Table 1: DPPH, ABTS-radical scavenging, FRAP and AChE inhibitory potential of the studied compounds.

Compound	DPPH IC_{50} $\mu M\ L^{-1}$	ABTS IC_{50} $\mu M\ L^{-1}$	FRAP μM TE mM^{-1}	AchE Inhib IC_{50} $\mu M\ L^{-1}$
1	2329.83 ±10.45	379.85 ± 8.45	942.16 ± 4.03	192.19 ± 3.54
2	2840.206 ±12.63	3748.38 ± 25.56	642.95 ± 3.95	142.97 ± 4.62
3	181.85 ± 6.82	41.515 ± 0.85	ND	ND
4	917.215 ± 8.43	0.25 ± 0.005	ND	ND
5	1855.085 ± 9.52	87.17 ± 6.11	ND	ND
Hyperoside	141.52 ± 6.54	6.61 ± 0.31	7837.42 ±18.25	-
BHT	307.50 ± 2.45	0.08 ± 0.004	26.88 ± 2.41	-
Galantamine hydrobromide	-	-	-	0.43 ± 0.02

ND – Not Detectable
Results are represented as means ± standard deviation, $n = 3$

The essential requirement for effective radical scavenging is the orthodihydroxy configuration as well as double bond configured with a keto arrangement.[20] Considering the study results, we found a correlation between the DPPH radical scavenging and the number of free hydroxyl groups in structures of the benzophenones. The strong effect of compound **4** against ABTS free radical probably is related to the presence of methoxyl group in the aglycone moiety. However, compound **5** (rhamnoside) demonstrated lower DPPH and ABTS activity compared to compound **4**. The results revealed that glucose moiety probably exerts an influence on radical scavenging and antioxidant capabilities of the tested compounds.

In FRAP assay reduction of ferric tripyridyl triazine (Fe III TPTZ) complex to ferrous form (which has an intense blue color) at low pH can be monitored by measuring the change in absorption at 593 nm. The change in absorbance is therefore, directly related to the combined or "total" reducing power of the electron donating antioxidants present in the reaction mixture. Among the isolated compounds only benzophenone aglycons **1** and **2** manifested FRAP activity. These results correspond with previous investigation of the benzophenones (Annulatophenonoside and Acetylannulatophenonoside) isolated from *H. maculatum*[20] and unambiguously proved that benzophenone-O-glucosides did not manifest any FRAP activity probably because of the impossibility to break the free radical chain by donating a hydrogen atom.

In the present study, the inhibition of lipid peroxidation of compounds (0.1 mM) was determined in linoleic acid system using the FTC method [Figure 2]. The highest significant diminution was demonstrated by compound **4** and it hindered the oxidation of linoleic acid for five days, whereas the outer benzophenones retained the lipid peroxidation for four days [Figure 2]. However, all tested

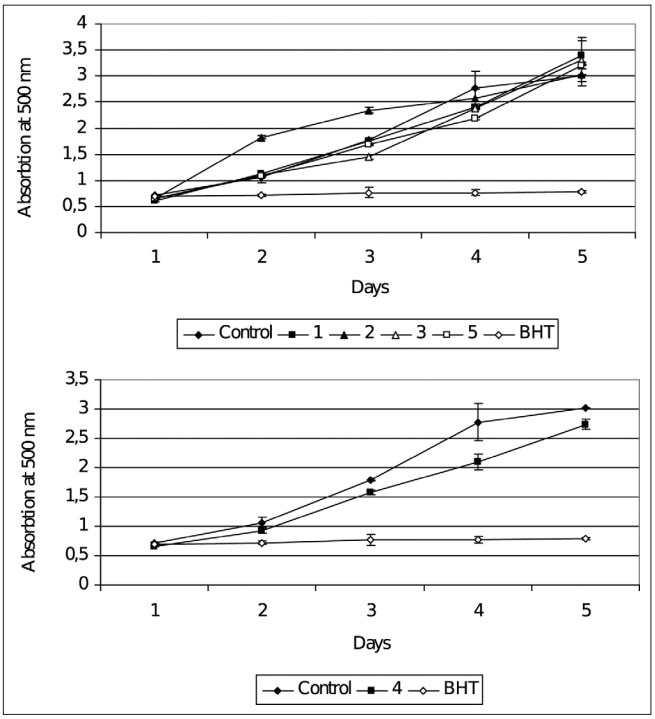

Figure 2: Antioxidant activity of benzophenones **1-5** in linoleic acid system

compounds demonstrated lower antioxidant activity compared to BHT.

The AChE inhibitory activity of the benzophenones was assayed by the method of Ellman *et al.* on AChE from electric eel. Concentration-inhibition curves were obtained from inhibitory concentration (IC_{50}) calculated by linear regression [Table 1]. The highest AChE inhibitory potency was displayed by compounds **1** and **2**, whose mean IC_{50} values (192.19 $\mu M\ L^{-1}$ ± 3.54 $\mu M\ L^{-1}$ and 142.97 $\mu M\ L^{-1}$ ± 4.62 $\mu M\ L^{-1}$) are lower than the IC_{50} value of Galantamine hydrobromide.

Several studies have reported moderate anticholinesterase activity of the plant extracts and drugs.[21-23] In our study, although compounds **1** and **2** did not inhibit AChE to a great extent, their inhibitory effect is of interest due to the fact that these substances belong to the group of prenylated benzophenones. Although, alkaloids are considered to be the major anticholinesterase compounds found in plants,[22] recently investigation reported a significant positive correlation between the total phenolic content and anticholinesterase activity of methanol extracts of *Acorus calamus* and *Nardostachys jatamansi*.[24] The results obtained confirmed the potential of several groups of phenolic compounds for antioxidants and aetylcholinesterase inhibitors.

Further in vivo investigations are required for a better understanding of the antioxidant mechanisms involved and for the possible application as a food supplement or in the pharmaceutical industry.

CONCLUSION

Prenylated benzophenones and benzophenone-O-glycosides isolated from *Hypericum elegans* were investigated for their antioxidant and AChE inhibitory potential for the first time. The results revealed that *H. elegans* provide: A potential natural source of bioactive compounds; benzophenones could be useful in therapy of free radical pathologies and neurodegenerative disorders.

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