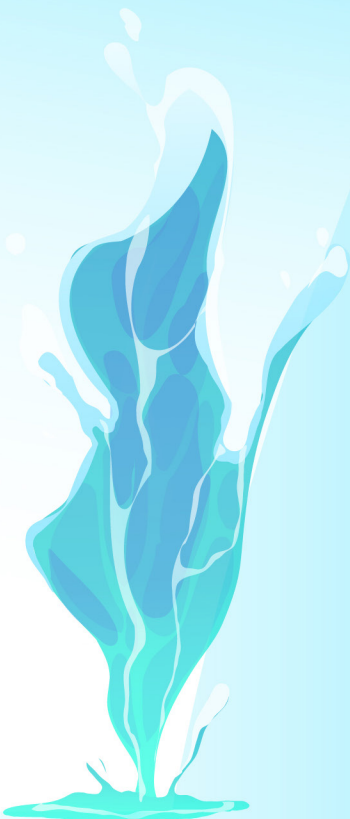




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## Assessment of the Nutritional Value and Practical Viability of Yeheb (*Cordeauxia Edulis*) Foliage as a Prominent Camel Feed During Dry Seasons in Bokh Woreda, Dollo Zone, Ethiopia

Abdurezak Ahmed Tahir<sup>1\*</sup>, Ahmed Ugaz Guntane<sup>1</sup>, Mohamed Hassen<sup>1</sup>

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### ABSTRACT

This study assesses the nutritional value and practical viability of Yeheb (*Cordeauxia edulis*) foliage as a prominent camel feed during dry seasons in Bokh Woreda, Dollo Zone, Ethiopia. Yeheb is an indigenous drought-resistant shrub tree that plays an important role in pastoralist communities, although its nutritional value and effect on camel feed remain un researched so far. A mixed research methods approach consisting of Household surveys, Field observations, and laboratory analysis was used to evaluate the Nutritional composition, availability, and utilization of Yeheb foliage. Findings indicated that Yeheb is widely recognized as an essential forage, with 91% of respondents regularly using it as camel feed, particularly during the dry season. Laboratory analysis showed that Yeheb contains moderate crude protein (9.6%), high dry matter (94.92%), and significant fiber content, making it a viable supplement for sustaining camel health and productivity. Furthermore, pastoralists described benefits such as increased body condition, weight gain, enhanced milk production, and boosted drought resilience among camels consuming Yeheb. Nevertheless, challenges such as overgrazing, excessive cutting, and limited awareness hinder its optimum utilization. To increase its widely use, the research recommends increasing awareness among pastoralists, implementing conservation approaches, and encouraging the cultivation of Yeheb to ensure future availability. Strengthening local knowledge and management practices could help integrate Yeheb into sustainable camel feeding systems, thereby improving pastoral resilience in the study area.

### INTRODUCTION

*Cordeauxia edulis* (Leguminosae), commonly called Yeheb or Yicib (in Somali), is a small tree or shrub species endemic to Ethiopia and Somalia. It is hardy to drought and a source of food to both animals and humans. *Cordeauxia edulis* Hemsl., locally called yeheb, is a multi-branched evergreen shrub that belongs to the family Fabaceae or Leguminosae (Ali, 1988). It is highly branched bush with thick and vertical branches, with an average height of 2-3 meters but it can grow up to 4m high in sheltered spots. It has a taproot system up to 3 m deep with small secondary rhizomes near the surface and nodules on younger roots. *C. edulis* is a drought resistant and desertification tolerant plant. For optimal plant development, average temperature and rainfall requirements are 25°C – 28°C and 85-400 mm/year, respectively. It grows on red, alkaline, low nitrogen content, fine to coarse sand or grit to loamy textured, sandy soil (Convention on Biological Diversity (CBD), 2009 Ethiopia's 4th Country Report). *C. edulis* prefers elevated stands, where no water accumulates.

It is a multi-purpose plant where most parts of the plant are used. It is an evergreen shrub and produces seeds called Yeheb nut (Katz, 2008). The seeds are edible and eaten fresh, roasted, boiled or dried (Teketay & Eshete, 2004). The nut is the staple food for the local people, which is the same as rice and dates. (Kazmi, 1979). Additionally, due to its nutritious food, the local people

in the border line between Somalia and Ethiopia often prefer to as a staple food like maize and sorghum. The harvested nut is sold on the market and even exported to the coastal cities of Somalia as source of income to the local people (Miège & Miège, 1978; Bally, 1966; Mussa, 2010; Brink, 2006).

*Cordeauxia edulis*, commonly known as Yeheb or Yicib in Somali, is a resilient small tree or shrub species endemic to the arid regions of Ethiopia and Somalia (Ali, 1988; Farah, 1994). Belonging to the Fabaceae family, this highly branched, evergreen plant is well adapted to drought conditions and plays a crucial role in the local ecosystem as a source of food for both humans and animals (Ali, 1988; Kuchar, 1995).

