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Chemistry

Determination the Anti –Oxidant Capacity, Total Phenols, Minerals and Evaluation the Anti- Bacteria Activity of Leafs and Stems of Gaper Plant Extracts

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Abstract **Original Research Article**

In this study, Caper plant were collected from Al-Jabal Al-Akhdar region (Libya) during the spring season (2023), the leaves and stems of the plant were separated and dried in the open air. The contents of minerals and metals (Na, K, Ca, Fe and Ni) were determined. The strength of antioxidants was determined using the Prussian blue method. Also, phenol compounds were estimated by the Folin Ciacalteu Method. The results showed that the metal values were showed higher contents in the leaves comparing with their contents in the stems, where a relative increase was found in the leaves of capers with a value of (1.83 ppm) compared to its value in the stems (0.94 ppm), the phenol contents were recorded in leaves (0.530 ppm), and stems (0.362 ppm). The anti-bacterial activity using different concentrations of the plant extract concentrations of (25,50,75 and100%) on two types of bacteria (***Bacilli*** and ***Escherichia Coli***) was applied for the extracts. The results showed that the inhibition zone of the leave extracts was recorded in all concentrations of ***Bacilli***, in the stems the high inhibitaion zone were observed for concentrations (75%, &100%). The leaves and stems extract didn't showed any effect on ***Escherichia coli*** except for high concentrations of leaves (100%).

Keywords: Caper / Anti –Oxidant, Anti- Bacterial, Metals.

INTRODUCTION

Plants have been listed as a rich source of medicinal products because they generate a wide range of bioactive molecules, the majority of which probably evolved as a chemical protection against predation or infection and antioxidant compounds [1]. Many antioxidant compounds, including phenolic, carotenoids, anthocyanin's, and tocopherols, can be found in plant approximately 20% of known plants were used in pharmaceutical studies, with positive effects on the healthcare Plants that have beneficial phytochemicals can complement the needs of the human body by serving as natural antioxidants. Many studies have shown many plants to be rich sources of antioxidants. Examples include vitamins A, C, E and phenolic compounds they all act as plant-borne antioxidants, such as flavonoids, tannins and lignins [2]. With increased resistance to antibiotics, researchers began to look for alternative treatment or disease prevention so that medicinal plants were established extensively biological Resources of modern medicines [3]. Secondary metabolites largely determine specific characteristics such compounds are not involved in living cells, which are responsible for simple enhanced resistance to pests and diseases. Every species of plant has its own particular set of secondary metabolites. About 100,000 compounds are now identified from plants, with about 4,000 new ones being discovered each year [4]. These compounds are not associated with the living cells 'fundamental metabolic processes, but are associated in the developing organism's interaction with its environment. Plants have an almost limitless ability to synthesize aromatic Substances by following pathways of metabolism which have response to antimicrobial infection and antioxidant [5]. Plants generally produce several metabolites like phenols, flavonoids, quinines, tannins, alkaloids, and saponins which are important sources of biocides and many other pharmaceutical drugs [6].

Caper Plant History

The caper was used in ancient Greece as a carminative. It is represented in archaeological levels in the form of carbonized seeds and rarely as flower buds and fruits from archaic and Classical antiquity contexts. Athenaeus in *Deipnosophistae* pays a lot of attention to the caper, as do Pliny and Theophrastus [7]. Etymologically, the caper and its relatives in several

