Antioxidant Potential of different extracts of Banana (pulp and peel)

Aisha S. Aldroujee[1], Amal A. Muftah[2] , Saima Kumar[3]

[1]Faculty of Science, Al-zintan University, Libya
[2]Faculty of Education, BaniWalid University, BaniWalid, Libya
[3]Department of Chemistry, SHUATS, Allahabad
amalmoftah@bwu.edu.ly

Submission data 14 . 07.2022 Acceptance data 24. 8 .2022 Electronic publishing data: 15.11.2022

Abstract: The study has been aimed to evaluate and compare the antioxidant activity in peel and pulp extracts of banana. The effect of variation of banana parts on the antioxidant activity showed different values. The DPPH free radical scavenging activity of banana parts (peel and pulp) were determined using different extracts (methanol, ethyl acetate and ethanol). Results represent that all extracts showed very good activity at highest concentration 800µg/ml. Among the all extracts, methanol extract of pulp exhibited highest free radical scavenging 91.27% at 800µg/ml. Maximum reducing activity of banana peel was observed at 800µg/ml and showing 0.260 in methanol. The data showed that, the entire sample increased their reducing ability when the concentration of extract increased. There was slight difference in reducing ability of all the three extracts. . The study suggests that peel and pulp extracts of banana could be useful to combat free radical mediated diseases.

KeyWords: the antioxidant activity**,** peel and pulp extracts of banana.

1. Introduction

Medicinal plants are an important source of antioxidants [1]. Natural antioxidants increase the antioxidant capacity of the plasma and reduce the risk of certain diseases such as cancer, heart diseases and stroke [2]. The secondary metabolites like phenolics and flavonoids from plants have been reported to be potent free radical scavengers. Medicinal plants appear to have these desired comparative advantages, hence the growing interest in natural antioxidants from plants [3].

Antioxidants are considered a promising therapeutic approach as they may be playing neuroprotective (preventingapoptosis) and neurodegenerative roles. The maincharacteristic of an antioxidant is its ability to trap free radicals [4]. Free radicals toward endogenous molecules (DNA, proteins, and lipids) have a beneficial role (antimicrobial activity) but are implied especially in the pathology physiology of numerous affections: atherosclerosis, heart failure, liver injury and a plethora of other diseases. Under normal conditions, the body is equipped with defense mechanisms that scavenge reactive oxygen species (ROS) and protect the cell from oxidative

damage. The damage is made to proteins, lipids and nucleic acids signaling cascades leading to disruption of ion homeostasis and modification of the genetic apparatus, with the consequence of apoptotic cell death. The relation between free radicals and disease can be explained by the concept of 'oxidative stresses. In a normal healthy human body, the generation of pro-oxidants in the form of ROS and reactive nitrogen speciesare effectively kept in check by the various levels of antioxidant defense [5].

Mammalian cells possess elaborate defense mechanisms for radical detoxification. Antioxidants are agents, which scavenge the free radicals and prevent the damage caused by them. In spite of these in-built defense mechanisms, it seems more meaningful to utilize extra antioxidants available in diets, especially from fruits, vegetables and whole grains. Due to their minimal side effects, there are growing in using natural products for preventive and therapeutic medicine [6].

In addition to these uses of natural antioxidants in medicine, these compounds have many industrial uses, such as preservatives in food and cosmetics and preventing the degradation of rubber and gasoline. For many years chemists have known that free radicals cause oxidation which can be controlled or prevented by a range of antioxidant substances [7].

Some antioxidants are produced in the body, while others must be sequestered from the diet or through supplementation. Fruits, and cruciferous vegetables are rich sources of antioxidants. There are several naturally occurring and synthetic antioxidants known. These antioxidants belong to different classes of compounds, such as carotenoids, polyphenolics, polyamines, gallic acid derivatives, tannins and catechins. Examples include phytic acid, lipoic acid, bilirubin, melatonin, quercetin, carnosol, carnosic acid, hydroxytyrosol, rutin, butylatedhydroxyanisole, and butylatedhydroxytoluene. Vitamins E and C are among the most effective antioxidants with preventive effects against heart disease and cancers. The main drawback of using synthetic antioxidants is their potential of causing health hazards. Thus, safer and natural alternatives of antioxidative compounds are desirable [8,9,10].

