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Nutritional and anti-nutritional composition of some wild edible plants consumed in Southwest Ethiopia

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Abstract

The Meinit community utilized wild edible plants (WEPs) widely for a variety of purposes mainly as food, household healthcare, and market value. WEPs namely, *Solanum nigrum* L., *Vigna membranacea* A. Rich, *Dioscorea praehensilis* Benth., *Trilepisium madagascariense* D.C., and *Cleome gynandra* L., are naturally grown and consumed by Meinit cultural community in Bench Maji Zone, Southwest Ethiopia. However, the proximate, mineral, and anti-nutritional compositions of these WEPs were not evaluate. This study aims to evaluate the proximate, mineral, and ant-nutritional contents of five WEPs. The WEPs were randomly collected from natural habitats and pooled samples were made. The nutritional and anti-nutritional composition of these WEPs were analyzed following standard food analysis methods. Nutritional analysis reveal that the WEPs had important nutrients in the ranges of protein (4.00 to 21.66%), fat (0.67 to 6.14%), fiber (10.06 to 22.28%), carbohydrate (38.11to 82.99%), and energy (274.99 to 371.05kcal/100g). Moreover, these WEPs contained substantial value of macro and micro minerals such as calcium (3.69 to 594.78mg/100g), potassium (440.61 to 1487.80mg/100g), sodium (174.87 to 277.42mg/100g), magnesium (68.19 to 588.06mg/100g), iron (0.83 to 38.46mg/100g), zinc (2.41 to 5.94mg/100g), and copper (0.06 to 0.49mg/100g). The anti-nutritional composition of five WEPs ranged of phytate (8.60 to 307.33mg/100g, condensed tannin (5.76 to 328.96mg/100g), and oxalate (43.68 to 443.87mg/100g). These results demonstrate that these WEPs had a significant sources of food nutrients that contribute to dietary diversification, food and nutrition security in rural people of southwest Ethiopia and elsewhere the tropical country. Additionally, this research outputs provide a baseline information for the food industry, policy makers, and community nutrition.

Keywords: Anti-nutritional content, Mineral analysis, Nutrient composition, Wild edible plants
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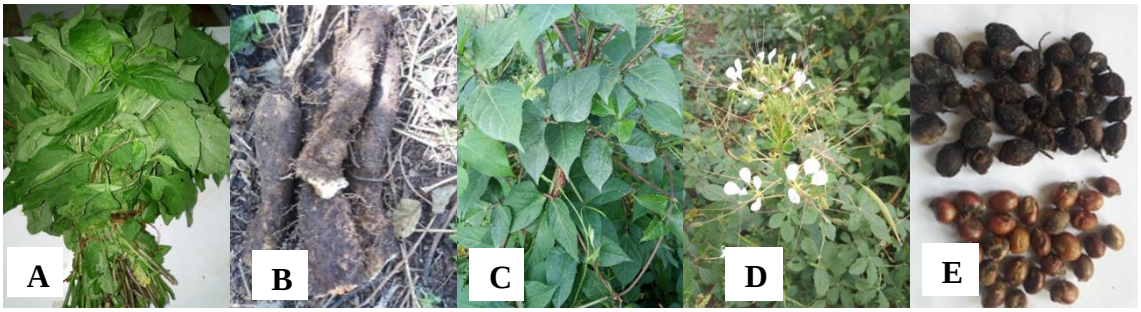
1. Introduction

Wild edible plants (WFPs) have the potential, through diversification, to make global food production more sustainable and resilient (Shelef et al., 2017). WEPs supplement the staple diet, which is high in fiber, carbohydrates, iron, zinc, calcium, potassium, and vitamins C and A (Rana et al., 2019; Shelef et al., 2017). Some WEPs are also a good source of fat and protein and have appealing dietary and medicinal potential for adulthood illness and other conditions (Ayessou et al., 2014; Garcıa-Herrera et al., 2014; Hyun et al., 2015). Although WEPs are rich in many macro- and micronutrients, comparable to or greater than cultivated crops (Kibar & Kibar, 2017), their nutritional and anti-nutritional compositions of these foods are overlooked by researchers. Few studies have been conducted on analyzes of nutritional and anti-nutritional factors of semi-wild or WEPs grown in Ethiopia (Adamu et al., 2022; Addis, et al., 2013; Olika et al., 2020; Woldegiorgis et al., 2015). Therefore, more effort is needed to study the nutritional and anti-nutritional of these lesser-known WEPs. Therefore, this study aimed to assess the diet quality of some WEPs, namely *Solanum nigrum* L., *Vigna membranacea* A. Rich., *Dioscorea praehensilis* Benth., *Trilepisium madagascariense* D.C., and *Cleome gynandra* L. grown and consumed in Bench Maji zone, southwest Ethiopia.

2. Material and Methods

2.1 Study site and plant specimen collection

The experimental wild edible plants were collected from three districts of Guraferda, Meinit Goldiye, and Meinit Shasha, located in the Bench Maji zone, southwest Ethiopia. The five WEPs widely consumed by the Meinit community are presented in Fig. 1. The sample plant species were prepared, identified and then deposited in the National Herbarium of Addis Ababa University, Ethiopia.



(A) Solanum nigrum, (B) Dioscorea praehensilis, (C) Vigna membranacea, (D) Cleome gynandra, and (E) Trilepisium madagascariense.

