SHORT COMMUNICATION

NUTRITIONAL VALUE VARIATION IN LOCAL PALM KERNEL CAKE FOR ANIMAL FEEDS

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ABSTRACT. Palm kernel cake (PKC) has long been known to be an important ingredient for the formulation of animal feeds. However the recommended levels of inclusion seem to vary from one reporter to another. This factor is considered important especially when formulating feeds for non-ruminant diets. The variation of its major constituents such as protein, fibre and fat contents is said to depend on the sources, oil removal technology and the efficiency of oil extraction from the kernel. For comparison, a set of compilation data of 300 local PKC samples from the past years on these basic nutritional constituents were studied. Majority of the samples analysed were from southern region of Peninsular Malaysia meant for animal feeds. Mean percentage values and their respective standard deviations were as follows; crude protein 16.1±1.65, crude fibre 19.3±4.22, crude ash 5.9±2.48, ether extract 5.6±3.36, dry matter 91.3±2.65, and metabolisable energy 7.75 MJ/kg. The objective of the study was to observe the distribution pattern of these values compared to other surveys. From this study, the highest relative standard deviation (RSD) reached 60% for ether extract, followed by ash 42.1%, and crude fibre 21.8%. From the variation point of view, periodical results for quality control of PKC must be initiated as an useful indicator for its accuracy of each diet formulation .

Keywords: palm kernel cake (PKC), variation, animal feeds

METHOD AND RESULTS

The proximate analysis was conducted according to AOAC Official Method of Analysis (2000). PKC samples were received from various sources of senders such as feed millers, home mixers and individuals from the past years for routine quality analysis activities at the Department of Veterinary Services laboratories. Majority of the samples analysed and data compiled were from the southern states of Peninsular Malaysia. All samples were classified as one common type based on their physical feature. About 35% of the samples were detected with significantly high concentration of calcium when tested with atomic absorption spectroscopy standard method. Results of analysis and distribution patterns in their nutritional constituent values are shown in Figures 1 to 5 respectively. Table 1 shows the results of SD of PKC samples under study. Table 2 shows the ranges of nutritional constituent values as reported by different

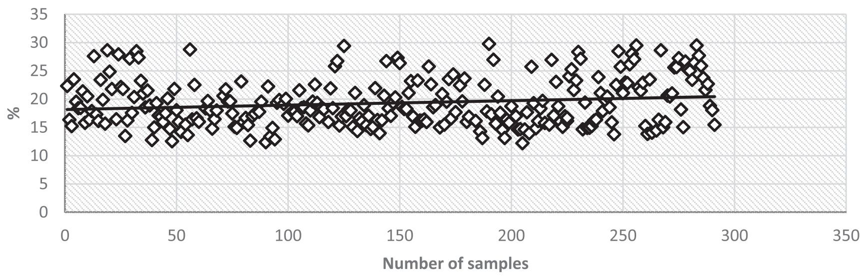

Figure 1. Distribution pattern of crude fibre

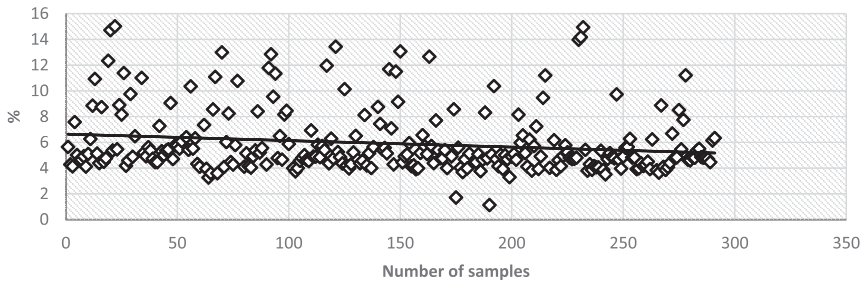

Figure 2. Distribution pattern of ash.

