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THE PERCEPTION OF THE COMMUNITY ON THE BIOCHEMICAL BASIS OF HERBAL MEDICINES AND THEIR EFFECTIVENESS: A CASE STUDY OF KATSINA STATE

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ABSTRACT

This study examined community perception of the biochemical basis, effectiveness, and safety of herbal medicines in Katsina State. The research was motivated by the widespread use of herbal remedies alongside limited scientific awareness of their chemical composition, regulation, and potential health risks. A descriptive survey research design was adopted, and data were collected from respondents across different demographic backgrounds using structured questionnaires. The data were analyzed using descriptive statistical methods, including frequency distributions and percentages. The findings revealed that herbal medicine use is highly prevalent in Katsina State, with 75.0% of respondents reporting regular use. Herbal remedies are commonly used to treat malaria, typhoid, stomach ache, body pain, and cold/flu While respondents view herbal medicines as effective, knowledge of their active ingredients is low, with 60% unaware of their biochemical compounds. Despite most reporting no side effects, many experienced adverse reactions and were uncertain about herb drug interactions. Awareness of NAFDAC's regulatory role is moderate, and label-checking is inconsistent. The study highlights the need for better public education, awareness of regulations, and the integration of scientific data into traditional practices to ensure safer use of herbal medicines in Katsina State.

KEYWORDS: Biochemical basis, herbal medicines, and Katsina State.

1. INTRODUCTION

Herbal medicines play a vital role in global healthcare, particularly in developing countries where they remain an accessible and affordable alternative to conventional drugs. The World Health Organization (WHO) estimates that up to 80% of the population in Africa relies on traditional medicine for their primary healthcare needs (WHO, 2019). In Nigeria, especially in northern states such as Katsina, herbal remedies are widely used to treat common ailments, reflecting deep cultural and historical reliance on ethnomedicine (Yakubu, Salihu, & Haruna, 2020). Despite their widespread use, the scientific and biochemical validation of many herbal medicines remains limited. Research highlights both potential benefits, such as antioxidant, antimicrobial, and anti-inflammatory properties, and risks, including toxicity, contamination, and herb drug interactions (Ekor, 2014; Fasinu, Pillay, & Nlooto, 2016). These gaps in knowledge raise critical questions about safety, dosage, and long-term health impacts. At the community level, perception often drives acceptance and use of herbal medicines, sometimes outweighing biomedical evidence (Owolabi et al., 2021).

Globally, there is increasing recognition of the need to integrate traditional medicine into modern healthcare systems, but this requires better understanding of community beliefs, scientific validation, and regulatory frameworks (WHO, 2014; Tilburt & Kaptchuk, 2008). In Nigeria, regulatory bodies such as the National Agency for Food and Drug Administration and Control (NAFDAC) emphasize the importance of safety and standardization, yet community awareness and perception often shape practices more strongly than formal regulation (Chukwuma, Soladoye, & Feyisola, 2015). Despite efforts by successive democratically elected governments to establish numerous health facilities across Katsina State, many of these institutions remain poorly equipped and lack adequately trained medical personnel. This challenge is particularly acute in rural communities, where the majority of the population resides. As a result of these gaps, alongside factors such as affordability, accessibility, and cultural conservativeness, many residents rely heavily on complementary and alternative healthcare services, particularly the use of medicinal plants. These plants are not only readily available but are also perceived as relatively safer compared to synthetic drugs commonly used in orthodox medicine. However, the increasing dependence on herbal remedies has led to the indiscriminate harvesting of plant resources, posing significant threats to biodiversity, which is already under pressure from deforestation, desertification, and the impacts of climate change.

Systematic documentation of medicinal plants used in maternal healthcare in Katsina State, Nigeria, is essential to preserve Indigenous Knowledge (IK) and provide baseline data for conservation strategies. This study identified 111 plant species from 101 genera and 50 families utilized for maternal healthcare, with common families including Euphorbiaceae, Asteraceae, and Fabaceae. Notably, one plant, Cancana kwanikka, could not be classified at the genus level due to missing floral structures. The findings align with previous research indicating similar dominant families in northern Maputaland, South Africa. Kaingu et al. (2013) also observed Euphorbiaceae as the most commonly used family for managing women's reproductive health in Tana River County, Kenya. In contrast, Borokini et al. (2013) noted that Poaceae and Caesalpiniaceae were more dominant in Oyo State, Nigeria. The high prevalence of Fabaceae in Katsina may be attributed to the wide seasonal availability of its species, which are well adapted to the harsh environmental conditions of the Sahel region. Given Katsina State's reliance on herbal remedies, understanding how communities perceive the biochemical basis of herbal medicines and their effectiveness is essential. Such insights can inform safe practices, bridge the gap between traditional knowledge and scientific validation, and guide public health interventions and regulatory strategies.

1.1 Public Use of Herbal Medicines and Awareness of Herb–Drug Interactions

Herbal medicine constitutes a central pillar of complementary and alternative medicine (CAM) and remains deeply embedded in healthcare practices across diverse cultural and geographical contexts (Tabish, 2008; Tulunay et al., 2015). Over recent decades, the global consumption of herbal medicines and natural products has expanded significantly, reflecting increasing public interest in alternative therapeutic approaches (Alsayari et al., 2018). These products are commonly marketed as dietary supplements and are widely accessible as over-the-counter remedies (Vickers et al., 2006). Current estimates suggest that more than 70% of the world's population depends on traditional herbal remedies for the management and treatment of various health conditions (Shaikh et al., 2020). In Saudi Arabia, the concurrent use of herbal remedies alongside conventional pharmaceutical therapies is particularly prevalent, indicating strong cultural acceptance and widespread public reliance on traditional medicine systems (Al Akeel et al., 2018; Al-Arifi, 2013; Suleiman, 2014).

