Effect of Adding Palm Kernel Meal Extract to Rations Using Microparticle Protein Sources On Fatty Meat and Carcass Weight of Broiler Chicken

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Abstract

The study aimed to examine the effect of adding palm kernel meal extract (PKME) to rations using microparticle protein sources on broiler chickens' fatty meat and carcass weight. The experimental chickens used were unsexed CP707 strain broilers aged eight days, as many as 200 birds with an average body weight of 153.98 ± 4.41 g. Palm kernel meal extract as treatment material. Ration composition includes ground corn, rice bran, microparticle soybean meal, microparticle fish meal, CaCO3, premix, lysine, and methionine. The study was arranged using a completely randomized design with five treatments and four replicates. Each experimental unit was filled with ten animals. The treatments applied are T0=rations using protein microparticles/RPM, T1=RPM+PKME 0,2%, T2=RK+PKME 0,4%, T3=PKME+EBS 0,6%, dan T4=PKME+EBS 0,8%. Parameters measured included fat digestibility, the relative weight of abdominal fat, meat fat mass, and carcass weight. Data were analyzed for variance at the 5% significance level; if there was a significant effect, Duncan's test was conducted at the 5% significance level. The results showed that adding EBS to rations using microparticle protein sources has a significant impact ($p<0.05$) on fat digestibility, the relative weight of abdominal fat, fat meat mass, and carcass weight of broiler chickens. The conclusion is that adding 0.8% palm kernel meal extract to rations using microparticle protein sources can reduce fat digestibility, the relative importance of abdominal fat, fat meat mass, and carcass weight of broiler chickens.

Keywords : broiler chicken; carcass; fatty meat; palm kernel meal extract; microparticle protein

Introduction

Rations in poultry farming contribute the highest composition, between 65-70%. Poultry feed ingredients, especially broiler chickens, which have the

potential to contribute to high prices, are imported protein source feed ingredients. Commonly used protein source feed ingredients come from soybean meal and fishmeal. Both feed ingredients contain high protein, but the price always increases. Some alternative steps while maintaining these two ingredients so that the protein needs of broiler chickens are met by reducing the protein content of the ration from 21% to 18%, but the particle size of the protein source was reduced.

Microparticles aim to change the particle size to increase protein utilization by livestock (Suthama & Wibawa, 2018). Based on the results of research by Cholis et al. (2018) and Wulandari et al. (2016) that the provision of 2 rations with a protein content of 21% produced carcass weight and daily weight gain of broilers that were the same as rations using microparticle protein sources at 18% protein content. The same research results by Harumdewi et al. (2018) showed that giving percentages with 21% protein content produces fat digestibility and relative weight of abdominal fat, which is not different from rations with 18% protein content of microparticle sources.

Prebiotics is an alternative to antibiotics, which the Indonesian government has banned since January 1, 2018. Prebiotics can be naturally found in pre-extracted palm kernel meals as mannan oligosaccharides. Mannan in palm kernel cake extract has a good impact on the intestinal tract because it can spur the development of beneficial bacteria and prevent pathogenic bacteria that stick to the intestines (Nur'aini, 2017). The utilization of palm kernel cake as a prebiotic is based on the abundant availability of palm kernel cake in Indonesia, which can be seen from data showing the high production of palm kernel of 46,223,300 tons in 2021 (Badan Pusat Statistik, 2021).

Using mannan added to microparticle protein rations can nourish the digestive tract. The fermentation process between bacteria and the addition of mannan as a prebiotic produces lactic acid and short-chain fatty acids (SCFA). These conditions optimize LAB's growth, which can make the enzyme bile salt hydrolase (BSH). The BSH enzyme can reduce fat content through bile salt deconjugation, which results in fat that cannot be absorbed so that fat is wasted through excreta (Kirana et al., 2017). Mannan as a prebiotic is supported by feeding rations using microparticle protein sources. Microparticle protein rations can increase protein digestibility while adding mannan can reduce fat digestibility so that the combination produces low-fat meat with a high meat protein value (Harumdewi et al., 2018).

The research examines the addition of mannan from palm kernel cake extract in rations that use protein sources on fat digestibility, the relative weight of abdominal fat, fat meat mass, and carcass weight of broiler chickens.

Materials and Methods

Livestock, Rations and Research Equipment

The material used was broiler strain CP707 produced by PT Charoen Pokphand, unsexed eight days old, as many as 200 birds with an average body weight of 153.98 ± 4.41g. Palm kernel meal extract (PKME) is a feed additive

treatment. The research ration was prepared from a mixture of feed ingredients presented in Table 1. Materials used to prepare PKME include palm kernel cake, distilled water, 98% isopropyl solution, fine filter paper, and aluminum foil. Materials used to prepare microparticles were fish meal, virgin coconut oil (VCO), soybean meal, filter cloth, and distilled water.

