

**زانکۆی سەلاحەددین – هەولێر**

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***By:***

***Sarchl Sarbast Salih – Saria Mahir Sahid***

***Supervisor by:***

***Asst. Prof. Dr. Saber W. Hamad***

***Asst. Lecturer. Baghawan A. Omer***

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# Abstract

Natural products have a vital role in the treatment of sickness around the world. It is believed that more than 70% of the world’s population depend on natural goods. The survey discovered that Kurdish people prefer to treat their illnesses using medicinal herbs rather than pharmaceuticals and believe that medicinal plants might help treat a variety of ailments. Unfortunately, knowledge is passed down from generation to generation verbally, without recording. The study's goal is to describe natural remedies utilized by Kurdish individuals to treat and manage a variety of diseases. Visits were made to several businesses and herbalists in Hawler, including Qaysare, Kuran bazar, Nawroz bazar, 40-meter bazar (langa), and some herbalists. Herbalists were interviewed based on questionnaires that included a variety of questions. Twenty individuals were interviewed which100% were men. 92 plants were documented from 42 families as its worth mentioning that Asteraceae was having the highest abundance whereas, Salecaceae family was the least. Qualitatively, excel 2016 was used to calculate descriptive statistics of socio-demographic information of the respondents. Ninety-two medicinal plants were documented and used for the management of various ailments: stomach, inflammation, blood pressure, headache, cholesterol, liver, kidney, and hypertension. Leaves were reported as the most used part of the plant (50 %), oral as the most form of administration (103.26). The usage of medicinal plants from patients mostly single 92.39% while about 7.61% were used as combine. The most preparation methods are boiling which were (48.91%) and the least was powdered form (2.17%). Hawler has a varied range of medicinal plants, according to the current study, and the use of medicinal plants and plant-based therapies is still common in the area. The study aimed to comprehensively document the traditional medicinal plants utilized by the people of Hawler. It will serve as an avenue for further development of herbal formulations and modern medicines in the Region.

# Chapter 1: Introduction

For thousands of years, plants have been valuable sources of medicine. For a great number of people on the planet, they are the primary source of life-saving medications (Leena and Jaindra, 2003). Herbal remedies are widely used for the treatment and prevention of various diseases that contain highly active pharmacological compounds (Saad, *et al*., 2006). Among other things, the essential oil content of a plant depends on its component, growing season, age, location, extraction techniques, solvent, and time (Kaul, *et al*. 2003). The Iraqi people have a rich medical history, hundreds of years of belief, and observations as the foundation for their understanding of medicinal plants (Alsamarkandi, 1985; Khalil, 1979). The World Health Organization reports that over 80% of people worldwide, particularly in the least developed nations, get their basic medical treatment from medicinal plants (Yaseen, *et al*., 2015).

According to Ahmad and Askari (2015), ethnobotanical studies record, describe, and evaluate various links that exist between and within cultures as well as the ways in which plants are used in human communities. Unfortunately, before it is documented, the ethnobotanical legacy of many ethnic groups is swiftly vanishing, particularly in underdeveloped or emerging nations. Iraq's Kurdistan is not an exception.

Therefore, Heywood, 1999; Hamilton *et al*. (2003) studied that the ethnobotanical studies can be seen as a door into cultural and traditional features as well as a way to better understand the future of human relationships with the nature. The study of plant-human interactions throughout human history is known as ethnobotany (Muthu, 2006). The term "ethnobotany" was first used in history in 1896 by American botanist John Harshberger to describe the study of plants utilized by aboriginal and primitive people. Since then, it has been described as the traditional knowledge that native populations have of the variety of plants in their environment and the study of the ways in which members of a certain culture and geographic area utilize native plants. Ethnobotany has its roots in botany (Harshberger, 1896).

The study of medicinal plants and their traditional uses has attracted a lot of attention in recent decades from all over the world (Redouan, *et al*., 2022). One frequent objective of ethnobotanical study was to locate and learn more about plants that were already in use by local communities (Redouan, *et al*., 2022). Throughout recorded history, people have looked to the natural world for treatment from a wide range of medical conditions (Dogara, 2022; Sakna, *et al*., 2019). Since ancient times, wild food plants have been essential to human survival and settlement. Native plant species have long been utilized by human communities for a variety of purposes, including food, fuel, medicine, clothing, and the manufacture of household chemicals as well as animal feed (Hamilton *et al*., 2003; Schulp *et al*., 2014). The habit of gathering wild foods continues across the world despite the development of agriculture, mostly because of their nutritional worth and potential health advantages for humans (Pardo-de-Santayana *et al*., 2007).