This growing utilization of herbal products has attracted increased attention from regulatory authorities, healthcare professionals, and researchers due to its implications for patient safety and healthcare quality (Alsayari et al., 2018). Herbal medicines contain diverse bioactive compounds derived from multiple plant components, including roots, leaves, seeds, stems,

and flowers (Alsayari et al., 2018). Although often perceived as "natural" and therefore harmless, these products may pose significant health risks due to complex chemical compositions, possible contamination, adulteration, and variability in phytochemical content (Alsayari et al., 2018; Van Breemen, 2015). Reports of adverse reactions associated with herbal product use underscore the importance of systematic safety evaluation and regulatory oversight (Avigan et al., 2016). Consequently, the integration of herbal medicine into modern healthcare systems necessitates rigorous scientific research and quality-control mechanisms to ensure patient safety.

Unlike conventional pharmaceuticals, dietary supplements are not routinely subjected to mandatory pre-marketing safety and efficacy evaluations by the U.S. Food and Drug Administration (FDA), and not all products available in the market are formally registered (Avigan et al., 2016). Furthermore, inconsistencies in phytochemical composition between different manufacturers, formulations, and production batches create substantial challenges for standardization and safety assessment (Finley et al., 2014; Van Breemen, 2015). These regulatory and quality-control gaps are particularly concerning given growing clinical evidence demonstrating that herbal medicines can interact with conventional pharmaceutical drugs (Izzo, 2012). Herb–drug interactions are broadly categorized into pharmacokinetic and pharmacodynamic interactions (Izzo, 2012). Pharmacokinetic interactions occur when herbal products alter drug absorption, distribution, metabolism, or excretion, potentially leading to reduced therapeutic efficacy or increased toxicity (Kahraman et al., 2020). Pharmacodynamic interactions, although less common, arise when herbal products modify the pharmacological action of co-administered drugs, producing either synergistic or antagonistic effects (Asher et al., 2017). Both interaction mechanisms present significant clinical risks, particularly in patients using multiple therapies concurrently, highlighting the need for healthcare professionals to be aware of herbal medicine use during clinical consultations.

Despite the widespread use of herbal products, public knowledge regarding their safety and potential interactions with conventional medicines remains limited. Studies conducted in Saudi Arabia have reported inadequate public awareness and insufficient knowledge regarding herbal medicine use and safety (Suleiman, 2014), as well as poor labeling and limited availability of reliable information on natural health products (Ahmed et al., 2021). Although previous research has explored general knowledge, attitudes, and practices related to herbal medicine use (Al Akeel et al., 2018; Al-Arifi, 2013; Suleiman, 2014), there is a notable lack of studies specifically assessing public understanding of herb–drug interactions. Identifying knowledge gaps in this area is essential for developing targeted public health

education strategies and strengthening clinical safety practices. Therefore, the present study aims to evaluate the knowledge and awareness of herb drug interactions among the general population in Saudi Arabia, with the goal of supporting safer healthcare practices and reducing preventable medication-related risks.

1.2 Objectives of the Study

The aim of this research is to assess community perceptions in Katsina State regarding the biochemical basis and perceived effectiveness of herbal medicines, and how these perceptions relate to usage patterns, safety awareness, and trust in regulation.

Objectives of the study are to:

1. Determine the prevalence, indications, and sources of information for herbal-medicine use in Katsina communities.
2. Evaluate community knowledge of biochemical constituents/mechanisms (e.g., alkaloids, flavonoids, terpenoids) and how this knowledge influences perceived effectiveness.
3. Document self-reported effectiveness, adverse effects, and herb–drug interaction experiences among users.
4. Assess awareness and trust in regulatory standards and labeling (NAFDAC), and associations between sociodemographic factors and perceptions/behavior.

2. Literature Review

2.1 Overview of Herbal Medicine Use: Prevalence, Therapeutic Applications, and Safety Concerns

Advances in medical, biological, and pharmaceutical sciences have intensified interest in drugs derived from biologically active compounds found in medicinal plants. Herbal medicines are often perceived as safer alternatives to synthetic drugs due to their reportedly low incidence of allergic reactions, toxicity, withdrawal effects, and dependence (Ekor, 2014). Preparations that conform to naturopathic principles and demonstrate pharmacological efficacy have been widely used in the prevention and treatment of numerous diseases. According to the World Health Organization (WHO), the global utilization of herbal medicinal products is estimated to be two to three times higher than that of conventional pharmaceutical medicines (World Health Organization [WHO], 2000). Despite their widespread use, herbal medicines are not classified as drugs by the U.S. Food and Drug Administration (FDA), as they are regarded as natural products derived from plant sources. This regulatory status has contributed to the widespread public perception that herbal

remedies are inherently safe (Alghadir et al., 2022). Globally, approximately 75–80% of the population relies on herbal medicine as a primary source of healthcare, particularly in developing regions where access to modern medical facilities is limited (Tabuti et al., 2012; WHO, 2000). The use of herbal medicine dates back more than 5,000 years, with documentation in ancient Indian, Chinese, Egyptian, Greek, Roman, and Syrian medical texts, reflecting a long-standing scientific and cultural heritage that continues to influence contemporary healthcare practices.

