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# Phytochemical Studies on Some Important Egyptian Medicinal Plants

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**ABSTRACT**

Ten Egyptian medicinal plants are selected for phytochemical screening and estimation of total phenolics studies, these plants are: *Moringa olifera*, *Nigella sativa*, *Syzygium aromaticum (Caryphyllus aromaticus*), *Pimpinella anisum*, *Punica granatum*, *Trigonella foenum graecum*, *Cinnamomum sp.*, *Cassia fistula*, *Artemisia monosperma*, *Cuminum cyminum* and Mixture of all these plants in equal ratios. Phytochemical screening studies of three descending successive extracts of these plants (water, methanol and petroleum ether extracts) showed variation in the presence/absence of different phytochemicals between different extracts, in this regard it was found that, all plants are rich in Carbohydrates and/or Glycosides, Tannins, Anthraquinones, Flavonoids, Sublimable substances, Unsaturated sterols and/or Triterpenoids, Alkaloids, Saponins, Cardiac Glycosides, Coumarins, Iridoids, Chlorides and Sulphates, with special reference to the methanol extract of mixture of these plants. Results of estimation of total phenolics in methanol extracts of all plants showed that, all plants are rich in phenolics, with special reference to the mixture of these plants (50.833±0.002 mg/ml).

**Keywords:** Preliminary phytochemical screening - Successive extraction - Total phenolics - Medicinal plants.

## 1. INTRODUCTION

Use of the black seeds is recommended in daily use because it is regarded as one of the greatest forms of healing medium available to treat many diseases according to traditional local healers. It has been traditionally used as a natural remedy for a number of ailments that include asthma, chest congestion, hypertension, diabetes, inflammation, cough, bronchitis, headache, fever, dizziness, and influenza and for general well-being. Different pharmacological effects such as gastric ulcer healing, anti-microbial, anti-cancer, cardiovascular disorders, gastroprotective, antioxidant, immunomodulatory, anti-inflammatory, antitumor, antitussive, anti-anxiety, anti-asthmatic and anti-inflammatory effects in pancreatic cancer cells, anti-helicobacter activity, tumor growth suppression, anti-viral activity against cytomegalovirus, hepatoprotective activity have been reported for this medicinal plant (Ishtiaq *et al*., 2013 and Reddy *et al*., 2018). *Cassia fistula* Linn is widely used for its medicinal properties, its main property being that of a mild laxative suitable for children and pregnant women. It is also a purgative due to the wax aloin and a tonic and has been reported to treat many other intestinal disorders like healing ulcers (Ashraf, 2014). *Pimpinella anisum* has many therapeutic properties. It helps in relieving gastrointestinal spasms and it has carminative properties. Moreover, extracts of the aniseeds are used as medicine for their diuretic and laxative effect, expectorant and anti-spasmodic action, and their ability to ease gastric pain and flatulence. Additionally, the production of milk in lactating women is also observed to increase after the consumption of aniseed. It also reduces the gastrointestinal problems of their children. Due to all these benefits, it is one of the oldest spices used in traditional medicine. It has also been reported that aniseed is a potent anti-peroxidative and anti-diabetic agent and thereby, possesses a vast spectrum of applications and exploitations in the food and drug industry (Islam *et al*., 2016). The genus *Cinnamomum* comprises of about 300 species of which four species are used to obtain the spice 'cinnamon'. Studies have demonstrated many beneficial health effects of cinnamon, such as anti-inflammatory properties, anti-microbial

