ISSN 1682-8356
ansinet.org/ijps

INTERNATIONAL JOURNAL OF
POULTRY SCIENCE

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International Journal of Poultry Science 15 (3): 103-110, 2016
ISSN 1682-8356

Nutrient Digestibility in Pegagan Ducks Fed Diet Containing Locally Sourced Ingredients Fermented with Yeast Inoculum

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Abstract: The aim of this study was to evaluate the digestibility of nutrients in the diets of Pegagan ducks fermented with a various of yeast inoculum. The yeast varieties used included tape yeast, tempe yeast and bread yeast. This study evaluated 200 female Pegagan ducks aged 2 weeks who were reared for 5 weeks. A completely randomized design (CRD) was used that consisted of 5 treatments and 4 replications. Treatment rations given were as R0 (commercial ration/control), R1 (locally sourced ration without fermentation), R2 (locally sourced ration fermented with bread yeast), R3 (locally sourced ration fermented with tape yeast) and R4 (locally sourced ration fermented with the tempe yeast). The variables observed included the digestibility coefficient of dry matter (DCDM), organic matter (DCOM), crude fiber (DCCFb), crude protein (DCCP), crude fat (DCCFt), N-free extract digestibility (NFED), nitrogen-corrected metabolizable energy (NCME) and nitrogen retention (NR). Data were analyzed using analysis of Variance (ANOVA) followed by Duncan's multiple range test at 5%. The DCDM, DCOM, DCCFb, DCCP, DCCFt, NFED, NCME and NR values were affected by treatment ($p<0.05$). The DCDM, DCOM, DCCFb, DCCP, DCCFt, NFED, NCME and NR values between locally sourced ration fermented with bread yeast (R2), tape yeast (R3) and tempe yeast (R4) were not significantly different ($p>0.05$). The fermentation process using three types of inoculant yeast (tape yeast, tempe yeast and bread yeast) did not increase nutrient digestibility in pegagan ducks.

Key words: Digestibility, fermentation, locally-sourced ration, pegagan ducks, yeast

INTRODUCTION

Ration is a mixture of feed ingredients which is structured to meet the needs of livestock for 24 h so that optimal productivity can be achieved (Prawitasari *et al*., 2012). Ration contains a variety of nutrients, such as carbohydrates, proteins, fats, fiber, vitamins and minerals. Livestock nutrient needs are determined by several factors, including genetic variation, age, body weight, activity, energy content of the ration and ambient temperature (Wahju, 2004). The quality of the ration is determined by the digestibility of nutrients in the ration; therefore, nutrient digestibility value is often used as an indicator to measure the quality of ration (Abun, 2007); the higher the nutrient digestibility of the ration, the better the quality ration.

One factor that can reduce the nutrient digestibility of the ration is crude fiber, which is generally composed of cellulose, hemicellulose and lignin and can not be digested by poultry (Wahju, 2004). Due to the limitations of poultry to digest crude fiber, the administration of crude fiber in the diet should be limited. The process of crude fiber digestion in poultry takes place in the cecum, in which microorganisms produce cellulase enzymes to digest crude fiber (Wahju, 2004). Crude fiber can be digested in the cecum at levels reaching 20-30% (Suprijatna, 2010). Crude fiber digestibility can also accelerate the rate of digesta in the digestive tract of poultry (Amerah *et al*., 2007); the higher the crude fiber consumed, the faster the rate of digesta in the digestive tract, depending on the time it takes the digestive enzymes to degrade nutrients diminishing and eventually declining the digestibility of some nutrients in the ration (Tillman *et al*., 1998).

The use of local ingredients in poultry ration, such as snail meal, water hyacinth meal and cassava leaf meal, is widely utilized. The main reason for using locally sourced ingredients is to reduce the cost of feed (Setiawan, 2013), since the cost of feed is the biggest cost component in the maintenance of livestock, which can reach 70% (Budiansyah, 2010). Although the price of local feed ingredients is cheaper, they have a high fiber content, such as the water hyacinth meal of 33% (Rahmawati *et al*., 2000) and cassava leaf meal of 30.92% (Ketaren, 2002). Feed processing technology that can reduce the fiber content of feed ingredients is based on fermentation (Mahmilia, 2005), which involves microbial activity that produces enzyme of cellulase and other enzymes to break down the complex bonds of

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crude fiber (Zaman *et al.*, 2013). Yeast can be used for fermentation because it contains microbes, such as fungi and molds. Several studies have reported that nutrient digestibility of ration fermented using different types of yeast differs. Each type of microbe has a different capacity to degrade nutrients such that the digestibility values are also different (Hidanah *et al.*, 2013). Further research is needed to evaluate the nutrient digestibility of ration based on locally sourced ingredients fermented with a variety of yeast inoculum.

