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Effect of Supplementing *Saccharomyces cerevisiae* into Low Quality Local-Based Feeds on Performance and Nutrient Digestibility of Late Starter Local Pigs

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Abstract: The study aimed at evaluating the effect of supplementing *Saccharomyces cerevisiae* into low quality local-based feeds on performance and nutrient digestibility of late starter to grower stage local pigs. There were total 16 late starter local pigs fed with four treatment feeds based on block design with four pigs in each treatment. The four treatment feeds offered consisted of: commercial starter feeds Charoen Pokphand 552 (T_0), basal feeds + yeast 2% of daily feeds requirement (T_1), basal feeds + yeast 4% of daily feeds requirement (T_2) and basal feeds + yeast 6% of daily feeds requirement (T3). Feed intake, daily weight gain, feed conversion efficiency, protein and crude fiber digestibility were evaluated in the study. The findings showed that supplementing *S. cerevisiae* into low quality local-based diet improved 0.9%-2.7% feeds' crude protein, 10%-19% feeds intake, 1%-6% daily weight gain, 3%-4% crude protein digestibility and 4%-5% crude fiber digestibility, but reduced feeds conversion efficiency by 0.3-0.4. The conclusion drawn is that supplementing *S. cerevisiae* (yeast) up to 6% improved performances of starter local pigs fed low quality feeds and performed the similar result with feeding commercial starter feeds Charoen Pokphand 552. Further research by widening the range and increasing the level of yeast supplementation could be done.

Key words: Yeast, *Saccharomyces cerevisiae*, local pigs and feeds, performance, nutrient digestibility.

1. Introduction

Mostly home scale pig farmers in the middle parts of Indonesia prefer to use local and household wastes, because those are cheaper than commercial feeds [1]. As a consequence, however, pig's productivity in this region is low (< 100 g daily gain) [2]. Low protein (2%-5%) and high crude fiber (10%-15%) contents are the most disadvantages of the local-based feeds [1]. Therefore, the solving methods that are able to improve protein content of the feeds and at the same time may increase the fiber digestibility by pigs are needed. The methods should be technically easy and acceptable, as the small farmers in general have low skills in feed processing and are not interested in using complicated ways. Supplementing pigs with an additional essential nutrient or compound that contains essential nutrients with fibre-fermenting capability into local-based feeds would be one of the helpful ways.

Brewer's yeast, most familiar as *Saccharomyces cerevisiae*, for it contains 85% *S. cerevisiae* microbes, is a rich-protein compound and known as a single protein [3, 4]. It can play role as probiotic and be used as a feed additive for pigs [5]. Such advantages of using *S. cerevisiae* for pigs are improving protein content, creating healthy digestive tract by increasing benefit microbes population and supporting immunity formation in digestive tracts, and increasing fiber digestibility by fermentative role in pigs [6]. These advantages are useful to prepare young pigs for their old nutrient digestion. Scientific study on using *S. cerevisiae* for pigs is rarely conducted in Indonesia,

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but study on supplementing 2%-6% *Rhizopus oligosporus* in growing pigs' feeds has been successfully carried out [7].

The study was carried out to provide information of supplementing *S. cerevisiae* into local-based feeds of late starter to grower stage local pigs.

2. Materials and Methods

The feeding trial was carried out by using 16 late starter (two months old) local pigs. The pigs were housed in 16 individual pens of 1 m × 1 m during early five weeks trial. At the 6th week of the trial, each pen was modified to be metabolic pens by reducing the pens width to 1 m × 0.5 m, and 1.10 m × 6 m metal sheet was set on each pen's floor. Such metabolic pens were designed to diminish pig's movement, resulting in facilitating faecal collection. Block design of four treatments with four blocks procedure was applied in the study. The four treatment feeds offered consisted of: commercial starter feeds Charoen Pokphand 552 (T_0), local-based feed + yeast 2% of daily feeds requirement (T_1), local-based feeds + yeast 4% of daily feeds requirement (T_2) and local-based feeds + yeast 6% of daily feeds requirement (T_3).

