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Research paper

Expected pharmacological influences related to alkaloids extracted from flavedo peel layers of citrus fruits

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Abstract

This study was focused at Extraction of Alkaloids from Flavedo layers of Citrus Fruits peels and its Expected Anti-Oxidant Influences on Human Health. Alkaloids have a wide range of pharmacological activities. Albedo extract was separated. Study results clearly showed the presence ($p \leq 0.05$) of alkaloids in Albedo citrus peel layers compared to control. Phytochemicals are major bioactive compounds known for their health benefits. They contain significant amounts of alkaloid, which exist in edible and non-edible parts of citrus fruits.

Keywords: *Antioxidant Potential; Citrus; Medicinal Agents; Oxidative Stress; Secondary Metabolites.*

1. Introduction

Citrus fruits, which belong to the genus Citrus of the family Rutaceae, are of various forms and sizes (from round to oblong), commonly known as oranges, mandarins, limes, lemons, grapefruits and citrons. The sensory attributes of fruits (color, sweet taste, bitterness, and astringency) constitute decisive organoleptic and commercial properties [13]. Citrus species are consumed mainly as fresh or raw materials for juices or are canned as segments. Additionally, Citrus fruits can also be used in the food, beverage, cosmetic and pharmaceutical industries as additives, spices, cosmetic ingredients and chemoprophylactic drugs, respectively [6]. Citrus fruits are good sources of nutrition with an ample amount of vitamin C. Besides, the fruits are abundant in other macronutrients, including sugars, dietary fiber, potassium, folate, calcium, thiamin, niacin, vitamin B6, phosphorus, magnesium, copper, riboflavin and pantothenic acid [2]. However, secondary metabolites are an especially popular topic in the present research. These constituents, also known as phytochemicals, are small molecules that are not strictly necessarily for the survival of the plants but represent pharmacological activity. Citrus fruits contain a number of secondary metabolites, such as flavonoids, alkaloids, coumarins, limonoids, carotenoids, phenol acids and essential oils. These active secondary metabolites show several bioactivities of vital importance to human health, including anti-oxidative, anti-inflammatory, anti-cancer, as well as cardiovascular protective effects, neuroprotective effects, etc. In addition, Citrus fruits have been used as traditional medicinal herbs in several Asian countries, such as China, Japan and Korea. Nine traditional Chinese medicines have been recorded in the Chinese Pharmacopoeia for appropriate medical use from six Citrus species [Committee NP (2010) Pharmacopoeia of People's Republic of China, vol 2. China Medicinal Science and Technology Press, Beijing]. The Rutaceae family contains roughly 160 genera, with citrus being the most important [4]. It is grown on all continents. Antioxidants like ascorbic acid, flavonoids, as well as phenolic compounds are abundant in citrus fruits and drinks. Citrus peels are a potential source of essential oils as an agroindustrial waste [8]. Peel oil is a valuable product that may be produced by effective recycling of citrus fruit peel, which is where the essential oil is most concentrated [1]. Lemon, a member of the family Rutaceae, has therapeutic properties. Lemon is used mostly for its anticancer alkaloids, although antibacterial activity of crude extracts from several parts of the Lemon (leaves, stem, root, juice, peel, and flower) has been documented against clinically significant bacterial strains [16]. A great number of modern medicines have been derived from plants that are considered as important sources of medicinal agents to treat different diseases [17]. For drug development, bioactive compounds like flavonoids, tannins, phenols, and alkaloids in medicinal plants play a vital role [9]. Although ROS, which are produced from partial reduction of oxygen during high metabolism, are important for life, repeated stress conditions lead to increase in energy utilization and hence production of more ROS, which may harm cells, tissues, and organs. Several plant extracts possess significant antioxidant activities to treat many diseases and disorders such as liver toxicity, diabetes hepatotoxicity, and other complications [10]. Phytochemicals derived from plants are non-nutritional natural compounds that are important for numerous body functions in humans. Many of these compounds found in food products are known to have antioxidant potential due to the occurrence of OH group [7]. The antioxidants prohibit the oxidative damage to various macromolecules like nucleic acids, proteins, and lipids and scavenge free radicals generated from biochemical reactions [11]. A reaction of these free radicals with macromolecules has been reported to stimulate apoptosis that may cause various physiological, cardiovascular, and neurological disorders [15]. Various types of phytochemicals such as phenolic acids, ascorbic acid, tocopherols, and bioflavonoids having antioxidant characteristics have been used to treat many diseases [5]. Alkaloids occur in approximately 20% of plant species. They are structurally very diverse and their number is extensive including more than 16 000 structures. Alkaloids have always attracted a high interest due to their positive but also toxic effects on human being. This article aims at summarizing the influence of natural alkaloids and their close semisynthetic derivatives on oxidative stress. The main emphasis is given to experi-

