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Structure-Antioxidant Activity Relationship of Some Flavonoids Isolated from *Warionia saharae* (*Asteraceae*)

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The antioxidant behaviour of flavonoids including flavone, flavanol and isoflavone isolated from leaves of *Warionia saharae* and the related activity-structure relationships were investigated by measuring their abilty to scavenge the free radical 2,2-diphenylpicrylhydrazyl show that the antioxidant activity depends both on substitution of hydroxyl groups of the flavonoids skeleton and the presence of an unsaturation at the C2 -C3 bond in conjugation with 4 oxo function.

Key Words: Flavonoid, *Warionia saharae*, Antioxidant, Free radical, Scavenge.

INTRODUCTION

Reactive oxygen species readily attack and induce oxidative damage to various biomolecules including proteins, lipids, lipoproteins and DNA. This oxidative damage is a crucial etiological factor implicated in several chronic human diseases namely cardiovascular diseases, rheumatism, diabetes mellitus and cancer[1,2].

The human body possesses many defense mechanisms against oxidative stress, including antioxidant enzyme and non-enzymatic compounds[3], antioxidants are chemical substances that reduce or prevent oxidation, they have the ability to counteract the damaging effects of free radicals in tissues[1,4].

Many studies have shown that phenolic compounds display antioxidant activity as a result of their capacity to scavenge free radicals. Flavonoids belong to a group of phenolic compound with a number of biological activities such as antibacterial,antimutagenic, cytotoxic, anticarcinogenic and antioxidant activity[5].

The antioxidant property of flavonoids was the first mechanisms of action studied in particular with regard to their protective effect against cardiovascular diseases, flavonoids have been shown to be highly effective scavengers of most types of oxidizing molecules, including singlet oxygen and various free radicals[6,7].

The objective of this study was to elucidate the antioxidant activity of flavonoids isolated from leaves of *Warionia saharae* and determine their activity-structure relationships as antioxidant by using the DPPH radical scavenging.

EXPERIMENTAL

DPPH radical scavenging method: The antioxidant activity of the flavonoids isolated from leaves of *Warionia saharae* was assesses by the mean of 2,2-diphenyl-1-picrylhydrazyl (DPPH$^{\cdot}$) colorimetric method[1]. This method depends on the reduction of purple DPPH to a yellow coloured diphenylpicrylhydrazine and the remaining DPPH$^{\cdot}$, which showed maximum absorption at 517 nm was measured (spectrophotometer). About 2 mL of a 20 mg/mL DPPH solution were added to 1 mL of a methanolic solution of each fractions (1-100 µg/mL). A mixture of 2 mL of DPPH and 1 mL of methanol served as control. The mixture was shaken vigorously then incubated for 15 min in darkness at room temperature. Absorbance was measured at 517 nm, each experiment was performed in triplicate. The DPPH radical scavenging activity was calculated according to the following equation:

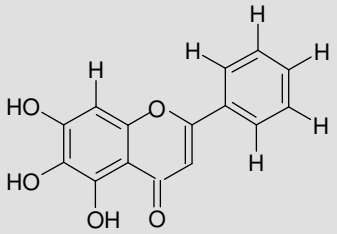
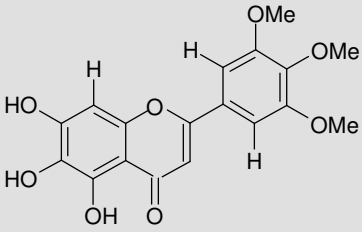
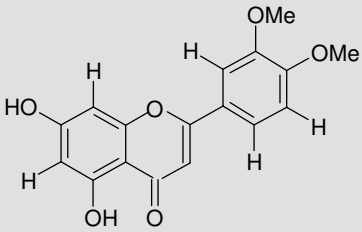
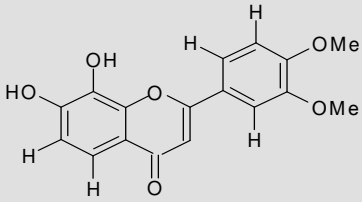
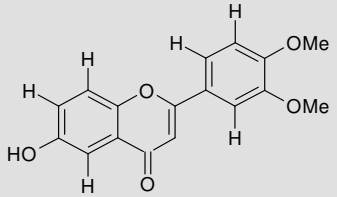
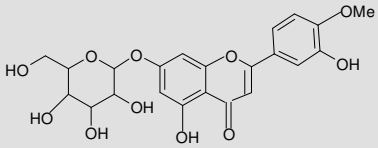
$$\text{DPPH radical scavenging activity (\%)} \quad \frac{A_{control} - A_{sample}}{A_{control}}$$

where A_{sample}: absorbance of sample; $A_{control}$: absorbance of control.

RESULTS AND DISCUSSION

Ten different flavonoids including flavones, flavanol and isoflavone isolated from leaves of *Warionia saharae* were measured for antioxidant properties in this study by using DPPH radical scavenging.

