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Nutritional Assessment of Turkey Berry Leaves in Livestock Production

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Abstract

This study analyzed the turkey berry (Solanum torvum) leaf phytochemicals along with its mineral content and proximate composition. The production of Solanum torvum leaf meal began with seven days of leaf air-drying at room temperature, followed by grinding the leaves. Atomic absorption spectrometry evaluated both phytochemical compounds (saponin, tannin, flavonoid, and alkaloid) along with minerals (calcium Ca, sodium Na, potassium K, magnesium Mg, phosphorus P, and iron Fe) in the leaves. High concentrations of dry matter and nitrogen free extract, moderate crude protein, low crude fiber, ether extract and ash, were found in the leaves according to proximate analysis. According to mineral analysis, Solanum torvum leaves were found to contain minerals (g/100g) including Ca, Na, K, Mg, P, and Fe. Solanum torvum leaves have appreciable levels of flavonoids, alkaloids, mucilage, saponin, and tannin. The crude protein and mineral contents of Solanum torvum leaves particularly calcium and potassium as well as the resulting phytochemical qualities suggest that these leaves have excellent nutritional value and might be used as a feed additive in poultry production.

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Introduction

The scientific classification of *Solanum torvum* is turkey berry, so the plant has garnered attention because of its many health benefits and rich nutritional values. This plant exists under two names for common usage: devil's fig and shoo-shoo bush, and it enjoys widespread growth across tropical regions especially in Africa, Asia and parts of the Americas. Traditionally, turkey berry leaves hold a special position because multiple cultures both use them as medical remedies and include them in the diet as food. Scientific studies confirm turkey berry leaves have remarkable nutritional properties because they contain essential vitamins, minerals and antioxidants (Elizalde-romero et al., 2021; Abraham et al., 2022). Turkey berry leaves have a low-fat content yet contain high quantities of iron together with calcium, vitamins A and C and dietary fiber (Asante, et al., 2024). Research suggests that turkey berry leaves serve as dietary components that strengthen human health because of their nutritional value (Abraham et al., 2022).

Moreover, the medicinal properties of turkey berry leaves have been documented extensively. They are believed to possess anti-inflammatory, antioxidant, and antimicrobial effects, making them valuable for treating conditions such as high blood pressure, anemia, and infections (Asante, et al., 2024). Given their nutritional and therapeutic potential, a comprehensive assessment of the nutritional value of

turkey berry leaves is essential to further understand their role in livestock diet and health. This study aimed to explore the nutritional composition of turkey berry leaves in livestock production through detailed analysis on their health benefits. By elucidating the nutrient profile and potential applications of these leaves in animal dietary practices, which may contribute to the growing body of knowledge surrounding *S. torvum* and its significance in nutrition and traditional medicine.

Materials and Methods

Experimental site

The experiment was carried out at the Animal Production Technology Teaching and Research Farm and laboratory of The Federal Polytechnic Ilaro, Ogun State, Nigeria.

Plant Material Collection and Processing

The study utilized fresh leaves of *S. torvum*, which were sourced within The Federal Polytechnic Ilaro Farm, Ogun State, Nigeria. The leaves were selected from 3 months old Turkey berry plants, based on their freshness and absence of visible damage. Turkey berry leaves were carefully removed from the harvested plants, air-dried at room temperature. (35^0C) for seven days, milled using a laboratory blender, and stored in an airtight container for the assessment of proximate, mineral and phytochemical composition.

Proximate analysis of *Solanum torvum* leaves

The proximate contents of sample of *S. torvum* leaf meal were determined. As advised by AOAC (2010), the oven dry method was used to determine the moisture content. The Kjeldahl Nitrogen method, as outlined by AOAC (2012), was used to determine crude protein and crude fiber, a non-digestible component of food samples that undergoes two rounds of testing: acid and alkaline solution.

Mineral Analysis

Minerals were analyzed by dry ashing the samples to a consistent weight at 550 ºC and then dissolving the ash in a volumetric flask with distilled, de-ionized water and 5ml of concentrated hydrochloric acid. The concentrations of sodium, calcium, and potassium were measured using a flame photometer using NaCl and KCl as standards. Atomic absorption spectrophotometry was used to determine Fe and Mg using buck 600 AAS. Phosphorus was determined using calorimetric method.

