

# THE FEED QUALITY STATUS OF WHOLE *Typha domingensis* PLANT

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**ABSTRACT:** Whole *Typha domingensis* plant which is locally known as Kachalla in “Hausa” land was randomly sampled in Bauchi, Bauchi State, Nigeria and analyzed for its nutritive and mineral composition using standard analytical techniques. The results obtained revealed that all the parameters investigated (available carbohydrate, crude protein, crude lipid, crude fibre, ash content, moisture content and minerals) were present at varying levels. The plant was found to contain  $57.81 \pm 0.42$  % moisture content,  $9.08 \pm 0.69$  % ash content,  $1.90 \pm 0.09$  % crude lipid,  $8.86 \pm 0.55$  % crude protein,  $17.46 \pm 0.76$  % crude fibre,  $4.89 \pm 0.18$  % available carbohydrate and  $63.24 \pm 0.87$  kcal/100 g energy content. The results of the mineral composition revealed that the noxious plant contains calcium ( $23,900.00 \pm 100.00$  mg/kg), magnesium ( $27,400.00 \pm 70.00$  mg/kg), sodium ( $1,520.00 \pm 6.50$  mg/kg), potassium ( $7,920.00 \pm 105.00$  mg/kg) and phosphorus ( $11,260.00 \pm 65.00$  mg/kg) as predominant elements. The levels of the microelements (copper, zinc, manganese and iron) are within the range of  $20.00 \pm 0.50$  to  $700.00 \pm 4.50$  mg/kg dry matter. Comparison of the results with the recommended dietary allowance (RDA) showed that whole *Typha domingensis* plant can be used in livestock feed formulation especially for goats and cows.

Key words: *Typha domingensis*, minerals, proximate, microelements and Recommended dietary allowance.

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## 1 INTRODUCTION

**T***ypha* is a genus of about eleven (11) species of monocotyledonous flowering plant in the family *Typhaceae*. The genus has a largely Northern hemisphere distribution, but is essentially cosmopolitan, being found in a variety of wetland habitat [1].

The most widely spread is *Typha latifolia*. However, *Typha domingensis* and *Typha angustifolia* are also as widespread. The species of interest (*Typha domingensis*) is a herbaceous, colonial, rhizomatous perennial

plant with long, slender, green stalks topped with brown and fluffy sausage shaped flowering head [2].

*Typha domingensis* is often among the first wetland plants to colonize areas of newly exposed wet mud, with its abundant wind dispersed seeds. It also survives in the soil for a long period with buried seeds [3]. It germinates best in sunlight and fluctuating temperature, which is typical of many wetland plants that regenerate on mud flats [4].

Most foods are always obtained through agriculture. However, with increasing concern over both the methods and modern industrial agriculture, there has been a growing trend towards sustainable agricultural practice and increased research on raw materials of feed formulation for livestock [5]. Food deprivation leads to malnutrition and ultimately starvation, for both human and livestock.

In Nigeria, the most important factor militating against rapid development in livestock production is the increasing unavailability and high cost of conventional feeds [6]. This has therefore threatened the potential for increasing animal feed production which is in short supply. The aim of the present study is to determine the proximate and mineral composition of whole *Typha domingensis* plant as this could serve as the basis for exploring the plant in ruminants feed formulation.

## 2 MATERIALS AND METHODS

Analytical reagent (Analar) grade chemicals and distilled water were used in the research. All the glass wares utilized were thoroughly washed with detergent solution, 20.00 % (v/v) nitric acid, rinsed with tap water and finally with distilled water. The apparatus were then allowed to dry [7].

### 2.1 Sample Location and Site Description

Bauchi is the capital city of Bauchi State in Nigeria. It is situated in the Northern part of Nigeria and located between longitude 9°49' North and latitude 10°17' East with an altitude of 6902 meter above sea level. It has a land area of 2840.51 km<sup>2</sup> with minimum and maximum temperatures of 13.7° C and 30.1° C respectively.

### 2.2 Sampling of *Typha* plant

Whole *Typha* plants with their rhizome were randomly obtained from ten (10) different sampling points along Ningi road, Bauchi,

Bauchi State, Nigeria on 16<sup>th</sup> January, 2013. The plant samples were thoroughly washed with tap water to get rid of extraneous and adhering substances and finally rinsed with water. The plant was identified in the Department of Biological Sciences, Abubakar Tafawa Balewa University, Bauchi as *Typha domingensis*. The sample was weighed, cut into pieces, air-dried under shade for two (2) months until a constant mass was obtained and finally weighed to determine the moisture content. This was then ground to powder using a previously cleaned and dried wooden pestle and mortar to obtain the finest possible powder for analyses. The powdered samples were then kept in screw-capped polyethylene bottles and labeled for analyses.

## 3 ANALYTICAL PROCEDURE

### 3.1 Proximate Analysis

The sample was analyzed for its proximate composition (moisture content, crude fibre, crude protein, crude lipid, ash content and available carbohydrate).