*Cordeauxia edulis* not only provides nutritional benefits but also holds cultural significance in the regions it inhabits. Its adaptability and ecological importance make it a vital species for promoting biodiversity and sustaining livelihoods in its native habitats (Farah, 1994).

Camel rearing is an important source of livelihood for many pastoral communities in the dry lowlands of Ethiopia specially somali region. However, prolonged dry seasons pose severe challenges due to shortage of adequate forage. This often leads to poor health and low productivity of camel herds. Yeheb (*Cordeauxia edulis*) is an indigenous shrub species that remains green during severe drought and only available in the border between Somalia and Ethiopia.

<sup>1</sup> Somali Region Livestock and Agricultural Research Institute (Formerly SoRPARI), P.O. Box, 398, Jigjiga, Ethiopia

\* Corresponding author's e-mail: [guntanemuh@gmail.com](mailto:guntanemuh@gmail.com)

Camel rearing is a vital economic activity in the arid regions of Ethiopia, especially in the Bokh woreda, where pastoralists depend heavily on camels for their livelihood. However, prolonged dry seasons often lead to a severe shortage of feed, threatening camel health and productivity. This research aims to assess the nutritional composition of Yeheb (*Cordeauxia edulis*), a drought-resistant shrub native to the border between Ethiopia and Somalia, and its potential as a reliable feed resource during dry periods.

Yeheb (*Cordeauxia edulis*), locally known as Yicib or Yeheb, is an evergreen shrub endemic to arid and semi-arid regions of Ethiopia and Somalia. Known for its resilience to drought, the shrub has been traditionally used by pastoral communities as a supplementary feed for livestock, particularly camels, during periods of feed scarcity. Despite its potential, limited scientific research exists on the nutritional value and suitability of Yeheb foliage as camel feed.

Its foliage could potentially address dry season feed scarcity for camels. However, its nutritional composition and suitability as camel feed is not well documented so that this study will contribute the literature gap of the Nutritional aspects of yeheb foliage as camel feed during the dry season.

The primary objective of this study aims to evaluate the nutritional composition and significance of yeheb foliage (*Cordeauxia edulis*) as a key feed resource for camels during the dry seasons. Specifically, this research aims to determine the nutritional profile of yeheb foliage, assessing its essential nutrients and overall quality. Additionally, the study will explore the importance of yeheb as a feed resource for camels, focusing on its availability, palatability, and potential impacts on camel health and productivity during periods of feed scarcity. Based on the findings, the study will also provide recommendations for effectively utilizing yeheb foliage as a prominent camel feed in Bokh Woreda, Dollo Zone.

## LITERATURE REVIEW

*Cordeauxia edulis* has multiple stems, long root system that reaches the deep moisture and makes the bush stay green all year round and the taproot, which is up to three meters long, has small secondary rhizomes close to the surface (National Academy of Science [NAS], 1979). The lateral roots extend at 10 to 40 cm under the soil surface. There are many red glands on the underside of the leaves and stem. The leaves have an extremely thick cuticle and mesophyll consisting of palisade cells with lateral walls capable of folding in a concertina like way (Brink & Belay, 2006). Hemsley in 1907 named the yeheb, a bushy Caesalpiniaceae from the Amherstieae tribe, after Captain Cordeaux, who first obtained botanical samples of it in the Ogaden area, Ethiopia, in regions near to Somalia in the ex-Italian territories. It is a bush well adapted to semi-arid regions. It is also exotic in Israel, Kenya, Sudan, Tanzania and Yemen (Ali, 1988). It blooms during the rainy season once or twice if the rainfall is abundant. The

flowers are yellow and the plant starts to produce pods at an age of three to four years, which contains one to four seeds (NAS, 1979). *Cordeauxia edulis* is found to grow at an altitude of 100-1000 meter on sands locally called 'haud' (Booth & Wickens, 1988). Its native area is characterized by red colored sandy soil which is extremely low in nitrogen (Drechsel & Zech, 1988). The area where it grows is one of the most important livestock producing areas in Somalia (Somali agricultural technical group [SATG], 2004). The fodder value of the leaves is comparable to other tropical tree legumes (Drechsel & Zech, 1988). Two forms of *C. edulis* are known; the smaller Suley from Northern Somalia and the taller and more common Moqley (Soderberg, 2010). Suley is pale green with large leaflets, stem thickness, and the pods contain several smaller seeds and have a bit higher protein and fat contents while Moqley is dark green and have small leaflets, stem thickness, and the pods contain one large seed and less protein and fat contents (Yusuf, 2010).

## MATERIALS AND METHODS

### Description of Study Area

#### Location

Bokh is one of the district under Dollo zone in the Somali Regional State (Figure1). The only place where yeheb now occurs in Ethiopia. Over 85% of the human population of Bokh is pastoralist and dependent upon livestock. The area is arid, with a total annual rainfall of 150–250 mm that falls in two rainy seasons of varying reliability; the two pronounced dry seasons are each of at least 5 months' duration.

