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### Original Article

## Onion and ginger sprouting is associated with increased antioxidant activity.

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#### ABSTRACT

**Aim:** Although onion (*Allium cepa*) and ginger (*Zinziber officinale*) has been extensively studied for its health benefits, sprouted onion and ginger has received little attention. We hypothesized that sprouting onion and ginger would stimulate the production of various phytochemicals that improve health. **Objectives:** To investigate the effect of sprouting on the antioxidant activity of *Allium cepa* and *Zinziber officinale* and to compare the antioxidant activity of both *Allium cepa* and *Zinziber officinale*. **Methods:** Ethanolic extracts from onion and ginger sprouted for different periods had variable antioxidant activities were assessed with in vitro assays, including the 2,2-diphenyl-1-picrylhydrazyl radical scavenging activity assay and their total phenolic content for over a period of 15 days. **Results:** Extracts from onion sprouted for 7 days had the highest antioxidant activity, whereas extracts from raw onion had relatively low antioxidant activity. Similarly extracts from ginger sprouted for 15 days had the highest antioxidant activity, whereas extracts from raw ginger had relatively low antioxidant activity. Furthermore, sprouting changed the total phenolic content of both onion and ginger. **Conclusion:** Sprouting may be a useful way to improve the antioxidant potential of both onion and ginger.

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### 1. Introduction

Antioxidants are believed to play a very important role in the body defense system against reactive oxygen species (ROS) or free radicals, which are harmful by-products generated during aerobic activity of normal cells. Generation of free radicals or reactive oxygen species (ROS) during metabolism and other activities beyond the antioxidant capacity of a biological system gives rise to oxidative stress [1], which plays a role in heart diseases, neurodegenerative diseases, cancer and in the aging process [2].

Diets rich in fruits and vegetables have been associated with decreased risks of several chronic diseases, such as coronary heart disease and some cancers [3, 4, 5]. These protective effects have been attributed partly to the various antioxidant compounds present in fruits and vegetables for example, vitamins C and E,  $\beta$ -carotene and polyphenolics [6,7]. One group of polyphenolics, flavonoids are found ubiquitously in the plant kingdom with a great variety of structures. In vegetables, quercetin glycosides are predominant, but glycosides of kaempferol, luteolin and apigenin are also present [8] which are powerful antioxidants.

The Allium family has over 700 members; each with different tastes, forms and colours; they are close in biochemical, phytochemical, and nutraceutical contents [9]. Onion is one of the major sources of dietary flavonoids in many countries [4, 10]. In contrast to other vegetables, onions have the highest amounts of quercetin. Many reports have indicated that onions have a wide range of beneficial properties for human health, such as anti-cholesterolaemic, anti-mutagenic, and antioxidant capacity. An increasing attention has been paid to the antioxidant content of onion because epidemiological studies have indicated that regular consumption of onions is associated with a reduced risk of neurodegenerative disorders, many forms of cancer, and cataract formation [11].

Ginger (*Zingiber officinale*) has been used as a spice for over thousands of years. Its roots and the obtained extracts contain polyphenol compounds (6-gingerol and its derivatives), which have a high antioxidant activity. *Zingiber officinale* contains a number of antioxidants such as beta-carotene, ascorbic acid, terpenoids, alkaloids, and polyphenols such as flavonoids, flavones glycosides etc [12].

Both onion and ginger are consumed, without sprouting and there are no studies reporting the effect of sprouting on the antioxidant activity hence the objective of the present study was to investigate the effect of sprouting on the antioxidant activity of onion and ginger.

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## MATERIALS AND METHODS

### Preparation of crude extract

The onions and ginger were purchased from the local market, they were planted in separate clay pots in order to carry out their sprouting. On day 0, 7 and 15 samples were harvested and dried overnight in hot air oven at 55°C. For extraction of the antioxidant compounds, a fine dried powder of the sample (0.5 g) was extracted using 50 ml of methanol by sonication at room temperature for 20 min. The extracts were filtered through whatman filter paper No. 1 paper.

