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ETHNOBOTANICAL KNOWLEDGE AND UTILIZATION OF LOCAL MEDICINAL PLANTS IN HEALTHCARE AMONG THE PEOPLE OF BOGURA, BANGLADESH: A CROSS-SECTIONAL SURVEY

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ABSTRACT

Background: Medicinal plants have long been an integral component of traditional healthcare systems and continue to play an important role in community-based healthcare, particularly in low- and middle-income countries. In Bangladesh, traditional medicinal knowledge is preserved through family practices, traditional medicine practitioners, and community-based knowledge transmission. Despite the widespread use of medicinal plants, systematic documentation of ethnobotanical knowledge, utilization patterns, and healthcare-related perceptions among Bogura District's general population remains limited.

Objective: This study aimed to assess ethnobotanical knowledge and utilization of local medicinal plants in healthcare among the people of Bogura, Bangladesh, focusing on awareness, commonly used medicinal plant species, health conditions addressed, preparation methods, sources of knowledge, perceived effectiveness, safety perceptions, and healthcare preferences.

Conclusion: Medicinal plants remain an important component of healthcare knowledge and practices among the surveyed population of Bogura, Bangladesh. The findings demonstrate substantial acceptance of herbal medicine, diverse utilization patterns, and the continuing influence of traditional practitioners and family-based knowledge transmission. Nevertheless, modern medicine remained the preferred healthcare system, and perceptions of herbal medicine safety were mixed.

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1. Introduction

Medicinal plants have played a fundamental role in human healthcare since ancient times and continue to be widely used in healthcare systems worldwide. Throughout history, different civilizations have relied on plants for disease prevention, treatment, and management because of their therapeutic potential, accessibility, affordability, and cultural significance. Despite advances in modern medicine, plant-based remedies remain an important healthcare resource, particularly in low- and middle-income countries where access to conventional healthcare services may be limited. The World Health Organization (WHO) recognizes traditional medicine as a significant component of global healthcare and emphasizes the dependence of a substantial proportion of populations in developing countries on traditional medicine, including plant-based therapies, to meet their primary healthcare needs (WHO, 2019).

Medicinal plants contain numerous bioactive constituents, including alkaloids, flavonoids, tannins, terpenoids, phenolic compounds, and glycosides, which have been associated with various pharmacological activities, such as antimicrobial, antioxidant, anti-inflammatory, antidiabetic, and anticancer effects (Fabricant & Farnsworth, 2001). Traditional knowledge of medicinal plants has also contributed to modern drug discovery, as several important therapeutic agents have originated from natural products, highlighting the potential value of indigenous medicinal knowledge in pharmaceutical research (Newman & Cragg, 2020). Ethnobotany is an interdisciplinary scientific field concerned with the relationships between people and plants, encompassing their identification, traditional uses, cultural importance, and conservation. Ethnobotanical investigations offer valuable insights into indigenous knowledge, plant selection, preparation practices, and community-based healthcare systems (Cotton, 1996; Martin, 1995).

Communities commonly develop traditional medicinal knowledge through accumulated experience and transmit it across generations, primarily through families, traditional healers, and older members of society. This knowledge includes plant identification, harvesting practices, selecting plant parts, preparation procedures, dosage forms, and traditional therapeutic applications. People may prepare medicinal plants as decoctions, infusions, juices, pastes, or powders, or consume them directly in their natural forms. Traditional medicine often uses leaves because they are readily accessible, renewable, and contain diverse bioactive constituents (Uddin &Zidorn, 2020). Beyond their therapeutic applications, traditional plant knowledge reflects the cultural heritage and ecological understanding of local communities. Nevertheless, modernization, urbanization, environmental deterioration, and changing lifestyles increasingly threaten the continuity of this knowledge. Consequently, systematically documenting ethnobotanical practices is essential to preserve cultural heritage and identify medicinal plants that warrant further pharmacological investigation (Heinrich, 2010).

In developing countries, medicinal plants remain particularly important because they are affordable, locally available, and accepted within established cultural practices. Rural populations often use traditional plant-based remedies to manage common health problems, including gastrointestinal disorders, respiratory infections, skin conditions, fever, wounds, pain, inflammation, and chronic diseases. Several interconnected factors influence the selection and use of medicinal plants, including local plant availability, socioeconomic circumstances, access to healthcare facilities, cultural beliefs, and previous experiences with traditional treatments. For many rural households, medicinal plants constitute an integral component of routine healthcare rather than merely an alternative to conventional medical services.

Traditional medicine also has socioeconomic significance because it may reduce healthcare expenditure and provide accessible treatment options within local communities. However, scientific documentation and evaluation are necessary because traditional use alone cannot establish a medicinal plant's efficacy or safety. Ethnobotanical research can provide a foundation for subsequent phytochemical characterization, pharmacological assessment, and clinical investigation.

Bangladesh has substantial biological diversity, supported by its tropical climate, fertile plains, forests, wetlands, and varied ecological environments. These conditions support numerous medicinal plant species found in rural settlements, household gardens, agricultural lands, and natural habitats. Traditional healthcare systems, including Ayurveda, Unani, and folk medicine, have historically contributed to healthcare practices throughout the country. Rural communities continue to use locally available plants to manage a range of health conditions. Traditional practitioners, commonly known as *Kabiraj*, and experienced older community members often retain considerable knowledge concerning plant identification, preparation, and therapeutic use. People often use medicinal plants cultivated or collected near households to treat digestive complaints, fever, respiratory disorders, skin diseases, wounds, and diabetes (Ghani, 2003).

Previous ethnobotanical investigations in Bangladesh have documented extensive medicinal plant knowledge among rural and indigenous communities. Rahmatullah et al. (2012) described diverse therapeutic applications of medicinal plants among traditional practitioners, whereas Alam et al. (2011) highlighted the importance of conserving indigenous medicinal knowledge. Existing evidence also indicates that medicinal plant use varies by geographical setting, ecological characteristics, and cultural traditions. Although several studies have examined medicinal plants in different parts of Bangladesh, some geographical areas remain inadequately investigated. Previous research has often focused on indigenous populations, forest-dependent communities, or specific ecological regions, leaving traditional medicinal knowledge among the broader rural population comparatively under-documented.

Bogura District, in northern Bangladesh, is predominantly rural, with agriculture and traditional practices central to everyday life. Residents may use medicinal plants obtained from their surroundings to manage minor illnesses and support household healthcare. However, despite the potential importance of these practices, comprehensive information concerning local medicinal plant knowledge, utilization patterns, and healthcare applications among the population of Bogura remains limited. Location-specific ethnobotanical surveys matter because local biodiversity, environmental conditions, cultural traditions, and community experiences shape medicinal plant use. Investigating these practices in Bogura can therefore establish baseline information for traditional knowledge preservation, biodiversity conservation, and future pharmacological research.

Documenting medicinal plant use is also relevant to biodiversity conservation. Habitat destruction, agricultural expansion, climate change, and unsustainable harvesting may threaten medicinal plant species, potentially resulting in the loss of both biological resources and the traditional knowledge associated with them. Ethnobotanical studies can identify culturally important medicinal species, document their traditional uses, and support sustainable management of plant resources. Such information may contribute to conservation initiatives and facilitate the scientific investigation of medicinal plants for potential therapeutic development (Hamilton, 2004). Nevertheless, the integration of traditional knowledge into contemporary healthcare requires appropriate scientific validation, toxicity evaluation, and quality control before broader therapeutic recommendations can be made.

Given medicinal plants' continued contribution to community healthcare and the limited documentation of their traditional use in Bogura, Bangladesh, further systematic investigation is warranted. A better understanding of how local people identify, prepare, use, and preserve medicinal plant resources may provide valuable evidence concerning community healthcare practices and the continuity of indigenous knowledge. Accordingly, this study aimed to assess ethnobotanical knowledge and the utilization of local medicinal plants in healthcare among the people of Bogura, Bangladesh, through a cross-sectional survey. Specifically, the study examined commonly used medicinal plants, their traditional therapeutic applications, the plant parts utilized, preparation methods, sources of medicinal knowledge, and patterns of community use. The findings are expected to contribute to documenting and preserving traditional medicinal knowledge, encourage medicinal plant conservation, and provide a basis for future phytochemical and pharmacological investigations.

2. Review of Literature

Ethnobotany is an interdisciplinary field that explores the dynamic relationship between human societies and plant resources, focusing on traditional knowledge, cultural practices, and the use of plants for food, medicine, and other purposes. The discipline provides a framework for understanding how indigenous and local communities identify, manage, and use biological resources in their environment (Martin, 1995; Cotton, 1996). Among applications of ethnobotanical knowledge, medicinal plant use remains one of the most studied areas because it directly supports community healthcare and may contribute to pharmaceutical discovery.Traditional medicinal knowledge has developed through generations of observation, experimentation, and cultural transmission. Local communities often possess detailed knowledge regarding plant identification, harvesting periods, preparation methods, dosage forms, and therapeutic applications. However, this knowledge is frequently transmitted orally and remains undocumented, making it vulnerable to loss due to modernization, environmental changes, and reduced interaction between younger generations and traditional knowledge holders (Heinrich, 2010; Vandebroek & Balick, 2012).Ethnobotanical investigations are therefore important not only for documenting cultural heritage but also for identifying medicinal plants with potential therapeutic value. Information obtained from traditional medicine practices has historically contributed to the discovery of biologically active compounds and modern pharmaceutical agents. Natural products derived from medicinal plants continue to provide important sources for antimicrobial, anticancer, anti-inflammatory, antidiabetic, and cardiovascular drugs (Fabricant & Farnsworth, 2001; Newman & Cragg, 2020).

Medicinal plants continue to play a significant role in healthcare systems worldwide, particularly in developing countries where healthcare accessibility and affordability remain major challenges. The World Health Organization (WHO) recognizes traditional medicine as an important component of primary healthcare and emphasizes the need for evidence-based evaluation, conservation, and sustainable utilization of medicinal plant resources (World Health Organization [WHO], 2019).Rural communities often depend on medicinal plants because they are locally available, culturally accepted, and economically affordable. People commonly use these plants to treat common illnesses such as gastrointestinal disorders, respiratory infections, skin diseases, fever, wounds, pain, inflammation, and chronic conditions. Continued reliance on medicinal plants reflects not only healthcare needs but also the preservation of traditional ecological knowledge.Ethnobotanical studies across different geographical regions have shown considerable diversity in medicinal plant use. These studies document variations in plant species selection, disease categories treated, plant parts used, and preparation methods across ecological conditions and cultural backgrounds (Bussmann & Sharon, 2006). These variations highlight the importance of conducting region-specific ethnobotanical surveys because local environmental and sociocultural factors strongly influence traditional knowledge.

The therapeutic importance of medicinal plants largely stems from their diverse phytochemical constituents. Plants produce secondary metabolites such as alkaloids, flavonoids, phenolic compounds, tannins, terpenoids, and glycosides that demonstrate various biological activities. Scientific investigations of traditionally used plants have frequently identified pharmacologically active compounds that support their traditional applications (Fabricant & Farnsworth, 2001).Historically, ethnobotanical information has contributed significantly to pharmaceutical development. For example, several clinically important drugs have originated from natural products, including anticancer agents, antimalarial compounds, and cardiovascular medicines. Newman and Cragg (2020) reported that natural products and their derivatives remain a major source of new therapeutic agents despite advances in synthetic chemistry.Integrating ethnobotanical knowledge with modern pharmacological research offers an effective strategy for selecting promising medicinal plants for further investigation. Quantitative ethnobotanical approaches, including use value (UV), fidelity level (FL), informant consensus factor (ICF), and relative frequency of citation (RFC), have improved the scientific evaluation of traditional medicinal practices (Tardío& Pardo-de-Santayana, 2008).

Bangladesh possesses rich biodiversity due to its tropical climate, fertile agricultural lands, forests, wetlands, and diverse ecosystems. The country contains numerous medicinal plant species that rural communities and indigenous populations traditionally use. Traditional healthcare systems, including Ayurveda, Unani, and folk medicine, have historically played important roles in disease management throughout Bangladesh (Ghani, 2003).Rural households frequently use medicinal plants obtained from home gardens, agricultural fields, and surrounding natural habitats. Traditional healers (*Kabiraj*) and elderly community members often serve as key sources of knowledge about medicinal plants. Commonly reported medicinal applications include treatment of

gastrointestinal disorders, respiratory problems, skin diseases, diabetes, fever, wounds, and reproductive health problems.Several ethnobotanical studies in Bangladesh have demonstrated the richness of traditional medicinal knowledge. Rahmatullah et al. (2012) documented numerous medicinal plant species used by traditional practitioners and highlighted the importance of preserving folk medicinal knowledge. Similarly, Uddin and Hassan (2014) reported significant ethnomedicinal knowledge among rural communities and emphasized the importance of documenting plant-based healthcare practices.Recent ethnobotanical investigations have further demonstrated the diversity of medicinal plant practices in different regions of Bangladesh. A study among the Pangkhua indigenous community in Rangamati documented extensive ethnomedicinal knowledge and identified numerous plant species used for healthcare purposes, highlighting the cultural importance of medicinal plants among indigenous populations (Faruque et al., 2019). Similarly, studies from northern Bangladesh have reported considerable medicinal plant diversity. An ethnobotanical survey conducted in Dinajpur documented 109 medicinal plant species belonging to 60 families used for treating 55 different ailments, demonstrating the extensive dependence of local communities on plant-based healthcare resources.

