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Analysis of factors affecting the consumption of medicinal plants and their products

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Abstract

Medicinal properties, market demand, and satisfaction level are among the most important economic indicators of a medicinal plant. Therefore, it is necessary to investigate the factors affecting the consumption of medicinal plants to analyze the behavior of consumers to implement management strategies in this field. Accordingly, the present research investigates the factors affecting the use of medicinal plants in Shiraz, an important metropolis in Iran. This study was conducted using a survey and questionnaire with approved validity and reliability. The data were collected from 385 people in 11 municipal districts of Shiraz using a random sampling method. A set of demographic, economic, social, and cultural factors affecting on the consumption of medicinal plants and their products was investigated. The data was analyzed using a logit model. The results demonstrated that the studied factors except gender and income level had positive effects on people's decisions for medicinal plants' consumption. Education, age, awareness about medical properties of plants, lower side effects, advertisement, family knowledge, doctor's prescription, personal experience, effective distribution marketing channels, consumption experience, anxiety caused by infectious diseases, unwillingness to attend the clinic, and the belief that medicinal plants are more compatible with the body were among the factors influencing people's decisions for medicinal plants' consumption. Regarding the tendency to use medicinal plants, it is necessary for policymakers to pay attention to the factors affecting the use of those products. By knowing the behavior of consumers, more appropriate policies could be implemented in the medicinal plant industry such as development of suitable distribution markets, production, supply, and consumption of herbal medicines under easy conditions according to international standards, and practical training to increase community knowledge in the field of medicinal plants.

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Introduction

Almost two-thirds of the world's population use medicinal plants to treat or prevent disease, as well as to maintain and improve overall health (Oladeji, 2016). Today, due to limited financial resources—particularly in developing countries (Mirjalili, 2021)—and growing public awareness of the side effects associated with chemical treatments, herbal medicines have become a key source of health care worldwide (Hilal and Hilal, 2017). According to the World Health Organization (WHO), approximately 90% of the population in developing countries rely on traditional medicine and use medicinal plants for primary health care (Toksoy et al., 2010). The COVID-19 pandemic has also led to significant changes in dietary habits across the globe, the full effects of which have yet to be thoroughly studied, understood, or experienced. In this context, food industry experts anticipate a widespread shift toward organic products in the post-COVID-19 era (Gerasimova et al., 2020), and plant-based foods are considered beneficial for regulating the immune system (Sari et al., 2021).

Various studies have investigated the effectiveness of medicinal plants in strengthening the immune system, preventing infections, and even controlling coronavirus (Saruk Islam et al., 2021). Herbal compounds used in China have shown positive results in a pilot study involving COVID-19 patients; however, prospective randomized trials with larger sample sizes are still needed to confirm these findings (Lee et al., 2021; Shi et al., 2020). Studies conducted in Brazil also indicate that *Melissa officinalis*, *Peumus boldus*, and *Mentha spicata* are among the most commonly used medicinal plants for treating this disease (da Silva et al., 2023).

In Iranian traditional medicine, the general approach prioritizes prevention over treatment (Monfared et al., 2019). Moreover, according to the World Health Organization, the gradual replacement of chemical substances with natural alternatives has encouraged various countries to invest in the cultivation, development, and marketing of medicinal plants. In developing countries, two important aspects stand out: first, local communities rely on their indigenous knowledge and experience with medicinal plants to address diseases and health issues; and second, they derive income from medicinal plants as a primary or secondary occupation. Consequently, policymakers in these countries have prioritized the cultivation and use of medicinal plants to harness available capacities (Kiasi, 2019).

Economic, social, and cultural characteristics can influence a community's tendency to use medicinal plants, either increasing or decreasing their consumption. Therefore, one of the initial steps toward promoting the cultivation and production of medicinal plants is to identify consumer profiles (Haghjou et al., 2011; Heidarzade et al., 2015). Understanding the factors that affect the use of medicinal plants facilitates the identification of behavioral patterns, which can help researchers expand the appropriate use of medicinal plants or effective herbal medicines while limiting their use in unsuitable cases. Such knowledge also enables researchers to raise consumer awareness and improve attitudes, thereby encouraging greater use of medicinal plants.