MATERIALS AND METHODS

This study used 200 laying Pegagan ducks in the starter phase (2 weeks old). Ducks were obtained from a duck farmer group in the village of Kota Daro, Ogan Ilir, South Sumatra. A 20 plot litter system made of bamboo with a length x width x height of 2 x 2 x 0.8 m was used in this study and was equipped with a place to feed and water and 25-watt incandescent lamps. Ration used consisted of two types, commercial ration and ration composed of locally sourced ingredients, such as refined corn, refined rice bran, water hyacinth leaves meal, coconut pulp, snail meal, cassava leaf meal and egg shell meal. The composition and nutrient content of the ration are presented in Table 1.

Experimental design: This study used a completely randomized design (CRD) that consisted of 5 treatments and 4 replicates. The treatment consisted of R0 (commercial ration/control), R1 (locally sourced ration without fermentation), R2 (locally sourced ration fermented with bread yeast), R3 (locally sourced ration fermented with tape yeast) and R4 (locally sourced ration fermented with the tempe yeast).

Fermentation procedures

Fermentation with tape yeast: The process of ration fermentation was based on Bidura *et al.* (2014) modified. A total of 0.2% of yeast tape was dissolved in 1 liter of molasses. The solution was stirred until homogeneous and then mixed into the ration gradually until a water content of ±35% was reached. Once mixed, the ration was then fermented aerobically for 3 days.

Fermentation with bread yeast

Preparing starter: Fermipan Brands was grown on the growth substrate. The growth substrate was made of a mixture of 1000 ml of distilled water and 100 g of sugar (sugar solution concentration of 10%) and then placed in a glass beaker. The mixture was homogenized using a magnetic stirrer and then sterilized using an autoclave at a temperature of 121°C for 15 min until the solution reached 30-33°C. 50 g of yeast was mixed with the substrate and incubated at 30°C for 8 h (Azizah *et al.*, 2012).

Fermentation process: 1 kg of ration was mixed with a starter and stirred until blended. Then, the ration was fermented aerobically for 60 h (Richana, 2011).

Fermentation with tempe yeast: The fermentation process with tempe yeast was based on Zaman *et al.* (2013) modified. The ration was dried and mixed with molasses with a ratio of 1000 g ration to 55.56 g molasses. The ration mixed with molasses was steamed for 30 minutes and then aerated. Then, the ration was mixed with tempe yeast at a ratio of 1 kg ration to 18 g of tempe yeast. The ration mixed with tempe yeast was incubated for 7 days under aerobic conditions.

Preparation of research: Two weeks before the ducks went into the cage, the cage was cleaned and sanitized. After sanitizing, each unit enclosure was numbered with treatments and replicates for ease of recording. Ducks were given a 5% sugar water solution during the first 1 hour after arriving in the cage. Then, ducks were weighed and body weight was recorded. To reduce stress after weighing, ducks were given vitamins dissolved into drinking water. The ration was given 3 times a day (morning, noon and evening), while drinking water was given by *ad libitum*. Ducks were reared for 5 weeks.

Variables observed: The variables recorded included the digestibility coefficient of dry matter (DCDM), organic matter (DCOM), crude fiber (DCCFb), crude protein (DCCP), crude fat (DCCFt), N-free extract digestibility (NFED), nitrogen-corrected metabolizable energy (NCME) and nitrogen retention (NR).

