



# Nutritional values of indigenous browse and herbaceous legume species for ruminants in Ethiopia: a Meta-analysis

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## Introduction

- The utilization of foliage from browse species and forage legumes has been proposed as a good alternative to increase productivity of ruminants in Ethiopia.
- Due to their high protein content and better digestibility compared to common tropical grasses, they have the potential to be used as protein-rich supplements.
- However, the proper utilisation of these underutilised fodder sources in Ethiopia require establishment of comprehensive data on their feeding value.
- This review summarised nutritional value and the effects of including foliage of browse species and herbaceous forage legumes in the diets of ruminants.



## Material and methods

### Literature search and data extraction

- Web search (Google Scholars, Scopus, and PubMed): Herzing's Publish or Perish-free packages.
- Separate databases were built for nutritional values and feeding trials data.
- Treatment means collected from feeding trials were weighted to the number replications.

### Statistical analysis

- Species categorized as indigenous browse spp. (IBS), herbaceous forage legumes (HL), and multipurpose fodder spp. (MPF).
- Some selected species from each forage category were also considered.
- Summary statistics (mean, SD, minimum, and maximum) calculated for nutritional value and animal performance variables (SAS Version 9.0).
- A random-effect model meta-analysis was applied to estimate the effect size (standardized mean difference/Hedges' d) using OpenMEE free package.

## Results

### Nutritional value

- About 165 species (148 indigenous browses and 17 cultivated forage legumes of herbaceous and woody types) reported in 62 studies.
- The mean chemical composition, *in vitro* digestibility and metabolizable energy data revealed that they had good nutritional value for use in ruminant feeding.

- CP content (17.6±5.2-22.4±4.5%)
- NDF content (39.1±12.3-50.2±10.7%)
- IVDMD (61.9±11.8-77.0±7.9%)
- IVOMD (54.7±9.8-59.3±11.7%)
- ME (8.1±1.2-8.9±1.4 MJ/kg DM)

- Sources of variation in the nutritional value within forage category;