The present study examines the various factors influencing the consumption and selection preferences of medicinal plants as an alternative or supplementary treatment in Shiraz city—a city that served as Iran's capital at various historical periods when traditional medicine was widely practiced (Javanbakht and Esmaili, 2014).

Materials and Methods

Study area

Shiraz is located in Fars Province, Iran with a geographic coordinate of 29.5926° N and 52.5836° E. The area is 10,434 km2, of which 60.4% is in mountainous areas and 39.6% in plains and lowlands. Shiraz is divided into 11 regions. According to the latest population and housing census in 2021, its population is 1,955,500.

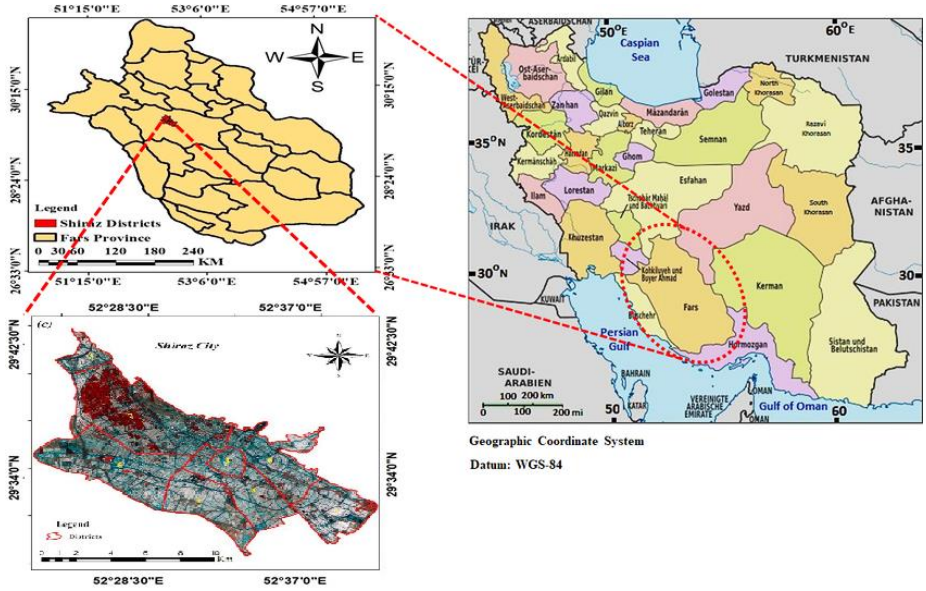

Figure 1. Location of the study area in Iran

Method

The research method was based on field studies and data collection through a questionnaire and random sampling. To collect the required data, a questionnaire was designed and administered. The instrument consisted of two main sections: the first covered demographic information (including gender, age, education level, occupation, income, insurance status, and similar variables), while the second addressed reasons for using medicinal plants, sources of information, attitudes toward medicinal plants, and factors influencing consumption levels. A total of 385 questionnaires were distributed across various districts of the city, and data were gathered through direct interviews. The sample size was determined using the Cochran formula (Yeganeh et al., 2022).

$$n = \frac{N.p.q.t^2}{N.d^2+p.q.t^2} \quad (1)$$

In this equation, N is the statistical population of Shiraz, n is the required sample size, p and q are the response probability and not responding (equal to 0.5), the t is equal to 1.96, and d is the sampling accuracy (d = 0.05-0.3). The number of people was estimated at 385 according to the Cochran formula, and the same number of questionnaires were distributed randomly. A panel of academic experts in the field of medicinal plants confirmed the validity of the study indicators. According to the reliability test, Cronbach's alpha coefficient was 0.805 for the mentioned indicators, indicating a high internal correlation. According to the purpose of the study (investigating people's preferences for using medicinal plants), the dependent variable is people's acceptance or non-acceptance of medicinal plants, which is a binomial variable with 0 and 1 digits. The value of this variable is 1 for the users of medicinal plants and 0 for people who do not want to use medicinal plants. Among the suitable models for such dependent variables is the logit model; since the response variable is in 2 states (0 or 1), it is not appropriate to use the normal linear model.

