Medicinal & Aromatic Plants
ISSN: 2167-0412

Ahmed et al., Med Aromat Plants 2012, 1:8
DOI: 10.4172/2167-0412.1000e132

Editorial Open Access

Is the prooxidant effect of polyphenols harmful?

Moussa Ahmed[1]*, Saad Aissat[1] and Noureddine Djebli[2]

[1]*Institute of Veterinary Sciences University, Ibn-Khaldoun Tiaret, Algeria*
[2]*Department of Biology, Faculty of Sciences, Mostaganem University, Algeria*

Diets rich in polyphenols are epidemiologically associated with lower risk of developing some age-related diseases in humans. Apparent disease-protective effect of polyphenols is often attributed to their powerful antioxidant activities, as established in vitro. However, polyphenols can also exert pro-oxidant activities under certain experimental conditions. Neither pro-oxidant nor anti-oxidant activities have yet been clearly established to occur in vivo in humans, nor are they likely given the limited levels of polyphenols that are achievable *in vivo* after consumption of foods and beverages rich in them [1]. Polyphenols oxidize readily in beverages [2-4]. They can also oxidize in cell culture media and in the oral cavity. Often, these pro-oxidant effects involve interactions of polyphenols with transition metal ions. Flavonoids can chelate metal ions, often decreasing the pro-oxidant activity of metal ions [5,6]. On the other hand for many individuals, minerals can be difficult for the body to absorb and use efficiently. Chelated minerals can include any ligand that helps the body to absorb the mineral during digestion. The benefits of proper trace mineral intake include support of muscle tissue and heart rhythm, immune system function, proper bone and collagen formation, mental wellbeing and healthy metabolism [7-9]. However, there are some studies that can make the link between this oxidant/pro-oxidant effective, but unfortunately they do not seem to have attracted the interest of many researchers. Though polyphenols may modulate human neutrophil functions, there are some documents showing that neutrophils may modify polyphenolic compounds biochemically [10]. It is hypothesized that inflammatory cell-specific metabolism of polyphenolics can modify the properties of these compounds at the local site of inflammation [11,12]. Polyphenols are capable of both scavenging and generating radicals and may exert their beneficial effects by a combination of both mechanisms [13], the more effective antioxidants the polyphenols were, the more are they cytotoxic and antiproliferative. This could be due to a dual antioxidant/pro-oxidant effect of polyphenols or better to their capacity to either scavenge or generate radicals depending on the environment. However, the reaction between flavonols and HOCl may be more complicated than a simple oxidant-antioxidant interaction, and that phenolic compounds can react with HOCl to form stable chlorinated components, with each product potentially having a unique reactivity [14,15]. The flavonoids and iso-flavonoids have been shown to react with peroxyl radicals, superoxide, hydroxyl radicals, and $ONOO^-$. The antioxidant behavior of the flavonoids and isoflavonoids is related to the structure of the compound [16-18]. The aromatic nature of polyphenols makes them potential targets of HOCl and $ONOO^-$. These reactions may create novel pharmacophores at the site of inflammation [12]. Under certain pathological conditions *in vivo* (e.g., inflammation), flavonols may be converted to chlorinated derivatives, which exhibit an enhanced antioxidant potential and thereby play a role in cardio protection. Quercetin chlorinated derivatives exhibited significantly greater antioxidant capacity than the unmodified quercetin. The chlorination of quercetin enhances the inhibition of LDL oxidation, increases the Total Radical Antioxidant Potential and plays a role in cardioprotection [19].

