

Awareness of herbal medicine within the Bulgarian population—a pilot study

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Abstract

Background: Herbal medicine has been an integral part of Bulgarian life and culture for centuries. However, incorrect use, resulting from a lack of adequate or false understanding of medicinal plants' therapeutic properties, poses serious health risks for patients.

Objectives: The main goal is to determine the sources of information about herbal medicine. Secondary objectives include identifying the most commonly used medicinal plants, the ways to obtain them, and assessing whether herbs are used correctly by respondents.

Methods: A pilot, observational, prospective, cross-sectional online survey was conducted from 19 June 2023 to 31 July 2023. A specific questionnaire with four sections was developed. Statistical analysis was performed using MedCalc software, including descriptive statistics, frequency and graphical analysis, Fisher's exact test, and chi-squared tests.

Results: The number of respondents was 59, with a predominance of individuals aged 18–30 (57.6%), women (72.8%), and university graduates (64.4%). About 31% suffer from chronic diseases, with the most common being related to the digestive system ($n = 3$), the nervous system ($n = 3$), and allergies ($n = 3$). Herbal medicine is considered an effective therapy by 81.4% ($p < 0.0001$). For acute diseases, herbs are preferred by 22 patients, while for chronic diseases, by 6. The most widely used herbs are *Mentha* sp. ($n = 18$) and *Thymus* sp. ($n = 14$) from the Lamiaceae family and *Matricaria chamomilla* ($n = 15$) from the Asteraceae family. There is a predominance of herbs reported to be used correctly ($n = 123$ vs. $n = 22$, $p < 0.0001$). Most respondents (70.4%) buy herbs from a herbal pharmacy or drugstore ($p = 0.0004$). The preferred sources of information are medical professionals ($n = 51$) and the Internet ($n = 31$) ($p = 0.1080$).

Conclusion: A significant number of respondents obtain information from the Internet, which can lead to misinformation. Efforts are needed to develop a reliable online source of information.

Keywords

traditional medicine, herbal medicine, medicinal plants, phytotherapy, health information survey

Introduction

Medicinal plants and plant substances, known as herbs, have become increasingly common in recent decades. By 2014, up to four billion people (representing 80% of the

world's population) relied on herbal medicinal products as a primary source of healthcare, and traditional medical practice involving herbs was an integral part of their culture (Martins 2014). Their widespread and often uncontrolled use, coupled with the rising number of

adverse events, raises concerns for national healthcare institutions. By 2004, in response to the request from the Member States, the World Health Organization (WHO) created guidelines for monitoring the safety of herbs in pharmacovigilance systems (World Health Organization 2004). Actions needed by the WHO include the provision of technical guidance for expanding existing monitoring systems for herbal medicine adverse drug reactions, establishing national drug safety monitoring systems where they do not exist, and supporting countries in strengthening their pharmacovigilance systems for herbal drugs with the involvement of health-care providers, consumers, and manufacturers.

Simultaneously, more and more Internet users are obtaining health information from various websites, often unable to differentiate false information from accurate sources. Recent data from the Health Information National Trends Survey (HINTS) shows that 70.1% of all surveyed patients ($n = 3,846$) seek health information on the Internet (Health Information National Trends Survey 2014). Another study from Saudi Arabia stated that out of the total respondents, 68.3% ($n = 3,311$) frequently sought medication-related information, with most social media users being women (83.5%, $n = 2,766$) (Bahkali et al. 2016). This leads to dangers, as not all websites are managed by medical professionals to ensure the accuracy and reliability of the content. Another study stated that the public accurately perceived a high prevalence of health misinformation, up to 87% (Stimpson et al. 2023).

