Commercial Utilization of Palm Kernel Cake in an Intensive Production System of Ruminants

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Introduction

Palm kernel cake (PKC) is a by-product of oil palm industry with high nutritive values that can be used as basal diets in animals, especially in ruminants. The diet is easily available in the country and in 1997 alone Malaysia had exported about 1.1 million tones of PKC. However, the high copper contents in PKC can cause toxicity, especially when used among sheep (1, 2, 3). Goats, cattle and buffaloes seem to tolerate the toxic effect of copper in PKC, although the hepatic copper content in the PKC fed animals were significantly elevated (4, 5, 6, 7). This is of public health importance as liver and other visceral organs are commonly used for human consumption. Furthermore, toxicity may occur after long use of the diet. Recent studies had successfully produced a safe PKC diet by dietary zinc supplementation either with or without ammonium molybdate (8, 9, 10). However, the product needs to be improved for commercial utilisation. A new PKC product which is safe, economic, that could be conveniently used, and improve growth performance of animals need be developed.

Materials and Methods

Four types of PKC based diet namely; PKC with zinc supplementation (Diet 1), PKC with zinc, mineral salts and vitamins supplementation (Diet 2), PKC with zinc, mineral salts, vitamins and feed additive (chlortetracycline) supplementation (Diet 3) and PKC with zinc, mineral salts, vitamins and feed additive (*monensin*) supplementation (Diet 4) were formulated and fed in four groups of Malin x Polled Dorset crossbred lambs. The animals were fed solely (100%) on the diet and the feed intakes and body weight were recorded. The animals were monitored throughout the feeding trial an slaughtered as they reached a body weight of 30 kg. The carcass was examined for any gross lesions and the right lobe of the liver sample was collected for copper and zinc analysis using an atomic absorption spectrophotometer (11). The liver sample was also fixed in 10% buffered formalin and 2.5% glutaraldehyde for histological and ultrastructural examination, respectively (12).

Results and Discussion

The study showed that all animals (100%) fed diet 3 and 50% of the sheep fed diets 2 and 4 achieved the targeted body weight of 30 kg within 12 to 20 weeks of the feeding trial. In contrast, all sheep (100%) fed diet 1 failed to reach the targeted body weight during the period. The average daily gain of animals fed diet 1 (43.4 $\pm$ 4.7g) was significantly lower ($p<0.05$) than those of sheep fed diet 2 (179.3 $\pm$ 11.9g), diet 3 (174.1 $\pm$ 9.6g) and diet 4 (172.5 $\pm$ 19.7g). The animals fed diet 1 (10.9 $\pm$ 1.0) also had poorer ($p<0.05$) feed conversion ratio than those of sheep fed with diet 2 (4.1 $\pm$ 0.3), diet 3 (4.9 $\pm$ 0.4) and diet 4 (4.6 $\pm$ 0.5). The average daily gain of animals fed diet 2 (94.3 $\pm$ 3.6 g) and diet 4 (88.6 $\pm$ 17.2g) which failed to achieve the targeted body weight were also significantly higher ($p<0.05$) than in sheep fed with diet 1. The feed conversion ratio was 7.3 $\pm$ 0.3 and 9.3 $\pm$ 1.8 in the sheep fed with diets 2 and 4, respectively. Neither clinical signs nor gross lesions of copper and zinc intoxication or copper deficiency were observed throughout the trial, except one animal each from group fed diets 1 and 4 died due to pneumonic pasteurellosis with some lesions of copper toxicity at 18 weeks of the feeding trial. The histological changes in the liver of sheep sacrificed as they reached the targeted body weight of 30 kg were rather mild or mild to moderate. Hepatocytes degeneration with single to multiple areas of necrosis observed in the central vein (zone 3). Mild fatty degeneration was also observed in the region. The hepatic copper concentration in sheep fed diets 2, 3 and 4 were 1147.4 $\pm$ 55.7 ug/g, 1214.2 $\pm$ 158.8 ug/g and 1285.6 $\pm$ 281.5 ug/g, respectively. This study has demonstrated that the new formulated PKC diet 2 can improve the performance of sheep to about double when compared to the diet 1. Furthermore, the quality of the diet was further improved when feed additives, namely chlortetracycline was added in the diet. Chlortetracycline is being used as feed additives in poultry, pigs and lambs (13, 14). It may improve the performance of the animals by changing the microorganism population in the gastrointestinal tract and increased the digestibility of PKC. In contrast, the usage of monensin in the diet in the present study did not show much impact on the performance of the animals when compared with that of chlortertracycline. Monensin can enhance the production of propionate and improve the efficacy of use of volatile fatty acid (13). It was also reported to increase feed efficiency in cattle and broiler chickens (14).

Conclusions

This study has successfully developed a safe and high quality PKC based diet for intensive production system of sheep. Dietary zinc supplementation can confer protection against PKC toxicity. The performance of the sheep was significantly improved when the diet was further supplemented with mineral salts and vitamins either with or without feed additives.

Benefits from the study

A safe and high quality PKC diet was successfully developed for commercial utilisation. An intensive production

system of sheep fed solely on PKC based diet was proved to be effective and improved growth performance of the animals. The new PKC diet may also be practically used for other ruminants such as goats, cattle and buffaloes.

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Graduate Research

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