Herbal medicine refers to the use of whole plants or plant-derived materials—including leaves, stems, flowers, roots, and seeds for disease prevention and treatment. Commonly used herbal products include Devil's claw, kava, Echinacea, ginseng, ginger, St. John's wort, black and blue cohosh, red raspberry leaf, and castor oil (Al-Ghamdi et al., 2017). These products may be consumed in their raw form or processed into extracts using solvents such as water or alcohol to isolate bioactive phytochemicals. Herbal preparations typically contain a wide range of compounds, including alkaloids, flavonoids, glycosides, saponins, sterols, fatty acids, and essential oils. Owing to the complexity and variability of plant constituents, manufacturers often attempt to standardize herbal products by identifying specific active ingredients and applying technological processes to achieve consistent concentrations (Bent, 2008). The reliance on herbal medicine remains prevalent in both developed and developing countries despite the growing adoption of modern medical practices. The WHO estimates that nearly 80% of populations in Asia and Africa depend on traditional medicine to meet their basic healthcare needs (Nyeko et al., 2016). Historically, medicinal plants have served as the foundation of pharmacological science, with many modern drugs originating from botanical sources. Notable examples include morphine from opium poppy, digoxin from foxglove, quinine from cinchona bark, and aspirin from willow bark. The early nineteenth century marked a pivotal period in pharmaceutical development with the isolation and validation of alkaloids and glycosides from medicinal plants, followed by the discovery of other bioactive compounds such as tannins, saponins, vitamins, and hormones (Petrovska, 2012).

Herbal medicines continue to play a significant role in the management of a wide range of health conditions, including psychiatric and immunological disorders, reproductive health problems, cancer, trauma, infectious diseases, and noncommunicable diseases such as malaria (Al Akeel et al., 2018). In regions such as Pakistan, where ecological diversity supports the growth of numerous medicinal plant species, herbal remedies are commonly used to treat respiratory conditions such as asthma, bronchitis, pneumonia, cough, and the common cold. Studies have identified at least 21 medicinal plant species from families including Lamiaceae,

Boraginaceae, and Zingiberaceae used in the treatment of respiratory infections, with species such as *Glycyrrhiza glabra*, *Acacia arabica*, and *Mentha piperita* demonstrating notable therapeutic potential (Afzal et al., 2021).

Similarly, research on traditional herbal treatments for diabetes reveals that elderly populations in rural communities rely heavily on indigenous medicinal plants, often perceiving them as more effective, affordable, and sustainable than conventional therapies. Indigenous knowledge remains central to healthcare practices in these communities, underscoring the importance of continued phytochemical and clinical investigations to scientifically validate traditional remedies (Ahmad et al., 2009). The sustained intergenerational transmission of herbal knowledge reflects both its perceived effectiveness and cultural significance. Nevertheless, the growing belief that herbal medicines are universally safe and natural alternatives to conventional drugs has contributed to their increasing use, both independently and in combination with allopathic medications (Adisa & Fakeye, 2007). This assumption raises significant safety concerns, particularly in self-care contexts where individuals manage their health without professional guidance. Consequently, herbal medicine has become an integral component of self-care and complementary therapy, highlighting the need for evidence-based evaluation, public education, and effective regulatory oversight to ensure their safe and appropriate use (Miller et al., 2000).

2.2 Ethnobotanical Use, Biochemical Basis, and Safety of Herbal Medicines in Maternal Healthcare

The study of herbal medicines has attracted increasing scholarly attention due to their wide acceptance in many cultures and their potential therapeutic benefits. Literature on the biochemical basis of herbal remedies emphasizes their pharmacologically active compounds, such as alkaloids, flavonoids, tannins, and saponins, which are responsible for their medicinal properties. An ethnobotanical study by Kankara et al. (2015) in Katsina State, Nigeria, reported 101 genera belonging to 50 plant families traditionally applied in maternal healthcare. The research, which engaged 300 respondents, highlighted Fabaceae, Asteraceae, Malvaceae, and Anacardiaceae as the dominant families. Among the species, *Acacia nilotica* and *Guiera senegalensis* recorded the highest Relative Frequency of Citation and Fidelity Level, nearing 100%, reflecting their consistent and significant traditional relevance. Globally, Nigeria, alongside five other countries, contributes to nearly half (49%) of maternal mortality rates (Hogan et al., 2010). This alarming statistic is closely associated with the widespread reliance of Nigerian women—particularly in rural areas—on alternative traditional healthcare services provided by Traditional Birth Attendants (TBAs) and

Traditional Healers (THs), who depend largely on medicinal plants for maternal care due to the limited accessibility of modern health facilities. The use of plants to treat illnesses predates recorded history and continues to be a global practice (Abe & Ohtani, 2013). The earliest documented evidence of medicinal plant use was discovered on a Sumerian clay slab from Nagpur, dated around 5000 years ago (Cristine et al., 2012). The isolation of morphine from opium in the early 19th century marked a significant turning point, inspiring subsequent research into active compounds from plants (Balunas & Kinghorn, 2005). This paved the way for isolating key bioactive substances such as cocaine, codeine, digitoxin, and quinine.