Banana is one of the most popular fruits and several studies have indicated that both banana pulp and peel contain antibacterial and antioxidant principles [12,13]**.** Considering the nutritional aspects, it is one of the world's leading food crops with a great source of minerals, vitamins, carbohydrates, flavonoids, phenolic compounds, etc. It is both economical and easily accessible to people from all sections of society, thus addressing food insecurity problems in many countries. It can be consumed both as cooked and uncooked form. As oxidative damage of lipids, proteins, and nucleic acids is implicated in the pathology of many chronic diseases, a great interest was developed by many research groups in exploring the major phytochemicals with antioxidant properties in banana [14]. Other studies focused their studies onestimation of total phenolic compounds and antioxidant activity in various fruits using different methods [15-17].

The present study has been aimed to evaluate and compare the antioxidant activities in the peel and pulp extracts of bananas to assess their protective role against free radical-induced cell damage

2. Material and Methods

The banana fruit were collected from Rambagh market of Allahabad. Bananas were washed, separated into pulps and peels and sliced into a thickness of 2 mm. sliced bananas were dried separately under shade for several days. After several days of air drying at about 35°C, the sample was oven dried at 45°C to constant weight. Dried samples were then powdered using a laboratory scale mill and blender. Ground material (20g) was extracted independently with 200 ml of methanol, ethyl acetate and ethanol at room temperature. Extraction was carried out for 24 hours. The resulting extracts were filtered using filter paper (Whatman No. 1) and the solvents in the extracts were removed under reduced pressure at 40°C using rotary evaporator or kept in water bath. The standard extracts were obtained and sealed with aluminum foils and stored in the refrigerator at 4°C until use [18].

3. Antioxidant activities assay

3.1 DPPH free radical scavenging assay

Different dilutions of the extract (200, 400,600 and 800 µg/ml) were prepared. 1 ml of extract from each dilution was added into the test tube containing 2 ml of DPPH solution [19]. The absorbance of DPPH diluted in methanol was considered as a control which was prepared by adding 1 ml of methanol to 2 ml of DPPH solution and ascorbic acid was used as standard. The mixture was shaken vigorously and left to stand in the dark for 30 min. The absorbance of the resulting solution was measured spectrophotometrically at 517nm. The scavenging activity of each extract on DPPH radicals was calculated using the following formula.

% Scavenging activity = [Absorbance of control - Absorbance of sample/ Absorbance] x 100

The results were expressed as shown in Fig.1 and Fig.2 .

3.2 Reducing power assay

Phosphate buffer (0.2M, pH 6.6), Potassium ferric cyanide (1%), Tri chloro acetic acid (10%) and Ferric chloride (0.1%) were used in this experiment [20]. The reducing power of the test sample was determined by taking different concentrations of methanol, ethyl acetate and ethanol extractions (200, 400, 600 and 800 µg/ml) in 1ml methanol, then mixed with 2.5ml of phosphate buffer and 2.5ml of potassium ferric cyanide in test tubes. The mixtures were incubated for 20 min. at 50°C. At the end of the incubation 2.5ml of tri-chloroacetic acid was added to the mixtures followed by centrifugation at 500 rpm for 10 min. The upper layers (2.5ml) were mixed in 2.5ml of distilled water and 0.5ml of ferric chloride and the absorbance was

measured at 700nm. The reducing power tests were run in triplicates. An increase in absorbance of the reaction mixture indicated the reducing power of samples.

4. Result and Discussion

Antioxidant activity of banana pulp and peel flour

DPPH is a stable organic nitrogen radical and free radical compound with a purple color which changes into a stable yellow compound in reacting with an antioxidant. In brief, the reduction capacity of DPPH was determined by the decrease in its absorbance at 517 nm, which is reduced by the antioxidant [21]**.** The DPPH free radical scavenging activity of two parts of banana plant peel and pulp was determined at different concentrations of 200, 400, 600 and 800µg/ml.

The DPPH free radical scavenging activity of banana plant peel was determined for different extracts methanol, ethyl acetate and ethanol. Ascorbic acid was taken as standard. The obtained results have been showing that all extracts had the highest activity at the highest concentration. Among the extracts, ethanol extract showed the highest activity (90.00%), while methanol showed 89.29% and ethyl acetate showed 72.48 %. The standard ascorbic acid showed 94.61 %. Thus, it was clear that all the extracts showed lower activity than ascorbic acid.