activity, blood glucose control, reducing cardiovascular disease, boosting cognitive function and reducing cardiovascular disease, boosting cognitive function and reducing risk of colonic cancer. Phytochemical moieties in *Cinnamomum spp.* possess antioxidant action that may prove beneficial against free radical damage to cell membranes (Goud Gajula *et al.*, 2016). *Cuminum cyminum* L., is one of the old cultivated medicinal food herbs in Asia, Africa and Europe. This plant is well-known as Cumin. In traditional medicine, Cumin seeds were used for their therapeutic effects on gastrointestinal, gynecological and respiratory disorders, and also for the treatment of toothache, diarrhea and epilepsy. These seeds were also documented as stimulant, carminative and astringent. Antimicrobial activity has been reported from the volatile oils and aqueous extract of Cumin. (Gohari and Saeidnia, 2011). *Moringa oleifera* is referred to as a "miracle tree" or a "wonder tree" of significant socio economic importance because of its several nutritional, pharmacological and industrial applications. They have been reported to possess substantial anti-carcinogenic and anti-mutagenic activities due to their anti-oxidant and -inflammatory properties. They are also active in reducing high blood pressure (Kasolo *et al.,* 2010). The potential therapeutic properties of pomegranate are wide-ranging and include treatment and prevention of cancers, cardiovascular disease, diabetes, dental conditions, erectile dysfunction and prevention from ultra violet (UV) radiation. The pericarp of P. granatum is used to treat infections found in human sexual organs as well as mastitis, acne, folliculitis, piles, allergic dermatitis, timpanists, scalds, diarrhea and dysentery. (Sreedevi *et al*., 2017). *Syzygium aromaticum* (Syn. *Caryophyllus aromaticus, Eugenia aromatica, E. caryophyllata*) commonly known as clove tree. The plant has numerous medicinal properties. The flower buds (cloves) are carminative, stimulant and antimalarial. It is used in dyspepsia, gastric troubles, nausea and vomiting. Its oil is a strong germicide, antiseptic, analgesic, local anesthetic, antioxidant, emetic and spasmolytic. It contains eugenol which is an effective local anesthetic and has long been used in dentistry (Sabira Begum *et al.*, 2014). Artemisinin has received considerable attention in the last few decades as the current drug of choice for treatment of malaria and a number of other diseases. Because of the development of resistance against other malarial drugs, the demand for artemisinin has rapidly increased during the past decade. The high unexpected concentration of artemisinin and some of its related analogues detected in this study reported *Artemisia herba alba* and *Artemisia monosperma* for the first time as a novel potential plant sources for artemisinin and some of its related analogues that may be helpful for its commercial pharmaceutical production and could lead to the improvement of the overall supply of artemisinin at a reduced market price offering an acceptable price for most patients especially that these *Artemisia* species are abundant in distribution in Egyptian desert (El Maggar, 2012). *Trigonella foenum-graecum* was found to possess different activities such as anticancer, anti-inflammatory, antiseptic, aphrodisiac, astringent, bitter, demulcent, emollient, expectorant, anthelmintic, wound healing and gastro protective (Rashmi yadav *et al*., 2011). The main target of this work is preliminary phytochemical screening of different successive extracts of ten Egyptian medicinal plants: *Moringa olifera*, *Nigella sativa*, *Syzygium aromaticum (Caryphyllus aromaticus*), *Pimpinella anisum*, *Punica granatum*, *Trigonella foenum-graecum*, *Cinnamomum sp.*, *Cassia fistula*, *Artemisia monosperma*, *Cuminum cyminum* and the mixture of all these plants in equal ratios, in addition to estimation of total phenolics of the extract which is the richest in phytochemicals under investigation in the light of preliminary phytochemical screening results.

## 2. MATERIAL AND METHODS

### 2.1. Plant materials

Ten Egyptian medicinal plants were collected from the Egyptian markets to be studied phytochemically, in addition to the mixture of all these ten plants in equal ratios was prepared to be studied phytochemically also.

**Table - 1: Names of the investigated ten Egyptian medicinal plants and used parts of these plants.**

| Sample name | Used Parts |
|---|---|
| *Artemisia monosperma* | Shoot systems |
| *Nigella sativum* | Seeds |
| *Syzygium aromaticum (Caryphyllus aromaticus)* | Fruits |
| *Cassia fistula* | Fruits |
| *Cinnamomum sp.* | Stem bark |
| *Punica granatum* | Peels of Fruits |
| *Moringa oleifera* | Seeds |
| *Trigonella foenum-graecum* | Seeds |
| *Pimpinella anisum* | Seeds |
| *Cuminum cyminum* | Seeds |
| Mixture of all plants in equal ratios | All the used parts of the above mentioned plants |

**2.2. Phytochemical studies:**

**2.2.1. Extraction:**

All samples are cleaned, air dried and extracted by using hot water, methanol (80 %), petroleum ether (40-60) for extraction, then filtered; each 1 ml of extract of different plant materials contains 50 mg Dry Weight (Alam, A. E., 2019).

