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PHYTOCHEMICAL ANALYSIS, NUTRITIONAL VALUE AND ETHNOBOTANICAL KNOWLEDGE OF *Pelargonium quercetorum* AGNEW *(Geraniaceae)*

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ABSTRACT

Pelargonium quercetorum **Agnew is an edible wild species of Pelargonium genus which has a lot of concern in term of ethnobotanical knowledge, nutrition value and phytochemical analysis. Traditionally, it was providing local and rural people medicines and food security. Nowadays, wild edible plants (WEPs) become a central action to preserve the culture that belongs to the natural heritage. Thus, the aim of this research is to investigate ethnobotanical knowledge related to the traditions, phytochemical and nutritional value of *P. quercetorum.* Semi questionnaire has been used in Deralok town for ethnobotanical knowledge determination. The findings showed the main threats were overgrazing and overharvesting of this WEPs; a quantity of (10kg) took per year as a food and medicines during spring season. The plant was in a high abundance but required bio-conservation alongside it can be taken together with medication with the very rare side effect on the people. Furthermore, the analysis part has been done in the laboratories of college of agricultural engineering science, University of Duhok, Kurdistan region of Iraq. The findings of this research shown interestingly the highest level contents of (fat=3.68g / 100g, carbohydrate=46.78g /100g, dry matter moisture content=10.93g / 100g and fibers=20.56g / 100g), macro mineral (Ca=4512.9mg / 100g and Mg=229.69mg / 100 g), micro minerals (Zn=4.398mg / 100 g, Mn=3.926mg / 100 g and Cu=1.074mg / 100g) were seen in leaves part. But, the highest content of (Energy value 185.44g/100g, Protein 23.38g/100g and Ash 7.63g / 100g), macro mineral (P=928.5mg / 100g, S=4.036mg / 100g, K=1147.9mg/100g and Na= 118.54mg / 100g), micro minerals (Fe=23.779mg / 100g) were seen in root part. Hence, the study evidence shown that this geranium species can enhance nutrition value and food security as well as natural remedies for the local people.**

KEYWORDS: Pelargonium, Edible Plant, Phytochemicals, Traditional knowledge, Medicinal Plant.

1. INTRODUCTION

The interaction and relationship that occur between plant and human traditional culture are the core of understanding of the human well-being and conservation of nature (MEA, 2005). For the basic needs human being depended on the natural resources for the clothing, food production, fertilizer, medicines, shelter, flavours and transportation (Prance and Nesbitt, 2012). Thus, wild edible plant has assembled the fundamental base of practical use in medicine that has been used traditionally, which existed in the past and still provide remedy for human at the present (Heinrich *et al*., 2017). Even though, there are some medicinal properties related to the plants that have confirmed in medicinal therapy (Heinrich *et al*., 2004, 2017). Nowadays, there is a rising interest on the herbal medicinal plants and their practical usage has obtained acceptance and truthfulness with both medical and local people community (Hamilton *et al*., 2003). There are many drugs and medicines have been extracted from the wild edible plants many years ago (Gurib-Fakim, 2006).

Alongside with the wild edible plants, it contain a significant nutrition value for example vitamins and valuable amount of antioxidants, carbohydrate, fat, protein, minerals to the body of human (Geissler and Powers, 2017). In the time of crises become an important source of food security (Tomkins *et al*., 2019). In term of tradition, local and rural communities have an

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increasing interest to achieve natural product for both daily meals and medicines high nutrition value, low side effect and diversity choice (Geissler and Powers, 2017). One of the well-known wild edible plants can be outlined by *Pelargonium quercetorum* Agnew from *Geraniaceae* family_which consist of 11 genera and 750 plant species (Brendler and Van, 2008). The distribution of this taxon cover a part of the Zagrosian areas including Kurdistan region of Iraq (North of Iraq), SE Turkey and W Iran 5Marivan-Kurdistan province). Although it is a narrow Zagrosian endemic species but it is locally abundant throughout its geographic distribution range particularly in spring (Davis *et al*, 1988; Schonbeck-Temesy, 1992). This plant species is native to Kurdistan Region of Iraq, and locally known as a Tolîtirş (Youssef *et al*., 2019; Hussien *et al*., 2020). It is mainly occurs in the upper forest zone and frequently penetrates in the thorn-cushion zone which characterised by a high altitudinal humidity conditions. *P. quercetorum* has an important commercial value for the local people and they used it as a culinary food and medicine purposes (İdris and Tunçtürk, 2014; Youssef et al., 2019). *P. quercetorum* has a traditional use as an antiparasitic in the Zagrosian region (Taherpour *et al*, 2007). *P. quercetorum* seeds and leaves have been used in Turkey as a treatment of skin wounds and throat disorders, as well as, it stated that this herb is effective features to use for chronic headache, migraine and throat pain (İdris and Tunçtürk, 2014). Several studies highlighted that medicinal properties and nutrient values of *Pelargonium* taxa (Latté and Kolodziej, 2000). In tradition, *Pelargonium* taxa are widely used to cure in some region in South Africa for respiratory tract infections, dysentery, wounds, fever, liver complaints, and diarrhea (Watt and Breyer-Brandwijk, 1962). Moreover, their phytochemical properties can cure the impact of (antioxidant, antimicrobial, anticancer, etc) (Fayed, 2009; Ozbilge *et al*., 2010) as well as, *P. quercetorum* has been used traditionally to treat human intestinal from worms (Kaval *et al*., 2014). Nowadays, the phytochemical compound that come from nature are prevailing due to their medicinal usage that plays a great role against a huge number of illness foe example cancer, arthritis, asthma, etc. which considered human friendly medicines due to their lack of side effect (Sahira and Cathrine, 2015).

In Kurdistan region of Iraq, wild edible plants harvesting has an important linkage to the local and rural people to the nature. However, *P. quercetorum* is been known from its phytochemical properties and nutritional values which has not been tested and documented. Thus, this study is aim to provide phytochemical features and nutritional values of the *Pelargonium quercetorum*, as well as, establish a Kurdish ethnobotanical knowledge documentation in regard to the uses of this WEPs.