In this case, a regression model is used with a 2-mode response or linear probability model (which is a regression model with a 2-state dependent variable).

$$yi = xi\,\beta+\varepsilon i \quad (2)$$

In the above equation, xi indicates the values for the ith observation, β the parameters, and εi the error factor. If the desired event has occurred, y = 1. Otherwise, y=0 is considered. If we have only one independent variable, the structure is as follows.

$$yi = \alpha+\beta\, xi + \varepsilon i \quad (3)$$

If y is a two-state random variable, the

unconditional expectation is in the form of the following relationship.

$$(yi)=1\times P(yi=1)+0\times P(yi=0)=P(yi=1) \quad (4)$$

While the conditional expectation for the regression model is as follows:

(5)

$$E(yi|\ xi)=1\times P(yi=1|\ xi)+0\times P(yi=0|\ xi)=P(yi=1|\ xi)$$

In other words, in this case, the model can be rewritten as a linear probability model as follows.

$$P(yi=1|\ xi) = xi\ \beta \quad (6)$$

Logit model 1 is based on the cumulative probability of logistic 2. It is a special type of regression model in which the dependent variable is 2-state and can only take the values of 0 or 1. Based on this model, the probability of acceptance of medicinal plants is calculated using the following equation:

(7)

$$Pi=F(zi) = F(\beta 0 + \sum_{i=1}^{n} B_j Xu) = \frac{1}{1+e^{-xi}} = \frac{e^{xi}}{1+e^{xi}}$$

where pi is the probability of consumption of medicinal plants by the ith person, F is a functional relation, β0 is the width from the origin of the model, Bj is the parameters estimated by the model, Xu is the explanatory variables in the form of a set of socio-economic characteristics of the person, i is the person number (questionnaire number), n is the total number of explanatory variables, and zi is the individual response index. The response index is a random variable that if its value is greater than a certain limit (for example, zi), the person in question will be among the users of medicinal plants; otherwise, they will be among those who do not use medicinal plants. This index is obtained from the following relationship for the i-th person:

$$Zi=\ln\frac{fi}{1-fi} = \beta_0+\sum_{1=i}^{n} B_j Xu \quad (8)$$

As the above equation shows, to calculate Zi, the regression model of the following relationship should be estimated:

$$Zi= \beta_0+ \sum_{1=i}^{n} B_j Xu+ Vi \quad (9)$$

Then, by using the parameters of the estimated model for independent variable Xi, Zi is calculated for each individual. In the logit model, the relative effect of descriptive variable Xij on the probability of consuming medicinal plants can be calculated by deriving the model compared to the explanatory variable, which is given in Equation (Toksoy et al., 2010):

$$\frac{\partial P_i}{\partial X_{ji}} = \frac{B_j e^{zi}}{(1+e^{zi})} \quad (10)$$

According to the type of explanatory variable, the final effect in the logit model is also calculated as follows:

If Xk is a quantitative variable, the change in the probability of success of the dependent variable (Yi=1) due to a change of one unit in Xk, which is called the final effect, is defined as follows:

$$ME=\frac{\partial P_i}{\partial X_{ji}} = \frac{\exp(Bx)}{(1-exp(Bx))^2} \quad (11)$$