Fig. 1. Wild edible plant species used for the present investigation

2.2 Plant sample collection, preparation and analysis

The selection and collection of edible plant samples for chemical analysis was performed as suggested by Kalra (1998). Proximate and mineral composition of WEPs were determined following standard procedure of AOAC,2005 and AOAC,2000, respectively. The anti-nutritional composition such as phytate, condensed tannin and oxalate were determined as described by the methods of Vaintraub & Lapteva, 1988 , Maxson & Rooney, 1972 and AOAC, 2000,respectively. One-way analysis of variance (ANOVA) was used at $p<0.05$ significant level. Tukey's HSD test was used for mean separation. Mean and standard deviation were used to report the results.

3. Results and Discussion

3.1 Proximate composition of wild edible plants

The moisture content(mc), ash, fat, protein, fiber, carbohydrate and energy value of five WEPs are presented in Table1. Some of WEPs contained good amount of these proximate composition. Among studied edible plants**,** *S. nigrum* leaves contained high protein content (21.7%) and fiber content (22.3%.) while it was observed low in terms of carbohydrate and energy composition. The protein content of this study was consistent with a previous study by Alfawaz (2006) in protein content of *R.vesicarius* leaves and similar to Afolayan & Jimoh (2009) who reported in crude fiber content of *S. nigrum.* This obtained results of *S. nigrum* may contribute to combat protein deficiency diseases, reduction of constipation, obesity and colon cancer in rural communities.

Table 1. Proximate composition (% on a dry basis) of five selected WEPs (mean ±SD).

Edible plant	MC(db)	Ash	Fat	Protein	Fiber	Carbohydrate	Energy
S. nigrum	6.0 ± 0.6^{b}	14.0 ± 0.4^{b}	4.0 ± 0.6^{b}	21.7 ± 0.9^{a}	22.3 ± 0.4^{a}	38.1 ± 1.2^{e}	275.0 ± 5.9^{c}
V. membranacea	5.9 ± 0.5^{b}	12.6 ± 0.8^{b}	4.3 ± 0.1^{b}	11.8 ± 1.1^{b}	21.1 ± 0.4^{a}	50.3 ± 1.9^{c}	286.6 ± 5.0^{c}
D.praehensilis	5.2 ± 0.4^{b}	3.5 ± 0.1^{c}	0.7 ± 0.1^{c}	4.0 ± 0.5^{d}	8.9 ± 1.3^{c}	83.0 ± 0.8^{a}	354.1 ± 5.4^{b}
T.madagascariense	7.9 ± 0.1^{a}	4.9 ± 0.3^{c}	6.1 ± 0.1^{a}	6.3 ± 0.6^{c}	10.1 ± 0.6^{c}	72.6 ± 0.8^{b}	371.1 ± 1.6^{a}
C. gynandra	7.1 ± 0.7^{a}	16.4 ± 0.7^{a}	3.3 ± 0.6^{b}	20.1 ± 0.6^{a}	18.8 ± 0.8^{b}	41.4 ± 0.5^{d}	276.0 ± 4.5^{c}
CV(%)	7.9	6.8	10.7	6.0	4.6	2.0	1.5
LSD($p<0.05$)	5.1	0.1	0.2	0.6	0.1	3.2	12.7

Values are the mean of three independent measurements; Values within a column followed by different superscripts are significantly different at $p<0.05$ level; MC stands for moisture content, db for dry weight basis.

3.2 Mineral composition of wild edible plant

The highest amount of iron (38.5) and cupper (0.5) as well as low in sodium(174.9mg/100g) content were observed in *V. membranacea* leaves powder. This results suggested that *V.*

membranacea leaves rich iron content and it contributes to combat micronutrient deficiency such as anemia. This highest Fe value was consistent with those of Alfawaz (2006) who reported 36.2 mg/100 g in the *R. vesicarius* leaf. Moreover, the mineral composition such as iron (0.8), zinc (2.4), and cupper(0.1mg/100g) were obtained smallest amount in *T. madagascariense* fruit powder. In contrast, *C. gynandra* leaf had high amount in many mineral elements sodium (277.4), potassium (1487.8), calcium (594.8) and magnesium (588.1mg/100g) while it was recorded low in cupper (0.1mg/100g) value. These fluctuations in the mineral content could be attributed to different soil types, plant species and the stage of maturity of the plants. Calcium contributes to bone health, osteoporosis, and muscle and tooth strength (Baugreet et al., 2017).

3.3 Anti-nutritional composition of wild edible plants

The lowest the content of phytate (8.6 mg/100 g) was recorded in *D.praehensilis* tubers while highest condensed tannin content was found in *C. gynandra* (329.0 mg/100 g). This variation could be related to genetic variability, phonological period and environmental factors. The obtained results of phytate were lower than the results of (Gupta et al., 1989) who reported phytate levels of 520 mg/100 g in pumpkin leaves. The present result of condensed tannin was lower than the value found by Padhan et al. (2020) in *P. turgidum* leaf (413mg/100 g). The total oxalate content was found high in *S. nigrum* (43.7 mg/100 g*)* while it was obtained low in *T. madagascariense (*443.9 mg/100 g). Although the results of this study showed relatively high levels of some anti-nutritional factors, these WEPs were consumed exclusively in boiled or fried form, which may reduce the anti-nutritional effects.

4. Conclusions and recommendations

This work shows that the studied WEPs can make a significant contribution to a dietary nutrient for subsistence farmers in the rural community. Sustainable conservation practices and production of these studied WEPs is recommended. Future experiment should focus on anti-bacterial and anticancer effects of these plants.

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