used to treat chronic diseases including kidney problems like kidney stones, liver disease, neurological complaints, and GI ulcers and are used as lactagogue, while lesser FFs are used to treat acute diseases and symptoms (43%), including nausea and vomiting, common cold, diarrhea, sore throat, and allergy. Most FFs of Bavi tribe are prepared using aromatic plants (75%) responsible for aroma in the final FF. Probably, aromatic FFs increase patient acceptance, without mimicking unpleasant memory of drug recommendation. Plants that are used in FF are mostly perennial (80%) and wild growing (80%), indicating continuous contact of natives and so having memory with such habitant herbals. Treating diseases by homemade FFs which are prepared by well-known aromatic herbals is a routine procedure among natives like the Bavi tribe. Such easily made FFs with well-known taste and flavors which may change the patient's mood should be studied in a new approach, "memorial FFs", as a novel opportunity for healthcare and curing.

Keywords: Bavi tribe, Functional foods, Ethnic foods, Memorial functional foods, Food-cultural studies

Introduction

Ethno medicine contains knowledge, skills, and activities which are based on behavior, culture, and experience of natives. Such knowledge is used to treat various physical and mental ailments. Traditional Persian medicine (TPM) divides practical medicine into "Hifze Sehat" (hygiene) and "Moalejat" (therapeutic medicine) branches [1]. Due to the close relation of traditional and ethnic phytopharmaceuticals, they have long been valuable guides for modern research and development of pharmaceuticals [2]. Today, globalization and mixing of cultures has gradually faded differentiated ethnic groups features, such as

languages and traditions; as a result, rules and ethnic medical knowledge of natives barely have remained alive. Moreover, due to changes in the awareness of indigenous people, and increasing impact of globalization, indigenous knowledge is constantly declining [2]. In many parts of the world, especially in isolated places and areas where physicians and pharmacists are not available, people commonly use their ancestors' home remedies and ethno medicine. In fact, what is transmitted from generation to generation is not only information but also indigenous memories and beliefs. According to Jennings, family is the most important source of knowledge in the community [3]. As a result, local medications and functional food (FF) procedures have been transmitted from parents to children during the centuries, and in the present age, as a result of gape between generations, there is no guarantee for continuation of this transition [2].

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Native FFs

As a definition, “food provides energy and building materials for countless substances that are essential for the growth and survival of every human being” [4]. Diplock notes that food can be considered as a pharmaceutical, if it has beneficial effects on the functions of the body, in order to create effects beyond nutritional effects such as health and prevention of illness [5]. This concept has been expressed by Hippocrates thousands of years ago as: “Let food be thy medicine and medicine be thy food.” This means that food should have pharmacological effects, and medicine should have food criteria. The term “FF” was first introduced by the Japanese in the mid-1980s, meaning processed foods for medicinal and health purposes. Furthermore, FF is described as a kind of food that is nutritional and stimulates or exerts a specific activity in the body [6]. Many epidemiological researchers, clinical assessors, and biochemists of modern foods have considered the link between food and health. For instance, if the proper diet is consumed, it will regulate the physiology of the body. Studies on diet patterns indicate the importance of fruit and vegetable consuming for a healthy diet [7]. In fact, using fruit and vegetables can alleviate depression and anxiety and cause better mood for patients [8]. Vegetarian foods, in addition to providing daily energy to the body, can also prevent diseases and promote health due to their phytochemicals [9–11]. In fact, phytochemical compounds present in medicinal plants which are used in foods improve the health of individuals, help cure chronic diseases, and prevent cancer and cardiovascular and neurological diseases [12]. All in all, as it is reported in the literature, the minimum criteria for FF would be unified as the following [9–11]:

- The product used by the patient should be in the form of food, not in the form of pills, capsules, syrups, and other dosage forms.
- The food should be included as a part of daily diet.
- Consumption of the product should affect certain processes in the body that includes impact on the mechanisms of defense, prevention, and treatment of certain diseases, adjustment of physical and mental conditions, and delay in the aging process.

