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UTILIZATION OF PALM KERNEL CAKE IN MUSCOVY DUCKS

MUSTAFA FADIL MOHAMMED

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Thesis Submitted to the School of Graduate Studies, Universiti Putra Malaysia,
in Fulfilment of the Requirements for the Degree of Doctor of Philosophy

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DEDICATION

TO MY LATE FATHER AND MY DAUGHTER MARYAM

Abstract of thesis presented to the Senate of Universiti Putra Malaysia in fulfilment of the requirements for the degree of Doctor of Philosophy

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Chairman: **Associate Professor Abd Razak Alimon, Ph.D.**

Faculty: **Agriculture**

Four experiments were conducted on Muscovy ducks to evaluate their utilization, performance and nutrient digestibility when offered diets containing different levels of palm kernel cake (PKC). In the first experiment, two types of PKC (solvent and expeller extracted) were force-fed to male and female ducks 7 weeks of age and the nutrient digestibility, true metabolizable energy and true amino acid digestibility were determined. There was no significant ($p>0.05$) effect on the type of PKC used on crude protein (CP), ether extract (EE), metabolizable energy (ME) and amino acid (AA) digestibility, except for those of dry matter (DM) and neutral detergent fibre (NDF) which was higher in solvent extracted compared to expeller extracted PKC. It was found that the ducks utilized about 47% of the gross energy in PKC. The average apparent metabolizable energy value of PKC for Muscovy ducks was obtained to be 1870 kcal/kg, which was rather higher than those reported in broiler chickens.

The performance of male and female Muscovy ducks when fed diets containing 15% and 35% levels of PKC were investigated. The results indicated that inclusion of up to 15% of PKC in growing diet for ducks did not depress growth nor feed conversion ratio (FCR) at any significant degree. Given the low cost of PKC, such usage is likely to be economic, depending, to some extent, on cost of added oil. At this level no negative effect in faecal consistency nor carcass fatness were observed. As PKC level increased up to 35%, the ducks ate more feed and as a result had poorer FCR. The explanation for the poorer FCR could be related to the decline in the energy and protein digestibility when ducks were fed at higher PKC level as compared to the control diet. It could be suggested that addition of oil to PKC based diet may improve the palatability and thus the feed intake and the performance of the ducks.

Differences in the feed efficiency and nutrient digestibility between Muscovy ducks and broiler chickens were found when PKC was included up to 25% in the diet. Feeding up to 25% level of PKC to ducks was not associated in any detrimental effects on the performance and FCR. However, FCR was depressed when PKC was added at 25% level to broiler grower diet. The ME value was found to be higher in ducks than in chickens. This indicates that the ME value for chickens cannot be applied to ducks. The digestibility of NDF was found to be higher for ducks than for chickens and this could be due to the higher hemicellulose digestibility for ducks than for chickens.

The effect of feeding PKC on the intestine dimension, villus height and shape was examined after two and five weeks post-feeding. The results showed that there was no effect of feeding PKC on the intestinal length and weight at both ages. There was no effect on the villus height of the jejunum of the diet, sex and age. However, villus height in the ileum of the male ducks fed PKC after two weeks post-feeding was found to be shorter than those of the control diet. There was no effect in the villus height of the ileum after five weeks post-feeding. The morphology of different intestinal parts was examined under the scanning electron microscope (SEM) at both periods. No damage was found at any intestinal part that could be related to dietary PKC. The results suggested that PKC have no adverse effect on the intestine of Muscovy ducks.

Abstrak tesis yang dikemukakan kepada Senat Universiti Putra Malaysia sebagai memenuhi keperluan untuk ijazah Doktor Falsafah

PENGGUNAAN HAMPAS ISIRUNG KELAPA SAWIT (PKC) PADA MAKANAN ITIK MUSCOVY

Oleh

MUSTAFA FADIL MOHAMMED

Ogos 2003

Pengerusi : Profesor Madya Abd Razak Alimon, Ph.D.

Fakulti : Pertanian

Empat ujikaji telah dijalankan ke atas itik Muscovy untuk menilai tahap pengambilan, prestasi dan nilai cerna nutrien apabila diberi diet-diet yang mengandungi aras PKC yang berbeza. Dalam ujikaji pertama, dua jenis PKC (secara pelarut dan perah asak) telah diberikan secara paksa kepada itik jantan dan betina semasa tempoh pertumbuhan (umur 7 minggu). Nilai cerna nutrien, tenaga metabolisma sebenar dan nilai cerna asid amino sebenar ditentukan. Tiada perbezaan ketara diperolehi antara kedua-dua jenis PKC tersebut daripada segi nilai cerna bahan kering, protein kasar dan asid amino kecuali NDF yang didapati lebih tinggi pada kumpulan yang diberi makan PKC secara pelarut berbanding dengan PKC perah asak. Itik-itik ini didapati menggunakan kira-kira 47% tenaga kasar daripada PKC. Purata nilai tenaga metabolisma PKC pada itik-itik tersebut adalah 1870 kcal/kg.