From an economic perspective, traditional markets and rural people may be able to supplement their income by choosing these edibles. wild plants (Hamilton *et al*., 2003; Lead *et al*., 2010). In Erbil, medicinal plants are still utilized to cure ailments, particularly those that need long-term care. The Iraqi-Kurdistan mountains are habitat to a wide diversity of plants (Shahbaz, 2010), most of which are used as pasturage by herds of goats and sheep. However, many species are also carefully harvested, primarily by women, for their therapeutic qualities (Howell, 1965). Indeed, hundreds of years of beliefs, observations, and a rich medical history have formed the basis of Kurdistan people's understanding about medicinal plants (Alsamarkandi, 1985; Avicenna, 1980). Indeed, in Kurdistan, as in other developing nations, traditional herbal medicine remains the first choice for the primary treatment of several diseases, particularly for those unable to afford the more costly, current synthetic medications.

# Aim

This study's goal was to gather and record data on plants that were traditionally utilized in Erbil to treat and manage a variety of diseases (Abdullah *et al*., 2016).

# Chapter 2: Literature Review

# 2.1. Medicinal Plants in Kurdistan Region

In Kurdistan, traditional herbal medicine remains the first choice for primary healthcare for many diseases, and herbalists are the ones the local community turns to especially for those that cannot afford expensive pharmaceuticals. Herbal medicine has increased in popularity in Kurdish society during the last two decades. Media are filled with information on herbal remedies, and the researchers experienced that Kurds often seek knowledge of herbs from friends and relatives. The growing interest for herbal medicine in Kurdistan has brought a new wave of private investors establishing clinics focusing on herbal medicine (Mati and Boer, 2010). The study was found that 32 plants from 23 families were utilized in traditional medicine to treat a variety of illnesses, and that the traditional healers were not licensed professionals. The discovered plants are listed in a table along with their common names, portions that are beneficial, dosage forms, and medical applications. Although there is little proof of their potential for phytotherapy, several known plant species are utilized in traditional medicine in the Erbil, Kurdistan area. There are still many native plants to be investigated, which might produce a wealth of fascinating information for more research (Naqishbandi, 2014).

Abdulrahman *et al*. (2022) studied that forty-two medicinal plants were documented and used for the management of various ailments: diabetes, fever, immune booster, aphrodisiac, stomach pain, headache, fungal, and bacterial infections by the Kurdish people in Ranya city to the treatment and management of various ailments. Also, during the research, it was revealed that the residents of Ranya were diligent guardians of their traditional knowledge of medicinal plants and utilized to improve their health status.

The study was conducted in Ballakayati region of Erbil in North Iraq, and to determine the local names and uses of those plants, the study was carried out for approximately 3 years between 2016 and 2018. During this period of time, 85 plant specimens were collected and face-to-face questionnaires were conducted with interviews during busy hours in public areas (school, gardens, houses, etc.). The study showed that plants are used in the treatment of many health problems mostly for the treatment of a cold, shortness of breath, and heart and gastrointestinal diseases. In addition, drying medicinal plants enabled the local people to use them in every season of the year (Kawarty *et al*., 2020).

# 2.2. Traditional Herbal Medicine in Evolution

The use of herbal medicine has increased in developed countries. Alternative remedies are perceived to be innocuous and may provide placebo effects from the rituals associated with their ingestion. Use of herbal medicines increased in the USA by 25% between 1990 and 1997. Approximately 10% of US adults were using herbal remedies in 1999. Approximately $US 4.2 out of the $US 17.8 billion spent on ‘dietary supplements’ in 2001 were for herbs and other botanical remedies. Approximately $US 5 billion worth of over-the-counter herbal medicines were sold in the European countries in 2003. Herbal medicine accounted for approximately 26% of all alternative and complimentary medicine use in Australia. The global annual turnover in herbal medicines is estimated at $US60 billion, representing approximately 20% of the overall drug market 15.76 According to the World Health Organization, approximately 80% of the world’s population in developing countries relies on traditional medicines, which are mostly derived from plants, for their primary health care (Chivian, *et al.*, 2002). Epidemiological studies have shown that many of the phytochemicals from medicinal plants possess anti-inflammatory, antiatherosclerosis, antitumor, antimutagenic, anticarcinogenic, antibacterial, or antiviral activities (Sala *et al*., 2002). They are also associated with reduced risks of cancer, cardiovascular disease, diabetes and lower mortality rates of several human diseases (Anderson *et al*., 2001; Sun *et al*., 2002). Mati and Boer, (2010) conducted an experiment in Qaysari bazaar, in Erbil city in the Kurdistan Region, Iraq. Free list surveys were conducted with 18 of herbalists to determine diversity and salience of traded traditional medicinal plants.