European languages can be traced back to Classical Latin *capparis*, "caper", in turn borrowed from the Greek, *kápparis*, whose origin (as that of the plant) is unknown but is probably Asian. Another theory links *kápparis* to the name of the island of Cyprus (Κύπρος, *Kýpros*), where capers grow abundantly [8]. *Capparis spinosa*, the caper bush, also called Flinders rose [8], is a perennial plant that bears rounded, fleshy leaves and large white to pinkish-white flowers [9]. The plant is best known for the edible flower buds (capers), used as a seasoning, and the fruit (caper berries), both of which are usually consumed pickled. Other species of *Capparis* are also picked along with *C. spinosa* for their buds or fruits. Other parts of *Capparis* plants are used in the manufacture of medicines and cosmetics. *Capparis spinosa* is native to almost all the circum-Mediterranean countries, and is included in the flora of most of them, but whether it is indigenous to this region is uncertain. The family Capparaceae could have originated in the tropics, and later spread to the Mediterranean basin [10]. The taxonomic status of the species is controversial and unsettled. Species within the genus *Capparis* are highly variable, and interspecific hybrids have been common throughout the evolutionary history of the genus. As a result, some authors have considered *C. spinosa* to be composed of multiple distinct species, others that the taxon is a single species with multiple varieties or subspecies, or that the taxon *C. spinosa* is a hybrid between *C. orientalis* and *C. sicula* [11].

Culinary Uses

The salted and pickled caper bud (called simply a caper) is used as an ingredient, seasoning or garnish. Capers are a common ingredient in Mediterranean cuisine, especially Cypriot, Italian, Aeolian Greek and Maltese food. The immature fruit of the caper shrub are prepared similarly and marketed as caper berries. Fully mature fruit are not preferred, as they contain many hard seeds [12]. The buds, when ready to pick, are a dark olive green and range in size from under 7mm to more than 14mm. They are picked, then pickled in salt, or a salt and vinegar solution, and drained. Intense flavor, sometimes described as being similar to black pepper or mustard, is developed as gluco capparin, a glycoside organ sulfur molecule, is released from each caper bud. This enzymatic reaction leads to the formation of rutine, often seen as crystallized white spots on the surfaces of individual caper buds [13]. Capers are a distinctive ingredient in Italian cuisine, especially in Sicilian, Aeolian and southern Italian cooking. They are commonly used in salads, pasta salads, meat dishes, and pasta sauces. Capers are one of the ingredients of tartar sauce. They are often served with cold smoked salmon or cured salmon dishes (especially lox and cream cheese). Capers and caper berries are sometimes substituted for olives to garnish a martini [14]. Capers are categorized and sold by their size, defined as follows, with the smallest sizes being the most desirable: non-pareil (up to 7 mm), surfines (7–8 mm), capucines (8–9 mm), capotes (9–11 mm), fines (11– 13 mm), and grusas (14+ mm). If the caper bud is not picked, it flowers and produces a caper berry. The fruit can be pickled and then served as a Greek *mezze* [15].

Caper leafs, which are hard to find outside of Greece or Cyprus, are used particularly in salads and fish dishes. They are pickled or boiled and preserved in jars with brine like caper buds. Dried caper leafs are also used as a substitute for rennet in the manufacturing of high-quality cheese. This study were designed to obtain information regarding to the following aspects: Estimate the total phenol compounds, Estimate the mineral contents (Na, K and Ca) of the plants beside determine the values of some metals (Fe and Ni), Measuring the anti-oxidant activity of the studied plants. Evaluation of anti-bacteria activity on the leafs and stem extracts.

EXPERIMENTAL PART

The Studied Plants

Due to the importance of many plants which used at AL-Gabal AL- Khder region (Libya), this study was designed to select of the most plants which used in disease treatments, this plant is (***Caper***). The samples were collected from Al-Gabel Al –Kadar region during spring season of (2023) year. leafs and stems of the selected plant were separated and, then dried in open air, (Figure, 1). The collected samples were identified in ***Seliphium*** herbarium, Botany Department, Faculty of Science, Omar Al Mukhtar University.

Determination of Antioxidant Power by Prussian blue Method

One gram of powder was defatted with petroleum ether. The defatted powder was then extracted sequentially by stirring with 10 ml methanol twice, then with 10 ml 1% hydrochloric acid: methanol (v/v). The three combined extracts were evaporated under vacuum and the residue was dissolved in 10 ml methanol. Half ml of the solution was diluted with 3 ml distilled water, 3 ml (0.008 M) of $K_3Fe(CN)_6$ Was added, 3 ml 0.1M HCl, and 1 ml 1% $FeCl_3$. The blue color is allowed to develop for 5 min and the absorbance is measured at 720 nm against the blank [16]. The contents were measured from the standard curve, Figure (1).

