



POTENTIAL OF *PROSOPIS CHILENSIS* (MOLINA) STUNTZ AS A NON-CONVENTIONAL ANIMAL FEED IN THE DRY LANDS OF SUDAN

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**ABSTRACT:** Animal grazing is considered an important economic practice in the developing countries, which goes hand-in-hand with agriculture. Both activities are largely dependent on climatic conditions. Under severe drought conditions, water required for maintaining agriculture and pasture lands becomes too scarce and hence constitutes the most limiting factor which directly affects the productivity for both agriculture and grazing lands. Under normal conditions, animal grazers utilize grass lands and pastures to avail fodder for their animals. However, due to the increasing number of grazing animals coupled with the deteriorating grazing capacity of the range lands, forest trees are often viewed as a good alternative for providing fodder to sustain livestock production. In the present study, the nutritional value for fruits of *Prosopis chilensis* (seeds and pods) at the lower Atbara river basin in north-eastern Sudan was investigated. The purpose of this study is to assess the nutritional features and potential of *Prosopis chilensis* fruits as an alternative fodder for livestock in the area. Field samples of fruits were collected each sample was kept separately in a small cloth kit. Chemical analysis of fruit samples was conducted to quantify the content of various nutritional attributes including: the crude protein, crude fibers, fats, starch, ash, and moisture content in addition to some minerals namely; P, Ca, Mg, Na, Cu and Fe. Chemical analysis revealed that CP was 18.61%, CF reached 13.40%, the starch content 15.14%, fat 2.06%, and ash content 7.50%. These values obviously point to the high nutritional values of *Prosopis chilensis* fruits. Mineral contents analysis also exhibited good amounts of Na and Ca required by livestock for adequate growth. Based on the present findings, it might be possible to assign *Prosopis chilensis* as a good alternative for provision of animal fodder to livestock, particularly when grazing conditions are far below the optimum. Further detailed studies on the capacity of *Prosopis chilensis* to provide animal fodder are needed.

**Key words:** *Prosopis chilensis*, fodder, fruit, nutritional value, Sudan.

## INTRODUCTION

In most tropical countries grazing for animal production depends primarily on grasslands where pastures provide the feeding demand for the animals. However, the use of browse species as fodder for ruminants is becoming increasingly important in many parts in the tropics including Sudan particularly when the quantity and the quality of pastures are poor for long periods [1]. Foliage and fruits from trees and shrubs have great potentials to provide both protein and energy supplements during the periods of feed gap or during drought [2, 3]. Tree fodder is rich in crude protein (CP), minerals and digestible nutrients than grasses [4, 5].

Some reports have documented that the use of tree legume fodder as supplement has improved feed intake, digestibility and animal performance [6, 7]. In Sudan, information on the nutritive value of trees and shrubs as feed to livestock is limited. Moreover, the experimental research on important native tree species are limited than those of the introduced tree species like *Leucaena* [8].

Generally due to the risk of in-ability of pasture lands to sustain feed supplies to livestock as a result of harsh environmental conditions such as drought, a recent growing concern has been directed to trees and shrubs as alternatives for animal fodder. Reports on the composition and nutritive value of *Prosopis chilensis* pods showed that they are a potential source of protein and energy [9]. The pods display as high as 35% sugar content and 10-12% crude protein [10, 11]. Seeds are sometimes ground in a concentrate for animal feeds as they are particularly rich in protein (32.5 %). In another investigation, [12] reported that the pods are rather poor in protein (9-13 % DM) and rich in fibre (crude fibre) 20-26 % DM.

In Sudan, *Prosopis chilensis* was introduced in 1917 by Massy [13]. Pods can be an adequate maintenance ration for goats and sheep particularly when the presence of other pasture plants is rather scarce in the long dry season. For livestock fattening, pods should be supplemented with a source of energy and protein [12]. The whole pod and seed of *Prosopis species* were evaluated to determine Ca concentration [9, 14, 15] and it was indicated that it ranged from 0.32 to 0.6% while P ranged from 0.08 to 0.41%. *Prosopis chilensis* has recently gained much concern and its potential utilization is still a matter of conflicting debate. On one hand, this species is viewed as a tree species, which constitutes a real hazard to the neighboring agricultural land it colonizes as it spreads quickly and exhausts the soil and thus creating competition with the other crops. On the other side, and in the light of the grazing problems for the livestock especially at times of forage scarcity, *Prosopis chilensis* seems to offer a practical answer for such a problem. Therefore, the present investigation was undertaken with the main aim to assess the potential of *Prosopis chilensis* as a possible fodder tree species for livestock. To realize that aim, the chemical analysis involving several nutrition attributes was performed in addition to determination of the mineral contents in pods (fruits) of *Prosopis chilensis*. Availability of such information regarding the suitability of *Prosopis chilensis* as forage-producing tree species will assist decision makers in both forestry and rangeland sectors to design rational plans to be implemented for optimal utilization of this valuable forest tree species.