- Species and variety
- Growing environment
- Season
- Plant parts analysed

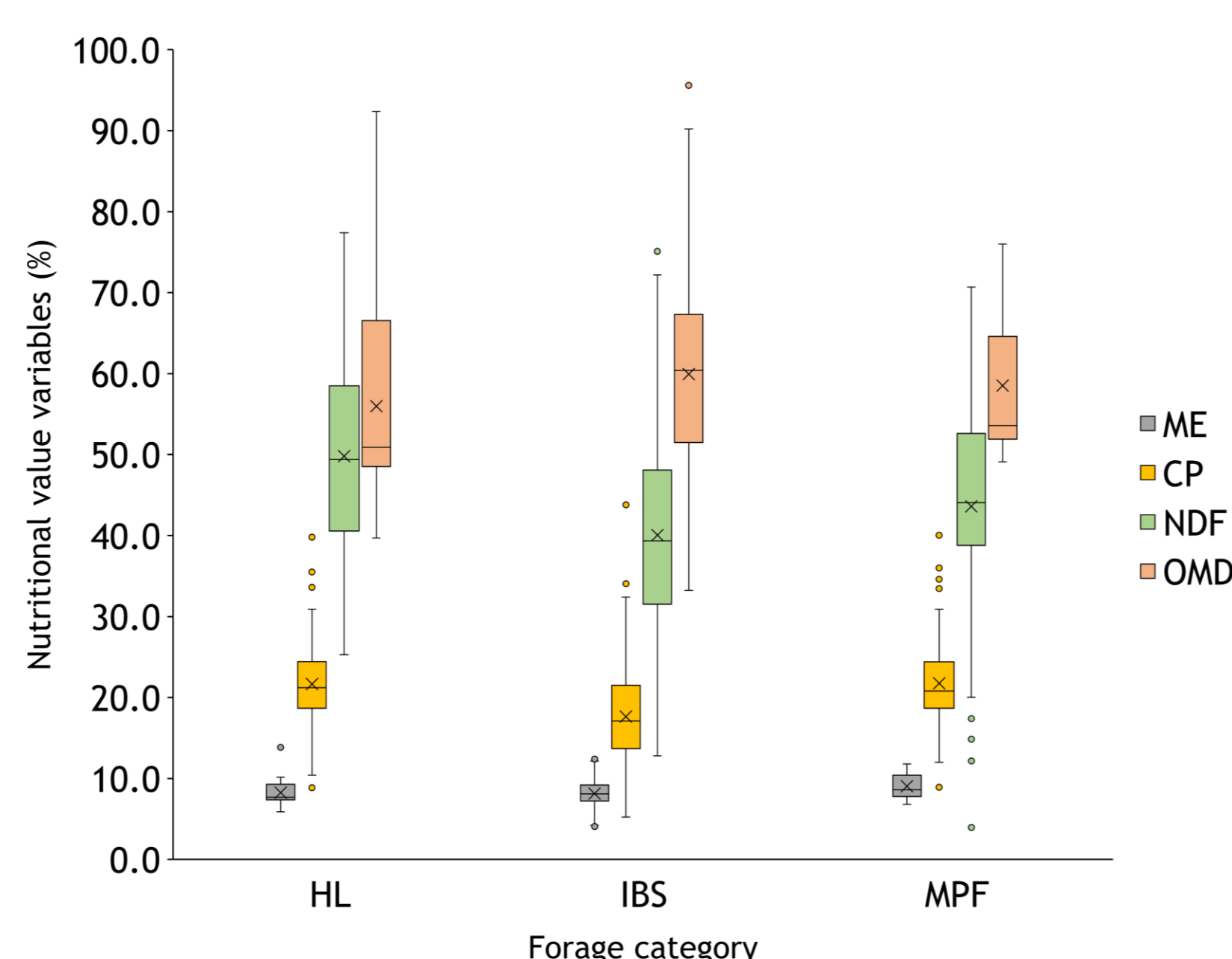


Figure 1: Crude protein, fiber (NDF), organic matter digestibility and metabolizable energy value of the species categorized under different forage types

### Effects on animal performance

- Browse species and herbaceous forage legumes for supplementation were studied in 72 feeding trials
  - 25 studies (34.7%) as supplements
  - 47 studies (65.3%) substitute for concentrate feedstuffs

Table 1: Description of experimental diets and animal performance variables of studies included in meta-analysis

Variables	N	Mean	SD	Minimum	Maximum
Body weight (Kg)	25	17.7	3.3	11.7	24.5
Replication	25	5.4	0.9	4	8
Crude protein (% DM)	25	7.2	2.0	3.6	12.2
	25	19.4	5.1	11.5	30.0
NDF (% DM)	25	70.6	6.1	53.7	83.1
	25	43.9	12.2	13.2	64.8
Level of supplementation (g/day/head)	25	284.0	70.3	100	479.4
DM intake (g/day)	25	574.0	165.0	277.0	985.2
	25	739.3	189.9	367.3	1221.3
CP intake (g/day)	24	47.9	18.9	16.5	99.9
	24	86.3	30.8	42.0	180
NDF intake (g/day)	20	403.1	120	210.2	775.7
	20	461.5	143.3	245.3	872.8
ME intake (MJ/day)	9	5.8	2.0	3.6	9.3
	9	8.6	2.8	5.9	13.1
Weight gain (g/day)	22	10.6	23.8	-19.3	90.3
	22	39.7	26.9	2.2	129.2

N: number of studies, DM: dry matter, CP: crude protein, NDF: neutral detergent fiber, ME: metabolizable energy \*: (natural pasture hay, crop residue and cultivated grass)

- Effect size analysis revealed significant improvement in DMI (Hedges' d = 0.395, P = 0.005), protein intake (Hedges' d = 0.478, P = 0.001) and ADF (Hedges' d = 0.266, P = 0.040).

