Antioxidant Chronicles of Allium CEPA the Fight Against Cancer

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***Abstract*: Onions (Allium cepa) have long been prized for their culinary qualities, but they also have a number of possible medical advantages, such as anti-cancer capabilities. These positive effects are mostly due to bioactive components contained in onions, such as flavonoids (particularly quercetin), Sulphur compounds, and other phytochemicals. Here's an outline of how onions may exert anticancer action. The dry outer onion leaves produced by industrial onion processing are currently thrown as agricultural waste, despite the fact that some researches have shown the biological advantages of onion peel. Taking into account the conventional uses of onion peel, the current Using methanol, ethanol, acetone, or ethyl acetate as the extracting solvents, the study examined the chemical and biological characteristics of four different kinds of onion peel extracts" The chemical makeup, antioxidant capacity, and antibacterial activity of the extracts were examined. The extracts' antibacterial ability was tested against a wide range of gastrointestinal pathogens using the microdilution method. The findings revealed that all four extracts have strong antibacterial power against the investigated pathogens, with the ethanol extract having the maximum antimicrobial potency.**

***Index Terms*—Anti-Oxidant, Tumor, Anti-Bacterial.**

I. INTRODUCTION

The term "cancer" refers to a collection of disorders that exhibit irregularities with normal cell cycle dynamics, rendering them incapable of controlling their proliferation. The developing tumor can attract noncancerous cells to create the so-called "tumor microenvironment" after transforming into cancerous cells. This encourages the formation of new blood vessels to meet nutritional needs and allows the tumor to spread throughout the body, resulting in metastasis. These significant traits are part of the so-called "hallmarks of cancer" and are shared by different cancer subtypes (Hanahan D, 2012) (D, 2022).The onion (Allium cepa L.) is the second most widely grown vegetable crop in the world. In 2021, it produced over 107 million tons worldwide, including shallots. Onion processing in industry produces a lot of agricultural waste, primarily dried peels, which is burned or dumped in landfills, adding to environmental stressors. Due to possible adverse effects on the environment, the growing amounts of agricultural waste made of plant debris that come out of the increase in the production of food crops worldwide are a constant source of concern (Maji S, 2020). Onions, or Allium cepa L., are a widely used food with antioxidant properties that are associated with consumption. The flavonoids are identified as the primary contributed to this positive outcome among its biologically active components. One class of secondary metabolite found in plants, flavonoids, is well recognized for its antioxidant properties (M., 2003).

II. MATERIALS AND METHODS

A. Plant Material

The trials were conducted using peels of the brown-skinned onion (Allium cepa L.) variety Elenka F1 (Cora Seeds, Cesena, Italy), a long-day, spring-summer cultivar that matures in November.

B. Extraction of Onion Peel

Acetone, ethyl acetate, methanol, and ethanol are the order of polarity of the four organic solvents that were used to extract the onion peels. The extraction process involved pulverizing dried onion peel in a blender and then covering the ground plant material with pure solvents (the ratio of solvent to plant material was 5 mL:1 g). A rotary evaporator (IKARV10, Staufen, Germany) was used to remove the extraction solvents from the containers holding the extracted materials, which were then left for seven days at room temperature in the dark. Resulting crude extracts are stored at 4 °C until they checked.

C. Total Content of Flavonoids and Phenolics

Folin–Ciocalteu technique, with certain changes, was employed to ascertain the total phenolic content of the extracts. (TFC) (Singleton VL, 1999)[Aliquots of the extract solutions (300 µL and 1500 µL) were added to the Folin–Ciocalteau reagent (1:10 ratio) prior to adding 1200 µL of sodium carbonate (7.5%) to each sample after 6 minutes in the dark. Following two hours of room temperature incubation in the dark, the absorbance at 740 nm was measured. TPC was calculated as gallic acid equivalents per g of dry weight of the extract (GA/g DW) using a gallic acid (GA) calibration curve (10–100 mg/L). Every measurement was carried out in triplicate. The Woisky and Salatino method was used to calculate TFC (total flavonoid content) (Woisky RG, 1998). The quercetin (Qu) calibration curve (10–100 mg/L) was used to determine the total flavonoid concentration, which was expressed as quercetin equivalents per g of dry weight of extract (Qu/g DW). Three duplicates of each measurement were made.

