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TOTAL PHENOLICS AND ANTIOXIDANT PROPERTY OF WATER EXTRACT OF FESTUCA

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ABSTRACT

The grasses- Poaceae (Gramineae), grass family of monocotyledonous flowering plants is the most important group of useful plants. Some of the grass species have been proved to show therapeutic effect and have been effective in treatment of inflammation and sclerosis as they contain bioactive components called antioxidants which delay or prevent the oxidation of cellular substrates. These antioxidants exert their effect by scavenging reactive oxygen species (ROS) or preventing their generation. ROS are usually generated in physiological processes to produce energy and metabolites or to generate defenses against invasive microorganisms but can also cause oxidative damage associated with many degenerative diseases such as cardiovascular disease, cancer and neurodegenerative diseases such as Parkinson's and Alzheimer's diseases. Polyphenols like flavonoids and phenolic acids are one of the most important natural antioxidants present in this grass family. Examples of flavonoids are glycosides of apigenin, luteolin and tricin and examples of phenolic acids are ferulic acid, caffeic acid and p-hydroxybenzoic acid. These compounds show a wide spectrum of chemical and biological activities including radical scavenging activity. This paper will discuss the total content of phenolic compounds present in the sample of Festuca grass, species of Poaceae family by Folin-Ciocalteu method. The paper will also highlight the total flavonoid content with the help of aluminium chloride colorimetric method. The results indicated that Festuca grass is a good natural source of antioxidant compounds for use in food and pharmaceutical industry.

Keywords: antioxidants, reactive oxygen species, oxidative damage, degenerative diseases, Polyphenols

INTRODUCTION

Natural antioxidants, particularly in fruits and vegetables have gained increasing interest among consumers and the scientific community because epidemiological studies have indicated that frequent consumption of natural antioxidants is associated with a lower risk of cardiovascular disease and cancer. The defensive effects of natural antioxidants in fruits and vegetables are related to three major groups: vitamins, phenolics, and carotenoids [1]. Ascorbic acid and phenolics are known as hydrophilic antioxidants, while carotenoids are known as lipophilic antioxidants [2].

Recent studies on cultured mammalian cells and animals indicate that polyphenolic compounds from numerous fruits and vegetables exert several health-promoting functions, including reducing the risks of cancer and heart

and neurodegenerative diseases [3]. Besides that, epidemiological studies also show positive associations between intake of fruits and vegetables and reduced mortality rate from heart diseases, common cancers, and other degenerative diseases.

The free-radical scavenging capability and consequent antioxidant properties of the phenolics play an important role in protecting the cells and tissues from oxidative stress and other biological effects associated with these chronic diseases. DNA is continuously attacked by reactive species that can affect its structure and function severely. Structural modifications to DNA mainly arise from modifications in its bases that primarily occur due to their exposure to different reactive species. Apart from this, DNA strand break, inter- and intra-strand crosslinks and DNA–protein crosslinks can also affect the structure of DNA significantly. These structural modifications are involved in mutation, cancer and many other diseases. As it has the least oxidation potential among all the DNA bases, guanine is frequently attacked by reactive species, producing a plethora of lethal lesions. DNA damage by reactive species has created profound interest in the medicinal fraternity because of the involvement of reactive species in different pathological conditions such as cancer, aging, neurodegenerative diseases, rheumatoid arthritis, etc. Reactive species such as free radicals, one-electron oxidants, different chemicals, etc., can react with different components of DNA to produce a plethora of DNA lesions. These reactive species can modify bases, induce inter and intra strand crosslinks, promote DNA– protein crosslinks and create strand break [4].

The contents of phenolic compounds and their antioxidant activity in selected grass species have been poorly investigated. Therefore, testing their antiradical properties is of interest, primarily in order to find new sources of natural antioxidants [5].

MATERIAL AND METHODS

Sample preparations:

40gm sample grass was weighed and mascinerated, boiled in distilled water at 60 degree Celsius for half an hour, the residue was filtered and mixed with 400 ml of distilled water.

Determination of total phenolic content:

The determination of TPC of the grass extract was performed by using Folin-Ciocalteu reagent [6]. Briefly, 1ml of extract was prepared with 1.8 ml of Folin-Ciocalteu reagent (10 fold diluted) and kept for 5 min at 25 degree Celsius. Later 1.2 ml of 15% Sodium Carbonate was added to the reaction mixture and kept for 90 min at RT and the absorbance was measured at 765nm. The concentration of the TPC was determined as mg of gallic acid equivalents (GAE) per gm FW.