The tools used to extract palm kernel cake are a water bath, 1-liter beaker, stirring rod, 500 ml measuring cup, digital balance with 1 g accuracy, and tray. Tools used in the preparation of microparticles are a grinder with a filter size of 100 mesh, sieve with a diameter of 0.3 mm, powersonic45 sonicator, digital scales with a precision of 1 g, 2-liter beaker glass, measuring cup with a size of 500 ml and tray. The research design in the study used a complete randomized design (CRD) with five treatments and four replicates, so there were 20 experimental units, each consisting of 10 birds. The treatments applied were as follows:

T0 = rations using protein microparticles/RPM
T1 = RPM + PKME 0,2%
T2 = RPM + PKME 0,4%
T3 = RPM + PKME 0,6%
T4 = RPM + PKME 0,8%

Preparation

The PKME process refers to the modified method of Anindita et al. (2016), which has been changed. The extraction procedure is that the palm kernel cake is weighed as much as 200 g, and distilled water is prepared as much as 3,000 ml and accommodated in a 2-liter beaker glass. Furthermore, the palm kernel cake was cooked to boil at 100 oC, then stirred for 3 hours. After that, the sample was filtered using fine filter paper to obtain the filtrate. In the next stage, the filtrate was given a 98% isopropyl alcohol solution of as much as 2,000 ml, then covered with aluminum foil and left for 12 hours until a precipitate formed. The residue was then dried under the sun, then pulverized with a blender into flour form.

The preparation of protein source microparticles refers to the method of Suthama and Wibawa (2018). The microparticle procedure begins with grinding the protein source feed ingredients such as fishmeal and soybean meal and filtering. Soybean meal was pulverized using a 100-mash grinder, while fish meal was sieved using a 0.3 mm sieve. Fish meal and soybean meal were dissolved in distilled water using a ratio of 1:4, then 2% VCO was added. The solution was then sonicated using an ultrasound transducer for 60 minutes with a wavelength of 50 Hz at 37oC. The ingredients were then dried in an oven at 40° C and pulverized using a grinder.

The cage preparation includes cleaning it by sanitizing it with detergent, liming the walls, floor, and experimental unit, spraying formalin, and preparing cage equipment.

Chickens management

The rearing of 200 broiler chickens lasted for 35 days. The rearing process begins with the chick-in-day-old chicks (DOC), which are weighed as the initial weight. Day-old chicks were put in a colony cage of as many as 20 experimental units. Rations and drinking water were provided ad libitum. The initial ration given at the age of 1-7 days was 100% commercial ration BR 511B produced by PT Charoen Pokphand Indonesia, and then on day eight, the allocation was given in the ratio of 75% commercial ration + 25% research ration, day 9 with a ratio of 50% commercial ration + 50%, day 10 with a ratio of 25% commercial ration + 75% research ration and days 11-35 with a balance of 100% research ration.

Table 1. Composition of feed ingredients and nutritional content of rations

Bahan Pakan	Komposisi
	----------(%)----------
Jagung Giling	54.55
Bekatul	15.22
Bungkil Kedelai Mikropartikel	20.38
Tepung Ikan Mikropartikel	9.00
$CaCO_3$	0.30
Premik	0.25
Lisin	0.10
Metionin	0.20
Total	100,00
Kadar Nutrien	
Energi metabolis (kkal/kg)*	3,000.86
Protein Kasar (%)**	18.31
Lemak Kasar (%)**	4.47
Serat Kasar (%)**	5.84
Kalsium (%)**	1.08
Fosfor (%)**	0.86

Keterangan: *Ransum diuji proksimat, kalsium dan fosfor di Laboratorium Ilmu Nutrisi dan Pakan, Fakultas Peternakan dan Pertanian Universitas Diponegoro (2021).
**Perhitungan menggunakan rumus Bolton (1967).