The Micro-Kjeldhal method was used for the determination of crude protein, the procedure adopted by Akintomide and Sylvester, 2012 [8] was used for the determination of crude fibre, while crude lipid was determined according to the method adopted by Ali, 2010 [9]. Moisture content was found based on the method adopted by Okoh *et al.*, 2011 [10], while the ash content was determined according to AOAC, 2003 method [11]. Available carbohydrate was calculated by difference and the energy content was estimated in kcal/100 g [12].

### 3.2 Mineral Analysis

Whole *Typha domingensis* sample solution was prepared by heating 1.00 g of the ground sample with 15.00 cm<sup>3</sup> of acid digestion mixture of HNO<sub>3</sub>, H<sub>2</sub>SO<sub>4</sub> and HClO<sub>4</sub> in a ratio of 5:1:1 (v/v) in a conical flask maintained at a temperature of 80° C

until a transparent yellow solution was obtained [13]. After cooling, the digest was filtered using Whatmann Filter Paper Number 42 into a 100 cm<sup>3</sup> volumetric flask and made to volume with water. The sample solution was transferred into a screw-capped plastic container and labeled appropriately. The concentrations of the metals in the sample solution were determined using Buck Scientific Atomic Absorption Spectrophotometer Model 210-VGP. The concentration of phosphorus was determined using standard colorimetric procedure by means of a Cecil UV/Visible Spectrophotometer Model 91743 [14].

#### 4. RESULTS AND DISCUSSION

The mean results of the proximate analyses of whole *Typha domingensis* plant are shown in Table 1. The plant has a high moisture content of 57.81 %. This value is

the highest proximate composition determined in the plant, which indicates that it contains a significant amount of moisture. This may be because it is a wetland plant. The value is within the reported literature moisture content range of 56.00 to 93.40 % in some green leafy vegetables consumed in Sokoto, Nigeria [15]. Afolabi *et al.*, 2013 reported a moisture content range of 61.95 to 72.07 % in browse leaves and tuber peels used as ruminant feeds [16]. High moisture content determined in this study is of disadvantage since low moisture content is a measure of stability, susceptibility of microbial contamination and is also important for storage purposes [7]. The high moisture content is an indication that the noxious weed must be dried for proper storage since moisture content greater than 15.00 % favours microbial growth [17].

**Table 1: Proximate Composition of whole *Typha domingensis* plant**

Parameters	Concentration (% Dry Mass)
Moisture Content	57.81 ± 0.42
Ash Content	9.08 ± 0.69
Crude Protein	8.86 ± 0.55
Crude Lipid	1.90 ± 0.09
Crude Fibre	17.46 ± 0.76
Available Carbohydrate	4.89 ± 0.18
Energy Content (kcal/100 g)	63.24 ± 0.87

Values are mean ± Standard error of the mean (n = 4).

The crude lipid content was found to be 1.90 % (Table 1). The value is higher than 0.38 % in *Ipomoea butatas* leaves [18], 0.92 % in Baobab leaves [19] and 0.62 % in peels of *Dioscorea alata* [6]. Fats are important in animal diets as they are source of fat-soluble vitamins that promote their absorption. They are also high energy nutrients that do not add to the bulk of the diet [20].

The ash level of the plant was 9.08 % which is higher than the reported literature values of 2.40 % in *Cinnamon* [21] and 6.70 % in *Adenantha pavonina* [20]. The ash content of a plant is an index of essential mineral components that are necessary for blood coagulation and prevention of some blood related ailments [22]. This suggests that the ash content of *Typha domingensis* is favourable in feed formulation; hence to formulate animal feeds using the plant, low

amount of ash will be required. A threshold level of 2.50 % ash content was earlier reported [7].

The mean crude fibre content of the plant was 17.46 %, which is lower than 29.00 % in *Momordica balsamina* leaves [23] and 33.00 % in *Cinnamon* [21]. The plant will therefore be suitable in feed formulation since ruminant animals (cattle, sheep, goat and deer) are able to ferment fibre for energy [24]. Fibre content is commonly used as an index of value in both poultry and feeding stock feeds [7] and it also lowers some diseases in animals [25].

The crude protein value was 8.86 %, which is higher than the reported literature value of subtle (5.00 %) which is commonly used as animal feeds in the North-Western Nigeria [12]. The determined value compares fairly well and can be described as being relatively adequate to meet the demand (10.00 %) for the body maintenance of sheep and goats [12].

Animal feeds containing less than 1.30 % nitrogen (8.00 % crude protein) are regarded as deficient as they cannot provide the minimum ammonia levels needed or required by ruminants [26], [27]. The plant is therefore considered as a good source of protein. Protein is the material which makes up muscle, skin, wool and most of the bodies of animals and hence needs to be provided in the diet of animals for the provision of meat, milk and eggs.

The available carbohydrate content of 4.89 % was determined. The value is very low when compared to 52.00 % in *Cinnamon* [21] and 39.05 % in *Momordica balsamina* leaves [23]. This suggests that the plant is a poor source of energy and could therefore be responsible for the low energy content obtained (63.24 kcal/100 g). The plant is therefore suitable for high temperature feed processes due to its low carbohydrate content [28].