Interviews were conducted to document use, trade volume, origin, stock and value of the reported species. Kurdistan has a long history of using herbal medicine, which is demonstrated by the strong and varied trading in medicinal plants that are exported from the districts around Erbil to nations like Libya, Spain, and India. Marketplaces are the center of a region's trade and culture, and they may provide quick information on customs and the importance of marketed health goods. Trade increases each year and herbalists continue adding new medicinal products to their inventories. Herbalists wanting to keep pace with developments are taking after the herbal clinics, and offer prepacked imported herbal products to provide easy treatments without risking taking blame. As the trade is moving from traditional culture to mainstream, herbalists are likely to gradually lose their positions as traditional healers and become businessmen trading herbal products (Mati and Boer, 2010).

# 2.3. The Uses of Medicinal Plants for Chronic Diseases

Chronic diseases, also known as non-communicable diseases (NCDs), are defined by the World Health Organization as long-term disorders, which usually progress slowly and are not transmissible between people (WHO, 2014). The risk factors of chronic diseases are complex and results of a combination of different genetic, physiological, behavioral and environmental factors (WHO, 2014). Chronic diseases such as hypertension, diabetes, cancer, asthma, and chronic kidney diseases are increasingly becoming a major problem of health care systems worldwide due to their considerably increasing prevalence (Kawarty *et al*., 2020).

In 2008, around 36 million (63%) of all global deaths were caused by chronic diseases (Alwan *et al*., 2011), this number increased to 39 million (72%) of all global deaths in 2016 (Naghavi *et al*., 2016). Herbal drugs have been used since ancient times as medicines for the treatment of a range of diseases. Medicinal plants have played a key role in world health. In spite of the great advances observed in modern medicine in recent decades, plants still make an important contribution to health care. Medicinal plants are distributed worldwide, but they are most abundant in tropical countries. Over the past decade, interest in drugs derived from higher plants, especially the phototherapeutic ones, has increased expressively. It is estimated that about 25% of all modern medicines are directly or indirectly derived from higher plants (Farnsworth and Morris, 1976; Shu, 1998). In some particular cases, such as antitumoral and antimicrobial drugs, about 60% of the medicines currently available on the market and most of those in the late stages of clinical trials are derived from natural products, mainly from higher plants (Cragg *et al*., 1997).

Ahmed, (2016) was carried out an ethnobotanical survey to collect data and document traditional knowledge on the medicinal plants in the province of Sulaymaniyah during 2014– 2015. The data were collected by interviewing 45 traditional healers (36 males and 9 females between the ages of 25 and 80 years) who retain traditional knowledge on medicinal plants. Furthermore, the use value (UV) of taxa was determined and informant consensus factor (ICF) was calculated for the medicinal plants included in the study. The results were found that a total of sixty-six plant species, belonging to sixty-three genera within thirty-four plant families, used to treat nighty-nine different types of ailments and diseases. The most important family was Lamiaceae (7 species), followed by Apiaceae, Asteraceae, and Fabaceae (6 species each). The most frequently used parts were leaves (46 %), followed by flowers (15 %), and seeds (10 %). The most common preparation method was decoction (68 %), whereas few taxa were consumed as a vegetable (13 %) or ingested in powder form (10 %). The respiratory issues category had the highest ICF value (0.68), followed by inflammations and women’s diseases (0.58 and 0.54), respectively. The highest UVs were recorded for the species Zingiber officinale (0.48), *Matricaria chamomilla* (0.37), *Adiantum capillus-veneris* (0.31), *Thymus vulgaris* (0.31) and *Pimpinella anisum* (0.31).

