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International Journal of Current Research
Vol. 7, Issue, 02, pp.12300-12303, February, 2015

INTERNATIONAL JOURNAL OF CURRENT RESEARCH

ISSN: 0975-833X

RESEARCH ARTICLE

INCULCATION OF RESPONSIBLE ENVIRONMENTAL BEHAVIOUR (REB) AMONG B.Ed. STUDENTS THROUGH CHEMISTRY

***Dr. Nimmi Maria Oommen and Abraham, K. J.**

Assistant Professor of Education, Titus II Teachers College, Tiruvalla, Kerala, India

ARTICLE INFO

Article History:
Received 17th November, 2014
Received in revised form
09th December, 2014
Accepted 05th January, 2015
Published online 26th February, 2015

Key words:

Banana,
Responsible Environmental Behaviour,
Education.

ABSTRACT

Our environment is blessed with plants and vegetables which form part of our food. Amongst the different fruits which play a vital role as dietary food, Banana has an important role. The fruit, which is grown in the most of the world's tropical areas, is harvested while still green. When stored at room temperature, most bananas ripen in a few days. The consumption of fruits are thought to be associated with a reduced risk of many diseases including cancer, atherosclerosis and neurodegenerative diseases, which are related to elevated levels of oxidative stress. Banana is one such fruit yielding tropical plant that may protect itself from the oxidative stress caused by strong sunshine and high temperature by producing large amounts of antioxidants. Through the process of education there should be ample opportunities to identify and understand the natural and common fruits which shall be the integral part of our food. This study is conducted among B.Ed. students to create a responsible environmental behaviour in this area to educate the society.

INTRODUCTION

Healthful, filling and tasty bananas are one of nature's ideal snacks. The fruit, which is grown in the most of the world's tropical areas, is harvested while still green. When stored at room temperature, most bananas ripen in a few days. The consumption of fruits are thought to be associated with a reduced risk of many diseases including cancer, atherosclerosis and neurodegenerative diseases, which are related to elevated levels of oxidative stress. Banana is one such fruit yielding tropical plant that may protect itself from the oxidative stress caused by strong sunshine and high temperature by producing large amounts of antioxidants.

Photochemical

There are many phytochemicals or secondary metabolites and each works differently. The phytochemicals may be defined as plant substances which are derived biosynthetically from primary metabolic compounds like carbohydrates, fats and amino acids. The plant produces numerous secondary metabolites such as alkaloids, terpenoids, phenols, resins, tannins, several of phytohormones, purines and pyrimidine bases, porphyrins and different coenzymes.

Antioxidants

Most phytochemicals have antioxidant activity and protect our cells against oxidative damage and reduce development of certain types of cancer. Anti-oxidant may also defined as a nutrient or a chemical react with and neutralizes free radicals. Antioxidants are also called free radical scavengers. By intercepting the free radicals, antioxidants prevent them from damaging molecular structures such as DNA. Any element that has an unpaired electron in its outermost shell is considered to possess a free radical. The free radicals are often referred to as Reactive Oxygen Species (ROS) because the most biological significant free radical is oxygen centered.

Musa Paradisiaca (Banana)

Banana is a tropical plant. It is usually cultivated for its carbohydrate content and can be consumed as an unripe fruit or when ripe. The unripe fruit contains more starch and less sugar as compared to the ripe fruits: its edible portion, which easily digestible, is about 7%. Banana contains eleven vitamins, like vitamins A, B, and C. Although fat and protein contents are very low, bananas are rich in some minerals, notably phosphorus which is essential for bone development, and calcium. Calorific value is 1 calorie per gram.

I. Photochemical Analysis

a) Quali Tative Analysis

1. TEST FOR PHENOL
Color with Ferric chloride
2. TEST FOR TANNINS
Reaction with 2% Gelatin

Corresponding author: Dr. Nimmi Maria Oommen,
Assistant professor of Titus II Teachers College, Tiruvalla, Kerala, India.