To determine the data collinearity, the variance inflation factor (VIF) was used. This index was calculated as follows:

$$VIF(bi) = \frac{1}{(1-R_i^2)} \quad (12)$$

Where R_i^2 is the multiple recognition coefficient obtained from the regression of Xi on k-1 remaining independent variables. If there is no linear relationship between the independent variables, then R_i^2 will be 0, and the VIF value will be 1. Deviation of VIF from the value of 1 indicates deviation from orthogonality and a tendency to collinearity. The approach of R_i^2 to 1 is a sign of a linear relationship between the independent variables, in which the VIF related to β_i tends to infinity. If the VIF is greater than 10, it may cause estimation problems. To evaluate the logistic regression model, the logarithm of the likelihood, Cox and Snell, Nagelkerke correlation coefficient, and Hosmer and Lemeshow test were used (Zare Chahuki, 2013). Those criteria show the degree of compatibility of the logistic model with the data. The data were analyzed using SPSS version 5 (SPSS Inc., Chicago, Ill, USA) and the ordinal logit model to introduce the factors affecting the consumption of medicinal plants.

Results

The results indicated that 55% of the medicinal plants are used to treat various diseases, 32.5% are used as food (mostly in the form of herbal extracts and spices), and 4.4% are used for cosmetic purposes (mostly for skin, hair, and detergents). However, 8.1% of the respondents did not use medicinal plants and products (Table 1).

Table 1. The frequency distribution of interviewees based on the use or non-use of medicinal plants

Monthly consumption	Frequency	Percentage
No consumption	32	8.3
Consumption	353	91.7
Total	385	100

The results of Table 2 show that among the respondents, 55% of the medicinal plants are used to treat various diseases, 32.5% as food (mainly herbal extracts and spices), and 4.4% for cosmetic purposes (mostly for skin, hair, and detergents).

Table 2. The frequency distribution of reason for using medicinal plants

Priority for consumption	Frequency	Percentage
Disease	212	55
Edible	125	32.5
Cosmetic	17	4.4
Non-use	31	8.1
Total	385	100

Based on the collected data, medicinal plants are most commonly used to treat colds, COVID-19, and flu (51.5%). They are also used for digestive disorders (41%), blood pressure management (33.2%), culinary and flavoring purposes (28.5%), and as sedatives (24.4%), in descending order of frequency.

As presented in Table 4, respondents reported various reasons for using medicinal plants. The most frequently cited factors included their perceived effectiveness and usefulness, fewer side effects compared to chemical alternatives, recommendations from knowledgeable individuals, exposure to advertisements, and lower cost.

Table 3. The frequency distribution of consumption of medicinal plants

Disease	Frequency *	Percentage
Cold - Corona - Flu	198	51.5%
Sedative	94	24.4%
Anemia	43	11.2%
Blood sugar	52	13.5%
Blood lipids	61	15.8%
Blood pressure	128	33.2%
Fitness	89	23.1%
Heart disease	45	11.6%
Musculoskeletal pain	59	15.3%
Digestive diseases	158	41%
Obstetrics and gynecology	29	7.5%
Liver and kidney diseases	36	9.3%
Skin diseases	84	21.8%
Body strengthening	31	8%
Oral disease	4	1%
Cancer	8	2%
Eye disease	5	1.3%
Edible, flavoring	110	28.5%

* Because every respondent provided more than one answer to each question, the sum of the frequency of answers is more than 100.

According to the results, most of the interviewees purchased their medicinal plants from herbal medicine stores available in the city and then from pharmacies. With a significant difference of 73% (compared to pharmacies with 33%), herbal medicine stores are the priority of providing medicinal plant products.

The findings showed that in Shiraz, medicinal plants were mainly bought wholesale, dry (72.5% of respondents), and as herbal extracts (53.7%). Other modes of consumption were placed in other categories.

