Indigenous knowledge and identification of local woody plant species as potential feeds for goats in the communal farming areas of Namibia

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Abstract

A survey was conducted through farmer's interviews to describe indigenous knowledge on local woody plant species that could be used as supplements for ruminants during the dry season. A structured questionnaire was used to obtain common woody plant species that were utilized by ruminants in Omatako, Guinas, Tsandi, Daurês, Gibeon and Kongola constituencies located in communal farming areas of Namibia. Households were randomly selected using purposive sampling strategy which focused primarily on livestock keepers. A sample of sixty (60) households (10 per constituency) was interviewed for the identification of woody plant species.

Most households interviewed were male-headed (73 %) aged between 41- 60 years (43 %) and who had at least primary (53.3 %), secondary (35.0 %) and very few with no education (3.3 %) background. The highest number of cattle (39 %) and goats (31 %) were recorded in Guinas, sheep (77.7 %) in Gibeon and chicken (34.1 %) in Kongola. *Acacia erioloba* and *Combretum apiculatum* were most listed across all the constituencies, and *Acacia hereroensis*, *Combretum collinum* and *Rhigozum trichotomum* were the least common species listed as they were confined to certain locations. The study observed that 47 % of farmers recognised the importance of woody plants such as pods and leaves as feeds for livestock. However, 53 % respondents indicated that woody plant pod collection was not part of their animal feeding practice, anticipated that animals would source the pods on their own during grazing. The reason for this could be that farmers had inadequate knowledge on pods collection, processing, and how they should be included in the animal feeding rations. *Colophospermum mopane*, *Ziziphus mucronata*, *Grewia bicolor*, *Acacia erioloba* and *Terminalia sericea* were used in the treatment of diarrhoea in cattle and goats, whereas, *Boscia albitrunca* was used to improve fertility in breeding bulls. The study concluded that farmers had

profound knowledge of the predominant woody plants species utilised by ruminants and their multiple uses. Furthermore, there is need to integrate the chemical and nutritional value (animal feeding) of the leaves and pods.

Keywords: *ethno-veterinary medicine, indigenous knowledge, livestock farmers*

Introduction

Namibia has a diverse vegetation of woody plants and shrubs which form part of the diet of grazing livestock on natural rangelands. The study focused on communal areas of Namibia, which is dominated by subsistence mixed crop-livestock farming system (Marius et al 2012). Livestock rearing is considered as a major source of income for the majority of resource-poor farmers in these areas. In most developing countries in Africa, research has shown that, sustainable production of livestock usually involves efficient utilization of locally available resources, predominantly feed and remedies (Chepape et al 2011). Similarly, most people living in the rural areas, especially the low income groups, rear livestock on diets consisting of high quantities of indigenous plants. Communal farmers rely on their visual observations and experiences in feeding and health management of livestock (Kavana and Msangi 2005) and ethnobotany or traditional healers (Cheikhyoussef et al 2011) in the use of indigenous plants**.** However, the low quality and quantity of available forages during the dry season are major constraints for improved livestock production in these areas.

Like in many rural areas of Namibia, the available grazing is not generally sufficient to meet the maintenance requirements of grazing animals (Katjiua and Ward 2006) during the dry season. Woody plant species form a major source of animal feeds in Africa, and are highly valued by rural and peri-urban communities. These woody plants have multiple roles in helping the people to meet their basic needs such as feed, fire wood, timber and building materials, wood carving and as human and veterinary medicines (Mannheimer and Curtis 2009). Woody plants contain appreciable amounts of nutrients that are deficient in other feed resources such as grasses during dry period of the year. Fodder trees and shrubs have deep root systems enabling the extraction of water and nutrients from deep down in the soil profile. Most browse plants have high crude protein, ranging from 10 to more than 25 % on a dry matter basis (Moleele 1998; Aganga and Mesho 2008). The reliable amount of protein in the browse resource can be used to develop a sustainable feeding system and increase livestock productivity. Different communities have their own knowledge about plants and their uses. Farmers have an impressive knowledge of browse species (Komwihangilo et al 2001). Involving farmers in the process of data collection is important because as potential users of new technologies to be developed, their knowledge and preferences are critical (Haugerud and Collinson 1990). However, some of the knowledge is likely to be distorted or lost completely if transfer is not done continuously from one generation to another.

