The Effect of Modified Palm Kernel Meal Utilization to Replacing Corn in The Diets Based on Intestinal Quality and Metabolizable Energy

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ABSTRACT
The research conducted to investigated the effect of modified palm kernel meal containing α-β-mannanase to replacing corn in the diets based on nutrient digestibility and intestinal morphology. Twenty hybrid ducks [(Pekin x Khaki Campbell)] aged 52 days (unsexed) with 1623.3 ± 162.17 g BW were divided into 5 groups of dietary treatments and 4 replications for each treatment. These dietary treatments were: PKM0 (basal diets; corn-rice bran-meal based diet), PKM5 (maize replacement with PKM modified 5%), PKM10 (maize replacement with PKM modified 10%), PKM15 (maize replacement with PKM modified 15%), PKM20 (maize replacement with PKM modified 20%). Curvilinear, the result was presented no effect on the digestibility. The result of this study showed the PKM modified successfully significant difference ($p< 0.05$) on the intestinal quality. In conclusion, the increasing of the level palm kernel meal modified were had positive effect on the hybrid ducks based on intestinal quality and digestibility.

Keywords: *Hybrid duck, Palm kernel meal, α-β mannanase enzyme, Corn subtitution.*

1. INTRODUCTION

An outbreak pandemic announcement by the Tiongkok Government in 2019 later called (2019-ncov) that began in Wuhan, Tiongkok has spread rapidly to worldwide countries including Indonesia [1]. The pandemic caused a crisis among thought the world especially in food security. Thus, condition made Indonesia government made imposed strict quarantine doesn't allowed imported of live animal science and by-product originating from Tiongkok or Transiting into Indonesia territory. To overcome this limitation an alternative agro-product development to promote maize as staple feed for poultry conducted [2,3]. One of agro-product were used palm kernel meal as an alternative to overcome this limitation. Indonesia was at the top level in the world to produce the palm kernel meal above 40.56 MT in 2019-2020, following with Malaysia in the second place [4]. Palm kernel meal is a waste from oil palm agricultural products which are widely known in Indonesia. Indonesia is the largest country in the world as a producer of palm oil and palm kernel. Although it had experienced a decline in 2016, the area of oil palm plantations in Indonesia has again increased in a few years later. Until 2018, it was recorded that the total area of oil palm plantations reached 12.76 hectares. Meanwhile, palm oil (CPO) products are 36.59 million tones and palm kernel around 7.31 million tones [4]. So, representatives of palm kernel meal can reach 45-46% of palm kernel [4], so the production of palm kernel cake in 2018 can reach 3.29 million tons. The abundance of palm kernel meal is the main reason for its relatively cheap price. Thus, palm kernel meal (PKM) can be considered as a feed ingredient based on its relatively cheap price, abundant availability, and does not compete with human needs. PKM is widely used as an alternative feed ingredient. Later, local name or malayan name of this product in Indonesia called *Bungkil Inti Sawit* (BIS).

Palm kernel meal has a limiting factor to be used as animal feed. The limiting factor for the use of PKM, especially in non-ruminant feed is crude fiber. The crude fiber content of PKM was 21.7%, including hemicellulose, namely, mannan and galactomannan [8]. PKM contains shells which contribute greatly to the high crude fiber content [5]. The content of these shells also

makes the PKM texture rough. The roughness (grittiness) and dark color of the PKM feed ingredients make the level of palatability is low. PKM Roughness is thought to also cause low digestibility. PKM Roughness can disrupt the digestive system of poultry. Excess crude fiber can generally erode the intestinal villi. The intestinal villi, especially the small intestine, has function to absorb the nutrients contained in the feed. Damaged drains can interfere with the absorption of feed nutrients. Accordingly, this situation the research conducted to investigated the effect of modified palm kernel meal containing α-β-mannanase to replacing corn in the diets based on nutrient digestibility and intestinal morphology.