2. MATERIALS AND METHODS

2.1. Study Area:

The research has been done in the Deralok district, Duhok governorate, Kurdistan region of Iraq. It is located approximately 50km in the North East of Duhok Central city with the (latitudes = 37.071684; longitudes = 43.753681). (Figure 1). The climate condition of the study site is arid, cold semi-arid climate, hot dry summer and cold dry winter (Peel *et al*., 2007). Recently, Youssef *et al*., (2019) classified Deralok area has a Continental Mediterranean climate; dry warm summer and wet, mild winter. The precipitation falls from December (late winter) to March (late spring)

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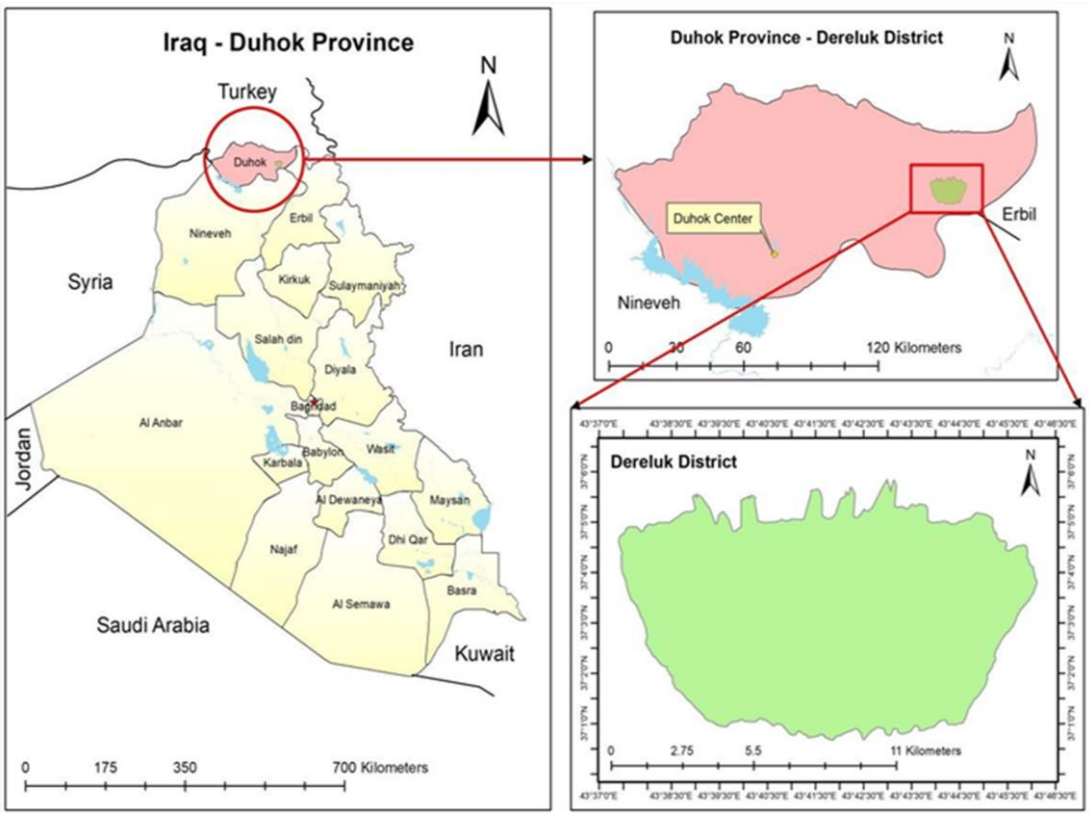

Fig. (1): Study Site, Deraluk District, Duhok Governorate – Kurdistan Region of Iraq. (Map; Hussein et al., 2020)

2.2. Traditional Ethnobotany Knowledge, Site Surveys and Data Collection in Deraluk Area:

The study conducted through a botanical surveys to determine the ethnobotany traditional knowledge in term of Socio-economic to provide best conservation solutions for heritage in this region. The maximum ethnobotanical traditional knowledge of wild edible plants was gained though semi- structured questionnaire (Appendix 1) managed for the people living in Deralok district (4 questionnaires were from town and 26 from villages). This interview has been carried out from mid-February to early March, with the people of different categories such as gender, educational level, age, etc. within focusing on the uses and traditional knowledge of endemic and native plants in the study area. Age were divided into three main categories (table 1). The field questionnaire framework that has been chosen for this study was carried out by the standard of international methods of ethnobotany (Cotton and Wilkie, 1996; Martin, 2010). The plant data that acquired was containing details on how to obtain plant, traditional use, consumption way, Kurdish local/common names, growing season knowledge, conservation and production information, threats to the plant, etc. (Appendix 1). The research includes 30 participants from various gender and ages (40% were women and 60% men). The questionnaire participate were categorized into four groups depending on educational level (university, diploma, secondary school, medium school, primary school and illiteracy (10%, 10%, 13.3%, 6.6%, 20% and 40%) respectively. Moreover, the role of people occupation were divided into four groups (table 2

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Table (1): Age of participant and number of questionnaire filled

Ages	No. of informants
20-40	12
41-60	13
More than 61	5

Table (2): Number of informants per occupation

Occupation	No. of informants
Agriculture	5
Free-worker	11
Public-worker	10
without-work	4

2.3. Phytochemical Analysis and Nutritional Values of *Pelargonium quercetorum*:

2.3.1. Sample collection and preparation:

The samples were collected from North aspect of Gara Mountain in a village called (Harike) in Deralok district within the elevation 1392 m asl and (Latitude: 37.0003.1; Longitude: 43.4200.7). For the aim of measurement appropriation of the phytochemical and nutrition values, the plant has been harvested in the mid of April 2020 where the plant in a fully period of growth. The collected sample were situated in a polyethylene bag for the moisture loss prevention. Leaves and stem (Shoot system) were cleaned: it has been washed with a water, then put it into a plastic dish in order to remove the rest of moisture. After this step, samples were cut it into a small chunk and dried in the shade twenty days at room temperature. Next, the electric blender has been used to make this chunk powder. The powder has been stored in a fridge (around 5 °C) in a glass pitcher for the study analysis. The various samples parameter estimation were mineral analysis including (Essential Minerals or Macro-minerals; Calcium, Magnesium, Potassium, phosphorous, Sodium, and Sulfur) and (Trace minerals or micro minerals; Copper, Chromium, Iron, Manganese, and Zinc) on the dried weight were conducted by usage of 100g of dry powdered plant samples at the College of Agricultural Engineering Science' central laboratory, Duhok University.