Digestibility of dry matter and organic matter: Dry matter and organic matter in the ration and excreta were measured according to AOAC (1990). The organic matter was calculated by substracting the dry matter with ash content. The ash content was obtained using the following steps: a porcelain cup was inserted into an oven (60°C) for approximately 6 h, then placed into the desiccator and weighed (X). A sample of 1 g (Y) was placed into a porcelain cup, then inserted into the electric furnace at a temperature of 600°C for approximately 6 h. After the ashes, the cup was moved into a desiccator then weighed (Z). The calculation of ash content used the formula:

$$\text{Ash content (\%)} = \frac{Z\text{-}X}{Y} \times 100\%$$

The digestibility coefficient of dry matter (DCDM) was calculated using the formula:

$$\text{DCDM (\%)} = \left[\frac{\left(\text{Dry matter consumed} - \text{dry matter excreta}\right)}{\left(\text{Dry matter consumed}\right)}\right] \text{x } 100\%$$

The digestibility coefficient of organic matter (DCOM) was calculated using the formula:

$$\text{DCOM (\%)} = \left\{\frac{\left[\text{Organic matter consumed-organic matter of excreta}\right]}{\left[\text{Organic matter consumed}\right]}\right\} \times 100\%$$

Digestibility of crude fiber: Crude fiber in the ration and excreta were measured according to AOAC (1990). Filter paper with a diameter of 4.5 cm and a porcelain cup were inserted into the oven and dried at a temperature of 105°C. A sample of 1 g (X) was inserted into the beaker and then 1.25% sulfuric acid was added and heated for 1 hour to boil. 50 mL NaOH was added and heated for 30 minutes. The dried filter paper was weighed (A) and placed into a Buchner funnel. It was filtered using a vacuum pump and washed successively with 50 mL of hot water and 100 mL of 1.25% sulfuric acid, washed again with 100 mL of distilled water and finally washed with 25 mL of acetone. Filter paper and its contents (residue) were inserted into a porcelain cup and dried using the oven for 1 h at temperatures of 105°C, then cooled in a desiccator and weighed (Y). It was burned on a hot plate until no smoke and put into an electric furnace until the ash is white and then weighed (Z):

$$\text{Crude fiber (\%)} = \frac{\text{Y-Z-A}}{\text{X}} \times 100\%$$

The digestibility coefficient of crude fiber (DCCF) was calculated using the following formula:

$$\text{DCCF (\%)} = \left\{\frac{\left[\text{Crude fiber consumed-crude fiber of excreta}\right]}{\left[\text{Crude fiber consumed}\right]}\right\} \times 100\%$$

Crude fat digestibility: Crude fat in the diet and excreta wee measured according to AOAC (1990). Fat flask and boiling stones were washed and dried in an oven at 60°C for ±6 h. Then, it was put into the desiccator and weighed (A). A sample of 1 g (X) was weighed and inserted into the sleeve fat flask and closed by using fat-free cotton. Gourd shells of fat (containing the sample) was inserted into the Soxhlet apparatus with petroleum ether and filtered over an electric stove. After 8 hours, fat flask was dried in an oven at 60°C for approximately 24 h and then inserted into the desiccator and weighed (B):

$$\text{Crude fat (\%)} = \frac{\text{B-A}}{\text{X}} \times 100\%$$

The digestibility coefficients of crude fat (DCCFt) was calculated using the following formula:

$$\text{DCCFt (\%)} = \left\{\frac{\left[\text{Crude fat consumed-crude fat of excreta}\right]}{\left[\text{Crude fat consumed}\right]}\right\} \times 100\%$$

N-free extract digestibility: N-free extract (NFE) in ration and excreta were calculated based on the AOAC (1990). The digestibility coefficient of N-free extract (DCNE) was calculated using the following formula:

$$\text{DCNE (\%)} = \left\{\frac{\left[\text{N-free extract consumed-N-free in excreta}\right]}{\left[\text{N-free extract consumed}\right]}\right\} \times 100\%$$

Nitrogen-corrected metabolizable energy (NCME): NCME was calculated using the equation according to Farrell (1978) which is cited by Djunaidi and Natsir (2003):

$$\text{NCME (\%)} = \left\{\frac{\left[\text{Gross energy intake-gross energy of excreta}\right]}{\left[\text{Gross energy intake}\right]}\right\} \text{-8.73 x N retention}$$

Nitrogen retention (NR): NR was calculated using equation according to Black and Griffiths (1975) which is cited by Djunaidi and Natsir (2003):

$$\text{NR (g)} = \text{N ration-N excreta}$$

Data analysis: The study used a completely randomized design (CRD) that consisted of 5 treatments and 4 replicates with 10 ducks each replication. Data were analyzed by analysis of Variance (ANOVA) followed by Duncan's multiple range test at 5% (Steel and Torrie, 1989).

