Polymerization degrees, molecular weights and protein-binding affinities of condensed tannin fractions from a leucaena leucocephala hybrid

Abstract

Condensed tannins (CTs) form insoluble complexes with proteins and are able to protect them from degradation, which could lead to rumen bypass proteins. Depending on their degrees of polymerization (DP) and molecular weights, CT fractions vary in their capability to bind proteins. In this study, purified condensed tannins (CTs) from a Leucaena leucocephala hybrid were fractionated into five different molecular weight fractions. The structures of the CT fractions were investigated using 13C-NMR. The DP of the CT fractions were determined using a modified vanillin assay and their molecular weights were determined using Q-TOF LC-MS. The protein-binding affinities of the respective CT fractions were determined using a protein precipitation assay. The DP of the five CT fractions (fractions F1-F5) measured by the vanillin assay in acetic acid ranged from 4.86 to 1.56. The 13C-NMR results showed that the CT fractions possessed monomer unit structural heterogeneity. The number-average molecular weights (Mn) of the different fractions were 1265.8, 1028.6, 652.2, 562.2, and 469.6 for fractions F1, F2, F3, F4, and F5, respectively. The b values representing the CT quantities needed to bind half of the maximum precipitable bovine serum albumin increased with decreasing molecular weight-from fraction F1 to fraction F5 with values of 0.216, 0.295, 0.359, 0.425, and 0.460, respectively. This indicated that higher molecular weight fractions of CTs from L. leucocephala have higher protein-binding affinities than those with lower molecular weights.