2.3.2. Mineral Elements Analysis:

The plant samples were went through wet digestion in a mixture of di-acid which was used for P, K, Ca, Mg, S, Fe, Mn, Zn Cu, Cd, Pb, Al, and Cr determination. The test was done by mixing (HNO3): (HCIO4) (ratio 9:4) with 1 g of dried plant powders in a volumetric flask (100ml) then 10ml of HNO3 (nitric acid) was added kept 24 hours before digestion. Later, 8ml of Perchloric Acid (HCIO4) was added and magnetic stirrer was used to twirl the solution gently. The volumetric flask was placed on a plate with the 100°C temperature then the temperature was increased to 260°C for around an hour for NO2 fume vanish. The flask content was evaporated unto volume minimized to around 4 ml without dryness. The digestion process continued and completed until the solution liquid color vanished. The solution cooled in a normal room temperature after that, it was added around 20ml of the deionized water to the flask. After made up the volume and deionized water has been used to dilute the volume to the mark, then the Whatman No. 1 filter paper was used to filter the solution samples. To determine the K, Ca, Mg, S, Fe, Mn, Zn Cu, Cd, Pb, Al, and Cr the solution that was prepared was used. The atomic absorption spectroscopy has been used for mineral nutrients estimation. Whereas, the estimation of phosphorus was done through using colorimetric method by spectrophotometer and with the absorbance measurement at 882nm (Hussain *et al.*, 2010).

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2.3.3. Nutrients Values analysis:

2.3.3.1. Crude oil determination:

The crude oil determination has done by using extraction of Soxhelt (6 hours). (3.0g) of powder sample was accurately weighted into thimble labelling. (250ml) dried flask has been weighted and added around 100 ml of (90%) hexane. The thimbles that has been extract were tightly plugged with wool (cotton). The apparatus of Soxhelt has been made up then the boiling flask was seated on the mantle of heat and attached to extractor then allowed for (6 hours) to reflux. Endpoint of extraction, the thimbles have been removed and the flask put in 70 ºC of oven to get heated till the evaporation of solvent and hexane was removed. Descicator was used to cool down the dried flask then re-weighted (AACC, 2000):

The percentage of crude oil was calculated using the formula:

$$\text{Crude oil (\%)} = (\text{Wt. of oil (g)} / \text{Wt. of original sample (g)}) \times 100$$

2.3.3.2. Protein Digestion, Distillation and Titration:

The digestion of protein has been determined by using (10ml) of 98% concentrate of H2SO4 to digest a 0.5g of roots and leaves. Then, before heating 2 ml of perchloride acid concentration (70%) was added and exposed to the heat in a chamber until samples were transparent content was achieved. The samples was diluted after cooling solution with distilled water until reached 100ml. Markham distillation was used to distillate protein which was condensate for 15mins. Then, a boric acid (2%) put in a conical flask (15ml) and placed under condenser. A small funnel was used to put around 5ml of digested leave and root separately by pipet into the Markham apparatus. After that, distillate water was used digested sample, later 5ml of NaOH solution was added. The digested sample was steamed in the condenser to obtain enough amount of ammonium salt. The indicator (Boric acid) solution was changed the color of sample to green, which mean the liberated ammonia was collected. The solution was titrated in a flask with HCl (0.01N) and the color changed to red and were determined by the amount of (HCl) that has been used in reaction estimation. Moreover, the calculation of Nitrogen was done after titration by the following formula:

$$\%N = \frac{\text{V. HCl} * \text{N HCl}(0.01) * \text{Nitrogen Atomic Mass}(14)}{1000} * \frac{\text{100ml D. Water}}{\text{5ml Sample Solution}} * \frac{\%100}{\text{0.5 Wt. of Sample}}$$

Then, the percentage of crude protein in the sample was calculated by the formula:

$$\%\text{Crude Protein} = \%N * F\ (6.25)$$

Where, F= Conversion factor is equivalent to (6.25)

Where: V. HCl = Volume of acid (ml) needs to be titrate, N HCl = HCl normality, D. Water = added water distilled, Wt = Sample weight (g).

2.3.3.3. Energy value determination:

Hussain *et al*., (2010) method was used to determine the energy value (kcal/100g). Which was determined by multiplication of content of fat by 9, content of carbohydrate by 4, and content of protein by 4. The equation that used to estimate energy value was as follows:

Energy Value (kcal/100g) = (Crude fat × 9) + (Crude protein × 4) + (Carbohydrate × 4)

2.3.3.4. Ash Content Determination:

The inorganic content after the samples were burnt completely under a (550°C) temperature in a furnace muffle. As well as, it is about all elements of non-volatile inorganic aggregation. (James, 1995) method was used to determine Ash content. Around (2g) of powder that has been dried was weighted into a crucibles (porcelain) which was empty pre weighted then the ash were achieved after sample was put it for (5 hours) at 55 ºC in a furnace muffle. Desiccator was used to cool the samples and weighted again.