RESULTS

Nutrient digestibility: The mean value of dry matter, organic matter, crude fat and crude fiber digestibility on ration treatment are shown in Table 2. The value of dry matter digestibility in ducks pegagan was significantly ($p<0.05$) affected by treatment. Based on the DMRT test, dry matter digestibility on ducks fed control diet/commercial ration (R0) was significantly ($p<0.05$) higher than that those locally sourced ration, both unfermented (R1) and fermented using different yeast inoculum (R2, R3 and R4). The digestibility value of dry

Table 1: The composition and nutrient content of the ration for Pegagan ducks

	Treatments				
	R0	R1	R2	R3	R4
Composition of materials (%)					
Refined corn meal	-	55.00	55.00	55.00	55.00
Refined rice bran	-	9.00	9.00	9.00	9.00
Water hyacinth leaves meal	-	2.00	2.00	2.00	2.00
Coconut pulp	-	2.00	2.00	2.00	2.00
Snail meal	-	17.00	17.00	17.00	17.00
Cassava leaf meal	-	13.00	13.00	13.00	13.00
Eggshell meal	-	1.00	1.00	1.00	1.00
DL-methionine	-	0.40	0.40	0.40	0.40
L-lysine	-	0.60	0.60	0.60	0.60
Total	-	100.00	100.00	100.00	100.00
Nutrient content of ration*					
Dry matter (%)	85.04	85.74	86.81	84.11	85.5
Ash (%)	5.25	7.19	7.34	7.16	7.96
Crude protein (%)	19.20	18.37	19.74	19.88	19.22
Crude fat (%)	3.39	3.43	3.32	3.38	3.24
Crude fiber (%)	3.24	6.37	6.08	6.17	6.16
ME (kkal/kg)	2995.39	2827.34	2842.96	2824.92	2843.66
Phytate acid (ppm)	3.87	4.48	3.08	3.03	3.02
Cyanide acid(ppm)	0	20.81	19.62	18.79	19.58
Ca (%)	0.94	1.27	1.56	1.08	1.25
P (%)	0.77	0.79	0.99	0.56	0.76
Methionine (g/100 g)	1.44	1.22	0.45	0.78	0.75
Lysine (g/100 g)	1.47	0.93	0.63	0.69	0.80

*Analysis results in Laboratory of Feed Technology, IPB Bogor, 2015. R0: Commercial ration/control, R1: Locally sourced ration without fermentation, R2: Locally sourced ration fermented with bread yeast, R3: Locally sourced ration fermented with tape yeast and R4: Locally sourced ration fermented with the tempe yeast

matter in ducks fed locally sourced ration fermented with various inoculum (R2, R3 and R4) showed the same results ($p>0.05$), but were significantly ($p<0.05$) lower than those fed locally sourced ration without fermentation (R1).

The results showed that treatment significantly ($p<0.05$) affected the organic matter digestibility of Pegagan ducks. Organic matter digestibility on ducks fed a control diet (commercial ration) was significantly ($p<0.05$) higher compared to other treatments. Organic matter digestibility of Pegagan ducks fed locally sourced ration fermented with a variety of yeast inoculum (R2, R3 and R4) showed the same results but were significantly ($p<0.05$) lower than those fed locally sourced ration without fermentation (R1). Based on analysis of variance, treatment significantly ($p<0.05$) affected crude fat digestibility. The digestibility of crude fat on ducks fed the control diet/commercial ration (R0) was significantly ($p<0.05$) higher compared to other treatments. In addition, the value of crude fat digestibility of the locally sourced ration, unfermented (R1) and fermented using different yeast inoculum (R2, R3 and R4), was not significantly different ($p>0.05$) (Table 2).

