Nutritional, Phytochemical and *In Vitro* Antimicrobial screening of some Indigenous Leafy Vegetables

Elias Kibiwot Mibei

A thesis submitted in partial fulfillment for the degree of Master of Science in Biochemistry in the Jomo Kenyatta University of Agriculture and Technology.

2011

ABSTRACT

Indigenous leafy vegetables (ILVs) are traditional vegetables whose leaves, young shoots and flowers are consumed. Four commonly-used ILVs were investigated in this study, viz.: *Corchorus olitorius* L. (Jute mallow), *Crotalaria ochroleuca* G. (Slender leaf), *Solanum scabrum* Mill. (Black nightshade) and *Cleome gynandra* L. (Spider plant). These ILVs were planted at Jomo Kenyatta University of Agriculture and Technology (JKUAT) Experimental Farm and harvested between 1 to 2 months after planting. Fresh, cooked and dried (shade and solar drying) leaf samples were analyzed for nutritional and phytochemical composition. The samples were also investigated for relative antioxidant and antimicrobial activities.

Proximate composition results indicated that dry matter, protein, fiber, fat and vitamin C (16.8±0.17%, 3.7±0.62%, 2.1±0.50%, 1.4±0.27% and 153.68±7.75mg/100g DWB, respectively) was significantly higher in *C. olitorius* as compared to the other three ILVs ($P<0.05$). *Crotalaria ochroleuca* on the other hand exhibited higher contents of dry matter and ash (18.2±0.20% and 11.2±0.49%, respectively). Vitamin C and β-carotene contents of fresh leaf samples were significantly higher than those of dried and cooked samples ($P< 0.05$). *Cleome gynandra* exhibited significantly high β-carotene (8.73±0.16 mg/100g), while *S. scabrum* had the lowest amounts of both β-carotene and vitamin C (4.55±0.25 mg/100g and 62.61±4.57 mg/100g DWB, respectively). Besides, all cooked samples showed significantly lower β-carotene contents ($P < 0.05$) compared to fresh samples. The fatty acid profile indicated that the ILVs generally had a higher amount of unsaturated fatty acids than saturated fats. *C. olitorius* exhibited predominant amounts of fatty acids, whereas *C. gynandra* reported significantly lower amount compared to the other ILVs.

The content of phenolic compounds and tannins in the leaf extracts was determined spectrophotometrically using Folin-Ciocalteu and Folin-Denis reagents and calculated as gallic acid and tannic acid equivalents, respectively. The total phenol contents varied from 0.40±0.03 to 4.45±0.10 g/100g and tannins from 0.70±0.03 to 7.25±0.05 g/100g DWB; *S. scabrum* gave relatively high tannins and phenolic compounds. Flavonoid and alkaloid contents were between 1.39±0.08 to 6.32±0.20 g/100g and 3.23±0.18 to 10.80±0.08 g/100g, respectively. The ability of the extracts to scavenge diphenyl picryl hydrazyl (DPPH) radicals was determined spectrophotometrically at 517nm. The four ILV extracts had significant radical scavenging effects and almost all reported a significantly higher percentage of DPPH inhibition than ascorbic acid ($P < 0.05$). The extracts of *C. olitorius* and *C. gynandra* were most effective since they had higher percentages of radical scavenging activity and lower IC_{50} values (concentration which scavenged 50% of the DPPH radicals).

The ILV extracts also displayed significant anti-microbial potency against micro-organisms such as *Escherichia coli*, *Staphylococcus aureus*, *Bacillus subtilis*, *Pseudomonas aeruginosa* and *Candida albicans*. The best activities against the micro-organisms were observed in *C. gynandra* extracts with minimum inhibitory concentration (MIC) below 200 mg/ml.

The nutritional, phytochemical and antioxidant potential of the ILVs is of health or nutraceutical significance and should help encourage consumption of the ILVs. Though the processing and preparation methods such as solar drying and cooking reduced their final consumed amount, they should be dried in dry and dark place under low temperature and cooking should be done within a short time for maximum retention of nutrients. There is still much that begs for sustained

research on ILVs, and this study forms the basis for future research, especially in regard to bio-prospecting and valorization (value addition) of the ILV biodiversity.