The study was presented in four different areas in the North center region of Morocco at May 1997, the data of Ethnobotanical information was obtained from 25 local traditional herbal healers and more than 1500 patients suffering from diabetes, cardiac and renal diseases. Also, about 90 plants were cited (54 plants for diabetes, 11 for cardiac diseases, 19 for hypertension and 33 for renal diseases). The plants reported have been identified with the vernacular name, useful parts, ecological distribution and medicinal uses. The data revealed that more than 1153 of the total patients interviewed (76%) used regularly medicinal plants to treat diabetes, cardiac and renal diseases. All the persons interviewed have indicated that the reasons of using phytotherapy is that the plant medicines are cheapest (54%) and more efficient (38%) than modern medicine. In addition, the result indicated that nine plants are extremely toxic at high doses and chronic treatment. Fifty nine percent of the interviewers have indicated that they used medicinal plants from the experience of the other (Jouad *et al*., 2001).

# 2.4. Chronic kidney disease (CKD)

The kidneys are two bean-shaped organs that extract waste from blood, balance body fluids, form urine, and aid in other important functions of the body. The main role of the kidneys is to filter waste products from the blood before converting them into urine. The kidneys also help maintain blood pressure, maintain the correct levels of chemicals in your body which, in turn, will help heart and muscles function properly, produce the active form of vitamin D that keeps bones healthy, produce a substance called erythropoietin, which stimulates production of red blood cells (Chand and Chand, 2015).

More than one fifth of people over ages of 65 years have some degrees of chronic kidney disease (CKD) (Nasri, 2013). This complication is attributed to oxidative stress. Oxidative stress is an important factor contributing to kidney damage by increasing production of oxidants, particularly insufficiency of endogenous antioxidant defense system (Nasri, 2013). Chronic kidney disease (CKD) is a progressive loss in kidney function over a period of months or years. Each of your kidneys has about a million tiny filters, called nephrons. If nephrons are damaged, they stop working. For a while, healthy nephrons can take on the extra work. But if the damage continues, more and more nephrons shut down. After a certain point, the nephrons that are left cannot filter your blood well enough to keep you healthy. Renal disorders have always remained a major area of concern for physicians since a long time. It is the 9th leading cause of death in United States. Incidence of kidney diseases leading to kidney failure is increasing day by day. A large number of chemicals in common use are potential renal toxins.

The use of herbal drugs for the prevention and treatment of various diseases is constantly developing throughout the world (Chand and Chand, 2015). Chronic kidney disease is the reduced ability of the kidney to carry out these functions in the long-term. This is most often caused by damage to the kidneys from other conditions, most commonly diabetes and high blood pressure. (Chand and Chand, 2015). The prevalence of chronic kidney disease is high in developing countries. The prevalence of chronic kidney disease was high in north and southwest regions compared with other regions. Other factors independently associated with kidney damage were age, sex, hypertension, diabetes, history of cardiovascular disease, hyperuricemia, area of residence, and economic status. Chronic kidney disease has become an important public health problem in China. Special attention should be paid to residents in economically improving rural areas and specific geographical regions in China.

El Hachlaf *et al*. (2020) was conducted an ethnobotanical survey in Morocco with traditional herbalists, on one hand, and with subjects suffering from chronic diseases on the other hand, during 5 months from February to June 2019. Data were collected in form of 581 questionnaire cards based on semi-structured interviews. Relative Citation Frequency, Family Importance Value, Plant Part Value, Fidelity Level, and Informant Consensus Factor were used in ethnobotanical data analysis. A total of 79 medicinal and aromatic plant species were identified, belonging to 74 genera and 39 botanical families, of which Lamiaceae and Asteraceae were the most frequently represented. The most cited plant species were *Nigella sativa*, and *Origanum compactum*. Leaves represent the most used plants part and decoction was the major preparation model of remedies (37.7%). Concerning treated diseases, chronic kidney disease has the highest. The most cited plant species are *Nigella sativa* L., *Origanum compactum* Benth, *Trigonella foenum-graecum* and *Salvia officinalis*. Furthermore, 18 cases of side effects were recorded, most of which were digestive. These side effects are related to the use of different medicinal plants such as *Aristolochia longa* L. and *Peganum harmala* L.

Hundreds of herbs used in prescriptions of a single herb, decoctions of multiple herbs, or patent medicines have been used to treat patients with CKD. These prescriptions have effects including promotion of diuresis, reduction of proteinuria, and improvement of renal function (Li *et al*., 1996). Mechanisms of action have been studied for some herbs. Their effects are mainly related to antiinflammation, antioxidation, antifibrosis, regulation of immune system, anticoagulation, and improvement of metabolic disturbance (Zhong *et al*., 2013; Wojcikowski *et al*., 2006).