Nowadays, global tendency to FFs has been increased due to reasons such as importance of FFs in preventing diseases [13]; potential of FFs for increasing life expectancy [14]; increasing healthcare costs [15]; and prevalence of chronic diseases, such as diabetes, obesity, cardiovascular disease, and even cancer [14]. The abovementioned factors have made FF market more prosperous than ever, and it is estimated to reach \$192 billion by 2020 [16]. Unfortunately, it seems that a small share of the market is

intended to be devoted to ethnic FFs. In spite of the fact that nutraceuticals and FFs are new subjects in medicine, there are examples of FFs in folk medicine and TPM [1]. The importance of FFs in TPM is to a degree that prominent Iranian scientist and physician, Razi (854–921 AD), says: “as long as you can use foods for curing diseases, avoid from pharmaceuticals, and use simple materia medica as long as not being forced of using multi-ingredient pharmaceuticals” [17]. Given that chronic diseases have been causing problems in all societies in the world, the World Health Organization (WHO) reported that chronic diseases are one of the most important causes of early death, for example, diabetes is a chronic disease that gradually develops in patients who are prone to kidney problems. Ethnic and traditional FF-based treatments not only can prevent and control chronic diseases without showing side effects of synthetic pharmaceuticals in humans, but also do not cause obesity, neurological problems, and cardiovascular disease [18]. Here, Bavi as a pure Iranian tribe, which is rich in folk medicine and FF experiences, is the subject of the study.

Bavi tribe

Kohgiluyeh va Boyerahmad province, Iran, has special climate variation which has led to biodiversity of medicinal plants in this province. People of Bavi—one of the tribes who live in this province—have long enjoyed the benefits of traditional and ethnic medicine and their experiences in order to meet their medical needs. Many trial and errors in the treatment of diseases by indigenous healers have led to availability of reliable ethnic therapeutic regimens for patients. The ethnic medicine of Bavi tribe is extensive and contains different FFs that reveal the role of diet in prevention and treatment of diseases [19].

Bavi tribe area includes Basht and Gachsaran cities, located in the south of Kohgiluyeh va Boyerahmad, the lands of Choram in the north, Boyerahmad-e garmsir in the northwest and west, Rostam and Mamasani in the northeast and east, and Zohreh River in the south of the Bavi region (Fig. 1). Traditionally, the Bavi land is divided into two areas: Poshtkoh and Zirkoh. Poshtkoh includes Basht and Kohmara. Zirkoh includes Poshtband and Zirband. Poshtkoh areas are cold regions, while Zirkoh areas are tropical [20]. Bavi tribe consists of four great gens, Shaikh Jalil, Dolyari (Dolatyari), Alishi (Alishahi), and Gashin, and 15 small gens [20]. The traditional way of livelihood of Bavis is based on livestock, gardening, and agriculture. After oil exploration in the Bavi region and the expansion of oil facilities in Gachsaran, groups of these people got hired at oil companies. From 1976 AD, the urban population gradually increased (although no exact figures are available), and their economic activities became diverse. Now, Bavi tribe families, besides traditional agricultural and livestock activities, are also engaged in urban occupations [20].

