# Amino Acid Profiles in Cool-Season Grass, Alfalfa & Teff & How They Could Affect Horse Health

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## Summary

Despite lower forage amino acid and higher fiber concentrations in teff compared to cool-season grasses (CSG) and alfalfa, minimal plasma amino acid differences were observed in grazing horses. This suggests sufficient amino acid availability and digestibility existed in all forage types regardless of forage protein differences.

## Introduction

Forage is an important component of the equine diet, with horses primarily consuming CSG, legumes, or warm-season grasses in the form of pasture or hay. However, these different forage types vary widely in their nutritional content. One main difference across forage types is their protein content, with the highest values often observed in legumes, such as alfalfa, and the lowest values observed in warm-season grasses, such as teff. Protein is an important component in the equine diet as it facilitates growth as well as muscle maintenance and repair. While crude protein (CP) is commonly used to estimate protein content, amino acids are a more accurate measure of protein quality. However, the amino acid profiles of different forage types are rarely reported.

**Table 1.** The nutrient content and essential amino acid profile of forage grazed by horses in July 2019.

| Nutrient | Alfalfa | CSG | Teff |
|---|---|---|---|
| DE, Mcal $kg^{-1}$ | 2.37 | 2.22 | 2.01 |
| CP, % DM | 23.3 | 24.1 | 15.4 |
| NDF, % DM | 43.2 | 53.4 | 65.0 |
| ADF, % DM | 33.1 | 30.9 | 37.0 |
| Amino Acid, % DM | | | |
| Arginine | 0.89 | 1.07 | 0.57 |
| Cystine | 0.22 | 0.25 | 0.14 |
| Histidine | 0.43 | 0.43 | 0.23 |
| Isoleucine | 0.95 | 1.01 | 0.58 |
| Leucine | 1.57 | 1.75 | 1.02 |
| Lysine | 1.17 | 1.25 | 0.72 |
| Methionine | 0.33 | 0.41 | 0.24 |
| Phenylalanine | 1.02 | 1.18 | 0.65 |
| Threonine | 0.81 | 0.92 | 0.51 |
| Tryptophan | 0.28 | 0.30 | 0.15 |
| Tyrosine | 0.57 | 0.61 | 0.33 |
| Valine | 1.16 | 1.28 | 0.74 |

## How Our Research Was Conducted

To determine the amino acid profile of three different forage types and the corresponding plasma amino acid response in grazing horses, six aged horses grazed CSG (Kentucky bluegrass and orchardgrass mixture), legumes (alfalfa), and warm-season grass (teff) pastures in July 2016. Forage samples and blood samples were taken prior to pasture turn-out and two and four hours following turn-out. Forage was analyzed for the nutrient content and amino acid profile while plasma was collected from the blood samples and analyzed for the amino acid concentration.

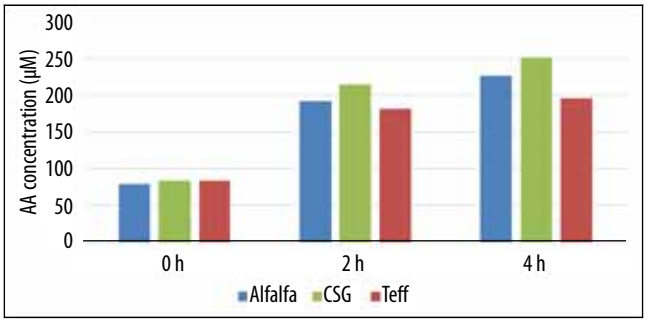
## Results & Discussions

*Forage Nutrient Content.* All nutritive values differed across forage species during the grazing period (Table 1). Alfalfa and CSG had higher digestible energy (DE) and crude protein (CP) compared to teff. In comparison, neutral detergent fiber (NDF) and acid detergent fiber (ADF) were highest in teff compared to the other species. While higher CP values are associated with higher amino acid concentrations, fiber content is important, as it can play a role in the availability of amino acids. The lower CP and higher fiber observed in teff suggests there are fewer amino acids present in this forage with decreased availability to horses.

*Forage Amino Acid Profile.* To further evaluate protein, amino acid profiles were evaluated (Table 1). Concentrations of amino acids in forages were often highest in CSG and lowest in teff with moderate values observed in alfalfa. Despite these differences, the lysine amino acid concentration in the current study was compared to lysine requirements of different classes of horses. Most, with the exception of growing horses and pregnant mares, would meet their lysine requirements when consuming teff pasture at 1.5% dry matter (DM) of their body weight. As a result, it appears the forage amino acid differences may not be problematic on a physiological level.

***Plasma Amino Acid Concentrations.*** Regardless of treatment, fasting amino acid levels (hour 0) remained the same for all horses, and acted as a baseline value. While most plasma amino acid concentrations were not different regardless of the forage type being grazed, plasma threonine did exhibit differences after four hours of grazing (Figure 1). Horses grazing CSG had higher plasma threonine concentrations than horses grazing teff. Results suggest threonine could be a limiting amino acid in horses grazing teff.

**Figure 1.** Plasma threonine concentrations in horses grazing alfalfa, CSG, and teff.




## Conclusion

Cool-season grasses and alfalfa had higher amino acid concentrations; however, the only difference in plasma was decreased threonine concentrations in horses grazing teff. While higher protein and lower fiber concentrations were observed in CSG and alfalfa, it appears horses grazing teff have a similar plasma amino acid response.