

Nutrient Digestibility in Goats Fed With Corn Fodder Supplemented With Palm Kernel Meal

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ABSTRACT

Sixteen (16) goats were randomly distributed to the four dietary treatments to determine their nutrient digestibility which constituted four treatment combinations - commercial cultivar of white corn variety, F1 Taiwanese corn fresh fodder, F1 Taiwanese corn fresh fodder + 0% palm kernel meal in mixed concentrate, and F1 Taiwanese corn fresh fodder + 30% palm kernel meal in mixed concentrate. These were randomized in a complete block design using SPSS Version 11.5 or Windows. Tukey test (Honestly Significant Difference) was used to test the significant differences among treatment means.

Results revealed highly significant differences in terms of dry matter intake, organic matter intake, organic matter digestibility, and apparent digestible energy. Observed results were attributed to better nutrient digestibility due to its rumen fermentation and micro-organism activity. Based on the results of the study, use of corn fodder (65-75 days after planting) and inclusion of 30% palm kernel meal in the diet are recommended since it improved nutrient digestibility, increased feed intake, and energy values compared to use of corn fodder alone. However, it is recommended that optimum level of palm kernel meal usage be further studied to measure the level of efficiency and nutrient digestibility in goats.

Keywords: corn fodder, diet, energy values, feed intake, nutrient digestibility, palm kernel meal

INTRODUCTION

Nutrient evaluation is one of the important key considerations in raising poultry and livestock. To beef up animal performance, this method should be applied for health, efficiency, and optimal growth. A balanced diet that contains roughages and concentrates should be given to the animal to meet its nutrient requirement for production, maintenance, gestation, and lactation. The analytical procedures used for determining major nutrient components of feedstuffs, foods and feces, as required for feed evaluation, diet formulation or research, should be accurate, regardless of the feed (plant or animal origin, part consumed, process, maturity, grade, etc.), the combination of feeds or animal feed (Fonnesbeck, 1981).

Agro-industrial by-products such as corn fodder and palm kernel meal are potential sources of feeds where tons are produced per year. With this development, research in efficient utilization method of the feed is needed to

improve nutritional values. The utilization of corn fodder and palm kernel meal fed in goats may improve its nutrient digestibility with the presence of its essential nutrients and higher fiber content through rumen fermentation.

A digestion trial and biological evaluation are essential in order to assess the performance of goats fed with corn fodder supplemented with palm kernel meal to evaluate the effects in nutrient digestibility; hence, the study was conducted.

MATERIALS AND METHODS

Feed Intake and Digestibility

Digestion trial was conducted with sixteen heads of bucks of Anglo-Nubian X Boer crossbreed; different weights (17-27 kg) were used in this study. Corn fodder and mixed concentrate with palm kernel meal were fed during the 7-day adjustment period and the 14-day experimental period. The experimental treatments consisted of corn fodder and basal concentrate diet with the supplementation of palm kernel meal. Experimental treatment diets were: Treatment 1 - 100% commercial cultivar of white corn variety; Treatment 2 – 100% F1 Taiwanese corn fodder; Treatment 3 – F1 Taiwanese corn fodder plus mixed concentrate with 0% palm kernel meal; and Treatment 4 – F1 Taiwanese corn fodder with 30% palm kernel meal in the total mixed concentrate ration.

Goats were housed in individual metabolic cages designed with feeding trough and waterer. Fecal collection bag (harness) made of cloth tailored to fit the animal's body for the collection of fecal material was used. The mixing of feed formulation was based on the nutrient requirement for meat producing goats (NRC, 1981). Feed intake and fecal excretion were recorded to determine its digestibility by computing the difference between amounts of feed consumed and amount of excreta over feed consumed. Fresh and air dried feed samples and dried fecal samples were analyzed in the laboratory to determine its nutrient value analysis using the AOAC method of analysis (AOAC, 1984).

Table 1. Proximate analysis in fresh and dry matter basis of F1 Taiwanese corn fodder (65 DAP) and commercial corn fodder (75 DAP).

Parameters	F1 Taiwanese corn fodder		Commercial corn fodder	
	Fresh Basis	Dry Matter Basis	Fresh Basis	Dry Matter Basis
Moisture, (%)	86.00	-	83.29	-
Dry matter, (%)	-	14	-	16.71
Ash, (%)	1.47	10.50	1.61	9.64
Organic matter, (%)	12.53	89.50	15.10	90.36
Crude protein, (%)	1.28	9.12	1.40	8.36
Crude fiber, (%)	5.25	37.39	5.78	34.57
Crude fat, (%)	0.76	5.44	0.33	1.99
NFE, (%)	5.24	37.44	7.59	45.44
NDF, (%)	11.05	78.91	13.93	83.38
ADF, (%)	7.36	52.57	9.72	58.20
Gross energy (kcal/kg)	539.31	3,852.21	620.62	3,714.04
Digestible energy, (kcal/kg)	409.88	2,927.68	496.49	2,971.23
TDN, (%)	12.42	88.71	15.04	90.03

Table 2. Average dry matter intake and digestibility of goats fed with corn fodder diets.