Table 4. The frequency distribution of interviewees based on reasons for choosing medicinal plants

Reasons for selecting medicinal plants	Frequency	Percentage
Lower price	77	20%
Fewer side effects	138	35.8%
Family indigenous knowledge	39	10.1%
Knowledgeable people recommendations	52	13.5%
advertisement (media and social networks)	119	30.9%
Personal experience (trial and error)	72	18.7%
Easy accessibility	21	5.4%

Reasons for selecting medicinal plants	Frequency	Percentage
Ease of use	9	2.3%
Going to the doctor	42	11
Going to traditional and local doctors	68	17.6%
Study and research	22	5.7%
Being organic	35	9%
Good quality and healthy products	38	9.8%
Effectiveness and usefulness	44	11.4%
Ensuring the content of the medicine	15	3.8%
Having learned from medicinal plants	24	6.2%

Table 5. The frequency distribution of respondents based on the business of purchasing medicinal plants

Business of purchasing medicinal plants	Frequency	Percentage
Fruit and vegetable markets	34	8.8%
Herbal medicine stores	281	72.9%
Supermarkets	29	7.5%
Mobile sellers	8	2%
Pharmacy	125	32.4%
Online sale	36	9.3%
Private farm or garden production	13	3.3%
Collecting from nature	12	3.1%

Table 6. The frequency distribution of consumption method

Consumption method	Frequency	Percentage
Herbal extracts	207	53.7%
Fresh wholesale	28	7.2%
Fresh packing	12	3.1%
Dry wholesale	279	72.4%
Dry packing	8	31%
Herbal medicine	104	27%
Essence	16	4.1%

Table 7 presents the results of the logit model, which indicate that, with the exception of gender and income level, all other variables had a positive effect on people's choice of medicinal plants. It should be noted that in logit models, the coefficients do not have a direct quantitative interpretation; rather, they merely reflect the influence of explanatory variables on the probability of accepting the dependent variable. Consequently, marginal (final) effects are typically interpreted for more meaningful insights. To this end, the final effects for each individual or across different consumption levels of medicinal plants were examined (Table 8). Positive final effects indicated a higher probability of consumption above the current level, whereas negative coefficients suggested a greater likelihood of remaining in the current or lower consumption group (Yeganeh et al., 2022).

The logit regression results further revealed that several factors significantly influenced people's choice of medicinal plants. These included gender, education, age, income level, knowledge of the healing properties of plants, perception of fewer side effects, advertisements, family-based indigenous knowledge, doctor's prescriptions, personal experience (trial and error), access to convenient distribution markets, prior consumption experiences, anxiety caused by COVID-19, reluctance to visit clinics, and the belief that medicinal plants are more compatible with the body. Among these variables, only gender and income level exerted a negative effect on consumption, while all others had a positive influence. For instance, the final effect of the gender variable indicated that changing a consumer from female to male reduced consumption, with a 1- unit change (i.e., from female to male) decreasing the probability of use by 5%. The significance levels for all variables are reported in Table 8.

Based on these findings, it is expected that a longer history of medicinal plant use within a family or among relatives increases individuals' tendency to purchase herbal medicines, thereby raising the likelihood of their use. Similarly, other variables—such as a doctor's prescription or recommendation, as well as prior experience with various

medicinal plants—demonstrated positive and statistically significant effects on the use of these remedies.

Table 7. The results of logit regression estimation for the factors affecting the consumption of medicinal plants

