

Chemical Nature of Antioxidant Complement Activators in Allergenic Extracts

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Key Words

Allergens · Antioxidants · Complement

Introduction

Allergenic extracts of house dust, mites and animal epithelia are known to trigger the non-antibody-mediated activation of the classical pathway of human complement (huC) in vitro [1]. This complement-activating property is due to degradation products of the melanoidin or 'Maillard'-type demonstrably present in all the extracts [1–3]. Similarly, the usual aqueous extracts of the pollen of grasses, weeds and trees also engage complement by direct binding of the first component C1, due in this case to condensed flavonoid-tannins and/or protein-bound polyphenolic sidechains in the extracts [3]. However, the chemical core structures involved in activating huC1, like the (polymeric) polyphenols, catechins, chlorogenic acid, or the 3-deoxyglycosulose-type melanoidins, do not overtly show common features [2–4]. We now report that these structurally distinct huC-activating substances share the characteristic functional property of being strong antioxidants.

Materials and Methods

Dialyzed (> 10 kDa) aqueous allergenic extracts were obtained as before [3, 4] and lyophilized. Synthetic or semisynthetic model compounds were prepared as described [2, 3]. Complement activation was

evaluated using 1:30 diluted fresh human sera preincubated with a concentration range of the test compound, followed by hemolytic assay of residual huC using the traditional sheep erythrocyte-amboceptor detection system [1–3]. A highly potent allergen preparation from house dust, No. 72E, was used for reference. The relative antioxidant activities of the allergens and model compounds were assessed spectrophotometrically by monitoring their abilities to quench the chromogenic radical cation, ABTS^{•+}, generated from interaction between ABTS [2,2'-azinobis(3-ethylbenzothiazoline-6-sulfonate)] and myoglobin activated with H₂O₂. The water-soluble vitamin E analogue Trolox (6-hydroxy-2,5,7,8-tetramethyl-chroman-2-carboxylic acid) was used as a reference standard [5].

Results and Conclusion

Among a series of dialyzed and lyophilized preparations from the pollen of various species of grasses, weeds and trees (n = 16) we noted an excellent correlation between the antioxidant potentials and the C-activating power (r = 0.80, p < 0.0002). In agreement with previous and ongoing studies [2, 3, 6], laboratory-produced melanoidins based on conjugates of proteins like β -lactoglobulin with simple sugars or o-diquinones likewise engage complement component C1, in close qualitative and quantitative relationship with allergenic preparations from the pollen/dust/mite/epithelia groups [3, 6]. Adducts of proteins or peptides with oxidized quercetin or chlorogenic acid prepared in the laboratory acquire similar functional characteristics (fig. 1). Naturally occurring condensed tannins like the nondialyzable epicatechin derivatives from green and black tea or coffee, as well as the polycondensates of peptides with flavonoid-agly-

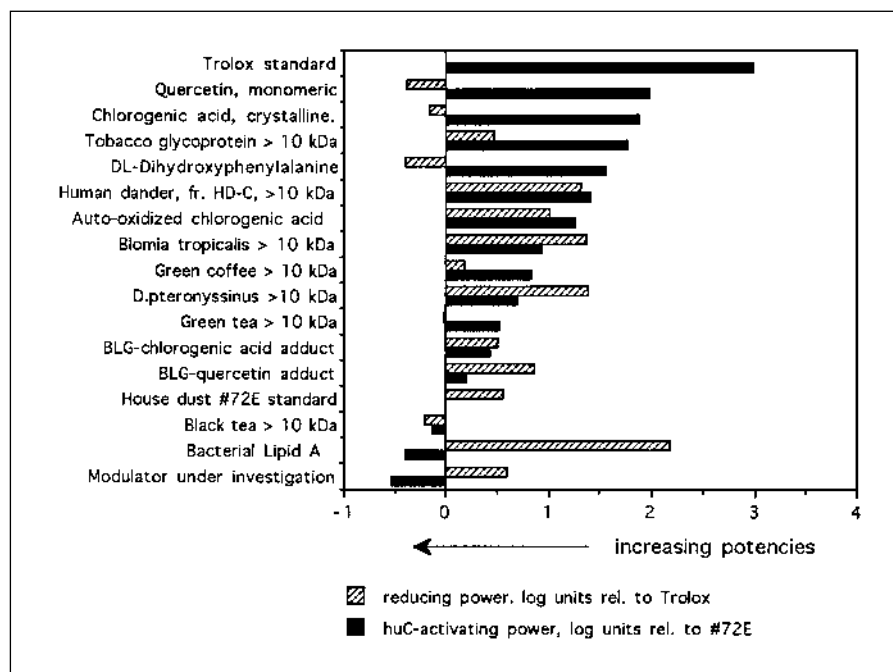


Fig. 1. Complement activation by some non-pollen-allergenic extracts and artificial model compounds in relation to their reducing power.

cones or chlorogenic acid prevalent in extracts of *Ambrosia* and *Parietaria* pollen were found to be even stronger complement-consuming agents than the melanoidin models (fig. 1).

The only common factor among the structurally distinct Maillard-type melanoidins, oxidized melanin intermediates, natural tannins and artificial polyphenol-protein adducts concerns the functional property of being strongly reducing agents (fig. 1). As with the pollen preparations, the antioxidant potential of allergenic extracts in general is firmly associated with the huC-activating potency and is related to the degree of chemical degradation [3]. Comparison of these results to those obtained with the non-complement-activating reference antioxidant Trolox, the nonreducing reference C1-activator lipid A, and the standard allergen No. 72E clearly shows that allergen-mimicking synthetic huC activators must display multiple reducing or oxygen-scavenging sites associated with negatively charged polymeric (>5–10 kDa) carrier molecules.

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