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$$\% \text{ Ash } = \frac{W2-W0}{W1-W0} X\ 100$$

Where: W0 = empty crucible weight (g), W1 = crucible weight + sample powder (g), W2 = crucible weight + Ash sample weight (g)

2.3.3.5. Crude Fiber Determination:

(Udo and Oguwele, 1986) method was used to determine crude fiber, a 2g of dried powdered *P. quercetorum* without fat were weighted and put it in conical flask (1000ml). (20ml) of (H_2SO_4 20%) and (100ml) of distilled water was added (30 min) gently boiled. Then, the Whatman No. 1 filter paper was used to filter the solution content. After, the residue content put it in a flask with the spatula. Later, about (20ml) of (NaOH 10%) and (100ml) of distilled water has been added (30 min) gently boiled. The solution content was filtered by Whatman filters and the residue content was washed by distilled water (Hot); HCl (10%) has been used to rinse the solution once, with ethanol twice and with petroleum three times. The samples was dried out and put it in a crucibles then put it in an oven (105 ºC) overnight that was dried. After that, desiccator was used to cool down the samples. The samples were weighted second time and has been ashed in an oven for 90 minutes at 600 ºC in a furnace muffle and it was removed and then desiccator has been used to cool down and weighted for third time. The crude fiber percentage has been calculated by the following equation:

$$\text{Crude fibre } (\%) = \frac{W1-W2}{W0} X\ 100$$

Where: W0 = Sample weight (g), W1 = Dried sample weight (g), W2 = Ash sample weight (g)

2.3.3.6. Total Carbohydrate:

Total carbohydrate percentage at dry weight (dwb) in the *Pelargonium quercetorum* samples were demonstrated though a methods of (James, 1995). The content of carbohydrate was achieved through a various between a 100g of dry weight mass of a sample with the aggregation of (crude fat, crude protein, ash, crude fiber and dry based moisture) of the sample minus it from hundred (Sarkiyayi, and Agar, 2010), the estimation was done through this question:

%Carbohydrate (dwb) =100 − (% crude fat + % crude protein + % ash + % crude fiber + %moisture)

3. RESULT AND DISCUSSION

3.1. Ethnobotanical Knowledge of *Pelargonium quercetorum*:

3.1.1. Source of acquiring, cultural/natural knowledge of *Pelargonium quercetorum*

The results showed that all the informants (100%) obtained this species nature none of them buy it or achieved from urban places (e.g. traditional markets, commercial center, etc.). Which mean that Deralok rural community, like almost Zagrosian rural communities, maintain their ethnobotany knowledge and still in living practice preservation (Youssef *et al*., 2017). For example, Hussein *et al*. (2020) also recorded the same ethnobotanical result in rural community for the wild edible plants with particular focus on *Allium* species. The majority of the participant (96% informants) acquire their ethnobotanical knowledge from ancestor while only two informants obtained their knowledge from (neighbours and friends). This finding agreed with the result of Hussein *et al*. (2020) whom highlighted the same result for the acquiring knowledge from ancestor. This also accords with the earlier ethnobotanical investigations, which showed that the Zagrosian rural people still preserve their ethnobotanical knowledge (Ahmad & Askari, 2015; Darwesh, 2017; Pieroni *et al*., 2017; Tahir, 2017; Youssef *et al*., 2017, 2019). Furthermore, the result also highlighted that the used part of this wild edible plant, all the people harvest all the plant part but they only used leaves (100% participants). All the informants were harvested this plant species in spring season.

3.1.2. Major threats and biological conservation of *Pelargonium quercetorum*:

According to various age (table 1) and occupation categories (table 2), the finding (Fig 2a) showed that the people recorded its necessary to conserve this plant biologically with the high necessity of action (73.33%), some other agreed with the medium action

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of biological conservation (20%) and surprisingly a countable participants agreed with no action and does not need conservation (6.67%).. In contrast, Youssef *et al*., (2019) noted that most of the plants need protection and conservation due to overharvesting e.g *Rheum sp.* and *Gundelia sp*. Additionally, (36.67%) of the informant confirmed that the overgrazing has a great part of threats on this WEP. Then followed by the overharvesting from the wild with (26.66%) may be due to their significant value as a food and medicine in tradition. The other threats were (climate changes, pesticide and fire) with the ratio (23.33, 10 and 3.33) respectively. Substantially, these results are consistent with those of other Zagrosian ethnobotanical studies and suggest that the overgrazing combined with overharvesting are the major threats for the WEPs (Darwesh, 2017; Tahir, 2017; Youssef *et al*., 2017). Most interesting finding was according to the participants there was no other threats rather than these threats that have been mentioned (Fig 2b).

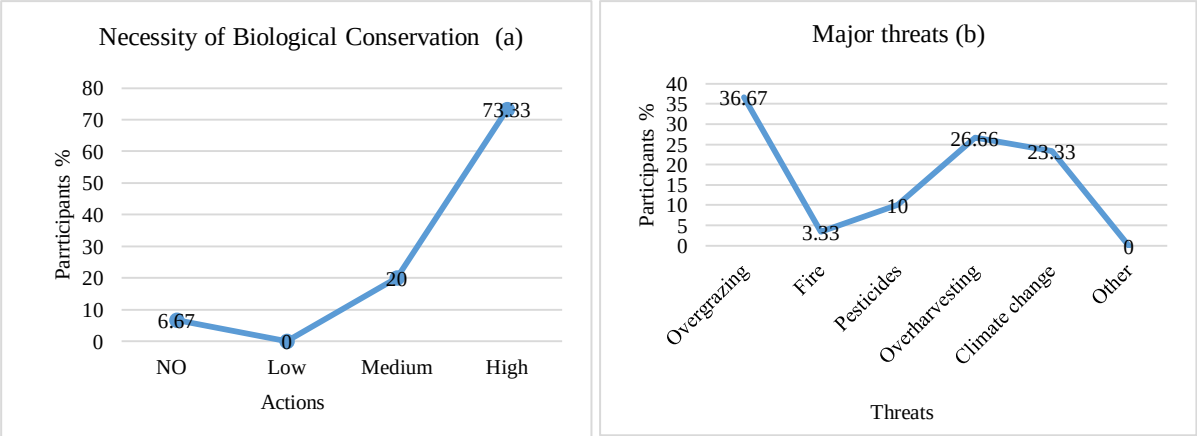

Fig. (2). a-Necessity of biological conservation and b-major threats to *P. quercetorum*