3. TEST FOR ALKALOIDS
Mayer's Test
4. TEST FOR SAPONINS
Foam Test
5. TEST FOR FLAVANOIDS
Color with Ferric chloride
6. TEST FOR CARBOHYDRATES
Fehling's Test
7. TEST FOR AMINO ACIDS
Ninhydrin Reaction

b) Quantitative analysis

1. Determination of total phenolic contents (tpc)
2. Determination of total flavonoids content (tfc)
3. Estimation of total carbohydrates - anthrone method
4. Analysis of tannin

II. Anti-oxidant activity analysis

1. Reducing power
2. Free radical scavenging activity (dpph)

III. Proximate analysis

a) Moisture Analysis
b) Ash content Analysis
c) Crude Protein Analysis - Kjeldahl Method
d) Crude fiber Analysis
d) Crude Fat Analysis - Soxhlet Method

IV. Mineral analysis

RESULTS

Qualitative test

Phytochemicals are important constituents of plants which have several properties. Some of their possible actions are antioxidant, hormonal action, stimulation of enzymes, antibacterial effect etc. So it is important to screen the phytoconstituents of fruits like banana which is consumed from infancy to old age. From the phytochemical analysis it was found that the major constituents were phenol, tannins, alkaloids, saponins, carbohydrates, amino acid and flavanoids.

Quantitative test

Polyphenol content (T P C)

Phenolic compounds are important fruit constituents because they exhibit antioxidant activity by inactivating lipid free radicals or preventing decomposition of hydroperoxides into free. The TPC ranged widely from 75.01 to 685.57 mg GAE/100 g of dry matter. It is evident that the amount of phenols in methanolic extract of ripe banana is 218.36 mg and in unripe banana is 362.41 mg in 100g. The TPC was generally higher in the unripe than the ripe banana.

Flavanoid Content (T F C)

The TFC was higher in unripe banana 223.83 mg compared to ripe banana195.72 mg. The variation in TPC and TFC among different plant materials might be attributed to factors such as natural chemical composition, maturity at harvest, soil state and conditions of post-harvest storage. The unripe banana had higher TFC than those obtained from the ripe banana.

Carbohydrate

Carbohydrate fills numerous roles in living things such as storage and transport of energy and structural components. Additionally, carbohydrates and their derivatives play major role in the working process of immune system, fertilization, pathogenesis, blood clotting and development. It is inferred that the methanol extract of ripe banana is 45.372 and in Unripe banana is 58.235 mg in 100g.

Tannins

Are polyphenols which are important in attributing antioxidant properties in banana. From the table it is evident that the amount of tannins in the methanolic extract of ripe banana is 8.839 and in Unripe banana is 12.26 mg in 100g.As bananas ripen the tannin content decreases and becomes part of the pulp.

Antioxidant activity

DPPH radical scavenging activity

Free radicals are able to induce lipid peroxidation. In order to evaluate the antioxidant potency through free radical scavenging by test samples the change optical density of DPPH radicals was monitored. Therefore DPPH scavenging activity of each sample was reported as the percentage of DPPH inhibition, with a higher value is associated to a stronger antioxidant activity. All extracts showed free radical scavenging properties in different levels. The inhibition of DPPH radical of the banana flour ranged from 26.55 to 52.66 %. The DPPH free radical scavenging ability of the methanolic extract of the ripe and unripe banana presented in graph revealed that concentration increases the radical scavenging ability also increases. Unripe banana shows more radical scavenging ability than ripe banana. Typically for plant materials, DPPH inhibition would follow a similar order of the TPC and TFC, i.e. as the concentration of phenolic compounds or degree of hydroxylation of the phenolic compounds increases, the DPPH radical scavenging activity also increases. These results imply that antioxidative compounds other than phenolics and flavonoids were also involved in inhibiting the DPPH radicals. Compounds such as ascorbic acid, β-carotene, α-carotene and different xanthophylls have been detected in banana and may have contributed to the antioxidant activity of the extracts.

Reducing power activity

For the measurement of reductive ability the Fe^{3+} – Fe^{2+} transformation in the presence of the samples of Ripe and Unripe banana were investigated. The absorbance of the solution increased with an increase in the concentration of the sample. The result shows that the methanolic extract of Ripe and Unripe banana has a moderate reducing power activity.

The reducing capacity of the compound may serve as a significant indicator of its potential antioxidant capacity. However the antioxidant activity of putative antioxidants have been attributed to various mechanisms among which are prevention of chain initiation, binding of transition metal ion catalysts , decomposition of peroxides, prevention of continued hydrogen abstraction and radical scavenging activity.

