Protein digestibility and metabolizable energy of palm kernel cake fermented by Starbio on chicken

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Abstract. The research is to find out the level starbio in palm kernel cake (PKC) on the energy and protein use on chicks. The chemical analysis was done in Quality and Certification Feed Laboratory in Bekasi, West Java. The experiment composed by five treatments i.e. dose of starbio (g/kg PKC) with level: 0%;0,25%; 0,5%; 0,75%; and 1%; for treatments P0;P1;P2;P3; and P4, respectively. The variables were observed composed of apparent metabolizable energy (AME), protein digestibility, and nitrogen retention. The starbio had significantly (P<0,01) effect on protein utilization and AME of PKC for chicks. Increasing that nutrient utilization on chicken in line with of dose of Starbio. it is concluded that starbio can improve PKC quality as feed for chicks.

1. Introduction
The potential for oil palm (Elaeis guineensis jacq) in the world is quite large, amounting to 4 billion tons. In Indonesia, the palm oil commodity is quite large so that it will support the potential for palm kernel cake (PKC) as by-product of the palm kernel oil manufacturing process. The use of agricultural waste products can reduce the cost of feed in Indonesia such as palm kernel cake which is very abundant because in Indonesia there are many palm oil factories, especially Sumatra and Kalimantan, but the crude fibre content in PKC is quite high, 16-23%. It is necessary to consider its use as an ingredient in poultry feed, because it is difficult to digest. Although the crude protein content is quite high reach 11.30-17.00% so that it is sufficiently used as a poultry feed ingredient, it needs attention because it is difficult to digest [1]. Therefore, it is necessary to study to increase PKC quality by fermentation with starbio.

Based on the nutritional content and availability, PKC has a large enough potential as animal feed, especially for ruminants. Efforts that can be done are fermenting the PKC itself so that the possibility of overhauling the nutrient components that are difficult to digest becomes easier to digest, so that it is also hoped that the nutritional value will increase and decrease the crude fibre, and it is also expected to extend the utilization of the feed ingredients.

2. Materials and methods
The research was done in the Animal Laboratory, Faculty of Agriculture, Universitas Sumatera Utara. The chemical analysis was done in Laboratory of the Feed Quality and Certification Centre, Bekasi, West Java. the tools used were the metabolism cage, syringes tube to be used when forced feeding. The materials used are PKC were fermented by starbio, boric acid and free-range chicken aged 3 months
with a body weight around 1.2 kg/head. The research was carried out experimentally using 20 Kampong Chicken with a completely randomized design (CRD) 5 treatments 4 replications. Length of fermentation time is 7 days, on aerobic condition and room temperature (28-30°C). The treatment was given is level starbio as follows:
P0 = 0 % (control)
P1 = 0.25%
P2 = 0.5%
P3 = 0.75%
P4 = 1%
The parameters observed in this study included:
protein digestibility. Digestibility can be calculated by the formula [2,3] as follows:

\[
\text{Digestibility} = \frac{\text{Protein Consumption} - \text{Protein excreta N corrected}}{\text{Protein Consumption}} \times 100\% \tag{1}
\]

Nitrogen retention. This value can be obtained from the difference between the Nitrogen consumption and the Nitrogen were excreted after being corrected by the value of endogenous protein excretion [4].

\[
\text{RN\%} = \frac{(\text{KN} - (\text{EN} - \text{ENN}))}{\text{KN}} \times 100\% \tag{2}
\]

RN: Nitrogen Retention (%)
KN: Nitrogen consumption (g / head)
EN: Nitrogen excretion (g / head)
ENN: Endogenous nitrogen (g / head)

Energy metabolism. Metabolic energy is the difference between the gross energy content of the ration and the gross energy lost through excreta. Metabolic energy is expressed by 4 variables [5], namely:
Apparent Metabolizable Energy (AME) (kcal/kilograms):

\[
\text{AME} = \frac{(\text{EB}.X - (\text{Ebe}.Y))}{X} \tag{3}
\]

True Metabolizable Energy (TME) (kcal/kilograms)

\[
\text{TME} = \frac{(\text{EB}.X - (\text{Ebe}.Y) - (\text{Ebe}.Z))}{X} \tag{4}
\]

Apparent Metabolizable Energy N corrected (AMEn) (kcal/kilograms)

\[
\text{EMSn} = \frac{(\text{EB} . X) - (\text{Ebe}.Y) + (8.22 . \text{RN})}{X} \tag{5}
\]

Note
EB: Gross energy feed (kcal/kilograms)
Ebe: gross energy of excreta (kcal/kilograms)
X: Feed consumption (grams)
Y: Weight of fed chicken excreta (g)
Z: Fasted chicken excreta weight (g)
RN: Nitrogen Retention
Metabolic energy conversion

$$\frac{\text{EMSn}}{\text{EB}} = \frac{\text{EMSn}}{\text{EB}}$$  \hspace{1cm} (6)

Note

EMSn : nitrogen-corrected apparent metabolic energy (kcal/kg)

EB : gross energy (kcal/kg)

3. Results and discussion

Percentage of protein digestibility in PKC was fermented using starbio (Table 1) with various doses were given on chickens with the highest average in treatment P4 (1% starbio) which was 75.007% and the lowest average percentage was in treatment P0 (without starbio) that is 64.412%. The results showed that the protein digestibility more than 50% that indicated is high value. The result of this research were shown on Table 1.