Data measurement

The data measured included fat digestibility, the relative weight of abdominal fat, fat meat mass, and broiler carcass weight. Measurement of fat digestibility begins with the total collection of excrement combined with indicators lasting for four days. The needle used was Fe2O3, as much as 0.5%. Excreta collected during the entire collection process was sprayed using 0.1 N HCL every 2 hours to minimize nitrogen evaporation. The calculation formula for fat digestibility, according to Moningkey et al. (2019) as follows :

$$\text{Fat Digestibility (\%)} = \frac{\text{fat intake} - \text{total of excreta fat}}{\text{fat intake}} \text{ x } 100\%$$

Abdominal fat is measured by weighing the fat in the abdominal cavity. The relative weight of abdominal fat can be calculated by the formula according to Mangais et al. (2016) as follows :

$$\text{Relative Weight of Abdominal Fat (\%)} = \frac{\text{abdominal fat weight}}{\text{live weight}} \text{ x } 100\%$$

Meat fat mass can be determined by calculating meat fat content and weight. Meat fat content was measured using a Soxhlet device with meat samples on the breast and thighs that had been mashed. Meat weight is obtained through weighing at the time of chicken slaughter on day 36. The formula calculates fat meat mass according to (Mentari et al., 2014) as follows:

Meat Fat Mass (g) = Meat Fat Content (%) × Meat Weight (g)

Carcass weight is taken from chicken carcasses at the end of rearing that have been slaughtered halal, separated head and feet, and removed offal using digital scales with an accuracy of 1 g.

Statistic Analysis

Data were tested using analysis of variance at the 5% significance level. If the effect is significant, it is continued with Duncan's 5% significance level test to determine the differences between treatments.

Results and Discussion

Table 2. Effect of EBS on Fatty Meat and Carcass Weight of BroilerChickens

Parameters	T0	T1	T2	T3	T4
Fat Digestibility (%)	81.90±2.02^{a}	74.67±1.08^{b}	68.43±1.13^{c}	66.52±3.46^{c}	66.17±1.48^{c}
Relative Weight of Abdominal Fat (g)	1.61±1.09^{a}	1.60±1.17^{a}	1.28±1.18^{b}	1.24±1.07^{b}	1.19±1.10^{b}
Meat Fat Mass (g)	9.65±0.83^{a}	8.94±0.79^{a}	7.02±0.73^{b}	6.89±0.67^{b}	6.51±0.84^{b}
Carcass Weight (g)	900±1.04^{d}	930.5±1.66^{c}	966.25±0.86^{bc}	984.5±0.62^{b}	1,054.75±0.39^{a}

Different superscripts in the same row indicate significant differences (P<0.05)

Effect of Treatment on Fat Digestibility

Analysis of variance showed that the addition of PKME had a significant effect ($p<0.05$) on fat digestibility. The addition of PKME at the level of 0.8% (T4) in the ratio using microparticle protein sources showed no significant difference ($p>0.05$) with treatments T2 and T3. Still, treatments T2, T3, and T4 had lower fat digestibility than treatments T0 and T1. The T1 treatment was lower ($p<0.05$) than the T0 treatment, and the T0 treatment was significantly higher ($p<0.05$) than the other treatments.

Treatment T4 was not significantly different ($p>0.05$) from treatments T2 and T3 due to the difference in the level of mannan as a prebiotic with a low difference of 0.2% (T3 and T4). Giving prebiotics with a low-level difference did not show significant changes in fat digestibility. Cholis et al. (2014) stated that the

addition of dahlia tuber extracts as a prebiotic in the form of inulin with a low-level difference of 0.4%, namely 0.8% and 1.2% resulted in the same fat digestibility of 74.74% and 75.14%. In addition, the pH data of the small intestine can support the T3 and T4 treatments to produce the same pH (Appendix 8). These conditions affect lipase activity and can not work optimally. Amalia et al. (2013) stated that the lipase enzyme works optimally at neutral pH. Treatment T2, T3, and T4 in the ratio using microparticle protein sources resulted in lower fat digestibility ($p<0.05$) compared to the T0 and T1 treatments. The decreased fat digestibility was influenced by the addition of EBS, which potentially contains mannan that can increase the LAB population. Krismiyanto et al. (2022) stated that prebiotics added to the ration could produce SCFA, changing the acidic atmosphere in the digestive tract so that the LAB population increases and pathogenic bacteria decrease. Lactic acid bacteria in the digestive tract can produce BSH enzymes that reduce fat digestibility. Kirana et al. (2017) stated that the BSH enzyme can reduce fat content by deconjugating bile salts, resulting in fat that cannot be absorbed, so that fat is wasted through excretion. Ration conditions that use microparticle protein sources can support low-fat absorption, where protein absorption is higher. Using microparticle protein rations can help reduce the fat digestibility of broiler chickens. Soybean meal used as an ingredient in microparticle protein rations contains Soybean oligosaccharides (SOS) which can be utilized by LAB so that it undergoes fermentation and produces SCFA, then has the effect of lowering pH and inhibiting lipase performance. Harumdewi et al. (2018) stated that the provision of microparticle protein rations using soybean meal containing SOS could be utilized by LAB and increase SCFA to produce a lower pH in the digestive tract, which reduces the performance of lipase enzymes so that fat digestibility decreases.