Herbal medicine has been integral to Bulgarian life for centuries, deeply rooted in their traditions. One of the oldest books on herbal medicine is “Lekarstvenik” (in Bulgarian), which contains a collection of folk recipes and home remedies dating back to the period of 927–969 (Nedelcheva 2012). Despite its small national territory, the country boasts a remarkable diversity of medicinal plant species and a rich composition of active ingredients (Evstatieva et al. 2007). In 2023, Bulgaria updated the list of medicinal plants covered by the Medicinal Plants Act, which regulates the conservation and sustainable use of medicinal plants, including the collection and purchase of herbs (Medicinal Plants Act 2023). About 250 medicinal plants are widely used and represent a traditional export product (Tucker 2023). The annual harvest of medicinal plants in Bulgaria amounts to about 15,000–17,000 tons, 80% of which is exported (Evstatieva et al. 2007). This ranks Bulgaria first in Europe and one of the first places in the world as the biggest exporter of herbs (Foundation for Information and Nature Protection 2015).

There is stability in the information flow, which has been transmitted and preserved over the years. Secondly, a trend of evolution is being pushed, and the knowledge of medicinal plants has been renewed in recent years. There are many valuable ethnobotanical scientific works with a focus on different Bulgarian regions (Kozuharova et al. 2012; Cherneva et al. 2017; Boycheva et al. 2021; Mincheva et al. 2022; Mincheva et al. 2023), studies of pharmacologically essential plants and their toxicity (Todorov et al. 2014; Nikolova et al. 2022; Zahariev 2022; Kozuharova et al.

2023), and studies that show the legislative acts dealing with their protection and management (Yaneva et al. 2020; Tashev et al. 2022). Many studies show that Bulgarians are open to traditional healing methods and trust traditional knowledge of herbal applications (Kozuharova et al. 2013; Dragoeva et al. 2015; Koleva et al. 2016). Most herbs in Bulgaria are used to treat disorders of the central nervous system (CNS) and bones, followed by those of the skin, gastrointestinal, and respiratory systems (Kozuharova et al. 2013). A larger proportion of all respondents ($n = 475$) in a survey from 2013 stated that they are not informed about the possible side effects of herbs: 18.11% are not familiar with these effects, and 39.16% declared that herbs cannot cause any harm (Koleva et al. 2016). The lack of knowledge about the correct application, dosage, sourcing, and potential side effects of herbs is related to a significant risk to the patient's health.

The study's primary aim is to determine the most reliable source of information on herbal remedies, primarily focusing on the proportion of individuals using the Internet for information. Secondary objectives include: (1) identifying the most commonly used medicinal plants for acute and chronic conditions and how often the respondents use them; (2) examining the methods used to obtain these herbs; (3) assessing whether the application of the herbs is correct.

Materials and methods

Study design and survey administration

A pilot observational prospective cross-sectional online survey was conducted in the period 19 June 2023–31 July 2023. The survey was disseminated among Bulgarian citizens aged 18 and over using a snowball sampling strategy, as the investigators leveraged their personal and professional contacts, along with their Internet networks. Public and confidential social media groups dedicated to herbal medicine were also used. The form did not collect email addresses or personal information to ensure anonymity. Participation was voluntary and without any benefits. All respondents provided online informed consent before answering the questions, indicating their agreement to participate in the study. The study is conducted in accordance with the Declaration of Helsinki on ethical principles for medical research involving human subjects and Regulation (EU) 2016/679 of the European Parliament and of the Council of 27 April 2016 on the protection of natural persons concerning the processing of personal data and the free movement of such data. Patients or the public were not involved in the research's design, conduct, reporting, or dissemination plans.

The survey featured specific open-ended and closed questions on the sources people use to learn about herbs, herbal products, and their therapeutic effects. It contained four sections: 1) demographic data (6 questions), 2) clinical and therapeutic data (4 questions), 3) herbal use (10 questions), and 4) sources of information about herbs (6 questions). The survey questions were developed through extensive discussions among the researchers, ad-

hering to established methodologies for designing questionnaire-based surveys. The technical functionality was tested by the researchers, along with a group of randomly selected participants ($n = 8$), who assessed the system's capabilities for entering, reviewing, and submitting responses. A summary of the study questions is presented in online Suppl. material 1.