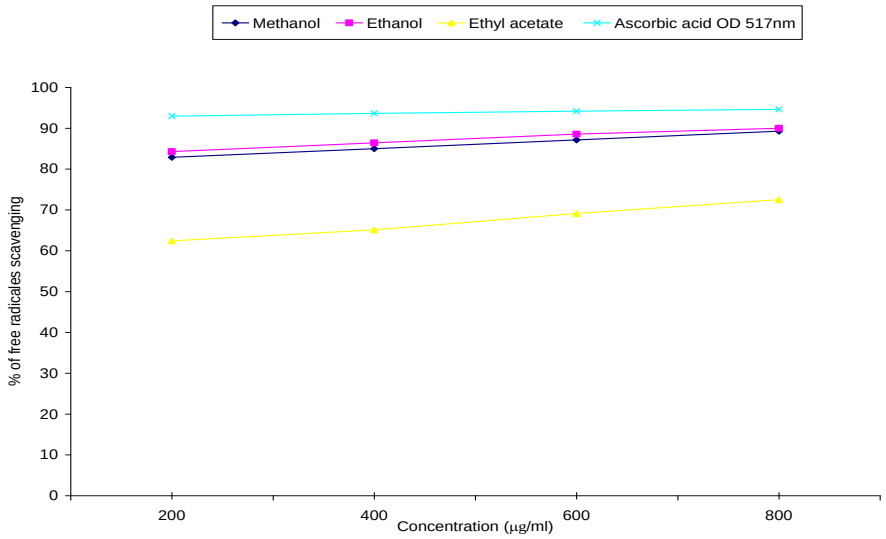

Fig. 1 DPPH free radical scavenging activity of peel extracts of banana

From the figure 2, it was observed that all the three extracts of pulp possess antioxidant activity .Methanol extract exhibited the highest free radical scavenging 91.27% than ethanolic 85.77% and ethyl acetate 69.98% extracts at 800µg/ml. Ascorbic acid is well known potent antioxidant, it was observed that the three extracts had reported lower antioxidant activity compared to the ascorbic acid (94.61%).

Reducing power

The reducing power of methanolic, ethanolic and ethyl acetate extracts of banana was determined and showed as the concentration of extracts increases (200,400,600,800µg/ml) the absorbance of sample increased gradually.

This method was based on the reduction of (Fe^{3+}) ferric cyanidein stoichiometric excess relative to the antioxidants. Fig.3 and Fig. 4 shows the reducing power of banana peel and pulp flour extracts as a function of their concentrations based on the ability to reduce ferric (Fe^{3+}) to ferrous (Fe^{2+}) ion through the donation of an electron. This assay just indicates how easily a given antioxidant donates electrons to reactive free radicals species, thus promoting the termination of free radical chain reactions. The ability of the antioxidant to reduce Fe^{3+} to its more active Fe^{2+} form might also be an indicator of its ability to act as a preoxidant in the system.

