

Utilisation of Oil Palm Kernel Cake in Compound Feed for Feeding Livestock

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SUMMARY

Palm kernel cake (PKC) being one of the potential sources of nutrients in the feed industry for ruminants and non-ruminants. PKC is a rich source of protein, dietary fibre, fats, amino acids, and many other micronutrients. So, PKC has got diverse application in the preparation of feed diet for animals including beef cattle, dairy cattle, poultry, sheeps, goats, swine, aquaculture etc. PKC has potential to reduce the cost of feeding to livestock with high nutrition source, however the use of PKC in diets of livestock is limited due to high fibre content which leads to digestive problems in livestock. Formulation of ration was done for various livestock based on their characteristics, which improved growth performance and production.

INTRODUCTION

Oil palm (*Elaeis guinensis* Jacq.) is known to be the highest edible oil yielding perennial crop originated in tropical rain forest of western Africa, is now being cultivated in more than 45 countries around the world especially tropical regions *i.e.*, Malaysia, Indonesia, Thailand, Nigeria, Columbia and Ghana. Besides producing palm oil, the plantations of oil palm also abundantly produce a number of useful by-products such as oil palm fronds (OPF), oil palm trunks (OPT), palm press fibre (PPF), empty fruit bunches (EFB), palm kernel cake (PKC), palm oil mill effluent (POME) and palm kernel shells (PKS) throughout the year and this guarantees their supply and availability.

Palm kernel cake is a solid high protein residue produced during extraction of oil from oil palm fruits and have been extensively used for feed application to ruminants, poultry, swine and fish, since it does not contain aflatoxins. Nutritionally, PKC is considered as an attractive food ingredient due to its considerable amount of nutrients comprising of 50.3% carbohydrate, 14.8% protein, 16.7% crude fibre, 7.9% edible oil, moisture 6.4%, 3.9% ash and many other micro nutrients. It can be explored as a potential source of plant protein and energy source for human food consumption and animal nutrition. The PKC can be used as compound feed for ruminants and non-ruminants, and other livestock. Compound feed is a mixture of feed ingredients obtained from various sources. A feed ingredient is only a constituent of a compound feed and if used as the sole ration fed, has to be enriched further. The composition of a compound feed is determined by three main criteria, *i.e.*, price, nutritional composition and the animal characteristics. The nutritional composition of a compound feed varies depending on the type of livestock to be fed and on their stages of growth. Attempts have been made to feed PKC to livestock practically and widely used most in ruminant diets compared to non-ruminant diets. The use of PKC as part of feed meal formulation for the non-ruminant and poultry industry is limited due to its high fibre content. The palm kernel cake (PKC) proportion in compound feed varies for various livestock. This paper highlights the formulation of compound feed for various livestock with different proportion of PKC.



Fig. 1 Palm kernel cake powder

PKC utilization in beef cattle and buffaloes

PKC is widely used as the main ingredient in rations for feedlot cattle and buffaloes. In Malaysia, feedlot cattle are normally fed up to 80% PKC with live weight gain (LWG) of 0.6-0.8 kg per day and 1-1.2 kg per day for local and crossbreed cattle, respectively. PKC at almost 100% has been fed to feedlot cattle with no negative effect provided that the supply of Ca and vitamins (in particular, A, D and E) is sufficient to meet their requirements. Many studies have shown that supplementing the traditional rations of beef cattle with 30-50% PKC gave improved performance and increased LWG. It is a common practice in Malaysia to produce complete feeds based on PKC, either as pellets, cubes, or total mixed ration (TMR). Apart from PKC, other common ingredients are rice bran, brewer's grain, palm oil mill effluent (POME), tapioca waste, urea, salt and minerals. Carcass analysis indicated that the beef cuts were of superior quality when compared to those for cattle fed on grass or pasture. An example formulation for beef cattle is PKC: 80%, grass/hay: 17.5%, limestone: 1.5% and mineral premix: 1.0%.

