Elevated Antiplatelet Activity Induced by Extracts from Onion Umbels

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Epidemiological data suggest that onion (*Allium cepa* L.) consumption promotes cardiovascular health (Kendler, 1987). Among the salutary effects of *Allium* vegetables on the cardiovascular system is the inhibition of platelet activity (Ariga et al., 1981; Goldman et al., 1995; Kiesewetter et al., 1991; Makheja et al., 1980), thus reducing clotting time and promoting blood circulation.

To my knowledge, bulbs are the only onion plant organ so far examined for antiplatelet activity. Observation of high levels of pungency in onion umbels during rouging of our onion breeding nursery led me to the hypothesis that high concentrations of organosulfur compounds may be present in onion umbels, therefore imparting greater antiplatelet activity. In the present report, I compared inducement of human antiplatelet activity by onion bulbs and umbels.

Seed of the inbred line W420B was sown in the center two rows of bordered four-row plots 4.2 m long at four locations: two in Randolph, Wis., and one each in Lake Labish, Ore., and Brooks, Ore., in 1994. Plots were arranged in a randomized complete block design with four replications in Wisconsin and two replications in Oregon. At maturity, onion bulbs were harvested from the middle two rows of each plot, placed in mesh bags, and stored at 4°C. An equal volume of tissue from five onion bulbs was excised with a longitudinal slice from each bulb, and homogenized via standard methods in a mechanical juicer. In this way, a transverse section (including top and bottom of bulb) was sampled from each bulb. Bulb tissue was juiced and centrifuged immediately following excision and the resulting supernatant was frozen at –80°C. All bulb tissue samples were excised, juiced, and centrifuged for identical durations.

Following vernalization, a sample of stored W420B bulbs was planted in six rows, each 4 m long at a spacing of 60 cm between rows in an onion nursery at the Asgrow Seed Co. in

DeForest, Wis., in May 1995. Umbels were excised from 20 randomly selected plants when >50% of the flowers had opened, placed in plastic bags, and transferred to 4°C in Madison, Wis. Juice was extracted from onion umbels by grinding tissue in a mortar and pestle. Freshly extracted juice was centrifuged, transferred to plastic tubes, and placed at –80°C.

Platelet aggregation assays were performed using thawed bulb and umbel extracts from the samples described. Antiplatelet activity can be accurately assessed from frozen tissue extracts (Goldman and Kopelberg, 1996). Although freeze–thaw cycles can affect flavor development, little change in antiplatelet activity has been noted in a single freeze–thaw cycle (Goldman and Kopelberg, unpublished data). Platelets were isolated from healthy human donors from blood drawn into citric acid anticoagulant. Platelet-rich plasma (PRP) was prepared from blood via centrifugation (Schwartz and Monroe, 1986). Platelet aggregation was measured in cuvettes containing 400 µl PRP, 25 µl onion extract, and 25 µl water using the standard photometric technique with a platelet aggregometer as described by Schwartz and Monroe (1986). Fifty microliters of a standard platelet agonist (ADP, Sigma, St. Louis) was added at 0.1 mM to platelet suspensions as a stimulus of platelet aggregation. ADP-stimulated platelet aggregation with a water control was assessed for comparison to onion samples. Components of the assay were added to the cuvette in the following order: PRP, onion extract, agonist. Aggregation was evaluated for 3 min per sample and documented with an attached recording device. Data from replicate samples were recorded. The height of the platelet aggregation curve for each experimental sample was compared to the height of the platelet aggregation curve for the water-only control. Curve heights induced by umbel and bulb tissue were compared by *t* test. Antiplatelet activity was also recorded as a percentage of

the water-only control. No significant change in antiplatelet activity rank among four onion accessions (including W420B) grown in these four environments in 1994 was detected (Goldman and Debaene, unpublished data); thus, antiplatelet activity data from the four growing environments were combined for statistical analysis.

Inducement of antiplatelet activity, measured as a percentage of control, was 336% higher in onion umbels than for bulbs (Table 1; $P < 0.03$). This finding indicates onion umbels are a more potent source of antiplatelet activity than onion bulbs. In addition, these data suggest that onion umbels may be a richer source of bioactive organosulfur compounds in onion tissue. Since onion reproductive structures may be protected from pests because they contain high levels of organosulfur compounds (Lancaster and Shaw, 1991), elevated antiplatelet activity in the umbel may point towards a functional role for these compounds in onion plants.

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Table 1. Mean antiplatelet activity and percentage of control of onion bulbs and umbels of genotype W420B grown in 1994 field trials and 1995 breeding nursery.

Plant portion	Antiplatelet activity ^z (ht of curve in mm)	Percent control
None (water-only control)	143	---
Umbel	12 ^y	8
None (water-only control)	147	---
Bulb ^x	42	28

^zThe height of the platelet aggregation curve is a reflection of the amount of light that passes through a platelet suspension. Light transmission increases as platelets aggregate.

^ySignificantly different from curve height induced by bulb tissue, based on *t* test ($P < 0.03$).

^xMean over all four locations.