Variable	coefficient	standard deviation	|P|>z	Final effects
Gender	-1.17	0.53	0.041*	-0.05
Education	0.31	0.18	0.016*	0.04
Age	0.12	0.11	0.028*	0.002
Income level	-0.38	0.21	0.011*	-0.03
Knowledge of the healing properties of plants	2.01	0.37	0.031*	0.11
Fewer side effects	0.31	0.51	0.019*	0.17
advertisement	1.07	0.42	0.045*	0.04
Family indigenous knowledge	1.03	0.24	0.039*	0.14
Doctor's prescription	1.01	0.78	0.01**	0.05
Seller's Knowledge	0.71	0.6	0.023*	0.13
Personal experience (trial and error)	0.88	0.37	0.027*	0.19
Number of family members as consumers	0.02	0.31	0**	0.002
Having a specific disease	0.15	0.15	0.06	0.01
price of product	0.34	0.21	0.48	0.04
The credit of the manufacturing company	0.25	0.12	0.08	0.004
Having a license and meeting the necessary standards	0.13	0.004	0.081	0.003
suitable packaging	0.45	0.08	0.12	0.12
Variety of products	0.19	0.14	0.151	0.009
Easy accessibility	0.87	0.09	0.204	0.02
Good smell and taste	0.45	0.19	0.13	0.005
Convenient distribution markets	0.25	0.11	0.022*	0.02
Consumption experience	1.33	0.16	0.05	0.16
Corona anxiety	1.43	0.14	0.003**	0.19
Reluctance to attend the office and clinic	0.91	0.49	0.000**	0.003
Preference for using herbal over chemical medicines	0.7	0.17	0.11	0.06
More compatibility of medicinal plants with the body	0.25	0.07	0.027*	0.07
Tendency to use organic plants	0.8	0.22	0.07	0.03

** Significant at 1% level, * significant at 5% level (p-value: 0.000)

Table 8. Results of logistic regression model

Test	2-log-likelihood	Cox and Snell R Squre	Nagelkirk R Squre	Hosmer and Lemeshow Test
Coefficient	28.7	0.71	0.79	0.81

Multicollinearity Assessment

As stated in the Materials and Methods section, the variance inflation factor (VIF) was examined prior to running the logistic regression model to check for multicollinearity among the measured variables. The results indicated that the VIF for all independent variables was below 10, confirming the absence of multicollinearity. The evaluation of the logistic regression model, based on four tests, is presented in Table 8. As model accuracy increases, the −2 log-likelihood value decreases, while the Nagelkerke, Cox, and Snell correlation coefficients increase. The Hosmer–Lemeshow test, analogous to a chi-square test, assesses the agreement between observed and expected cases for two groups of independent and dependent variables. A higher value indicates greater agreement, suggesting that the logistic model fits the data well (Zare Chahuki, 2013).

Discussion

The results revealed that nearly half of the respondents (51%) use medicinal plants to prevent or treat colds, COVID-19, or influenza. A review of previous studies indicates that during the SARS epidemic in 2003, medicinal plants also played a

significant role in disease prevention and treatment (Leung, 2007). For instance, during the SARS outbreak, the use of traditional medicinal plants alongside other medications substantially alleviated symptoms such as cough, respiratory distress, and fever (Li et al., 2020). More recent studies have shown that combining traditional medicine with standard care improved treatment outcomes in COVID-19 patients (Fan et al., 2020; Lee et al., 2020). The authors attribute the growing interest in medicinal plants to the lack of effective modern treatments for COVID-19 at the onset of the pandemic (Alyami et al., 2021). Nugraha (2021) similarly reported increased interest in using medicinal plants for COVID-19 prevention and treatment. However, reports on the number of medicinal plants used vary considerably across studies.

This study found that, overall, women used medicinal plants more frequently than men—both within the last year and at least once in their lifetime. Independent studies in the United States by Conboy et al. (2005), Honda and Jacobson (2005), and Lafferty et al. (2006) confirmed higher utilization of traditional medicine among women. In their research conducted in Tabriz, Javanbakht and Esmaili (2014) also observed that women share their experiences with each other more rapidly due to greater use of medicinal plants and firsthand observation of positive effects, leading to even higher consumption rates compared to men. Similarly, Yeganeh et al. (2022) found that consumption decreases when shifting from female to male users, resulting in negative changes at both medium and high consumption levels.