3.1.3. Preference usage and quantity harvesting per year of *P. quercetorum:*

Figure 3a showed that the people whom participate in this questionnaire answered the usage preference of *P. quercetorum* as a medicine or food. The results showed 66.67% of the participant in Deralok use this WEP as a medicine and food together, then 30% of informants use this plant as a food followed by the medicine with (3%) this is may be because of traditional use of this plant in Kurdish dishes and as a medicine for many illness such as antiparasitic. The combination Medicinal-culinary use of the WEPs in this study corroborates these earlier ecological traditional knowledge. Indeed, a predominant part of the WEPs have combined traditional medicine and culinary food uses like *Celtis tornifortii* Lam., *Crataegus azarolus* L., *P. khinjuk* and *Rheum ribes* L. among others (Youssef *et al*., 2017; Mahdi *et al*., 2018 ; Tomkins et al., 2019; Abduljabar et al., 2020). Fig 3b findings showed that most of the people with ratio (56.67%) quantity harvested of this plant from the wild per year was between (0 – 10kg), furthermore, the second category were (23.33%) of the participant recorded quantity harvested of this WEP about (11 – 20kg), moreover, (16.67% and 3.33%) of the people were harvested the quantity per year between (21 – 30kg and 31 – 40kg) respectively. Which is clearly a lot of harvesting of this wild edible plant if the study sample compare to the all residence of Deralok town. In addition, the Fig 3c showed that most the participants noted with highly abundant in the nature with (50%), as well as some other their ration of abundant of this plant was medium in the nature and was not far from the first category with (40%), then followed with (low and no) with (6.67 and 3.33) respectively.

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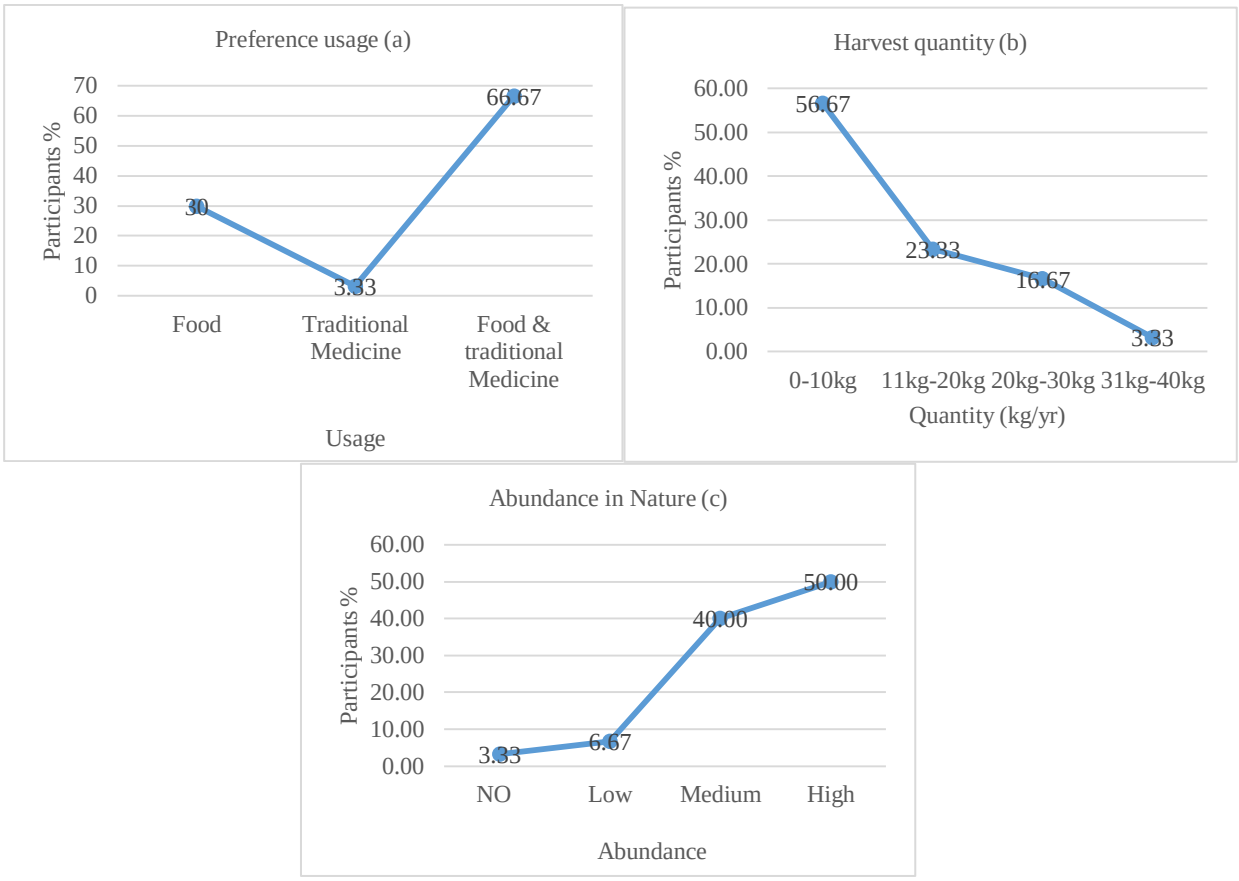

Fig. (3a,b,c): Preference usage and Harvest quantity and abundance in the nature of *P. quercetorum*

3.1.4. Traditional knowledge of *P. quercetorum* as a medication supplement:

Table 3 shows that some traditional knowledge of *P. quercetorum* related to the medication supplements and side effect. The results showed that the people answered A1 as plant safe to use as a natural, most of the people agreed with it (60%), while (13.33%) recorded not safe to use. However, (20%) of the participants were unaware of their safety. Interestingly, the present findings seem to be consistent with other research which found that the WEPs are safe in general and have less side effects than the chemical drugs (Castleman & Hendler, 1995; Ahmed, 2016).In addition, the informants answered A2 which is related to the mixturing natural herbal with medication, people with (56.67%) agreed that person can mix together and take it, while only (6.67%) of informants noted that it cannot take both side together, people with unsure of taking it together were (36.67%). Beside, (93.33%) of the participants agreed that does have a side effect comparing to the people whom does not agreed that this plant has a side effect with (6.67%). The informants that recorded this plant has a side effect, it has been recorded that (3.33%) faced kidney issues while (3.33%) faced stomach issues according to their meditational answer. Additionally, the findings showed that the (A5) informants answered on the question related to the normal amount that could be eaten without getting issues, (33.33%) agreed that it could be dangerous on the human life if the dosage more than what is standard recommend, followed with (13.33%) doesn't agreed and (53.33%) do not have any clue about it, which was the most answered option. This is may be due to lack of medication knowledge.

