The Comparison of the Parameters Antioxidant Activity of Ginger (*Zingiber officinale* Roscoe) and Commercial Antioxidants

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Abstract

The study was aimed at evaluating the antioxidant activity of *Zingiber officinale* Roscoe (ginger) extract compared to antioxidant compounds such as; Butyl Hydroxy toluene (BHT), Diethyl-dithiocarbamate (DDC) and Ascorbic Acid (Vit. C). The antioxidant activity (DPPH), total phenolic content (TPC) and reducing power (RP) were studied. DPPH inhibitory values demonstrated through IC_{50} from ginger extract were significantly lower than those of other antioxidants at the same concentrations: ginger (122.2 ± 16.78%), Vit. C (158.21 ± 4.14%), BHT (195.84 ± 5.94%) and DDC (240.39 ± 43.75%) respectively. This proves that ginger extract is more active inhibiting DPPH free radicals. At a concentration of 100 µg / ml, the TPC level indicates the order: Vit. C > DDC > BHT > ginger respectively. As for RP test at concentration 100 µg / ml also Vit. C > ginger > DDC > BHT respectively. The results obtained in present study indicate that, ginger extract is a potential source of natural antioxidant capable of inhibiting and breaking the free radical chain and it's expected to suppress the development of degenerative cells diseases.

***Keywords**: Antioxidant, Ginger, Zingiber officinale Roscoe.*

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A. INTRODUCTION

Bioactive compounds commonly found in fruits, vegetables, herbs and other plants have been shown to have possible health benefits with antioxidative. Interestingly, many herbs are known to contain large amounts of phenolic antioxidants other than well-known such as buthylated hydroxyl toluene (BHT), vitamin E, carotenoids. Phenolic antioxidants in herbs are mainly composed of phenolic acids. Some phenolic compounds in herbs have the capacities to scavenge free radicals. Free radicals of different forms are constantly generated for specific metabolic requirement and quenched by an efficient antioxidant network in body. When the generation of these species exceeds the levels of antioxidant mechanism, it leads to oxidative damage of tissues and biomolecules, eventually leading to disease conditions especially degenerative diseases. Besides the antioxidative capacity, the phenolic compounds of plants also have other physiological effect and potentiality for industrial use as food supplement and preservative agent [1,2].

The aim of the study was to investigate the antioxidant activity of *Zingiber officinale* Roscoe (ginger) extract compared to antioxidant compounds such as; Butyl Hydroxy toluene (BHT), Diethyl-dithiocarbamate (DDC) and Ascorbic Acid (Vit. C). The parameter of antioxidant activity such as DPPH radical scavenging activity, total phenolic content (TPC) and reducing power (RP).

B. MATERIALS AND METHODS

1. Chemicals

Standard 1,1-diphenyl-2-picrylhydrazyl free radical (DPPH), Ascorbic acid, Butylated hydroxyl toluene (BHT), Diethyl-dithiocarbamit (DDC), $FeCl_3$, Trichloroacetic acid, Folin-Ciocalteus's phenol reagent, ethanol were purchased from Sigma-Aldrich (St. Louis, Mo., USA). Samples of oleoresin ginger (Zingiber officinale) were collected from Dr. Noor Azian Murad, *Clear, UTM Malaysia.* All the other chemicals used including solvents were of analytical grade.

2. Diphenyl Picryhydrazyl (DPPH) Radical Scavenging Activity

Antioxidants react with 1,1-diphenyl-2-picryl-hydrazyl (DPPH) radical and convert it to 1,1- diphenyl-2-picryl hydrazine. The degree of change in colour from purple to yellow can be used as a measure of the scavenging potential of antioxidant extracts. Aliquots of extract solutions were taken and made up the volume to 3 ml with methanol. 0,15 ml of freshly prepared DPPH solution was added, stirred and left to stand at room.

Temperature for 30 minutes in dark. The control contains only DPPH solution in methanol instead of sample while methanol served as the blank (negative control). Absorbance was read at 517 nm by spectrophotometer. The capacity of scavenging free radicals was calculated as follows [3].

$$\text{Scavenging activity (\%)} = \frac{\{[A_{\text{Control}} - A_{\text{Sample}}]\}}{A_{\text{Control}}} \times 100$$

3. Determination of Total Phenolic Content

Total phenolic content was estimated using the Folin-Ciocalteu method. Sample (100 µL) were mixed thoroughly with 2 mL of 2% Na_2CO_3. After 2 min. 100 µL of Folin- Ciocalteu reagent was added to mixtures. The resulting mixture was allowed to stand at room temperature for 30 min and absorbance was measured at 725 nm against a blank. Total phenolic content was expressed as gram of garlic equivalents per- 100 gram of dry weight of the plant samples [4].