Phytochemical Screening

Saponin determination

The experiment used a conical flask with a 20 g sample and 100 ml 20% ethanol solution. The heat procedure involved heating the sample to 55ºC for 4 hours with continuous stirring under a hot water bath. The filtrate underwent extraction using 200 ml of 20% ethyl alcohol. The mixed extract reduction process occurred over a water bath maintaining temperatures near 90ºC until the volume reached 40 ml. The extracting solution was loaded into a 250 ml separating funnel before 20 ml of diethyl ether was added for extraction while maintaining forceful agitation. The researchers performed an additional purification step by discarding the diethyl ether layer followed by retaining the aqueous solution. The researchers performed two rinses of the n-butanol extract with 5% sodium chloride solutions while using 10 milliliters in each rinse. Pitching oven-dried samples to constant weight led to the boiling of leftover solution in a water bath.

Tannins content determination

0.2g of powdered *S. torvum* items were placed in 20ml of 50% methanol solution. The heated water bath maintained 800ºC temperatures for one hour to process the wrapped samples in paraffin. The researchers filtered the cooled solutions through Whatman filter paper before marking the 100 ml volumetric flask. The addition of 20 milliliters distilled water and 2.5 milliliters Folin-Dennis reagent occurred to both sample and blank standard solutions. The test solution and standard received 10 milliliters of a 17% sodium carbonate solution during mixing operations. To achieve a bluish-green tint the samples needed to remain undisturbed for twenty minutes. A photospherometer recorded the 760 nm absorbance values. The calculation of tannin content involved dividing the average absorbance by the product of

sample weight and 1000 and the gradient dilution factor.

Flavonoids determination

A mixture of 2g (W1) *S. torvum* leaf meal and 50ml HCl was heated for 30 minutes (Harbone, 1973) to determine flavonoid concentration. The sample was cooled before conducting filtration. The procedure started with a flask containing five milliliters of filtrate followed by adding five milliliters of ethyl acetate in drops to form a precipitate. An oven operating at 300 degrees Celsius dried the precipitate after filter paper (W2) received a weight measurement. The evaluation of flavonoid content required weighing the dried filter paper (W3) followed by an assessment calculation using (W3 – W2)/W1 x 100

Alkaloids determination

Harbone's (1973) identification method helped identify the alkaloids present. The experimental procedure involved weighing 5 grams of material, followed by adding 200 milliliters of 10% acetic acid in ethanol solution while covering the mixture during its four-hour standing period in a 250 milliliter beaker. The extract volume was reduced to one-fourth of its original size using a hot water bath after filtration. The extract required drop-by-drop addition of concentrated ammonium hydroxide until complete precipitation occurred. After the solution achieved full settlement we filtered the precipitate that was thoroughly cleaned with a diluted ammonium hydroxide solution. The substance weighing in as dried material represents the alkaloid.

Results and Discussion

The approximate composition of *S. torvum* is displayed in Table 1. The nutritional significance of turkey berry (*Solanum torvum*) leaves in animal diets is becoming better acknowledged. Important elements that support their nutritional advantages were identified by the proximate analysis. Turkey berry leaves had appreciable protein content of 5.16% and high dry matter level of 89.23%. Because of this, they are an excellent source of protein for animal feed, especially for ruminants. The comparatively low fat content (3.5%) is advantageous because high-fat diets can cause metabolic problems in animals. There is a significant amount of fiber (3.47%), which could support digestive health. With the exception of the percentage of ash, the results of this study were lower than those of Abraham et al. (2022), who reported that the moisture content, ash, crude fat, crude protein, and crude fiber for freeze-dried *S. torvum* leaves were 84.43 ± 1.11 %, 0.06 ± 0.01 %, 5.25 ± 0.98 %, 17.05 ± 1.08 %, and 16.27 ± 2.21 % respectively.

