Effects Of Boiling And Sun-Drying On The Chemical Composition Of *Waltheria indica* L. Leaves

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Abstract: The effects of boiling and sun-drying on the chemical composition of *Waltheria indica* leaves (WIL) was evaluated with the main aim of determining the chemical constituents. Freshly harvested WIL were collected from the wild and divided into three batches of 250g each. The first batch was pounded to form WIL paste (T_1WILP). The second batch was boiled for 30 minutes, drained, properly sundried and milled to form boiled WIL meal (T_2BWILM). The third batch was properly sundried and milled into sundried WIL meal (T_3SWILM). The representative samples were analysed in triplicates for their proximate composition, mineral contents and level of their anti-nutritional factors using standard laboratory procedures. The highest nutrient losses such as crude protein (21.13%), ether extract (3.16%) and ash (4.15%) were recorded in the BWILM. Similarly, the highest loss for calcium (20.41%), potassium (38.05%) and phosphorus (80.32%) were observed in the BWILM and other minerals followed similar trend. Boiling was observed to be effective in reducing the levels of anti-nutritional factors with a decrease of 57.69%, 63.86% and 47.92% for glycosides, phenols and tannins, respectively. Similar trend was observed for other anti-nutritional factors. It was concluded that boiling is more effective in reducing the levels of anti-nutritional factors compared to sun-drying, and it is, therefore, recommended for processing of WIL since the nutrient depreciation in the BWILM was not much.
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Introduction

The plant *Waltheria indica* belongs to the family *Sterculiacae*. It is wide spread in West Africa (Akobunda and Agyakwa, 1998). Locally, the plant is called “hankufah” or “hankubah” in Hausa, “kafafi” in Fulfulde, “korikodi” in Yoruba and “efu-abe” in Nupe. The uses of the plant are diverse; it is used in Northern Nigeria by the Hausas for the treatment of skin diseases, impotence and infertility, as an aphrodisiac, and as medicine at birth for children and during teething (Mohammed *et al.*, 2007). Most of the developing tropical countries depend on soya beans and other common leguminous grains as protein source for both humans and animals, but their production is not yet sufficient to meet the protein requirement of the increasing and expanding livestock industries. The scarcity and high cost of conventional feed ingredients has led to renewed interest in the use of non-conventional, cheap and readily available ingredients of wild legumes in livestock feeding (Yashim *et al.*, 2009). In view of the above, it has become imperative to exploit the nutritional potentials and the utilization of alternative feed sources. The leaves of *Waltheria indica* have the potential of being used as an alternative protein source for livestock. It is abundant on rangelands but the use of the leaves as feed ingredient for animals is limited by the presence of anti-nutritional factors such as alkaloids, saponin, tannins, oxalate, phytate, hydrocyanic acid and phytohaemaglutin. However, if detoxified, it may have potential for feeding animals. Furthermore, if precise information on its chemical composition and utilization is known, it can be used in feeding livestock without any nutritional errors. Existing reports revealed that *W. indica* has been reported to have the following activities: analgesic, anti-inflammatory, anti-bacterial, anti-fungal, anti-diarrhoeal, anti-malarial, antiviral, anti-convulsant, anti-anaemic and anti-oxidant activities (Zongo *et al.*, 2014).

Many indigenous tropical legume weeds are under-utilized because little has been done to explore their utilization as feed ingredients for livestock. An under-exploited plant worth exploring as non-conventional feed source is *Waltheria indica.* There is a need to determine the suitability *W. indica* of its leaves as feed resource for livestock. However, before recommending such plant as feedstuff, the nutritional properties of the processed leaves must be thoroughly investigated. In view of this, the recent study was conducted to determine the effects of processing methods on the chemical composition of *Waltheria indica* leaves.

Materials And Methods

Study Location

Mubi Local Government of Adamawa State is located between latitudes $9^o30^'$ and 11^o North of the equator and longitudes 13^o and 13^o 45^I East of the Greenwich meridian. The temperature regime in Mubi region is warm to hot throughout the year. However, there is usually a slight cold period between November and February (Adebayo, 2004).