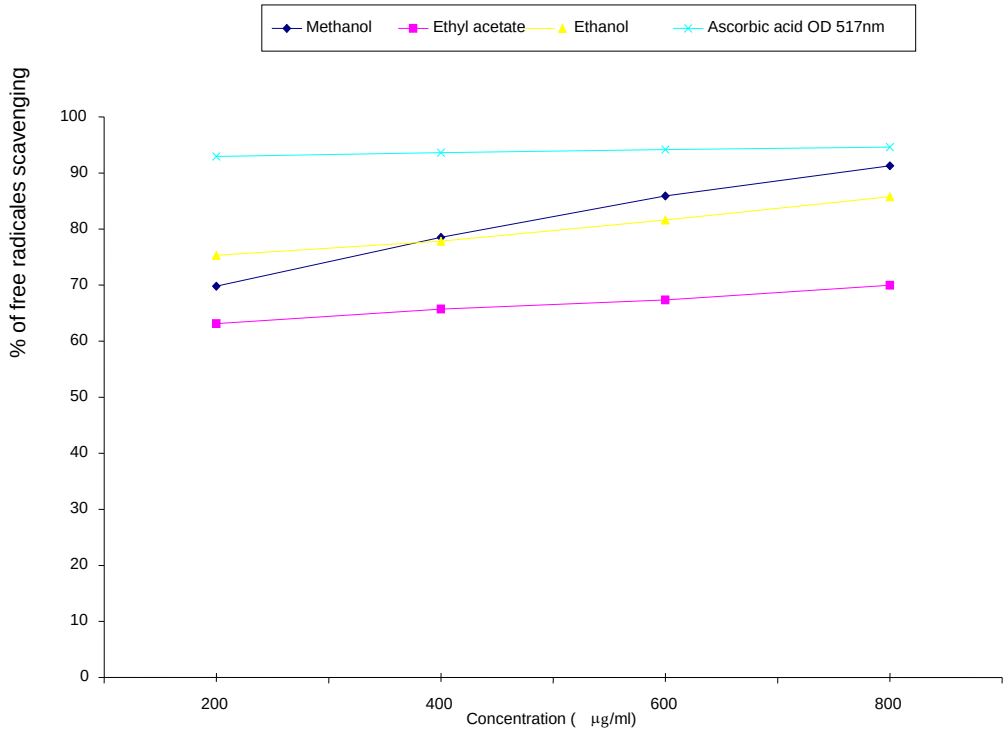

Fig. 2 DPPH free radical scavenging activity of pulp extracts of banana

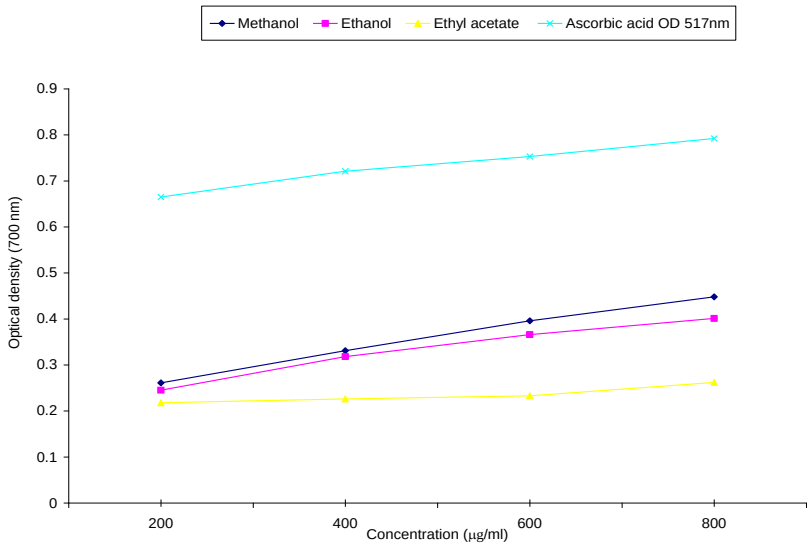

Fig 3 Reducing power activity of peel extracts of banana

Through reducing power assay antioxidant potential of the banana extracts was indirectly determined by measuring the capacity of the extract to reduce the transition metal iron (III) by electron transfer. An increase in the absorbance read at 700 nm indicates the reducing power of the extract. In this study, the peel extracts in concentrations of 200. 400. 600 and 800µg/ml were used for the assay. As the concentration increased, the absorbance also increased which gave the highest absorbance value at a concentration of 800mg/ml, which corresponds to increased reducing power. Upon comparing the absorbance value at 800µg/ml, it was seen that methanol exhibited the highest reducing power. The reducing power of the three extracts of peel was in the order methanol (0.448)>ethanol (0.401)>ethyl acetate (0.262) (Figure 3). In a previous study, a comparative analysis of the reducing power of different fruits was carried out including banana with an absorbance value of 0.08 at 20 mg/ml [22].

Maximum reducing power was observed i.e.0.195 with 200µg/ml of methanol extract of the banana pulp as compared to ethyl acetate extract 0.112 and ethanol 0.129. In the case of methanol extract of sample 400µg/ml highest reducing power was 0.205 than ethanol extract 0.134 and ethyl acetate 0.122. Maximum reducing activity of banana pulp was observed at 800µg/ml concentration was observed at 0.260 in methanol, the next higher reducing power was observed in ethanol extract, that is 0.155 and lower reducing power was showing 0.133 by ethyl acetate extract. The data showed that the entire sample increased their reducing ability when the concentration of extract increased. There was a slight difference in reducing ability of all three extracts. All sample extract showed lowest reducing power as compare to ascorbic acid **(fig. 4)**