Bangladesh has a long history of traditional healthcare practices in which medicinal plants constitute an important component of primary healthcare, particularly among rural populations. Despite the expansion of modern healthcare facilities, many communities continue to depend on locally available medicinal plants because of their accessibility, affordability, and cultural acceptance. Traditional healers (*Kabiraj*), elderly community members, and household caregivers frequently preserve and transmit knowledge regarding plant-based remedies through generations (Ghani, 2003).Ethnobotanical investigations conducted in different regions of Bangladesh have revealed considerable diversity in medicinal plant utilization. Studies have documented that local communities use medicinal plants for treating a wide range of health conditions, including gastrointestinal disorders, respiratory problems, skin diseases, fever, pain, inflammation, diabetes, hypertension, and reproductive health problems. The selection of medicinal plants and their therapeutic applications vary according to geographical location, environmental availability, and cultural practices (Rahmatullah et al., 2012).A survey conducted among traditional medicinal practitioners in Bangladesh demonstrated that folk healers possess extensive knowledge regarding medicinal plant species, disease-specific applications, and preparation techniques. The study emphasized that medicinal plant knowledge is highly localized and differs significantly between communities, highlighting the importance of conducting ethnobotanical studies at regional levels (Rahmatullah et al., 2012). Similar observations have been reported from different parts of Bangladesh, where researchers documented diverse plant species used for traditional healthcare management.The medicinal plant practices of indigenous and forest-dependent communities have also received considerable research attention. Studies conducted in the Chittagong Hill Tracts and other biodiversity-rich regions of Bangladesh have documented extensive traditional knowledge regarding medicinal plants and their therapeutic applications. These studies indicate that indigenous communities maintain unique relationships with surrounding plant resources and possess valuable ecological knowledge that contributes to healthcare practices and biodiversity conservation.

The therapeutic application of medicinal plants depends not only on plant species selection but also on the specific plant parts utilized and methods of preparation. Ethnobotanical studies worldwide have reported that leaves are among the most frequently used plant parts, followed by roots, bark, seeds, fruits, flowers, and whole plants. The frequent use of leaves may be associated with their accessibility, ease of collection, and renewable nature compared with underground plant parts (Uddin & Hassan, 2014).Traditional preparation methods vary according to cultural practices and the type of disease being treated. Common methods include decoction, infusion, extraction of fresh juice, preparation of pastes, powders, and direct consumption of plant materials. These preparation techniques represent accumulated empirical knowledge regarding extraction of therapeutic components from medicinal plants (Martin, 1995).In Bangladesh, medicinal plants are commonly prepared using simple household techniques without advanced processing. For example, leaves may be crushed into pastes for external application on wounds or skin disorders, while roots, bark, or seeds may be boiled to prepare decoctions for internal consumption. Although these practices have been maintained for generations, scientific evaluation is necessary to determine appropriate dosage, toxicity profiles, and therapeutic effectiveness.The relationship between traditional preparation methods and pharmacological activity has been increasingly recognized. Ethnopharmacological research suggests that traditional methods of preparation may influence the concentration and biological activity of phytochemicals present in medicinal plants (Tanaka & Kashiwada, 2021). Therefore, documenting preparation methods is an essential component of ethnobotanical research because it provides important information for future pharmacological investigations.

The utilization of medicinal plants is influenced by various demographic, socioeconomic, and cultural factors. Age, education level, occupation, income status, healthcare accessibility, and cultural background may affect individuals' knowledge and practices regarding medicinal plant use. Elderly individuals often possess greater traditional knowledge because they have accumulated experience and have received information from previous generations.Education and modernization may influence traditional knowledge in complex ways. While increased education may improve awareness regarding healthcare safety and scientific evaluation, it may also contribute to reduced reliance on traditional practices. Similarly, younger generations may show less interest in learning medicinal plant knowledge due to lifestyle changes and increased dependence on modern healthcare systems (Vandebroek & Balick, 2012).Economic conditions also play an important role in medicinal plant utilization. Rural populations with limited financial resources may rely more heavily on traditional remedies because they provide low-cost alternatives to conventional medicine. However, medicinal plant use is not limited only to economically disadvantaged groups; many communities continue to use herbal remedies because of cultural preferences and perceived effectiveness.Understanding these socioeconomic influences is important because ethnobotanical knowledge is not uniformly distributed within communities. Therefore, studies investigating medicinal plant utilization should consider demographic characteristics to identify factors associated with traditional healthcare practices.

Although medicinal plants represent valuable biological and cultural resources, they face increasing threats due to environmental and socioeconomic changes. Habitat destruction, agricultural expansion, deforestation, climate change, and unsustainable harvesting

practices contribute to the decline of medicinal plant diversity. Loss of medicinal plant species may also result in the disappearance of associated traditional knowledge.Conservation of medicinal plants requires an integrated approach combining ecological protection, sustainable harvesting, community participation, and documentation of traditional knowledge. Ethnobotanical studies can contribute to conservation by identifying important medicinal species, understanding patterns of utilization, and promoting sustainable management practices (Hamilton, 2004).In Bangladesh, rapid land-use changes and biodiversity loss have raised concerns regarding the availability of medicinal plant resources. Many traditionally used plants are increasingly difficult to find in natural habitats, leading communities to depend more on cultivated or commercially available herbal products. Therefore, documenting local medicinal plant knowledge is essential before such information disappears.

Although several ethnobotanical studies have been conducted in Bangladesh, significant gaps remain regarding community-level medicinal plant knowledge and utilization patterns. Existing research has primarily focused on indigenous populations, traditional healers, forest-dependent communities, and specific ecological regions. However, limited information is available regarding medicinal plant practices among general populations living in districts such as Bogura.Bogura District represents an important area for ethnobotanical investigation because of its rural population structure, agricultural environment, and continuing practice of traditional healthcare. Many residents use locally available medicinal plants for managing common illnesses; however, systematic documentation of these practices remains insufficient.Furthermore, previous studies have often focused on documenting plant species rather than examining broader healthcare-related aspects such as awareness, perceived effectiveness, satisfaction, recommendation behavior, and socioeconomic factors influencing medicinal plant use. Understanding these dimensions is important for evaluating the contemporary role of medicinal plants in community healthcare.

Therefore, a comprehensive assessment of ethnobotanical knowledge and utilization patterns among the people of Bogura is necessary. Such information can contribute to preserving traditional knowledge, supporting medicinal plant conservation, and providing baseline evidence for future pharmacological and public health research.The present study was therefore conducted to investigate ethnobotanical knowledge and utilization of local medicinal plants in healthcare among the people of Bogura, Bangladesh, using a cross-sectional survey approach.

3. Materials and Methods

3.1 Ethical Approval and Consent

The study was conducted after obtaining ethical approval from the Hamdard University Bangladesh Research Ethics Committee (HUBREC). The research protocol followed the ethical principles of the Declaration of Helsinki for research involving human participants (World Medical Association, 2013). Before data collection, all participants were informed about the purpose, procedures, and voluntary nature of the study. Written informed consent was obtained from each participant prior to participation. All collected information was kept confidential and used exclusively for research purposes.

3.2 Study Design and Study Period

A descriptive cross-sectional survey was conducted to assess ethnobotanical knowledge, utilization patterns, and healthcare practices related to local medicinal plants among the people of Bogura District, Bangladesh. The cross-sectional design was selected to evaluate the distribution of medicinal plant-related knowledge and practices among the study population during a defined period (Setia, 2016).The study was conducted from April 2022 to September 2022. Data were collected through face-to-face interviews using a structured questionnaire. The survey assessed participants' socio-demographic characteristics, knowledge and utilization of medicinal plants, plant-based healthcare practices, perceived effectiveness, satisfaction level, and recommendations regarding the use of medicinal plants in primary healthcare.

3.3 Study Area

The study was conducted in Bogura District, Bangladesh. Bogura is located in the northern region of Bangladesh and consists of both rural and semi-urban communities. The population of this region has long-standing traditions of using locally available medicinal plants for managing common health conditions. Medicinal plants are commonly obtained from household gardens, agricultural fields, and surrounding natural environments. The cultural dependence on traditional healthcare practices makes Bogura an important area for documenting local ethnobotanical knowledge.

3.4 Study Population

The study population consisted of permanent residents of Bogura District, Bangladesh, who had knowledge of or experience with the use of medicinal plants for healthcare purposes. Individuals aged between 18 and 75 years were eligible for participation. Participants were included in the study if they were permanent residents of Bogura District, within the specified age range, willing to participate voluntarily, and able to communicate effectively during the interview process. Individuals were excluded if they were below 18 years or above 75 years of age, seriously ill or requiring emergency medical attention at the time of data collection, or unable to provide reliable information due to physical, cognitive, communication, or other limitations.

3.5 Sample Size Determination

The required sample size was estimated using the standard formula for cross-sectional studies:

$N=Z^2pq/d^2$

Where N represents the required sample size, Z represents the standard normal deviation at a 95% confidence level (1.96), p represents the estimated prevalence, q represents (1−p), and d represents the acceptable margin of error (0.05).

Due to the lack of previous studies estimating the prevalence of medicinal plant utilization among the population of Bogura, a prevalence value of 50% was assumed to obtain the maximum sample size.Therefore:

$N= z^2pq/d^2$

Here, N = the desired sample size, Z = the standard normal deviation, usually set at 1.96, which corresponds to 95% confidence level, P = Prevalence rate

So, the thumb rule will be followed

P= 50% or 0.5

p+q=1 or q= 1-p or q= 1- 0.5 or q=0.5

d= degree of accuracy desired usually set 0.05

Now, the calculated sample size will be

$(1.96)^2 (0.5) (0.5)/(0.05)^2 =384$

Although the calculated sample size was 384, due to limitations related to time, resources, and field accessibility, a feasible sample size was selected. A total of 304 participants were approached, and 300 participants completed the survey after excluding four individuals who declined participation. The final response rate was approximately 98.08%.

3.6 Sampling Technique

A convenience sampling technique was used to recruit participants. Individuals available during the study period who fulfilled the eligibility criteria were approached and invited to participate. Convenience sampling was considered appropriate because the study aimed to explore community-level knowledge and practices regarding medicinal plant utilization in a specific geographical area (Etikan et al., 2016).Participants were interviewed directly after obtaining written informed consent. Each interview was conducted using a structured questionnaire, and responses were recorded systematically.

3.7 Data Collection Tool and Procedure

Data were collected through a structured interviewer-administered questionnaire developed based on established ethnobotanical research methodologies (Martin, 1995; Cotton, 1996). The questionnaire was adapted and modified according to the local context of Bogura District to ensure its relevance for assessing community-level knowledge and utilization patterns of medicinal plants. The questionnaire consisted of two major sections. The first section collected information on the socio-demographic characteristics of the participants, including age, gender, educational qualification, occupation, income status, economic dependency, residential characteristics, and household conditions. The second section focused on medicinal plant utilization and healthcare practices, including participants' awareness and use of medicinal plants, health conditions treated with medicinal plants, commonly used herbal remedies, plant parts utilized, sources of medicinal plant knowledge, perceived effectiveness, satisfaction with medicinal plant use, and willingness to recommend medicinal plants for primary healthcare. Most questions were structured with predefined response options, including "Yes," "No," "Not sure," and "Not applicable." Responses categorized as "Not applicable" were excluded from the relevant statistical analyses to ensure appropriate interpretation of the findings.

3.8 Study Variables

The study variables were categorized into two major groups.

3.8.1 Socio-demographic Variables

Socio-demographic variables included age, gender, occupation, educational status, economic condition, dependency status, and housing characteristics.

3.8.2 Ethnobotanical and Healthcare-related Variables

The ethnobotanical variables included medicinal plant usage patterns, knowledge regarding medicinal plants, healthcare applications, perceived benefits, satisfaction level, and recommendation practices.

3.9 Data Management and Statistical Analysis

Collected questionnaires were reviewed for completeness and consistency before data entry. The responses were coded and entered into a Microsoft Excel database. Data cleaning and verification were performed before statistical analysis.