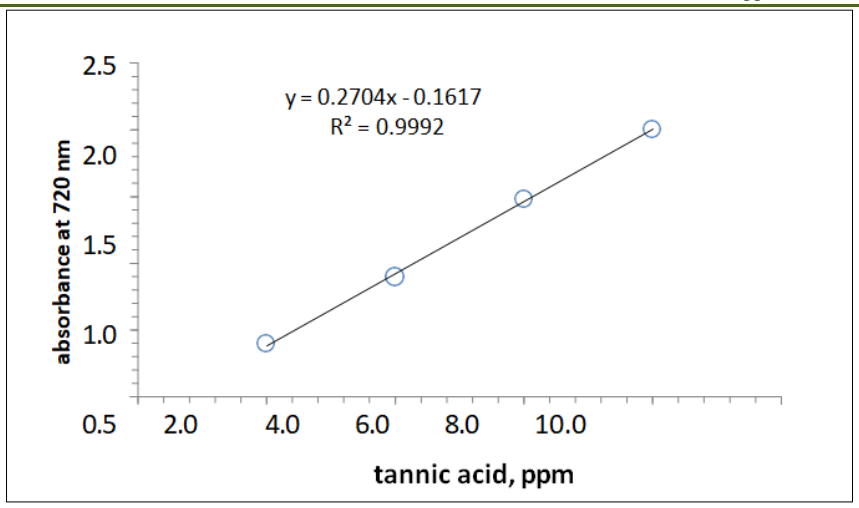

Figure 1: The standard curve of anti-oxidant capacity

Determination of Phenols Compound by Folin Ciacalteu Method

This method was carried out to determine phenolic compound the aqueous extracts, where 10 ml was added to 3ml of distilled water with Folin Ciacalteu reagent. According to the method of Slinkard and Singleton that using tannic acid as a standard. Samples (leafs and seeds of barley plant) were introduced into test curettes', and then 0.5mL of Folin-Ciocalteu reagent and 2ml of Na_2CO_3 (20%) were added. The absorbance of all samples was measured at 650 nm using UV–Vis spectrophotometer after incubating at 1 min and cooled for 15 min. Results were expressed as milligrams of Tannic acid equivalent per gram of fresh weight [16]. The total phenols values were measured from standard curve, Figure (2).

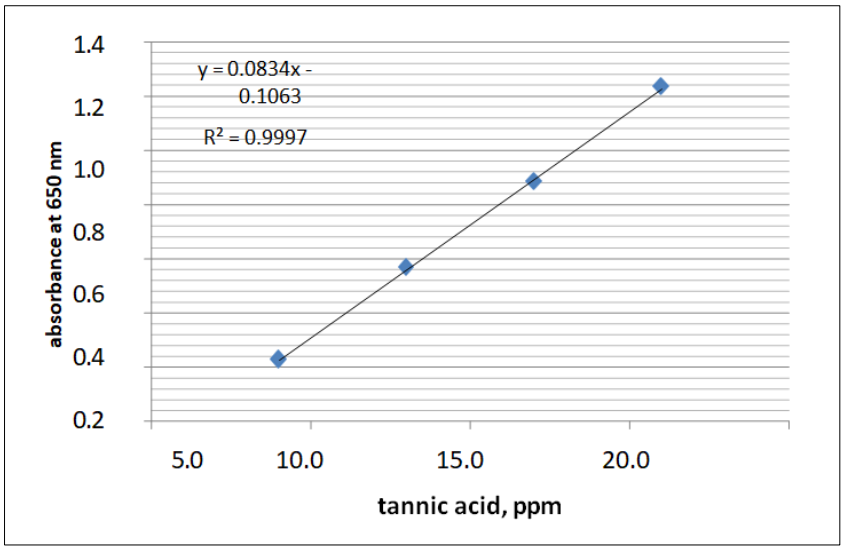

Figure 2: Standard Curve of phenolic compounds

Anti-Bacteria Activity

The antimicrobial activity studies were carried out on the aqueous and ethanol extracts for both leafs and stems of the studied plant against some species of bacteria. The minimum inhibition concentration (MIC) was used to estimate the affective concentration [17].

