Nutrient intake and digestibility in sheep fed oil palm cake diets

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Keywords: Nutrition, Animal Production, Ruminants.

Introduction: Oil palm cake is the product resulting from the dry palm oil pulp, after milling and extraction of its oil. Oil palm cake is availabe throughout the year, and it is an excellent alternative for feed supplementation of ruminants, especially in critical periods, when the availability of fodder decreases considerably. The objective of this study was to evaluate the voluntary intake of confined sheep and digestibility of nutrients in diets with increasing inclusion levels (0, 8, 16 and 24%) of oil palm cake.

Material and methods: Thirty two Santa Inês ewes were used, with initial body weight of 47.61 ± 5.44 kg and approximate age of 8 years. The diets were provided in the ratio of 80% concentrated feed and 20% roughage. Aliquots of concentrate and roughage from those supplied to animals were sampled weekly. Post-consumption leftovers were sampled daily. At the end of the collection period, an individual composite sample was performed for further processing and analysis of its chemical composition. Leftovers and feces samples were analyzed for of DM, MM, EE, CP and ADF**.** During the analysis of NFD**,** the samples were treated with thermostable alpha-amylase and 8 mol / L urea solution without sodium sulfite and corrected for residual ash. It was recorded daily the consumption of animals (supplied - leftovers) to determine the dry matter intake (DMI) and the apparent digestibility coefficients of DM, OM, CP, EE, NDFcp, e NFC, were estimated by the difference between the amount of nutrients ingested and excreted in the faeces. Daily fecal excretion was estimated using the internal marker of the NDFi. The determination of the concentration of the NDFi the samples were performed by *in situ* incubation for 288h and neutral detergent fiber analysis.

Results and discussions: With the increasing levels of inclusion of palm oil cake in the diet of animals, the consumption of DMi, EE, NDFcp, NDFi and the TC increased linearly ($P < 0.05$). While the consumption of DM, OM e CP, were not influenced ($P > 0.05$). However, the consumption of CNF e ED, decreased linearly ($P < 0.05$) with increasing palm oil inclusion levels (Table 1). It is likely that this reduction is related to the composition of the diets (Table 2), since increasing the level of palm oil cake reduced the levels of NFC e DE.
As the level of inclusion of palm oil cake in the diets increased, there was a linear reduction ($P < 0.05$) for the digestibility of DM, OM, CP, NDF, NFC e TC. The only nutrient that was not influenced ($P > 0.05$) by this inclusion was the digestibility of the EE (Table 2).

Table 1. Nutrient diestibility as a function of palm oil cake inclusion levels (g kg^{-1} DM) in the diets of discarded sheep

Item	Inclusion palm oil pie g kg^{-1} DM				MSE	Value of P		RE
	0	80	160	240		L	Q	
DM (g day^{-1})	1464.4	1458.7	1498.6	1438.4	24.5	0.8342	0.5136	$\hat{Y}$ = 1466.2
DMi (g day^{-1})	102.6	153.1	161.4	256.5	7.0	<.0001	0.0007	1
OM (g day^{-1})	1400.7	1396.5	1423.0	1360.1	23.3	0.5837	0.4593	$\hat{Y}$ =1396.3
EE (g day^{-1})	49.7	56.9	62.0	68.8	1.3	<.0001	0.9210	2
CP (g day^{-1})	230.8	210.9	218.2	218.8	3.8	0.3233	0.1085	$\hat{Y}$ = 220.6
NDFcp (g day^{-1})	411.4	432.8	461.0	470.1	8.2	0.0007	0.6637	3
NDFi (g day^{-1})	67.96	107.44	130.05	189.03	5.3	<.0001	0.0561	4
NFC (g day^{-1})	721.4	676.9	648.0	601.4	12.4	<.0001	0.9650	5
TC (g day^{-1})	1046.4	1052.0	1063.2	1077.2	0.5	0.6147	0.9243	$\hat{Y}$ = 1059.4
DE (Kcal day^{-1})	3.3	3.2	3.1	2.9	0.1	<.0001	0.6764	6

RE: $\hat{Y}1 = 96.7274 + 0.6166x$ (r^2=0.89); $\hat{Y}2 = 50.5124 + 0.0738x$ (r^2=0.99); $\hat{Y}3 = 413.9007 + 0.2442x$ (r^2=0.97); $\hat{Y}\ 4 = 65.8693 + 0.5038x$ (r^2=0.97); $\hat{Y}5 = 736.3333 - 0.5163x$ (r^2=0.99); $\hat{Y}6 = 3.3104 - 0.0019x$ (r^2=0.96), MSE: Mean standard error; L: Linear; Q: Quadratic; RE: Regression equation; BW: Body Weight; MW: metabolic weight; ($MW=BW^{0,75}$).

The drop in digestibility of DM may be attributed to a reduction in the levels of NFC, and the increase in NDF in the diets of sheep. The decreased digestibility of CP can probably be explained by the proportion of unavailable nitrogen associated with lignin and fibrous fractions found in palm oil cake.

Table 2. Nutrient digestibility coefficients of diets containing increasing levels of palm oil inclusion (%) in the diets of discarded ewes.

Item	Palm oil pie				EPM	Value of P		ER
	0	80	160	240		L	Q	
DM	70.7	65.9	64.9	62.0	1.0	0.0018	0.6157	1
OM	73.2	68.2	67.7	65.1	0.9	0.0023	0.5142	2
EE	86.2	84.0	83.8	84.6	0.6	0.3302	0.2240	$\hat{Y}$ = 84.8
CP	64.4	61.1	59.6	57.2	1.0	0.0032	0.8056	3
NDF	59.2	57.9	57.2	51.7	1.1	0.0115	0.3353	4
NFC	81.3	77.5	76.2	73.6	0.8	0.0004	0.7226	5
TC	72.5	68.4	68.0	64.8	0.8	0.0008	0.7750	6

ER: $\hat{Y}1 = 68.4692 - 0.0247x$ (r^2=0.93); $\hat{Y}2 = 71.1145 - 0.0229x$ (r^2=0.89); $\hat{Y}3 = 60.6955 - 0.0089x$ (r^2=0.98); $\hat{Y}4 = 58.6296 - 0.0167x$ (r^2=0.82); $\hat{Y}5 = 80.4649 - 0.0256x$ (r^2=0.97); $\hat{Y}6 = .72.5500 – 0.0286x$ (r^2=0.92).

Conclusion: It is inferred that the inclusion of palm oil cake at levels up to 24% in the sheep diet increased the consumption of most nutrientes (EE, NDFcp, NDFi and TC). However, it negatively affected nutrient digestibility.