APPLE LEAVES AND BARK AS BROWSE ITEMS FOR HEBIVOROUS MONO-GASTRICS UNDER HUMAN CARE

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Abstract
Many zoological institutions are faced with challenges when developing and providing a diet for their non-ruminant browsing herbivores. The most prominent issue remains providing readily available, safe and sufficient quantities of plant material. Zoos are often forced, usually by climate, to utilize seasonally available, local, appropriate and or novel plant species in order to decrease the effort and expense required to cultivate or import plant foods naturally consumed by species in the wild. The main goals of this study were to (1) quantify the edible portions of an apple browse branch, (2) provide a framework for evaluating the suitability of apple browse as a safe edible item for non-ruminant herbivores.

It is essential to quantify the contribution of browse to the diet, which includes an understanding of the composition, and the relative proportion of any individual plant part. These parameters can then be utilized to better predict the physiological impact and to enhance diet formulations. Leaves, bark and twigs were analyzed for their nutritive profile periodically over the course of the harvesting period (May to October). Results demonstrated little seasonal effect on nutritive parameters. Apple leaves contained on average the highest level of protein (9.6% DM) compared to bark (4.1% DM) or twigs (3.9% DM). Apple bark and twigs contain high levels of both ADF and NDF relative to leaves. The micronutrient analysis revealed that leaves have the highest level of Fe content. Apple bark contained highest level of Ca and apple twigs the highest level of Zn. Neither leaves, bark nor twigs contained significant levels of Na. Allometric equations reflecting the correlation between basal diameter and plant portions (leaf, twig and bark) were established. The corresponding r^2 values indicated that basal diameter was well correlated with whole branch weight and bark weight; however leaves and twigs did not demonstrate a high correlation.

An animal feeding trial was performed in order to gain insight into the possible physiological effects apple leaves or bark could have upon ingestion by a non-ruminant herbivore. A large feeding trial was performed with 36 young male New Zealand White rabbits. Rabbits were randomly assigned to one of 6 treatment groups. Three treatment groups were offered rabbit pellets at 80% ad-libitum level and were offered no browse (control) or ad-libitum apples leaves or bark. Similarly, the remaining three treatment groups were offered 50% ad-libitum pellet levels and offered no browse (control) or ad-libitum apple leaves or bark. The trial length was 4 weeks in total and blood was collected before and after the trial for serum analysis. AST and ALT levels were found to be within previously published normal physiological ranges, indicating no unusual negative effect of treatment diets. Serum cholesterol, HDL-c and triglyceride concentrations were assessed.

Rabbits in groups consuming low browse and high pellet exhibited highest circulating triglyceride levels. Rabbits consuming highest levels of either apple leaves or bark had the highest ratio of HDL-c:cholesterol. Antioxidant markers glutathione peroxidase (GlutPx) and superoxide dismutase (SOD) were measured. Results indicated no effect on SOD or GlutPx activity. Liver and kidney weights indicated no difference between treatments. Overall results indicate that browse consumption does not negatively affect liver or kidney function, serum antioxidant activity, or organ weights. A high ratio of HDL-c:cholesterol, as seen in the high browse groups, indicates a potential beneficial response to treatment diets. In conclusion, apple browse leaves and bark are a good quality and safe dietary items that imparts little to no risk to mono-gastric herbivores. We can now make better dietary recommendations and formulations using allometric equations and nutritive profiles of plant parts.