### Antioxidant activity (Radical scavenging activity)

DPPH was used to evaluate the free radical scavenging activity of plant extracts as described by Hatano and others 1989 [13]. Briefly methanolic extract of onion and ginger samples were diluted to get a final concentration of 1mg/ml. From 1mg/ml stock serial dilutions were performed to get final concentrations 1000, 500, 250, 125, 100, 75, 50, and 25 µg/ml. Diluted samples (1ml each) were mixed with 1ml of methanolic solution of DPPH (1mg/ml). DPPH was filtered through Whatman filter paper no.1 after preparation. After 30 min incubation in darkness at room temperature (25°C), the absorbance was recorded at 517nm. Control sample contained all the reagents except the plant extract. Percentage inhibition was calculated using equation given below:

$$\text{Inhibition (\%)} = \frac{\text{Abs}_{517}(\text{control}) - \text{Abs}_{517}(\text{extract})}{\text{Abs}_{517}(\text{control})} * 100$$

The IC50 values were determined from plots of percent inhibition versus log inhibitor concentration and were calculated by non linear regression analysis from the mean inhibitory values. Ascorbic acid was used as the reference. All tests were performed in triplicate.

### Determination of Total Phenolic Content

Total phenolic constituents of plant extracts were performed employing the literature methods involving Folin-Ciocalteu reagent and Gallic acid as standard [14]. About 1.0 ml of plant extract (5µg/ml) was taken in a test tube. Then 5 ml of Folin-ciocalteu (diluted 10 fold) reagent solution and 4 ml of sodium carbonate solution (7.5%) was added into the test tube. The test tube was incubated for 30 minutes at 20°C to complete the reaction. Then the absorbance of the solution was measured at 765 nm using spectrophotometer against blank. The total content of phenolic compounds in plant ethanol extracts in Gallic acid equivalents (GAE) was calculated.

### STATISTICAL ANALYSIS

All experiments were performed with at least 3 replicates. One-way ANOVA was applied to determine the significance of results between different treatments. All the statistical analyses were done using SPSS v.11.5 for Windows.

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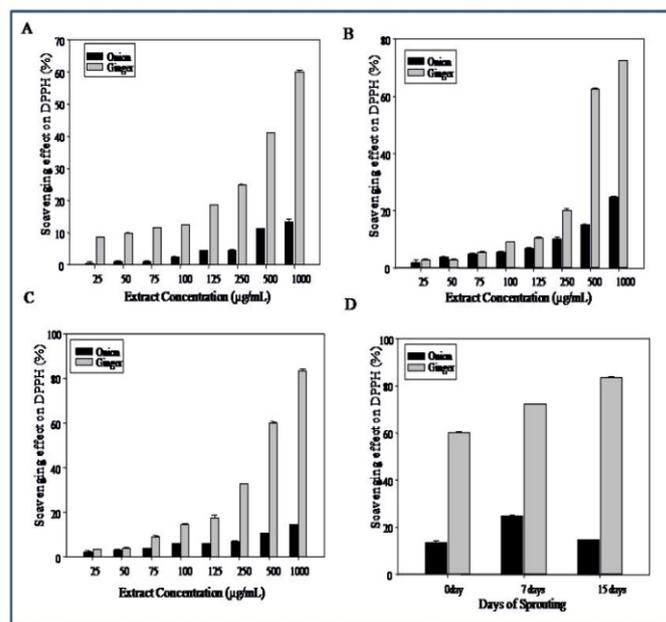
### RESULTS

DPPH Radical Scavenging Activity of Sprouted Onion and ginger The antioxidant activities of onion, ginger and sprouted onion and ginger are shown in Figure 1 as the percentage of DPPH radical scavenging activity. The DPPH radical scavenging activity of sprouted onion as well as ginger was found to be higher than that of unsprouted onion and ginger (Figure 1). Of the extracts from samples sprouted 0, 7 and 15 days, the ethanol extract from onion sprouted for 7 days showed the highest DPPH radical scavenging activity (Figure 1B) whereas ginger extracts showed highest DPPH radical scavenging activity at 15 days of sprouting.