The study was conducted to describe indigenous knowledge and identify feed resource available in the six constituencies of Namibia. Further, to assess gender, age, the level of education of farmers, utilization of the woody species as animal feeds, ethno-veterinary knowledge and number of livestock species available.

Materials and methods

Location of the study area

Namibia is divided into 14 regions and subdivided into 121 constituencies under which cascaded districts, towns, settlements and villages. A settlement is a place occupied by people, which may further develop into a small town. A constituency consists of different villages, which are further subdivided into many households, each representing a family unit. There are currently 121 constituencies in Namibia, the number and size of each constituency varies with the size and population of each area. This study focused on six constituencies mainly; Omatako, Guinas, Daurês, Tsandi, Gibeon and Kongola situated in communal farming areas of Namibia. In Gibeon and Kongola, the constituency structure is defined into households and no distinct villages per se.

Table 1 shows the description of the study constituencies. There is diversity of farming systems in Namibia, due to different amount of rainfall received and hence vegetation type in each Region. The annual mean temperature in winter ranged between 3 and 10 ºC and the mean temperature in summer ranged between 10 and 36 ºC. Otjozondjupa Region is characterized by Thorn bush savanna with mean rainfall that ranged between 266- 505 mm and therefore limited to livestock farming. Oshikoto Region, the mean rainfall is slightly higher (550-660 mm) defined with mixed trees and shrubs suitable for mixed crop and livestock farming. Hardap Region in the southern part of the country is dominated by Dwarf shrub savanna, suitable for sheep and goats farming. Zambezi region tended to have the highest rainfall in the country, and is described by Forest savanna and woodland with mixed crop-livestock farming system (Mendelson 2006; Sweet and Burke 2006; Jürgens et al 2010; Marius et al 2012).

Table 1. The description of the study locations

Region	Constituency	Settlement/ Village	Geographical coordinates	Mean annual rainfall	Mean temperature
Otjozondjupa	Omatako	Ovitoto	21.97733S 17.21905 E	266-505mm	3°-36° C
Oshikoto	Guinas	Oshivelo	18.57014 S 17.20885 E	550-660mm	3°-40° C
Omusati	Tsandi	Omakange	18.14556 S 14.29066 E	270-300mm	10°-30° C or above
Erongo	Dâures	Omatjette	21.05431 S 15.50664 E	100-350mm	3°-36° C
Hardap	Gibeon	Gibeon	25.12689 S 17.77933 E	100-300mm	1°-36° C
Zambezi	Kongola	Kongola	17.82136 S 23.39718 E	500-900mm	10°-36° C or above

Source: Mendelssohn 2006; Sweet and Burke 2006; Jürgens et al 2010; Marius et al 2012

Survey sampling strategy

The target population of the study was defined as consisting primarily of livestock keepers in Omatako, Guinas, Tsandi, Daurês, Gibeon and Kongola constituencies. Households were randomly selected using purposive sampling strategy. Figure 1 shows Map of Namibia showing the survey way-points in each constituency. Geographical point system (GPS) point-reading was used to identify and mark the centre and evenly space the points in the village at distance of 5 to 15 Kilometres apart. Households without livestock species were not interviewed.

Questionnaire administration

A structured questionnaire was used to interview face to face with farmers in the local language spoken in each of the study locations. A sample of sixty households (10 per location) was obtained for the identification of local feed resources. Data were collected from Omatako, Guinas, Tsandi, Daures, Gibeon and Kongola constituencies in January 2014.

Statistical analysis

Data analysis was performed using Statistical Package for Social Sciences (SPSS 2013) Version 21 software and descriptive statistics (percentage or proportions and frequencies) were presented.

Figure 1. Map of Namibia showing constituencies and distribution of the survey way-points around each constituency

Results and discussion

Socio-demographic description of the respondents

Table 2 shows gender, age and level of education of the household head per study location. A total of 60 livestock keepers and herders with profound knowledge on plant species browsed were interviewed, of which 73 % were males and 27 % females. This could be attributed to the fact that more households were headed by males and in their absence; the respondents were predominantly male herders.