**2.2.2. Preliminary Phytochemical Screening:**

**2.2.2.1. Carbohydrates and/ or Glycosides:**

About one gram of the dried sample was extracted with 10 ml of 50% ethanol. The ethanolic extract (5ml) was mixed with 0.5 ml of ethanolic α- naphthol reagent, then 1ml of sulphuric acid was carefully poured on the walls of the test tube. A violet ring was formed at the interface indicating the presence of carbohydrates and / or glycosides (Stank *et al.,* 1963).

**2.2.2.2. Saponins:**

Saponins were determined according to the methods adopted by Hungund and Pathak, (1971).

*a- Forth test:*

About 3 grams of the dried sample were extracted with boiling water then filtered. After cooling, the aliquot was shacked vigorously until forth was obtained, then allowed to stand for 15-20 minutes and classified according to their saponin contents (No forth means negative, forth less than 1Cm height = weakly positive and forth 1-2 Cm or higher means positive).

*b- Blood hemolysis test:*

About 5 grams of the dried sample were extracted with hot ethanol (95%). One ml aliquot portion was added to 10 ml of 1:4 suspensions of erythrocytes in physiological saline solution and hemolysis was observed indicating the presence of saponins.

**2.2.2.3. Tannins:**

About 5 grams of the dried sample were extracted with ethanol (50%) and filtered. The addition of ferric chloride reagent to the filtrate gave a green color, then changed to a bluish black color or precipitate indicates the presence of tannins (Trease and Evans, 1978).

**2.2.2.4. Unsaturated sterols and / or Triterpenes:**

The alcoholic extract (corresponding to 2 grams of the dried sample) was evaporated. The residue was treated with anhydrous chloroform (10 ml) and filtered; the filtrate was divided into two portions and subjected to the following reactions:

*a- Liebermann- Burchardt's test:*

To the first portion, 1 ml of acetic anhydride was added, followed by 2 ml of $H_2SO_4$ down on the wall of the test tube. If a reddish - violet ring was produced at the junction of two layers, then the solution become bluish- green in color in the acetic acid layer it indicates the presence of unsaturated sterols and / or triterpenes (Claus, 1967).

*b- Salkowiskit's test:*

To the second portion, an equal volume of sulphuric acid was added; if a red color was produced it indicates the presence of unsaturated sterols and / or triterpenes (Schmidt, 1964).

**2.2.2.5. Alkaloids and / or Nitrogenous bases:**

About 10 grams of the dried sample were extracted with 100 ml of dilute hydrochloric acid. The acidic extract was filtered, adjusted to be alkaline with ammonium hydroxide solution and extracted with chloroform. The chloroformic extract was evaporated to dryness and the residue was dissolved in about 2 ml of hydrochloric acid. The acidic solution gave faint brown precipitate with Wagner's reagent {1.3 grams of Iodine, 2 grams of Potassium iodide, dissolved in 100 ml dist. water} and very slight yellow precipitate with Mayer's reagent {1.36 grams of Mercuric chloride, 5 grams of Potassium iodide, dissolved in 100 ml dist. water }(Shellard, 1957).

**2.2.2.6. Cardiac glycosides:**

About 2 grams of the dried sample were boiled with 15 ml of 70 % methyl alcohol for five minutes and filtered. The filtrate was diluted with distilled water and 0.5 ml of concentrated solution of lead acetate was added (to remove chlorophyll and other pigments) and filtered, to remove the excess of lead acetate, $H_2SO_4$ (10%) was added drop wise until no further precipitate was formed, then filtered. The filtrate was extracted with 10 ml chloroform. The chloroform extract was evaporated to dryness and the following tests were carried out according to Balbaa *et al*., (1981).

*a- Killer –Kiliani test :*

About 1ml of ferric chloride solution (3.5 %) in glacial acetic acid was added to one portion of chloroform residue and left, concentrated sulfuric acid was added carefully down the wall of the test tube. On standing, a brown or red layer appeared at the interface (due to the aglycone) and the upper acetic acid layer becomes blue to green (due to desoxy sugar).

*b- Kedde's reaction:*

To another portion of the chloroform residue, 3.5-dinitrobenzoic acid (2%) in 90% methanol and one drop of NaOH (2%) were added. The solution acquired a violet color on standing.