The survey was available in Bulgarian, and Google Forms was used online to collect and summarise the answers. All questions were mandatory for completing the survey. In the course of completing the questionnaire, respondents can use a back button to return to previous pages in the survey and update their responses. Once the survey has been submitted, it cannot be modified or filled out again. This pilot study was conducted prior to the dissemination of the main questionnaire to all potential respondents. All participants completed the questionnaire fully, with no missing responses recorded. Based on the results of this pilot study, a more widely disseminated survey is planned.

Sample size

The initial sample size calculation is based on achieving a 95% confidence level and a 5% margin of error (Δ), assuming an estimated general percentage (P) of 50% for maximum variability. This resulted in a target sample size of 385 participants, intended to ensure representativeness for the larger study population. However, as this study was designed as a pilot, the final sample size of 59 participants reflects practical limitations during the data collection period. Therefore, this pilot study's results should be considered preliminary, providing a foundation for future, larger-scale research.

Statistical methods

Descriptive statistics, including frequencies, percentages, and graphical representations, were used to summarise dichotomous and categorical variables. Fisher's exact test was applied to analyse proportions between categorical variables within independent samples ($n < 40$). This test was specifically used to compare the proportion of correct versus incorrect use of herbs, the preference for medical versus non-medical sources of information, and to analyse the relationship between gender and consultation with a pharmacist. The Chi2 test is applied when comparing categorical variables within independent samples ($n > 40$). This test examined whether there was a significant difference in the distribution of participants' methods of obtaining herbs (buying from a pharmacy or drugstore versus collecting them personally).

Statistical significance was set at $p < 0.05$ for all analyses. All statistical analyses were performed using MedCalc software version 16.4.1 (<https://www.medcalc.org/>), which is commonly used for statistical analyses in medical studies. The proper use of herbs was critically assessed through both Bulgarian and international specialised literature based on the responses provided by the participants.

Results

Currently, the data collected is from 59 respondents based on a pilot online survey. Using this microsample, a sample estimate can be determined for the generic attribute being assessed (i.e., the percentage of individuals using the Internet as a source of information about herbs).

Section 1. Respondents data

Table 1 presents the demographic characteristics of the participants. It was estimated that 72.8% were women, while 27.2% were men. The sample is primarily composed of individuals aged 18–30 (57.6%), followed by those aged 50–60 (15.3%) ($p = 0.0016$). The sample is dominated by persons with higher education (64.4%) compared to persons with secondary education ($p = 0.0001$). Employed individuals represent 59.3% of the sample ($p < 0.0001$), with the highest percentage working in the information technology (IT) and communication sector (18.6%), followed by healthcare (15.6%), administrative, office, and business activities (13.6%), and education (13.6%).

Table 1. Demographic characteristics of the participants ($n = 59$).

Participant characteristics	N respondents (%)
Gender	
Male	16 (27.2%)
Female	43 (72.8%)
Age group	
18–30	9 (57.6%)
30–40	5 (11.9%)
40–50	2 (10.2%)
50–60	6 (15.3%)
Above 60	3 (5.1%)
Residence	
Town	57 (96.6%)
Village	2 (3.4%)
Education	
Student	13 (22%)
High school	7 (11.9%)
Bachelor's degree	23 (39%)
Master's degree	15 (25.4%)
Doctorate	1 (1.7%)
Employment status	
Student	21 (35.6%)
Worker	35 (59.3%)
Retired	1 (1.7%)
Unemployed	2 (3.4%)
Employment sectors	
IT & Telecommunications	11 (18.6%)
Administrative, Office and Business Activities	8 (13.6%)
Health care	9 (15.3%)
Education	8 (13.6%)
Trade and sales	4 (6.8%)
Design, Creative, Art	3 (5.1%)
Restaurants, pubs, hotels, tourism	2 (3.4%)
Production	0
Logistics, freight forwarding	0
Construction, architecture	4 (6.8%)
Other	