Determination of total flavonoid content:

TFC of grass extract was determined by using the aluminium chloride colorimetric method [7]. Briefly, 0.5 ml of the extract, 1.5 ml of methanol, 0.1 ml of 10% aluminium chloride, 0.1 ml of 1 M potassium acetate and 2.8 ml of distilled water were mixed for 5 min by vortexing. Reaction mixture was kept at RT for 30 min and the absorbance was measured at 415 nm. The results were expressed as mg of rutin equivalents (RE) per gm FW.

Determination of reducing power:

The reducing power assay can be determined by the method Athukorala et al (2006) [8]. 1 ml sample of different concentration were taken. 1ml 0.2M sodium phosphate buffer pH 6.6 was added to each sample. 1ml of 1% potassium ferricyanide was added and incubated at 50^0C for 20 mins. 1ml of 10% TCA (W/V) was added and then the samples were centrifuged at 2000 rpm for 10 mins, 2.5ml of upper layer was taken and mixed with 2.5 ml DW. 0.5 ml of 0.1% fresh ferric chloride was added and then the readings for their optical density were taken at 700 nm.

RESULTS AND DISCUSSION

Total phenolic content:

The variation of the total phenolic content over time for various concentrations of WEF sample is presented in Table 1. TPC of the extract was expressed as mg GAE/g FW. Phenolic content GAE is increasing with increasing concentration of WEF sample concentration.

Table 1: Total phenolic content of WEF

S. No.	Sample conc. (gm/ml)	Phenolic content GAE (gm/gm)
1	0.10	2.40
2	0.08	1.80
3	0.06	1.50
4	0.04	0.85

Total flavonoid content:

The variation of flavonoid content over time for various concentration of WEF sample is shown in table 2. TPC of the extract was expressed as mg RE/g FW. The TFC in different concentrations of the grass sample varied considerably, and occurr maximum at 0.1 gm/ml concentration of WEF sample. Flavonid content RE is increasing with increasing concentration of WEF sample concentration.

Table 2: Total flavonoid content of WEF

S. No.	Sample conc. (gm/ml)	Flavonoid content RE (gm/gm)
1	0.05	12.0
2	0.04	10.1
3	0.03	6.6
4	0.02	2.8

Reducing power assay:

The variation in reducing activity for various concentrations of WEF samples is shown in table 3. Reducing activity increases with increasing concentration of WEF sample.

Table 3: Reducing activity of WEF

S. N.	Sample conc.	Reducing activity
1	0.1	0.377 $\pm$ 0.012
2	0.08	0.176 $\pm$ 0.123
3	0.06	0.145 $\pm$ 0.068
4	0.04	0.139 $\pm$ 0.034

CONCLUSION

WEF showed high polyphenolic and flavonoid content as well as strong antioxidant potential. The grass extract contains lower amount of phenolics as compared to the flavonoids. The raw material i.e. Festuca being inexpensive and easily available should be regarded as potential nutraceutical resource, capable of offering significant nutritional dietary supplements. Also the natural antibiotics in the form of phenols and flavonoids can be easily extracted and thus it offers opportunities to formulate value added products in nutraceutical and food applications to enhance health benefits.

REFERENCE

1. Mustakim M F B, Soxhlet Extraction of Ascorbic Acid from Guava, Faculty of Chemical & Natural Resources Engineering, Universiti Malaysia Pahang, 2009
2. Promminta A, Chaisawadi S, Maha T , Deerasamee O, Phytochemical Screening for Antioxidant Capacity of Mangosteen Rind Extracts with different Solvents, 38th Congress on Science and Technology of Thailand, 2012, 1-5
3. Abdullah, LBT, Antioxidant Activity of the Peels of Guava, Papaya and Pineapple, Faculty of Applied Sciences, Universiti Teknologi Mara, 2009
4. Jena Nr, DNA Damage by Reactive Species: Mechanisms, Mutation and Repair, J Biosci., 2012, 37(3), 503-17
5. Maciej Balcerek, Izabela Rąk, Gabriela Majtkowska, Włodzimierz Majtkowski, Antioxidant activity and total phenolic compounds in extracts of selected grasses (Poaceae), 2009, 559(3), 214-221.
6. Sun, T., Powers, J. R., & Tang, J. Evaluation of the antioxidant activity of asparagus, broccoli and their juices. Food Chemistry, 2007,105(1), 101–106.
7. Chang C, Yang M, Wen H, Chern J, Estimation of total flavonoid content in prepolis by two complementary methods, J Food Drug Anal, 2002, 10, 178-182
8. Athukorala, Y., Jeon Y. and Kim, K. Antiproliferative and antioxidant properties of an enzymatic hydrolysate from brown alga, Ecklonia cava. Food Chemical Toxicology, 2006, 44 (7): 1065-1074.