*c- Libermann's reaction:*

The third portion of the chloroform residue was dissolved in glacial acetic acid, then acetic anhydride (2 ml) was added. Concentrated $H_2SO_4$ was added carefully down the wall of the test tube. On standing, two layers were afforded, pink color (upper layer) and green color (lower layer).

**2.2.2.7. Flavonoids:**

About 5 grams of the dried sample were soaked for one day with 150 ml of 1% HCl and filtered. The filtrate was tested for flavonoid compounds as follows:

About 10 ml of the filtrate were adjusted to be alkaline with sodium hydroxide. The formation of a yellow color indicates the presence of flavonoids. About 5 ml of the filtrate were mixed with 5ml HCl and small pieces of magnesium metal (0.5 g). The formation of red color after 3 minutes indicates the presence of flavonoids (Mabry *et al*., 1970).

**2.2.2.8. Anthraquinones:**

About 2 grams of the dried sample were boiled for few minutes with 0.5 N KOH (10 ml) to which 1ml of diluted $H_2O_2$ was added. After cooling, the mixture was filtered and acidified, then extracted with benzene (10 ml). The benzene extract was shacked with $NH_4OH$ (5ml). The presence of anthraquinones was indicated by the formation of red color in the alkaline layer (Farnsworth *et al.,* 1969).

**2.2.2.9. Coumarins:**

A small amount (5 g) of the moistened dried sample was placed in a test tube that covered with a filter paper moistened with diluted NaOH (0.1 N) solution. The tube was then removed and examined under U.V. light and any fluorescence is indicated for the presence of coumarins (Feigl, 1960).

**2.2.2.10. Irodoids:**

About 2 grams of fresh samples were cut into small pieces and placed in a test tube with 5 ml of 1% aqueous HCl. After 3-6 hours, 0.1 ml of the macerate was decanted into another tube containing 1 ml of the Trim and Hill reagent (10 ml acetic acid, 1 ml 0.2 % Cu $SO_4$ in water and 0.5 ml Conc. HCl). When the tube is heated for a short time on a flame, a blue color is produced if a certain irodoid is present (Weiffering, 1966).

**2.2.2.11. Chlorides and Sulphates:**

Chlorides and Sulphates were determined according to the methods adopted by Islam *et al*., (1993).

*a- Chlorides:*

Silver nitrate solution gives with a solution containing chlorides a white flocculent precipitate of silver chloride which dissolves in ammonium hydroxide solution and does not dissolve in dilute nitric acid.

*Note*: The color of the precipitate changes gradually in direct sunlight to violet.

*b- Sulphates:*

Barium chloride solution gives a white precipitate of barium sulphate which does not dissolve in mineral acids.

**2.2.2.12. Sublimation:**

One gram of each sample was carefully subjected to microsublimation in dry crucible, covered with a clean slide. Dark yellowish-brown fumes were evolved and condensed on the lower surface of a slide as a dark brown oily condensate which dissolved in potassium hydroxide solution producing red color indicating the presence of anthraquinons (Afifi, 1972).

**2.2.3. Chemical examination of successive extractives solvents:**

Chemical examination of successive extractives solvents (according to decreasing in polarity gradients) of different plant materials was carried out according to Afifi, (1972), using hot water, methanol (80%) petroleum ether (40-60) for extraction (1:20 w/v). These extracts were tested for the presence of carbohydrates and/or glycosides, tannins, saponins, flavonoids, sterols and/or triterpenes, alkaloids, cardiac glycosides, coumarins, iridoids, chlorides, sulphates, anthraquinones and sublimable substances using methods discussed in the preliminary phytochemical screening studies.

**2.2.4. Assay for total phenolics:**

Total phenolics were estimated following the method of Gursoy *et al.,* (2009) involving Folin–Ciocalteu reagent and Gallic acid as standard. 1 ml of methanol extract of different plant materials (contains 50 mg D.W.) was added to 1 ml Folin–Ciocalteu reagent in a volumetric flask then 45 ml distilled water was added. The flask was shaken vigorously. After 3 minutes, 3 ml of $Na_2CO_3$ (2%) solution was added and the mixture was allowed to stand for 2 hours by

intermittent shaking. Each sample was done in triplicate. Absorbance was measured at 760 nm (by using UV 2401 Pc, UV-VIS recording spectrophotometer, Shimazu, Germany). Concentrations of phenolic compounds were calculated according to the following equation that was obtained from the standard Gallic acid graph.