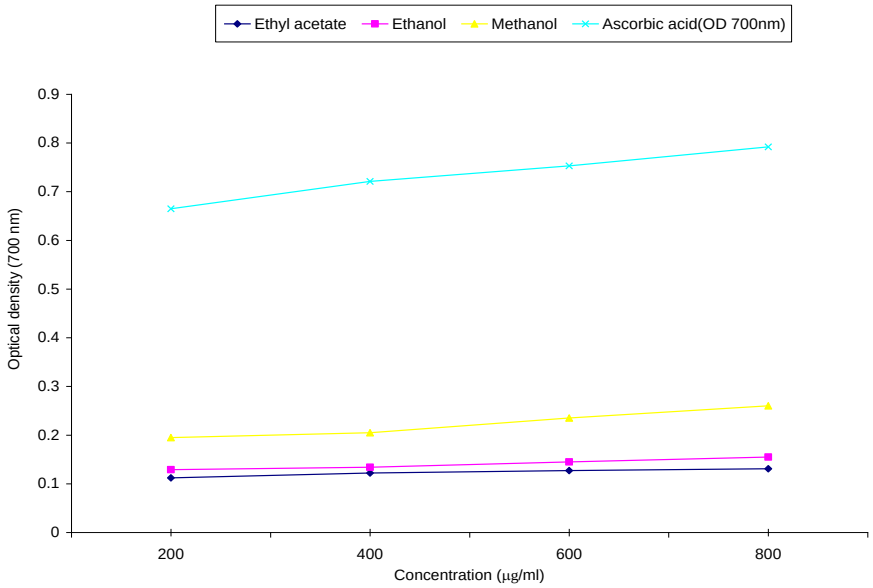

Fig.4Reducing power activity of pulp extracts of banana

Quite a number of work has demonstrated the occurrence of different types of antioxidants in both banana pulp and peel **[34],** however, the influence of the variety of bananas, stage of ripeness and parts of fruits on antioxidative compounds and antioxidant activity have not been studied. So it is clear that all extracts of banana peel and pulp are good sources of antioxidant activity.

CONCLUSION

The DPPH free radical scavenging activity of banana parts (peel and pulp) was determined for different extracts: methanol, ethyl acetate and ethanol. Ascorbic acid was taken as standard. Results represent that all extracts showed very good activity. And all extracts had highest activity at the highest concentration 800µg/ml. Among the extracts of peel; methanol showed 89.29%, ethanol 90.00% and ethyl acetate showed 72.48% and standard ascorbic acid showed 94.61% at 800µg/ml. But in pulp extracts of banana; methanol extract exhibited highest free radical scavenging 91.27% than ethanolic 85.77% and ethyl acetate 69.98% extracts at 800µg/ml.

Maximum reducing activity of banana peel was observed at 800µg/ml concentration was observed at 0.260 in methanol, the next higher reducing power was observed in ethanol extract, that is 0.155 and lower reducing power was showing 0.133 by ethyl acetate extract. The data showed that the entire sample increased their reducing ability when the concentration of extract increased. There was slight difference in reducing ability of all the three extracts. The reducing power of the three extracts of pulp were in the order methanol (0.448)> ethanol (0.401)> ethyl

acetate (0.262). All sample extract showed lowest reducing power as compare to ascorbic acid.

Banana peel extracts has shown maximum results of antioxidant when compared with antioxidant levels of banana pulp extracts.