The south-west monsoon brings the main rains in March/April to May/June; the north-east monsoon brings rain in October–November. The area is frost free with a mean annual temperature of 28 °C. Altitude is 300–1,000 m. The mean monthly wind speed is 2–3 km h<sup>-1</sup> except during the south-west monsoon, when it is 4–5 km h<sup>-1</sup>. Mean annual potential evapotranspiration is 1,700–2,600 mm (Drechsel & Zech, 1988; Yusuf, 2010).

Its geographical feature is semi-arid plateau with thick browsing vegetation and localized grazing areas. It's known for its dominance of the yeheb plant that favors the type of soil which mostly red and sandy which is rich in ferrous oxide and absorbs water quickly.

#### Research Design

This study employs a mixed-methods approach, consisting of a survey to assess local knowledge and perceptions of Yeheb foliage, along with a laboratory experiment to analyze its nutritional composition. The research is conducted in Bokh woreda selected its reliance on Yeheb as a feed resource.

#### Sampling Design

Three kebeles were purposively selected from the Woredas based on their access to Yeheb. The kebeles include Gamberey, Dab-habalan and Maaneed. A total of 100 households were selected for the survey using a

proportional allocation method of Yamane's Formula:  
 $n = N / (1 + N * e^2)$

Where,

- n = Required sample size
- N = Population size (total of all groups)
- e = Margin of error (in decimal form, 10% = 0.10)

### Sample Size Determination

The sample size was determined by using a simplified formula provided by Yamane to determine the required sample size at Margin of error (in decimal form, 10% = 0.10) Such determination was made to reconcile manageability with representativeness.

$$n = N / (1 + N(e)^2)$$

Where,

n is the sample size,

N is the population size, and

e is the level of precision.

$$n = 30,558 / (1 + 30,558(0.1)^2) = 30,558 / 306.58 = 99.7 \approx 100$$

Adopting proportional allocation, the researcher had got the sample sizes as under for the different strata. Thus, assuming that n<sub>1</sub> is strata of Gamberey, n<sub>2</sub> is strata of Maaneed, and n<sub>3</sub> is strata of Dab-habalan. Then the sample size of stratum is as follow.

$$n_i = (p_i \times n) / N$$

Where, n<sub>i</sub> = the strata sample size

P<sub>i</sub> = total population of the strata

N = the total population of the study area

$$\text{For strata with } n_1 = p_1 \times n / N = 12,958 \times 100 / 30,500 = 42$$

$$\text{For strata with } n_2 = p_2 \times n / N = 9,320 \times 100 / 30,500 = 31$$

$$\text{For strata with } n_3 = p_3 \times n / N = 8,280 \times 100 / 30,500 = 27$$

Therefore, the formula will be used to allocate proportional sample from each strata as:

Sample<sub>1</sub> = 42, from Gamberey

Sample<sub>2</sub> = 31, from Maaneed

Sample<sub>3</sub> = 27, from Dab-habalan

### Method of Data Collection

Primary data were collected using semi-structured questionnaires, focus group discussions (FGDs), and field observations. Secondary data were obtained from district

offices regarding livestock and pastoral development. Yeheb foliage samples were collected during the dry and wet season, when the plant is most likely to be used as feed.

### Yeheb Foliage Sample Collection

The nutritional composition of the Yeheb samples was analyzed in the Haramaya University central laboratory. Proximate analysis was performed using the AOAC (2005) method. The nutritional content, including crude protein (CP), neutral detergent fiber (NDF), acid detergent fiber (ADF), and acid detergent lignin (ADL), was determined using standard laboratory procedures (Van Soest *et al.*, 1991).

### Chemical Analysis

Analysis of feed samples had undertaken at the Haramaya University central laboratory, according to the proximate method (AOAC, 2005); with the objective of determining the chemical composition of the major feed resources for livestock. CP content was calculated by multiplying nitrogen with a factor of (6.25). But for feed sample containing the structural plant constituents was calculated undertaking for neutral detergent fiber (NDF), acid detergent fiber (ADF), and acid detergent lignin (ADL), by using the detergent extraction method (Van Soest *et al.*, 1991).

### Statistical Analysis

Data were analyzed using SPSS (version 20) and SAS (version 9.0) for descriptive statistics (mean, frequency, standard error) and inferential analysis (ANOVA). The results were presented using tables and charts

## RESULTS AND DISCUSSION

### Demographic Data

The demographic characteristics of the respondents provide valuable insights into the composition of the surveyed population. In terms of sex, education and Age of the Respondents The analysis of the demographic characteristics data of respondents is summarized below.