| Table 1. The effect of Starbio on protein and energy utilization in chicken |
|---------------------------------------------|
| Parameter | P0 | P1 | P2 | P3 | P4 |
|-----------|----|----|----|----|----|
| Protein digestibility (%) | 64.41<sup>D</sup> | 64.40<sup>C</sup> | 68.60<sup>B</sup> | 69.82<sup>B</sup> | 75.00<sup>A</sup> |
| Nitrogen retention (%) | 79.08<sup>C</sup> | 82.72<sup>C</sup> | 85.15<sup>AB</sup> | 85.75<sup>AB</sup> | 89.78<sup>A</sup> |
| Apparent Metabolizable Energy (kcal/kg) | 2546.19<sup>A</sup><sup>B</sup> | 2192.26<sup>C</sup> | 2749.06<sup>A</sup> | 2314.90<sup>B</sup> | 2822.22<sup>A</sup> |
| True Metabolizable Energy (kcal/kg) | 2410.6<sup>m</sup> | 2489.57<sup>m</sup> | 2872.46<sup>m</sup> | 2581.39<sup>m</sup> | 2758.16<sup>am</sup> |
| Apparent Metabolizable Energy corrected N | 2546.02<sup>A</sup><sup>B</sup> | 2192.46<sup>C</sup> | 2879.25<sup>A</sup> | 2314.84<sup>B</sup> | 2822.42<sup>A</sup> |
| Metabolizable Energy conversion | 0.76<sup>A</sup> | 0.57<sup>B</sup> | 0.80<sup>A</sup> | 0.62<sup>B</sup> | 0.78<sup>A</sup> |

Note: different superscript on rows showed significant differences (P<0.01)

The results of the ANOVA showed that the starbio significantly (P <0.01) increase of protein digestibility as feed for chickens. High protein digestibility values indicate high quality of feed and protein that is easily digested is a good quality protein [6]. The protein digestibility depends on the protein content of feed ingredients, the amount of protein that enters the digestive tract, and also with quality [7]. Fermentation can increase the digestibility value of the original protein. The increase in protein digestibility due to fermentation is a reflection of the decomposition of the crude protein components being digested [8]. This is thought to be due to the role of the starbio product protease enzyme which is able to degrade protein.

The increase in protein levels is thought to be because starbio contains proteolytic bacteria which produce protease enzymes which break down protein into smaller polypeptides which then become simple peptides. There was an increase in crude protein content in the fermentation of rumen-filled flour with various doses of starbio, the crude protein content of unfermented rumen-filled flour by 12% increased to 19.22% [9]. The starbio bio activator in corn cob fermentation can increase the digestibility of crude protein and decrease the digestibility of crude fibre compared to other bio activators [10].

The percentage of nitrogen retention in (PKC) was fermented using starbio with various doses given to native chickens (Table 1) showed the highest average value was seen in P4 treatment (1% starbio) i.e. 89.78%, while the lowest average seen in treatment P0 (starbio) of 79.08%. Analysis of variance on RN showed that giving fermented PKC with different starbio doses had different effect (P <0.01) on nitrogen retention. Fermentation using starbio on PKC increased the nutritional content so that the nitrogen value the higher the retention. This is in accordance which states that the high percentage of nitrogen causes
higher retention compared to rations with lower nutrient content so that the retained nitrogen value is also lower [11]. It is also supported which states that nitrogen retention values can be different due to different nutritional factors [12].

The results of the analysis for AME in native chickens which were given on Table 1 showed that the highest fermentation of PKC was shown by treatment P2 (0.5% starbio) i.e. 2879.1 kcal/kg, while the lowest pseudo metabolic energy at P1 (0.25% starbio) i.e. 2192.3 kcal/kg. The analysis variance showed that the provision of fermented PKC with different doses of starbio influenced (P <0.01) on AME. The addition of starbio with different doses to fermentation of PKC can break down crude fibre into components that are easily digested. This is due to the large number of starbio given so that it has a lot of microbes so that many cellulase enzymes are produced to break down carbohydrates into easily form which ultimately improves the quality of fermented PKC. This result is relevance that the product that undergoes fermentation has a better quality and is easier for livestock to digest [13].

The results of the analysis of TME in native chickens given fermentation of PKC were the highest shown in P2 treatment (0.5% starbio) i.e. 2872.5 kcal/kg, while the lowest was at P0 (without starbio) amounting to 2410.6 kcal/kg. Statistical analysis showed that giving fermented PKC with different starbio doses had no significant effect (P> 0.05) TME. The results of AMEn in native chickens were given PKC showed the highest shown in treatment P2 (2879.3 kcal/kg), while the lowest is in treatment P1 (2192.5 kcal/kg). Analysis of variance showed that giving fermented PKC with different starbio doses increased (P <0.01) on AMEn.

This increasing nitrogen consumption will cause an increase in nitrogen retention, thus having an effect on the value of metabolic energy [2]. The result on Table 1 showed that the highest average energy conversion was shown in treatment P2 (0.80) while the lowest average metabolic energy conversion was shown in treatment P1 (0.57). Analysis variance showed that the provision of fermented PKC with different starbio doses significant effect (P <0.01) on energy conversion. There is another result showed that to increase nutritive value with extraction process [14,15]. or with enzymes [16]. This means that PKC which has been fermented using starbio increase nutrient utility in chicken.

4. Conclusions
Doses of starbio in palm kernel cake fermentation showed increasing protein digestibility, nitrogen retention, and metabolic energy in chickens. The level 1% of starbio show higher value on palm kernel cake fermentation that could be applied as feed for chicken.

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