References

1. Rice-Evans C (2004). Flavonoids and isoflavones: absorption, metabolism and bioactivity. *Free Rad. Biol. Med.* 36: 827-828
2. Prior R L, Cao G (2000). Antioxidant phytochemicals in fruits and vegetables. *Diet and health implications. Hortic. Sci.*35: 588-592.
3. Chanda S., and Dave R., (2009) In vitromodels for antioxidant activity evaluation and some medicinal plants possessing antioxidant properties.An overview African *Journal of Microbiology Research* 13: 981-996.
4. Mon M M., Maw S S., and Oo Z K., (2011) Quantitative Determination of Free Radical Scavenging Activity and Anti-tumor Activity of Some Myanmar Herbal Plants.*World Academy of Science, Engineering and Technology*, 51.
5. Devasagayam T., Tilak J., BoloorKK., Ketaki S., Saroj S., Ghaskadbi., and Lele R D.,(2004) Free Radicals and Antioxidants in Human Health Current Status and Future Prospects.*JournalGerontol*11:298-300.
6. Baskar R., Shrisakthi S., Sathyapriya B., Shyampriya R., Nithya R., and Palanisamy P., (2011)Antioxidant Potential of Peel Extracts of Banana Varieties (*Musa sapientum*)Food and Nutrition Sciences, 2: 1128-1133.
7. Darsini, D T P., Maheshu V., Vishnupriya M and Sasikumar J M., (2012).*In vitro* antioxidant activity of banana (*Musa* spp. ABB *cv*. PisangAwak). *Indian Journal of Biochemistry and Biophysics* 49: 124-129.
8. Bjelakovic G., Nikolova D., Gluud L L., Simonetti, R.G; Gluud, C., (2007). Mortality in randomized trials of antioxidant supplements for primary and secondary prevention: systematic review and meta-analysis. *JAMA*297(8): 842–857.
9. Fatemeh S R., Saifullah R., Abbas F M A., and Azhar M E., (2012)Totalphenolics, flavonoids and antioxidant activity of banana pulp and peel flours: influence of variety and stage of ripeness.*International Food Research Journal* 19:1041-1046.
10. Preethi R., Vimal V., Devanathan and Loganathan M.,(2010)Antimicrobial and Antioxidant Efficacy of Some Medicinal Plants against Food Borne Pathogens. *Advances in Biological Research*, 2:122-125.
11. Kumar K P S., Bhowmik D., Duraivel S., and Duraivei M., (2012)Traditional and Medicinal Uses of Banana. *Journal of Pharmacognosy and Phytochemistry*1(3): 51-63.
12. Mokbel M S., and Hashinaga F., (2005) Antibacterial and Antioxidant Activities of Banana (*Musa*, AAA cv. Cavendish) Fruits Peel. *American Journal of Biochemistry and Biotechnology*, 1(3):125-131.

13. Sulaiman S F, Yusoff N A M, Eldeen I M, Seow E M, Sajak A A B, Supriatno O K L (2011). Correlation between total phenolic and mineral contents with antioxidant activity of eight Malaysian bananas (Musa sp.). *J. Food Comp. Ana*., 24: 1-10.
14. Babu, M. A., Suriyakala M. A., and Gothandam K. M., (2012)Varietal Impact on Phytochemical Contents and Antioxidant Properties of *Musa acuminata*(Banana)*Journal Pharmacology Science & Research,* 10:1950-55.
15. Wall M M., (2006) Ascorbic acid, vitamin A, and mineral composition of banana (Musa sp.) and papaya (Carica papaya) cultivars grown in Hawaii. *Journal of Food Composition and Analysis* 19: 434–445.
16. Mahmood A., Ngah N., and Omar M N., (2011) Phytochemicals Constituent and Antioxidant Activities in Musa x ParadisiacaFlower.*European Journal of Scientific Research* 66:311-318.
17. Sultana B., and Anwar F., (2008) Flavonols (kaempferol, quercetin ,myricetin) contents of selected fruits, vegetables and medicinal plants. *Food Chem*. 108:879-884.
18. S.T. Chang, Yu-Tang Tung, Jyh-HorngWu,Yueh-HsiungKuo, (2007) Antioxidant activities of natural phenolic compounds from Acacia confusa bark. Bioresource Technology 98: 1120–1123.
19. Shiant T E., Abdullah A., Musa K H., Maskat M Y., and Ghani M.,(2012)Antioxidant Properties of Three Banana Cultivars(*Musa acuminata*'*Berangan'*, '*Mas'* and '*Raja'*) Extracts.*SainsMalaysiana*,3:319–324.
20. Lim Y Y., Lim T T., and Tee J J., (2007) Antioxidant properties of several tropical fruits. A comparative study. *Food Chemistry* 103:1003-1008
21. Duh P D., (1998) Antioxidant activity of Burdock (*Arctiumlappa*Linne) its scavenging effect on free-radical and active oxygen, *Journal American Oil Chemical Society* 75: 455-461.
22. Someya S., Yoshiki Y., and Okubo K., (2002). Antioxidant compounds from banana (Musa Cavendish). *Food Chemistry* 79: 351-354.