The calibration curve of reference standard (Gallic acid) was made using four different concentrations.

Absorbance = 0.0167 Gallic acid (µg) + 0.017 ($R^2$ = 0.997).

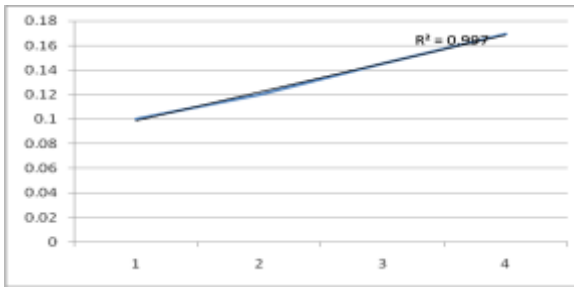


**Figure - 1: Standard curve of Gallic acid (Total phenolic content).**

1= GA (25 ppm), 2= GA (50 ppm), 3= GA (100 ppm), 4= GA (200 ppm).

**2.3. Statistical analysis:**

Statistical analysis was done using Fisher analysis of variance methodology. A least significant difference test was applied at 5 and 1% probability level to determine the differences among treatment means (Steel and Torrie, 1984). The CO-STAT computerized package program was subjected to the regular statistical analysis of variance (Nissen *et al.,* 1985), using two designs - 1- Anova-1 completely randomized design (CRD) - 2- Factorial implemented in completely randomized design. Each reading = mean of three replicates ± SE for all experiments.

**3. RESULTS AND DISCUSSION**

Ten Egyptian medicinal plants are selected for phytochemical screening and estimation of total phenolics studies, these plants are: *Moringa olifera*, *Nigella sativa*, *Syzygium aromaticum (Caryphyllus aromaticus*), *Pimpinella anisum*, *Punica granatum*, *Trigonella foenum-graecum*, *Cinnamomum sp.*, *Cassia fistula*, *Artemisia monosperma*, *Cuminum cyminum* and Mixture of all these plants in equal ratios will be studied also.

**3.1. Preliminary Phytochemical screening:**

Preliminary Phytochemical screening studies of three descending successive extracts (water, methanol and petroleum ether extracts) of these investigated plants and their mixture showed variation in the presence/absence of different phytochemicals between different extracts, in this regard it was found that, all plants are rich in Carbohydrates and/or Glycosides, Tannins, Anthraquinones, Flavonoids, Sublimable substances, Unsaturated sterols and/or Triterpenoids, Alkaloids, Saponins, Cardiac Glycosides, Coumarins, Iridoids, Chlorides and Sulphates, with special reference to the methanol extract of mixture of these plants, followed by its water extract. Meanwhile petroleum ether extracts of these plants are containing only Carbohydrates and/or Glycosides, Unsaturated sterols and/or Triterpenoids, Iridoids, Sulphates and Coumarins, with special reference to the petroleum ether extract of mixture of these plants also (Tables: 2-4).

**Table - 2: Preliminary phytochemical screening of water extracts of ten Egyptian plants and their mixture under investigation.**

| Experiment | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Carbohydrates and/or Glycosides | ++ | ++ | ++ | ++ | ++ | ++ | ++ | ++ | ++ | ++ | ++ |
| Tannins | ++ | + | ++ | ++ | ++ | ++ | + | ++ | ++ | ++ | ++ |
| Anthraquinones | ++ | + | + | + | + | ++ | ++ | ++ | ++ | ++ | ++ |
| Sublimable Substances | ++ | + | + | + | + | ++ | ++ | ++ | ++ | ++ | ++ |
| Flavonoids | ++ | + | + | + | ++ | ++ | + | ++ | ++ | ++ | + |
| Unsaturated sterols and/or Triterpenoids | ++ | – | – | ++ | – | + | – | ++ | + | ++ | + |
| Alkaloids | ++ | + | + | ++ | + | ++ | + | + | ++ | ++ | + |
| Saponins | ++ | + | + | + | ++ | + | + | + | + | + | + |
| Cardiac Glycosides | ++ | + | + | + | – | ++ | + | ++ | ++ | ++ | ++ |
| Iridoids | + | + | + | + | + | + | + | + | + | + | + |
| Chlorides | + | + | + | + | + | + | + | + | + | + | + |
| Sulphates | + | ++ | ++ | ++ | + | + | ++ | + | + | + | + |
| Coumarins | ++ | ++ | ++ | ++ | ++ | ++ | ++ | ++ | ++ | ++ | ++ |