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Table (3): Some traditional question on traditional knowledge of *P. quercetorum* as a medication supplement.

Questions	Options	No. Participants %
A1. Tola-Tirsh supplements are safe to use as they are from natural ingredients.	TRUE	60
	FALSE	13.33
	I do not know	20
A2. Herbal supplements and medication can be taken together at the same time.	TRUE	56.67
	FALSE	6.67
	I do not know	36.67
A3. Herbal supplements do not have side effects.	False (go to A4)	93.33
	True (go to A5)	6.67
A4. If FALSE, please choose the side effects that are caused:	Allergy	0
	Liver problems	0
	Kidney problems	3.33
	Gastrointestinal problems	3.33
	Hormonal problems	0
	Low blood sugar	0
	Others	0
A5. Tola-Tirsh herbal supplements can be dangerous if the amount taken is higher than the recommended dosage on the label.	TRUE	33.33
	FALSE	13.33
	I do not know	53.33

3.2. Phytochemical Analysis and Nutrition Values of *Pelargonium quercetorum:*

3.2.1. Trace-Mineral components of *Pelargonium quercetorum:*

The finding of table (4) shows that the trace mineral analysis there was no huge differences in both roots and leaves except in Iron. The result of analysis recorded that high levels of Copper, Manganese and Zinc were 1.074, 3.926 and 4.398 mg/100g respectively found in leaves compared to the low level of these element in roots 0.999, 2.385 and 2.354mg/ 100g. Moreover only high levels of Iron found in Roots 23.779mg/100g compared to the 6.708mg/100g in leaves.

Table (4): Micro-mineral contents of *Pelargonium quercetorum* in both roots and leaves.

Micro-elements composition (mg/100g)	Roots	Leaves
Zinc (Zn)	2.354±0.12	4.398±0.09
Iron (Fe)	23.779±0.36	6.708±0.13
Manganese (Mn)	2.385±0.03	3.926±0.05
Copper (Cu)	0.999±0.01	1.074±0.02

*Nutritional value per 100g of dry plant material ± standard deviation for three replications.

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The results of this study was disagreed with the result of Gâlea *et al.* (2015) who recorded the amount of zinc in *Pelargonium roseum* were 62.5mg/kg in roots and in leaves 31.5mg/kg, while for iron in leaves were 606mg/kg and in roots were 1175.6mg/kg. Moreover the level content of manganese who highlighted the highest value was in leaves 53.3mg/kg while in roots was 40.8mg/kg. However, this study was in contrary with study of Gâlea *et al.* (2015) who recorded the highest level of copper (cu) in roots 19.7mg/kg and lowest in leaves with 4.8mg/kg might be due to change in *Pelargonium* taxa, as well as, might be due to impact of various factors for example precipitation, growing status, sun exposure, temperature and animal and plant interaction inside ecosystem (Hussein *et al*., 2020). These data must be interpreted with caution because there have not any research study highlighted before the nutritional value of *P. quercetorum.* Nevertheless, these differences between *P. quercetorum* and *P. roseum* can be mainly explained by the geographic origin, genetic, soil type, environment conditions among others which highly affected the nutritional values of the plant species (Clarkson 1985; Hornick, 1992; Karthika *et al*., 2018)

3.2.2. Essential-Mineral components of *Pelargonium quercetorum:*

Table (5) showed the essential minerals analysis of both root and leaves, there was a variation in phosphorous, sulfur, potassium and sodium. The high content levels were found in roots 928.5, 4.063, 1147.99 and 118.544mg/100g respectively in comparison with the values that found in leaves were 164.3, 3.438, 349.807 and 63.555 mg/100g respectively. While, the highest contents level of calcium and magnesium found in leaves 4512.9 and 229.697mg/100g in compare with the low levels that found in roots 1448.25 and 152.87mg/100g.

Table (5): Macro-mineral elements of studied of *Pelargonium quercetorum* in both leaves and roots.

Essential-elements composition (mg/100g)	Leaves	Roots
Calcium (Ca)	4512.9±12.5	1448.25±9.8
Phosphorus (P)	164.3±4.2	928.5±9.08
Magnesium (Mg)	229.697±2.24	152.87±2.1
Sulfur (S)	3.438±0.31	4.063±0.26
Potassium (K)	349.807±6.3	1147.99±10.03
Sodium (Na)	63.555±1.1	118.544±1.05

*Nutritional value per 100g of dry plant material ± standard deviation for three replications.

The study findings showed the contrary value of Ca with the research of Elad and Volpin (1988) whom reported that there is low rate of Ca in *Pelargonium domesticum.* Which is essential element in bones and tooth enamel (Whitney and Rofles, 2018). There was a supervising value of phosphorus (P) in roots which is an important element of enhance energy (Graham and Vance, 2003). Moreover, the sodium and potassium value were high in the roots which are very important for muscle transmission, volume and fluid cellular regulation (Whitney and Rofles, 2018). The value of sulfur was acceptable in this study, the element has a great role in minimizing blood pressure and cholesterol (Komarnisky et al., 2003), while immune system function promotion enhance by magnesium (Whitney and Rofles, 2018) the result showed an acceptable value content of Mg in this Geranium taxa. Substantially, beside the genetic variation (genotype differences exist among plant species and within species), the absorption of mineral nutrients (e.g. Ca, K, Na, P, etc.) is mainly influenced by environmental factors like the soil aeration and temperature that affect particularly the root metabolism (Marschner, 1995; Pallardy, 2010).