Statistical analysis was conducted using IBM SPSS Statistics version 20. Descriptive statistics were used to summarize participant characteristics and medicinal plant utilization patterns. Continuous variables were presented as mean ± standard deviation, whereas categorical variables were expressed as frequencies and percentages.

The association between socio-demographic characteristics and medicinal plant-related responses was evaluated using the Pearson's chi-square test. Variables assessed included age, gender, occupation, education level, income status, economic dependency, and housing conditions. Statistical significance was considered at a p-value <0.05.

4. Results

4.1. Socio-demographic and Socioeconomic Characteristics of Respondents

A total of 300 respondents participated in the study. The mean age of the respondents was 33.9 ± 12.8 years, with the largest proportion belonging to the 25–34 years age group (98, 32.7%), followed by 35–44 years (72, 24.0%) and 18–24 years (55, 18.3%). Respondents aged 45–54 years and ≥55 years accounted for 15.0% (45) and 10.0% (30) of the study population, respectively.

Regarding sex distribution, the majority of respondents were male (194, 64.7%), while 106 (35.3%) were female. In terms of marital status, most participants were married (185, 61.7%), followed by unmarried respondents (102, 34.0%). Widowed/widower and divorced respondents represented 3.0% (9) and 1.3% (4) of the participants, respectively.

The educational status of respondents revealed that the majority were literate (244, 81.3%). However, 35 respondents (11.7%) had no formal education, and 21 respondents (7.0%) were illiterate. Regarding economic dependency, 141 respondents (47.0%) were dependent, whereas 131 (43.7%) were non-dependent. Information regarding economic dependency was refused by 12 respondents (4.0%), while 16 (5.3%) responses were missing or unclear.

With respect to residential area, respondents were distributed across sub-urban (108, 36.0%), rural (97, 32.3%), and urban (95, 31.7%) settings. Regarding residence type, tin-shed houses were the most common (115, 38.3%), followed by single-family houses (75, 25.0%), apartments (63, 21.0%), and other types of residences (47, 15.7%).

The annual income of respondents varied considerably, with a mean annual income of 117,180.33 ± 147,674.37 BDT. Nearly half of the respondents reported no income (137, 45.67%). Among income-earning participants, the largest proportion reported an annual income of 200,001–250,000 BDT (32, 10.67%), followed by 150,001–200,000 BDT (27, 9.0%) and 50,001–100,000 BDT (26, 8.67%). Only a small proportion reported an annual income above 400,000 BDT (9, 3.0%).

Regarding occupational status, the highest proportion of respondents belonged to the other occupation category (64, 21.3%), followed by unemployed participants (59, 19.7%) and those engaged in business activities (55, 18.3%). Job holders represented 49 (16.3%) respondents, while 44 (14.7%) were students and 29 (9.7%) were housewives.

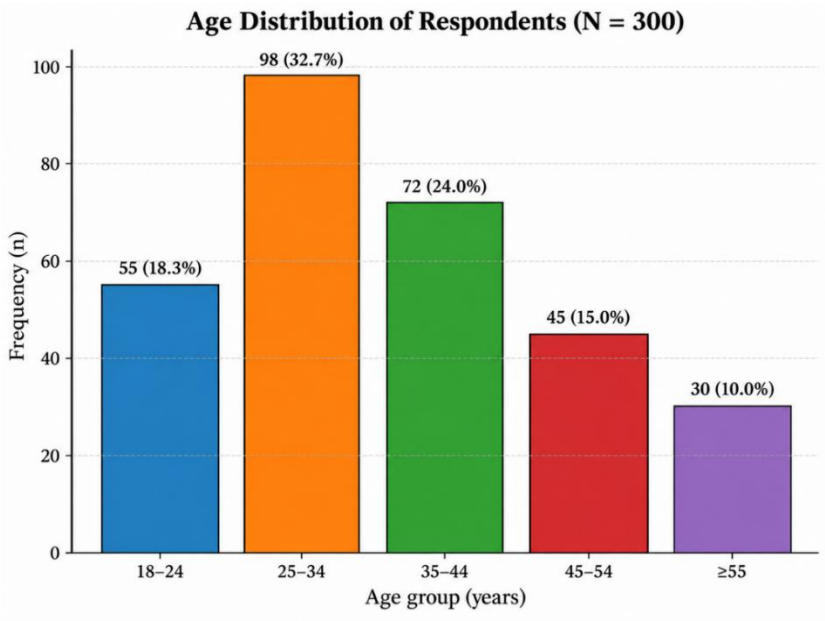
Analysis of housing characteristics showed that tin-shed houses were the predominant housing type (117, 39.0%), followed by apartments (66, 22.0%) and single-family houses (37, 12.3%). A smaller proportion of respondents lived in high-rise buildings (21, 7.0%) and mud houses (11, 3.7%).

The study population consisted mainly of young and middle-aged adults, predominantly male, married, and literate respondents. Although educational attainment was relatively high, a considerable proportion of participants were economically dependent and reported no personal income, indicating socioeconomic diversity among the study participants.

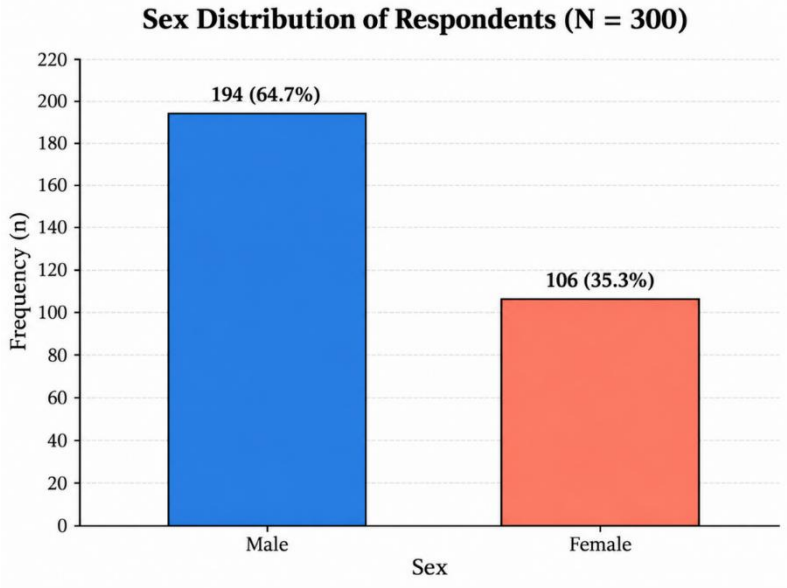
Table 4.1. Socio-demographic characteristics of the participants (N = 300)

Characteristics	Frequency (n)	Percentage (%)
Age group (years)		
18–24	55	18.3
25–34	98	32.7
35–44	72	24.0
45–54	45	15.0
≥55	30	10.0
Mean ± SD = 33.9 ± 12.8 years		
Sex		
Male	194	64.7
Female	106	35.3
Marital status		
Married	185	61.7
Unmarried	102	34.0
Widowed/Widower	9	3.0
Divorced	4	1.3
Educational status		
Literate	244	81.3
Illiterate	21	7.0
No formal education	35	11.7
Economic dependency		
Dependent	141	47.0

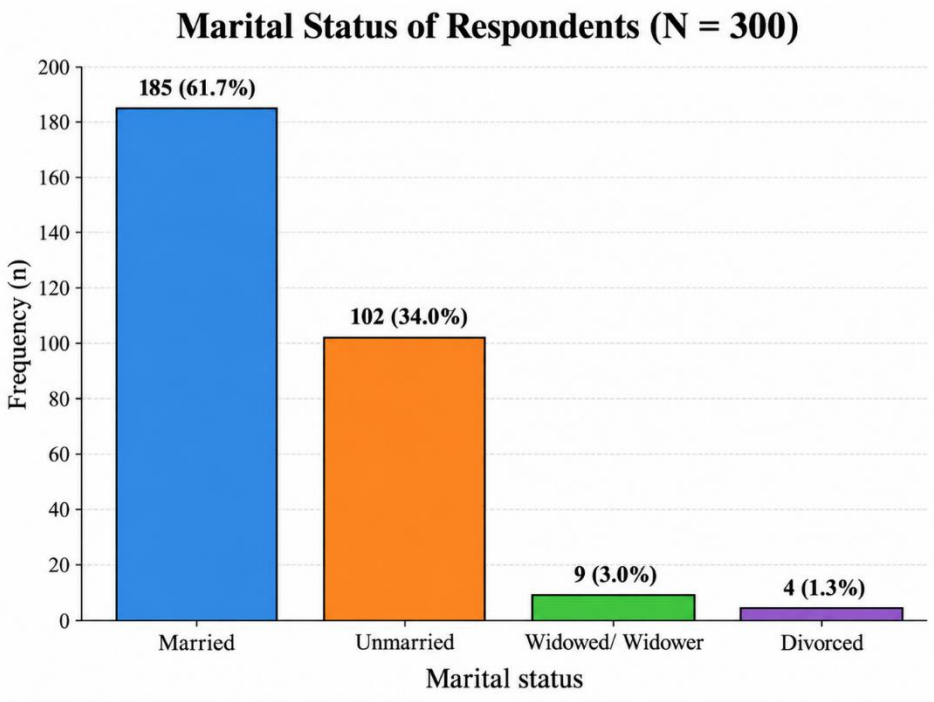
Non-dependent	131	43.7
Refused to answer	12	4.0
Missing/unclear	16	5.3
Housing area		
Urban	95	31.7
Rural	97	32.3
Sub-urban	108	36.0
Residence Type		
Tin shed	115	38.3
Apartment	63	21.0
Home/Single family house	75	25.0
Others	47	15.7
Annual income (BDT)		
No income (0)	137	45.67
≤50,000	11	3.67
50,001–100,000	26	8.67
100,001–150,000	22	7.33
150,001–200,000	27	9.00
200,001–250,000	32	10.67
250,001–300,000	22	7.33
300,001–400,000	14	4.67
>400,000	9	3.00
Mean ± SD = 117,180.33 ± 147,674.37		
Occupation		
Unemployed	59	19.7
Student	44	14.7
Job holder	49	16.3
Housewife	29	9.7
Business	55	18.3
Others	64	21.3
Total	**300**	**100.0**



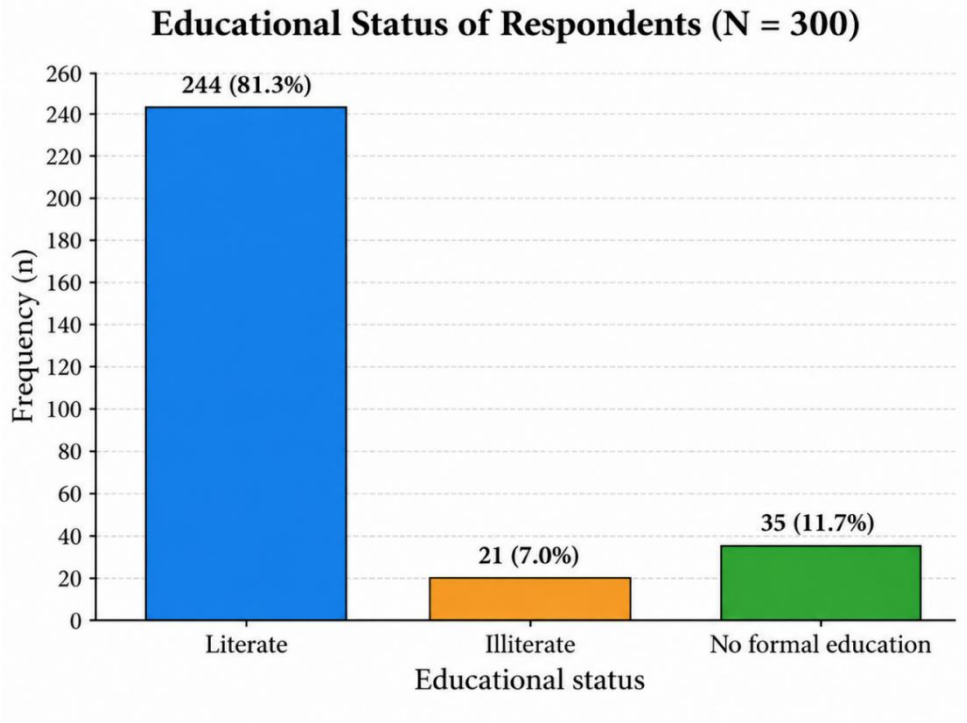
Graph 4.1. Age Distribution of Respondents (N=300)