Determination of Metals and Minerals

The metals of (Cu, Fe and Ni), were determined with an Atomic absorption spectrophotometer (Perkin Elmer 800) according to the method described by (Lorenz *et al*., 1980). Soluble sodium and potassium, calcium contents measured by a Flame Photometer (JENWAY Flame Photometer) according to the method described by [18, 19], in central lab of Faculty of Science, Omar Al-Mukhtar University.

RESULTS AND DISCUSSION

The minerals and metal contents of the leafs and stems of the studied plant (***Caper***) were shown in Tables (1) and Figures (3&4): The concentrations of the elements of the ***Caper*** plant were fluctuated as following: The high sodium content (35.86 µg/g) was recorded in leafs comparing with its value in stem sample of (9.31

µg/g). On other side the high concentration of potassium (57.01 µg/g) was recorded ***Caper*** stems comparing with the value of (31.30 µg/g) which recorded in ***Caper*** plant leafs. Consequently, the high content of Calcium was recorded in ***Caper*** leafs (4.32ppm), whereas the calcium content in ***Caper*** stems was (1.95 µg/g). The Nickel was present in higher concentration of ***Caper*** leafs (0.12 µg/g) followed by its content in stems with concentration of (0.09 ppm). The high iron content was in ***Caper*** leafs of concentration of (1.15 ppm) comparing with its content in stem (0.98 µg/g) Table (1) and Figure (3).

Table 1: Mineral and metal contents of water extract of leafs and stems of Caper plant plants (µg/g).

Elements Samples	Na	K	Ca	Fe	Ni
Caper leafs	35.86	57.01	1.95	1.15	0.12
Caper Stems	9.31	31.30	4.32	0.98	0.09