Collection and Authentication of *Waltheria indica* Leaves

The test materials, *Waltheria indica* plant, was collected from the wild around Mubi area of Adamawa State, Nigeria. *Waltheria indica* leaves were collected from uncultivated range sites at Gidan Madara, Mubi Local Government area, Adamawa State. The leaves were authenticated at the Department of Botany, Adamawa State University, Mubi.

Processing of *Waltheria indica* Leaves

Samples of *Waltheria indica* leaves were divided into three batches. The first batch was freshly pounded leaves into paste (FWILP), which served as the control. The second batch was properly sundried while the third batch was boiled for 30 minutes. Thereafter, the samples were ground into *Waltheria indica* leaf meal (WILM).

Chemical analysis

The samples were analyzed in triplicate for their proximate composition, amino acid profile and levels of anti-nutritional factors using the procedure described by AOAC (2004).

Statistical Analysis

Data obtained was subjected to Analysis of variance (ANOVA) of the Complete Randomized Design (CRD). Least Significant Difference was used to separate the means where significant difference occurred.

Results And Discussion

The result of the proximate composition of *Waltheria indica* leaves (WIL) subjected to different processing methods is presented in Table 1. More nutrient losses were observed in the boiled *Waltheria indica* leaf meal (BOWILM). The decrease in the crude fibre observed in the BOWILM could be an advantage in feeding monogastric animals that require less fibre in their diets. The reduction in the crude protein content in the BOWILM could possibly be due to leaching of some nitrogenous compounds during boiling. This finding is in agreement with the report of Augustine *et al.* (2017), who in a similar study soaked and boiled *Senna obtusifolia* seeds and reported a decrease in the proximate components of the seeds.

Table 1: Proximate composition of *Waltheria indica* leaves subjected to different processing methods

Proximate composition	T_1(FWILP)	T_2(BOWILM)	T_3(SWILM)	SEM
Dry matter	10-55^c	90.85^b	96.57^a	5.44
% DM decrease	0.00	2.91%	2. 58%	
Crude Protein	14.62^a	11.53^c	18.50^b	0.67
% CP decrease	0.00	20.13%	14.50%	
Crude fibre	17.21^c	7.52^b	6.68^c	4.30
% CF decrease	0.00	56.30%	61.12%	
Ether extract	4.34^a	3.16^b	2.43^c	0.79
% EE decrease	0.00	44.00%	27.19%	
Ash	9.13^c	4.15^b	3.76^a	0.43
% ash decrease	0.00	58.82%	54.55%	
Nitrogen free extract	43.56^c	40.38^a	41.25^b	0.03
% NFE decrease	0.00	7.30%	5.30%	

*Means of three replications.

abc values with different superscripts on the same column are significantly different ($P< 0.05$).

FWILP- Fresh *Waltheria indica* leaves paste (control)

BOWILM- Boiled *Waltheria indica* leaf Meal for 30 minutes

SWILM- Sun dried *waltheria indica* leaf meal for 5 days

Mineral Element Contents of *Waltheria indica* leaves subjected to different processing methods

It was observed that the leaves have appreciable content of some vital minerals such as calcium, iron, potassium, magnesium, phosphous and sodium. The presence of Iron and Calcium also lend credence to the folkloric use of *Waltheria indica* leaves in the management of anemia (Oladiji *et al*., 2005). Moreover, mineral elements such as Mg, Zn and Fe present in *Waltheria indica* plant also support its use as immune enhancer.

The result indicated significantly ($p<0.05$) decrease in the mineral content of the BOWILM. The low mineral content observed in the BOWILM was due to the leaching of mineral into the boiling water. This is in agreement with the findings of Iyayi and Egharevba, (1998) who in a similar study boiled and soaked castor oil seeds and reported that the decrease in mineral content could be due to leaching out of mineral in the boiling water.