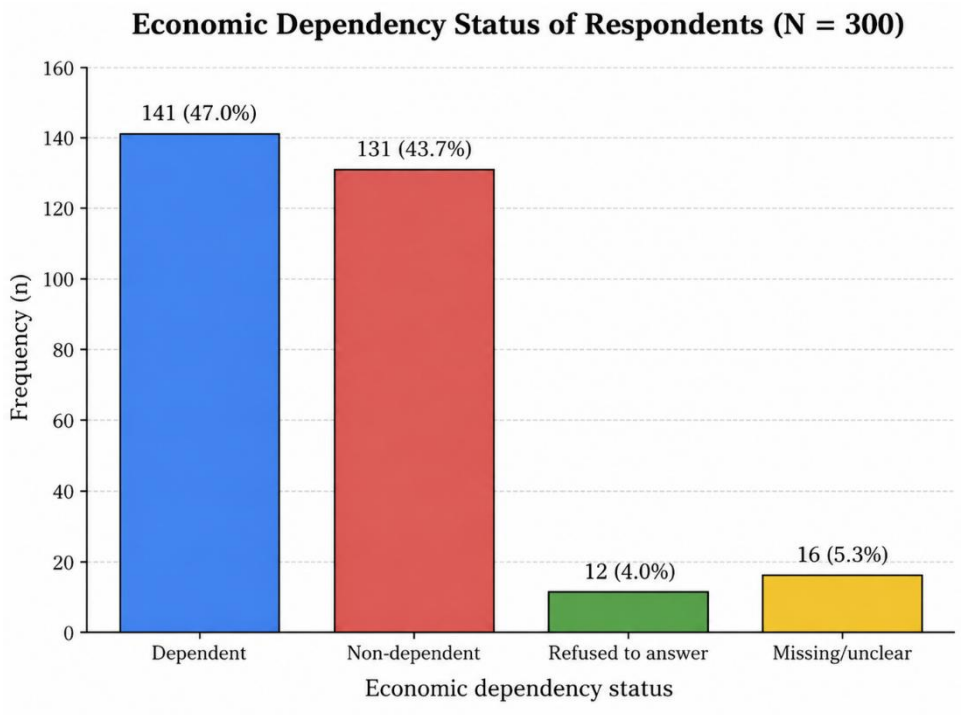
Graph 4.2.Sex Distribution of Respondents (N=300)



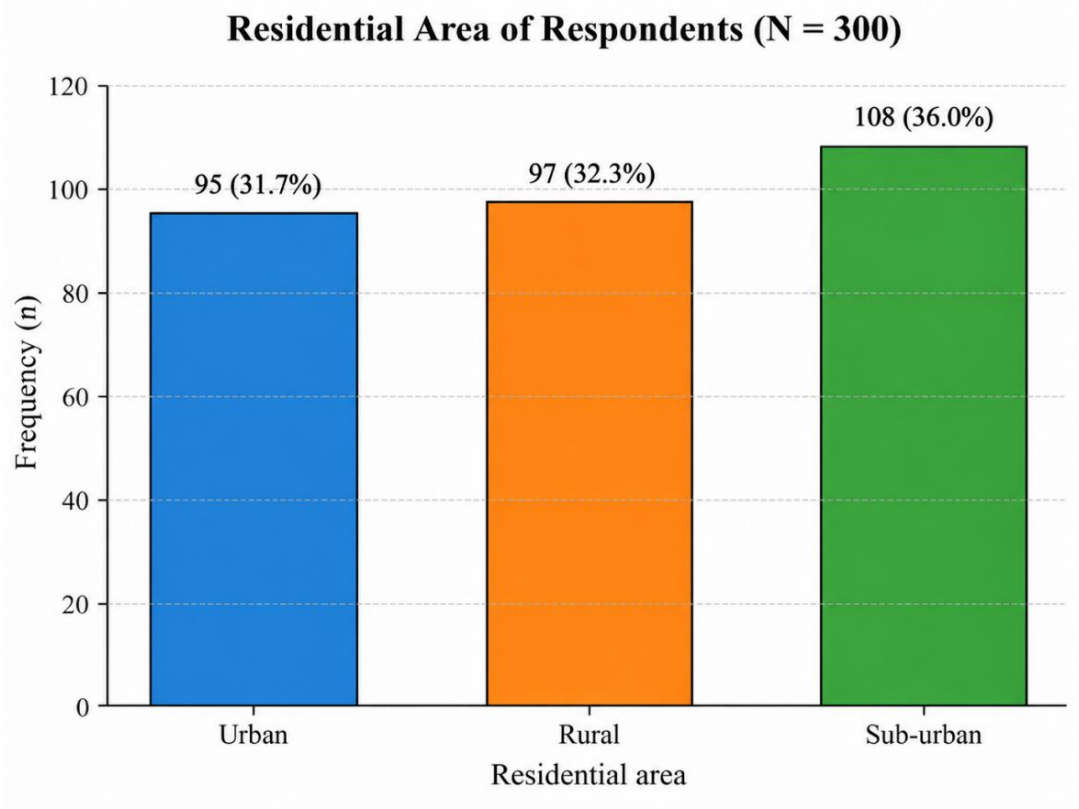
Graph 4.3.Marital Status of Respondents (N=300)



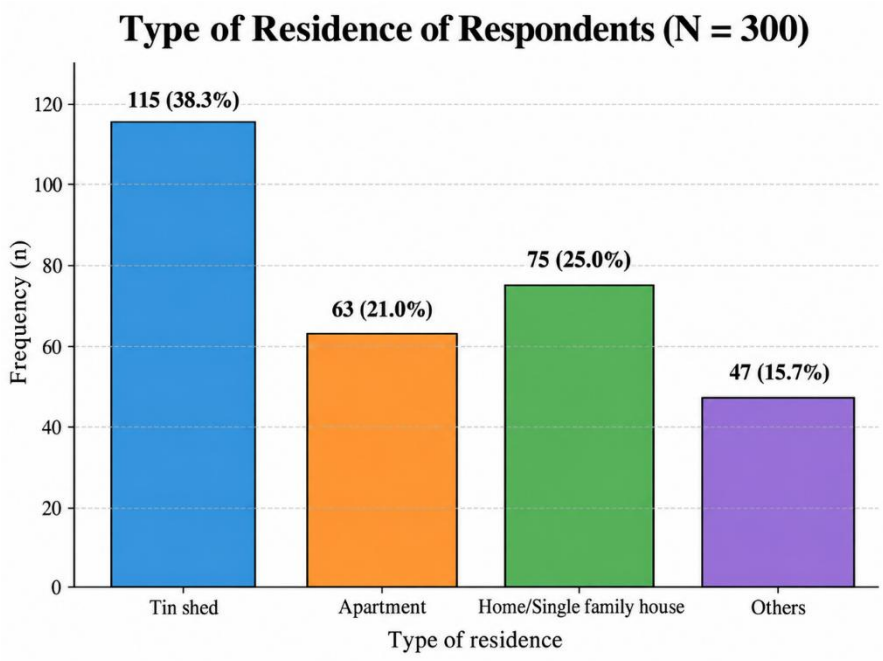
Graph 4.4.Educational Status of Respondents (N=300)



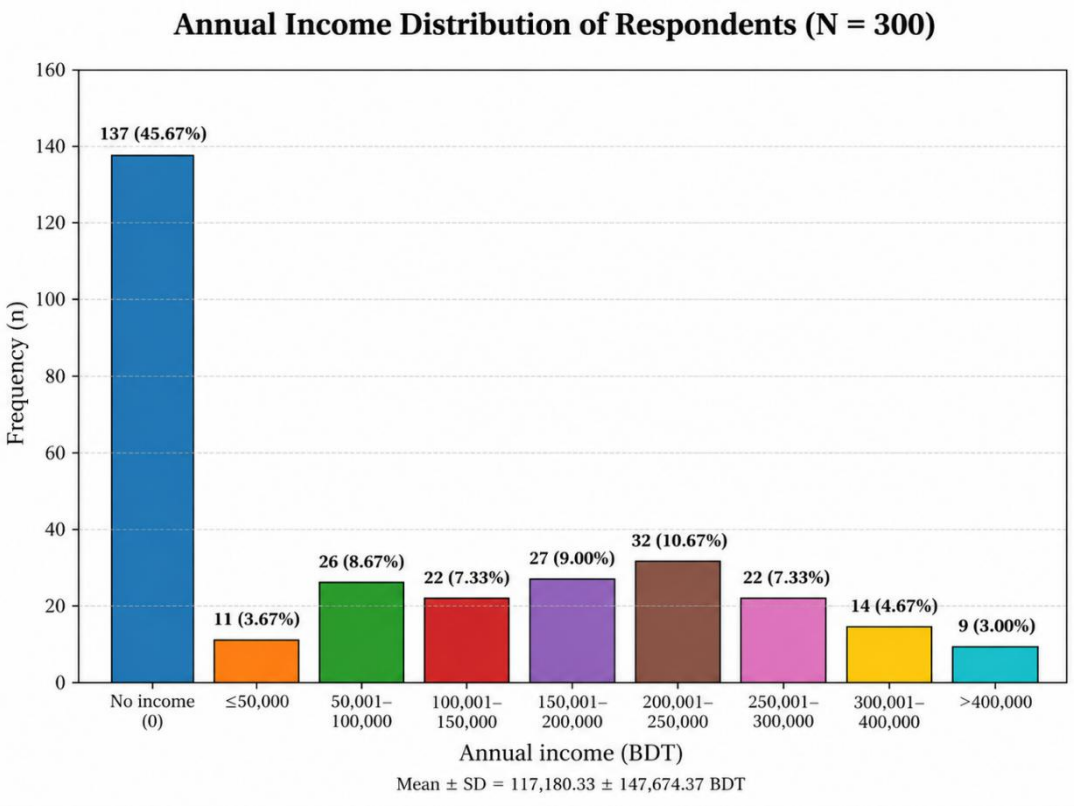
Graph 4.5.Economic Dependency Statusof Respondents (N=300)



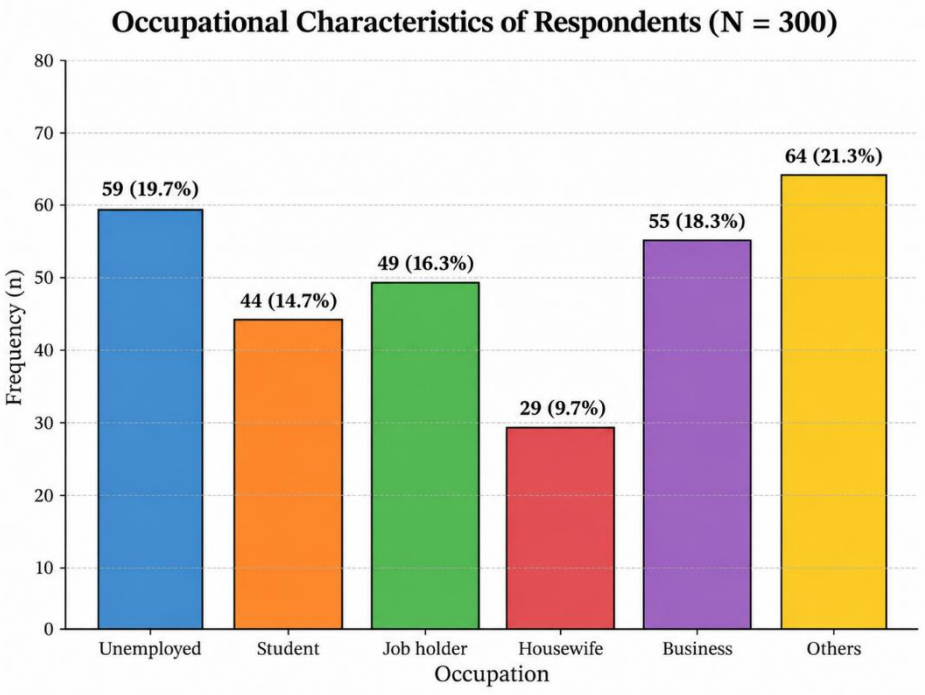
Graph 4.6.Residential Area of Respondents (N=300)



Graph 4.7.Type of Residenceof Respondents (N=300)



Graph 4.8.Annual Income Distribution of Respondents (N=300)