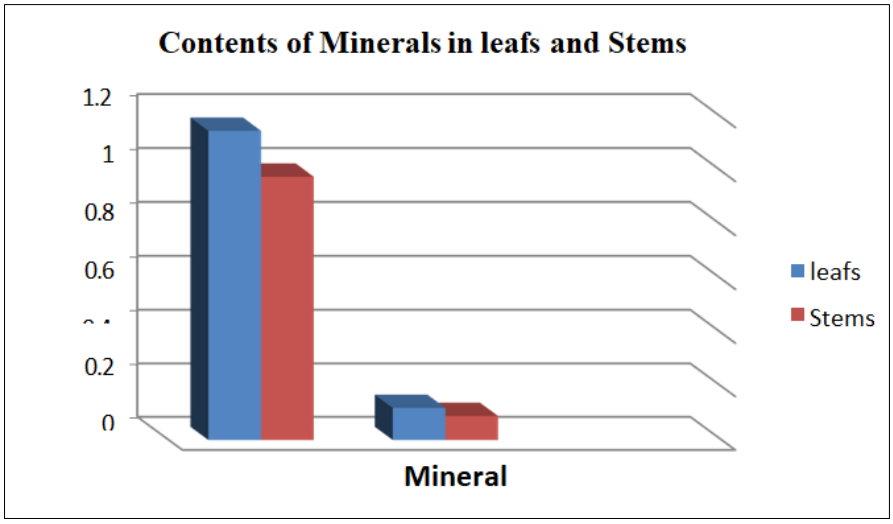

Figure 3: The contents of minerals in leafs and stems of *Caper* plant

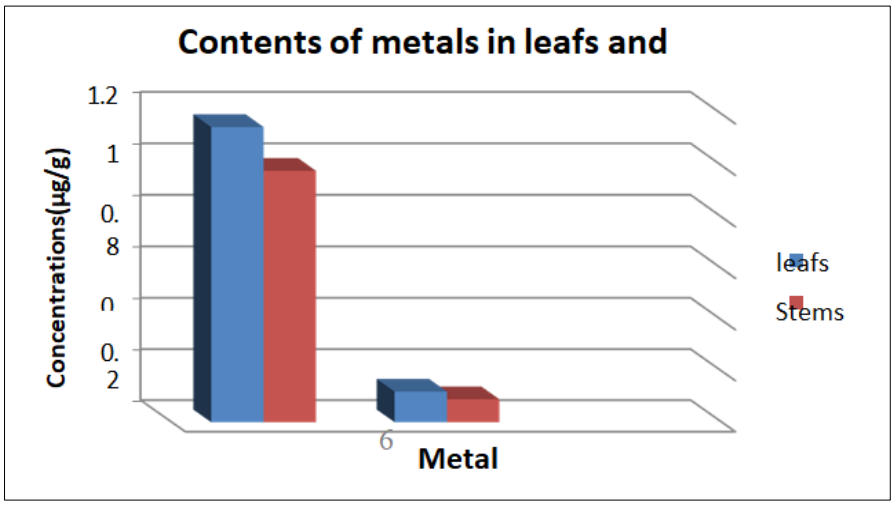

Figure 4: The contents of metals (Fe &Ni) in leafs and stems of *Caper* plant

Total Phenol Content

The total phenol contents small variation in their contents in leafs and stems of Caper plant. Where the relative increase in phenolic content was recorded in leafs (0.530 ppm) compared with its content in stems (0.362 ppm), Table (2) and Figure (6). Phenolic and flavonoid compounds have been reported to be responsible for the antioxidant activities of medicinal plants and other botanical materials.

Anti – Oxidant Capacity

The contents of anti – oxidant capacity of Caper plant were coordinated with the total phenolic compounds, where there is relative increasing in Caper leafs in anti –oxidant capacity of value of (1.83 ppm) comparing with its value in Caper stems (0.940 ppm). Table (2) and Figure (5).

Table 2: Total phenols and anti –Oxidant contents of leafs and stems of Caper plant (µg/g).

Factor Samples	Total phenols	Anti- Oxidant
Caper leafs	5.108	6.18
Caper Stems	3.04	2.88