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3.2.3. Some nutritional composition of *Pelargonium quercetorum:*

The composition contents analysis of this research were shown in table (6). In term of carbohydrate the high level percentage content finds in leaves with 46.78%, while the lowest level percentage was in root with 43.03%. The highest level of the dry based mater moisture content 10.93% was found in leaves while the lowest found in roots 8.95%. The leaves were containing the highest level content of crude oil 3.68% compared to roots with 0.68%. Furthermore, the higher value of energy was shown in roots 185.44% in comparison with leaves 94.12%, moreover, the highest content level of crude protein and Ash, according to the results (23.38% and 7.63%) respectively, and the lowest level were found in leaves with 10.17% and 1.44%. The crude fiber were found higher in leaves 20.56% than the roots 16.33%.

Table (6): Some nutritional composition of *Pelargonium quercetorum* in both leaves and roots.

The parameters (g/100 g)	Roots	Leaves
%Total Carbohydrate (dwb)	43.03±1.1	46.78±0.32
%Crude oil (dwb)	0.68±0.11	3.68±0.84
%Dry matter Moisture Content	8.95±1.12	10.93±0.92
%Energy value kcal/100g	185.44±6.2	94.12±3.04
%Crude Protein (dwb)	23.38±0.67	10.17±0.32
% Crude Fiber (dwb)	16.33±0.56	20.56±0.83
% Ash (dwb)	7.63±0.35	1.44±0.105

*Values are mean on a dry weight basis ± standard deviation for three replications.

The value of crude oil in the findings of Zheng *et al*. (2011) was much higher in leaves than this study 3.68%, which was 13.89 %. This sigificative differences of the crude oil concentration can be explained in party by the fact that the result concerns two well different species of *Pelargonium*: *P. quercetorum* for the present study while *P. raveolens* (Zheng *et al*. 2011). Furthermore, it seems also possible that this differences is partly due to the considerable differences in environmental conditions where these two species occur (i.e. *P. quercetorum* is endemic to Zagros areas while *P. raveolens* is endemic to South Africa).

5. CONCLUSION

This species is one of the geranium genus, geranium has been collected in Kurdistan region of Iraq. It has been used traditionally for a various medicinal and food security purposes. The study structured a questionnaire and analysis of the phytochemicals and nutritional value of geranium species. The result of ethnobotanical knowledge questionnaire showed that the rural and local people still preserve the WEP and confirmed that all threats are known especially (overgrazing and overharvesting), mainly on spring. Moreover, almost all participants collected a quantity of this plant for medicinal and food usage which was in a high level of abundance according to the results in the nature. Besides, the informants noted that it's safe to use natural ingredients, and can take together with medication with the very rare side effect on the people. The study also has given the reasons traditional usage of *Pelargonium quercetorum* by the local and rural population in Deralok town, Kurdistan region of Iraq. The findings of this research shown surprisingly the highest content of (Energy value, Protein and Ash), macro mineral (P, S, K and Na), micro minerals (Fe) were seen it in root part. While, the highest level contents of (fat, carbohydrate, dry matter moisture and fibers), macro mineral (Ca and Mg), micro minerals (Zn, Mn and Cu) were seen it in leaves part.

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پوختە

Pelargonium quercetorum ***جورەکە ژ جوریچن گیایین خارنی ژ جنسی*** ***Pelargonium*** ***گەلەك گرنگی یا هەی ژ لایی زانینا ئیپنوبوتانی, بهایی خارنی و شلوقەکرنا پیکهاتین کیمیایی یین رووەکی د کلتوریدا. خەلکی گوندان گەلەك مفا ژی ددیت ژلایی خارن و بکارئینان وەکو دەرمان. دڤی دەمیدا, رووەکین د سروشتی دا ئەوین تینە خارن ژ لایی مروڤان ڤە گرنگییەکا زور یا هەی ل سەر پاراستنا رەوشەنبیریی ئەوا گریدای ب رەوشەنبیریا سرهوشتی. و هوسا, مەرەم ژ ئەنجامدانا ڤی ڤەکولینی, دەستڤەئینانا زانین و پیزانین ل سەر رووەکین گریدایی ب کەلتوری ڤە, بهایی خارنی و شلوقەکرنا کیمیایی یا پیکهاتین (*** ***P. quercetorum*** ***). ژبو مەرەما وەرلگرتنا زانین ل سەر ڤی رووەکی پرسەریز هاتنە بکارئینان. ئەنجامان هوسا دیارکر کو زور بکارئینان و چەروانی زیدە دبیتە مەترسی ل سەر ڤی جوری رووەکی خارنی د سروشتی دا و خەلك هیشتا یی گریدایە ب پاراستنا سروشت و ژینگەها خو. و سالانە (10کغ) بکارتینن وەکو خارن و دەرمان بتایبەت د وەرزی بهاریدا, و هەبونا رووەکی یا زور بو د سروشت دا لی هەر پیتڤی پاراستنی بون دا کو نە کەڤیتە مەترسیدا. ل گورەی ئەنجامان خەلك دشیت دگەل دەرمانیت کیمیای بخوت و نەباشیین گەلەك کیم بیت هەین ل سەر مروڤان. هەروەسان, شلوقەکرنا ڤی رووەکی هاتەکرن ل لابورین کولیژا زانستین ئەندازیایا چاندنی, زانکویا دهوك, هەریما کوردستانا عیراقی. ئەنجامان هوسا دیارکر کو بلندترین ئاستی بهایین خارنی (دوهن =*** ***3.68*** ***گم/100گم, کاربوهیدرات =*** ***46.78*** ***گم/ 100گم, ریژا شهی (کیشا هشك) =*** ***10.93*** ***گم/100گم, فایبەر =*** ***20.56*** ***گم/100گم), کانزایین ماکرو (کالیسیوم =*** ***4512.5*** ***مگم/100گم, مگنیسیوم =*** ***229.69*** ***مگم/ 100گم) کانزایین مایکرو (زینگ =*** ***4.398***مگم/ ***100گم, مەنگەنیس =*** ***3.92*** ***مگم/ 100گم, کوپر (سفر) =*** ***1.074*** ***مگم/ 100گم) د پارچا بەلگی رووەکی دا بون. بلندترین ئاستی بهایین خارنی (بهایی هیزی =*** ***185.44*** ***کالوری/ 100گم, پروتین =*** ***23.38*** ***گم/ 100گم, خولی =*** ***7.63*** ***گم/ 100گم), کانزایین ماکرو (فسفور=*** ***928.5*** ***مگم/ 100گم, گوگرد=*** ***4.036*** ***مگم/ 100گم, پوتاسیوم=*** ***1147.9*** ***مگم/ 100گم و سودیوم=*** ***118.54*** ***مگم/ 100گم) و کانزایین مایکرو (ئاسن=*** ***23.779*** ***مگم/ 100گم) د پارچا رەها یا رووەکی دا بو. ڤەکولینی هوسا دیارکر کو ئەف جوری گیایان دشین بکاربینین ژبەر بهایی خارنی و هەروەسا وەك دەرمانەك سروشتی بو خەلکی دەڤەری.**