1= *Moringa olifera*, *2= Nigella sativa*, 3= *Syzygium aromaticum (Caryphyllus aromaticus*), 4= *Pimpinella anisum*, 5= *Punica granatum*, 6=*Trigonella foenum-graecum*, 7=*Cinnamomum sp.*, 8= *Cassia fistula*, 9= *Artemisia monosperma*, 10=*Cuminum cyminum* and 11= Mixture of all plants.

**Table - 3: Preliminary phytochemical screening of methanol extracts of ten Egyptian plants and their mixture under investigation.**

| Experiment | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Carbohydrates and/or Glycosides | ++ | ++ | ++ | ++ | ++ | ++ | ++ | ++ | ++ | ++ | ++ |
| Tannins | + | + | ++ | ++ | ++ | ++ | ++ | ++ | ++ | ++ | ++ |
| Anthraquinones | + | + | ++ | + | ++ | ++ | ++ | ++ | ++ | + | ++ |
| Sublimable Substances | + | + | ++ | + | ++ | ++ | ++ | ++ | ++ | + | ++ |
| Flavonoids | + | + | ++ | ++ | ++ | ++ | ++ | + | ++ | ++ | ++ |
| Unsaturated sterols and/or Triterpenoids | + | ++ | ++ | + | ++ | + | ++ | ++ | + | + | ++ |
| Alkaloids | ++ | + | + | ++ | ++ | + | ++ | + | ++ | ++ | ++ |
| Saponins | + | + | + | + | ++ | + | + | + | + | + | ++ |
| Cardiac Glycosides | + | + | ++ | ++ | ++ | ++ | ++ | ++ | ++ | ++ | ++ |
| Iridoids | ++ | ++ | ++ | ++ | ++ | ++ | + | ++ | ++ | ++ | ++ |
| Chlorides | ++ | ++ | ++ | ++ | ++ | ++ | + | + | ++ | ++ | ++ |
| Sulphates | ++ | ++ | ++ | ++ | + | ++ | + | + | ++ | ++ | ++ |
| Coumarins | ++ | ++ | + | ++ | ++ | ++ | + | ++ | ++ | ++ | ++ |

1= *Moringa olifera*, *2= Nigella sativa*, 3= *Syzygium aromaticum (Caryphyllus aromaticus*), 4= *Pimpinella anisum*, 5= *Punica granatum*, 6=*Trigonella foenum-graecum*, 7=*Cinnamomum sp.*, 8= *Cassia fistula*, 9= *Artemisia monosperma*, 10=*Cuminum cyminum* and 11= Mixture of all plants.

**Table - 4: Preliminary phytochemical screening of petroleum ether extracts of ten Egyptian plants and their mixture under investigation.**

| Experiment | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1-Carbohydrates and/or Glycosides | ++ | ++ | ++ | ++ | ++ | ++ | ++ | ++ | ++ | ++ | ++ |
| 2-Tannins | – | – | – | – | – | – | – | – | – | – | – |
| 3-Anthraquinones | – | – | – | – | – | – | – | – | – | – | – |
| 4- Sublimable Substances | – | – | – | – | – | – | – | – | – | – | – |
| 5-Flavonoids | – | – | – | – | – | – | – | – | – | – | – |
| 6-Unsaturated sterols and/or Triterpenoids | + | ++ | ++ | + | ++ | ++ | ++ | ++ | + | ++ | ++ |
| 7-Alkaloids | – | – | – | – | – | – | – | – | – | – | – |
| 8- Saponins | – | – | – | – | – | – | – | – | – | – | – |
| 9-Cardiac Glycosides | – | – | – | – | – | – | – | – | – | – | – |
| 10-Iridoids | ++ | ++ | ++ | ++ | ++ | ++ | ++ | ++ | ++ | ++ | ++ |
| 11-Chlorides | – | – | – | – | – | – | – | – | – | – | – |
| 12-Sulphates | + | + | + | + | + | + | + | + | + | + | + |
| 13- Coumarins | ++ | ++ | ++ | ++ | ++ | ++ | ++ | ++ | ++ | ++ | ++ |

