Nutrition quality of extraction mannan residue from palm kernel cake on broiler chicken

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Abstract. This study aims to find out the nutrient residue of palm kernel cake from mannan extraction on broiler chicken by evaluating physical quality (specific gravity, bulk density and compacted bulk density), chemical quality (proximate analysis and Van Soest Test) and biological test (metabolizable energy). Treatment composed of T0 : palm kernel cake extracted aquadest (control), T1 : palm kernel cake extracted acetic acid (CH3COOH) 1%, T2 : palm kernel cake extracted aquadest + mannanase enzyme 100 u/l and T3 : palm kernel cake extracted acetic acid (CH3COOH) 1% + enzyme mannanase 100 u/l. The results showed that mannan extraction had significant effect (P<0.05) in improving the quality of physical and numerically increase the value of crude protein and decrease the value of NDF (Neutral Detergent Fiber). Treatments had highly significant influence (P<0.01) on the metabolizable energy value of palm kernel cake residue in broiler chickens. It can be concluded that extraction with aquadest + enzyme mannanase 100 u/l yields the best nutrient quality of palm kernel cake residue for broiler chicken.

1. Introduction
The palm kernel cake (PKC) high in coarse fiber, this is one of the limiting factors in its use as a source of monogastric animal feed especially in poultry. Poultry is a livestock that is intolerant to feed ingredients that contain high crude fiber because in the gastrointestinal tract there is no cellulase enzyme such as ruminants. The dominant component of crude fiber in PKC is mannose which reaches 56.4% of the total PKC and exists in the form of β-mannan bond [1]. Tafsin [2] reported that the detected sugar component of PKC is composed of mannose, glucose and galactose components with a ratio of approximately 3: 1: 1. High mannan content being the limiting factor for PKC digestibility in monogastric animals can also be considered as potential for feed like prebiotics that will improve the health of livestock. Sundu [3] suspect that there is a similarity between PKC and mannanoligosakarida (MOS) that will improve the health and immune system of poultry.

So far, PKC is only used as one source of feed, but see the potential can be added value added to feed raw material feed additives. In the process of increasing the added value of the use of PKC as a feed additive is done processing technology, in this case with the combination of extraction using acetic acid (CH3COOH) which is a group of weak acids that have the ability to break the fiber and harmless when consumed by humans and animals with the right dose and with enzyme mannanase which has the ability to break the bond non starch polysaccharide by increasing the digestibility of PKC. From the result of PKC extraction with acetic acid (CH3COOH) and mannanase enzyme will be produced supernatant (liquid) which is considered able to become immunostimulator in chicken [2].
and residue (solid). The residue of PKC resulting from the extraction is considered waste and not utilized again. By looking at the potential of supernatant that can become immunostimulator, PKC residue is expected to be utilized as one source of feed material for poultry.

Research on residual extraction of mannan from PKC has not been done and there is no related information about the physical-chemical properties and the value of its metabolic energy. Starting from that point, this research needs to be done. The purpose of this research is to know the physical-chemical quality and energy value of residual metabolism of mannan extraction process from PKC.

2. Materials And Methods
The ingredients used are palm kernel cake (PKC), Acetic Acid (CH₃COOH) 1%, mannanase enzymes, aquades and chemicals for laboratory analysis obtained from commercial companies and 25 broiler chickens aged 5 weeks used to measure metabolizable energy.

Tools used include grinder, digital scales, oven, sieve, freezer, autoclave, water bath shaker, centrifuge, measuring cup, aluminum foil, vortex mixer, test tube, Erlenmeyer flask, gourd flask, micro pipette, heat resistant plastic, metabolic cage size 50 x 20 x 50 cm with a fecal container, feeding and water holder.

2.1. Mannan extraction process from palm kernel cake
The palm kernel cake obtained from the industry is separated using a mesh (2 mm / 0.787 inches). The sifted palm kernel cake weighed 50 g and then poured into a 500 ml Erlenmeyer flask was added aquades of 500 ml. The ratio of PKC to aquades is 1:10. The PKC solution with homogenized aquades is then wrapped in a heat resistant plastic. Sterilized with autoclave at 110 °C for 1 hour then cooled to 40 °C then mixed PKC with aquades dicontrifuge at 15 °C 4200 rpm for 15 minutes. The supernatant and residue are separated, collected and stored in a freezer at 50 °C. The residue is sterilized at 60 °C for 24 hours. This dry residue becomes the treatment for T0. The same process was performed to obtain P1 treatment by substituting aquades with 1% acetic acid.