Despite advancements in synthetic approaches such as molecular modeling and combinatorial chemistry, natural products, particularly medicinal plants, remain an essential source of novel drugs, drug leads, and chemical entities (Newman et al., 2000; Butler, 2004). Globally, medicinal plants are extensively used for prenatal and postnatal care (Zumsteg & Weckerle, 2007), with studies documenting their application in addressing obstetric and gynecological issues, including infertility, pregnancy complications, childbirth challenges, and birth control (Lamxay et al., 2011; Attah et al., 2012; Nordeng et al., 2013; Borokini et al., 2013; Abdillahi & Van Staden, 2013). Indigenous communities have preserved and transmitted knowledge of medicinal plant use orally and empirically across generations (Abel et al., 2005). Such longstanding usage has contributed to the perception of medicinal plants as natural and safer alternatives to conventional pharmaceuticals, although scientific validation for this assumption remains limited (Raskin et al., 2002). Research has revealed that some medicinal plants may be toxic, mutagenic, or carcinogenic (Fennell et al., 2004). Adverse health outcomes, including poisoning, often arise from misidentification, improper preparation, or incorrect dosage, with health centers reporting numerous cases of harmful and even fatal effects from herbal product use (Rodriguez-Fragoso et al., 2008).

Traditionally, most medicinal plants are harvested from the wild, but unsustainable practices such as overharvesting, deforestation, desertification, and climate change threaten their survival. Estimates suggest that about 15,000 medicinal plant species face extinction due to habitat loss, overexploitation, and commercial pressures (Naguib, 2011). The situation is aggravated by the industrial demand for these plants as raw materials in sectors like cosmetics, textiles, biomass, food, and confectionaries, thereby placing enormous strain on their biodiversity. The exploitation of medicinal plants is especially acute in developing nations, where they remain the primary source of healthcare for much of the population. Katsina State, one of Nigeria's most densely populated but economically disadvantaged regions, had a population of 5,801,584 in 2006 (NPC, 2006). Historically, it is notable for

housing two ancient cities Daura and Katsina the former regarded as the birthplace of Hausa language and cultural governance.

2.3 Prevalence, Patterns, and Safety Concerns of Herbal Medicine Use in Global Perspectives

The global use of herbal medicine (HM) has increased substantially in recent decades and is frequently associated with self-administration practices (Welz et al., 2018). The therapeutic use of herbs predates recorded history and represents the foundation of much of modern medicine (Rani & Yadav, 2018). Historically, many synthetic pharmaceuticals were derived from plant sources, and until the early twentieth century, the majority of effective medicines were plant-based (Vickers et al., 2001). Contemporary Western herbalism emphasizes the interaction of herbal remedies with the body's own physiological systems, highlighting their role in promoting holistic health and self-regulation (Gupta et al., 2015).

Growing interest in self-care has contributed to the widespread adoption of traditional healing practices, particularly among individuals who perceive herbal medicines as "natural" alternatives to synthetic drugs (Portman & Garrett, 2006; Samojlik et al., 2013). Despite these perceptions, evidence suggests that herbal medicines may pose significant health risks. Certain herbal products have been associated with nephropathy and hepatotoxicity due to the presence of toxic phytochemicals, heavy metals, or harmful interactions with conventional medications (Boon, 2010). The absence of adequate systematic surveillance has meant that even severe adverse reactions, including kidney and liver injury caused by specific plant species, remained unrecognized until relatively recently (Byard et al., 2017).

In the Kingdom of Saudi Arabia (KSA), the use of traditional herbal medicine is common in the management of various health conditions, including hypertension (Hughes et al., 2013), type II diabetes mellitus (Ali & Mahfouz, 2014), infertility (Kaadaaga et al., 2014), and osteoporosis-related fractures (Wang et al., 2019). Ethnobotanical surveys indicate that more than 25 plant species are used by local populations for medicinal purposes (Abdel-Kader et al., 2018). Evidence further suggests that herbal medicine use is more prevalent among females in Saudi Arabia (Al Akeel et al., 2018), with reported usage rates reaching as high as 69.9% among certain population groups (Abuelgasim et al., 2018). Regional studies provide further insight into herbal medicine utilization patterns in Saudi Arabia. Research conducted in Al-Khobah, Jazan, documented the use of more than 25 medicinal plant species for treating various diseases (Abdel-Kader et al., 2018). Another study reported that 84.9% of herbal medicine users were female (Al Akeel et al., 2018). Additionally, a study carried out in Riyadh revealed that herbal medicine use among women occurred during pregnancy (25.3%),

labor (33.7%), and post-delivery (48.9%) (Al-Ghamdi et al., 2017). Similarly, research conducted in Jazan in 2012 found that 81% of women used herbal remedies, while only 40.5% consulted physicians, with oral administration being the most common route of use (Zaghloul & Salman, 2012).

More recent findings indicate increasing awareness and engagement with complementary and alternative medicine (CAM) in Saudi Arabia. A 2019 study conducted in Riyadh showed that most participants possessed knowledge of CAM and actively practiced it, particularly older individuals, with more than half reporting discussions about CAM use with healthcare professionals (Alarbash et al., 2019). Furthermore, a systematic review published in 2019 reported that the prevalence of herbal medicine use in Saudi Arabia ranged from 10.3% to 75.0%, with usage strongly associated with spiritual beliefs, perceived effectiveness, dissatisfaction or hopelessness regarding conventional medicine, and the presence of chronic illnesses (Aldossary, 2019).

This review therefore draws on existing literature to explore the biochemical basis of herbal medicines, their perceived effectiveness, safety considerations, and the role of community beliefs in shaping their use, with a focus on Katsina State, Nigeria.

