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Application of high resolution NMR, FTIR, and GC-MS to a comparative study of some indigenous seed oils from Botswana

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ABSTRACT

Spectroscopic techniques utilizing FTIR, ^{1}H and ^{13}C NMR spectral fingerprints of the neat oils, as well as standard titrimetric and GC-MS analyses were all employed to determine the quality parameters and fatty acid (FA) profiles for Soxhlet-extracted seed oils of four indigenous plants from Botswana: *Tylosema esculentum* (morama), *Schinziophyton rautanenii* (mungongo), *Citrullus lanatus* (kgengwe) and *Bauhinia petersiana* (mogose). The physicochemical parameters and FA composition obtained from spectroscopic methods were found to be similar to those obtained from classical procedures indicating that oil quality parameters can reliably be obtained from spectroscopic data. The FA analysis showed the presence of 73-84% unsaturated FAs in the four seed oils. In addition, spectroscopic data clearly established the presence of the uncommon tri-unsaturated FA, α-eleostearic acid (α-ESA) in mungongo seed oil which was quantified as 25 % by ^{13}C NMR. Generally, the high levels of unsaturated FAs in the oils indicates their suitability in health food supplements.

Industrial Relevance

The four plants studied are highly treasured in the areas where they grow due to the fact that they have for centuries provided food security, and means of livelihood for populations living in the Kalahari Desert and other marginal regions of the southern Africa region. Currently, there is a drive to add value to such often underutilized plants to aid in poverty alleviation by processing and marketing the products as healthy food supplements or cosmetic formulations. To this end, reliable methods for characterization and comparison of the FA composition of the seed oils from different geographical locations is required. The development of rapid, non-destructive spectroscopic techniques that can be applied directly on the neat oils is therefore an important venture.

Key words: FTIR; ^{1}H NMR; ^{13}C NMR; GC-MS; Fatty acid composition; α-eleostearic acid.