The local-based feeds was prepared by 50% corn meal + 31.1% rice bran + 7.9% fishmeal + 11% bean curd extract to perform 16% crude protein (CP), lower than common starter feeds (20%) or grower feeds (18%). This feed was not used as trial feeds, but it was supposed as a low quality local-based feeds (16% CP is lower that 18% CP in common late starter or early grower feed in the commercial feeds). So, in this study, local-based feeds was improved by supplementing three levels of *S. cerevisiae*. The supplementation of three levels of *S. cerevisiae* were stated in order to meet 17%-18% CP content for late starter or early grower to grower stages pigs, which were refered to 2%-6% *Rhyzopus oliogosporus* levels used in previous experiment [7]. The piglets were grouped based on their initial body weight.

The CP, fat, crude fiber (CF), nitrogen free extract and gross energy of four feeds (T_0, T_1, T_2 and T_3) were measured by using proximate analysis method in the Chemical and Nutrition Laboratory, Faculty of Animal Husbandry, Nusa Cendana University, Kupang Indonesia, while Ca and P content were measured with atomic absorption spectroscopy (AAS) in the Soil Laboratory of Agriculture Faculty, Nusa Cendana University, Kupang, Indonesia.

The yeast was added into base feeds as much as 2%, 4% and 6% of daily pig's requirement for T_1, T_2 and T_3 trial feeds, respectively. The yeast package is commonest mark available in the bread shops in Kupang city with a commercial name "Gold Pakmaya" distributed by PT Hakiki Donarte. The trial was conducted for eight weeks divided into two constructive steps: two weeks for adaptation and six weeks for data collection steps. Daily feeding were offered thrice (8:00, 12:00 and 16:00) based on their total previous day feeds intake. Variables studied consisted of daily intake, daily weight gain, feed conversion efficiency (FCE), CP and CF digestibility values.

Data collection for digestibility calculation was according to the method described by Li [8]. Feces were collected during the last two weeks (the 7th and 8th week) of the feeding trial. Feed intake was timed, limited (based on daily requirement) and constantly monitored until the amount of daily intake and feces remained relatively constant (not fluctuating) during continuous 7 d at the 6th week before the collection period [8]. Feces were collected daily during 14 d. Fresh weight of daily feces was recorded and sundried until their weight constant, then 10% of collectively sundried feces were sampled and sent to laboratory for nutrient analysis. Both CP and CF digestibility values (%) were calculated according to the method described by Li [8], using the following Eq. (1):

$$\text{Digestibility} = \frac{\text{component intake} - \text{component feces}}{\text{component intake}} \times 100 \quad (1)$$

where, component intake is the intake of CP or CF and component feces is CP or CF content in the feces.

Data were analyzed using analysis of variances, followed with Duncan's multiple range test [9].

3. Results and Discussion

The nutrient compositions of feeds are shown in Table 1. The feeds supplemented with *S. cerevisiae* increased 0.9%-2.8% CP, 253-343 kcal energy content and 0.2% fat content, as compared with local-based feeds. CF content in T_1, T_2 and T_3 was higher than that in T_0 (commercial starter feeds), due to the contribution of *S. cerevisiae* in those nutrients. CP content was increased by 0.9%-2.8%, which is higher than the increase of other nutrients contents, because *S. cerevisiae* is a single cell protein that contains high CP content (up 45%) [3]. CP content in T_1 was lower, in T_2 similar and in T3 higher than that in T_0, but fat, energy and minerals contents in T_1-T_3 were lower than that in T_0. Low CP content in T_1 is because that there was only ± 0.9% CP supplied from 2% of *S. cerevisiae* into the basal feeds. Lower increase in fat content is because that *S. cerevisiae* is low fat content resulting in low contribution of this nutrient into basal feeds. CF contents in T_1-T_3 were higher than that in T_0 as a consequence of additional 6% CF content that came from 31.1% rice bran (4.0%) and 11% bean curd extract (2%). These figures shows that supplementing *S. cerevisiae* could improve the essential nutrients, mainly CP content, followed by the increase of fat and energy content, in comparison with the local-based feeds.