3. Research Method

3.1 Study Area

The study was conducted in Katsina State, Nigeria, a predominantly Hausa–Fulani state located in the northwestern region of the country. Katsina State was characterized by a mix of urban and rural settlements where both modern and traditional healthcare systems coexisted. Herbal medicine was widely used in the state due to cultural beliefs, affordability, accessibility, and trust in indigenous practices.

The study population consisted of adult residents of Katsina State, including herbal medicine users, local herbal practitioners, and selected healthcare workers. Participants were drawn from both urban centers such as Katsina metropolis, Daura, and Funtua, as well as rural communities where traditional medicine remained deeply rooted. The inclusion criteria focused on individuals with knowledge or experience in the use of herbal medicines, while the exclusion criteria were applied to respondents who were unwilling to participate or who lacked relevant experience.

3.2 Data Collection Method

The research utilized a mixed-methods approach, combining quantitative data from questionnaires on demographics, herbal medicine use, perceived effectiveness, and safety

knowledge with qualitative insights from Focus Group Discussions and Key Informant Interviews. These qualitative discussions included users, practitioners, and healthcare experts to address cultural beliefs, safety perceptions, and integration monitoring. Additionally, secondary data from relevant documents and guidelines were reviewed.

3.3 Method of data analysis

The study utilized descriptive statistical techniques to analyze data related to respondents' demographics, herbal medicine use, chemical awareness, perceived effectiveness, side effects, herb-drug interactions, regulatory knowledge, and label-checking behavior. Results were summarized using frequency distributions and percentages, presented in tables for clarity, highlighting trends and community perceptions without variable manipulation.

4. RESULT AND DISCUSSION

Table 4.1: Age Distribution of Respondents.

Age Group (Years)	Frequency	Percentage (%)
18–29	72	21.2
30–39	86	25.3
40–49	74	21.8
50–59	61	17.9
60 and above	47	13.8
Total	340	100.0

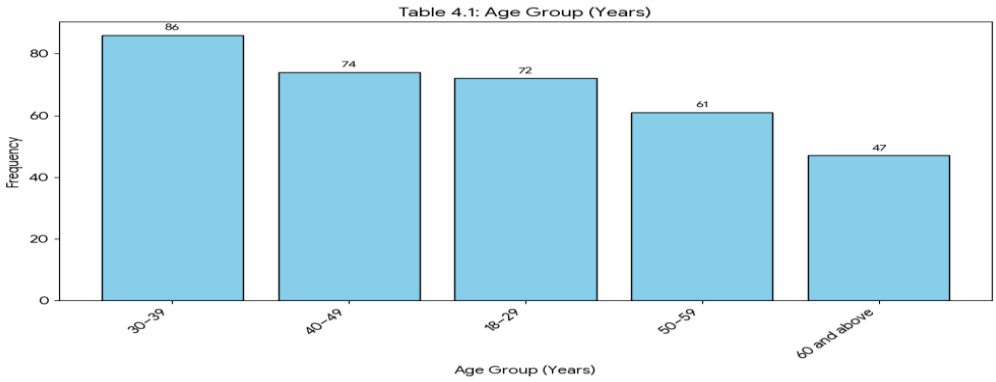

Figure 4.1: Chart showing age distribution of respondents.

The age distribution of respondents in this study indicates that the majority of individuals fall within the economically active age groups, particularly 30–39 years (25.3%), followed closely by 40–49 years (21.8%) and 18–29 years (21.2%). This suggests that the working-age population forms the largest segment engaging with herbal medicines in Katsina State. Their significant representation may be attributed to a combination of health awareness, active participation in family health decisions, and exposure to both traditional and modern

healthcare options. The middle-aged group's dominance also reflects a demographic that is likely more financially capable of purchasing herbal remedies compared to younger or older groups.

The study indicates older adults (50+) are underrepresented in herbal medicine surveys, with only 17.9% from ages 50–59 and 13.8% from 60+. This may be due to lower survey participation, less engagement with herbal medicine, or a preference for conventional healthcare. The majority of respondents are younger to middle-aged, highlighting the need for health education efforts targeting this demographic. Strategies should also be developed to engage older adults, who may be more susceptible to adverse effects, to effectively shape community health strategies in Katsina State.

Table 4.2: Table showing Gender Distribution.

Gender	Frequency	Percentage (%)
Male	162	47.6
Female	178	52.4
Total	340	100.0

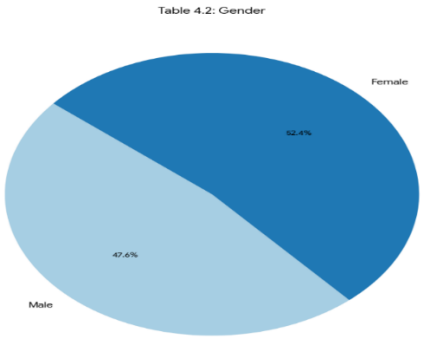

Figure 4.2: Chart showing gender distribution.