# 2.5. Medicinal Plants for Treating Obesity

Nowadays, changes in human lifestyle and high energy diet have increased the incidence of obesity and even have become a risk factor to the population of children (Klop *et al*., 2013; Kopelman, 2000). There are several pharmacologic substances available as anti-obesity drugs, however they have hazardous side effects and hence natural products have been used for treating obesity in many Asian countries (Matson and Fallon, 2012). The potential of natural products for the treatment of obesity is still largely unexplored and can be an excellent alternative for the safe and effective development of anti-obesity drugs (Bhutani *et al*., 2007).

Obesity is characterized by increase in adipose cell size which is determined by amount of fat accumulated in the cytoplasm of adipocytes (Devlin *et al*., 2000). This change in the metabolism in the adipocytes is regulated by various enzymes such as fatty acid synthase, lipoprotein lipase and adipocyte fatty acid-binding protein (Rosen *et al*., 2000). Obesity is becoming one of the most prevalent health concerns among all populations and age groups worldwide, resulting into a significant increase in mortality and morbidity related to coronary heart diseases, diabetes type 2, metabolic syndrome, stroke and cancers (Rosen *et al*., 2000). Both lifestyle and pharmacotherapy interventions have been considered by physicians and other health care professionals as obesity treatment modalities. Studies show that only 5-10 % subjects can maintain their weight loss over the years (Hasani-Ranjbar *et al*., 2008). The complex pathogenesis of obesity indicates the need of different intervention strategies to confront this problem with a simple drug therapy which is more acceptable to patients (Mahan and Escott-Stump, 2008). Disappointing results, after cessation the lifestyle modification or pharmacotherapy indicated the need of other treatment modalities to produce better and long-lasting results, in terms of weight loss (Liu *et al*., 2002). Unfortunately, drug treatment of obesity despite short-term benefits, is often associated with rebound weight gain after the cessation of drug use, side effects from the medication, and the potential for drug abuse (Abdollahi and Afshar-Imani, 2003).

Herbal supplements and diet-based therapies for weight loss are among the most common complementary and alternative medicine [CAM] modalities (Barnes *et al*., 2004). A vast range of these natural products and medicinal plants, including crude extracts and isolated compounds from plants can be used to induce weight loss and prevent diet-induced obesity. In the recent decades, these have been vastly used in management of obesity Hanl *et al*. (2005) due to containing a large variety of several components with different anti-obesity and anti-oxidant effects on body metabolism and fat oxidation. Medicinal plants have been investigated and reported to be useful in treatment of obesity, diabetes and other chronic diseases (Hasani-Ranjbar *et al*., 2009; Hasani-Ranjbar *et al*., 2010).

Complementary and alternative therapies have long been used in the Eastern world but recently these therapies are being used increasingly worldwide (Hasani-Ranjbar *et al*., 2008). When conventional medicine fails to treat chronic diseases and conditions such as obesity efficaciously and without adverse events, many people seek unconventional therapies including herbal medicine (Liu *et al*., 2002). Although the number of randomized trials on complementary therapies has doubled every 5 years and the Cochrane library included 100 systematic reviews of unconventional interventions (Liu *et al*., 2013), none of these studies specifically mentioned herbal therapy in obesity.

# 2.6. Diabetes

Diabetes mellitus is a major endocrine disorder, affecting approximately 5% of the world’s population. WHO estimates that almost 3 million deaths occurring annually are as a result of diabetes and that there will be 366 million cases of diabetes by the year 2030 (Sunil *et al*., 2012). Diabetes is characterized by abnormalities in carbohydrate, lipid and lipoprotein metabolisms, which not only lead to hyperglycemia but also cause many complications such as hyperlipidemia, hyperinsulinemia, hypertension and atherosclerosis (Bakırel *et al*., 2008; Itankar *et al*., 2011).

There is increasing evidence that complications associated with diabetes may be related to oxidative stress induced by the production of free radicals (Ozkol *et al*., 2013). Pancreatic β-cells are particularly susceptible to the detrimental effects of reactive oxygen species (ROS), because of their low expression of the antioxidant enzymes genes as compared to other tissues. Thus, the increase of ROS leads to damage of β-cells through the induction of apoptosis and suppression of insulin biosynthesis (Bakırel *et al*., 2008). Antioxidants have been shown to prevent the destruction of β-cells by inhibiting the peroxidation chain reaction and thus they may provide protection against the development of diabetes (Aslan *et al*., 2010).

