Evaluation of superoxide anion radical scavenging activities of plantains and pastures by electron spin resonance (ESR)

Y. Tamura[1] and T. Masumizu[2]
[1]*National Agricultural Research Centre for Tohoku Region, Shimokuriyagawa Akahira 4, Morioka, Iwate 020-0198, Japan, Email:fumi@affrc.go.jp,* [2]*JEOL Ltd., 3-1-2 Musashino, Akishima, Tokyo 142-8501, Japan*

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Introduction Producing animals without using feed-grade antibiotic growth promoters and chemical medicines is essential. In response, many scientists are now studying medicinal plants and herbs to identify and quantify those plants that may have a beneficial effect on animal production. Plantains have been used in herbal medicines and are being evaluated as a potential pasture species because of their medicinal values in animal health. In this study, antioxidant activities of plantains were compared to those of common pasture species to clarify the effects of plantains on animal health and production.

Materials and methods Two plantain (*Plantago lanceolata* L., *Plantago asiatica* L.) and three pasture species (*Lolium perenne* L., *Phleum pratense* L. and *Trifolium repens* L.) were used. Superoxide anion radical (O_2^-) scavenging activities of methanol-soluble extracts from freeze-dried leaves were determined by the spin-trapping method using an electron spin resonance spectrometer (ESR, JES-FA200 JEOL Ltd.), according to Sekine *et al.* (1998). The assays were made with and without ascorbate oxidase to distinguish the scavenging activities of antioxidant compositions from foliar ascorbate (Figure 1).

Results The scavenging activities of the extracts from the plantains and the pastures for O_2^- are shown in Figure 2. The extracts from the plantains exhibited much higher levels of O_2^- scavenging activity than those of the pasture species. The scavenging activities of *T. repens* were the lowest and those of *L. perenne* and *P. pratense* were between those of the plantains and *T. repens*. The results with/without the ascorbate oxidase treatment indicated that over 50% of the O_2^- scavenging activity in *T. repens* could be attributed to ascorbate, and that *P. lanceolata* and *P. asiatica* were due to bioactive compounds These species are known to contain compounds with high antioxidative activity, such as acteoside and plantamajoside.

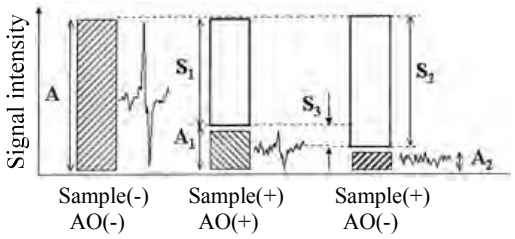

Figure 1 Estimation of scavenging activity
Note: sample(+) and (-) indicate with and without Samples. AO(+) and (-) indicate with and without ascorbate oxidase, respectively. A, A1 and A2; DMPO adduct signal intensity of control, with AO and without AO. S1, S2 and S3; Scavenging activity with AO, without AO and of ascorbate, respectively

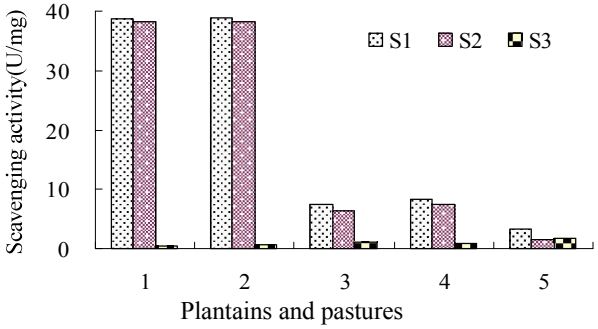

Figure 2 Scavenging activities of the plantains and pastures.
Note: 1;*P. lanceolata* L, 2;*P. asiatica* L, 3; *L. perenne* L, 4;*P. pratense* L. and 5;*T repens* L.. S1, S2, S3; Scavenging activity without AO, with AO and of ascorbate, respectively

Conclusions *P. lanceolata* and *P. asiatica* exhibited significantly higher scavenging activity than the pasture species. The effects on animal health from *Plantago lanceolata* L. feeding, such as increased essential fatty acid in chickens (Yamamoto *et al*., 2002) and decreased blood glucose in pigs (Fujii *et al*., 2002), may therefore be related to the scavenging activity for O_2^-. These results indicate that effects of the plantains on animal health may be exerted through antioxidant composition and other bioactive compounds such as aucubin and catalpol. Further studies on the mechanisms underlying the effects of bioactive compounds on animals are needed.

References

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