The value of crude fiber digestibility was significantly ($p<0.05$) affected by treatment. The crude fiber digestibility on ducks fed control diet/commercial ration was significantly ($p<0.05$) higher than that the locally sourced ration, both fermented and unfermented. There was no significant difference ($p>0.05$) in crude fiber digestibility between ducks fed locally sourced ration, both without fermentation (R1) and with fermentation using different yeast inoculum (R2, R3 and R4). N-free extract digestibility in ducks pegagan was significantly ($p<0.05$) affected by treatment. DCNE value of the ducks fed control diet (commercial ration) was significantly ($p<0.05$) the highest compared to other treatments. The value of DCNE on ducks fed locally sourced ration fermented with a variety of yeast inoculum (R2, R3 and R4) showed the same results or not significantly different ($p>0.05$) but was significantly ($p<0.05$) lower than those fed locally sourced ration without fermentation (R1).

Metabolizable energy and nitrogen retention: Metabolizable energy measured was nitrogen-corrected metabolizable energy (NCME). Mean of NCME and nitrogen retention (NR) to each of experimental ration can be seen in Table 3.

NCME was significantly ($p<0.05$) affected by treatment. NCME on ducks fed control diet (commercial ration) was significantly ($p<0.05$) higher compared to the other treatment rations (3040.2 kcal/kg). NCME value of ducks fed locally sourced ration, both unfermented (R1) and fermented with a variety of yeast inoculum (R2, R3 and R4), showed a relatively similar result ($p>0.05$; 2324.8 kcal/kg (R1); 2129.4 kcal/kg (R2); 2200.1 kcal/kg (R3); 2119.7 kcal/kg (R4)). Nitrogen retention (NR) was significantly ($p<0.05$) affected by treatment. NR on ducks

Table 2: Mean values of nutrient digestibility

Treatment	DCDM	DCOM	DCCFt	DCCFb	DCNE
R0	87.24±1.43[a]	85.76±1.48[a]	87.13±2.17[a]	56.49±2.93[a]	89.69±1.95[a]
R1	80.60±3.07[b]	79.33±2.06[b]	81.70±2.78[b]	42.39±10.28[b]	85.85±1.32[b]
R2	76.23±0.60[c]	74.99±0.88[c]	80.06±3.16[b]	39.46±3.76[b]	81.41±1.52[c]
R3	76.15±2.95[c]	74.03±2.42[c]	77.67±5.75[b]	36.67±10.07[b]	79.45±3.75[c]
R4	76.78±1.49[c]	75.16±1.28[c]	78.55±5.13[b]	38.15±10.45[b]	82.81±1.10[c]

R0: Commercial ration/control, R1: Locally sourced ration without fermentation, R2: Locally sourced ration fermented with bread yeast, R3: Locally sourced ration fermented with tape yeast and R4: Locally sourced ration fermented with the tempe yeast

Table 3: Mean of nitrogen-corrected metabolizable energy (NCME) and nitrogen retention (NR)

Treatments	NCME (kcal/kg)	NR (%)
R0	3040.2±189.2[a]	70.74±3.31[a]
R1	2324.8±92.39[b]	59.57±3.90[b]
R2	2129.4±132.78[b]	57.64±4.64[b]
R3	2200.1±273.24[b]	56.57±5.29[b]
R4	2119.7±100.51[b]	55.44±3.76[b]

R0: Commercial ration/control, R1: Locally sourced ration without fermentation, R2: Locally source ration fermented with bread yeast, R3: Locally sourced ration fermented with tape yeast and R4: Locally sourced ration fermented with the tempe yeast

fed control diet (R0) was significantly ($p<0.05$) higher compared to other treatment rations (70.74%). The value of NR on ducks given locally sourced ration, unfermented (R1) and fermented using different yeast inoculum (R2, R3 and R4), was not significantly different ($p>0.05$), compared to others [59.57% (R1); 57.64% (R2); 56.57% (R3); 55.44% (R4)].