TABLE-1
STRUCTURE AND ANTIOXIDANT ACTIVITY OF TESTED FLAVONE

N	Name	Code	Structure	AA %
1	5,6,7-Trihydroxy flavone	w.sAD(L-L) 07		81.65
2	3',4'-Dimethoxy-5,7,8-trihydroxy flavones	w.sbu 02		70.16
3	3',4'-Dimethoxy-5,7-flavone	w.s bu 16		73.52
4	3',4'-Dimethoxy-7,8-dihydroxy flavones	w.sbu 11		69.33
5	3',4'-Dimethoxy-6-hydroxy flavone (flavone)	w.sbu 03		75.92
6	Luteolin-O-glycosyl-4'-methoxy-5-hydroxy (flavone-glycosylé)	w.sbu 15		67.56

As shown in Table-1, the 5,7 hydroxyl group in A ring the C2-C3 double bond in conjugation with 4 oxo[8-10] function present in compound **1** (5,6,7-trihydroxy flavones), is known to improve antioxidant efficiency and this may be the reason why this flavone has a high potent antioxidant activity (86.65 %).

As present in Table-1, it is observed that compounds **2**, **3**, **4** having a lower antioxidant activity than the activity of compound **1** due to presence of methoxylation group in 3', 4' and 5' position in A ring[9,10].

The presence of glycosylation group in 7 position for compound **6** reduce the antioxidant activity[10].

In the Table-2, the antioxidant activity of taxifolin 6-hydroxy is higher 96.40 % due to existence of hydroxyl group in 5, 7 position in A ring and 3 position in C ring[8-10].

The taxifolin 6-hydroxy, 4' methoxy has a low antioxidant activity percentage than taxifolin 6-hydroxy due to presence of methoxylation group in 5' position in A ring[10].

As present in Table-3, the compound **1** has a high antioxidant activity 86.71 % due to presence of hydroxyl group in 5, 6, 7 position in A ring and the unsaturation between C2-C3 in conjugation with 4-oxo function in C ring[8-12].

The absence of unsaturation between C2-C3 in C ring reduce the antioxidant activity for compound **2**[9,11-13].

Conclusion

The results of this study provide evidence that flavonoids have radical scavenging activity or antioxidant activity due to presence of substitution patterns on the B ring appear to be the most important contributor to the antioxidant activity,

TABLE-2
STRUCTURE AND ANTIOXIDANT ACTIVITY OF TESTED FLAVANOLS

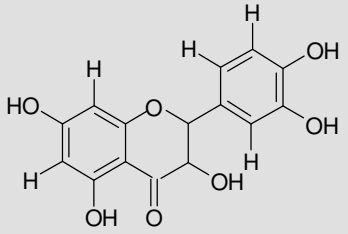
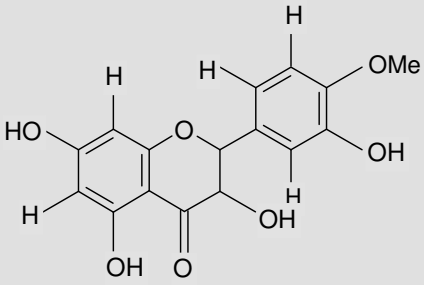
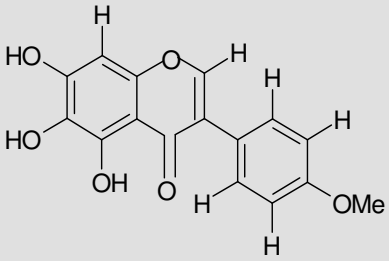
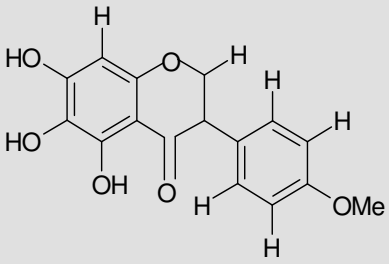
N	Name	Code	Structure	AA %
1	Taxifolin 6-hydroxy (flavanol)	w.s AD 18		96.40
2	4',5,7-Taxifolin (flavanol)	w.sbu 12		66.16

TABLE-3
STRUCTURE AND ANTIOXIDANT ACTIVITY OF TESTED ISOFLAVONE

N	Name	Code	Structure	AA %
1	6-Hydroxy biochanin A (isoflavone)	w.s AD(L-L) 03		86.71
2	6-Hydroxy biochanin A (isoflavone)	w.sbu 13		69.59

hydroxyl groups boost the antioxidant activity, whereas methoxy and glycosyl groups reduce the antioxidant activity. Presence of unsaturation between C2-C3 in conjugation with 4 oxo function enhances the antioxidant capacity. A hydroxyl group at the C3 position is also beneficial to the ability of flavonoids to scavenge free radical.

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