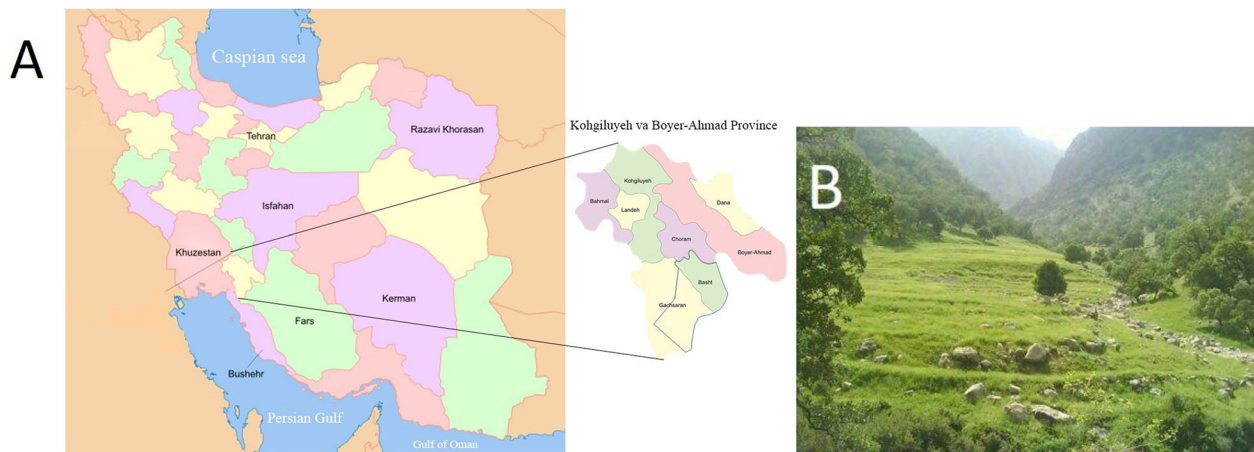


Fig. 1 **a** Location of Bavi tribe in Kohgiluyeh va Boyerahmad province (southwestern), Iran. All the people living in the town of Basht are originally from Bavi tribe, but part of them have been immigrated to Gachsaran in the last 50 years. **b** Bavi tribe nature. Khami Mountain separates Gachsaran and Basht city from each other. It is located at southwest of Basht and northeast of Gachsaran City, 3200 m high. The people of Bavi tribe live in the mentioned two cities and related villages around this mountain. The photo was taken by Mr. Ahmad Kamaei in the spring season

Methods and materials

Data gathering and preparing functional foods

For collecting information, local therapists were identified and interviewed from Bavi tribe's residence: Basht and Gachsaran regions in Kohgiluyeh va Boyerahmad province, Iran (30.16–30.77 N, 50.89–51.5 E) (Fig. 1). Of 11 interviewed therapists (7 males and 4 females), a therapist was from Shaikh Jalil gen, another one from Dolyari (Dolatyari) gen, also a therapist from Alishi (Alishahi) gen, 2 therapists were from Gashin gens, and 6 therapists were from small gens. Ten therapists did not have academic degree and a therapist had bachelor degree. The most abundant age range of participants in this study was 65–74 years old, which comprises 36% of the participants in the study. Here, 114 questions were asked in the form of open questionnaire. Questions were about the treatment of various diseases, maintaining body balance, and human health. Questions were asked from medical practitioners and local experts by an expert native researcher in the location areas of Bavi tribe (Fig. 2). The procedure of FF preparation was asked, and they were prepared again by a local expert by means of native tools and raw materials and ethnic procedures. Local FF preparation methods were recorded, and as an example, the preparation of Shole-e Bayomi tape video is included as the supplementary data.

Plant materials

Plant materials which are used in the FFs' formulations were collected and identified by our botanist: Sedigheh Khademian and voucher samples are kept in the Herbarium of Shiraz Faculty of Pharmacy.

Categorization and literature review

After collecting data, information about FFs were extracted and categorized into five groups: functional beverages, functional dairy products, functional halvas, functional soups, and functional stews. Local name, method of preparing, and therapeutic uses of the FFs, as well as information about herbals which is used for preparing FFs including plant's name, type, and part used



Fig. 2 Interview of a folk lady therapist by our native expert researcher. "Bibi Meshki Taheri" is a local 76-year-old therapist. She learned her experiences (herbal therapy, midwifery, and orthopedics) from her uncle as a local therapist. She collects herbals directly from nature, and also she dries and prepares remedies and FFs at home.

are included in Table 1. Literature review for herbal FFs' ingredients was performed based on articles indexed in Scopus, PubMed, and Google Scholar up to July 2018 and related texts.

Results and discussion

The climate conditions in Kohgiluyeh va Boyerahmad province (Iran) have led to growth of various medicinal plants. The cities Basht and Gachsaran, which are the residence fields of Bavi tribe, are located in this province. The deprivation of the area and the lack of access to physicians and midwives in the past have made local therapists able to take advantage of all the potential of nature and use herbal therapies and advising FFs for treatment. Many trials and errors in the treatment of illnesses by traditional physicians have led to the availability of reliable patient care regimens today [2].

Historical, cultural, and social significance of Bavi tribe's FFs

In minor ethnicities, most foods are used based on beliefs and rituals. Food-related customs appear to be the result of people's long-term contact, usage, and credence on their health properties. Below are the historical, cultural, and social characteristics of available Bavi tribe FFs.

Ghandaghak-e Khakshir: Given the scarcity of food sources in the past, it was enjoyable for people to intake sweet foods. In addition to giving Ghandaghak-e Khakshir to the patients, it also has been given to children who like sweets.