2. MATERIALS AND METHOD

Twenty hybrid ducks (Pekin x Khaki Campbell) aged 52 with 1623.3 ± 162.17 g BW) were divided into 5 groups of dietary treatments (unsexed) and 4 replicates per treatments with completely randomize design (CRD) for the experimental design. All ducks were keeping in unconventionally-environmentally controlled room. The housing relatively temperature and humidity among 29 °C and 64%, respectively. The rice hull-littered floor pens. The hybrid duck was taken from commercial farmer from Blitar Regency, East Java, Indonesia. The ducks (unsexed) were given food and drink ad libitum. The composition of feed in the experiment showed in Table 2 and 3. The dietary treatments were: PKM0 (basal diets; maize-rice bran-meal based diet), PKM5 (maize replacement with PKM modified 5%), PKM10 (maize replacement with PKM modified 10%), PKM15 (maize replacement with PKM modified 15%), PKM20 (maize replacement with PKM modified 20%). A commercial mannanase enzyme and palm kernel meal obtained from PT. Wilmar Cahaya Indonesia Tbk and used for this experiment.

2.1. Data collection and measurement

The data were used to calculate AME, AMEn, TME and TMEn values according to the following formulae:AME=IE-FE

TME=AME+FEL

Where IE=ingested energy; FE=fecal energy voided by the fed birds; while FEL=fasting energy loss by the unfed birds.

The values corrected to zero N balance, AMEn and TMEn, are calculated as follows:

AMEn=AME-(8.22×ANR/FI)

TMEn=TME-(8.22×FNL/FI) - (8.22×ANR/FI)

Table 1. Nutrient composition

Ingredients (%)	Treatment				
	PKM0	PKM5	PKM10	PKM15	PKM20
Rice bran	60	60	60	60	60
Commercial feed	20	20	20	20	20
Maize	20	15	10	5	0
PKM Modified	0	5	10	15	20
Total	100	100	100	100	100
Analysis's composition.					
GE (Kcal/kg)**	3846.3	3854.9	3863.7	3890.9	3880.8
CP (%)*	17.19	17.54	17.89	18.32	18.59
CF (%)**	2.23	2.77	3.31	3.91	4.39
Fat (%)*	7.03	7.21	7.38	7.59	7.73

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Where ANR=apparent N retention; FI=feed intake; and FNL=fasting N loss by the unfed bird; The factor 8.22 kcal/g for N retained in the body has been used according to Mustafa [6]. The sample about 6 cm from the middle of duodenum, jejunum, and ileum were excised and flushed with ice-cold saline and immediately placed in combination of liquid of NA_2PO_4 2%; $NA_2H_2PO_4$ 2%, 24% Formaldehyde; and 900 ml reverse osmosis water for morphometric analysis. The method used were Hematoxylin eosin staining coloring. The indices of villus height, crypt depth (μm) and villus height and crypt depth ratio were measured using computer-aided light microscope image software m-shot digital image system with 200x zooming according to method from Sjofjan [9]. The data of parameters were identification using SAS University online Ed 64-red hat.

3. RESULT AND DISCUSSION

PKM0 (negative control; maize-rice bran-meal based diet), PKM5 (maize replacement with PKM modified 5%), PKM10 (maize replacement with PKM modified 10%), PKM20 (maize replacement with PKM modified 15%), PKM25 (maize replacement with PKM modified 20%).

The increasing level of modified palm kernel meal were successful successfully significant difference ($p<$ 0.05) on overall intestinal condition started from villus height crypt depth, total villus, apical width, and basal width. It means the modified palm kernel meal does not affect negatively to hybrid duck. According to Mustafa [6], enzymes are biological compounds that function as catalysts. Enzymes can affect the rate of reactions contained in cells but do not cause changes in the enzyme structure. Substrate compounds are compounds that undergo a catalytic process in the presence of enzymes [7, 8]. β-mannanase is a key enzyme to hydrolyse mannan. Mannan, which is classified into linear mannan, glucomannan, galactomannan and galactogluco mannan, has been widely distributed in plant cell walls. Many β-mannanases have been observed in a wide variety of microorganisms including actinomycetes, bacteria and fungi [8].