The P2 treatment material was obtained by sieving palm kernel cake weighed 50 g, then poured into a 500 ml Erlenmeyer flask with 500 ml added aquades and 83 μl mannanase enzyme. The PKC comparison with aquades is 1:10. The solution was incubated with water bath shaker at 60 °C for 72 hours then cooled to 40 °C, then mixed BIS with aquades + enzyme mannanase dicontrifuge at 15 °C 4200 rpm for 15 minutes. The supernatant and the residue were separated, collected and stored at a temperature of 5 °C. The residue was washed at 60 °C for 24 hours. This residue becomes the treatment of P2. The same process was performed to obtain P3 treatment by substituting aquades with 1% acetic acid.

2.2. Testing of physical and chemical quality
Measurements were made by taking representative of PKC residue for five observations each of 200 g of 1 kg of PKC residue. The measurement of physical properties following the Khalil [4] method includes the density of the pile, the density of pile compaction and specific gravity. Meanwhile, chemical properties use proximate analysis [5] and fiber components [6].

2.3. Measurement of metabolizable energy
Calculation of the value of metabolizable energy is calculated by the formula Sibbald [7]. Experiments started with broilers fasted for 24 hours in a metabolic cage. Then, the feed was given forcibly as much as 35 g with the help of a funnel (fed) on 20 broiler, while 5 other tailed back to measure endogenous energy. Drinking water is given ad libitum. Collection of excreta done for 24 hours. During excreta collection, every ± 2 hours of excreta was sprayed with aqueous H₂SO₄ solution (0.01N). The collected excreta is stored in the freezer. The excreta stored in the freezer is then removed, diluted and dried in a 60 °C oven for ± 24 hours. The crushed dry excreta is measured in its bruton energy by using a calorimeter bomb.
2.4. Experiment design and data analysis
The experimental method used was experimental using complete randomized design with 4 treatments and 5 replications with each chicken as experimental unit on biological test (metabolic energy). The ratio of palm kernel extract to the extract in each treatment is 1:10. The treatment in this research are: T0 = Palm Kernel Cake + Aquadest (Control), T1 = Palm Kernel Cake + Acetic Acid 1%, T2 = Palm Kernel Cake + Aquades + Enzyme Mannanase 100 U/l, T3 = Palm Kernel Cake + Acetic Acid 1% + Enzyme Mannanase 100 U/l. Metabolizable energy measurement data and physical properties data were analyzed variance (Anova). If there is a noticeable difference in the further tests of Duncan [8]. Data analysis was performed according to SAS procedure 9.1.3. Meanwhile, the chemical properties were processed using descriptive statistics.

2.5. The variables observed
The variables observed in the research are physical test (pile density, pile compaction density, specific gravity), chemical test (moisture content, ash content, dry weight, crude protein, crude fiber, crude fat, gross energy, ADF and NDF) (Metabolizable energy).

3. Results And Discussion
3.1. The physical and chemical quality of residues from palm kernel cake
The result of statistical analysis by using Anava (Varian Analysis) showed that extraction with mannanase enzyme 100 u/l gave a real effect (P˂0.05) in increasing the physical properties value on the extracted PKC residue.

Table 1. The results of the physical and chemical quality of residues from palm kernel cake

| Information                  | Treatment     |
|------------------------------|---------------|
|                              | T0            | T1            | T2            | T3            |
| Chemical quality:            |               |               |               |               |
| - DW (%)                     | 95.21         | 96.66         | 95.26         | 95.74         |
| - AC (%)                     | 2.76          | 2.07          | 2.42          | 2.15          |
| - CP (%)                     | 17.85         | 18.15         | 19.20         |               |
| 17.84                        |               |               |               |               |
| - CF (%)                     | 22.74         | 23.38         | 23.92         | 24.72         |
| - C.Fat (%)                  | 8.57          | 8.47          | 7.89          | 7.36          |
| - ADF (%)                    | 55.74         | 57.67         | 51.55         | 36.45         |
| - NDF (%)                    | 80.59         | 78.76         | 75.70         | 77.75         |
| Physical quality:            |               |               |               |               |
| - SG (Kg/m³)                 | 162.64ab ± 0.09 | 162.68ab ± 0.08 | 162.78a ± 0.09 | 162.70ab ± 0.08 |
| 0.08                         |               |               |               |               |
| - BD (Kg/m³)                 | 31.87b ± 0.18 | 319.99ab ± 0.15 | 320.13a ± 0.18 | 320.07ab ± 0.18 |
| 0.18                         |               |               |               |               |
| - CBD(Kg/m³)                 | 330.90b ± 0.19 | 330.99ab ± 0.15 | 331.17a ± 0.19 | 331.10ab ± 0.19 |
| 0.15                         |               |               |               |               |
| Mannosa content (ppm)        | 7.327 ± 0.05  | 2.433 ± 0.31  | 173.36 ± 15.5 | 629.14 ± 0.96 |

Explanation: T0 = PKC extracted with aquadest; T1 = PKC extracted with acetic acid 1%; T2 = PKC extracted with aquades + enzyme mannanase 100U/l; T3 = PKC extracted with acetic acid 1% + enzyme mannanase 100U/l; DW= Dry Weigth; AC= Ash Content; CP = Crude Protein; CF = Crude Fiber; C.Fat = Crude Fat; ADF = Acid Detergent Fiber; NDF= Neutral Detergent Fiber; SG= specific gravity; BD= bulk density; CBD= compacted bulk density.