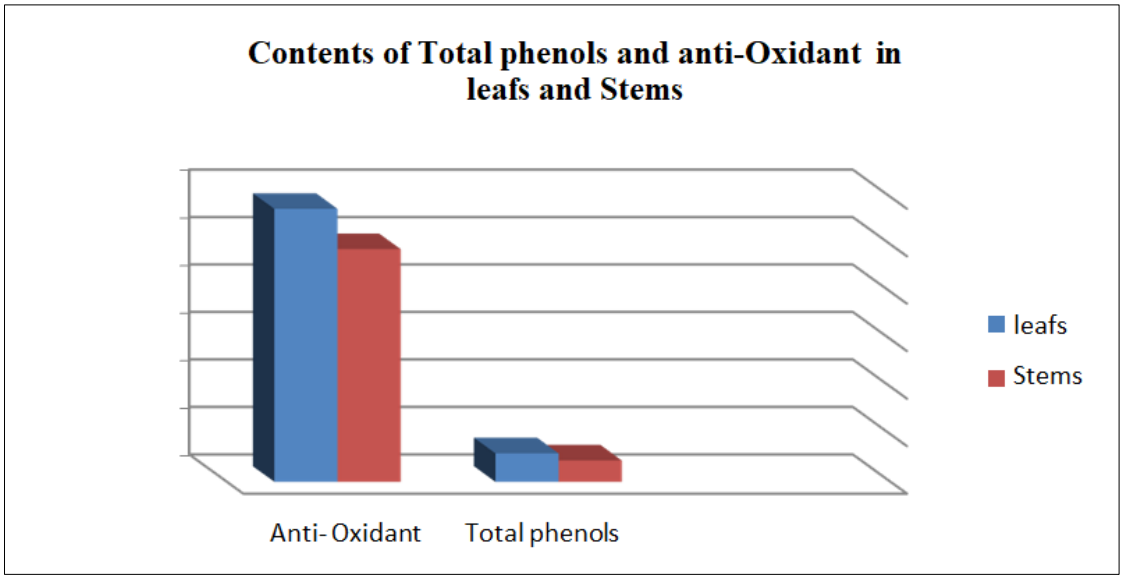

Figure 5: The contents of Total phenols and anti-oxidant capacity in leafs and stems of *Caper* plant

Antibacterial Activity

Figures (6, 7 and 8) showed the effect of different concentrations of studied plant extracts against *Bacilli* and *Escherichia Coli* bacteria**.** Where the concentrations which in this investigations were ranged between (25,50,75 and 100 % of the extract. The results showed that the inhibition zone and MIC of leaf extracts recorded at 25,50, 75 and 100 % with values of (1 ,3,7 and 10 µm) Against *Bacilli* bacteria, on the other side no inhabitation zone were recorded for the stems extract expect for the high concentrations of 75 and 100 %, were the inhibition zones were 2&4 µm, respectively. Also the results showed that the extracts of leafs and stems not affected on ***Escherichia Coli*** bacteria, except for high concentrations of leafs (100 %), where the inhibition zone was (2 µm).

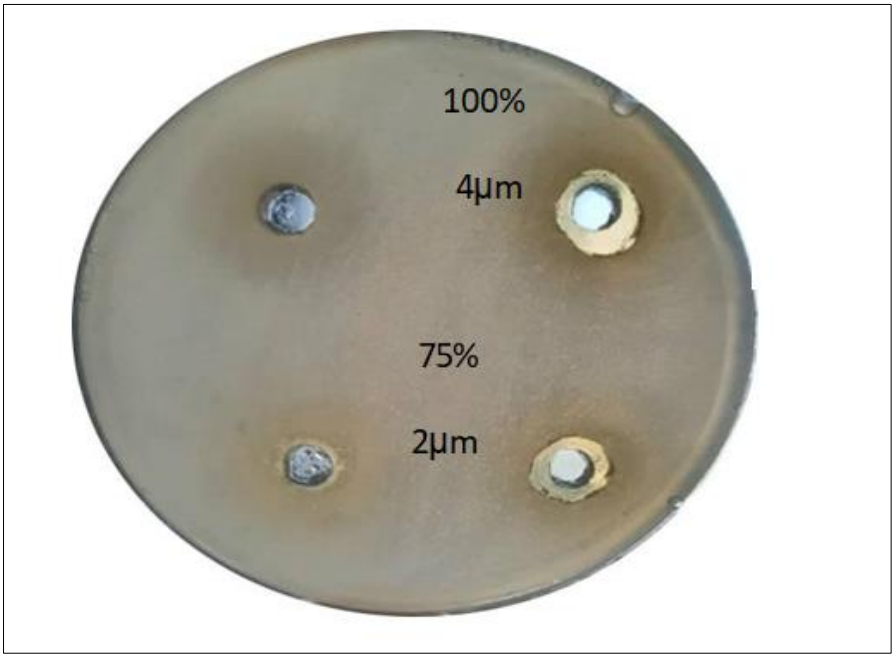

Figure 6: The inhibition zones of ethanol extract of stems on the *Bacilli* bacteria

Figure 7: The inhibition zones of ethanol extract of leafs on the *Bacilli* bacteria

Figure 8: The inhibition zones of ethanol extract of leafs on the *Escherichia Coli* bacteria

CONCLUSION

The results of this study recorded that the Caper plan extract containing minerals, have anti-oxidant capacity, total phenols and gave anti- bacterial activity on some species of bacteria. By comparing between the studied chemical contents in leafs and stems of Caper plant, the results showed that the leafs have high values comparing with the steams.

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