Reported from Sjofjan [9], the level addition of a probiotic to broiler increased the villus height leading to increased intestinal surface area and therefore to an increased digestion and absorption of nutrients in the basal diet. Thus, the increasing of villus height theorically from decreased intestinal cell turnover and gene expression [9].

Continued at digestibility were reflected of the carcass and internal organ weight. Curvilinear, the result was presented no effect ($p>0.05$) on the digestibility. Energy metabolism can also be disrupted by the presence of cation-binding capacity in fibre's [6]. The effect of substitution of palm kernel meal flour on commercial feed had a positive impact on several digestibility variables. Giving palm kernel meal flour up to 15% can increase the fat digestibility value. However, giving palm kernel cake at a level of 15% does not affect the metabolic energy of feed and digestibility of dry matter [8].

Table 2. The effect of modified palm kernel meal on intestinal and digestibility of hybrid duck

	Treatments					
Intestinal (µm)	PKM0	PKM5	PKM10	PKM15	PKM20	SEM
Villus Height	310.11^{a}	357.29^{b}	363.12^{b}	394.26^{b}	393.41^{b}	2.33
Crypt depth	114.11^{a}	114.14^{a}	116.44^{ab}	134.66^{b}	145.66^{b}	3.12
Total villus	34.33^{a}	46.00^{b}	49.75^{b}	56.00^{b}	56.50^{b}	0.11
Apical width	52.61^{a}	57.09^{ab}	61.87^{b}	63.46^{b}	80.47^{b}	14.33
Basal width	110.77^{a}	114.51^{ab}	120.34^{b}	128.21^{b}	134.09^{b}	2.11
VH/CD	2.71^{a}	3.13^{b}	3.11^{b}	2.92^{ab}	2.70^{a}	0.26
Digestibility (kcal/kg)						
AME	1,223	1,111	1,233	1,233	1,455	23.44
AMEn	1,333	1,222	1,333	1,222	1,221	45.77
TME	2,066	2,054	2,033	2,012	2,022	0.33
TMEn	2,011	2,014	2,033	2,111	2,111	0.21

^{ab} Mean values in the same row without common superscript differ at p<005

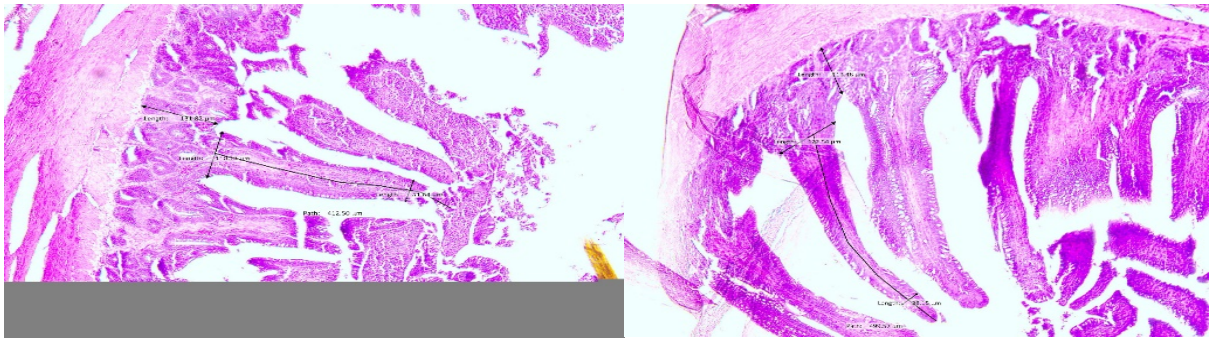

Figure 1. Representative of intestinal condition after administering modified palm kernel meal

4. CONCLUSION

The increasing of the level palm kernel modified were had positive effect on the hybrid ducks and replacement of palm kernel meal by 25% with the addition of modified PKM was able to improve digestibility before ready to cook as a carcass

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