# Chapter 3: Materials and Methods

# 3.1. Study area

The region of Erbil that has been studied of the most well-known cities of the presence famous fortress several ancient Kurdistan is home to homes, museums, and locally manufactured crafts in the citadel on central Erbil. Northern Iraq's regional administration. Kurdish is the language spoken by Muslims and locals in Erbil, and the city's economy is based on tourism, small factories, the oil industry, and agriculture. Erbil is brimming with wonderful plants. Given the varied climates and ambient living spaces of the locations, such as lakes, hills, valleys, fields, and mountains.

# 3.2. Plant materials

The study was carried out between 2023 and 2024. The plants used by the locals and especially naturally growing plants form our material. During this period of time. The first one included information about the traditional healers including the address, age, sex, duration of practicing herbal medicine and educational level. The second questionnaire included information about using medicinal plants by traditional healers including plant botanical and vernacular name, part used, form of use and therapeutical use. Anonymity of the participants was ensured. After compilation of all the data, plant materials were collected.

# 3.3. Data collection

Ethnobotanical studies also involve the collection of cultural data, such as interviews with herbalist, customer’s, and peoples who sold medicinal plants. These data were typically collected, and used a range of methods to collect and record the data (Albuquerque, 2014).

# 3.4. Data analysis

Using Descriptive Statistical approaches, the gathered data were examined and summarized using Microsoft Excel 2010. The thesis was written in Microsoft Word, and the local name, scientific name, family, and the parts of the plant that were used, method of usage, method of preparations and medicinal effects the plants were explained for all the used of this study (Ahmed, 2017).

# 3.5. Sampling and Interview Sessions

The methods of non-random probability and the expert sampling were employed in this research. (Table 1).

**Questionnaire**

1. **Gender**
2. **Age**
3. **Education**
4. **Occupation**
5. **Practicing traditional herbalism for how long?**
6. **Name of any traditional medicinal plants you used for the treatment of Disease.**

**Table1. Some questions employed during the interview**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Scientific Name** | **Part of the plant use** | **How do you use it single or combine specify?** | **Method of preparation** | **Mode of administration** | **Disease**  **treatment** |
|  |  |  |  |  |  |
|  |  |  |  |  |  |

# Chapter 4: Result and Discussion

# 4.1 Demographic profile

According to demographic information from the respondents who were questioned, of the total 20 respondents, 100 % were men (Table 2). Our result is disagreed with the findings of Kankara *et al*. (2015) who reported that 64.33% of the respondents interviewed were female in their study of ethnomedicinal knowledge. Most participated were 45% from age 26-35 and the least participated were 15% from age (20-25). Mild value (20% each from ages 36 to 45, 46 to 55) which is in conformity with the findings of Mahmood *et al*. (2012) demonstrated that traditional herbal medicinal plants were mostly maintained by elderly members. The traditional knowledge of medicinal plants in this ethnic group may be seriously challenged by this, since it may eventually be lost due to the aging of the elder population.

**Table 2. Demographic information of the persons interviewed**

**Gender**

|  |  |  |
| --- | --- | --- |
| **Male** | **20** | **100%** |

Fig 1. Demographic profile of the informant’s age.

# 4.2. Educations levels of participations

For the instructive stages, the education level of participated divided into five groups primary school, secondary school, high school, institute and university accounting for 3,8,4,3 and 2 of the customers. The findings from the study showed that a majority of the respondents has attained a secondary school was that 40%, thus is to confirm that they are aware of modern medicine and high school was 20% while at least primary school and institute were 15% and the lowest value was 10% of university (Fig 1). This finding is not in agreement with the study by Kanakara *et al*. (2015) who reported that a majority of the respondents do not have a basic level of education. However, this data is not agreement with the study by Mahmood *et al*. (2012) who revealed that a majority of the respondents has attained a basic level of education.

Fig 2. Educations level of the informants.

# 4.3. Preparation methods

Figure 3 shows that boiling is the most prepared method (48.91%) followed by decoction (23.91%), infusion (11.96%), direct (16.3%), in capsule (5.43%) and powdered form (2.17%). The finding is as a result of the boiling that extracts more compounds from the plant parts which are the constituents responsible for the medicinal value and due to hard parts of some plants. The results also disagreed with Kankara *et al*. (2015) who also reported decoction (32%) as the most frequent form of herbal medicine preparations. It has also been documented that most of the traditional herbal medicine were utilized dried and fresh this is due to the most of the medicinal plants were wild thus the plants have to be collected in excess to avoid any risk (Mahmoud *et al*., 2017)

Fig 3. Frequency of different plants preparation methods used in the study area (%).