References

1. Halliwell B (2008) Are polyphenols antioxidants or pro-oxidants? What do we learn from cell culture and *in vivo* studies? Arch Biochem Biophys 476: 107-112.
2. Aoshima H, Ayabe S (2007) Prevention of the deterioration of polyphenol-rich beverages. Food Chem 100: 350–355.
3. Sang S, Lee MJ, Hou Z, Ho CT, Yang CS, et al. (2005) Stability of tea polyphenol (-)-epigallocatechin-3-gallate and formation of dimers and epimers under common experimental conditions. J Agric Food Chem 53: 9478–9484.
4. Akagawa M, Shigemitsu T, Suyama K (2003) Production of hydrogen peroxide by polyphenols and polyphenol-rich beverages under quasi-physiological conditions. Biosci Biotechnol Biochem 67: 2632-2640.
5. Rice-Evans C (2000) Wake Up to Flavonoids, Royal Society of Medicine Press Ltd., London, 13-23.
6. Mira L, Fernandez MT, Santos M, Rocha R, Florencio MH, et al. (2002) Interactions of flavonoids with iron and copper ions: a mechanism for their antioxidant activity. Free Radic Res 36: 1199-1208.
7. Graff DC (1970) Absorption of minerals compared with chelates made from various sources into rat jejunal slices *in vitro*. Proc Lit Acad-Arts, Letters, and Sciences.
8. Ashmead HH, Ashmead HD, Graff DJ (1989) Amino acid chelated compositions formulated for delivery to specific biological tissue sites. U.S. Patent No. 4863898. Washington DC, USA.
9. Clayton PT (2006) B6-responsive disorders: a model of vitamin dependency. J Inherit Metab Dis 29: 317-26.
10. Neyestani TR (2008) Polyphenols and Immunity. Wild-Type Food in Health Promotion and Disease Prevention 413-434.
11. Boersma BJ, D'Alessandro T, Benton MR, Kirk M, Wilson LS, et al. (2003) Neutrophil myeloperoxidase chlorinates and nitrates soy isoflavones and enhances their antioxidant properties. Free Radic Biol Med 35: 1417-1430.
12. D'Alessandro T, Prasain J, Benton MR, Botting N, Moore R, et al. (2003) Polyphenols, inflammatory response, and cancer prevention: chlorination of isoflavones by human neutrophils. J Nutr 133: 3773S–3777S.
13. Touriño S, Lizárraga D, Carreras A, Matito C, Ugartondo V, et al. (2008) Antioxidant/prooxidant effects of bioactive polyphenolics. EJEAFChe 7: 3348-3352.
14. Boersma BJ, Patel RP, Kirk M, Jackson PL, Muccio D, et al. (1999) Chlorination and nitration of soy isoflavones. Arch Biochem Biophys 368: 265-275.
15. Eiserich JP, Hristova M, Cross CE, Jones AD, Freeman BA, et al. (1998) Formation of nitric oxide-derived inflammatory oxidants by myeloperoxidase in neutrophils. Nature 391: 393-397.

***Corresponding author:** Moussa Ahmed, Institute of Veterinary Sciences University, Ibn-Khaldoun Tiaret, Algeria, Tel: 213 65234059; Fax: 213 65234059; E-mail: moussa7014@yahoo.fr

Received October 22, 2011; **Accepted** October 23, 2012; **Published** October 30, 2012

Citation: Ahmed M, Aissat S, Djebli N (2012) Is the prooxidant effect of polyphenols harmful? Med Aromat Plants 1:e132. doi:10.4172/2167-0412.1000e132

16. Cao G, Sofic E, Prior LR (1997) Antioxidant and prooxidant behavior of flavonoids: structure-activity relationships. Free Radic Biol Med 22: 749-760.

17. Sichel G, Corsaro C, Scalia M, Bilio AJ, Bonomo RP (1991) *In vitro* scavenger activity of some flavonoids and melanins against O2-(.). Free Radic Biol Med 11: 1-8.

18. Pannala AS, Razaq R, Halliwell B, Singh S, Rice-Evans CA (1998) Inhibition of peroxynitrite dependent tyrosine nitration by hydroxycinnamates: nitration or electron donation? Free Radic Biol Med 24: 594-606.

19. Binsack R, Boersma BJ, Patel RP, Kirk M, White CR , et al. (2001) Enhanced Antioxidant Activity After Chlorination of Quercetin by Hypochlorous Acid. Alcohol Clin Exp Res 25: 434-443.