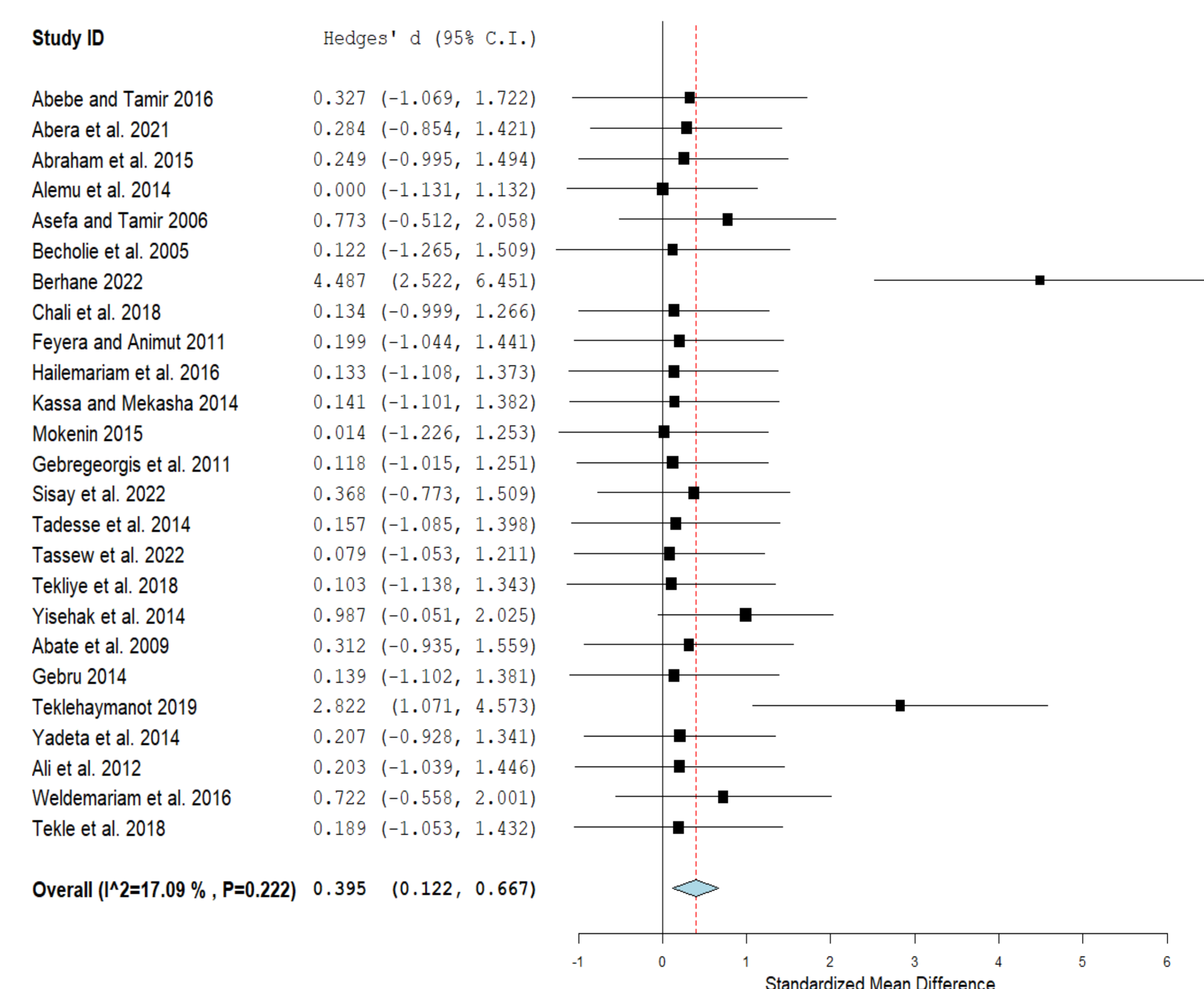


Figure 3: Forest plot showing Hedges' d for the effect of browse species and herbaceous forage legumes supplementation on DMI (g/day) of ruminants in Ethiopia.

## Conclusion

- The studied species from different forage category had medium to high nutritional value.
- Inclusion of browse species and herbaceous forage legumes in low-quality basal diets improved nutrient intake and production performance of ruminants.
- Large variation both in the nutritional composition and effects on animal performance.
  - Screening species and varieties with high nutritional quality traits
  - Determination of optimum supplementation level (basal diet dependant)



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