# 4.4. Plant parts used

The different parts of plants were utilized among different diseases i.e. roots, stems, leaves, flower, fruit, bulbs, buds and nuts. The whole plant was also as in case of herb. The most repeatedly used plant parts were leaves (50%) followed by flower (27%), seed and root (23%), fruit (15%), stem (13%), bark (9 %), bud (2%) and nuts, bulb (1%) (Fig. 4). The frequent usage of the leaves was documented in this study, probably due to the fact that secondary metabolites are primarily produced in the leaves where the photosynthesis takes place and later transported to other parts of the plants, and may also as a result of the easy collection of the leaves when compared to other parts of the plant like root, bark and whole plant (Abdulrahman *et al*., 2018). The leaves of plants contain high amount medicinal compounds for this reason they are highly prized in traditional medicine (Mahmood *et al*., 2012). Although the frequent use of plant leaves poses a serious threat to biodiversity conservation and could accelerate global warming by reducing the uptake of carbon dioxide and oxygen, the use of leaves is consistent with numerous botanical studies conducted throughout Peninsular Malaysia, Asia, and the world. The results in the studies Lulekal *et al*. (2008) and Nelson-Harrison *et al*. (2002) showed that the two main factors in reduction of medicinal plants population are agricultural expansion, cutting for fuel wood at large scale pooled with seasonal drought. The most plant parts which was used leaves and root, which agrees with most other ethnobotanical studies (Gazzaneo et al., 2005; Yineger et al., 2008).

Fig 4. Parts of the plants used for treatment of diseases.

# 4.5. Administration methods

The most methods of administration were oral and dermal. Oral has been reported as the most accepted mode of administration (103.26 %), followed by dermal (11.96%), (Figure 4). Moreover, this finding is in line with the studies carried out on medicinal plants by Kankara *et al*. (2015) and Mahmoud *et al*. (2017). The most popular method of administration of medicinal plants was established from previous researches it was oral application (Mahmood *et al.,* 2012; Giday *et al*., 2003). On the other hand, dermal and oral use of medicinal plant preparations might result in their faster physiological action and greater therapeutic efficiency (Abdulrahman *et al*., 2023). These results are consistent with the finding Lulekal *et al*. (2008) who indicated that oral application (116 preparations, 50.43 %) was the highest and most commonly used route of application followed by dermal application (54 preparations, 23.48 %). This is consistent with a study conducted in Mascara in Algeria (Benlamdini *et al*. 2014), which showed that the oral route allows a better absorption of active compounds contained in an herbal remedy.

Fig 5. Administration methods (%) of plants

# 4.6. Diversity of plants

The most common medicinal plants used as drug were the members of family Asteraceae (12 species), followed by Fabaceae (9 species); Laminaceae (8 species), Apiaceae (7 species); Rosaceae (3 species); Zingiberaceae, Solanaceae, Rubiaceae, Malvaceae, Anacardiaceae were (2 species); whereas the rest (31 families) have one species each, which were Zygophyllaceae, Urticaceae, Theaceae, Salicaceae, Rutaceae, Ranunculaceae, Rhamnaceae, Passifloraceae, Phyllanthaceae, plantaginaceae, Portulacaceae, Poaceae, Oleaceae, Moringaceae, Myrtaceae, Moraceae, Lauraceae, Linaceae, Juglandaceae, Iridaceae, Ganodermataceae, Geraniaceae, Euphorbiaceae, Clusiaceae, Convolvulaceae, Caryophyllaceae, Cucurbitaceae, Burseraceae , Boraginaceae , Brassicaceae, Araliaceae were represented by 1 species having medicinal importance (Figure 5). Family Asteraceae and Fabaceae have the utmost range of plant species used as herbal remedy. These results agree with (Abdulrahman *et al*., 2023). However, our results disagreement with the finding Lulekal *et al*. (2008) who revealed that the family Fabaceae was represented by the highest number of species (26 species, 11.3%) and this was followed by Asteraceae (19 species, 8.3%). These families are considered the main sources of phytochemicals so the use of their plant species is widespread.