Treatment T1 showed higher fat digestibility ($p<0.05$) than treatments T2, T3, and T4. This condition may be due to the effect of the lowest EBS level so that the ability of EBS at the time in the small intestine utilized by LAB is not optimal compared to treatments T2, T3, and T4. The higher level of prebiotics given is easier to utilize by LAB to increase LAB growth. Krismiyanto et al. (2021) reported that adding prebiotic inulin with the highest level of administration (1.17%) could increase the LAB population in the duodenum, jejunum, and ileum. The T0 treatment showed the highest fat digestibility due to the absence of PKME in the ratio. Harumdewi et al. (2018) reported that utilizing 18% microparticle protein rations with the addition of Lactobacillus sp. can increase crude fat digestibility.

Effect of Treatment on Relative Weight of Abdominal Fat

Analysis of variance showed that the addition of EBS had a significant effect ($p<0.05$) on the relative weight of abdominal fat. The addition of EBS at the 0.8% (T4) level in the ratio using microparticle protein sources showed no significant difference with the T2 and T3 treatments. Still, the T4, T3, and T2 treatments had lower abdominal fat relative weights ($p<0.05$) than the T0 and T1 treatments. The same result occurred in the T1 and T0 treatments. In contrast, T0

and T1 treatments were significantly higher ($p<0.05$) than T2, T3, and T4 treatments.

Treatment T4 was not significantly different ($p>0.05$) from treatments T2 and T3 due to differences in the level of mannan as a prebiotic with a low difference of 0.2% (T3 and T4). Prebiotics with a low-level difference did not show significant changes in abdominal fat. Massolo et al. (2016) stated that the addition of dahlia tuber extract as a prebiotic in the form of inulin with a low-level difference of 0.2%, namely 0.8% and 1.0%, resulted in the same abdominal fat percentage of 1.99% and 2.04%. Fermentation results between MOS and LAB can produce SCFA, which causes an acidic digestive tract atmosphere, so lipase performance is not optimal. Firdaus et al. (2017) stated that pH 6.5 is a condition where lipase works optimally and decreases its performance along with high and low pH changes. Lipase that is not optimal can reduce abdominal fat.

Treatments T4, T3, and T2 had lower abdominal fat relative weights ($p<0.05$) than treatments T0 and T1. This result is in line with fat digestibility (Table 5). The ability of the T4 treatment to reduce abdominal fat is likely due to an increase in the LAB population in the digestive tract. The fermentation between LAB and MOS can produce SCFA, making the digestive tract's acidic atmosphere optimal for LAB growth. Krismaputri et al. (2016) stated that adding prebiotics in the ratio can be utilized by LAB as a substrate to support growth. Lactic acid bacteria in the digestive tract play a role in the secretion of BSH enzymes with the ability to reduce fat absorption so that abdominal fat decreases. Kirana et al. (2017) stated that the BSH enzyme could reduce fat levels by deconjugating bile salts, resulting in fat that cannot be absorbed, so that fat is wasted through excretion.

Treatments T0 and T1 were significantly higher ($p<0.05$) than treatments T2, T3, and T4 (Table 5). Although the T0 treatment used a microparticle protein source, the number of LAB populations present was insufficient to produce BSH enzymes, so abdominal fat deposition increased. Fajrih and Khoiruddin (2020) reported that adding 1.5% inulin in the ratio resulted in abdominal fat of 1.58%, lower than the control treatment (without adding additives) of 1.98%. Palm meal extract as a prebiotic plays a positive role in producing BSH, which can suppress fat deposition. Cholis (2014) stated that the addition of prebiotics will increase the LAB population that has the ability to produce BSH enzymes.

Effect of Treatment on Meat Fat Mass

Analysis of variance showed that the addition of EBS had a significant effect ($p<0.05$) on meat fat mass. The addition of EBS at the 0.8% (T4) level to the ratio using microparticle protein sources showed no significant difference with the T2 and T3 treatments. Still, the T4, T3, and T2 treatments had lower meat fat mass than the T0 and T1 treatments. The same result occurred in the T1 and T0 treatments. In contrast, the T0 treatment was significantly higher ($p<0.05$) than the T2, T3, and T4 treatments.