The results using Duncan's multiple range test showed that the treatment for T2 (PKC extracted with aquades + 100U/l mannanase enzymes) had a physical quality value higher than or equal to the
T3 treatment (PKC extracted with 1% acetic acid + 100 U/l mannanase enzyme) and T1 treatment (PKC extracted with 1% acetic acid) between treatments. The treatment T0 (PKC extracted with aquades) showed a significant effect.

Calculation of physical quality correlation on PKC residue of treatment and NDF content shows that there is a very strong relationship between nutrient content contained by residue of PKC treatment result with value of physical quality possessed. The NDF content represents the chemical component of PKC residue treated by the effect of the value of the physical quality of the treated residue, the lower the NDF content the higher the physical quality of the PKC residue of treatment. This is in accordance with the opinion of Khalil [4] which states that the variation in the value of physical quality is influenced by the nutrient content of the material, particle size distribution and particle surface characteristics.

Based on the chemical test table on the residual PKC treatment results showed that the residue PKC extraction process using 100 U/l mannanase enzyme (T2) has the highest protein content among treatments. This may occur because of the addition of the mannanase enzyme in the PKC extraction process. This is in accordance with the opinion Jhonson [9] argues that mannanase is the enzyme decomposers mannan and galaktomanan become mannose and galactose. This enzyme randomly cuts the main chains of mannan and hetero ß-D-mannan into dissolved sugars ie manodextrins and mannose.

The table above shows that the use of the B-mannanase enzyme shows the highest mannosa component compared to other treatments. The lowest yield was shown on the treatment using 1% acetic acid. Measurements are made to the sample directly without using the hydrolysis process. These results indicate that the detected component of the mannosa is a relatively simple component (close to monosaccharides). The use of autoclave, centrifuge and mannanase enzyme activity results in increased protein molecules liberated from fiber bonds. So that the residue of PKC of T2 treatment had high crude protein content in this study.

The fiber component can be seen from contents ADF (Acid Detergent Fiber) with the Van Soest analysis. The ADF content in PKC reaches 50.74% while in residue the extraction process is ranged from 36.45% - 57.67%. The lowest ADF content was shown in a 1% acetic acid combination treatment with b-mannannase enzyme which showed a value of 36.45%. These results indicate that the use of acetic acid treatment combinations with enzymes is most effective compared to other treatments in overhauling the fiber component into a soluble material in the extraction process.

The higher the ADF, the higher the digestibility of feed ingredients. Judging from the value of ADF content of PKC residue of treatment result, T3 treatment has the lowest ADF content, but the crude protein content of T3 including the lowest and the highest crude fiber content among treatments. The result is assumed that the nutritional value of T3 is dissolved in the extraction process with the combination of acetic acid and mannanase enzyme 100 u / l and the ADF content possessed by T3 treatment is suspected that the fiber component already resistant is already in the form of lignin.

3.2. The result metabolizable energy of palm kernel cake residue

The result of variance analysis showed a very real effect (P<0.01) from the extract treatment of palm kernel to the metabolic energy value of PKC residue of treatment. Further test results using Duncan multiple range test showed that T2 treatment (PKC extracted with aquades + 100 U/l mannanase enzyme) or T1 treatment (PKC extracted with 1% acetic acid) had higher metabolic energy values between treatments. Furthermore, T3 treatment (PKC extracted with 1% acetic acid plus 100 u/l enzyme mannanase) or T0 treatment (PKC extracted with aquades) showed significant effect. Different metabolic energy values of PKC residue due to differences in nutrient content and physical quality of PKC residue of treatment.

Factors that affect the value of metabolic energy in poultry is the ability of livestock to metabolism rations in the body. This factor is influenced by the physical properties of feed, pH, gastrointestinal enzymes, food composition, environmental temperature and physiological livestock [5].


4. Conclusion

The extraction residue results in a significantly different value of physical quality. PKC extracted with aquadest + 100 u/l enzyme mannanase result specific gravity, bulk density and compacted bulk density greater than between treatments and can increase the value of crude protein and decrease the NDF value and produce different metabolic energy values. The PKC extracted with aquadest + 100 u/l mannanase enzyme or extracted with acetic acid is greater in the value of its metabolic energy than the PKC contracted with aquadest or extracted acetic acid + 100 u/l enzyme mannanase.

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