Effect of species and harvesting site on phytochemicals and nutritive value of woody browse species found in semi-arid areas

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GENERAL ABSTRACT

The main objective of this research study was designed to assess the effect of woody browse species and harvesting sites on nutritive value and bioactive compounds of woody browse species found in rangeland parts of South Africa such as Limpopo and the North-West provinces. The current study was influenced by harvesting sites (Limpopo and North-West Province), where Limpopo had Glenrosa, Mispah and Lithosols (GM-L) soil types and North-West sites had Aeolian Kalahari sand, Clovelly and Hutton (AKS-CH) soil types. Fresh browse leaves from five trees per plant species from fifty-two tree species were randomly selected. The fifty-two tree species selected were namely, *Adansonia digitate*, *Androstachys johnsonii*, *Balanites maughamii*, *Berchemia discolor*, *Berchemia zeyheri, Bridelia mollis* Hutch*, Carissa edulis, Catha edulis, Colophospermum mopane, Combretum imberbe, Combretum molle, Combretum collinum, Dalbergia melanoxylon, Dichrostachys cinerea*, *Diospros lycioides, Diospyros mespiliformis, Euclea divinorum, Flueggea virosa, Grewia flava, Grewia flavescens, Grewia monticola, Grewia occidentalis, Melia azedarach, Peltophorum africanum, Prosopis velutina, Pseudolachnostylis maprouneifolia, Pterocarpus rotundifolius, Schinus molle, Schotia brachypetala, Sclerocarya birrea, Searsia lancea, Searsia leptodictya, Searsia pyroides, Senegalia caffra, Senegalia galpinii, Senegalia mellifera, Senegalia nigrescens, Senegalia polyacantha, Strychnos madagascariensis, Terminalia sericea, Trichilia emetic, Vachellia erioloba, Vachellia hebeclada, Vachellia karroo, Vachellia nilotica, Vachellia nilotica* subsp*. kraussiana, Vachellia rechmanniana, Vachellia robusta, Vachellia tortilis, Vachellia tortilis* subsp*. raddiana, Vangueria infausta* and *Ziziphus mucronata*. These browse species were chosen and then harvested from the selected sites by hand-picking. There were 45 browse species in the Limpopo site, and 21 browse species in the North West site and 14 browse species were common in both sites. For laboratory analysis (nutritive value and bioactive compounds), samples were air-dried for seven days at room temperature and then ground to pass through a 0.2 mm sieve. In Chapter 3, data were subjected to one-way analysis of variance (for those species that were not common in both sites) and two-way factorial (for those species that were common in both sites) in a completely randomized design. The highest (P<0.05) CP content (223.2 g/kg DM) in GM-L soil type was obtained from *Melia azedarach,* whilst in AKS-CH soils was obtained from *V. hebeclada* (189.2 g/kg DM). The lowest (P<0.05) NDF, ADF and ADL concentration levels (187.5 g/kg DM, 163.6 g/kg DM and 84.9 g/kg DM, respectively) in AKS-CH soil type were obtained from *V. nilotica* subsp *krasssiana*. In both soil types (GM-L and AKS-CH), *Melia azedarach* leaves in GM-L had the highest (P<0.05) values for most amino acids when compared to all other browse species in both soil types. In Chapter 4, only quantitative analysis data on tannins and phenols were subjected to a two-way analysis for those browse species that were common in both sites using a completely

randomized design. The methanol and distilled water extracts of the browse species leaves showed the presence of common phytoconstituents including saponins, flavonoids, tannins, phenols, cardio glycosides, terpenoids and phlobatannins as major active compounds in browse species leaves. The level of soluble phenolics ranged from 0.0160 (*V. hebeclada*) to 0.1011% DM (*D. cinerea*) in the browse leaves harvested from GM-L, while the leaves from AKS-CH ranged between 0.0334 (*V. hebeclada*) to 0.1009% DM (*Z. mucronata*). Within each soil type (AKS-CH), *D. cinerea* (0.0453 % DM) had the highest insoluble tannins concentration while *V. hebeclada* had the least (0.0064 % DM) insoluble tannins content. All browse species had enough CP to be utilized as a supplement to livestock fed low-quality roughages, regardless of the influence of the harvesting site on nutritional value. There is a need to determine the level of unquantified phytochemicals contained in these browse species and valorise the high bioactive compound-browse species to enhance and maximize intake of these browse species and also improve livestock production.

Keywords: Chemical composition, Bioactive compounds, Livestock, and Soil types, communal areas.