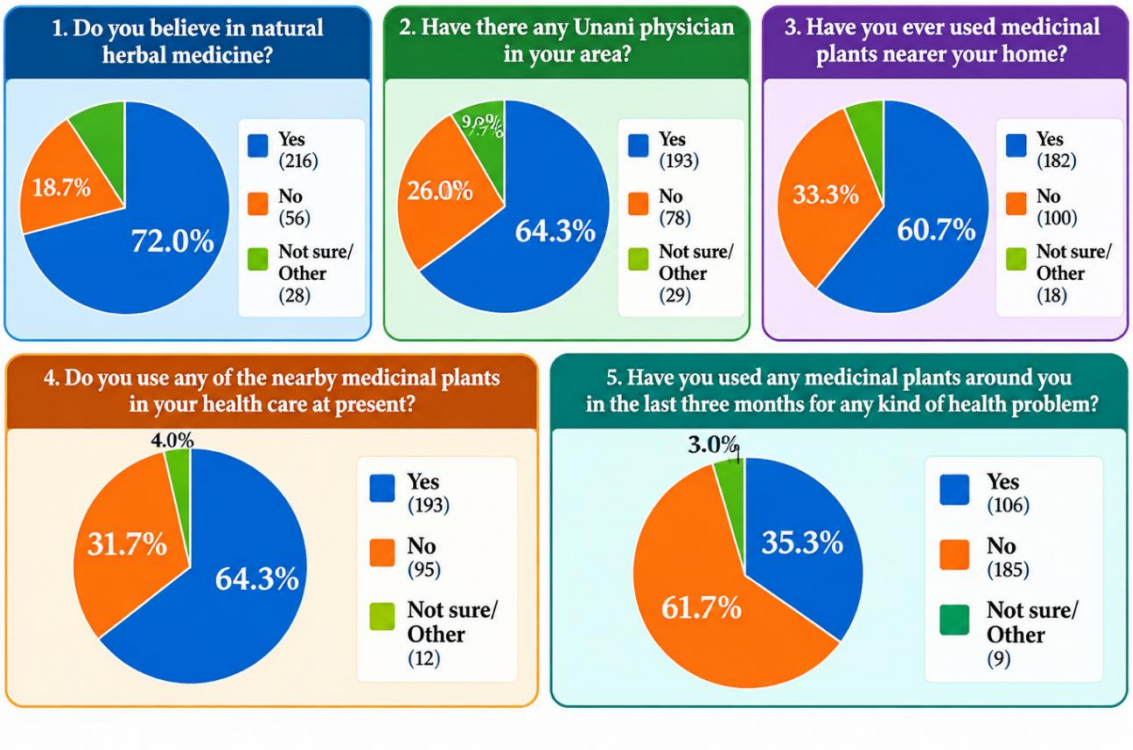
Graph 4.9.Occupational Characteristics of Respondents (N=300)

4.2 Awareness, Availability, and Utilization of Herbal Medicine among Respondents

Table 4.2: Awareness, Availability, and Utilization of Herbal Medicine among Respondents (N=300)

Question	Yes n(%)	No n(%)	Not sure/Other n(%)
Do you believe in natural herbal medicine?	216 (72.0%)	56 (18.7%)	28 (9.3%)
Are there any Unani physicians in your area?	193 (64.3%)	78 (26.0%)	29 (9.7%)
Have you ever used medicinal plants near your home for healthcare?	182 (60.7%)	100 (33.3%)	18 (6.0%)
Do you use any of the nearby medicinal plants	193 (64.3%)	95 (31.7%)	12 (4.0%)

in your health care at present?			
Have you used any medicinal plants around you in the last three months for any kind of health problem?	106 (35.3%)	185 (61.7%)	9 (3.0%)



Graph 4.10: Awareness, Availability, and Utilization of Herbal Medicine among Respondents (N=300)

The awareness, availability, and utilization pattern of herbal medicine among the respondents are presented in Table 2. Among the 300 respondents, the majority (216, 72.0%) reported that they believed in natural herbal medicine, while 56 (18.7%) did not believe in herbal medicine and 28 (9.3%) were uncertain or provided other responses.Regarding the availability of traditional healthcare providers, 193 respondents (64.3%) reported the presence of a Unani physician in their locality, whereas 78 (26.0%) reported no availability of such practitioners. About 29 respondents (9.7%) were unsure about the presence of a Unani physician in their area.In terms of previous use of medicinal plants, 182 respondents (60.7%) reported that they had used medicinal plants available near their homes for healthcare purposes, while 100 (33.3%) had never used nearby medicinal plants. A small proportion (18, 6.0%) were unsure about their previous use.Regarding current utilization of nearby medicinal plants, 193 respondents (64.3%) reported that they currently used medicinal plants as part of their healthcare practices. In contrast, 95 respondents (31.7%) reported that they did not currently use medicinal plants, and 12 (4.0%) were uncertain or provided other responses.When asked about recent use of medicinal plants for any health problems within the previous three months, 106 respondents (35.3%) reported using medicinal plants, whereas 185 (61.7%) had not used medicinal plants during this period. Only 9 respondents (3.0%) were unsure or provided other responses.Overall, the findings indicate that although a large proportion of respondents demonstrated positive beliefs and awareness regarding herbal medicine, recent utilization of medicinal plants for health problems was comparatively lower. The presence of Unani physicians in local communities and the continued use of household medicinal plants suggest that traditional medicine remains an important component of healthcare practices among the studied population.

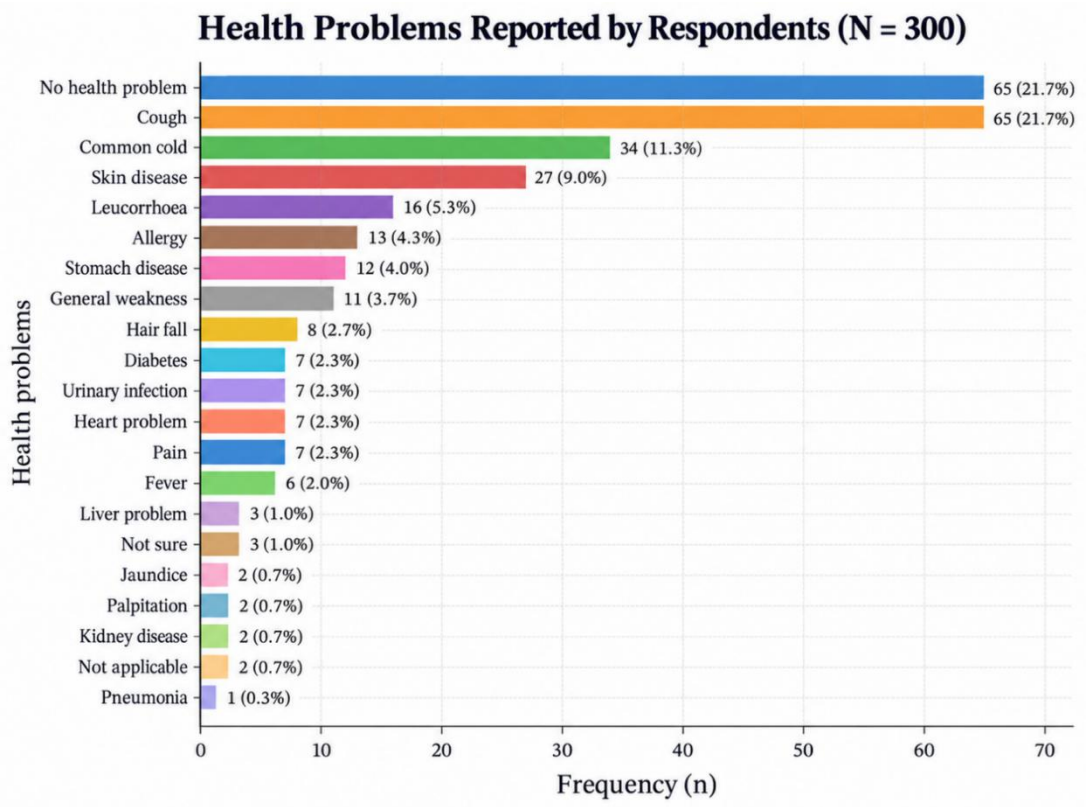
4.3 Health Problems Reported by Respondents

Table 4.3: Distribution of Reported Health Problems among Respondents (N=300)

Health Problems Reported	Frequency (n)	Percentage (%)
No health problem	65	21.7
Cough	65	21.7
Common cold	34	11.3
Jaundice	2	0.7
Skin disease	27	9.0
General weakness	11	3.7
Palpitation	2	0.7
Hair fall	8	2.7

Fever	6	2.0
Liver problem	3	1.0
Diabetes	7	2.3
Urinary infection	7	2.3
Heart problem	7	2.3
Leucorrhoea	16	5.3
Allergy	13	4.3
Kidney disease	2	0.7
Stomach disease	12	4.0
Pain	7	2.3
Pneumonia	1	0.3
Not applicable	2	0.7
Not sure	3	1.0
Total	**300**	**100.0**

The distribution of health problems reported by the respondents is presented in Table 3. Among the 300 respondents, 65 (21.7%) reported having no health problems, while an equal proportion (65, 21.7%) reported cough as a health problem for which medicinal plants or healthcare practices were used. Common cold was reported by 34 respondents (11.3%), making it the third most frequently reported health condition.Skin-related problems were reported by 27 respondents (9.0%), whereas leucorrhoea was reported by 16 respondents (5.3%). Other commonly reported conditions included allergy (13, 4.3%), stomach disease (12, 4.0%), and general weakness (11, 3.7%).A smaller proportion of respondents reported hair fall (8, 2.7%), diabetes (7, 2.3%), urinary infection (7, 2.3%), heart problems (7, 2.3%), and pain (7, 2.3%). Fever was reported by 6 respondents (2.0%), while liver problems (3, 1.0%) and kidney disease (2, 0.7%) were less frequently reported.Rarely reported health problems included jaundice (2, 0.7%), palpitation (2, 0.7%), and pneumonia (1, 0.3%). Additionally, 2 respondents (0.7%) reported responses as not applicable, and 3 respondents (1.0%) were unsure about their health condition.Overall, respiratory-related complaints, particularly cough and common cold, represented the most frequently reported health problems among respondents, followed by skin disorders and gastrointestinal complaints. The findings suggest that medicinal plant use in the study population was mainly associated with the management of common, non-communicable, and minor health conditions.

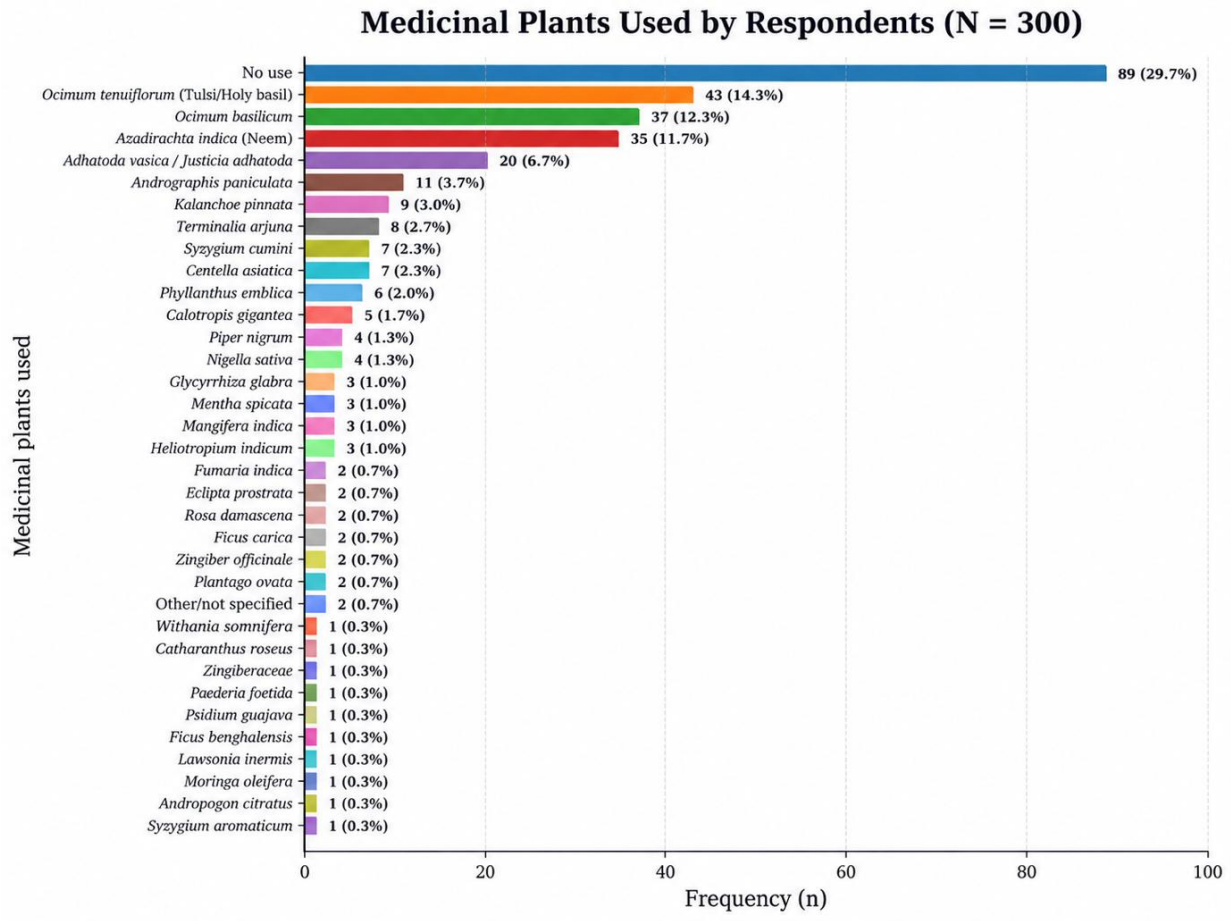


Graph 4.11. Health problems reported by respondents (N=300)