Table 2. Proportion (%) of gender, age and level of education of the respondents (10 respondents per study location)

	Location						
	Omatako	**Guinas**	**Tsandi**	**Daurês**	**Gibeon**	**Kongola**	**Total**
Gender							
Female	40	20	40	20	20	20	16
Male	60	80	60	80	80	80	44
Age							
21-40	10	30	50	10	10	20	13
41-60	50	50	50	40	40	30	26
>60	40	20	0	50	50	50	21
Level of education							

Primary	60	60	30	70	40	60	32
Secondary	30	20	70	20	50	20	21
Tertiary	10	20	0	0	0	20	5
No education	0	0	0	10	10	0	2

The largest (43 %) group consisted of individual between 41-60 years in all the locations. Komwihangilo et al (2001) and Chepape et al (2011) reported similar gender, age group, and that pensioners (older people) were readily available and had profound knowledge on plant species browsed by animals. The majority of the respondents had at least primary education (53.3 %) followed by those with secondary level (35.0 %), tertiary education (8.3 %) and very few with no education (3.3 %) background. In contrast by Chepape et al (2011) who reported more illiterate respondents in the study. This observation implies that educated individuals are more likely to adopt the new feeding strategy generated by the study.

Livestock species reported by respondents

Table 3 below indicates livestock species in the study locations. Livestock provides a livelihood to the majority of the people in communal areas in the study. Among livestock species, cattle, goats and chicken were commonly kept in the study locations. The highest number of cattle (39 %) and goats (31 %) were recorded in Guinas, sheep (77.7%) in Gibeon, chicken (34.1 %) in Kongola and donkeys (36.7 %) in Daurês.

Table 3. Proportion (%) of livestock species in the study (10 respondents per study location)

	Location						
	Omatako	**Guinas**	**Tsandi**	**Daurês**	**Gibeon**	**Kongola**	**Total**
Cattle	11	39	12	20	5	13	2620
Goats	28	31	20	16	24	0.3	2950
Sheep	18.4	0.3	2.8	0.7	77.7	0	683
Pigs	0	75	6.3	0	18.8	0	16
Chicken	13.1	23.3	10.7	10.2	8.5	34.1	656
Donkeys	5.5	12.5	21.9	36.7	23.4	0	128

Keynote: Zero (0) means the species was not listed

Guinas constituency is located in Oshikoto Region where cattle and goat numbers were higher than in other northern Regions namely; Oshana, Omusati and Ohangwena (MAWF 2014). The average annual rainfall varies from 550-660 mm and the area is characterized by bush shrubs suitable for goat farming (Table 1), however, very few sheep were listed as these were mostly found in the southern part of the country. The southern part of the country is dominated by dwarf shrubs savanna that also associated with low rainfall, however, suitable for both goat and sheep farming. There was no sheep, pigs and donkeys recorded in Kongola, and pigs were not kept in Omatako and Daurês constituency. The result is in agreement with those reported by Mendelsohn (2006) who did not found similar livestock species in Kongola. The reason for this could be attributed to the culture, tradition and religious of the farmers in each study constituency.

Utilization, availability and accessibility of local woody plant species

Respondents indicated predominant woody species in their locations as shown in Table 4. In Omatako constituency, *Combretum apiculatum, Ziziphus mucronata and* fewer *Acacia mellifera and A. erioloba* species listed by 80, 70, 50 and 30 % respondents respectively. The predominant trees and shrubs indicated by the respondents in Guinas Constituency were namely; *Terminalia sericea* by 90 %, *Terminalia prunioides and Bauhinia petersiana* (10 %) lowest. In Tsandi constituency, *Combretum apiculatum* (70 %), *Colophospermum mopane* (50 %), *Catophractes alexandri,* and *Terminalia prunioides* (60 %) were the predominant woody species mentioned by respondents in the study. In Daures constituency, *Acacia karoo* (90 %) and *Catophractes alexandri* (60 %) were the most abundant woody species in the area mostly browsed by goats. In the southern part of the country (Gibeon), *Acacia mellifera* (50 %), *Rhigozum trichotomum* (90 %) *and Catophractes alexandri* (60 %) were the most dominant browse species and formed a large part of the small-stock diet. *Baphia massaiensis, Combretum collinum* and *Terminalia sericea* were the predominant woody species mentioned by the respondents in Kongola constituency. Respondents identified the woody species they have listed and the researcher's opinion was very important as some local woody plant names were based on genus only and not specific to the species name. As per information obtained in the survey, several species were limited to certain constituencies.