### Sex of the Respondents

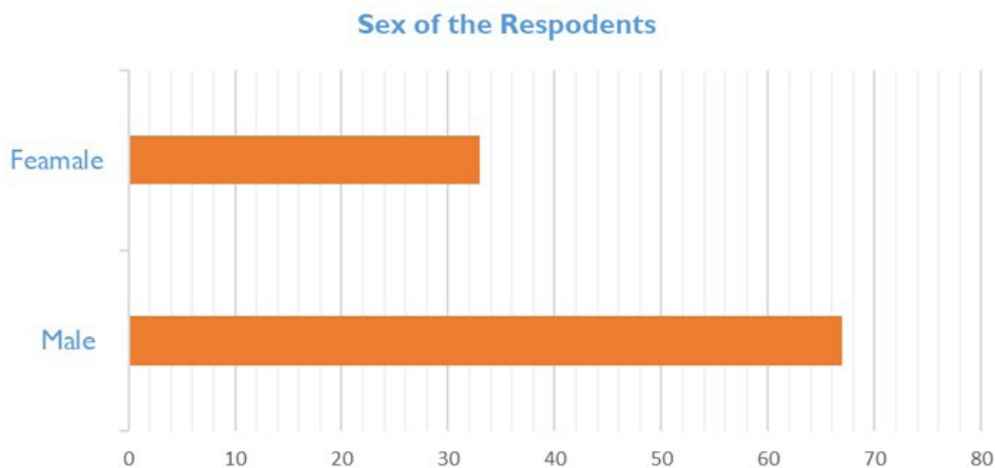
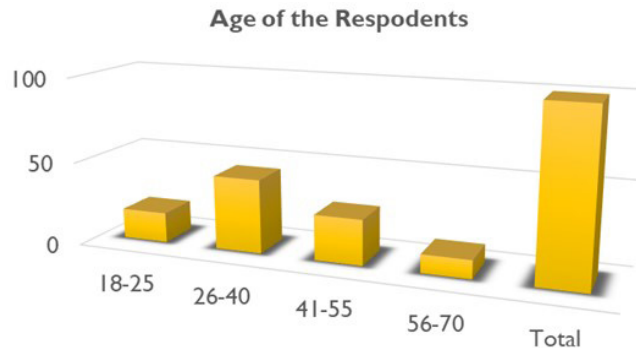


Figure 1: Sex of the Respondents

In the analysis of the survey data, sex of the respondents. The male respondents make up a significant majority, with their representation nearing 70%, while female respondents account for approximately 30%. This disparity highlights a

notable gender difference in the survey population, providing insight into the demographics of those who participated in the study.

**Age of the Respondents**

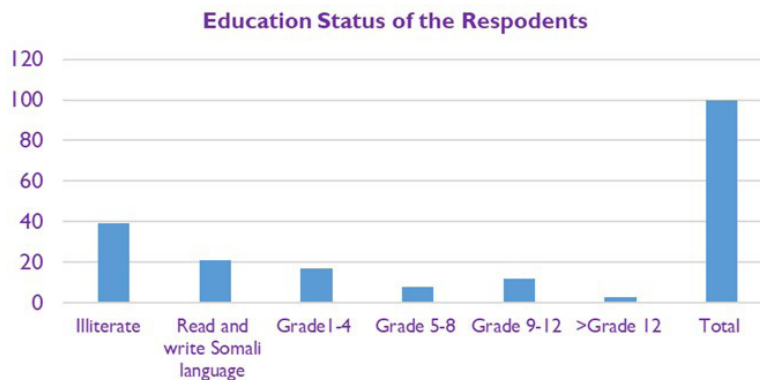


**Figure 2:** Age of the Respondents

as the above chart indicated the age distribution of the respondents shows that 20 respondents were fall between 18 and 25 age group, also 40 respondents were in the 26-40 age range. This recommends a significant representation of young adults in the research, with the 26-40 group were the largest age group of the study.

**Education of the Respondents**

This table summarizes the education level of the respondents. A majority of residents have completed Grade 5-8, also a significant percentage of the participants were illiterate. The data shows varying levels of educational achievement among the respondents, with most having at least some formal education.



**Figure 3:** Education of the respondents

**Primary Occupation**

The study shows that the most of respondents categorized as pastoralists, representing for 76% of the total. This important representation indicates the importance of pastoralism in the community, showing a lifestyle of the community heavily depend on livestock management and migration patterns. Pastoralists typically involve in the herding of livestock, which delivers not only food but

also income for families. This occupation is often tied to cultural practices and traditions, making it a central aspect of life for many in the surveyed population.

In contrast, agro-pastoralists make up 0% of the respondents, indicating that this particular occupation may not be prevalent in the area or that those involved in agro-pastoralism did not participate in the survey. This absenteeism shows a significant gap in agricultural practices that combine crop farming with livestock practicing, which could be an area for future exploration. Understanding the challenges and opportunities for agro-pastoralists could provide valuable perceptions into improving food security and economic strength in the Study Area.

Furthermore, other occupations such as livestock trading, small business activities, and daily labor contribute to the economic background, Livestock traders represent 10%

**Table 1:** Primary Occupation of the Respondents

	No.	Percentage
Pastoralists	76	76%
Agro-Pastoralists	0	0%
Livestock Trader	10	10%
Other	14	14%
<b>Total</b>	<b>100</b>	<b>100%</b>

of respondents, highlighting a niche market that supports pastoralists by facilitating the buying and selling of animals. Meanwhile, those involved in small businesses and daily labor make up 14% of the surveyed population. These occupations indicate the diversification of income sources

and the adaptability of individuals in the community, showcasing how they navigate economic challenges and opportunities beyond traditional pastoralism.