Ou-shireh: Mothers, especially in winter, give Ou-shireh to children and patients as a snack between breakfast and lunch. Adults have good feelings about eating Ou-Shireh because of their memories and background from their childhood.

Doo va noon: This food is frequently used among Bavi tribe ranchers or farmers.

Kalg-o Mas: It is one of the historical Bavi's FFs in the tribe since this region is a rich habitat of oak trees as a source for Kalg (oak). This FF was mostly used in diseases without specific custom.

Mas-o Berenjas-o Darameh: Basically, plant vegetation and people's occupation are determinants of food preparing style [32]. Berenjs (*Achillea santolinoides*) and Darameh (*Artemisia sieberi*) are mostly grown in the cold regions of Bavi's tribe. Therefore, their fresh plant materials are attractive for cold boundary people, while dried plants are used for food preparing in tropical regions.

Mas-e Toleii: This is one of the locals' favorite foods. Because of popularity, nowadays, Tola (*Malva sylvestris*) is frozen and used for not growing seasons of the plant.

Shol-e Shiri: This food is used by Bavi tribe in happy ceremonies and family gatherings in cold seasons.

Mother of the family usually cooks this nostalgic food for the whole family.

Gelafteh: It is also one of the most nostalgic foods which is mostly cooked for celebrations.

Doo va Kardeh: Kardeh (*Arum rupicola*) grows mostly in the high and cold regions, and it is collected by local people in winter. The mother of the family starts preparing Doo va Kardeh as an attractive FF from the previous night, and normally, it is ready around 4 a.m. as a breakfast. Because of difficulties in preparing, neighbors often make turns in preparation and gifting the food to each other.

Shol-e Bayomi: Given that this food contains bitter almond (Bayom) which is an abundant tree in the mountains of Bavi tribe region, people can easily prepare it. Shepherds as almond collectors pick fruits of the tree while grazing sheep.

Medicinal and healthcare properties of Bavi tribe's FFs

In this research, after collecting information about all common ethnic medicines used in Bavi tribe, 21 FF formulations were collected and presented in Table 1. Naming of Bavi tribe FFs is usually based on their ingredients. In some cases of FFs, the first part of the name reflects the form of that food. For instance, "Shole" in "Shole-e Shiri" or "Shole-e Bayomi" means soup, while sometimes the word which is used at the beginning of the name of the food indicates the importance of that FF, i.e., "Dova" (means medicine) indicates that FF's role for medicinal purposes. Such naming of FF reflects powerful cultural beliefs and background of the Bavi tribe.

According to the food preparation method, Bavi's FFs may be categorized into eight functional dairy products, seven functional soups, five functional beverages, a functional halva, and a functional stew. Bavi tribe FFs usually contain high levels of primary metabolites as the food basis, e.g., carbohydrates, proteins, vegetable acids, oils, or lipid ingredients in the form of rice, flour, sugar, milk, or fruit juices. For instance, FF dairy products (Table 1) are rich in lipids and proteins, while FF soups are rich in carbohydrates, proteins, or lipids. The similarity of such food-based medicines with common foods like cooking process (62% here), taste and smell, can be factors that affect appetite and compliance of patients. The second part of FFs in most cases is a medicinal plant which is responsible for FF action, e.g., *Quercus brantii* in Kalg-o Mas or *Malva sylvestris* in Mas-e toleii in Bavi tribe. Plants are the most important source of FFs and pharmaceuticals of ethnic groups [33–35]. In this study, we have made all Bavi formulation again according to native recipe using local tools. Most of the tools are wooden and can be made easily, and also herbal sources are abundant and available in Bavi living place.

Table 1 Bavi tribe functional foods: medicinal and healthcare properties, ingredients, and preparation method