4. Reducing Power Activity

0.2 ml of the sample of different concentrations was mixed with 200 µl of 1% potassium ferricyanide. The mixture was incubated in the water bath for 20 min at 50^0 C. Trichloroacetic acid (250 µl) was added to the mixture and was centrifuged at 1000 rpm for 10 min at room temperature. The supernatant (500 µl was added with 500 µl of distilled water and 100 µl of 0.1% ferric chloride. The mixture was incubated in the oven at 37^0C for 10mins. Absorbance was recorded at 700 nm using Spectrophotometer. Ethanolic solution of known Fe (II) concentration in the range of 50-500 µM (FeSO4) were used as calibration curve. The reducing power was expressed as equivalent concentration (EC). This parameter was defined as the concentration of antioxidant having a ferric reducing ability equivalent to that of 1 mM FeSO4 and butylated hydroxytoluene (BHT) was used as a positive control [5].

C. RESULT AND DISCUSSION

It was demonstrated that an ethanol extract of ginger has stronger antioxidant activity, as assayed by the reduction of DPPH. The IC_{50} values of ginger (122.2 ± 16.78%) significantly lower than those of other antioxidants at the same concentrations; Ascorbic Acid, Vit. C (158.21 ± 4.14%); Butyl Hydroxy toluene, BHT (195.84 ± 5.94%) and Diethyl-dithiocarbamate, DDC (240.39 ± 43.75%) respectively.

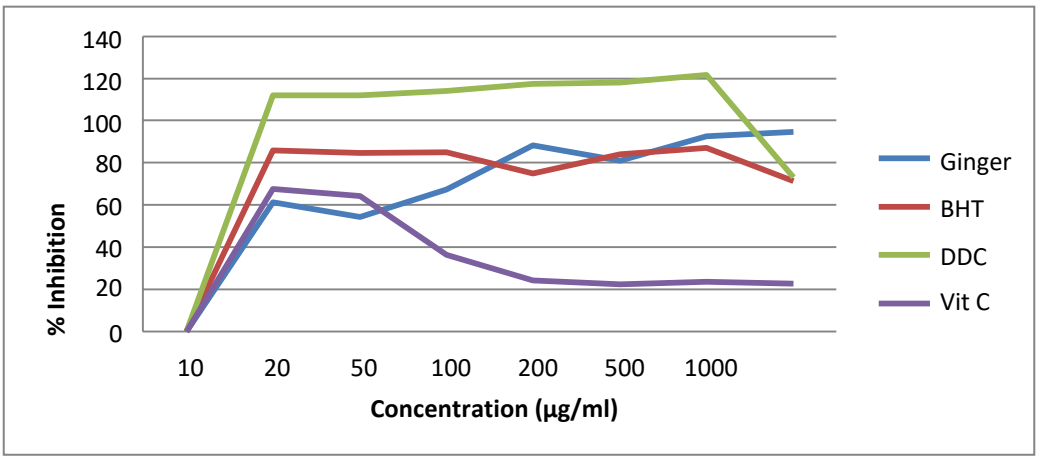

Figure 1. Percentage Inhibition (%) of DPPH Free Radical

As antioxidant activity is often attributed to phenolic compounds within plants the total phenolic content (TPC) within the aqueous extracts were measured. Phenolic compounds that contained in the plants have redox properties allow them acting as antioxidants[6]. At a concentration of 100 µg / ml, the TPC level indicates the order: Vit. C (0,577 ± 0,03 > DDC (0,428 ± 0,06) > BHT (0,355 ± 0,01) > ginger (0,233 ± 0,01) respectively.