### Experience in Camel Rearing

**Table 2:** Experience in camel rearing

	No.	Percentage
Less than 5 years	4	4%
5-10 Years	19	19%
10-20 Years	47	47%
More Than 20 Years	30	30%
<b>Total</b>	<b>100</b>	<b>100%</b>

The table presents data on the experience of respondents in camel rearing, categorized by years of experience.

Out of a total of 100 respondents, a small segment, 4 individuals (4%), reported having less than 5 years of experience. This indicates that there are relatively few newcomers in the field.

In the next category, 19 respondents (19%) have between 5 to 10 years of experience, the largest group consists of those with 10 to 20 years of experience, comprising 47 respondents (47%). This significant portion indicates a strong presence of seasoned camel rearers who likely

possess extensive knowledge and skills in the practice.

Finally, 30 respondents (30%) reported having more than 20 years of experience, reflecting a wealth of expertise among these individuals.

In General, the data suggests that the majority of respondents have considerable experience in camel rearing, with nearly half falling within the 10 to 20-year bracket.

### Availability and Usage of Yeheb (*Cordiaxia edulis*) Foliage

**Table 3:** Availability and Usage of Yeheb (*Cordiaxia edulis*) Foliage

	Response	Number of Respondents	Percentage (%)
How abundant is Yeheb foliage in your area?	Very abundant	69	25%
	Moderately available	26	26%
	Scarce	5	5%
	Not available	0	0%
<b>Total</b>		<b>100</b>	<b>100%</b>
Do you use Yeheb foliage as camel feed?	Yes, regularly	91	91%
	Yes, occasionally	6	6%
	Rarely	3	3%
	No, never	0	0%
	Camels refuse to eat it	0	0%
	Other (specify)	0	0%
<b>Total</b>		<b>100</b>	<b>100%</b>
During which season do you mostly use Yeheb foliage?	Dry season only	78	78%
	Wet season only	7	7%
	Both dry and wet seasons	15	15%
	I do not use it at all	0	0%
<b>Total</b>		<b>100</b>	<b>100%</b>
What part of Yeheb do camels prefer to eat?	Leaves	86	86%
	Twigs and small branches	9	9%
	Fruits	3	3%
	Whole plant	2	2%
<b>Total</b>		<b>100</b>	<b>100%</b>

As indicated the above table data gathered on the availability and usage of Yeheb foliage provides valuable insights into its role in camel rearing.

When asked about the abundance of Yeheb foliage in their area, a significant majority of respondents reported that it is either very abundant or moderately available. Specifically, 25% of respondents indicated that Yeheb foliage is very abundant, while 26% noted it is moderately available. Only a small fraction, 5%, described the foliage as scarce, and notably, no respondents reported it as unavailable. This suggests that Yeheb foliage is generally accessible across the Research Area.

In terms of its usage as camel feed, the responses indicate a positive trend. About 91% of respondents use Yeheb foliage regularly for feeding their camels, while 6% use it occasionally. However, 3% reported that they rarely incorporate it into their feed regimen.

Seasonal usage of Yeheb foliage reveals a clear pattern. An overwhelming 78% of respondents reported using it exclusively during the dry season, with only 7% utilizing

it in the wet season. Additionally, 15% indicated they use it in both seasons. This predominance of dry season usage suggests that Yeheb foliage plays a critical role in providing nutrition when other feed options may be limited.

When considering the parts of Yeheb that camels prefer, the data shows a strong preference for the leaves, with 86% of respondents indicating this as the favored part. Meanwhile, 9 % mentioned twigs and small branches, and a smaller percentage indicated fruits and the whole plant as preferred options. This preference for leaves emphasizes their nutritional importance in the diet of camels.

Overall, the findings paint a picture of Yeheb foliage as a widely recognized and utilized resource in camel rearing, particularly during the dry season data underscores the foliage's significance in supporting the health and nutrition of camels in the surveyed areas.

### Nutritional and Health Impact of Yeheb (*Cordia edulis*) on Camels

**Table 3:** Nutritional and Health Impact of Yeheb (*Cordia edulis*) on Camels

	Response	Number of Respondents	Percentage (%)
How do you rate the nutritional value of Yeheb for camels?	Very high	59	59%
	Moderate	31	31%
	Low	4	4%
	I don't know	6	6%
<b>Total</b>		<b>100</b>	<b>100%</b>
How does Yeheb foliage affect camel health?	Improves health and body condition	86	86%
	No noticeable effect	3	3%
	Causes health problems	0	0%
	I am not sure	1	1%
<b>Total</b>		<b>100</b>	<b>100%</b>
Have you observed any health issues in camels after feeding on Yeheb?	No, never	100	100%
	Sometimes	0	0%
	Frequently	0	0%
	Yes, always	0	0%
<b>Total</b>		<b>100</b>	<b>100%</b>
What benefits have you noticed in camels that consume Yeheb foliage?	Increased milk production	20	20%
	Improved body condition	40	40%
	Enhanced resistance to diseases	15	15%
	Faster recovery from drought stress	25	25%
	No noticeable benefits	0	0%
<b>Total</b>		<b>100</b>	<b>100%</b>
Do camels gain weight when fed on Yeheb foliage?	Yes, significantly	65	65%
	Yes, slightly	30	30%
	No change in weight	5	5%
	No, they lose weight	0	0%
<b>Total</b>		<b>100</b>	<b>100%</b>