FF name	Medicinal uses/healthcare properties	Method of preparation	Vernacular and scientific names	Voucher no.	Plant part	References ¹
Functional beverages						
Ghandaghak-e Khakshir	Emmenagogue	Khakshir is added to sugar containing water and heated for a while.	Khakshir: <i>Descurania sophia</i> L. (Brassicaceae)	PM205	Fr	
Naranj	For liver problems; for neurological complaints	Oranges peel and flower is added to black tea.	Naranj: <i>Citrus × aurantium</i> L. (Rutaceae)	PM197	Fr peel	[21]
Ou-shireh	Lactagogue	The fresh plants are heated with rice and rinsed and the resulting liquid is recommended.	Tola: <i>Malva sylvestris</i> L. (Malvaceae) Shevet: <i>Anethum graveolens</i> L. (Apiaceae) Bavineh: <i>Matricaria chamomilla</i> L. (Asteraceae)	718 PM570	L L	[22]
Otorosho	For nausea and vomiting	Orange juice with a little salt is prescribed to the patient.	Naranj: <i>Citrus × aurantium</i> L. (Rutaceae)	PM 197	Fr	[23]
Sharbat-e Khakshir	Alleviate hyperthermia	Sugar and water are added to Khakshir till producing syrup.	Khakshir: <i>Descurania sophia</i> L. (Brassicaceae)	PM 205	Fr	
Functional dairy products						
Doo va Noon	Anti-GI ulcers	Dough is put in a cloth so water is separated; dried Chavil and Mint are added.	Naana (Mint): <i>Mentha × piperita</i> L. (Lamiaceae)	1091	L; S	[24]
Kalg-o Mas	Anti-diarrhea	Powdered oak fruit is dispersed in water and baked on a pan. The resulting bread is used alone or in a mixture with yogurt.	Chavil: <i>Ferulago angulata</i> L. (Apiaceae)	PM991	L; S	[25]
Mas-o Berenjās-o Darameh	Anti-burp	Dried Berenjās and Darameh are mixed in yogurt.	Bali: <i>Quercus brantii</i> Lindl. (Fagaceae) Berenjās: <i>Achillea santolinoides</i> subsp. <i>wilhelmsii</i> (K.Koch) Greuter (Asteraceae)	PM709 PM717	Fr L; S	[26]
Mas-o Kashni	Alleviate hot temperament	Dried Kashni is mixed into yogurt.	Daramah: <i>Artemisia sieberi</i> Besser. (Asteraceae)	PM208	L	
Mas-e Toleii	For leg and back pain	Chopped tola is poured in yogurt.	Kashni: <i>Cichorium intybus</i> L. (Asteraceae)	237	L	
Shir-o Neshasteh	Treating sore throat	Starch is dissolved in milk and prescribed.	Tola: <i>Malva sylvestris</i> L. (Malvaceae)	PM718	L; FI	
Shir-e Saalabi	Treating common cold	Saalab is dissolved in milk and administrated.	Neshasteh: <i>Triticum aestivum</i> L. (Poaceae)	PM 255	Fr	[27]
Shole-e Shiri	Treating common cold	Macerated rice, milk, and fresh Rajona are boiled for 20 min.	Saalab: <i>Orchis mascula</i> L. (Orchidaceae) Rajona: <i>Foeniculum vulgare</i> Mill. (Apiaceae)	PM1092 PM 269	R Fr	
Functional halva						
Gelaftah	For cough; for muscle bruising	Roasted flour, Orishom, and vegetable oil are added to the	Orishom: <i>Zataria multiflora</i>	PM201	L; S	

Table 1 Bavi tribe functional foods: medicinal and healthcare properties, ingredients, and preparation method (Continued)

FF name	Medicinal uses/healthcare properties	Method of preparation	Vernacular and scientific names	Voucher no.	Plant part	References ¹
Functional soups						
Ash-e Bilahari	Improving life style of cancerous patients	boiling water till Halva is prepared	Boiss. (Lamiaceae)	746	L; S	[28]
Ash-e Kardeh	a. Disposing of intestinal worms b. Treatment of kidney problems	Rice is boiled in water and Bilahar decoction is added. Kardeh, rice, and dough are kept one day in a warm place and then they are cooked.	Bilahar: <i>Dorema ammoniacum</i> D.Don (Apiaceae) Kardeh: <i>Arum rupicola</i> Boiss. (Araceae)	2067	L; S	
Ash-e Leazaki	Disposing of kidney stone	Rice is first boiled and Leazak is added.	Leazak (Bon sorkh): <i>Allium jesdianum</i> Boiss. (Liliaceae)	PM987	L; S	[29, 30]
Doo va Kardeh	Anti-allergy	Yogurt, Kardeh, and rice are heated for half an hour.	Kardeh: <i>Arum rupicola</i> Boiss. (Araceae)	2067	L; S	
Ou Gandomi	Treating sore throat	Wheat is minced in wooden local mortar called "Sirko", and boiled.	Ganom: <i>Triticum aestivum</i> L. (Poaceae)	721	Fr	[27]
Shole-e Bayomi	Treating sore throat and bronchitis	Bitter almonds are triturated by mortar and pestil, and the result is boiled with table salt. Aliquot is added to the rice and is heated up to boiling.	Bayom: <i>Amygdalus communis</i> L. (Rosaceae)	PM 229	Fr	[31]
See Shole-e Shiri in functional dairy products						
Functional stew						
Khosh-e Jashir	Increasing physical strength	Fresh Jashir is boiled in water and fried in vegetable oil.	Jashir: <i>Prangos asperula</i> Boiss. (Apiaceae)	PM1123	L; S	