Treatments	Treatment Mean		
	Dry Matter ** Intake (% voluntary)	Dry Matter** Intake (% body weight)	Dry Matter ^{ns} Digestibility (%)
Commercial corn fodder	1.22 ^c	5.75 ^c	90.50
Taiwanese corn fodder	1.04 ^c	4.95 ^c	89.20
Tai. Corn fodder + (0%PKM)	2.73 ^a	12.35 ^a	89.21
Tai. Corn fodder + (30% PKM)	1.82 ^b	8.10 ^b	89.85

Means having the same letter are not significantly different based on Tukey's test

** = highly significant

Results were tabulated and analyzed using the Tukey Test (Honestly Significant Difference) to test if there was significant difference among the observed treatment means (Gomez and Gomez, 1984).

RESULTS AND DISCUSSION

The proximate analysis of corn fodder in fresh and dry matter is shown in Table 1. The dry matter of corn fodder revealed high in commercial fodder with 16.71% as compared to Taiwanese corn fodder with only 14%. Values on the parameters such as ash (%), organic matter (%), crude protein (%), and energy have comparable results. However, fiber content and crude fat of Taiwanese corn fodder revealed higher as compared to the commercial corn fodder. These differences can be due to age of maturity and the variety of corn.

Dry matter digestibility revealed no significant differences among treatment means. As the total feed intake increased, fecal excretion increased but the digestibility decreased when goats were fed with corn fodder diets. Goats efficiently digests fibrous feeds due to its microbial action present in the rumen. Feeding higher amount of fibrous and indigestible feed in the diets results to lower digestibility. The result implies that there was an inverse relationship between feeding fibrous intake and digestibility.

The digestibility correlation in this study corroborated with the study by Woods, *et al.* (2003) which said that increasing level of feeding palm kernel meal fed in sheep and cattle would decrease the dry matter digestibility. Result also showed higher digestibility of corn fodder alone compared with corn fodder added with concentrate ration due to the amount of fiber and lignin in the feed.

Dry matter intake differed highly significant when goats were fed with 30% palm kernel meal and Taiwanese corn fodder as compared to corn fodder alone. However, results revealed that dry matter intake of goats were highly significant when mixed concentrates and corn fodder were fed.

The differences of chemical composition were affected by various factors such as stage of maturity, time of harvesting, temperature, and other climatic factors. The quantity of feed ingested changed with the type of diet by the different treatment schemes in the experiment.

The results showed that total feed intake (in dry matter basis) was highly significant when goats were fed with corn fodder added with mixed concentrate

ration in treatment 3 and treatment 4. The result conformed to the findings of Soliman et al. (1975) in the use of corn fodder, its silage, and corn stover as an animal feed where significant differences were observed in the feed intake (in dry matter basis) and biological value of the three products. Variation in feed intake was due to the fibrous component of palm kernel meal composed of mainly insoluble mannose (mannan) based polysaccharides. Cell wall consists of 58% mannan, 12% cellulose, and 4% xylan as reported in the study of Jaafar and Jarvis (1992) on the chemical composition of palm kernel cake.

Organic Matter Digestibility

The digestibility of organic matter and apparent digestible energy obtained by *in vivo* method are shown in Table 3. Highly significant effects among treatment means were observed based on Tukey test. There was an increase of organic matter digestibility in treatments that received corn fodder added with mixed concentrate ration in treatment 3 and treatment 4 compared to corn fodder alone (T₁ and T₂). A significant negative correlation was found between digestible organic matter and NDF (%) as reported by Ceresnakova, et al. (1996), where higher NDF in the feed would decrease its organic matter digestibility.

Highly significant differences were observed in organic matter digestibility. T₃ (0% PKM) showed the highest organic matter digestibility (%) with 84.94% followed by T₄ (30% PKM) with 76.74%. This implies that addition of palm kernel meal to the ration would increase its organic matter digestibility. More cell wall content was digestible to the rumen micro-organisms to degrade and ferment available carbohydrates through microbial digestion.

Results indicated that increasing the level of feed intake in palm kernel based concentrate ration would decrease its organic matter digestibility as corroborated with this study by Woods, *et al.* (2003).