الخلاصة

Pelargonium quercetorum **هو نوع من الأنواع النباتات البرية الصالحة للأكل من جنس** ***Pelargonium*** **والتي لديها الكثير من الاهتمام من حيث المعرفة العرقية وقيمة التغذية والتحليل الكيميائي النباتي. تقليديا ، تم توفير الأدوية والأمن الغذائي للسكان المحليين والريفيين. في الوقت الحاضر ، أصبحت النباتات البرية الصالحة للأكل عملًا مركزيًا للحفاظ على الثقافة التى ينتمى إلى التراث الطبيعي. وهكذا ، فإن الهدف من هذا البحث هو التحقيق في المعرفة النباتية المتعلقة بالتقاليد والكيمياء النباتية والقيمة الغذائية ل** ***.P. quercetorum*** **تم استخدام الاستبيان في مدينة ديرالوك لتحديد المعرفة النباتية. أوضحت النتائج أن التهديدات الرئيسية كانت هي الإفراط في الرعي والإفراط في حصاد** **WEPs** **، ويحافظ الناس على طبيعتهم وبيئتهم ، ويأخذ كمية (10 كجم) سنويًا كغذاء وأدوية خلال موسم الربيع ،**

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وكان النبات موجود بكثرة ولكنه مطلوب الحفظ الحيوي جنبًا إلى جنب مع الاستخدام الآمن للمكونات الطبيعية ، ويمكن تناوله مع الأدوية و ذات التأثير الجانبي النادر جدًا على الناس. علاوة على ذلك ، تم إجراء الجزء التحليلي في مختبرات كلية علوم الهندسة الزراعية ، جامعة دهوك ، اقليم كردستان العراق. أظهرت نتائج هذا البحث بشكل مثير للاهتمام أعلى مستويات المحتوى (الدهون = 3.68 جم / 100 جم ، الكربوهيدرات = 46.78 جم / 100 جم ، رطوبة المادة الجافة = 10.93 جم / 100 جم وألياف = 20.56 جم / 100 جم) ، المعادن الكلية (Ca = 4512.9 mg / 100g و Mg = 229.69mg / 100 g) ، شوهدت المعادن الدقيقة (Zn = 4.398mg / 100 g ، Mn = 3.926mg / 100 g و Cu = 1.074mg / 100g) في جزء الأوراق. لكن أعلى محتوى من (قيمة الطاقة 185.44 جم / 100 جم ، بروتين 23.38 جم / 100 جم ورماد 7.63 جم / 100 جم) ، معدن كلي (P = 928.5 مجم / 100 جم ، S = 4.036مجم / 100 جم ، K = 1147.9 مجم / 100 جم (و Na = 118.54mg / 100g) ، شوهدت المعادن الدقيقة (Fe = 23.779mg / 100g) في جزء الجذر. ومن ثم ، أظهرت أدلة الدراسة أن هذه الأنواع من إبرة الراعي يمكن أن تعزز قيمة التغذية والأمن الغذائي وكذلك العلاجات الطبيعية للسكان المحليين.

Appendix 1 **Ethnobotany questionnaire**

Ethnobotany Study of Wild Edible and Medicinal Plants in Deralok District

NO:…….. Date:…….

Gender: F…..M.. Age:…… Location:……

Level of Education: Illiterate, Premier, Middle, Secondary, Diploma University

Occupation: Agriculture Commercial Head-house Free-worker Public-worker Without-worker

General Ethnobotanical knowledge:

- Acquiring **Sources of WEPs**: Market Nature Cultivation Others
- **Sources of Ethnobotanical knowledge**: Ancestors Media Neighboura/friends Traditional Medicine
- **Conservation for wild edible plants is necessary**: Non, Low necessary, Middle necessary, Very necessary
- **Preference usage of wild edible plants collections**: Food, Traditional Medicine, Both, Others
- **Major Causes of wild edible plants threatened**: Over-grazing, Fire, Pesticide, Over-exploitation, Climate change, Others.
- **Used Part:** Leaves, Roots, Leaves and Roots, Others
- **Frequency of uses per year:** 0-20, 21-40, 41-60, more than 60 times
- **Harvesting quantity per year:** 0-10 kg, 11-20kg, 21-30kg, 31-40kg
- **Harvesting season:** Spring, Summer, Autumn, Winter
- **Its abundance in nature:** No, Low, Medium, High

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Traditionnel knowledge of the local people to the Tolitirsh

A1. Tola-Tirsh supplements are safe to use as they are from natural ingredients.	**TRUE**
	FALSE
	I do not know
A2. Herbal supplements and medication can be taken together at the same time.	TRUE
	FALSE
	I do not know
A3. Herbal supplements do not have side effects.	False (go to A4)
	True (go to A5)
A4. If FALSE, please choose the side effects that are caused:	Allergy
	Liver problems
	Kidney problems
	Gastrointestinal problems
	Hormonal problems
	Low blood sugar
	Others
A5. Tola-Tirsh herbal supplements can be dangerous if the amount takenis higher than the recommended dosage on the label.	TRUE
	FALSE
	I do not know

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