Section 2. Clinical and therapeutic data

About 31% of the survey participants have chronic diseases, with the most common being digestive (gastritis, ulcers) ($n = 3$), nervous system (migraine, myasthenia, neuralgia) ($n = 3$), and allergies ($n = 3$). Other participants reported that they suffer from endocrine diseases (congenital adrenal hyperplasia, hypothyroidism) ($n = 2$), diseases of the musculoskeletal system and connective tissue (arthritis, arthralgia) ($n = 2$), diseases of the genitourinary system (cystitis, nephrolithiasis) ($n = 2$), infectious and parasitic diseases (Lyme disease) ($n = 1$), diseases of the skin and subcutaneous tissue (psoriasis) ($n = 1$), and 1 respondent suffers from hypertension (diseases of the circulatory system).

Out of the total 29 respondents who reported having a chronic disease, six used herbal treatments, and only one used traditional herbal medicinal products. Twenty-two patients preferred herbal treatment for acute conditions such as cold and flu, while 11 preferred traditional herbal medicines. There are statistically significantly more responses indicating that in cases of acute illness, patients take medication (over the counter) instead of herbs ($P < 0.0001$).

Section 3. Herbal use

Approximately 82% of the respondents believe herbal medicines are an effective treatment approach ($p < 0.0001$). Furthermore, 59.3% of the respondents reported using herbs “sometimes” ($p < 0.0001$). Among the reported herbs used for various acute and chronic

conditions, 123 were found to effectively address the patient's symptoms, compared to 22 that did not, with the difference being statistically significant ($p < 0.0001$) (Suppl. material 2). Regarding procuring herbs, most respondents (70.4%) purchased them from a pharmacy, herbal pharmacy, or drugstore, while 16.7% personally collected them ($p = 0.0004$). The most commonly used herbs were from the family Lamiaceae: *Mentha* sp. ($n = 18$) and *Thymus* sp. ($n = 14$), *Matricaria chamomilla* L. ($n = 15$) of the Asteraceae family, *Hypericum perforatum* L. ($n = 11$), family Hypericaceae, and *Cotinus coggygia* Scop. ($n = 10$), family Anacardiaceae (Fig. 1).

Section 4. Sources of information about herbs

No statistically significant difference in the preferred sources of information relating to herbs' application, regimen, and contraindications ($n = 33$ —Internet; $n = 51$ —medical specialists, $p = 0.1080$) was found (Fig. 2). Among those who used online sources, 16 respondents relied on scientific articles and 5 on pharmacy websites. Smaller numbers surveyed used blogs ($n = 4$), free search ($n = 4$), social networks ($n = 3$), specialized herb registries ($n = 2$), and online books ($n = 2$) ($p > 0.05$).

When seeking advice from a pharmacist, 41% of people never receive any advice ($p = 0.0319$). Only 8.5% of individuals are dissatisfied during consultations, while 61% are either satisfied or fully satisfied ($p < 0.0001$). The majority of respondents (89.83%) say they would visit a pharmacy if comprehensive and accurate information about herbal medicine is provided.