Feeds intake, daily weight gain, CP, CF digestibility and FCE of pigs increased, as the *S. cerevisiae* level increased (Table 2). An increasing of feeds intake figures out the better palatability of the feeds [10], because *S. cerevisiae* can increase feeds palatability [11, 12] and create a ravenous aromatic and good taste in feeds with < 15% inclusion, but causes a bitter taste above this level [3, 13]. These mean that supplementing *S. cerevisiae* improved feeds palatability, resulting in higher feeds intake of the pigs. CP digestibility was improved 3%-4%, mainly because *S. cerevisiae* supplied the easily digestible protein group [11]. CF digestibility value increased at the range of 4%-5%, which is assumed to be the result of fermentative role of *S. cerevisiae* microbes [6] in improving fiber fraction fermentation of the feeds. Besides, CF in the feeds that came from rice bran and

Table 1 Nutrient composition of treatments feeds.

Nutrient	T_0	Basal feeds	T_1	T_2	T_3
CP (%)[2]	17.9	16.0	16.9	17.9	18.8
Fat (%)[2]	4.0	3.2	3.2	3.4	3.4
CF (%)[2]	6.1	7.1	7.0	7.1	7.1
NFE (%)[2]	70.6	70.8	72.5	72.6	71.4
Ca (%)[3]	0.9	0.5	0.5	0.6	0.6
P (%)[3]	0.7	1.1	1.1	1.1	1.2
GE (kcal/kg)[2]	4,348.5	3,963.0	4,216.8	4,293.6	4,306.6

CP: crude protein; CF: crude fiber; NFE: nitrogen free extract; GE: gross energy.

Table 2 Feed intake, weight gain, FCE, CP and CF digestibility of pigs fed with four different feeds.

Variable	T_0	Basal feeds	T_1	T_2	T_3
Feed intake (g)	935.2[a]	-	1,030.3[a]	1,043.1[a]	1,108.9[a]
Weight gain (g)	275.5[a]	-	278.3[a]	284.5[a]	291.8[a]
FCE (g/g)	3.4[a]	-	3.7[a]	3.7[a]	3.8[a]
CP digestibility (%)	78.9[a]	-	81.9[a]	82.3[a]	82.9[a]
CF digestibility (%)	74.3[a]	-	78.3[a]	79.6[a]	79.4

-: the basal feed was not fed alone in the feeding trial, for it was supposed as the low quality base-feeds of late starter or grower pigs.
[a] Means with the common superscript in the same row are not significantly different ($P > 0.05$).

bean crude extract is assumed mostly easily fermentable fractions.

An improving in daily weight gain is assumed directly by the better of both feeds intake and CP digestibility, as well CF digestibility. The daily weight gain of pigs in this study is up to 200% higher than commonly daily weight of local pigs in the study area. Based on calculation from Ly et al. [1] and Johns et al. [2], the common pigs traditionally reared in the study area need 2.5 years to meet 60-70 kg (local pigs) or 1.5 years to meet 75-80 kg (crossbred pigs) live weight (market weight). Slight lower of CF digestibility value in T_1-T_3 performed in the study is supposedly because of slightly higher of CF content in these feeds, which resulted in slight reduction of efficiency in feeds conversion, as compared to T_0. Statistically, these differences were not significant ($P < 0.05$).

4. Conclusions

The results showed that supplementing 2%-6% *S. cerevisiae* into low quality local based-feeds with 16% CP can improve the feed intake, weight gain, CP and CF digestibility values of starter local pigs. FCE value of the improved local based-feeds was similar to that of commercial Charoen Pokphand 552 starter feeds. The higher *S. cerevisiae* supplementation level (up to 6%), the higher the performances and digestibility values of pigs.

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