¹Literature represents scientific studies on the herbal ingredients which are used in Bavi tribe's FFs. FF Functional food, PM plant material, FI flower, Fr fruits, L leaves, R root, S stem

The results showed (Fig. 3) that most FFs are used to treat chronic proposes (57%) including kidney problems like kidney stones, liver disease, neurological complaints, and GI ulcers and are used as lactagogue, while lesser FFs are used to treat acute diseases and symptoms (43%), including nausea and vomiting, common cold, diarrhea, sore throat, and allergy. This highlights the importance of natural resources for treating chronic ailments.

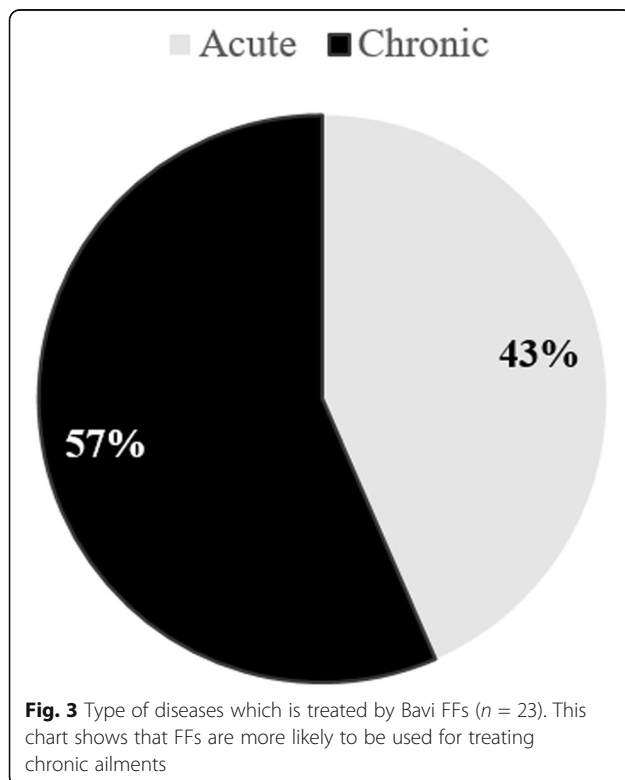
There are similarities between FFs usage and Bavi tribe with other parts of Iran, and literature supports action of some medicinal plants that is prominent in Bavi FFs. For example, it is reported that oral administration of Naranj peel can alleviate liver disease due to lowering cholesterol levels [21] that confirm its ethnic usage as liver drug. Moreover, it is reported that *Anethum graveolens* L. as a medicinal plant ingredient of Ou Shireh is responsible for milk production in nursing mothers [22]. The use of *Mentha×piperita* L. and *Ferulago angulate* L. in “Doo va Noon” as anti-GI ulcers can be supported by the results which show the effect of *Mentha×piperita* L. on gastric ulcers [24] and *Ferulago angulate* L. as a treatment for chronic stomach ulcers [25]. The astringency of oak powder cases show that some tribesmen and villagers in Kohgiluyeh va Boyerahmad province eat a mixture of honey and oak powder before breakfast for treating ulcer [36]. Tannin content would be responsible for oak [26] containing FFs anti-diarrhea effects, in

