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Chemical composition and antinutritional factors of *Lycianthes synanthera* leaves (chomte)

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Abstract

The leaves of *Lycianthes synanthera* (chomte), an edible Guatemalan plant, were analysed for some nutritional and antinutritional factors. Results of this study indicated that chomte leaves are rich sources of Ca, K, Fe, Zn, Cu, ascorbic acid, riboflavin, crude protein, carbohydrates and energy. Chomte leaves had hemagglutinating activity, trypsin inhibiting activity of 43.2 ± 1.0 TIU mg protein^{-1} and α-amylase inhibiting activity of 3.2 ± 0.9 AIU mg protein^{-1}. A cooking treatment, 15 min boiling, resulted in a considerable decrease in antinutritional factors.

Keywords: *Lycianthes synanthera* leaves; Chomte; Proximate composition, minerals and vitamins; Antinutritional factors

1. Introduction

Food availability in Guatemala is poor, mainly due to vulnerability to environmental factors, such as droughts and floods, deforestation and soil erosion and to inadequate agricultural and economic policies. Imports have increased, mainly for cereals, milk and animal fats. The food groups that sustain the population continue to be cereals (mainly maize), sugars and beans. These foods meet nearly 90% of energy requirements and are deficient in total fats, proteins of animal origin and micronutrients, especially in low-income population groups. Therefore, it is essential that cheaper sources of protein and other nutrients be found. These could be obtained from the plant materials most in abundance, which are under-utilised. Solanaceae and Leguminosae should be given priority in this quest.

Lycianthes synanthera (Sendtn.) Bitter, commonly named "chomte" or "tiuk" in Q'eqchì, and "chilete" or "chilete dulce" in Spanish, is an edible plant of the family Solanaceae that grows naturally in Guatemala from just above sea level to 900 m (Gentry & Stanely, 1974). The leaves of *L. synanthera* are used as food by people of the Q'eqchì ethnic group who live at Alta Verapaz, Guatemala. They cut the young branches, and separate the leaves, which are boiled, drained and squeezed because of their bitter taste; then tomato, onion, salt and vegetable oil are added to make the traditional dish "chomte en chirmol". Other forms of consumption are as chomte patties, chomte boiled with black beans and "tamalitos", a traditional ball made by steamed maize dough and chomte.

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Despite the use of this edible plant among the Mesoamerican native people, there are no data in the literature concerning the chemical composition and nutritional value of *L. synanthera* leaves. Recently we isolated three new furostanol oligoglycosides, named lycianthosides A–C, together with known flavone glycosides from chomte leaves (Piccinelli et al., 2005). In the present study, the leaves were investigated to determine their proximate composition, minerals, vitamin contents and antinutritional factors. The aim of this study was to demonstrate the nutritive value and thereby to encourage an increase in the consumption and utilization of this species in Guatemala.

2. Materials and methods

2.1. Plant material

Leaves of *Lycianthes synanthera* (Sendtn.) Bitter (''chomte'') were collected near Cobàn, Alta Verapaz (200 km from Guatemala City) in July 2000 and identified by J. Castillo. A voucher sample (LS1, 2000) is deposited at the Herbario of the Facultad de Agronomia, Universidad de San Carlos de Guatemala, Guatemala.

2.2. Proximate composition analysis

The moisture content was determined by drying the leaves in a Napco 430 oven at 105 °C until a constant weight was obtained (AOAC, 1990). Crude protein content was calculated by converting the nitrogen content, determined by Kjeldahl's method ($6.25 \times N$) (AOAC, 1990) in a Tecator 2020 digestor and Kjeltec 1030 autoanalyzer. Fat was determined by the method described by the AOAC (1990), using the Soxhlet system (AOAC, 1990). Ash content was determined by dry ashing in a Lindberg 51442 muffle furnace at 525 °C for 24 h. Crude fibre was determined in a Tecator Fibertec 1010 fiber digester (AOAC, 1990). Carbohydrates were calculated as ''Nitrogen free extract'' according to the formula: Carbohydrates = 100 − (% moisture + % protein + % crude fibre + % fat + % ash). Energy (kcal) was calculated according to the formula: Energy = (g protein × 4) + (g carbohydrates × 4) + (g fat × 9).

2.3. Mineral analysis

For mineral determination, the samples were digested in $HNO_3/HClO_4$. The elements, Na, K, Ca, Mg, Fe, Zn, Mn and Cu, were measured by atomic absorption spectrophotometry, using a Perkin–Elmer Lambda 34044 atomic absorption spectrophotometer (Perkin–Elmer, Norwalk, CT). Phosphorus (P) was measured by the vanadate colorimetric method (AOAC, 1990). The results were expressed as absorbance at 430 nm. Standard curves were used for the determination of the elements in question.

2.4. α- and β-Carotene analysis

α- and β-Carotenes were extracted with acetone and ether, separated by open column as previously reported (Carvalho, Collins, & Rodríguez–Amaya, 1992) and assayed by HPLC on a Agilent 1100 series system consisting of a G-1312 binary pump, a G-1328A Rheodyne injector (20 µl loop), a G-1322A degasser and a G-1315A photodiode array detector, equipped with an analytical Restek LC-18 ODS amine column (24 cm × 4.6 mm, 5 µm) plus its guard column. α- and β-Carotene peaks were monitored at their spectral maxima: all-*trans*-β-carotene (452 nm); all-*trans*-α-carotene (445 nm). Mobile phase: A = 20 µm $NaClO_4$ in MeOH/H_2O (96/4, v/v), B = MeOH/2-propanol (55/45, v/v); gradient program: % B 5 for 5 min, % B 20 in 15 min and then % B 90 in 25 min; flow: 1 ml/min. Quantification was carried out by external standards. Purity of the standards was checked before use.

2.5. Ascorbic and dehydroascorbic acid analysis

Dried leaves (500 mg) were homogenized under a flow of nitrogen for 3 min with a Teflon homogenizer at the maximum speed in the presence of 3.0 ml of 0.01 M saline sodium phosphate buffer (PBS), containing 1 mM EDTA, pH 7.0. Homogenates were centrifuged at 100,000g for 30 min, at 4 °C. The supernatant fraction (assay solution) was collected for vitamin C determination. Assay solution (500 µl) were treated with 2 µg of hypoxanthine (reference standard) and two volumes of 2% metaphosphoric acid for vit C analysis and with two volumes of 2% metaphosphoric acid supplemented with 6 mg/ml dithiothreitol for total vit C (ascorbic + dehydroascorbic acids) analysis. Both samples were stored at −80 °C under argon, and centrifuged before HPLC analysis. The supernatant was collected and volume adjusted to 1 ml with water. To determine total vitamin C content, the supernatant containing dithiothreitol was incubated at 45 °C for 2 h prior to HPLC analysis. Samples of 50 µl were injected on an analytical Supelcosil LC-18-DB column (24 cm × 4.6 mm, 5 µm, Supelco) plus its guard column, by using, in line, both photodiode array detectors set at 265 nm and an ESA CoulArray (oxidation potential: +400 mV). The mobile phase consisted of 0.0 2M NaH_2PO_4/CH_3CN, 99.5/0.5, v/v, containing 0.6 g/l of metaphosphoric acid; flow was 0.6 ml/min. Ascorbic acid was quantified by comparison of areas to those of authentic standards, including the reference standard.