Regarding education, the final effects indicated that higher educational attainment increases the likelihood of using medicinal plants. Laelago et al. (2016) similarly reported that factors such as sufficient knowledge of medicinal plants and level of education are significantly associated with their consumption. Moreover, Javanbakht and Esmaili (2014), Sereshti and Azari (2007), and Soner et al. (2013) all found a direct relationship between education and the use of herbal medicines. Studies by Honda and Jacobson (2005), Conboy et al. (2005), and Ni et al. (2020) further confirmed that individuals with higher education are more inclined to use medicinal methods.

The present study also demonstrated that increasing age, level of awareness, number of consumers within families, family knowledge, personal experience, and advertisements all contribute to greater use of medicinal plants. It can thus be inferred that with age, experience and awareness accumulate, leading to increased consumption—and that consumption is closely tied to people's awareness and knowledge of the benefits of medicinal plants. Consequently, indicators such as local awareness, indigenous knowledge, and personal experience are significant and positive factors in promoting consumption (Javanbakht and Esmaili, 2014). Ankli et al. (2002) and Boon et al. (2013) noted that public information through advertising is an effective driver of medicinal plant use. Therefore, enhancing knowledge—particularly through targeted advertising—can effectively boost consumption. These findings align with those of earlier studies.

Furthermore, the results indicate that a primary source of people's knowledge is personal experience or that of other family members from previous generations, reflecting the perceived effectiveness of plants in treating diseases and the role of indigenous knowledge in shaping willingness to use them. Accordingly, individuals with a longer history of plant use within their families tend to consume more medicinal plants. These findings are consistent with the studies of Sajadi et al. (2011), Tardío and Pardo-de-Santayana (2008), and Sojasi Qeidari and Azizi (2019). World Health Organization reports also indicate that most populations in developing countries rely on traditional medicine and indigenous knowledge of medicinal plants for primary health care (Toksoy et al., 2010).

Regarding individuals' inclination to purchase medicinal plants and their products, Bakhtiari (2010), Sedighi et al. (2004), and Heidarifar et al. (2013) reached similar conclusions, emphasizing that the primary driver of familiarity with plant usage is the experience

shared by relatives. In the study by Sereshti and Azari (2007), relatives' recommendations were a significant factor in herbal medicine use among women. Company credibility, seller knowledge, and doctor's prescriptions were also influential in consumption. It appears that company credibility and seller knowledge contribute to consumer trust and satisfaction, thereby increasing consumption. When doctors promote medicinal plants, consumption is likely to rise due to the social status of this educated group. This is consistent with the findings of Rashidi et al. (2013) and Heidarzade et al. (2015).

In other words, when herbal medicines are endorsed by physicians, they gain greater acceptance, potentially increasing consumption. This is particularly important given that only 12% of participants consulted a doctor before using medicinal plants or their products. Considering the potential side effects and acute toxicity of certain medicinal plants when consumed in excess (Ghorani-Azam et al., 2018), this can lead to unwanted reactions and adverse effects in the community. Therefore, policymakers must address this issue (Dabaghian et al., 2020). Notably, Evans (2008) reported that 86% of hospitalized patients in New Zealand expressed a preference for complementary and alternative methods, especially medicinal plants; however, physicians did not permit such treatments. Rashidi et al. (2013) also stated that increasing the number of physicians specializing in medicinal plants is a factor that enhances public inclination toward herbal medicine use, a finding supported by Heidarzade et al. (2015).

Another important reason for using medicinal plants is the belief that they are more compatible with the body than chemical drugs. Respondents' views regarding the natural origin of these plants, their lack of side effects, and their contribution to a healthier lifestyle are consistent with the findings of Edwards et al. (2012), Oladeji (2016), and Hilal and Hilal (2017). The results further indicate that greater diversity in available medicinal plants increases the likelihood of consumption, likely because consumers have a wider range of options—a finding in line with Heidarzade et al. (2015).

The analysis showed that income level had a negative effect on medicinal plant consumption; that is, higher household income was associated with lower consumption. A possible explanation is that medicinal plants, due to the traditional nature of their production and distribution, are predominantly purchased by middle- and lower-income groups, while wealthier individuals tend to prefer chemical or imported pharmaceuticals for treatment.