Table 2: Mineral Element Content of *Waltheria indica* leaves subjected to different processing methods

Mineral Element	T_1(FWILP)	T_2(BOWILM)	T_3(SWILM)	SEM
Calcium (Ca)	125.33[a]	99.75[c]	101.34[b]	5.07
% Ca increase	0.00	20.41%	19.14%	
Iron (Fe)	75[a]	19.22[c]	21.46[b]	0.08
% Fe increase	0.00	2.46%	2.76%	
Potassium (K)	201.30[a]	194.8[c]	124.7[b]	0.19
% k decrease	0.00	3.23%	38.05%	
Magnesium (Mg)	311.88[a]	28.68[c]	39.71[b]	0.01
% Mg decrease	0.00	90.80%	87.27%	
Phosphorus (P)	377.88[a]	76.25[c]	74.37[b]	0.01
% P decrease	0.00	79.82%	80.32%	
Sodium (Na)	154.33[a]	62.54[c]	64.54[b]	5.77
% Na increase	0.00	59.48%	58.18%	

*Means of three replications.
abc values with different superscripts on the same column are significantly different (P< 0.05).
RWILP- Raw *Waltheria indica* leaf paste (control)
BOWILM- Boiled *Waltheria indica* leaf meal for 30 minutes
SWILM- Sun dried *Waltheria indica* leaf meal

Anti-nutrients Content of *Waltheria indica* leaves (g/100g) subjected to different processing methods

The result of the anti-nutritional factors of processed *Waltheria indica* leaves is summarised in Table 3. The levels of anti-nutritional factors were significantly (p<0.05) affected by the different processing methods. The result indicated that the different processing methods were effective in reducing the levels of the anti-nutritional factors. However, BOWIL showed the highest level of reduction of the anti-nutritional factors followed by the SWIL. This agrees with the findings of Vadivel *et al.* (2008) who reported that, boiling was effective in reducing the levels of anti-nutritional factors of an under-exploited legume. Muhammad *et al.* (2002) in a similar, study reported that soaking and boiling had significantly reduced anti-nutritional factors of *Senna obtusifolia* seed. Augustine *et al.* (2018) reported similar findings on the effects of boiling on the chemical composition of *Senna obtusifolia* leaves. They concluded that boiling was effective in reducing the levels of anti-nutritional factors of *Senna obtusifolia* leaves.

Table 3: Anti-nutrients Content of *Waltheria indica* leaves (g/100g) subjected to different processing methods

Anti-nutrients	T_1(FWILP)	T_2(BOWILM)	T_3(SWILM)	SEM
Glycoside	0.52[a]	0.21[c]	0.24[b]	0.04
% Glycoside decrease	0.00	57.69%	53.85%	
Oxalates	0.81[a]	0.38[c]	0.50[b]	0.27
% Oxalates decrease	0.00	39.02%	53.64%	
Phenols	9.16[a]	3.31[c]	6.21[b]	0.47
% Phenols decrease	0.00	63.86%	32.21%	
Phytates	0.54[a]	0.23[c]	0.43[b]	0.06
% Phytates decrease	0.00	20.37%	57.41%	
Saponins	0.65[a]	0.30[c]	0.37[b]	0.06
% Saponins decrease	0.00	43.08%	53.85%	
Tannis	0.48[a]	0.25[c]	0.37[b]	0.00
% Tannis decrease	0.00	47.92%	22.92%	

*Means of three replications.
a, b, c values with different superscripts on the same column are significantly different (P< 0.05).
RAWIL- Raw *waltheria indica* leaves for 5 days (control)
BOWIL- Boiled *Waltheria indica* leaves for 30 minutes
SWIL- Sun dried *waltheria indica* leaves

Conclusion

The laboratory investigation revealed that *Waltheria indica* leaves have fair nutritional properties as alternative feed ingredients for livestock but contain some anti-nutritional factors such as tannins, phenols, saponins, oxalates, phytate, and glycoside. The boiling method used was effective in reducing the levels of the anti-nutritional factors compared to sun-drying. It is concluded that *Waltheria indica* can be processed by boiling instead of sun-drying.

Recommendations

Based on the findings of this study, the following recommendation are made:

i. boiling *Waltheria indica* leaves is recommended for effective processing for animal feedstuffs.

ii. feeding trial should be conducted using *Waltheria indica* leaves.

iii. work should be done on the amino acid profile present in *Waltheria indica.*

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