mentally tested alkaloids. Registered drugs, illicit drugs and those alkaloids that are a common part of human diet such as the well-described tropane (cocaine, interested readers can find information about cocaine and ROS [12].

2. Statistical analysis

Study results were statistically analyzed in accordance to SPSS version 2021, Anova, One sample T – test.

3. Materials and methods

3.1. Extraction of alkaloids

A known amount of powdered freeze-dried citrus tissues was exhaustively extracted in 80% aqueous methanol at 4 ◦C for three consecutive days. After centrifugation at 4500rpm for 15 min, supernatants of all three extractions were pooled and stored at −20 ◦C until used for the determination of total phenol and total flavonoids and for the antioxidant assays.

3.2. Phytochemical screening of alkaloids

Each one mL of extracted sample was added to 1% aqueous HCl over water bath and filtered. The filtrate was treated with Mayer's reagent which is prepared by (dissolved 1.35g of mercuric chloride in 60ml of distilled water, 5g of potassium iodide in 10ml of distil water were added, the whole solution was diluted to 100ml). Formation brown or reddish-brown precipitate indicates presence of alkaloids.

4. Results

Table 1: Phytochemical Screening of Ethanolic Extract of Dried Lemon Peel Layers (Mg AE/Gm)

One-Sample Test Test Value = 0					
				95% Confidence Interval of the Difference	
	t	sig. (2-tailed)	Mean Difference	Lower	Upper
Control	12.847	0.006	1.8667	1.242	2.492
Peel	18.676	0.003	4.7000	3.617	5.783

- Results of (value ≤ 0.05) are considered significant.

5. Discussions

Results in Table 1, clearly show significant ($p \leq 0.05$) presence of alkaloids in albedo citrus peel layers compared to control through phytochemical screening of ethanolic extract of dried lemon Peel layers (mg AE/gm). Study results are in agreement with [14], who stated that Alkaloids were significantly ($p < 0.05$) higher in Citrus maxima peel extract compared with Citrus maxima juice. Phytochemical alkaloids were found in all parts of the plant; however, the highest amounts were present in the leaf part of D. alba. The presence of alkaloids makes the plant anti-radically active with the various parts (extracts) of D. alba showing antioxidant activity [19]. Study results are confirmed by [18], who concluded that phytochemical screening confirmed the presence of free alkaloids in the orange peel extracts, suggesting that alkaloids are powerful tool that could be a promising source of health-promoting compounds from orange peel. After further clinical studies, the orange peel extracts obtained by subcritical water have the potential to be used in newer medicinal preparations, cosmetics, and functional foods. Also study results are in agreement with [20], who stated that Citrus-derived secondary metabolites, including flavonoids, alkaloids, limonoids, coumarins, carotenoids, phenolic acids and essential oils, are of vital importance to human health due to their active properties. These characteristics include anti-oxidative, anti-inflammatory, anti-cancer, as well as cardiovascular protective effects, neuroprotective effects.

6. Conclusions

In this study, it is clearly concluded that many powerful pharmacological influences are related to alkaloids derived from citrus fruits, including anti-oxidative, anti-inflammatory, anti-cancer, as well as cardiovascular protective and neuroprotective effects.

7. Recommendations

It is highly recommended to increase dietary intake of citrus fruits within the acceptable daily intakes (ADIs). Pharmaceuticals derived from citrus fruits with alkaloids as the active ingredients are recommended. Further studies concerning pharmacological benefits of alkaloids are highly recommended.

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9. References

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