4.4 Medicinal Plants Used by Respondents

Table 4.4: Medicinal Plants Used by Respondents (N = 300)

Medicinal plant used	Frequency (n)	Percentage (%)
Ocimum tenuiflorum (Tulsi/Holy basil)	43	14.3
Ocimum basilicum	37	12.3
Azadirachta indica (Neem)	35	11.7
Adhatodavasica / *Justicia adhatoda*	20	6.7
Andrographis paniculata	11	3.7
Kalanchoe pinnata	9	3.0
Terminalia arjuna	8	2.7
Syzygium cumini	7	2.3
Centella asiatica	7	2.3
Phyllanthus emblica	6	2.0
Calotropis gigantea	5	1.7
Piper nigrum	4	1.3
Nigella sativa	4	1.3
Glycyrrhiza glabra	3	1.0
Fumaria indica	2	0.7
Ecliptaprostrata	2	0.7
Rosa damascena	2	0.7
Ficus carica	2	0.7
Mentha spicata	3	1.0
Mangifera indica	3	1.0
Heliotropium indicum	3	1.0
Zingiber officinale	2	0.7
Plantago ovata	2	0.7
Withaniasomnifera	1	0.3
Catharanthus roseus	1	0.3
Zingiberaceae	1	0.3
Paederiafoetida	1	0.3
Psidium guajava	1	0.3
Ficus benghalensis	1	0.3
Lawsonia inermis	1	0.3
Moringa oleifera	1	0.3
Andropogon citratus	1	0.3
Syzygium aromaticum	1	0.3
No use	89	29.7
Other/not specified	2	0.7
Total	**300**	**100.0**



Graph 4.12. Medicinal Plants Used by Respondents (N = 300)

The distribution of medicinal plants used by the respondents is presented in Table 4. Among the 300 respondents, 89 (29.7%) reported that they did not use any medicinal plant. Among those who used medicinal plants, *Ocimum tenuiflorum* (Tulsi/Holy basil) was the most frequently reported species, used by 43 respondents (14.3%), followed by *Ocimum basilicum* (37, 12.3%) and *Azadirachta indica* (Neem) (35, 11.7%).Other commonly reported medicinal plants included *Adhatodavasica / Justicia adhatoda* (20, 6.7%), *Andrographis paniculata* (11, 3.7%), and *Kalanchoe pinnata* (9, 3.0%). In addition, *Terminalia arjuna* was reported by 8 respondents (2.7%), while *Syzygium cumini* and *Centella asiatica* were each mentioned by 7 respondents (2.3%). *Phyllanthus emblica* was used by 6 respondents (2.0%), and *Calotropis gigantea* by 5 respondents (1.7%).A smaller proportion of respondents reported using *Piper nigrum* and *Nigella sativa* (4, 1.3% each). *Glycyrrhiza glabra*, *Mentha spicata*, *Mangifera indica*, and *Heliotropium indicum* were each used by 3 respondents (1.0%). Several other medicinal plants, including *Fumaria indica*, *Ecliptaprostrata*, *Rosa damascena*, *Ficus carica*, *Zingiber officinale*, and *Plantago ovata*, were each reported by 2 respondents (0.7%). A number of plants, such as *Withaniasomnifera*, *Catharanthus roseus*, *Paederiafoetida*, *Psidium guajava*, *Ficus benghalensis*, *Lawsonia inermis*, *Moringa oleifera*, *Andropogon citratus*, and *Syzygium aromaticum*, were each reported by 1 respondent (0.3%).The findings indicate that although nearly one-third of the respondents did not use medicinal plants, a considerable proportion relied on a variety of herbal species, with Tulsi, basil, and neem being the most commonly used. This suggests that traditional medicinal plant use remains an important component of healthcare practices among the study population.

4.5 Sources of Knowledge Regarding Medicinal Plant Use among Respondents

Table 4.5: Sources of Knowledge Regarding Medicinal Plant Use among Respondents (N = 300)

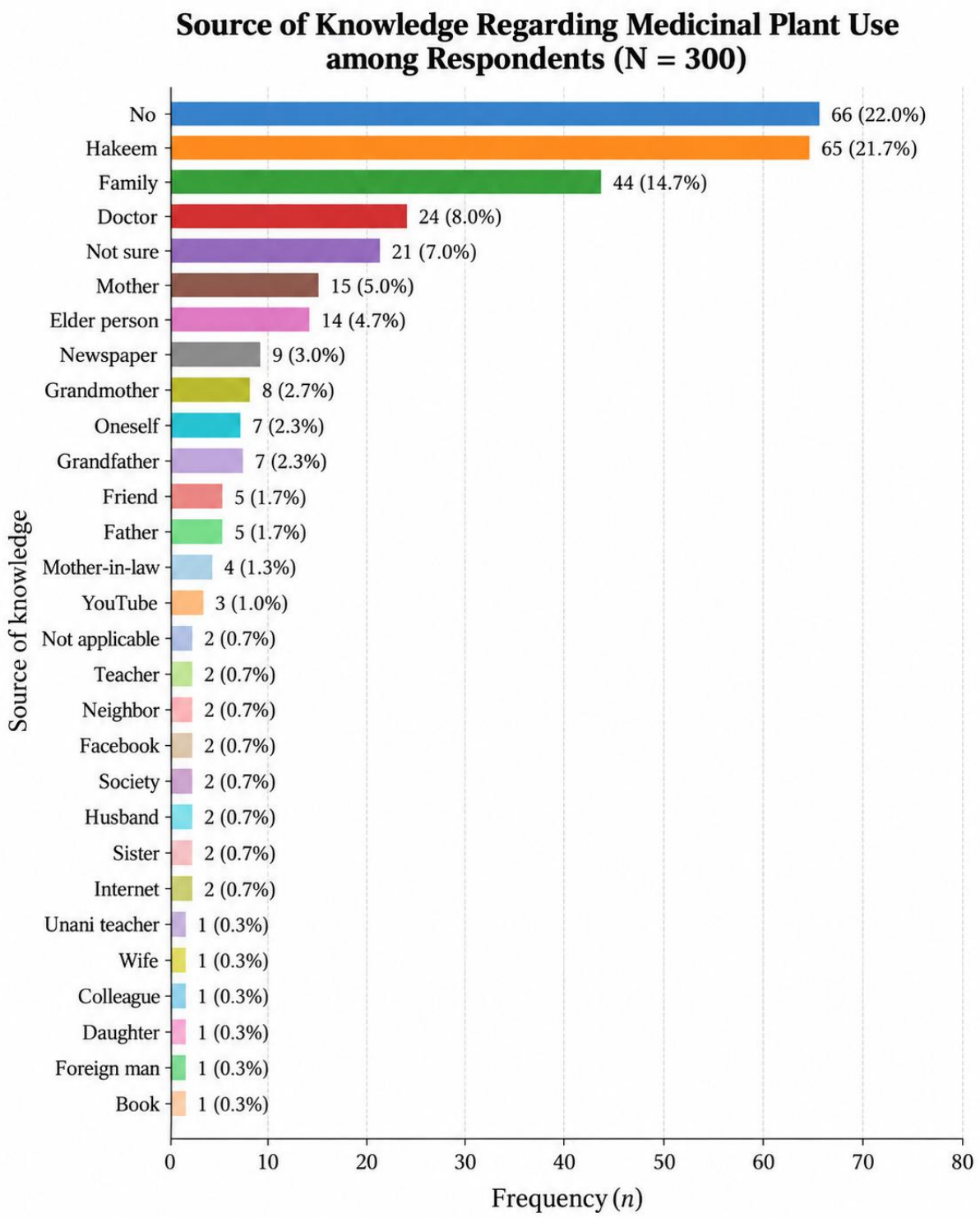
Source of Knowledge	Frequency (n)	Percentage (%)
No	66	22.0
Not applicable	2	0.7
Family	44	14.7
Friend	5	1.7
Not sure	21	7.0
Mother	15	5.0
Teacher	2	0.7
Elder person	14	4.7
Neighbor	2	0.7

Doctor	24	8.0
Grandmother	8	2.7
Mother-in-law	4	1.3
Oneself	7	2.3
Unani teacher	1	0.3
Wife	1	0.3
YouTube	3	1.0
Facebook	2	0.7
Society	2	0.7
Grandfather	7	2.3
Colleague	1	0.3
Hakeem	65	21.7
Newspaper	9	3.0
Father	5	1.7
Husband	2	0.7
Sister	2	0.7
Daughter	1	0.3
Internet	2	0.7
Foreign man	1	0.3
Book	1	0.3
Total	**300**	**100.0**

The sources of knowledge regarding medicinal plant use among the respondents are presented in Table 5. Among the 300 respondents, the most frequently reported source of knowledge was Hakeem (traditional medicine practitioner), accounting for 65 respondents (21.7%). This was followed by family members (44, 14.7%), indicating the important role of traditional family-based knowledge transmission in the use of medicinal plants.Other important sources of knowledge included doctors (24, 8.0%) and elderly people (14, 4.7%). Knowledge acquired from immediate family members was also notable, with respondents reporting mother (15, 5.0%), grandmother (8, 2.7%), grandfather (7, 2.3%), and father (5, 1.7%) as sources of information regarding medicinal plants.A proportion of respondents reported acquiring knowledge independently or through social networks, including oneself (7, 2.3%), friends (5, 1.7%), mother-in-law (4, 1.3%), and neighbors (2, 0.7%). Formal educational or professional sources contributed minimally, with only 2 respondents (0.7%) reporting teachers and 1 respondent (0.3%) reporting a Unani teacher as sources of knowledge.

Regarding modern information sources, relatively few respondents obtained medicinal plant knowledge from newspapers (9, 3.0%), YouTube (3, 1.0%), Facebook (2, 0.7%), internet sources (2, 0.7%), and books (1, 0.3%). Additionally, 66 respondents (22.0%) reported no specific source of knowledge, while 2 respondents (0.7%) indicated that the question was not applicable.

The findings demonstrate that traditional knowledge sources, particularly Hakeems and family members, remain the dominant pathways for acquiring information about medicinal plants. The limited contribution of digital and formal sources suggests that medicinal plant knowledge in the studied population is primarily maintained through cultural practices and interpersonal transmission rather than structured educational or online platforms.



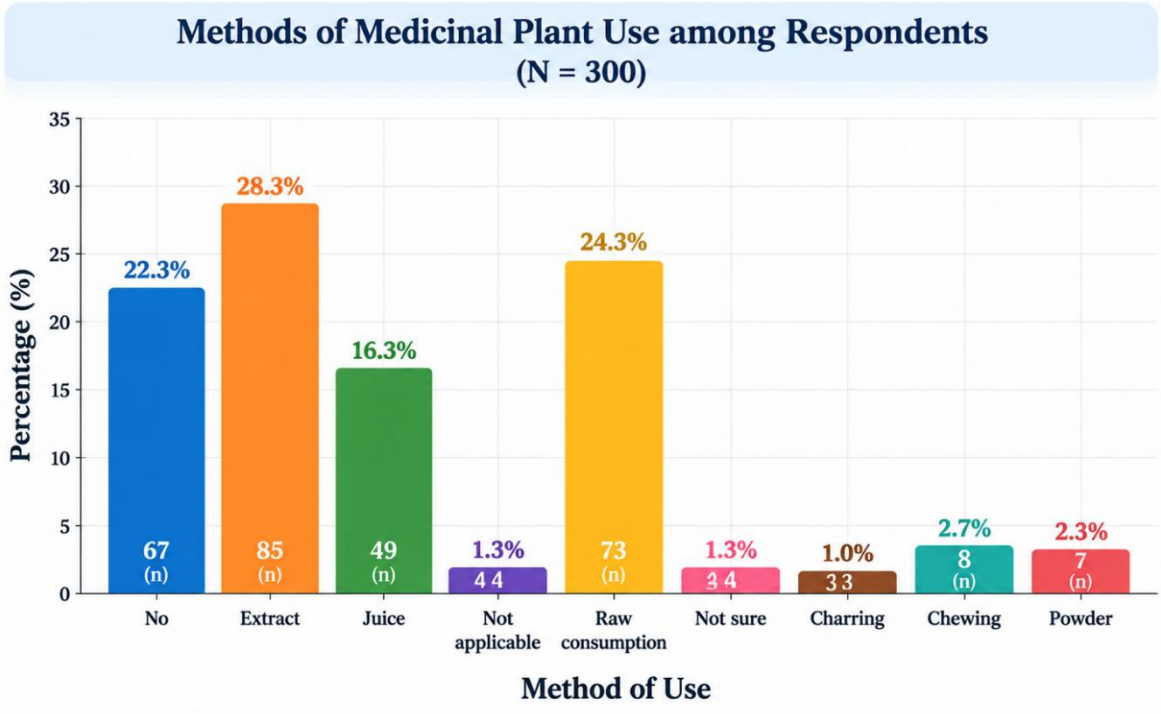
Graph 4.13.Sources of Knowledge Regarding Medicinal Plant Use among Respondents (N=300)