The gender distribution of respondents indicates a slightly higher participation of females (178; 52.4%) compared to males (162; 47.6%) in the study. This suggests that women are marginally more engaged in matters relating to herbal medicine usage in Katsina State. The nearly balanced representation between males and females, however, provides a fairly equitable perspective of community perceptions, ensuring that both genders' experiences and attitudes toward herbal remedies are captured. The higher proportion of female respondents may reflect social and cultural dynamics in which women often play central roles in family health management, including the selection, preparation, and administration of herbal medicines. Women's active involvement in household healthcare decisions could also mean they are more likely to use, observe, and report the effects of herbal remedies, providing a

richer insight into their effectiveness, safety, and perceived benefits. Conversely, men's slightly lower representation could indicate less direct engagement with herbal medicine practices, potentially due to reliance on formal healthcare services or differing health-seeking behaviors. The implications of this gender distribution are significant for public health interventions and educational strategies. Since women form the majority of users, awareness campaigns on safe usage, dosage, labeling, and possible herb–drug interactions should target them directly, as they are likely to influence family-wide practices. Additionally, strategies to encourage male participation in herbal medicine knowledge and safety could help bridge gender gaps in health education and ensure holistic community engagement. Understanding the gendered dynamics of herbal medicine use is therefore essential for effective policy formulation and health promotion in Katsina State.

Table 4.3: Educational Level of Respondents.

Education Level	Frequency	Percentage (%)
No Formal Education	84	24.7
Primary	91	26.8
Secondary	102	30.0
Tertiary	63	18.5
Total	340	100.0

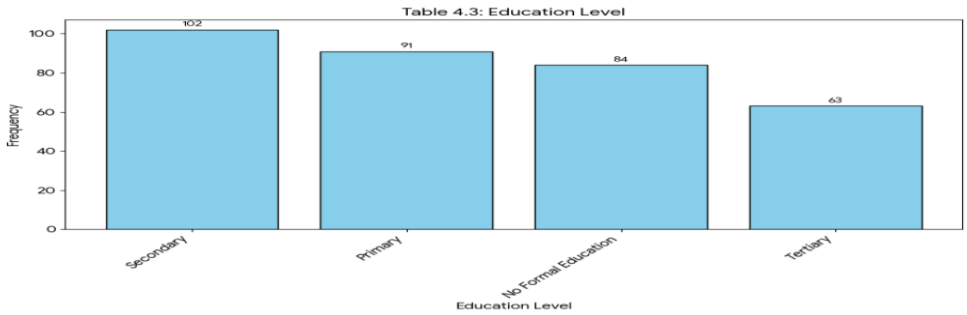

Figure 4.3: Chart showing Educational Level of Respondents.

The educational profile of respondents shows that the majority possess at least a basic level of education, with secondary education (102; 30.0%) being the most common, followed by primary education (91; 26.8%), and tertiary education (63; 18.5%). Meanwhile, 24.7% of respondents had no formal education. This distribution indicates that while a significant portion of the population has formal schooling, there remains a sizeable group with limited or no formal education, which may influence their understanding and interpretation of herbal medicines, including awareness of their chemical composition and potential side effects.

The educated population in Katsina State can critically assess herbal medicine use, with those holding tertiary and secondary education better able to understand dosage and evaluate safety and efficacy. In contrast, individuals without formal education may depend on traditional knowledge and community advice, affecting safety and consistency. Public health planning must address these educational disparities through tailored awareness campaigns and instructional programs at various reading levels to ensure safe usage and improve community knowledge about herbal medicines.

Table 4.4: Use of Herbal Medicines.

Response	Frequency	Percentage (%)
Yes	255	75.0
No	85	25.0
Total	340	100.0

The data on the use of herbal medicines in Katsina State shows that a substantial majority of respondents, 255 individuals (75.0%), reported using herbal remedies, while only 85 individuals (25.0%) indicated that they do not use them. This demonstrates that herbal medicine remains a widely accepted and integral part of healthcare practices in the community. The high usage rate highlights the continued relevance of traditional medicine alongside conventional healthcare, reflecting both cultural beliefs and accessibility of herbal remedies in the region. The predominance of herbal medicine use may also indicate that respondents perceive these remedies as effective, affordable, and convenient for treating common ailments. In many communities, herbal medicines are often preferred due to their availability, lower cost compared to pharmaceuticals, and alignment with cultural practices. Conversely, the 25% of respondents who do not use herbal medicines might prefer modern healthcare systems, may have concerns about efficacy, or could be influenced by higher educational or health awareness levels that lead them to seek regulated medical treatments. The widespread use of herbal remedies significantly impacts healthcare planning and policy, necessitating regulatory oversight for safety and proper labeling. Public health campaigns should educate users on safe preparation, dosage, side effects, and herb–drug interactions. Integrating herbal medicine with conventional practices may enhance patient outcomes, especially in rural or underserved regions.

Table 4.5: Frequency of Herbal Medicine Usage.