D. Scavenging Activity for DPPH

Using the stable DPPH radical as a reagentThe antioxidant activity of the onion peel extracts and two particular reference chemicals (vitamin C and butylated hydroxyanisole, BHA) was evaluated using the 2,2-diphenyl-1-picrylhydrazil (DPPH) radical scavenging method (Sigma, Burlington, MA, USA) (MS., 1959). The analysis involved adding 300 µL of the examined extracts to DPPH methanol solution (2700 µL; 0.04 mg/mL). Studied extracts were made by dissolving different quantities between 0.01 and 0.15 mg/mL of the crude extract in methanol at various doses After half an hour of standing at body temperature in dark, the absorbance of residual the DPPH radical at 517 nm quantified. Vitamin C, BHA, and the specimens were all quantified three times opposing methanol, It provided a blank.This equation was used to determine the Radical scavenging action of DPPH:

$$\textit{Scavenging}\ \text{activity}\ (\%) = (A_0 - A_1) \times 100/A_0$$

Absorbance of the samples is denoted by A1 and that of the original DPPH solution by A0.

E. Radical Scavenging Activity of ABTS

Using a modified Miller and Rice-Evans approach, the ability to scavenge radicals ABTS was assessed (Miller NJ, 1997). Make the ABTS+ (ABTS radical cation) solution, 5 mL of potassium persulfate and 19.4 mg of ABTS were combined. At 734 nm, an absorption of 0.7 ± 0.02 was obtained by adding 100–110 mL of water to 1 mL of the ABTS+ solution. after it had been stored at body temperature for 11–15 hours in dark. Reactive medium is prepared by combining 3 mL of diluted ABTS·+ solution with BHA solution or 75 µL of the extract in methanolic solution (0.1 mg/mL extract concentration). Then incubated for 30 minutes at 30 °C. Using water, the absorbance as a blank was measured at 734 nm. A calibration curve for vitamin C (Sigma, Burlington, MA, USA) ranging from 0 to 2 mg/L was utilized to ascertain the extracts' ABTS action that scavenges chemicals, which was then shown as Vitamin C/g of DW of the extract. Three duplicates of each measurement were made.

G. Analyzing Statistics

Results are given as averages ± standard deviation (SD), and all measurements are performed with three replicates. Utilizing OriginPro 8.0 (OriginLab, Northampton, MA, USA), a equation for sample concentration and scavenging operations was used to calculate the IC50 values obtained in the antioxidant experiments. Minitab®17 application was used to analyze the data using one-way analysis of variance and subsequently Tukey's HSD test ($p < 0.05$).

III. RESULTS

1. The extracts chemical composition is

To determine the main components that might contribute to the antioxidant and antibacterial activities, UHPLC-DAD-ESI analysis was utilized to look at the extracts made from onion peel.Methanol extract chromatogram is shown in Figure 1. According to number and area of peaks,extracts' corresponding chromatograms, as acquired using DAD and MS detectors, were comparable (Figures S1–S3 in the Supplementary Materials).