## MATERIALS AND METHODS

### Samples collection

The fruits (pods) of *Prosopis chilensis* were freshly collected during 2009, considering the most frequently browsed fruits. Five random samples were manually collected from different trees at different sites in the study area. The fresh weights of these samples were immediately determined. Following weight determination, samples were stored in clean cloth bags. Samples were identified and labeled with botanical and local names.

### Sample preparation for laboratory analysis

The fruit samples collected were subjected to sun-drying and subsequently their moisture contents were immediately determined. The dry samples were ground to a fine powder, burned to ash and then treated with both HCl and HNO<sub>3</sub> acids in order to digest any residues of organic matter that might be present. Thereafter, all the acid-treated samples were filtered for conducting chemical analysis after the method of [16].

### Chemical analysis

To quantify the chemical constituents in *Prosopis chilensis* fruits collected, detailed proximate analysis was performed for the chemical components namely; moisture content, crude protein, crude fiber, ash content, fat and starch contents, which were determined by using the NIRS (NIRS=Near-Infrared Reflectance Spectroscopy) technique.

### Mineral content

To provide a more comprehensive image on the nutritional value of *Prosopis chilensis*, the proximate analysis was supported by analysis of mineral contents in pods of *Prosopis chilensis*. Fruits minerals content was done to determine the concentration for phosphorus (P), calcium (Ca), sodium (Na), potassium (K), magnesium (Mg), iron (Fe) and copper (Cu) according to the methods described by [17]. Potassium and sodium were analyzed by flame-photometer (Corning EEL 100) while calcium, magnesium, iron and copper were determined by atomic absorption spectrophotometer (2380 Perkin Elmer) and phosphorus was determined by the spectrophotometer (SP 6-200 Unicam).

## RESULTS AND DISCUSSION

The current work was intended to shed light on the contribution of *Prosopis chilensis* as a possible alternative fodder tree species. The study was based on the assumption that *Prosopis chilensis* fruits (pods) could be suitable for grazing provided that during the dry period the grazing possibilities of rangelands and natural pastures are rather limited. Such a situation imposes a great pressure on livestock owners to seek solutions to sustain their livestock investment. In many communities around the globe, some forest trees are thought to be suitable and can be utilized for this purpose. In the present investigation, our findings with regard to the chemical composition of *Prosopis chilensis* fruits have shown that the crude protein was found to be 18.3% (Table 1.), which is obviously higher than that reported by other workers [11, 12] for *Prosopis chilensis* pods as 9-13% and 10 -12 % CP, respectively. This might be attributed to the considerable share of the seeds in the protein content as the *Prosopis chilensis* fruit in this study was totally analyzed and included both seeds and pods. On the other hand, the CP determined in this study was found to be lower than what has been reported in another work conducted by [10] with *Prosopis chilensis* seeds (32.5 % CP). The crude fiber (CF) content detected in the present study was 13.4%. That amount was relatively lower than the values reported by [12] for the tree pods as 20 -26%. The observed difference might be in part due to lower values of cell wall fraction in the seeds which were included in the chemical analysis in this investigation.

**Table 1: proximate analysis of *Prosopis chilensis* pods**

Parameter	Composition
DM	82.7%
CP	18.6%
CF	13.4%
Starch	15.14%
Fat	2.06%
Ash	7.5%

The mineral concentrations of *Prosopis chilensis* pods were determined as presented in Table 2. To date, information regarding minerals content in browse species, particularly microelements is not sufficiently available. The present results indicated that calcium, Ca content was (0.8%), which is well within the range of values reported in similar studies [9, 14, 15] as (0.3%-0.7%), while the phosphorus, P content in the current findings was (0.19%), which was similar to the value reported by [18, 19] for the whole pod of *Prosopis chilensis* tree, indicating that they contain sufficient amount of calcium and phosphorus, but the contents vary depending upon some factors mainly season and soil type.

**Table 2: Mineral Concentration of minerals in *Prosopis chilensis* pods**

Mineral	Concentration
Ca	0.80%
P	0.19
K	1.85%
Mg	0.18%
Na	996 ppm
Fe	55 ppm
Cu	12 ppm

## CONCLUSIONS

Dry lands, in which tropical Africa is no exception contain a rich wealth of indigenous fodder tree and shrub species which are regarded as an important source of fodder for livestock. However, only little is known about the nutritive value for most of these species identified. The present findings showed that the chemical composition as well as the mineral concentrations of *Prosopis chilensis* fruits were within the ranges reported elsewhere with the same browse species. The rich content of *Prosopis chilensis* fruits (pods) with protein, energy and mineral concentration might give a strong indication that *Prosopis chilensis* is potentially a suitable fodder tree that can meet the grazing requirements of livestock for the sustainability of animal production. Our current results likely encourage conducting further experimental work on *Prosopis chilensis* to enrich knowledge on the nutritional value of this important forest tree species.

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