PKC utilization in dairy cattle

In dairy cattle rations, PKC is used as a source of energy and fibre at the inclusion level of 30%-50%. PKC-based dairy cattle pellets are popular and are commonly fed together with grass and other concentrates. Grass and concentrates are fed at 50%-70% inclusion apart from PKC. Other common ingredients in rations, for dairy cattle are rice bran, brewers' grain, palm oil sludge (POS) and POME, soyabean waste, bakery waste, salt, and minerals. In some areas, grass and other forages high in protein are given ad libitum. An example of dairy cattle feed formulation is PKC: 50%, molasses: 5%, grass/hay: 42%, limestone: 1.5%, mineral premix: 1.0% and salt: 0.5%. Most of the PKC exported to Europe are used in dairy cattle rations, but the level of inclusion is rather limited, *i.e.*, about 7-15%.

PKC utilization in sheep and goats

The recommended inclusion level of PKC in sheep rations is 30%. Long-term feeding of PKC at high inclusion level (>80%) can cause Copper (Cu) toxicity in sheep as sheep is known to be very susceptible to Cu poisoning. Some sheep breeds (especially crossbreeds) accumulate Cu in their liver causing liver damage. Addition of 100 ppm of zinc sulphate or 5.2 mg kg⁻¹ ammonium molybdate together with 440 mg kg⁻¹ sodium sulphate in the rations can overcome the problem. Cu toxicity does not appear in cattle, buffaloes, goats, and other animals. An example of feed formulation for goat is PKC: 50%, grass/hay: 30%, rice bran: 10%, soyabean meal: 9% and mineral premix: 1.0%

PKC utilization in swine

PKC is also suitable for swine at 20%–25% inclusion for growers and finishers. In some areas in Peninsular Malaysia, PKC is used at lower levels (about 5%-10%). An example formulation for swine is PKC: 20%, maize: 65.5%, soyabean meal: 9.5%, fish meal: 3%, dicalcium phosphate: 1.5%, mineral premix: 0.2% and salt: 0.3%. In Nigeria, PKC is fed to swine at from 15%-40% without any negative effects on performance. In Ghana, PKC was included at 25%–35% in the rations of grower and finisher pigs, respectively.

PKC utilization in poultry

Owing to its high fibre content, the use of PKC in poultry rations is very limited. There exist wide variations in the optimum inclusion level of PKC in poultry rations. The main reasons are due to the origin and variations in the oil and shell content of the PKC used. Broilers can tolerate up to 20% PKC in their diets without affecting their growth performance and feed efficiency. A feed conversion ratio of 1:0.48 was reported for broilers fed palm kernel expeller (PKE) at 35 days of age. In layer rations, PKC can be included up to 25% without any deleterious effects on egg production and quality. Inclusion of PKC at levels >20% was reported to reduce egg production and egg quality but in another study, reduced egg production was observed only at levels >40%. Muscovy ducks can be fed PKE at 30% level without any deleterious effects on their performance. Apart from PKC, the locally available raw materials normally used in mixing feed for poultry are rice bran, wheat pollard, sago, tapioca, and broken rice.

PKC utilization in aquaculture

The use of PKC in aquaculture feed is quite limited due to high fibre content and its unpalatability. Earlier studies indicated that PKC can be tolerated up to 30% in catfish (*Clarias gariepinus*) and 20% in tilapia

(*Oreochromis niloticus*) rations with no deleterious effects on growth and performance. An example formulation for African catfish is PKC: 30%, fish meal: 20%, cassava flour: 15%, soyabean meal: 31%, sago: 1%, minerals and vitamins: 2% and vegetable oil: 1%.

Table 1 Recommended levels of PKC in livestock feeds

Livestock	Recommended level (%)
Beef cattle	50-80
Dairy cattle	30-50
Sheep	Maximum 30
Goat	30-50
Poultry-broiler	15-20
Poultry-layer	15-25
Swine	15-25
Freshwater fish	10-20

Note: *Specification based on Malaysian edible oil manufacturers' association standard

CONCLUSION

PKC has been shown to be a very promising source of energy and protein for ruminants and non-ruminants. PKC is a high energy source and is a cost-effective ingredient to be utilized in ration formulations for various livestock. PKC-based animal feeds in the form of pellets or cubes continues to be popular for livestock feeding. The optimum inclusion levels of PKC in the rations for beef cattle, dairy cattle, sheep, goats, poultry, swine, and freshwater fish are given for references if PKC is going to be utilized as an ingredient in the compound feeds. Improvement in feed efficiency with accelerating use of local feedstuffs represents a potential area of application to reduce this high cost. Use of PKC in rations of livestock eventually improved their growth performance and production.

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