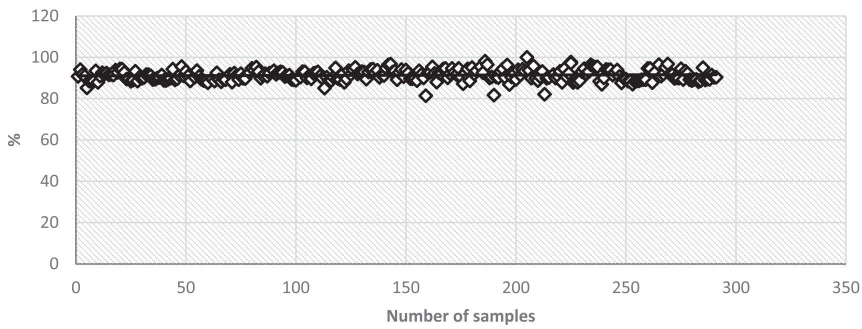

Figure 3. Distribution pattern of dry matter

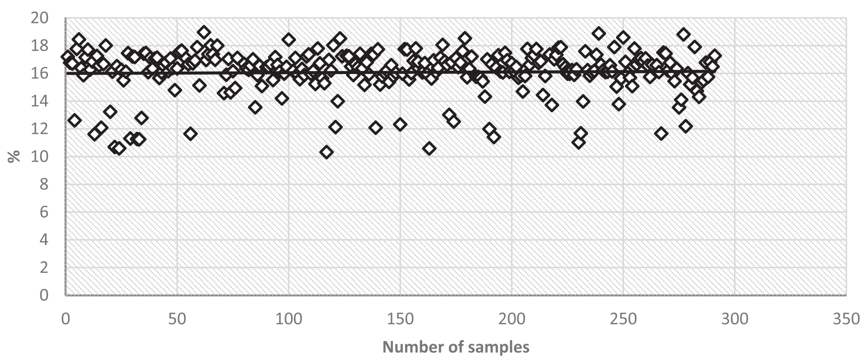

Figure 4. Distribution pattern of crude protein

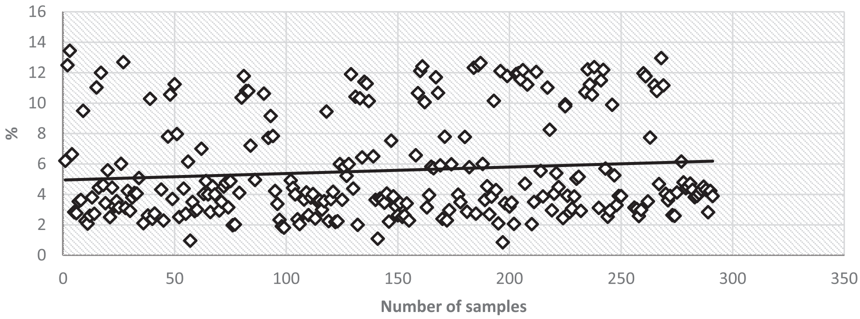

Figure 5. Distribution pattern of ether extract

Table 1. Variability in constituents of the 300 tested PKC samples.

Constituents	Mean	SD	RSD (%)
Dry matter	91.3	2.65	2.9
Crude protein	16.1	1.65	10.27
Crude fibre	19.3	4.22	21.85
Ash	5.9	2.48	42.11
Ether extract	5.6	3.36	60.32

Table 2. Comparison of constituents values between different references

Constituents	Range value (%)	Difference (%)	Reference
Dry matter	91.8-94	2.4	(1), (5)
Crude fibre	21-23	9	(1), (4)
Crude protein	14-21	40	(1), (2), (3)
Ash	3-6	67	(1), (4)
Ether extract	8-17	72	(1), (4)

selected researchers. Other constituents were not presented due to their inconsistent patterns.

DISCUSSION

PKC, sometimes referred to as palm kernel expeller (PKE), has long been known to be an important ingredient for the formulation of animal feeds. It is the main by-product of the palm kernel oil extraction process. It is a highly fibrous and medium grade protein feed, hence most suited to ruminant or rabbit feeding (Pickard, 2005). Palm kernel resulting from mechanical extraction contains 5% to 12% oil and solvent-extracted palm kernel meal contains 0.5% to 3% oil (Chin, 2001). Most of the palm kernel meal production goes to animal feeding (FAO, 2012). In 2016, Malaysia exported 2.4 million tonnes of PKC. About 90% of PKC produced in Malaysia was marketed to EU and other countries in Asia as feed ingredient with high ratio (50% to 80%) for ruminants. However, the use of this commercial PKC for poultry feed is said to be currently limited, despite the on-going research, due to the high content of fibrous material and shell (Malaysian Oil Palm Statistics 2016).