An increasing preference for medicinal plants over chemical drugs was associated with positive changes in the probability of their use. Therapeutic potential, minimal side effects, and affordability among economically average to poor populations have been cited as key indicators driving preference for medicinal plants (Ghavam et al., 2015; da Silva et al., 2023). Various studies have shown that although chemical drugs act faster, the durability and stability of the positive effects of herbal and natural medicines are more pronounced. Ondicho et al. (2015) similarly reported that the main reasons for positive attitudes toward medicinal plants were their better efficacy and natural composition. Thus, widespread use of medicinal plants could reduce reliance on chemical drugs and mitigate the associated physical and psychological risks.

Reluctance to visit doctors' offices and clinics was another factor influencing medicinal plant use, particularly during outbreaks of contagious diseases such as COVID-19. Fear and concern about being in enclosed spaces with high patient density appear to be major reasons, consistent with the findings of Sojasi Qeidari and Azizi (2019).

Given that the majority of respondents reported moderate to severe anxiety levels, our results revealed a significant relationship between psychological distress and a direct effect of anxiety on willingness to use medicinal plants. This finding is comparable to Fischhoff (2020), who discussed heightened anxiety during the COVID-19 pandemic. Anxiety may indirectly influence medicinal plant consumption—for example, through fear of visiting medical facilities. Community members, especially those with

lower education levels, have turned to medicinal plants as a result of anxiety, leading to behaviors such as self-treatment or self-initiated preventive measures. Furthermore, descriptive results showed that most respondents used medicinal plants based on recommendations from relatives and acquaintances to relieve anxiety and prevent or treat illness, compared to the pre-outbreak period. Thus, it is essential to provide proper and practical training to enhance community knowledge (Bayat, 2021; Karami and Ghanbari, 2023).

Conclusion

Based on the findings, increasing community awareness is an effective factor in promoting the use of medicinal plants, as the majority of consumers hold a generally positive attitude toward herbal medicines. In addition to raising public awareness through appropriate resources and advertising, ensuring the health and safety of these products can be a useful strategy for encouraging appropriate consumption. Given the interactions and side effects of certain plants and their products, policymakers must inform the public. Considering the influence of doctor's prescriptions and seller knowledge, it is essential to provide comprehensive information on herbal medicines—first through physicians, and subsequently through sellers and media—to prevent drug interactions. In other words, when herbal medicines are promoted by doctors, they gain greater acceptance and can lead to increased consumption; therefore, policymakers must prioritize this issue. Company credibility and convenient distribution networks also contribute to fostering a consumption culture.

In addition to the above, it is necessary to review pharmaceutical policies and establish regulations for the herbal medicine market, ensuring that production, supply, and consumption align with international standards. Appropriate reforms in the pharmaceutical system can enhance the use of medicinal plants. Such attention could stimulate demand for medicinal plants, which in turn may contribute to economic growth through the expansion of medicinal plant cultivation. Now that medicinal plants can improve health care during conditions such as pandemics, and given the public's positive attitude toward them, it is crucial to provide practical training to increase people's knowledge about medicinal plants and prevent possible side effects and toxicity. In this regard, quality control of these products, along with defining clear authority for their prescription and sale, is also essential.

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Conflict of interest

The authors declare no conflict of interest.

Author’s contribution

All authors listed on the title page have contributed significantly to the work. Conceptualization, designing the study and data collection: MRF. Data collection and writing: YK. Helping in data analysis: SZM and HNG. All authors have read and approved the final manuscript.

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Availability of data and material

All data generated or analyzed during this study are included in this published article.

Ethics approval and consent to participate

The authors asked for permission from the local people interviewed to carry out the study.

Competing interest

There is not competing interest to declare

Consent for publication

We confirm that all authors have read the manuscript, attested to the validity and legitimacy of the data and its interpretation, and agreed on its submission.

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