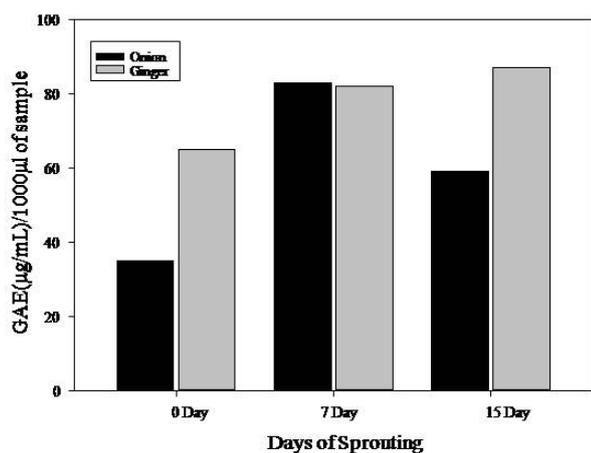
### Total Phenolic Content

The total phenolic content in onion as well as ginger increased during sprouting as shown in Figure 2. This increase was evident all along the sprouting period i.e. from 0 to 15 days. Onion showed the maximum phenolic content at 7 day whereas ginger exhibited maximum phenolic content at 15 day of sprouting.

**Figure 1 A: Free radical-scavenging activity of onion and ginger at 0 day; B: 7 day; C: 15 day respectively; D: Free radical-scavenging activity of onion and ginger at 0, 7 and 15 day at 1000µg/ml extract concentration. Data are expressed as the mean ± standard error (SE) of three independent experiments**



**Figure 2: Total phenol content (Gallic acid equivalent (GAE) ( $\mu\text{g/mL}$ )/1000 $\mu\text{l}$  of sample) of onion and ginger solvent extracts at day 0, 7 and 15 days of sprouting.**



## DISCUSSION

There is an increasing consumption of fruits and vegetables with a belief in potential health benefits, increasing availability, higher quality, and lifestyle changes [15, 16]. Allium crops are among the most widely consumed vegetables on a global basis and onion (*Allium cepa*) has long been used for medicinal purposes, owing to its anti-inflammatory and antimicrobial properties. Rhizomes of ginger plants (family Zingiberaceae) have been widely used as spices or condiments [17]. Rhizomes are eaten raw or cooked as vegetables and used for flavouring food. It has been used extensively for headaches, nausea and colds. It has also been suggested for the treatment of various other conditions, including atherosclerosis, migraine headaches, rheumatoid arthritis, high cholesterol, ulcers, depression and impotence [18]. Several studies [19, 20, 21, 22] reported that phenolic compounds in spices and herbs significantly contributed to their antioxidant properties. Plant polyphenols act as reducing agents, hydrogen-donating antioxidants, and singlet oxygen quenchers. In onion extracts it was observed that the amount of total phenolic content was in accordance to the observed antioxidant activity i.e. the total phenol content increased on sprouting till day 7 and then decreased; the antioxidant activity also increased at day 7 and then decreased at day 15 [Figure 1 and Figure 2]. Ginger extracts showed a different pattern – it was observed that the antioxidant activity as well as total phenol content increase at day 7 and further increased at day 15 of sprouting [Figure 1 and Figure 2]. Thus positive correlation was observed between total phenolic content and DPPH assay of onion and ginger extracts and the effect of sprouting which was highly significant ( $p < 0.01$ ). We also observed that the total phenol content of ginger is higher than onion and also the overall antioxidant activity of ginger was higher than onion which further increased on sprouting. However, further studies are required to define the antioxidative potential of the compounds that increased in sprouted onion and ginger and to characterize the components responsible for the antioxidative activities.

## CONCLUSION

This study indicates an increase in the in vitro antioxidant potential of solvent extracts of both onion and ginger on sprouting with results comparable to those of the standard compounds such as ascorbic acid. Ginger had higher phenol content and free radical scavenging activity as compared to onion and can therefore be proposed as new potential sources of natural additives for the food and/or pharmaceutical industries. In conclusion, sprouting could be a useful way to increase the antioxidative potential of both onion and ginger thereby expanding its use.

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