Conversely, the major problem of the feed industry for poultry production is its dependence on imported feedstuffs. Moreover, the global price of these imported feed ingredients is often subjected to price instability. To sustain, current emphasis is towards a constant supply of practical and low-cost feeds without compromising its nutritional value requirements. Utilising local crop residues and agriculture by-products like PKC or other substitutes through proper research channels for various types of livestock species need to be maximised. The challenge then, is for the livestock producers to accurately determine for each feed ingredient in terms of its nutrient content and the bioavailability of those nutrients to the animal. Then the amount of supplemental nutrients, if required, can be adjusted accurately to balance the diet to optimise animal performance and reduce the unnecessary amount of nutrient excretion. On the other hand, variation in nutrient contents can be another obstacle to livestock producers when the range of each constituent of concern sometimes differs significantly in its value. Based on expected variation, as described by St-Pierre N.R. *et al.* (1986) that feeds can be classified as having low, moderate, or high variability. Feeds with the largest variability in composition are by-products that are usually not a direct co-product of manufacturing. In Malaysia, three methods of palm kernel oil extraction have been reported; mechanical extraction (screw-pressing), solvent extraction and pre-pressing followed by solvent extraction (Saw *et al.*, 2012). Alimon (2004) reported that most of the PKC produced in Malaysia were from expeller extraction because the production cost was lower than solvent extraction. The PKC produced from screw-pressing contains higher oil content than those produced from solvent extraction and pre-pressing solvent extraction; however other composition, such as protein, crude fiber, and carbohydrate are almost similar (Tang and Teoh, 1985; Saw *et al.*, 2012).

From this study, it showed that relative standard deviation (RSD) of the tested PKC samples for ether extract was the highest, followed by RSD for ash, crude fibre and crude protein i.e. 60.3%, 42.1%, 21.9% and 10.27% respectively. While for dry matter, a relatively small RSD of 2.9% was observed (Table 1). These findings probably showed certain effects of different extraction processes , as reported by the above mention researchers, on the local PKC especially for ether extract and ash values. Table 2, shows the ranges of the constituent values reported by different researchers with the highest difference range is ether extract (72%), followed by ash (67%), crude protein (40%) and crude fiber (9%). For dry matter, the range is 2.4% which is almost comparable to the value obtained from this study. Values for fat and crude fibre needs to be considered more critically when used in mono-gastric animals. Even though a lot of work has been carried out concerning reduction of fibrous content in PKC using enzymes (Sharmila *et al.,* 2014), the yield was not really encouraging and the process was considered expensive. Enzymes can hydrolyse only a limited amount of mannan in PKC (Wan Zahari *et al.,* 2003), therefore the pretreatment of PKC is necessary before it can be used as chicken feed.

The data from Table 1 and Table 2 cannot be directly correlated since range is the difference between the largest and smallest values in a set of data whereas the standard deviation in this case is a measure of how far the data points are spread out in each set of samples. Laboratory and manufacturing techniques or even sampling methods applied in each of these surveys were not readily known.

Metabolisable energy (ME) values reported by many researchers also showed a wide variation. Alimon (2004) reported that the ME was between 1,553 to 1,792 kcal/kg; Sundu *et al*. (2005) reported it contained 1,479 and 2,260 kcal/kg. Ezieshi and Olumu (2007) observed that PKC produced through mechanical processing results in higher ME values compared to solvent extracted PKC showing that mechanical extraction contained higher residual oil, almost 8%, compared to PKC produced via solvent extraction (1%).From this study ME value of 1,852 kcal/kg (distribution pattern was not presented) is within the range as reported by Ezieshi and Olumu.

According to FAO reports, feedstuffs vary because of their genetic make-up and as a consequence of the processes applied to them (intrinsic variability of feedstuffs). Failure to do so will produce improperly averaged, generalised data that provide meaningless information. Another source of data variability results from differences in the methodologies used to obtain the information (extrinsic variability of feedstuffs). This type of variability needs to be minimal if reliable information is to be obtained. To achieve the necessary reliability, information regarding the chemical and nutritional characteristics of a feedstuff needs to be carefully examined before it is incorporated into a database. Failing to do so will produce false variability among feeds, ultimately resulting in errors in predicting animal performance and environmental effects and impairing the economics of animal products. This study propose that certain strategies for variability reduction need to be considered. In this case, manufacturing process technology could be the main factor contributing to the wide distribution pattern especially of ether extract.

CONCLUSION

Reliable information on feedstuff composition and nutritional value plays a fundamental role at the farm, feed manufacturer and government levels. Based on this study, the pattern of dry matter constituent is within a relatively consistent and small range while that of ether extract has a wide distribution pattern. This can be suggested that these nutritional data could have been influenced by different manufacturing process capacity. The quality control for each formulation is vital so that the diet has the correct value consistently. Without complete and timely ingredient analysis, feed manufacturers tend to over-formulate to account for nutrient content variability especially for non-ruminant animals. This not only increases ration costs but also potentially introduces excess nutrients to the environment.

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