1= *Moringa olifera*, *2= Nigella sativa*, 3= *Syzygium aromaticum (Caryphyllus aromaticus*), 4= *Pimpinella anisum*, 5= *Punica granatum*, 6=*Trigonella foenum-graecum*, 7=*Cinnamomum sp.*, 8= *Cassia fistula*, 9= *Artemisia monosperma*, 10=*Cuminum cyminum* and 11= Mixture of all plants.

**3.2. Determination of total phenolics:**

Results of estimation of total phenolics in methanol extracts of all plants showed that, all plants are rich in phenolics with special reference to the mixture of these plants (50.833±0.002 mg/ml), followed by *Cuminum cyminum* 45.417±0.001 mg/ml), *Artemisia monosperma* (40.417±0.001 mg/ml), *Cassia fistula* (38.750±0.001 mg/ml), *Cinnamomum sp*. (34.583±0.001 mg/ml), *Trigonella foenum-graecum* (31.250±0.001 mg/ml), *Punica granatum* (30.000±0.001mg/ml), *Caryphyllus aromaticus*

(19.167±0.001 mg/ml), *Pimpinella anisum* and *Nigella sativa* (17.500±0.001 mg/ml), in this regard it was found that the methanol extract of *Moringa olifera* (15.833±0.001 mg/ml) is containing the least amount of phenolics (Figure.2).

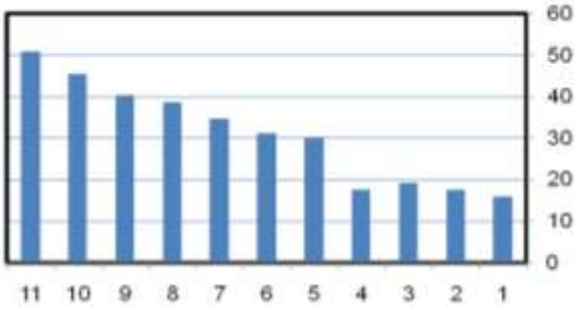


**Figure - 2: Total phenolic contents of methanol extracts of investigated plants and their mixture (mg/ml)**.

(1= *Moringa olifera*, *2= Nigella sativa*, 3= *Syzygium aromaticum (Caryphyllus aromaticus*), 4= *Pimpinella anisum*, 5= *Punica granatum*, 6=*Trigonella foenum-graecum*, 7=*Cinnamomum sp.*, 8= *Cassia fistula*, 9= *Artemisia monosperma*, 10=*Cuminum cyminum* and 11= Mixture of all plants.)

These results agreed with results of other scientists, those considered these plants are rich sources of valuable phytochemicals to be used in pharmaceutical industries on a large scale (Nigam *et al*., 2019, Mukit *et al*., 2018, Kaur and Kaushal, 2018, El Zalabani *et al*., 2017, Rebeya *et al*., 2017, Sreedevi *et al.,* 2017, Jayaprakash, 2017, Islam *et al*., 2016, Goud Gajula *et al.*, 2016, Saini *et al.,* 2016, Mittal *et al*., 2014, Sabira Begum *et al*., 2014, Ashraf, 2014, Al-Snafi, 2013, Ishtiaq *et al*., 2013, Bora and Sharma, 2011, Rashmi yadav *et al*., 2011, Gohari and Saeidnia, 2011, Kasolo *et al.,* 2010 and Bahorun *et al.,* 2006).

## 4. CONCLUSION

To conclude, results indicated that, these plants and their mixture are rich sources of phytochemicals. These results will encourage us to more studies related to investigation of effects of different extracts of such plants against many diseases especially both common and neglected tropical diseases in Africa and also will encourage us to *in vitro* studies for improving the amount of secondary metabolites obtained from these green sources by using green biotechnology in the future. Also, based on these results mixing such plants is a good way to obtain more phytochemicals of interest but still we need to some toxicological studies on these mixtures to avoid the formation of any toxic components during mixing these extracts of these important medicinal plants.

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