The T4 treatment produced the same meat fat mass ($p>0.05$) as the T3 and T2 treatments. This is in line with the digestibility of fat and abdominal fat in treatments T4, T3, and T2 showed the same results ($p>0.05$). These results are

supported by the LAB population and pH of the small intestine of the same treatment (Appendix 10). Krismaputri et al. (2016) stated that adding 0.3% SOS (T4) reduced fat meat content in line with decreased fat digestibility. The addition of EBS prebiotics can help reduce fat meat mass; MOS levels in EBS can be utilized by LAB as a substrate so that it can develop properly and produce BSH enzymes. Abdurrahman et al. (2016) stated that the provision of prebiotics in the ration can increase the LAB population capable of producing BSH enzymes to make bile salts deconjugated which causes a decrease in fat digestibility along with meat fat mass.

Treatments T4, T3, and T2 with the addition of EBS at the level of 0.8%, 0.6%, and 0.4%, respectively, in the microparticle protein ratio resulted in lower meat fat mass ($p<0.05$) compared to treatments T0 and T1 (Table 7). Biswas et al. (2021) reported that adding 0.2% MOS as a prebiotic resulted in a lower percentage of meat fat than the control treatment (without additives). Palm meal extract contains MOS, which can increase the LAB population and reduce the digestive tract's pH, thus reducing lipase's effectiveness. Kirana et al. (2017) stated that lipase could decrease its performance at low pH, thus reducing fat digestibility. The microparticle protein ratio used also helps in reducing meat fat mass. Krismiyanto et al. (2022) reported that the addition of glucomannan (0.1%) in rations containing microparticle protein was able to reduce ($P < 0.05$) the fat content of broiler meat compared to the control treatment (without additives). Cholis et al. (2018) stated that soybean meal in microparticles causes SOS to be more easily digested by LAB to produce more SCFA so that the pH becomes acidic and the mass of meat fat becomes low.

Effect of Treatment on Carcass Weight

Variance analysis showed that adding EBS had a significant effect ($p<0.05$) on carcass weight. Adding PKME at the 0.8% (T4) level in the ratio using microparticle protein sources resulted in higher carcass weight compared to treatments T0, T1, T2, and T3. The same results occurred in treatments T2 and T3, T1 and T2, and T0 and T1. In contrast, the T0 treatment was significantly lower ($p<0.05$) than the T2, T3, and T4 treatments.

The addition of EBS at the 0.8% (T4) level in rations using microparticle protein sources showed significant differences with treatments T0, T1, T2, and T3. Prebiotics in the form of MOS added to microparticle protein rations increase the LAB population so that the production of lactic acid and SCFA increases and causes the digestive tract to become acidic. Acidic conditions in the digestive tract increase the performance of protease enzymes that play a role in protein breakdown. Widodo et al. (2015) stated that protease works optimally in acidic digestive tract conditions, affecting the absorption of ration protein to be more optimal. Anggraini et al. (2017) stated that protease enzymes could convert complex proteins into simple forms to be absorbed and utilized by the livestock body.

The increase in carcass weight in the T4 treatment was supported using microparticle rations. Krismiyanto et al. (2021) stated that protein source feeds ingredients in the form of microparticles can increase the surface area to facilitate

the work of enzymes and increase the absorption of nutrients in the body. Using microparticle rations supplemented with prebiotics as additives slows the digestion rate, making protein absorption more effective. Cholis et al. (2018) reported that using microparticle protein source feed ingredients in rations supplemented with Lactobacillus sp. increased the LAB population in line with the decrease in digesta rate and increased protein digestibility. Increased protein absorption can increase broiler carcass weight.

The T0 treatment was significantly lower ($p<0.05$) than the T1, T2, T3 and T4 treatments. The addition of PKME with low levels in the ratio has yet to be able to increase carcass weight optimally. Prebiotics in the form of MOS contained in EBS have a role as a substrate for LAB to produce SCFA, which affects the decrease in pH in the digestive tract. A decrease in the pH of the digestive tract affects the digesta rate to be slow. Cahyaningsih et al. (2013) stated that acidic conditions in the digestive tract due to an increase in LAB impact the high level of digestion rigidity so that the digestion rate becomes slow. The slow rate of digestion in the digestive tract has a positive impact on nutrient absorption, especially protein, so that protein digestibility will increase and be more optimally utilized by livestock. Sjofjan et al. (2020) stated that the slow digesta rate results in increased nutrient absorption so that the body will utilize it more effectively. The lower EBS level causes the digesta rate to be fast so that nutrient digestibility, especially protein digestibility, becomes ineffective and has an impact on the decrease in broiler carcass weight.

Conclusion

Adding palm oil cake extract at 0.8% to the diet using microparticle protein sources can reduce fat digestibility, the relative weight of abdominal fat, and fat meat mass and increase broiler carcass weight.

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