DISCUSSION

Digestibility of dry matter: The difference in dry matter digestibility between commercial ration and locally sourced ration, both fermented and unfermented, is related to the crude fiber content in each ration. According to Amrullah (2004), one of the factors that affects nutrient digestibility is the content of crude fiber in the ration, since crude fibers are bulky, which has an impact on a number of digestible nutrients (Jehemat and Koni, 2013). Thus, the higher the level of crude fiber, the lower the digestibility of nutrients. A high dry matter indicates that the number of bonds that makeup the compound feed material break down increase (Koswara, 2009). Based on proximate analysis, the crude fiber content of commercial feed/control (R0) was the lowest at 3.24%, while the locally sourced ration, both unfermented and fermented, had a higher content of crude fiber, among others [6.37% (R1); 6.08% (R2); 6.17% (R3); 6.16% (R4) (Table 1)]. The lower crude fiber content in the ration results in higher dry matter digestibility of commercial ration. Although the value of dry matter digestibility in the locally sourced ration fermented using yeast inoculum was not as high as the commercial ration, generally, the digestibility value close to the value of crude fiber digestibility in poultry. Cahyadi *et al.* (2014) reported that the average value of dry matter digestibility in the duck ration fermented with *Aspergillus niger* was 79.50%, while the dry matter digestibility of the ration in this study was from 76.15 to 76.78%.

Digestibility of organic matter: The digestibility of organic matter was lower than that of the commercial ration due to the persistently high crude fiber content of the locally sourced ration. Digestible organic matter is largely determined by the nutritional content of ration (Tillman *et al.*, 1998). Crude fiber is one of the nutritional contents in a ration that will determine its digestibility (Siri *et al.*, 1992) since crude fiber can cause nutritional components of organic matter contained in the ration to bind to cellulose so that it becomes difficult to digest (Mangisah *et al.*, 2009). In addition, the high crude fiber content of the fermented locally sourced ration was suspected due to the growth of yeast during the fermentation process which is not optimized so that the cellulolytic enzyme produced is not sufficient. Mold will continue to grow and produce crude fiber-digesting enzymes during the fermentation process (Mahmilia, 2005), which then leads to suboptimal crude fiber digestion.

There are several types of enzymes produced during fermentation by molds, including amylase, amyloglucosidase and cellulase, which degrade cellulose and reduce the level of crude fiber in the diet (Setiawan *et al.*, 2013). Compared to similar research, the organic matter digestibility of the fermented ration in this study was high. Mangisah *et al.* (2009) reported that the digestibility of organic matter in the ration fermented with *Aspergillus niger* ranged from 52.81 to 66.13%, while the organic matter digestibility of the ration fermented yeast in this study ranged from 74.03 to 75.16%.

Digestibility of crude fat: The crude fat digestibility in commercial ration was higher than that of the locally sourced ration. The crude fiber content of the locally sourced ration was higher than that of commercial ration, so crude fat digestion in the ducks was reduced. Jehemat and Koni (2013) and Amrullah (2004) reported that high crude fiber content in the diet resulted in a nutrient digestibility reduction, including crude fat digestibility. Wiseman (1990) reported that one of the factors that influence fat digestibility in non-ruminant livestock is the chemical structure of the fat.

Compared with similar studies that studied fermentation using fungi, crude fat digestibility in this study was low. Cahyadi *et al.* (2014) reported that the average crude fat digestibility in ration for ducks fermented with *Aspergillus niger* was 97.94%, while the results of this study showed that the average of crude fat digestibility on fermented locally sourced ration was 78.76%. In addition to different types of mold, another influential factor is the length of fermentation which can affect the growth of mold and the production of digestive enzymes to digest crude fiber. In this study, the fermentation process lasted for 3-7 days; however, Cahyadi *et al.* (2014) reported that the length of fermentation was 10 days. Mold growth was not optimized such that the production of digestive enzymes of crude fiber, such as cellulose, was low and crude fat digestibility was low.

Digestibility of crude fiber: The crude fiber digestibility on ducks fed controls diet/commercial ration was higher than that the locally sourced ration, both fermented and unfermented, due to the difference in the crude fiber content of the commercial and locally sourced ration. Based on the proximate analysis, the difference in crude fiber content between the commercial ration and locally sourced ration was large. The content of crude fiber in the locally sourced ration ranged from 6.08 to 6.37%, while the crude fiber content of commercial ration was 3.24%. The high content of crude fiber in the locally sourced ration resulted in the lower crude fiber digestibility. Hidanah *et al.* (2013) and Tillman *et al.* (1998) reported that, the higher crude fiber content, the lower the digestibility of crude fiber in the ration.