Table 1: Proximate Composition (%) of *Solanum torvum* leaf (STL)

Nutrients	**(%) Dry Matter**
Dry matter	89.23
Crude fibre	3.47
Crude protein	5.16
Ether extract	3.50
Ash	2.41
Nitrogen Free Extract	74.88

Table 2 displayed the mineral content of *S. torvum* leaves. Turkey berry leaves are good supplement to animal diets since they are high in vital nutrients. Turkey berry leaves had 0.01 g/100g of iron, which is necessary for blood health, and 0.23 g/100g of calcium, which is needed for bone health and metabolic processes. Sodium level (0.02 g/100g) controls osmotic pressure, while potassium content (0.19 g/100g) is essential for nerve and muscle signaling. For a number of metabolic processes, magnesium (0.08 g/100g) and phosphorus (0.05 g/100g) are essential. These values obtained for minerals are in agreement with the report of Abraham, et al., (2022), however this contradict the results reported by Asante, et al., (2024) as 16.30 mg/kg, 1.54 mg/kg, 98.07 mg/kg and 320.80 mg/kg for sodium, magnesium, potassium and iron respectively.

Table 2: Mineral Composition (g/100g) of *Solanum torvum* leaf

Parameters	**Concentration**
Calcium (Ca)	0.23
Sodium (Na)	0.02
Potassium (K)	0.19
Magnesium (Mg)	0.08
Phosphorus (P)	0.05
Iron (Fe)	0.01

The phytochemical composition of *S. torvum* leaves is displayed in Table 3. Phytochemicals found in turkey berry leaves offer further health advantages. Due to their antioxidant qualities, flavonoids (0.23%) may help lessen oxidative stress in cattle. By scavenging free radicals and bio-activating carcinogens for liver excretion, flavonoids in leaves may help prevent oxidative stress, among other things (Khanna, Rizvi & Chander, 2002). This demonstrated that the plant might be highly helpful in preventing aging and disorders like neuro-inflammation, which can cause cell damage owing to the presence of free radicals.

Significant levels of tannin (0.16%) and saponin (0.11%) may improve feed efficiency and have anti-parasitic properties. Antiviral, antibacterial, anti-parasitic, anti-inflammatory, anti-ulcer, and antioxidant qualities have been discovered in tannins (Endang et al., 2020). A unique class of glycosides with soapy properties are called saponins. Additionally, saponins have been demonstrated to be potent antifungal agents. Saponins are used for hemolytic purposes, as well as expectorants and cough suppressants (Noor & Ainul, 2019).

Alkaloids (0.04%) and mucilage (0.02%) known for their potential medicinal properties, in turkey berry leaves may contribute to overall health and disease resistance in livestock. Alkaloids are essential for protecting and ensuring the survival of animals because they ensure their survival against micro-organisms (antibacterial and antifungal activities). Plants that contained alkaloids can be used as spices and drugs. Alkaloids that have stimulant property as caffeine,

nicotine and morphine are used as analgesic and quinine as antimalarial drug (Muhammad *et al*., 2018). Plants produce alkaloids that exhibit three major pharmacological properties including blood pressure reduction treatments, anticancer agents and antiarrhythmic components.

In addition to providing colour, flavour and fragrance to host plants, phytochemicals fulfill a protective function as natural defense mechanisms. A plant relies on phytochemicals to protect itself from both fungi, bacteria and viruses. Phytochemical analysis can lead to new therapeutic drug discoveries by detecting main bioactive components (Harshal et al., 2014).

Table 3: Phytochemical profiling of *Solanum torvum* leaf (%)

Parameters	Concentration (%)
Saponin	0.11
Tannin	0.16
Flavonoid	0.23
Alkaloid	0.04
Mucilage	0.02

Conclusion

The incorporation of turkey berry leaves as a dietary element improves animal nutrition through various beneficial effects. Their rich proximate composition with essential minerals and favorable phytochemicals will support livestock growth and development as well as general health. Research on the best incorporation rates of turkey berry leaves could improve their potential as a sustainable animal feed. The study demonstrates the necessity of understanding the nutritional features of alternative feed sources such as turkey berry leaves for regions that face restrictions with traditional feed expenses.

Suggestions for Further Research

- Identification and isolation of bioactive compounds from turkey berry leaves in other to evaluate their potential applications in animal health and nutrition.
- Investigate the optimal levels of turkey berry leaves in livestock diets to maximize nutritional benefits while minimizing potential toxicity risks.
- Conduct long-term feeding trials to assess the impact of turkey berry leaves on animal health, growth and productivity.
- Investigate sustainable production and harvesting practices for turkey berry leaves to ensure a consistent supply for livestock production.

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