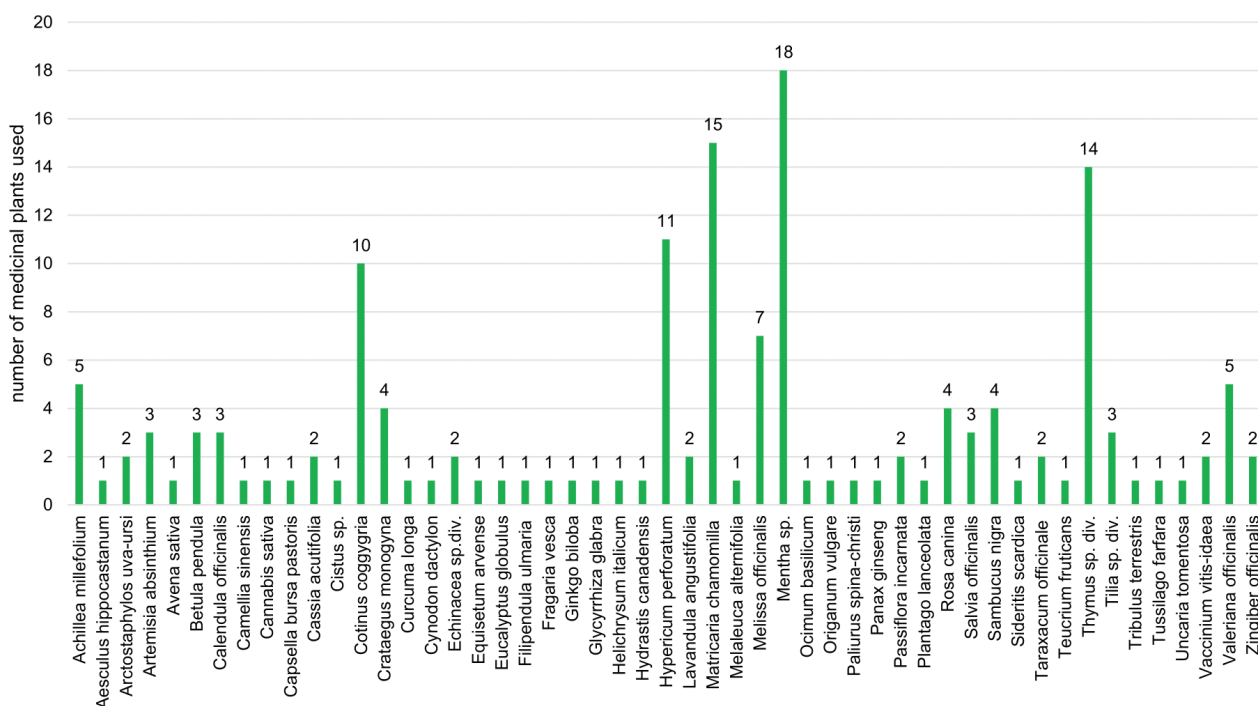


Figure 1. Type of herbs used by the participants.

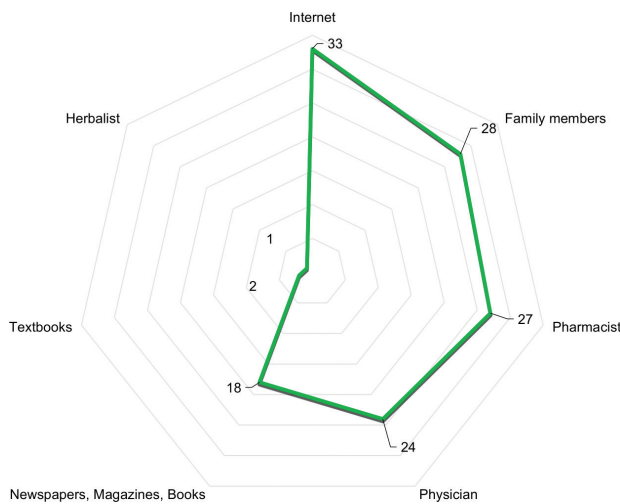


Figure 2. Preferred sources of information from the respondents.

Discussion

Main findings

Among the Bulgarian cohort observed in this study, the Internet was the most preferred source of information about herbs and herbal products. Interestingly, most respondents preferred scientific journals and e-books over less reliable sources such as blogs and untrustworthy websites. This is significant as it suggests that many individuals seek more structured and scientifically grounded information about their health. Moreover, 41% of respondents reported not having received any consultation from pharmacists despite expressing a preference for professional advice. This gap between the demand for expertise and access to consultations highlights a critical area for healthcare improvement in Bulgaria. Additionally, a considerable percentage of respondents also expressed belief in the effectiveness of herbal medicines as a treatment method and a willingness to self-treat with herbs. This reflects the Bulgarian population's preference for natural treatment sources over chemical alternatives.