How does Yeheb foliage compare to other camel feeds?	Better than most available feeds	42	42%
	Similar to other browse plants	55	55%
	Less nutritious than other feeds	0	0%
	I am not sure	3	3%
<b>Total</b>		<b>100</b>	<b>100%</b>

Based on the data collected on the nutritional and health impact of Yeheb foliage on camels reveals a strong positive perception among respondents regarding its benefits.

Starting with the nutritional value, an impressive 59% of respondents rated Yeheb foliage as having very high nutritional value for camels. Additionally, 31% considered it to have a moderate nutritional value, while only 4% rated it as low, and 6% were uncertain. This indicates a consensus on the foliage's overall nutritional benefits.

When evaluating the health effects of Yeheb foliage, a remarkable 86% of respondents noted that it improves the health and body condition of camels. In contrast, just 3% observed no noticeable effect, and there were no reports of health problems associated with its consumption. This overwhelmingly positive feedback suggests that Yeheb foliage plays a crucial role in enhancing the well-being of camels.

Surveyed respondents confirmed that they have not observed any health issues in camels after feeding them Yeheb, with 100% indicating "no, never." This further reinforces the foliage's reputation as a safe and beneficial food source.

In terms of specific benefits observed, 40% of respondents reported improvements in body condition,

while 25% noted faster recovery from drought stress. Additionally, 20% observed increased milk production, and 15% mentioned enhanced disease resistance. Notably, no respondents reported any noticeable benefits, indicating a strong recognition of Yeheb's positive effects. Regarding weight gain, 65% of respondents affirmed that camels gain weight significantly when fed Yeheb foliage, while 30% observed slight weight gain. Only 5% noted no change in weight, and none reported weight loss. This highlights Yeheb's efficacy as a feed that contributes to the overall growth and health of camels.

Finally, when comparing Yeheb foliage to other camel feeds, 42% of respondents believe it is better than most available feeds, while 55% consider it similar to other browse plants. Only 3% were unsure, and none rated it as less nutritious than other feeds. This suggests that Yeheb is viewed favorably in comparison to alternative feeding options.

Overall, the findings indicate that Yeheb foliage is highly valued for its nutritional and health benefits in camel rearing, contributing positively to both the well-being of the animals and the productivity of camel herders as the Pastoralists observed.

### Practical Viability and Sustainability

**Table 4:** Practical Viability and Sustainability

	Response	Number of Respondents	Percentage (%)
How easy is it to collect Yeheb foliage and fruit?	Very easy	20	20%
	Moderately easy	25	25%
	Difficult	50	50%
	Very difficult	5	5%
<b>Total</b>		<b>100</b>	<b>100%</b>
What are the major challenges in using Yeheb foliage as a camel feed?	Seasonal availability	5	5%
	Overgrazing and depletion	40	40%
	Low acceptance by camels	0	0%
	Lack of awareness	55	55%
<b>Total</b>		<b>100</b>	<b>100%</b>
How do you harvest Yeheb foliage and Fruits?	By hand picking	19	19%
	Cutting branches	1	1%
	Allowing camels to graze freely	80	80%
	Other (specify)	0	0%
<b>Total</b>		<b>100</b>	<b>100%</b>
Do you think Yeheb foliage can be a sustainable feed option in the future?	Yes, with proper management	70	70%
	Yes, but only in certain seasons	20	20%
	No, it is not a reliable option	5	5%
	I am not sure	5	5%

<b>Total</b>		<b>100</b>	<b>100%</b>
What should be done to improve the use of Yeheb foliage as camel feed?	Plant more Yeheb trees	25	25%
	Improve awareness among pastoralists	40	40%
	Develop conservation strategies	30	30%
	Improve harvesting and feeding techniques	5	5%
<b>Total</b>		<b>100</b>	<b>100%</b>

As indicated above table the survey results on the practical viability and sustainability of Yeheb foliage as camel feed present a comprehensive view of its accessibility and potential future use.

When asked about the ease of collecting Yeheb foliage and fruit, 20% of respondents found it very easy, while half of them (25%) described it as moderately easy. In contrast, 50% reported that collection is difficult, and 5% considered it very difficult. This suggests that while many find it manageable, a notable portion faces challenges in the collection process.

Respondents identified several major challenges in using Yeheb foliage as camel feed. A significant 55% indicated a lack of awareness about Yeheb as a feed option, highlighting a crucial area for improvement. Additionally, 40% of respondents pointed to overgrazing and depletion as significant concerns, while there were no reports of low acceptance by camels. This underscores the importance of education and awareness in promoting Yeheb as a viable feed source.