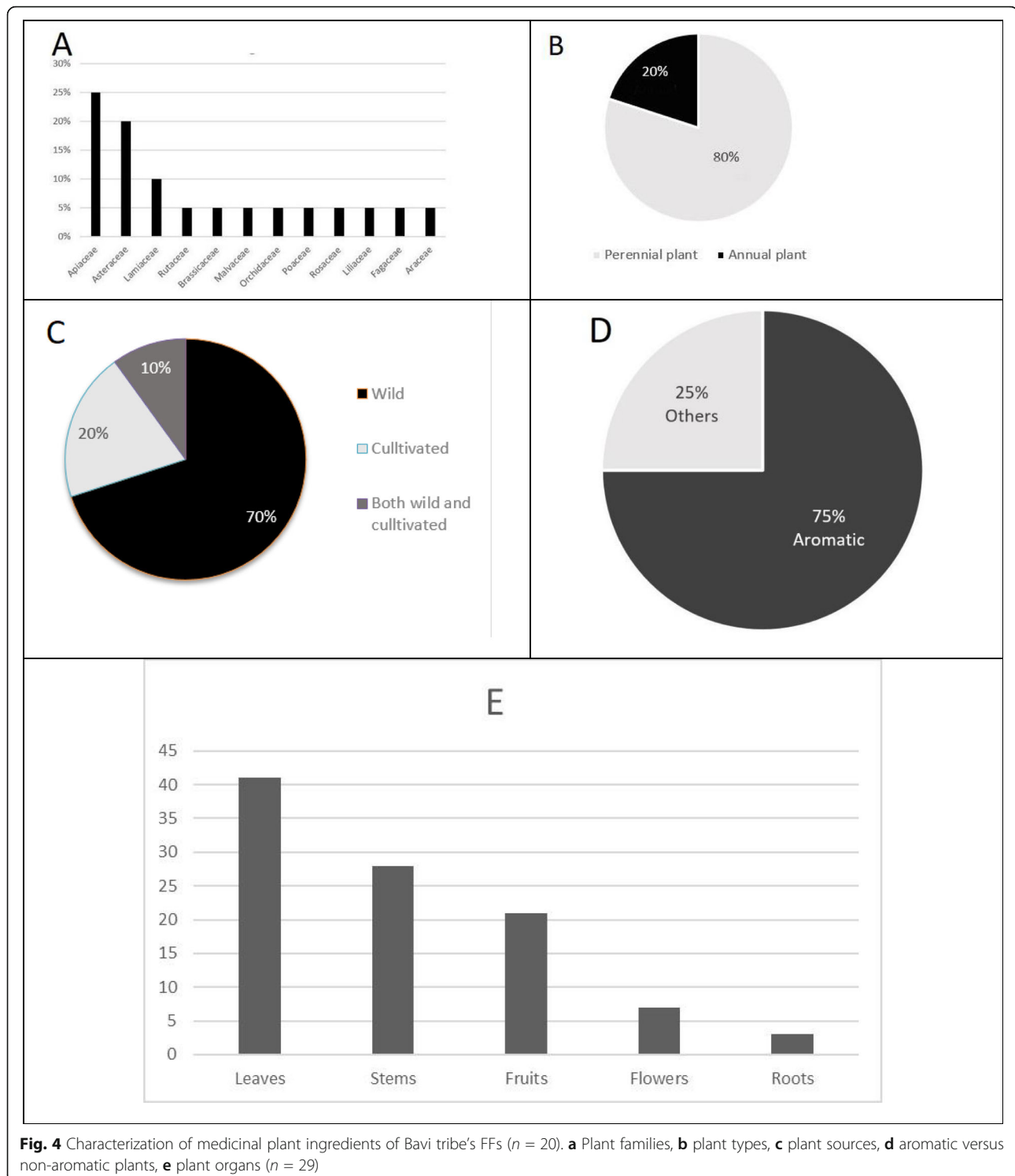
which their products are common in ethnic culture of the Bavi tribe. People of Bavi tribe use Shir-o Neshasteh as well as Ou Gandomi which are made from wheat (*Triticum aestivum* L.) for sore throat. Similarly, in areas of Meybod city (Yazd province), traditional FFs called “Harireh” and “Ferni” (cooked with milk and rice flour), hot liquids, pistachio, starch, and sugar are used for treating sore throats [30]. A similar effect of using *T. aestivum* extraction as a mouthwash for treating sore throat is reported in the literature [27]. Ash-e Bilahari is one of the ethnic foods from Bavi tribe which is presented for improving life style of cancerous patients. Cytotoxic effect of *Dorema ammoniacum* D. Don as the main medicinal plant constituents in Ash-e Bilahari is reported earlier [28]. It is reported that *Allium jesdianum* Boiss. in Ash-e Leazaki FF is used as a disposing urethral stones agent, and when it is added to the patient’s diet, it increases the rate of stone disposition [29]. Finally, the people of Bavi tribe use Shole-e Bayomi as a treatment for sore throat and bronchitis. Based on recent researches, antimicrobial property of bitter almond as an active ingredient of this FF has been reported [31], which supports the ethnic belief. Many researches showed that the pharmacological effects of FFs are the main reason of their consumption [37–39]. However, in some studies, it has been reported that the use of medication or food can be based on local people’s beliefs [3].