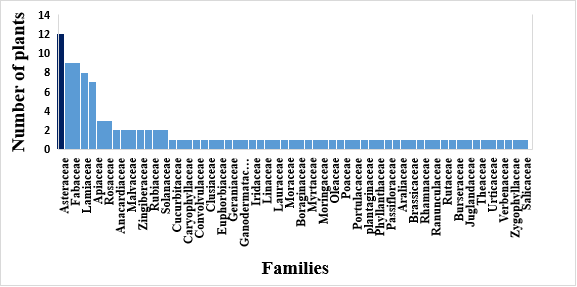


Fig 6. Frequency of the most represented botanical families

# 4.7. Single or Combined method for medicinal plant used

The use of medicinal plants divided into two groups single and combine. Single method recorded the highest level which was 92.39 and the lowest value which was 7.61 recorded for combine method (Figure 6). Medicinal plants are used in different ways, some mixed with water or honey or milk, and some separately (Abdulrahman *et al*., 2023).

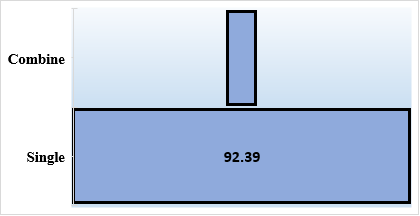


Fig 7. Single or combine use of medicinal plants (%)

# 4.8. The most ailments treated by plants

The percentage of herbal medicine used in Hawler region for various illnesses were showed in (Figure 7) ranged between (2-15%) included mainly those suffered from stomach, headache, inflammation, cholesterol, blood pressure, kidney, hypertension and liver diseases. In our study, several types of plants have been used by people for different diseases. Most plants for diseases have been taken which were stomach, headache, inflammation, cholesterol, blood pressure, and liver diseases by herbalists. The result as shown in Fig 7 indicates that stomach was the most common disease followed by inflammation and blood pressure for which patients commonly visit the traditional medical practitioners. Seventeen species are used as remedies against stomach problems, nine species for inflammation and blood pressure treatments, eight species for kidney treatments, seven species for liver problems, five species for headache and cholesterol treatments and the last hypertension ailment which was taken two species for treatment (Fig 7). This result disagreement with finding Dalar *et al*. (2018) who reported that the high number of the use-reports and medicinal plant species utilization in diabetes (19 plant taxa and 251 use-report) and gastro-intestinal (52 plant taxa and 423 use-report) groups might be due to the traditional taste habits such as consuming high amounts of carbohydrate-based food and salty (particularly milk products, such as cheese), sour and grid meals and as well as warm tea.

Fig 8. The most of treated diseases.

# 4.9. The growth habit of plants

The results of growth form analysis of medicinal plants showed that shrubs and trees made up the highest proportion being represented (33.7 %), followed by herbs (32.61%) (Figure 9). This finding is contrary to the general pattern seen in most medicinal inventories (Giday et al., 2003 and Yineger et al., 2007) where herbaceous medicinal plants dominate. This could be associated to the abundance and year-round availability of shrub species in the study area. Moreover, this result disagreement with the previous work by Ahmed, (2016) who indicates that herbs (75 %) were the most abundant plants utilized by traditional healers to treat various disorders and ailments in local areas of Sulaymaniyah Province, followed by trees (13 %) and shrub species (12 %).

Fig 7. Percentage of the recorded plants according to plant type (Habit).

# Conclusion

Herbal medicines are essential pharmaceuticals that have traditionally been utilized in Kurdistan to treat a variety of diseases. Herbal remedies were most commonly used by those who had gastrointestinal problems, inflammations, high blood pressure, high cholesterol, headaches, or hypertension. Herbal treatments from the plant groups Asteraceae, Fabaceae, Laminaceae, and Apiaceae were more commonly utilized in the city of Erbil.   
According to the findings of this study, the study region is rich in native medicinal plant species and associated traditional knowledge. Kurdish patients might acquire medicinal plants from traditional herbalists and doctors who had prior expertise using medicinal plants to cure ailments and improve health. They may benefit from utilizing medicinal plants rather than pharmaceutical medications since pharmaceutical drugs have several adverse effects on human health, whereas medicinal plants grow organically. Furthermore, therapeutic plants are less expensive than particular pharmaceutical treatments for poor and rural Kurdish people who cannot afford medicines.

# Recommendations

1. For treatments different diseases considering medicinal plants instead of pharmaceutical drugs.
2. It is important to give herbalists opportunity to open branches inside Hospitals.
3. Encourage local people to consume natural drugs.
4. More research is needed on medicinal plants Kurdistan Region.

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