Interpretation of the findings

The findings of our study reveal several crucial aspects of herbal medicine use in Bulgaria. Most herbal products available in the country can be obtained without a doctor's prescription, which allows patients to decide which products to use based on their symptoms. However, without consulting a doctor or pharmacist, patients may be at risk of overdosing on herbs, experiencing side effects, or encountering adverse interactions between the herbs and other medications they are taking. The literature broadly describes adverse events and potential organ toxicity when taking herbs, challenging the popular opinion that they are always safe (Asokkumar and Ramachandran 2019; Kahraman et al. 2021; Suroowan et al. 2021). Despite the availability of pharmacists as primary healthcare

providers, who play a significant role in ensuring the safe and informed use of herbal products, our study found the majority of respondents were not utilising their expertise. According to a 2019 survey with 280 Bulgarian participants, 92.6% of patients seek pharmacist advice before purchasing an over-the-counter (OTC) product (Lebanova et al. 2020). Similarly, another study found that 52.5% of respondents agree that a pharmacist's opinion significantly influences their decision to purchase OTC medicines (Tsvetkova et al. 2014). Despite this, several barriers hinder pharmacists from effectively consulting patients, such as the pressure to dispense medication quickly, a noisy work environment, limited knowledge of OTC products, lack of communication skills, or different social and cultural backgrounds of patients (Alseid et al. 2021). These limitations may explain why nearly 41% of survey respondents reported not receiving consultation from a pharmacist, which raises concerns about their health.

Additionally, access to accurate information remains a growing concern. While some of our respondents accessed more reliable online sources like scientific articles and pharmacy websites, others turned to unverified online content. Healthcare professionals (HCPs) need to give patients accurate information concerning the side effects of herbal drugs and the interaction between herbs and conventional medications. They should engage in open and helpful conversations. Physicians must be knowledgeable about the effects of medicinal plants when prescribing them, considering the patients' comorbidities and individual characteristics. A 2023 study found that doctors' lack of confidence in their knowledge is a reason they do not prescribe herbal medicinal plants or consult with their patients (Dores et al. 2023). It is also important to know where to check for reliable information about the mechanisms of action of the active substances contained in herbs and to advise patients where to find it on the Internet. Education programs for HCPs who prescribe herbal medicines are necessary, as well as for the pharmacists, who dispense these products, check the accuracy of prescribed medication concerning patients' characteristics, and provide consultation on the correct use of the medicines.

Many experts in the field have documented the current knowledge of medicinal plants in Bulgaria and their therapeutic effects (Ivancheva and Stancheva 2000; Ploetz 2000; Leporatti and Ivancheva 2003; Ploetz and Orr 2004; Kültür and Sami 2008; de Boer HJ 2010; Dragoeva et al. 2015; Boycheva and Ivanov 2021). Additionally, new applications of medicinal plants have been recorded (Kozuharova et al. 2012). These studies demonstrate the relative safety of medicinal plants, which accounts for their widespread use among the Bulgarian population. However, none of these studies revealed the significance of the Internet as a source of information regarding self-phytotherapy, nor did they address the respondent's low level of criticism toward the quality of information obtained from online sources, which was identified in our study.

Further study implications

Our study suggests that self-medication with medicinal plants should follow an evidence-based approach and requires guidance from qualified professionals. A key implication of our study is the need to develop a structured algorithm for guiding patients in the selection and proper use of herbal products. This algorithm should be integrated into everyday healthcare practices to ensure informed decisions about herbal treatments. Since many of these traditional products can be obtained without a prescription, pharmacists need to identify potential interactions, guide consumers on the proper use of herbs and supplements, and ultimately reduce the risk of harmful drug interactions, promoting overall public health (Dores et al. 2023).