Medicinal plant constituents of Bavi tribe FFs

According to Table 1, 20 plant species from 12 plant families are used as active raw materials in Bavi tribe FFs. Among them, Apiaceae (25%), Asteraceae (20%), and Lamiaceae (10%) families are the most common families (Fig. 4). Figure 4 shows that most of the plants (80%) which are used in FFs of Bavi tribe are perennials. Also, our results show that most plants used in FFs of Bavi tribe diets are wild growing (70%) compare with cultivated plants (20%), which may be related to the nomadic lifestyle of the tribe. Furthermore, the most commonly used plant parts in the Bavi tribe FFs are leaves with a frequency of 41% and stems with an abundance of 28% (Fig. 4). Significant share of leaves, fruits, flowers, and stems (97%) in the preparation of a large number of FFs of Bavi tribe compared with underground organs (3%) indicates native tendency for saving plants and using mainly renewable plant organs.

Figure 4 shows that most of the Bavi tribe FFs are produced from plants containing aromas (75%). In other words, in the Bavi tribe, natives use aromatic plants probably not only because of their health benefits but also as a condiment for improving FF flavor. Although some studies indicate that organoleptic characteristics of FF is not significantly effective in FF acceptance [40, 41], others have reported that organoleptic characteristics of FFs, including aroma, can be effective in determining how people tend to





consume those FFs [42]. In addition, from an ethnopharmacological view, taste is a key factor in indigenous FF selection, e.g., selecting bitter herbals for treat diabetes [34, 35]. Although it is difficult to determine human food behaviors, it is reported that specific characters, including social background, consumer demographic information, trusting,

personal motivation, health awareness, and their attitude to pharmaceuticals, may play an important role in human acceptance [43–45]. Such factors may be involved in the attraction and keeping tradition of preparing FFs for health and treatment among a native tribe like Bavi. Moreover, such ethnic FFs probably psychologically motivate people

to get a better medical outcome due to their historical backgrounds and simultaneous consumption of foods in a family gathering [46].

Conclusion

FFs from native sources like the Bavi tribe should present new opportunities for healthcare and treatment. In order to analyze native behaviors in choosing, consuming, and getting greater confidence to FFs, many factors should be reviewed, i.e., continuous contact with wild and perennial plant materials of FFs in the living field; accompanying family with patient during preparing, cooking period, and eating like a meal; probable dialogue on previous generations beliefs about beneficial effects of that FF; organoleptic food properties of FFs like aroma, taste, and appearance; and do not have unpleasant feelings of pharmaceutical dosage forms like injection because of food-like oral taking. "Memorial FFs" might be a suggesting term for ethnic FFs, since it triggers nostalgic and/or pleasurable memory revival in patients. This memory background might elicit better patients' compliance and/or better therapeutic output eventually. All in all, further study of ethnopharmacological aspects of native behaviors linked to psychological considerations would be the result in a new interdisciplinary opportunity for healthcare and curing.

Abbreviations

FF: Functional food; TPM: Traditional Persian medicine; WHO: World Health Organization

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Authors' contributions

EA wrote the manuscript and designed the diagrams. AM designed the research and supervised the study. HA interpreted the data, performed the survey, and made the photographic documentation. All authors read and approved the final manuscript.

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Availability of data and materials

The data that support the findings of this study are available from the corresponding author, prof. Abdolali Mohagheghzadeh, upon reasonable request.

Competing interests

The authors declare that they have no competing interests.

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