Table 4. Proportion (%) of farmers that identified woody plants species in the study locations (10 respondents per location)

Woody species	**Location**						
	Omatako	**Guinas**	**Tsandi**	**Daurês**	**Gibeon**	**Kongola**	**Total**
Acacia erioloba	30	60	20	40	10	20	18
Acacia hereroensis	-	-	-	10	-	-	1
Acacia karoo	-	-	-	90	30	-	12
Acacia mellifera	50	40	20	40	50	-	20
Baphia massaiensis	-	30	-	-	-	70	10
Bauhinia petersiana	-	10	10	-	-	-	2
Catophractes alexandri	20	-	50	60	60	-	19
Colophospermum mopane	-	-	50	20	-	-	7
Combretum apiculatum	80	20	70	30	10	30	24
Combretum collinum	-	-	-	-	-	80	8
Dichrostachys cinerea	20	50	10	10	-	-	9
Grewia bicolor	-	60	10	-	-	-	7
Philenoptera nelsii	-	60	30	-	-	30	12
Rhigozum trichotomum	-	-	-	-	90	-	9
Terminalia prunioides	10	10	60	30	-	-	11
Terminalia sericea	-	90	20	-	-	50	16
Ziziphus mucronata	70	-	-	50	10	-	13
Total	28	43	35	38	26	28	

Keynote: Values based on multiple responses; the dash (-) means the species was not listed

Table 5 shows the responses of respondents with regards, to woody plants available and whether it a tree or shrub. Respondents also indicated the edible parts of the plants, and the animal species mostly consuming the part. Respondent showed that leaves were the most consumed but pods of some woody species were also consumed. The local name used in the description is related to the language spoken in each constituencies were the woody plant is found.

The proportion of respondents (47 %) indicated to harvest pods and leaves for animal feeding was lower compared to those who do not practice at all. The results were in agreement with those reported by Komwihangilo et al (1995) in Central Tanzania, were farmers harvested pods and stored them in homes for the purpose of feeding calves and sick animals which could not walk long distances in search of water and feed during the dry season. The same results were also found in Kindness et al (1999) who indicated that livestock owners harvested and stored pods for dry season feeding.

Figure 2 shows the farmers problems in accessing the woody plant pods. In this survey, more respondents (53 %) did not harvest pods even if available, but could be useful feed resources for their livestock. Respondents assigned various reasons as to why they do not harvest woody plant pods. Some indicated that, woody pods do not easily dropped-off from the tree and difficult to harvest. Animals were allowed to find woody plant pods on their own during grazing/browsing, regardless whether they were accessible or not. In South Africa, Chepape et al (2011) reported farmers complained that browse harvest was somehow time consuming and laborious. Some respondents indicated that woody plant with pods were rather scarce in their farming surroundings. The author agreed that this situation could be true in Gibeon constituency, as it is dominated by dwarf shrubs mainly of *R. trichotomum* though highly favoured by goats, it do not bear fruits pods. The small stocks browse substantially on shrubs and can thrive in areas where cattle could only be farmed at very low stocking rates (Mendelsohn 2006).

Table 5. Woody plants, their edible parts and animal species identified by farmers in the study locations

Local Name	Common Name	Botanical name	Edible part	Habitat	A
Omwoonde (Osh), muhoto (Loz)	Camel-thorn	Acacia erioloba	Pods	Tree	C
Oroo (Otj)	Mountain-thorn	Acacia hereroensis	Leaves	Tree	C
Orusu (Otj)	Sweet karoo	Acacia karoo	Leaves & Pods	Tree	C
Okadhilankono (Osh), omusaona (Otj)	Black-thorn acacia	Acacia mellifera	Leaves & Pods	Tree/shrub	C
Ofufe (Osh), isunde (Loz)	Sand camwood	Baphia massaiensis	Early leaves	Shrub	C
Ofufe (Osh),	White bauhinia	Bauhinia petersiana	Early leaves	Shrub	C
Okalyadi (Osh), omukaravize (Otj)	Trumpet-thorn	Catophractes alexandri	Leaves	Shrub	C
Omusati (Osh),	Mopane	Colophospermum mopane	Early leaves	Tree/shrub	C
Omumbuti (Otj)	Kudu bush	Combretum apiculatum	Leaves	Tree	C
Mutobo (Loz)	Variable combretum	Combretum collinum	Leaves	Tree	C
Ongete (Osh), muselesele (Loz)	Sickle bush	Dichrostachys cinerea	Leaves & Pods	Tree/shrub	C
Omushe (Osh)	Two-coloured raisin-bush	Grewia bicolor	Leaves & fruits	Shrub	C