In terms of harvesting methods, a clear preference emerged. A substantial 80% of respondents allow camels to graze freely on Yeheb, which reflects a natural approach to feeding. Only 19% reported harvesting by hand picking, and a mere 1% used cutting branches.

This reliance on grazing may impact the sustainability of Yeheb if not managed properly.

Looking towards the future, an encouraging 70% of respondents believe that Yeheb foliage can be a sustainable feed option with proper management. Meanwhile, 20% think it can only be sustainable in certain seasons, and only 5% consider it an unreliable option. This optimistic outlook emphasizes the potential for developing Yeheb as a reliable feed source, provided that appropriate management strategies are implemented.

To improve the use of Yeheb foliage as camel feed, respondents suggested several measures. The majority, 40%, emphasized the need to improve awareness among pastoralists, while 30% called for the development of conservation strategies. Additionally, 25% advocated for planting more Yeheb trees, and only 5% suggested improving harvesting and feeding techniques. This feedback points to a clear path forward in enhancing the sustainability of Yeheb as a feed resource.

Overall, the findings reflect a positive perception of Yeheb foliage's potential as a camel feed option, tempered by challenges that can be addressed through education, management, and conservation efforts.

### Economic Aspects

**Table 5:** Economic Aspects

	Response	Number of Respondents	Percentage (%)
Do you think using Yeheb foliage reduces feeding costs	Yes, significantly	69	69%
	Yes, slightly	21	21%
	No change in cost	7	7%
	No, it increases costs	3	3%
<b>Total</b>		<b>100</b>	<b>100%</b>
What are the major challenges in using Yeheb foliage as a camel feed?	Seasonal availability	5	5%
	Overgrazing and depletion	40	40%
	Low acceptance by camels	0	0%
	Lack of awareness	55	55%
<b>Total</b>		<b>100</b>	<b>100%</b>
How do you harvest Yeheb foliage and Fruits?	By hand picking	19	19%
	Cutting branches	1	1%
	Allowing camels to graze freely	80	80%
	Other (specify)	0	0%
<b>Total</b>		<b>100</b>	<b>100%</b>
Do you think Yeheb foliage can be a sustainable feed option in the future?	Yes, with proper management	70	70%
	Yes, but only in certain seasons	20	20%

	No, it is not a reliable option	5	5%
	I am not sure	5	5%
<b>Total</b>		<b>100</b>	<b>100%</b>
What should be done to improve the use of Yeheb foliage as camel feed?	Plant more Yeheb trees	25	25%
	Improve awareness among pastoralists	40	40%
	Develop conservation strategies	30	30%
	Improve harvesting and feeding techniques	5	5%
<b>Total</b>		<b>100</b>	<b>100%</b>

As the above table shows the survey assessed perceptions regarding the use of Yeheb foliage as camel feed, revealing a largely positive sentiment about its cost-effectiveness. A significant 69% of respondents believe it reduces feeding costs significantly, while 21% perceive only slight reductions. However, challenges were also highlighted, with 55% citing a lack of awareness and 40% mentioning overgrazing and depletion as major issues. Interestingly, no respondents reported low acceptance by camels. Harvesting methods showed that 80% of participants allow camels to graze freely, indicating a straightforward approach but also raising concerns

about sustainability. Regarding future prospects, 70% expressed optimism for Yeheb foliage's viability with proper management, while 20% saw potential only in certain seasons. Recommendations for improvement included enhancing awareness among pastoralists (40%), developing conservation strategies (30%), and planting more Yeheb trees (25%). Overall, the findings suggest that with targeted education and resource management, Yeheb foliage could significantly contribute to sustainable camel feeding practices.

### Chemical Composition

**Table 6:** Chemical Composition

Nutrient	Poor Quality (%)	Moderate Quality (%)	High Quality (%)
Dry Matter (DM)	<20 (too wet)	20-85	85-92
Crude Protein (CP)	<7	8-15	>15
Neutral Detergent Fiber (NDF)	>50	40-50	<40
Acid Detergent Fiber (ADF)	>40	30-40	<30

In evaluating the quality of forages, several key nutrients are assessed, including Dry Matter (DM), Crude Protein (CP), Neutral Detergent Fiber (NDF), and Acid Detergent Fiber (ADF). Dry Matter refers to the portion of the forage that remains after all the water has been removed, with forages containing less than 20% DM considered too wet (poor quality), 20-85% DM categorized as moderate quality, and those with 85-92% DM classified as high quality.

Crude Protein measures the protein content essential for livestock growth, where forages with less than 7% CP are poor quality, those with 8-15% CP are moderate quality, and high-quality forages contain over 15% CP. Neutral

Detergent Fiber indicates the cell wall components that affect digestibility, with more than 50% NDF deemed poor quality, 40-50% NDF as moderate, and less than 40% NDF as high quality. Acid Detergent Fiber reflects the lignin and cellulose content, where forages exceeding 40% ADF are poor quality, those in the 30-40% range are moderate quality, and high-quality forages have less than 30% ADF. Understanding these nutrient levels is crucial for optimizing livestock nutrition and enhancing productivity (Undersander *et al.*, 2010).