**Table 2: Mineral Content of Whole *Typha domingensis* Plant (mg/kg) Dry Matter**

Mineral Element	Composition
Potassium	7,920.00 ± 105.00
Sodium	1,520.00 ± 6.50
Calcium	23,900.00 ± 100.00
Magnesium	27,400.00 ± 70.00
Copper	20.00 ± 0.50
Iron	700.00 ± 4.50
Manganese	470.00 ± 1.50
Zinc	43.00 ± 0.50
Phosphorus	11,260.00 ± 65.00

Values are mean ± Standard error of the mean (n = 4).

As shown in Table 2 above, whole *Typha domingensis* plant was found to have a potassium content of 7,920.00 mg/kg. The value is higher than the recommended dietary allowance (RDA) of 1,580.00 mg/kg for goats [29]. A potassium content of 1,548.00 and 896.00 mg/100 g in Yam and

Cassava peels that are respectively used as ruminants feed were reported [16]. Ruminants require up to 800.00 mg/100 g potassium in their feed [30]. Ruminant potassium requirements of between 50.00 to 80.00 mg/100 g were also reported [31].

This therefore shows that whole *Typha domingensis* plant is a potential and adequate source of potassium for livestock feed formulation. Potassium is essential to animals in hormone production, muscle function and also maintains acid/alkaline balance in their blood [29].

The level of sodium found in the invasive plant was 1,520.00 mg/kg which is lower than the respective RDA values of 5,150.00 mg/kg for goats and 16.00 g/day for cows [29]. This indicates that in formulating animal feed with the plant, other sources of the sodium mineral would have to be added so as to meet up with the RDA values of the herbivores. Sodium is important to animals in the regulation of the body fluids, gastric acid and the transportation of nutrients in the blood [29].

A calcium concentration of 23,900.00 mg/kg was determined in the noxious plant. This value is much higher than the RDA value of 2,980.00 mg/kg for goats, but less than 87.00 g/day for cows [29]. Afolabi et al., 2013 reported lower calcium levels of 780.00, 1,798.00 and 712.00 mg/100 g in *Albizia saman*, *Spondias mombin* and cassava peels respectively that were used as ruminants feed [16]. Reuter and Robinson, 1997 suggested calcium requirement for the maintenance of growing and lactating cattle and sheep to be between 120.00 and 260.00 mg/100 g [32]. However, a number of researchers also recommended calcium concentration of between 200.00 to 600.00 mg/100 g [26], [27], [33], [34], [35]. It therefore suffices to say that the level of calcium found in the plant is adequate in feed formulation. Calcium is needed by animals for bones and teeth development as well as for muscular, nervous system and heart functions [29].

The value of magnesium determined (27,400.00 mg/kg) in this study was much higher than the RDA (290.00 mg/kg) for goats and still higher than the RDA (24.00

g/day) for cows [29]. The value determined is also much higher than the reported literature value of 238.80 mg/100 g found in *Spondias mombin* [16]. The plant is therefore a potential source of magnesium for the ruminant animals. A 12.00 to 18.00 mg/100 g magnesium concentration was also reported to be adequate for ruminants [36]. Magnesium is a vital mineral element for animals as it is required for energy production, nervous system, and muscle tone and heart functions [29].

It is evident from Table 2 that whole *Typha domingensis* plant is a rich source of the mineral elements copper, iron, manganese, zinc and phosphorus respectively. The values determined (mg/kg) for copper (20.00), iron (700.00), manganese (470.00), zinc (43.00) and phosphorus (11,260.00) are respectively higher than their corresponding RDA values (mg/kg) of 9.00, 16.20, 0.93, 5.64 and 3,750.00 for goats. The level of iron determined (700.00 mg/kg) was also higher than the RDA value (516.00 mg/day) for cows. However, the concentrations of copper, manganese, zinc and phosphorus found in the weed plant are respectively lower than the corresponding RDA values of 206.00 mg/day, 688.00 mg/day, 688.00 mg/day and 64.00 g/day for cows [7], [29]. Other sources of these minerals (copper, manganese, zinc and phosphorus) would therefore have to be added in order to meet up with the requirements of the cows. Copper is important to animals in collagen synthesis and maintenance, enzyme function and red blood cells maturation [29]. Iron is an important component of haemoglobin and is involved in the transport of oxygen to cells. Iron deficiency rarely occurs except under conditions of parasitic infestations [29], [37]. Manganese is important to animals in bone and cartilage synthesis, enzyme system, reproduction and immune response [29]. Zinc on the other hand is also useful to animals in immune system,

epithelial tissue integrity and protein synthesis [29]. Finally, phosphorus is essential for the healthy growth of animals, carbohydrate metabolism and acid/alkaline balance in their blood [29].

## 5 CONCLUSION

The results of the proximate and mineral analyses of *Typha domingensis* plant revealed that the plant can be incorporated in feed formulation for cows and goats, as significant amounts of fibre, protein, ash and some mineral elements are present in it. However, other sources of minerals such as sodium would have to be added in order to meet up with the recommended dietary allowance (RDA) of both goats and cows. The mineral requirements of cows can therefore only be met when additional sources of phosphorus, manganese, copper, zinc and calcium respectively are incorporated during feed formulation.

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