Frequency	Frequency	Percentage (%)
Daily	63	18.5

Weekly	104	30.6
Occasionally	113	33.2
Rarely	60	17.7
Total	340	100.0

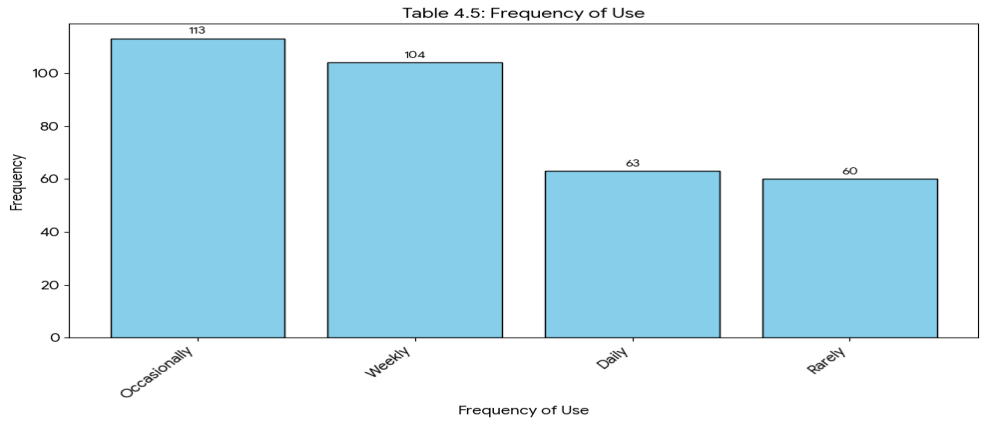

Figure 4.4 Chart showing the Frequency of Herbal Medicine Usage.

The frequency of herbal medicine use among respondents indicates that herbal remedies are an integral part of healthcare practices in Katsina State, but the level of regularity varies. Occasional use (113; 33.2%) was the most reported, followed by weekly use (104; 30.6%), daily use (63; 18.5%), and rare use (60; 17.7%). This suggests that while many respondents rely on herbal medicine, most do not use it as a constant daily treatment, instead opting for it as needed or when specific ailments arise.

The usage frequency of herbal medicine indicates its varying roles in the community. Occasional and weekly users typically address mild ailments, whereas daily users tend to depend on it for chronic issues. Rare users may prefer conventional medicine for various reasons. This highlights herbal medicine's dual role as a supplementary and primary healthcare option, which is crucial for public health planning. Tailored educational programs on safe usage and potential risks related to herbal remedies can improve treatment outcomes and inform healthcare decisions.

Table 4.6: Conditions Treated with Herbal Medicines.

Condition	Frequency	Percentage (%)
Malaria	96	28.2
Typhoid	71	20.9
Stomach Ache	69	20.3
Body Pain	56	16.5
Cold/Flu	48	14.1
Total	340	100.0

The data on conditions treated with herbal medicines in Katsina State indicates that herbal remedies are most frequently used for malaria (96; 28.2%), followed by typhoid (71; 20.9%), stomach ache (69; 20.3%), body pain (56; 16.5%), and cold/flu (48; 14.1%). This distribution shows that respondents primarily rely on herbal medicine to manage common infectious and symptomatic illnesses that affect the general population. The high prevalence of malaria treatment reflects the endemic nature of the disease in the region and the role of herbal remedies as accessible first-line healthcare options. The community's use of herbal medicine reflects a perception of efficacy, with individuals favoring these remedies for their availability, affordability, and cultural acceptance, particularly for conditions like stomachache and body pain. This reliance implies important considerations for public health, emphasizing the need for safe practices and education regarding herbal treatments, especially in common diseases like malaria and typhoid. Health authorities are encouraged to create community-based programs to educate on the integration of herbal remedies with conventional medical care and to promote research on their pharmacological effects and interactions.

Table 4.7: Awareness of Active Chemical Compounds.

Response	Frequency	Percentage (%)
Yes	136	40.0
No	204	60.0
Total	340	100.0

The data on awareness of active chemical compounds in herbal medicines reveals that a majority of respondents, 204 individuals (60.0%), are not aware of the chemical constituents in the herbal remedies they use, while only 136 individuals (40.0%) reported having such awareness. This indicates a significant knowledge gap among the community regarding the scientific composition and potential pharmacological effects of herbal medicines. The limited understanding of active compounds suggests that many users rely on traditional knowledge, experience, or community recommendations rather than evidence-based information.

This text discusses the implications of public awareness regarding herbal medicines, emphasizing that unawareness of active ingredients can lead to risks like improper dosage and adverse interactions with conventional drugs. In contrast, the 40% of respondents who are knowledgeable may utilize these medicines more safely. The findings underscore the necessity for public health education to enhance safe usage and minimize risks associated with self-medication. It highlights the role of regulatory bodies and healthcare providers in

improving community awareness of herbal ingredients, dosing, and drug interactions to better align traditional practices with modern healthcare safety standards.

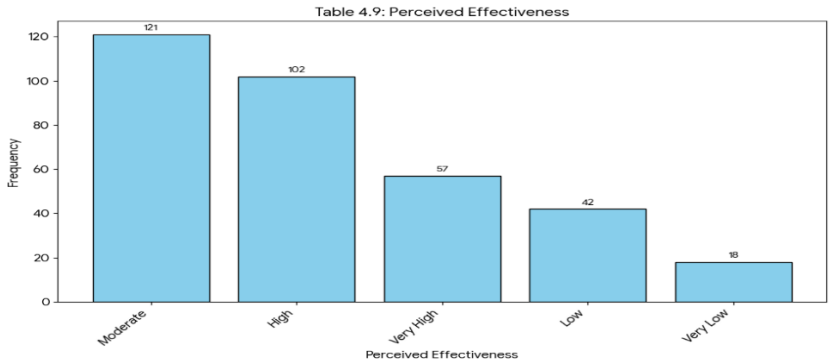

Figure 4.5: Perceived Effectiveness of Herbal Medicines.