4.6 Methods of Medicinal Plant Use among Respondents

Table 4.6: Methods of Using Medicinal Plants among Respondents (N = 300)

Method of Use	Frequency (n)	Percentage (%)
No	67	22.3
Extract	85	28.3
Juice	49	16.3
Not applicable	4	1.3
Raw consumption	73	24.3

Not sure	4	1.3
Charring	3	1.0
Chewing	8	2.7
Powder	7	2.3
Total	**300**	**100.0**



Graph 4.14.Methods of Medicinal Plant Use among Respondents

The different methods of medicinal plant use among the respondents are presented in Table 6. Among the 300 respondents, the most commonly reported method of using medicinal plants was extract preparation, reported by 85 respondents (28.3%). This was followed by raw consumption of plant materials (73, 24.3%) and juice preparation (49, 16.3%).A considerable proportion of respondents (67, 22.3%) reported that they did not use medicinal plants. Other less frequently reported methods included chewing (8, 2.7%) and powder preparation (7, 2.3%). Only a small proportion of respondents used medicinal plants through charring (3, 1.0%). Additionally, 4 respondents (1.3%) reported that the question was not applicable, while another 4 respondents (1.3%) were unsure about the method of use.Overall, the findings indicate that extract preparation and direct consumption (raw form or juice) were the predominant methods of medicinal plant utilization among respondents. These findings suggest that traditional household practices mainly rely on simple preparation techniques that require minimal processing and are easily accessible within the community.

4.7 Perceived Effectiveness, Recommendation, and Safety Perception of Medicinal Plants among Respondents

Table 4.7: Perception and Outcome of Medicinal Plant Use among Respondents (N = 300)

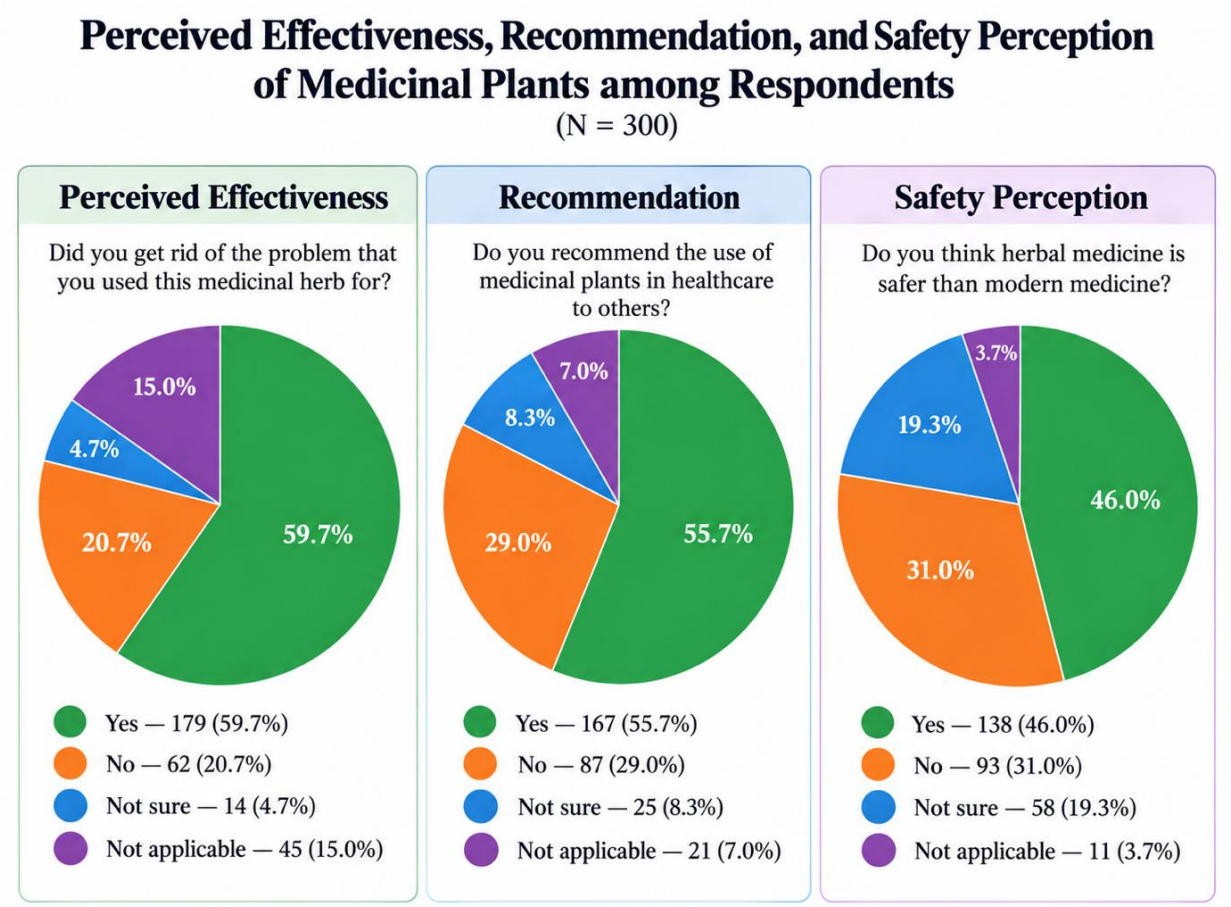
Related specific questions	Yes n(%)	No n (%)	Not sure n(%)	Not applicable n(%)
Did you get rid of the problem that you used this medicinal herb for?	179 (59.7)	62 (20.7)	14 (4.7)	45 (15.0)
Do you recommend the use of medicinal plants in healthcare to others?	167 (55.7)	87 (29.0)	25 (8.3)	21 (7.0)
Do you think herbal medicine is safer than modern medicine?	138 (46.0)	93 (31.0)	58 (19.3)	11 (3.7)

The perceived effectiveness, recommendation practices, and safety perceptions regarding medicinal plant use among respondents are presented in Table 7. Among the respondents who used medicinal plants, 179 (59.7%) reported that they experienced relief from the health problems for which they used medicinal herbs. In contrast, 62 respondents (20.7%) reported that they did not obtain relief, while 14 (4.7%) were unsure about the effectiveness of the herbal treatment. A further 45 respondents (15.0%) indicated that the question was not applicable.

Regarding the recommendation of medicinal plants for healthcare purposes, more than half of the respondents (167, 55.7%) reported that they would recommend the use of medicinal plants to others. However, 87 respondents (29.0%) did not recommend medicinal plant use, while 25 (8.3%) were uncertain and 21 (7.0%) considered the question not applicable.

When respondents were asked whether they considered herbal medicine safer than modern medicine, 138 respondents (46.0%) agreed that herbal medicine was safer. Conversely, 93 respondents (31.0%) disagreed with this perception, while 58 respondents (19.3%) were unsure. Only 11 respondents (3.7%) reported that the question was not applicable.

The findings indicate that a substantial proportion of respondents perceived medicinal plants as effective and suitable for healthcare use, with more than half reporting symptom improvement and willingness to recommend herbal remedies. However, perceptions regarding the comparative safety of herbal medicine over modern medicine remained mixed, suggesting that although traditional medicine is widely accepted, uncertainty regarding its relative safety persists among a proportion of the population.



Graph 4.15.Perceived Effectiveness, Recommendation, and Safety Perception of Medicinal Plants among Respondents

4.8 Preferred Health Service among Respondents

Table 4.8: Preferred Health Service among Respondents (N = 300)

Preferred health service	Frequency (n)	Percentage (%)
Unani medicine	83	27.7
Ayurveda medicine	22	7.3
Homeopathic medicine	24	8.0
Modern medicine	171	57.0
Total	**300**	**100.0**

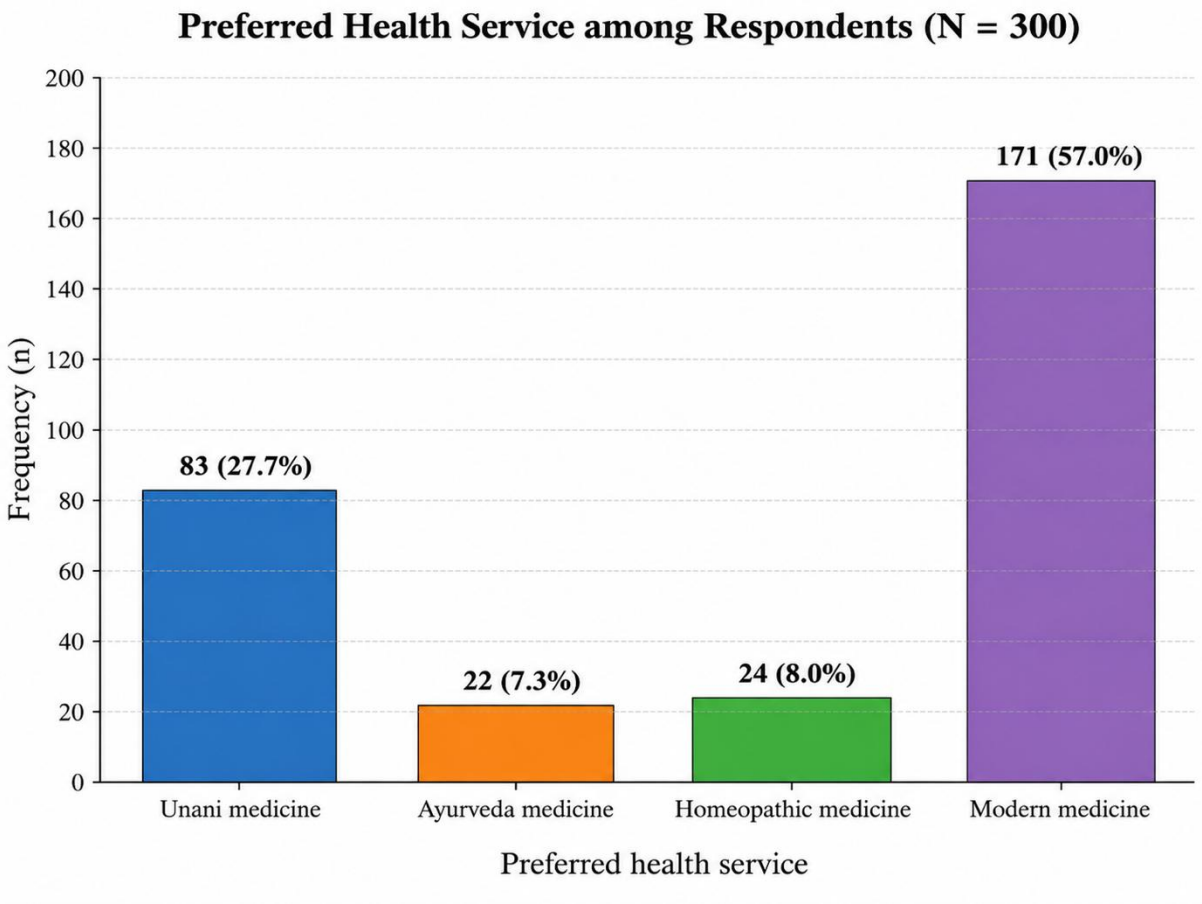


Figure 4.16. Preferred Health Service among Respondents (N = 300)

The preference for different healthcare systems among the respondents is presented in Table 8. Among the 300 respondents, modern medicine was the most preferred healthcare service, reported by 171 respondents (57.0%). This indicates that despite the widespread awareness and use of medicinal plants, the majority of respondents still relied on conventional healthcare services as their preferred option.

Among traditional and alternative healthcare systems, Unani medicine was preferred by 83 respondents (27.7%), making it the second most preferred healthcare service. Homeopathic medicine was preferred by 24 respondents (8.0%), while Ayurvedic medicine was selected by 22 respondents (7.3%).The findings demonstrate that modern medicine remains the dominant healthcare preference among the study population, whereas traditional medical systems, particularly Unani medicine, continue to maintain considerable acceptance. The relatively higher preference for Unani medicine compared with Ayurveda and homeopathy may reflect the influence of local availability, cultural familiarity, and the presence of traditional practitioners within the community.