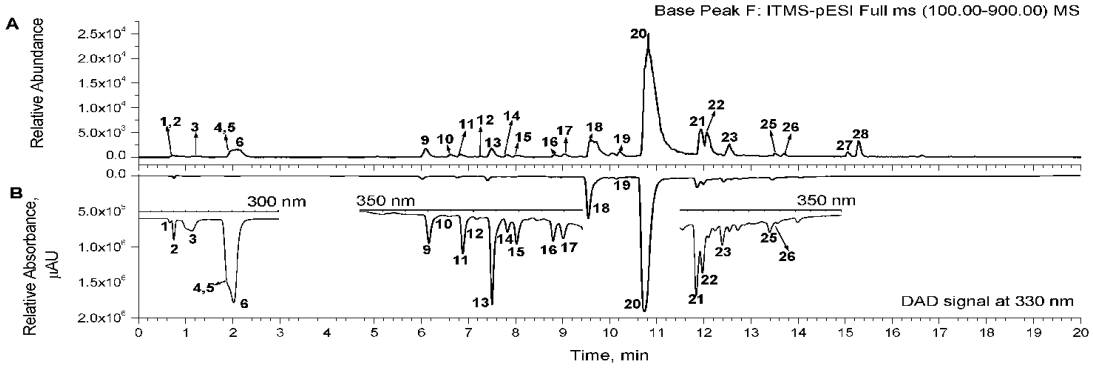

Figure 1: UPHLC Methanol Extract Chromatogram

Figure 1 shows an example UHPLC methanol extract chromatogram, which was obtained in the MS signal and ranged by the DAD-signal at 330 nm (B) and base peak (A). Furthermore, three insets (B) display magnified portions of the chromatogram at 300 nm (0–3 min), 350 nm (4.5–9.4 min), and 350 nm (11.5–15 min) for improved peak visualization.

Using reference standards, the extracts were discovered to include three aglycones: isorhamnetin, kaempferol, and quercetin. Their main molecular ions were detected at m/z 302, 284, and 316, respectively, in the mass spectrum.Mono- and diglycosides of the other flavonols are primarily hexosides (glucosides or galactosides.The found diglycosides (13 and 14) are Hexose units of isorhamnetin diexoside and quercetin, respectively. For the typical onion extracts, molecules 13 and 14 might be provisional. identified as For example, isorhamnetin-3,4′-diglucoside and quercetin-4′,7, respectively, based on The reversed-phase HPLC chromatography systems' elution order (LC-ESI-MSn., 2016).

Monoglycosides were detected in peaks 15, 16, and 18 for quercetin and peak 19 for isorhamnetin. Based on regarding the reversed-phase HPLC chromatography systems registered in the elution order several prior papers (Kramer CM, 2003). and the Quercetin hexosides (15 and 18) were identified as quercetin-7-O-glucoside and quercetin-4′-O-glucoside, respectively, based on the reference standard of quercetin-3-O-glucoside. Also, matching MS/MS spectra agreed with the existing literature (Kang J, 2016). Rhamnocitrin, 7-methyl ether, a kaempferol derivative, was identified as chemical 24 based on the MS/MS spectra.

The extracts' chromatograms (Figure 1) reveal that the two chemicals with the biggest peak areas, peak 20 of quercetin and peak 18 of quercetin hexoside, are ones that are most abundant in all extracts. Since all of the quercetin hexosides had essentially similar absorption UV-Vis and mass spectra, and only component 18, which was inferred to be glucoside quercetin-4′-O is found at greater quantities, a quercetin-3-O-glucoside equivalent was used to perform quercetin-4′-O-glucoside's related quantitative analysis.

2. Antioxidant Activity

The solvent utilized for the extraction had a substantial ($p < 0.05$) impact on the extracts' total phenol and flavonoid levels (Figure 2). The range of the total phenol content (TPC) was 25.02–60.56 mg GA/g DW.Complete phenols were lowest in ethyl acetate extract, while phenolic compounds were highest in the acetone extract. Additionally, acetone extract had highest level of total flavonoids (Figure 2), whereas the extracts of methanol, ethanol, and ethyl acetate h

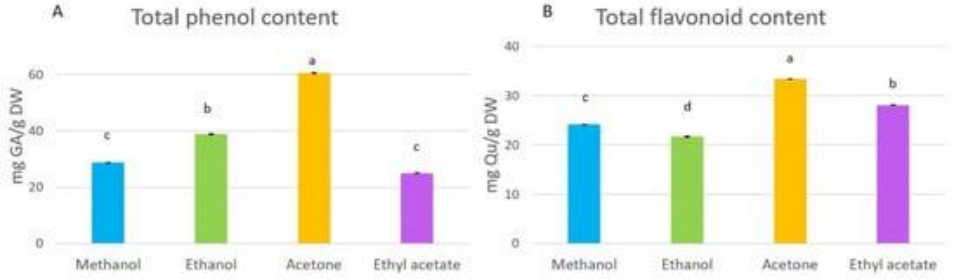

Figure 2 shows total flavonoids (B) and phenols (A) in extracts of methanol, ethanol, acetone, and ethyl-acetate.