Apparent Digestible Energy

The apparent digestible energy (kcal/kg) was based on Atwater's physiological fuel value. It was termed apparent because some of the fecal energy was of non-dietary origin such as excretions from the gastro intestinal tract (GIT), sloughed epithelial cells, and microbial cells. Commercial corn fodder (T₁) gave much higher energy compared to Taiwanese corn fodder (T₂). However, T₃ recorded the highest apparent digestible energy with 4,008.20 kcal/kg, followed by T₁ with 3,559.41 (kcal/kg), and 3,555.96 (kcal/kg) and 3,453.07 (kcal/kg) in T₄ and T₂, respectively. As reported by Knudsen (1997), palm kernel meal are having high amount of carbohydrates in the form of non-starch polysaccharides which contribute to high amount of digestible energy.

Statistical analysis revealed that apparent digestible energy of corn fodder added with palm kernel meal concentrate was found highly significant compared with Taiwanese corn fodder alone. This implies that feeding corn fodder with the addition of 30% of palm kernel meal in the total mixed concentrate ration would increase the digestible energy of goats. The results conformed with the findings of Omara, *et al.* (1999) that states, nutritive value of palm kernel meal measured *in vivo* using rumen fluid and enzymatic techniques reported that palm kernel meal constitutes high quality energy feed for ruminants.

Table 3. Average organic matter intake, organic matter digestibility, and total apparent digestible energy (kcal/kg) of goats fed with corn fodder based diets.

Treatments	Treatment Mean		
	Organic Matter ** Intake (kg)	Organic Matter ** Digestibility (%)	Apparent Digestible ** Energy (kcal/kg)
Commercial corn fodder	1.10 ^c	34.01 ^c	3,559.41 ^{ab}
Taiwanese corn fodder	0.93 ^c	22.55 ^d	3,453.07 ^c
Tai. Corn fodder + (0%PKM)	4.74 ^a	84.94 ^a	4,008.20 ^a
Tai. Corn fodder + (30% PKM)	3.09 ^b	76.74 ^b	3,555.96 ^{ab}

Means having the same letter are not significantly different based on Tukey's test.

** = highly significant

CONCLUSION

It is concluded that using corn fodder based-diets with palm kernel meal ration can improve the performance of goats in nutrient digestibility and revealed significant results. This is due to supply of nutrients for rumen fermentation and micro-organisms activity in the digestive tract of the goat. Using commercial corn fodder has more advantages than F1 Taiwanese corn fodder because it has high dry matter yield and herbage yield per hectare to supply the forage requirement of the animal. In addition, highly significant differences were observed in treatment means in terms of dry matter intake, organic matter intake, organic matter digestibility, and apparent digestible energy.

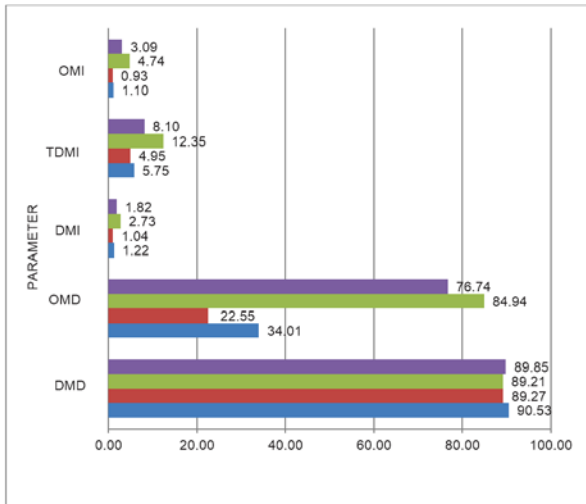


Figure 1. Average dry matter intake, dry matter digestibility, organic matter intake, total dry matter intake, and organic matter digestibility of goats fed with corn fodder based diets.

Legend: T₁ – Blue; T₂ – Red; T₃ – Green; T₄ – Purple

Parameter:

- DM Digestibility, (%)
- OM Digestibility, (%)
- DMI, (% voluntary)
- TDMI, (% body weight)
- OMI, (kg)

RECOMMENDATION

The results of this study indicate that inclusion of 30% palm kernel meal in the total mixed ration can improve the nutrient digestibility in goats in terms of dry matter intake, organic matter intake and digestibility, and apparent digestible energy. Additionally, forage corn has low total digestible nutrient (TDN) values based on the proximate analysis. It is, therefore, recommended to supplement palm kernel meal based ration to improve the feed intake, energy values, and growth performance of goats.

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