5. Discussion

The present study explored the awareness, perception, utilization patterns, and healthcare preferences regarding medicinal plants among 300 respondents in Bogura, Bangladesh. The findings demonstrate that traditional herbal medicine continues to play an important role in community healthcare practices. Although modern medicine was the preferred healthcare system among the majority of respondents, a substantial proportion showed positive attitudes toward medicinal plants, reported previous use of herbal remedies, and maintained traditional knowledge regarding plant-based healthcare. These findings highlight the coexistence of traditional and modern healthcare practices within the studied population.

In this study, 72.0% of respondents expressed belief in natural herbal medicine, indicating a strong level of acceptance of traditional therapeutic practices. Similar patterns of high acceptance of herbal medicine have been reported in several ethnobotanical studies conducted in South Asia, where medicinal plants remain an important component of primary healthcare, particularly in rural and semi-urban communities (Kala, 2005; Heinrich, 2010). The continued reliance on medicinal plants may be attributed to cultural familiarity, historical experience, perceived safety, affordability, and easy accessibility of plant resources.The World Health Organization (WHO) recognizes traditional medicine as an important component of healthcare systems, particularly in low- and middle-income countries, and emphasizes the need for evidence-based integration, regulation, and quality assurance of traditional medicine practices (World Health Organization [WHO], 2013).In Bangladesh, where healthcare accessibility and economic limitations influence treatment choices, medicinal plants often serve as accessible therapeutic options, especially for common health conditions.The high level of belief in herbal medicine observed in this study may also reflect the transmission of indigenous knowledge across generations. Traditional medical knowledge is frequently maintained through family practices, community healers, and local practitioners rather than through formal education systems (Cotton, 1996; Martin, 1995). This pattern was evident in the current study, where family members and Hakeems were among the major sources of medicinal plant knowledge.

Approximately 60.7% of respondents reported previous use of medicinal plants available near their homes, and 64.3% reported current use of nearby medicinal plants. These findings demonstrate that medicinal plant utilization remains an active healthcare practice among the studied population. Similar observations have been documented in ethnobotanical investigations from Bangladesh and other developing countries, where household medicinal plant use continues despite the availability of modern healthcare facilities (Giday et al., 2003; Rahmatullah et al., 2010).In the present study, *Ocimum tenuiflorum* (Tulsi/Holy basil), *Ocimum basilicum*, and *Azadirachta indica* (Neem) were the most frequently used medicinal plants. The widespread use of *Ocimum tenuiflorum* is consistent with previous ethnomedicinal studies reporting its extensive application for respiratory disorders, fever, inflammation, and general health maintenance (Pattanayak et al., 2010). The popularity of *Azadirachta indica* is also consistent with its traditional applications for skin diseases, infections, fever, and inflammatory conditions due to its reported antimicrobial and bioactive properties (Biswas et al., 2002).The frequent use of *Adhatodavasica*/*Justicia adhatoda* and *Andrographis paniculata* in this study may be associated with their traditional application for respiratory complaints. Previous pharmacological studies have demonstrated that these plants contain bioactive compounds with potential anti-inflammatory, antimicrobial, and respiratory therapeutic effects (Jarukamjorn& Nemoto, 2008; Claeson et al., 2000). However, traditional use does not always guarantee clinical effectiveness, and further pharmacological and clinical investigations remain necessary.The diversity of medicinal plants reported by respondents indicates rich ethnobotanical knowledge within the community. Similar studies have emphasized that documenting local medicinal plant knowledge is essential because modernization, environmental changes, and changing lifestyles may contribute to gradual loss of traditional knowledge (Kala, 2005; Quave, 2014).

The present study revealed that medicinal plants were mainly used for the management of common and minor health problems. Respiratory-related conditions were the most frequently reported health problems, with cough (21.7%) and common cold (11.3%) being the leading complaints. Similar findings have been reported in ethnobotanical studies from Bangladesh and other South Asian countries, where medicinal plants are commonly used for respiratory disorders, gastrointestinal problems, skin diseases, and general health maintenance (Rahmatullah et al., 2010; Biswas et al., 2002).

The frequent use of medicinal plants for cough and cold may be related to the traditional use of several locally available plants, including *Ocimum tenuiflorum*, *Adhatodavasica*, *Zingiber officinale*, and *Andrographis paniculata*. Previous pharmacological studies have reported that these plants contain phytochemicals such as alkaloids, flavonoids, terpenoids, and phenolic compounds that may contribute to antimicrobial, anti-inflammatory, and antioxidant activities (Jarukamjorn& Nemoto, 2008; Pattanayak et al., 2010).Skin disorders were another important health category reported by respondents (9.0%). Similar patterns have been documented in traditional medicine studies, where plants such as *Azadirachta indica*, *Calotropis gigantea*, and *Centella asiatica* are traditionally used for wound healing, skin infections, and inflammatory conditions (Biswas et al., 2002; James & Dubery, 2009). The use of medicinal plants for skin conditions may be associated with their easy availability and the perception that natural remedies are safer for topical application.Although fewer respondents reported chronic conditions such as diabetes, kidney disease, and cardiovascular problems, the presence of such uses indicates that community members also apply medicinal plants beyond acute illnesses. However, the effectiveness and safety of herbal remedies for chronic diseases require careful scientific evaluation because inappropriate use may delay effective medical treatment.

The method of preparation influences the extraction of bioactive compounds and may affect the therapeutic potential of medicinal plants. In this study, extract preparation was the most common method of use (28.3%), followed by raw consumption (24.3%) and juice preparation (16.3%). Similar preparation patterns have been reported in ethnobotanical studies, where decoctions, extracts, juices, and direct consumption are commonly practiced methods among indigenous communities (Martin, 1995; Cotton, 1996).

The preference for simple preparation methods reflects the household-based nature of herbal medicine practice. Extracts and juices can be prepared easily without specialized equipment, making them accessible to community members. Raw consumption of medicinal plants, particularly leaves and fresh plant parts, was also common, which may reflect traditional beliefs regarding preservation of natural therapeutic properties.However, variations in preparation methods may result in differences in dosage, concentration, and bioavailability of active compounds. Previous studies have emphasized that standardization of preparation methods is necessary to ensure consistent therapeutic outcomes and minimize potential toxicity (Ekor, 2014). Therefore, while traditional preparation techniques represent valuable indigenous knowledge, scientific validation and quality control are essential for safe integration into healthcare systems.The present study demonstrated that medicinal plant knowledge was mainly acquired through traditional social networks. Hakeems (21.7%) and family members (14.7%) were the major sources of knowledge, followed by doctors (8.0%) and elder persons (4.7%). This finding highlights the importance of traditional knowledge transmission through interpersonal relationships.

Ethnobotanical research has consistently shown that indigenous medical knowledge is commonly transferred orally from older generations to younger members of communities (Martin, 1995; Cotton, 1996). Family-based transmission allows communities to preserve knowledge regarding plant identification, preparation techniques, and therapeutic applications. However, such knowledge systems are vulnerable to erosion due to urbanization, modernization, and reduced dependence on traditional practices (Quave, 2014).The important role of Hakeems observed in this study reflects the continued influence of traditional practitioners in Bangladesh. Traditional healers often act as important healthcare providers, particularly in communities where they are culturally trusted and easily accessible. Similar observations have been reported from Bangladesh and other developing countries where traditional practitioners remain integrated into community healthcare practices (Rahmatullah et al., 2010).Interestingly, modern sources such as YouTube, Facebook, and internet platforms contributed relatively little to medicinal plant knowledge in this study. Although digital platforms are increasingly becoming sources of health information, their influence on traditional medicine knowledge appears limited among the studied population.

The majority of respondents who used medicinal plants reported positive outcomes. In this study, 59.7% of respondents stated that they recovered from the health problem for which they used medicinal herbs. Furthermore, 55.7% indicated that they would recommend medicinal plants to others. Similar positive perceptions regarding herbal medicine have been reported in community-based studies from developing countries, where personal experience strongly influences continued use of traditional remedies (Ekor, 2014; Heinrich, 2010).The perceived effectiveness of medicinal plants may be influenced by cultural beliefs, previous successful experiences, affordability, and accessibility. According to the WHO, traditional medicine remains an important healthcare resource because many communities rely on it due to social acceptance and availability (WHO, 2013).However, perceptions of safety were more variable. Although 46.0% of respondents believed herbal medicine was safer than modern medicine, 31.0% disagreed and 19.3% were uncertain. This indicates that while herbal medicine is widely accepted, respondents also recognize uncertainty regarding its comparative safety. Scientific evidence indicates that natural origin does not necessarily guarantee safety because some medicinal plants may cause toxicity, adverse interactions, or contamination if improperly prepared or consumed (Ekor, 2014).Therefore, public education regarding appropriate identification, dosage, preparation, and possible adverse effects is necessary. Evidence-based approaches combining traditional knowledge with scientific validation may help maximize benefits while reducing potential risks.

Despite widespread acceptance and utilization of medicinal plants, modern medicine remained the preferred healthcare service among respondents (57.0%). Unani medicine was the most preferred traditional healthcare system (27.7%), followed by homeopathy (8.0%) and Ayurveda (7.3%). This finding suggests that respondents do not necessarily view traditional and modern medicine as competing systems but may use them according to availability, disease severity, and personal preference.Similar patterns have been observed in many developing countries where communities utilize multiple healthcare systems simultaneously (WHO, 2013; Kleinman, 1980). Modern medicine is often preferred for serious illnesses because of perceived diagnostic accuracy and scientific evidence, whereas traditional medicine may be preferred for minor illnesses, preventive care, and culturally familiar treatments.The coexistence of traditional and modern healthcare practices highlights the importance of developing integrated healthcare approaches. Proper regulation, documentation, and scientific evaluation of medicinal plants could support safe incorporation of traditional medicine into broader healthcare strategies.

The findings of this study emphasize the continuing importance of medicinal plants in community healthcare practices in Bangladesh. The high level of awareness and utilization indicates that medicinal plants represent an important component of local health-seeking behavior. Documentation of ethnobotanical knowledge is particularly important because valuable traditional knowledge may disappear due to social and environmental changes.Future research should focus on phytochemical analysis, pharmacological evaluation, toxicity assessment, and clinical validation of commonly used medicinal plants. Additionally, conservation strategies are necessary to protect medicinal plant biodiversity and ensure sustainable availability of important species.

6. Limitations of the study

This study has several limitations. First, the cross-sectional design limits the ability to establish causal relationships between medicinal plant use and health outcomes. Second, information was based on self-reported responses, which may be influenced by recall bias and personal beliefs. Third, the study was conducted in a specific geographical area; therefore, findings may not be fully generalizable to other regions of Bangladesh. Finally, although commonly used medicinal plants were documented, laboratory-based confirmation of phytochemical composition and therapeutic efficacy was beyond the scope of this study.Despite these limitations, the study provides valuable insights into the awareness, utilization patterns, knowledge sources, and perceptions regarding medicinal plants among the local population and contributes to the documentation of traditional healthcare practices in Bangladesh.

7. Conclusion

The present study provides valuable insights into the awareness, utilization patterns, knowledge sources, and perceptions regarding medicinal plants among respondents in Bogura, Bangladesh. The findings demonstrate that traditional herbal medicine continues to hold an important position in community healthcare practices, with a large proportion of respondents expressing belief in natural herbal remedies and reporting previous or current use of medicinal plants. Although modern medicine remained the most preferred healthcare system, traditional medicine, particularly Unani medicine, showed considerable acceptance among the study population.A diverse range of medicinal plants was reported, with *Ocimum tenuiflorum* (Tulsi), *Ocimum basilicum*, and *Azadirachta indica* (Neem) being the most commonly used species. Respiratory problems, especially cough and common cold, were the major health conditions for which medicinal plants were used, reflecting the importance of easily available household remedies for common illnesses. Extract preparation, raw consumption, and juice preparation were the predominant methods of use, indicating that medicinal plant practices largely depend on simple and accessible preparation techniques.The study also highlights the significant role of traditional knowledge transmission, where Hakeems, family members, and older generations served as major sources of information regarding medicinal plants. More than half of the respondents reported positive health outcomes after using medicinal plants and expressed willingness to recommend their use to others. However, perceptions regarding the safety of herbal medicine compared with modern medicine were mixed, emphasizing the need for scientific validation, quality control, and public awareness regarding appropriate use.The findings suggest that medicinal plants represent an important component of local healthcare practices and cultural heritage. Therefore, systematic documentation, conservation of medicinal plant resources, pharmacological evaluation, and integration of evidence-based traditional medicine approaches into healthcare strategies are recommended. Further studies involving phytochemical analysis, toxicity assessment, and clinical trials are necessary to establish the therapeutic potential and safety profile of commonly used medicinal plants in Bangladesh. This research contributes to preserving indigenous knowledge and provides baseline information for future ethnobotanical and public health investigations.

8. References

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