In addition to differences in crude fiber, it was also predicted that the high digestibility of crude fiber on a commercial ration compared to the locally sourced ration would be affected by age, as Moharrery (2006) reported that the maturity level of the digestive organs of birds is determined by age. In this study, the ducks used were in the starter phase and the age range in this phase is 0 to 8 weeks (Ketaren, 2002). The maturity level of the digestive tract would optimize the activity of microorganisms in the digestive tract, especially in digesting crude fiber. Maynard *et al.* (2005) found that one of the factors that affects the ability to digest crude fiber is the activity of microorganisms.

Crude fiber digestibility between ducks fed locally sourced ration, both without fermentation (R1) and fermentation using different yeast inoculum (R2, R3 and R4), was the same, suggesting that the activity of yeast in digesting crude fiber during the fermentation process was not optimal. This could be due to the insufficient production of digestive enzymes of molds. Budiansyah (2010) reported that this non-significant change to crude fiber digestibility was due to low levels of the enzyme produced by the yeast microbes. Cahyadi *et al.* (2014) reported that the digestibility of crude fiber in ration fermented with *Aspergillus niger* was 42.97%, while the results of this study showed the value of crude fiber digestibility of the ration fermented was 38.09%.

N-free extract digestibility: N-free extract is a carbohydrate that does not contain crude fiber and contains a lot of starch (Tillman *et al.*, 1998). N-free extract digestibility depends on other components, such as ash, crude protein, crude lipid and crude fiber. The results in this study showed that the average NFED on ducks fed locally sourced ration, which is fermented with different yeast inoculum, was 81.22%. Syahrir (2011) reported that the NFED value also depends on the digestibility of other nutrient substances, where the higher the digestibility of other nutrient substances, the higher the NFED value. The average nutrient digestibility of the three types of ration fermented with a variety of yeast inoculum (R2, R3 and R4) was quite high (dry matter digestibility: 76.39%; organic matter: 74.73%; crude lipid: 78.76%). A reduction in N-free extract digestibility occurs if the content of crude fiber in the ration is high.

Nitrogen-corrected metabolizable energy and nitrogen retention: The high value of nitrogen-corrected metabolizable energy (NCME) on a commercial ration (R0) compared to locally sourced ration was due to low crude fiber content. McDonald *et al.* (1995) reported that high crude fiber content of feed ingredients lowers digestibility value, which results in an increase in metabolizable energy value of feed ingredients. NCME and digestibility showed a synergistic relationship, such that the higher the digestibility of feed ingredients, the higher the NCME value (Sembiring, 2009). There were no significant differences in NCME values between the unfermented and fermented locally sourced ration, indicating that the fermentation process did not run optimally. Sembiring (2009) reported that a change in value of metabolic energy from fermentation of fungi indicated a change in the composition of biological nutrients that affected the metabolizable energy content. The high value of nitrogen retention in commercial ration treatment due to the content of amino acids in commercial ration was higher than locally sourced ration. Table 1 shows that the content of methionine and lysine in commercial ration was 1.44 and 147 g/100 g, respectively, while the content of methionine and lysine in the locally sourced ration, either unfermented or fermented was 1.22 and 0.93 g/100 g (R0), 0.45 and 0.63 g/100 g (R1), 0.78 and 069 g/100 g (R3) and 0.75 and 0.80 g/100 g (R4), respectively. The data showed that the number of amino acids methionine and lysine in the locally sourced ration, both fermented and unfermented, was relatively similar; therefore, the value of nitrogen retention between them was not significant. Wahju (2004) reported that one of the factors affecting nitrogen retention is quality of protein and Resnawati (2006) stated that the retention of nitrogen is one method to assess the quality of protein in the feed. Protein quality was determined by the completeness and balance of amino acids, both essential and non-essential (Scott *et al.*, 1982).

Conclusion: The fermentation process of locally sourced ingredients using three types of yeast inoculum did not increase the nutrient digestibility of pegagan ducks in the starter phase, including digestibility of the dry matter and organic matter, crude fiber, crude protein, crude fat, N-free extract, nitrogen-corrected metabolizable energy and nitrogen retention.

ACKNOWLEDGMENT

Thanks to the Directorate of Research and Community Service (DP2M DIKTI), which has provided funding through the Competence Grant in 2015, so this research can be conducted properly.

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