Proximate Analysis

Constituents	% composition Ripe banana	% composition Unripe banana
Moisture content	72.85 %	48.69 %
Total Ash	0.566 %	0.853 %
Crude Protein	0.0931	0.0918
Crude Fiber	1.564 %	3.527 %
Total Fat	0.143 %	0.219 %

The results of the chemical analysis indicate that the chemical composition for banana vary in proportion to their maturity. Hence unripe banana flour can be used as composite flour in baking industry and can be better stored because of its low moisture contents compared to that ripe banana flour which had high moisture contents thereby limiting its usage in food industry.

Mineral analysis

Mineral composition of Ripe and Unripe banana on dry weight basis
Selected mineral analysis of freshly harvested raw plantain in mg/100g

Samples	Na	K	P	Ca	Fe	Mg	Zn
Ripe banana	0.86	8.76	59.43	5.38	1.05	10.20	6.23
Unripe banana	1.24	7.41	35.61	4.57	1.21	5.05	3.75

Responsible Environmental Behaviour (REB)

Van Liere and Dunlap (1981) presented REB as an expression or dimension of environmental concern which consisted of "activities that have been suggested as ways people can help solve environmental problems" (p. 662). Maloney and Ward (1973) defined REB in terms of what commitments people do make. These and other writers (e.g., Lipsey, 1977; Cook and Berrenberg, 1981) have suggested that REB should encompass the range of observable behavior "aimed at" or "intended to" contribute to the solution of environmental problems. Sia (1985) and Hines (1985) suggest that REB is equivalent to other terms which appear in the literature, such as pro-ecological behaviour, pro-environmental behavior, environmental action and environmental problem-solving. Researchers have developed an array of theoretical frameworks to explain the factors and connections underlying environmental behaviour change mostly focusing on the individual (**Kurtycz, 2005; Kollmuss and Agyeman, 2002**). The first approaches focused on raising environmental awareness to modify behaviour, and linking knowledge to attitudes and attitudes to behaviour, proved incomplete in practice (**Clover, 2002; McKenzie-Mohr and Smith, 1999**). Most cases of environmental behaviour can be, based on the knowledge of environmental science, judged according to their impact on the environment, and labeled as environment friendly or unfriendly. Responsible environmental behaviour is such behaviour which is generally judged in the context of the considered society as a protective way of environmental behaviour or a tribute to the healthy environment (**Kaiser *et al*., 1999**).

In this study, responsible environmental behaviour means approaching life, through a disciplined eco-friendly life style, not only for the good of our generation but also for the upcoming generations. Thus, could sustain the world as a living heaven to all creations

Educational implications

Responsible Environmental Behaviour (REB) is an essential need to protect our life today and tomorrow. This study investigates whether research method of teaching could inculcate REB among B.Ed. students. Here the study is conducted on Ripe and Unripe bananas to determine its phytochemical components. In this study we found that both Ripe and Unripe banana have nutritional significance, antioxidental activity and reducing property. This type of experimental study helps to create awareness among students about the nutritional value of fruits which are grown in our courtyard. Also students could develop REB through environmental education. This kind of research method of teaching could motivate them to create a healthy predicament towards the natural products. From this, responsible environmental behaviour to approaching life, through a disciplined eco-friendly life style, creates positive outlook not only for our generation but also for the upcoming generations. Thus, could sustain the world as a living heaven to all creations.

Conclusion

Food is the source of all of the components that make up the human body. Banana is included in human diet from infancy onwards because it is bland, easy to digest, and unlikely to produce allergies, they are an ideal early food for babies. In this work, phytochemical comparison on methanolic extract of ripe and unripe banana, the qualitative estimation showed the presence of phytochemical constituents like phenol, alkaloids, tannins, flavanoids, saponins, carbohydrate and amino acids. Quantitative estimation gave good percentage of various phytochemicals like phenols, carbohydrates and tannins. These phytochemical compounds are non-nutritive plant chemicals that have protective or disease preventive values. From the study it is clear that the methanolic extract of ripe and unripe banana have potent antioxidant activity. The advantages of unripe or green banana flour include the content of high resistant starch and dietary fiber that may confer beneficial benefits to human health. The advantages of banana flour prepared from ripe banana include high sugar content that is suitable for incorporation into food products requiring solubility, sweetness and high energy content. As more banana flour products are introduced into the market there will be a need to authenticate the varieties of banana used for the preparation of the flour.

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