The healthcare sector is experiencing rapid and successful digitalisation. Digital transformation can be defined as “a process that aims to improve an entity by triggering significant changes to its properties through combinations of information, computing, communication, and connectivity technologies” (Vial 2019). Our study indicates that younger populations are more inclined to turn to the Internet for health-related information. This demographic shift emphasises the importance of developing digital health education programs that target this younger group. In 2020, the WHO created the Digital Health Platform Handbook—a toolkit designed to help countries build and implement a digital health platform (DHP) (World Health Organisation 2020). The handbook is developed in the context of implementing WHO’s Global Strategy on Digital Health 2020–2025, which aims to “improve health for everyone, everywhere by accelerating the adoption of appropriate digital health” (World Health Organisation 2021). Several recent studies indicate that digital healthcare is advancing in Bulgaria, with various efforts to overcome potential challenges and barriers (Dimitrova 2023; Vazov et al. 2024; Toshev et al. 2024). Given that many respondents in our survey obtain information from the Internet, there is a need for a comprehensive DHP that provides accurate and reliable information about herbal treatments to ensure patient safety. Future directions in this field emphasise the importance of interdisciplinary collaboration, the utilisation of artificial intelligence, and personalised communication with the patient at a level that is comprehensible to them. In addition, it is necessary to implement strategies and innovative solutions to combat the disinformation that spreads rapidly on social media platforms, reaching large audiences before taking action to assess information critically (Okoro et al. 2024).

Strengths and limitations

To the best of our knowledge, this is one of the few studies focused on citizens’ awareness of natural treatment sources. It aims to engage various subgroups of citizens from different regions, educational backgrounds, and social levels. Considering the national specificities, this approach allows for a comprehensive analysis of the current landscape regarding herbal treatment and the preferred

sources of information across Bulgaria. Furthermore, this study could serve as a foundational pilot for more extensive research, ultimately informing policies and best practices related to herbal utilisation, particularly at the local level. Such initiatives could help mitigate the negative consequences associated with irrational herbal use.

It is also important to consider some limitations of this study. First, the participant selection was biased, as it relied primarily on the researchers’ personal networks, which likely influenced the educational and social demographics of the respondents. This limitation will be overcome in the following continuing research. Additionally, the study was conducted entirely online, introducing a potential selection bias favouring younger, more technologically literate respondents. The demographic profile, with 57% of participants aged 18–30, reflects this bias and may not represent the general population. Age groups were analysed in terms of their distribution within the sample, but no further stratification (e.g., behaviours by age) was performed, which limits the analysis. Future studies will aim to include more diverse demographic groups through alternative recruitment strategies. Secondly, the survey was not tested for comprehensiveness and readability using a Likert scale. Finally, the sample size is small, even for a pilot study, which limits our ability to draw statistically significant conclusions and compromises the accuracy and precision of the findings.

Conclusion

Many surveyed participants are confident that herbal remedies are effective and are open to self-treating with herbs. Many respondents rely on the Internet as their primary source of information, raising concerns about the potential for misinformation and its implications for public health. Efforts are needed to develop a reliable and accessible online source of evidence-based information. Looking ahead, cross-disciplinary collaboration, integration of advanced technologies, and global cooperation are crucial in combating health misinformation. Implementing these strategies can improve public awareness and understanding of herbal remedies and contribute to a healthier, more informed society.

Additional information

Conflict of interest

The authors have declared that no competing interests exist.

Ethical statements

The authors declared that no clinical trials were used in the present study.

The authors declared that no experiments on humans or human tissues were performed for the present study.

The authors declared that no informed consent was obtained from the humans, donors or donors’ representatives participating in the study.

The authors declared that no experiments on animals were performed for the present study.

The authors declared that no commercially available immortalised human and animal cell lines were used in the present study.

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Author contributions

EK provided the initial idea for this research. IN and MK conceptualized and conducted the survey, and MK and AK performed the statistical analysis. IN wrote the initial draft of this work,

which MK critically revised. All authors carefully reviewed and approved the final version of the manuscript. The authors have reached a consensus on the journal to which they will submit the article.

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Data availability

All of the data that support the findings of this study are available in the main text or Supplementary Information.

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Supplementary material 1

Structure of the survey

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Data type: docx

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Supplementary material 2

Herbs utilisation

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Data type: docx

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