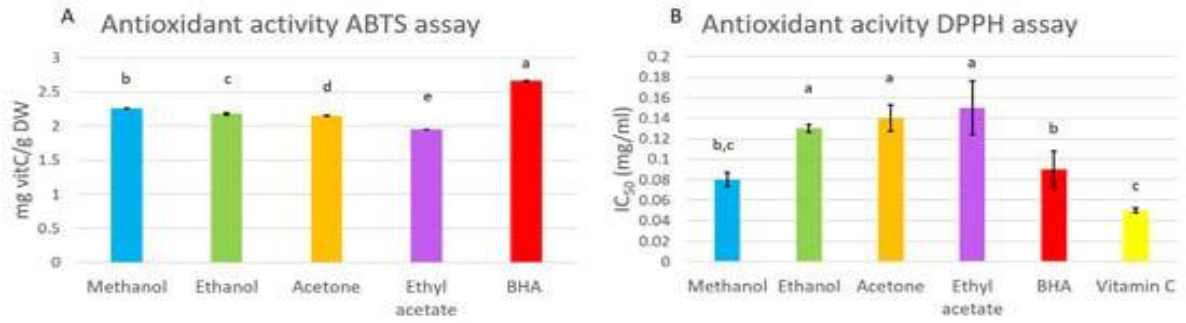

Figure 3: Antioxidant activity was quantified by the ABTS (A) and DPPH (B) techniques. Vitamin C and butylated hydroxyanisole (BHA) were used as benchmarks to compare the antioxidant activity. Results are shown as means ± SD. The test for ABTS antioxidant activity yielded values between 1.93 and 2.25 mg vitC/g DW (Figure 3). Methanol extract gave maximum activity, whereas the ethyl-acetate extract gave lowest.

To determine how well the extracts scavenge radicals, the DPPH and ABTS solutions' color reduction was employed to measure their antioxidant activity. Figure 3 shows that the methanol extract had a high application potential because its DPPH activity was comparable to that of the positive control, BHAThe methanol extract and BHA, the positive control, which have respective concentrations of 0.08 and 0.09 mg/mL.DPPH activity was higher in the ethanol, acetone, and ethyl acetate extracts, although between them, there was no statistically significant difference.

V. DISCUSSION

In culinary and pharmaceutical industries, Waste from onion peels is an important source of a variety of chemicals with a range of biological activity. Among the many variables influencing the quantity of phytochemicals in the trash, the type of onion used to produce the waste has the greatest impact (Beesk N, 2010). Onion peel extracts from other onion types showed comparable amounts of flavonoids and total phenolics (Benítez V, 2011) (Burri SC, 2017). Extracting individual flavonoids and total phenols from a yellow onion variety, discovered the methanol performed effective than ethanol and acetone (Kim J, 2013).

VI. CONCLUSION

The findings suggest dried onion peel can be used as useful raw material for extracting chemicals with significant biological effects. The solvent utilized in the extraction had substantial effect on the extract's biological activity. The maximum concentration of quercetin was found in the methanol extract,had strongest antioxidant activity. Furthermore, this paper is the first to report the ability of onion peel extracts to inhibit the growth of a variety of enteropathogenic microorganisms, such as human stool isolates and ATCC strains. Antibacterial activity in onion peel extracts confirms onion peel's potential source of chemicals that used to reduce the amount of GIT issues produced by examined microorganisms.

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