Kajian juga telah dijalankan terhadap prestasi itik Muscovy jantan dan betina yang diberi PKC pada aras 15% dan 35%. Keputusan menunjukkan bahawa

penambahan PKC sehingga 15% di dalam makanan itik yang sedang membesar tidak merencatkan pertumbuhan atau FCR. Berasaskan kos yang murah, penggunaannya mungkin lebih ekonomi. Walau bagaimanapun, ini bergantung kepada kos minyak sawit yang ditambahkan. Pada aras ini, tiada kesan negatif didapati pada aliran tahi dan kegemukkan karkas apabila aras PKC ditingkatkan sehingga 35%, itik-itik didapati mengambil lebih banyak makanan sehingga menyebabkan penurunan FCR. Penurunan FCR ini mungkin berkaitan dengan penurunan nilai cerna tenaga dan protein apabila ternakan ini diberi makan PKC pada aras 35%, berbanding dengan diet kawalan. Adalah dicadangkan bahawa penambahan minyak ke dalam diet berasaskan PKC boleh meningkatkan kecekapan dan pengambilan makanan serta presatasi itik-itik tersebut.

Perbezaan dalam kecekapan penukaran makanan kepada daging dan nilai cerna nutrien antara itik Muscovy dan ayam pedaging dikesan apabila aras PKC ditingkatkan sehingga 25% di dalam makanan. Pengambilan PKC sehingga ke aras 25% tidak memberi sebarang kesan pada prestasi dan FCR itik. Walau bagaimanapun, di dalam makanan ayam pedaging FCR mula direncat apabila PKC ditambah ke aras 25%. Nilai ME didapati lebih tinggi pada itik berbanding pada ayam. Ini menunjukkan bahawa nilai ME untuk ayam tidak boleh digunakan untuk itik. Nilai cerna NDF didapati lebih tinggi pada itik berbanding dengan nilai cerna pada ayam, dan ini terutamanya disebabkan oleh keupayaan mencerna hemiselulosa yang lebih tinggi pada itik berbanding pada ayam.

Ujian terhadap kesan pengambilan PKC terhadap morfologi usus,tinggi dan bentuk vilus telah dijalankan selepas dua dan lima minggu pengambilan makanan

tersebut. Keputusan menunjukkan bahawa pengambilan PKC tidak memberi kesan terhadap kepanjangan dan berat usus pada kedua-dua peringkat umur. Makanan, jantina dan umur tidak memberi kesan terhadap tinggi vilus pada jejunum. Walaupun begitu, ketinggian vilus di dalam bahagian ileum pada itik jantan yang mengambil makanan kawalan didapati lebih panjang berbanding kumpulan itik yang mengambil PKC selepas dua minggu. Tiada sebarang kesan pada ketinggian vilus di ileum selepas lima minggu pengambilan. Pemerhatian morfologi pada bahagian usus telah diperiksa menggunakan mikroskop elektron pada kedua-dua tempoh tersebut. Tiada terdapat sebarang kerosakan pada bahagian usus yang boleh dikaitkan dengan pengambilan PKC. Keputusan ini menunjukkan bahawa PKC tidak memudaratkan usus itik Muscovy.

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LIST OF ABBREVIATIONS

AA	Amino Acid
ANOVA	Analysis of Variance
AOAC	Association Official Agricultural Chemists
ADF	Acid Detergent Fibre
AME	Apparent Metabolizable Energy
AMEn	Apparent Metabolizable Energy Corrected to Zero Nitrogen
Ca	Calcium
CF	Crude Fibre
CP	Crude Protein
cm	Centimetre
Cu	Copper
DCP	Di Calcium Phosphate
DE	Digestible Energy
DM	Dry Matter
EE	Ether Extract
FCR	Feed Conversion Ratio
g	Gram
GE	Gross Energy
Kcal	Kilocalorie (1Kcal = 4.186 kJ)
kg	Kilogram
ME	Metabolizable Energy
Mg	Magnesium
Min	Minute

Mn	Manganese
N	Nitrogen
NRC	National Research Council
NDF	Neutral Detergent Fibre
NFE	Nitrogen Free Extract
NS	Not Significant
P	Phosphorus
PITC	Phenylisothiocyanate
PKC	Palm Kernel Cake
PTC	Phenylthiocarbamyl
SE	Standard Error
SEM	Scanning Electron Microscope
TEA	Triethylamine
TME	True Metabolizable Energy
TMEn	True Metabolizable Energy Corrected to Zero Nitrogen
VFA	Volatile Fatty Acid
Zn	Zinc