The perception of the effectiveness of herbal medicines among respondents shows that the majority consider these remedies to be moderately (121; 35.6%) to highly effective (102; 30.0%), with an additional 16.7% rating them as very high in effectiveness. Only a small portion of respondents perceive herbal medicines as low (42; 12.4%) or very low (18; 5.3%) in efficacy. This distribution indicates a generally positive community perception of herbal medicines, reflecting widespread trust and confidence in their ability to treat various ailments. This perception of herbal remedies is shaped by cultural beliefs and personal experiences, particularly regarding their effectiveness for conditions like malaria and typhoid. Users rating these remedies as effective often do so based on observable benefits, while those indicating low effectiveness may have faced inadequate results or prefer conventional treatments. These findings underscore the need for healthcare planning around herbal medicine regulation, emphasizing the importance of safe usage, proper dosage, and awareness of potential interactions and side effects.

Table 4.8: Experience of Side Effects.

Response	Frequency	Percentage (%)
Yes	86	25.3
No	254	74.7
Total	340	100.0

The data on the experience of side effects from herbal medicines shows that a majority of respondents, 254 individuals (74.7%), did not report any adverse effects, while 86 respondents (25.3%) indicated that they had experienced side effects. This suggests that while herbal medicines are generally perceived as safe, a significant minority of users do encounter

negative reactions, which could range from mild discomfort to more serious health concerns. The high proportion of respondents reporting no side effects may contribute to the widespread acceptance and trust in herbal remedies within the community. The highlighted occurrence of side effects in a quarter of users emphasizes the need for caution with herbal medicines, driven by factors such as improper dosage and contamination. Cultural familiarity contributes to their use despite risks, necessitating education on safe usage and monitoring for adverse reactions. The findings underscore the importance of public health interventions, regulatory oversight, and targeted health campaigns to enhance safer practices in herbal medicine in Katsina State.

Table 4.9: Herb–Drug Interaction Experience.

Response	Frequency	Percentage (%)
Yes	61	17.9
No	144	42.4
Not Sure	135	39.7
Total	340	100.0

The data on herb–drug interaction experiences shows that 42.4% of respondents (144 individuals) reported not experiencing any interactions, while 17.9% (61 individuals) acknowledged that they had experienced interactions between herbal medicines and conventional drugs. Notably, a large proportion, 39.7% (135 individuals), were uncertain whether such interactions had occurred. This distribution indicates a widespread lack of awareness or understanding of potential herb–drug interactions within the community, even among regular users of herbal remedies. The findings indicate that nearly 40% of respondents may be unaware of potential adverse interactions between herbal and conventional medicines, posing health risks for those on prescriptions. Symptoms like nausea and dizziness may be overlooked, affecting communication with healthcare providers. This highlights the necessity for public health initiatives to educate about herb–drug interactions and the importance of informing healthcare professionals about herbal consumption, aiming to promote safer herbal medicine use in Katsina State.

Table 4.10: Awareness of NAFDAC Regulation.

Response	Frequency	Percentage (%)
Yes	187	55.0
No	153	45.0
Total	340	100.0

The data indicates that 55% of respondents in Katsina State are aware of NAFDAC's regulation of herbal medicines, while 45% are not. This mixed awareness level may influence their choice of herbal products; those knowledgeable about regulations tend to select well-labeled, verified items, whereas the uninformed may rely on traditional knowledge, risking substandard purchases. This situation underscores the need for improved public health education and awareness campaigns to bolster consumer confidence and promote safe practices regarding herbal remedies.

Table 4.11: Label Checking Behaviour.

Response	Frequency	Percentage (%)
Always	98	28.8
Sometimes	151	44.4
Never	91	26.8
Total	340	100.0

The data reveals that 44.4% of respondents sometimes check herbal medicine labels, while 28.8% always check, and 26.8% never check. This suggests a general caution among consumers, but also highlights a substantial number who are inconsistent or neglectful in verifying important product information. The findings imply a need for improved public health education, advocating for regular label checking to enhance safety and compliance with regulatory standards, particularly by targeting those who rarely or never consult labels. Additionally, manufacturers should ensure labels are clear and accessible to promote better understanding among consumers.

5. CONCLUSION

Based on the findings of the study, it is concluded that herbal medicines are widely used and generally perceived as effective by communities in Katsina State. However, this widespread acceptance is not matched by adequate knowledge of their biochemical composition, potential side effects, herb–drug interactions, and regulatory requirements. The limited awareness of active chemical compounds and inconsistent safety practices pose potential health risks, particularly for individuals combining herbal remedies with conventional medicines.

The study concludes that while herbal medicines play an important role in community healthcare, there is a critical need for improved education, regulation, and integration of scientific knowledge to ensure their safe and effective use. Strengthening public awareness

and regulatory compliance will enhance consumer safety and maximize the health benefits of herbal medicines.

6. Recommendation

Based on the findings and conclusions of the study, the following recommendations are made:

- Government and health agencies should implement community-based education programs to improve awareness of the biochemical components, proper dosage, and potential side effects of herbal medicines.
- Health campaigns should emphasize the risks of combining herbal remedies with conventional drugs and encourage users to disclose herbal medicine use to healthcare professionals.
- NAFDAC and related bodies should intensify public awareness on the regulation, certification, and labeling of herbal products to promote safer consumption.
- Manufacturers should be required to provide clear, simple, and readable labels that include ingredients, dosage instructions, warnings, and regulatory approval information.
- Healthcare providers should incorporate discussions on herbal medicine use into routine medical consultations to improve patient safety and treatment outcomes.
- Researchers should conduct biochemical and pharmacological studies to validate the efficacy and safety of commonly used herbal medicines.

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