### Nutritional Composition of Yeheb Foliage Laboratory Analysis

**Table 7:** Laboratory Analysis

Sample code	Sample Wt	Cr Wt	Oven dried Sample+Cr Wt	DM%	Ash+Cr Wt	ASH%				
Yeheb	2.0048	17.9352	19.8382	1.903	0.949222	94.92219	18.0534	0.1182	0.062112	6.211245

Yeheb	samp Wt	Cr Wt	Oven dr Samp+ Cr Wt					ADF%					ADL%
Yeheb	0.5085	30.0805	30.3082	0.949222	0.2277	0.482679	0.471742	47.17418	30.2326	30.0964	0.1362	0.282175	28.21749
Yeheb	Samp Wt	Cr Wt	Oven dried sam+Cr Wt					NDF%					
Yeheb	0.5047	31.7327	32.0167	0.949222	0.284	0.479072	0.592812	59.28124					
	Samp Wt	Initial	Final							CP%			
Yeheb	0.307	11.5	14.7	0.949222	3.2	0.32	0.448	0.291411	1.537347	9.608419			

N.B: - DM-Dry Matter, CP-Crude Protein, NDF-Nutrient detergent fiber, ADF-Acid Detergent

As the above table shows The analysis of the Yicib Sample in Laboratory, scientifically known as *Cordeauxia edulis*, reveals important nutritional parameters that are crucial for evaluating its suitability as Camel feed in During the Dry Season.

The crude protein percentage (CP%) is measured at 9.608419%, indicating a moderate level of protein that can contribute to the dietary needs of livestock. This protein content is essential for growth, reproduction, and overall health.

The dry matter percentage (DM%) stands at 94.92219%, suggesting that the majority of the sample consists of solid matter, with minimal moisture content. High dry matter is favorable as it indicates a concentrated source of nutrients.

The ash content is recorded at 6.21%, which reflects the mineral content in the sample. This level of ash is significant as it provides essential minerals necessary for various physiological functions in animals.

In terms of fiber composition, the Neutral Detergent Fiber (NDF%) is at 59.281%, indicating a high level of total fiber, including hemicellulose, cellulose, and lignin. This high fiber content can influence the digestibility and intake of the feed.

The Acid Detergent Fiber (ADF%) measures 47.174%, which highlights the amount of cellulose and lignin present. Elevated ADF levels can suggest lower digestibility, impacting the energy available to the animals. Finally, the Acid Detergent Lignin (ADL%) is noted at 28.217%, representing the lignin component that further affects fiber digestibility. Higher lignin levels can make the feed less palatable and reduce its overall nutritional value. In summary, the nutritional profile of Yicib (*Cordeauxia edulis*) shows a balanced combination of protein, dry matter, minerals, and fiber, providing valuable insights

into its potential as a forage option for livestock, especially the camels. This aligns with previous research indicating its significance in supporting livestock nutrition in arid regions (Ali, 1988; Yusuf, 1996).

### CONCLUSION

In conclusion, the survey results provide a comprehensive overview of the demographic characteristics, primary occupations, experience in camel rearing, availability and usage of Yeheb foliage, nutritional and health impact of Yeheb on camels, practical viability and sustainability, economic aspects, and chemical composition of the forage. The data highlights the significant representation of pastoralists among respondents, the positive perception of Yeheb foliage as a camel feed, and its nutritional benefits for camel health and productivity.

Additionally, the chemical composition analysis of Yicib (*Cordeauxia edulis*) has provided valuable insights into its nutritional parameters, indicating a moderate level of protein, high dry matter content, significant mineral composition, and fiber content that can influence digestibility. Leveraging this knowledge, researchers and stakeholders can further explore the potential of Yicib as a forage option, especially during the dry season when feed resources may be limited. Continued research and monitoring of Yicib's nutritional profile and its impact on camel health can guide informed decision-making and sustainable practices in camel rearing, ultimately benefiting both the animals and the community's dependent on them.

Based on the above findings the Author recommended:

- Developing conservation strategies to address challenges such as overgrazing and depletion while promoting responsible harvesting practices can contribute to the long-term viability of Yeheb as a feed resource

- Furthermore, considering the positive economic impact of Yeheb foliage on reducing feeding costs for camel herders, there is a need to explore strategies for increasing the accessibility and ease of collecting Yeheb foliage and fruits.
- Planting more Yeheb trees and implementing proper management practices can help sustainably harness the nutritional benefits of Yeheb, ensuring its continued contribution to camel health, productivity, and the livelihoods of pastoralist communities.
- By addressing key challenges and leveraging the nutritional value of Yeheb, stakeholders can work towards a more resilient and prosperous camel rearing ecosystem in the study area.

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