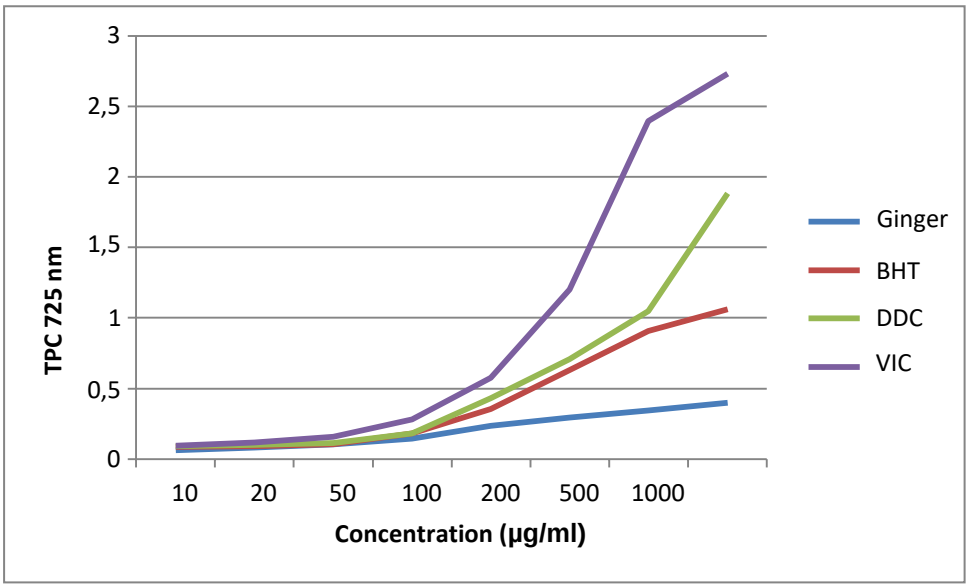

Figure 2. Total Phenolic Content

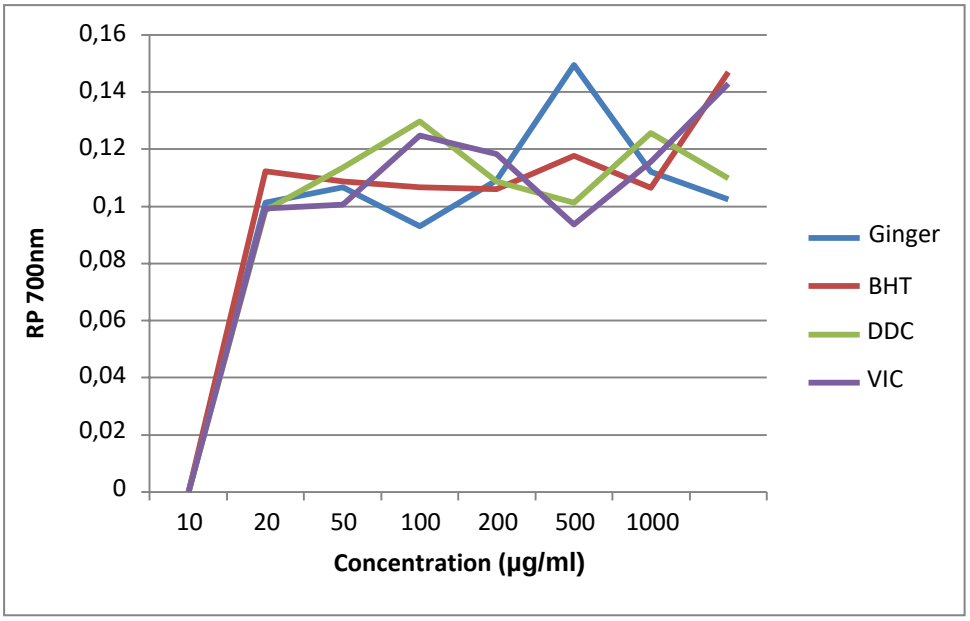

Figure 3. Reducing Power

The measurement of the reducing power, it has been investigated from ion Fe^{3+} to Fe^{2+}. Transformation ion Fe^{3+} reduction is often used as an indicator of electron donating activity, which is an important mechanism of phenolic antioxidant. The reducing properties of sample are generally associated with the presence of the reductor which have been shown to exert antioxidant action by breaking the free radical chain by donating hydrogen atom. The reducing power at concentration 100 µg / ml also Vit. C (0,118 ± 0,02) > ginger (0,109 ± 0,01) > DDC (0,108 ± 0,01) > BHT (0,106 ± 0,01) respectively.

Antioxidants may intervene at different levels in the oxidative process for example, by scavenging for free radicals and lipid peroxyl radicals, removing oxidatively damaged bio- molecules and having other types of action. Antioxidants can be grouped in to two; synthetic and natural antioxidant. Many synthetic antioxidants such as Butylated hydroxyanisole (BHA), Butyl Hydroxy toluene (BHT), Diethyl-dithiocarbamate (DDC) and propyl gallate (PG) have been used to retard the oxidation process.

In recent years, there has been a growing interest in the search for natural antioxidants, especially secondary metabolites, for three principal reasons: 1. Numerous clinical and epidemiological studies have demonstrated that consumption of spices, fruits and vegetables is associated with reduced risk and symptoms of developing chronic diseases such as diabetes, cardiovascular diseases and cancer. 2. Safety consideration regarding the potential harmful effects of the chronic consumption of synthetic antioxidants in foods and beverages, and 3. The public's perception that natural and dietary antioxidant are safer than synthetic antioxidants. Consumption of natural oxidants as free radical scavengers may become necessary to improve the depieted immune system. It is reported that the antioxidant constituents of plant materials provide protection from degenerative diseases [7,8].

There are many parameters that have high influence on the amount and composition of antioxidants in extracts include the extraction solvent, temperature, extraction time (duration), solvent to solid ratio and storage conditions[9]. The results has been an increased interest in spices, aromatic and phytomedicine as sources of natural antioxidants [10,11,12]. Natural antioxidants have demonstrated beneficial effects in maintenance of health, management of age-related diseases, a meliorating the harmful effects of toxic agents both chemical and physical [12,13].

Determination of the antioxidant activity from ginger is one of the ways how to biologically and nutritionally evaluate the quality of the spices. It has been proved that antioxidant activity depends on the type of phenolics present in the fruit, as some phenolic compounds exhibit higher antioxidant activity than others [12].

D. CONCLUSION

Overall result shows that ginger extract can be used as a source for functional ingredients for pharmaceutical drug industries. The oleoresin of ginger (Zingiber officinale) may be one of the contributing factors responsible for the activities by virtue of their different properties like antioxidant, anti-inflammatory, analgesic and anti-microbial activities.

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