Omupanda (Osh), mukololo (Loz)	Kalahari apple-leaf	Philenoptera nelsii	Leaves	Tree	C
Driedoring (Afr),	Three-thorn rihigozum	Rhigozum trichotomum	Leaves	Dwarf shrub	C
Omuhama (Otj)	Purple-pod Terminalia	Terminalia prunioides	Leaves	Tree/shrub	C
Omugolo (Osh), muhonono (Loz)	Silver teminalia	Terminalia sericea	Leaves	Tree/shrub	C
Omukaru (Otj)	Buffalo-thorn	Ziziphus mucronata	Leaves & fruits	Tree/shrub	C

Local languages which were used in the study were; Afrikaans (Afr), Otjiherero (Otj), Oshiwambo (Osh) and Lozi (Loz)

With regards to accessibility of leaves and pods, out of 60 respondents from study locations, 47 % indicated that they collected pods to feed their animals during the dry period. Whilst, 53 % respondents indicated that they do not collect pods or cut tree leaves for the purpose of feeding animals.

Farmers assigned various reasons as to why they do not collect woody plant pods as is indicated in Figure 2. The respondents were asked to state if they collect pods for animal feeding purpose. Of the 53 % who stated that they do not practice pod collection, 33.3 % of the respondents indicated that they just allow animals to find pods and leaves on their own during grazing. Others (8.3 %) mentioned that it was rather a difficult task to harvest or collect pods, and some do not fall from the tree (6.7 %). The least number of respondent indicated that woody species with pods were scarce around their farming areas (5 %).

Figure 2. Problems indicated by farmers in accessing the woody plant browses

Ethno-veterinary knowledge

Farmers showed practical indigenous knowledge of medicinal properties of woody plant species as outlined in Table 6. *Colophospermum mopane*, *Ziziphus mucronata*, *Grewia bicolor*, *Acacia erioloba* and *Terminalia sericea* were used to treat the condition of diarrhoea in cattle and goats. *Boscia albitrunca* leaves were used to improve fertility in breeding bulls. Tree or shrub roots were the common plant part used in the treatment of animal diseases.

Table 6. Farmers' indigenous knowledge of medicinal properties of woody plant species

Item	***Colophosperm-um mopane***	***Ziziphus mucronata***	***Grewia* species and *Acacia eriolo***
Part used	Leaves	Leaves and early stems	Roots
Animal Species	Cattle	Adult cattle and calves	Goats and cattl
Usage form	Leaves are grounded, mixed with water and given to the animal orally	Leaves and stems are grounded, added to boiling water, cooled, before it is given to the animal orally.	Grounded roots are so warm water, cooled ar to the animal oral
Nature of disease/	Diarrhoea	Diarrhoea and retained placenta in cows	Diarrhoea

The result indicated that farmers used woody species to treat different animal diseases and reproductive disorders. Tree leaves and roots of *Colophospermum mopane*, *Ziziphus mucronata*, *Grewia bicolor*, *Acacia erioloba* and *Terminalia sericea* were dried, grounded in to powder, mixed with water and the solution was offered to the sick animal. In addition, farmers in all constituencies indicated the value of *Aloe* plants as it was used to treat all general livestock diseases. However, the *Aloe* plant was not included in the list of woody species because it is an herb and not consumed by animals. The observation is in agreement with Mannheimer and Curtis (2009); Mablebyane (2010); Chepape (2011) who reported various multiple roles of woody plants including for veterinary medicines. More research is required to investigate the ethno-veterinary knowledge of the woody plants.

Conclusions and recommendations

- Respondents were knowledgeable in predominant woody plants utilized by livestock and that this could add value to feeding practices during dry period.
- Farmer's indigenous knowledge on plant species studies helped in easier identification of woody plants utilized by livestock, and their various uses on etho-veterinary practice.
- It is important to support farmer's knowledge with chemical composition of the leaves and pods and their response on animal feeding.

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