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Effects of Dietary Yeast Culture on Growth Performance, Feed Digestibility and Faecal Microbiota in Weaned Piglets

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ABSTRACT

Background: Generally, in pig farming, the most important thing is the health of the piglets and adequate nutrition for optimal growth. The purpose of this study was to examine the effect of yeast culture (YC) to the diet on growth performance and pathogenic bacteria in the excreta of piglets.

Methods: One hundred twenty male crossed Landrace piglets with an average body weight of 12.77+1.28 kg, were randomly divided into four treatment groups (30 piglets each). Piglets in the control group were given basal feed without the addition of YC (A); and the other group was fed a basal diet with an additional 0.20% YC (B); 0.40% YC (C) and 0.60% YC(D), respectively. In every 1 g of YC contains as much as 3.95×10^6 CFU/g *Saccharomyces spp*.

Result: Final body weight, average daily gain and feed: gain in the pig group that received YC in both growth phases of the piglets were a significant increase ($P<0.05$) rather than control. On the other hand, the addition of YC to the diet significantly ($P<0.05$) decreased *Coliform* and *E. coli* in faecal. It can be concluded that the addition of 0.20% YC to piglet feed can stimulate growth and suppress pathogenic bacteria (*E. coli* and *Coliform*).

Key words: *Coliform, E. coli*, Probiotics, Piglets, Yeast culture.

INTRODUCTION

One of the efforts to improve pig production and suppress the population of pathogenic bacteria is by adding antibiotics. Antibiotics have been added to the diet of freshly weaned piglets to reduce the occurrence of diarrhea, while at the same time improving growth performance. This is due to concerns about antibiotic residues in livestock products and the development of bacterial resistance to antibiotics. Therefore, the development of feed supplements for alternative antibiotics is very necessary (Kiros *et al*., 2018).

The use of probiotics in feed has beneficial effects on growth performance, blood parameters and IgG stimulation in weaned piglets, thereby reducing the risk of post-weaning diarrhea syndrome. Growing weaning piglets are very susceptible to disease caused by bacteria, viruses, fungi and other parasites (Dlamini *et al*., 2017; Zhu *et al*., 2017).

Probiotics can change the digestive microbial ecosystem and also produce natural antibiotics (bacitracin, hydrogen peroxide, acidolin), thus affecting the growth and health of the host (Zurmiati *et al*., 2014; Dlamini *et al*., 2017). Giving probiotic cultures to livestock is expected to cause a synergistic effect between probiotic microbial species and the host's digestive tract microbes, so that it can increase the ability to digest feed, so that feed efficiency increases (Bidura *et al*., 2019a; Dumitru *et al*., 2021).

Probiotics can create a balance of intestinal microflora, due to the presence of lactic acid bacteria in the intestines which can create an acidic atmosphere so as to suppress the growth of pathogenic bacteria in the small intestine (Zurmiati *et al*., 2014), reduced the incidence of diarrea and increased growth and feed efficeinsy (Dumitru *et al*., 2021). According to Kiros *et al*. (2018), feed supplementation with *S. cerevisiae* in post-weaning piglets for two weeks is very beneficial in reducing the duration and severity of diarrhea caused by enterotoxigenic *Escherichia coli*. According to Kiros *et al*. (2018), administration of YC through piglet feed in the early stages of life, is a strategy to change the composition and function of beneficial gut microbes. Besides yeast, according to Soni *et al*. (2021), *Lactobacillus* species from yogurt samples have potential probiotic properties. Contrary to the report of Jørgensen *et al*. (2016) that *Bacillus subtilis* supplementation in the diet did not have a significant effect on the health of piglets. Macasait *et al*. (2021) that there was no significant difference in the growth of pigs fed fermented feed (Yeast, *Lactobacillus* and *Streptococcus*).

The purpose of this study is to examine the effect of YC to the diet on growth performance and population of pathogenic bacteria in the excreta of piglets.

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MATERIALS AND METHODS

Animals, diets and management

The piglets used in this study were crossbred Landrace piglets provided by a breeding pig farm in Kediri District, Tabanan Regency, Bali. This experiment has been approved by the Animal Ethics Committees, Faculty of Veterinary Medicine, Udayana University, Denpasar. During the experimental period, no antibiotics were given to the experimental animals.

One hundred and twenty male crossed landrace piglets with initial body weight of 12.77+1.28 kg, divided into four treatment groups (30 piglets each). The research was conducted at the research station, Faculty of Animal Husbandry, Udayana University, Denpasar, from May-October 2021. Piglets in the control group were given basal feed without the addition of YC (A) and the other group was fed a basal diet with an additional 0.20% YC (B); 0.40% YC (C); and 0.60% YC (D), respectively. Each 1 g of YC contains as much as 3.95×10^6 CFU/g *Saccharomyces spp*. Piglets were fed experimental feed for two phases. The first phase was from 35-70 days old (CP: 18%; ME: 3160 kcal/kg) and the second phase was 70-112 days old (CP: 16%; ME: 3190 kcal/kg) (Table 1). Measurements on live weight gains, feed consumption and feed efficiency (feed consumption: live weight gains; g/g), were taken every week.

The dry matter digestibility (DM) and organic matter (OM) digestibility trials were carried out for 3 days in the last week of the study using metabolic cages. Sampling of treatment feed was carried out during morning feeding. Stool samples were taken daily for three days of the total collection period and stored in sterile plastic bottles. Then it was mixed homogeneously and 500 g was taken to analyze the content of DM and OM (AOAC, 1995). All tests were performed in triplicate.

Saccharomyces spp. probiotic culture

The isolate of *Saccharomyces spp*. was isolated from tape yeast and has passed the test at various levels of temperature, pH, acid and bile salts and was able to deconjugate cholesterol, making it potential as a probiotic (Bidura *et al*., 2012).

Faecal microbiota

The total number of microbes in the sample (faecal) using PCA (Plate Count Agar) media. While the method used to get the total bacteria *Coliform* and *E.coli* was the method of spreading using EMBA media. Analysis of the total number of plates in faecal was carried out in the way that was done by Sudatri (2021).

All data variables were analyzed by one-way ANOVA, if there was a significant difference ($P<0.05$) followed by Duncan's test.

RESULTS AND DISCUSSION

Growth performance

Growth performance of piglets in first phase (35-70 days) and 2nd phase (70-112 days) are presented in Table 2. The average daily weight gain of pigs in the first phase of groups B, C and D, were: 17.05%; 17.69% and 22.20% significantly ($P<0.05$) higher than control (A). Likewise, during the 2nd phase, the group of pigs that received feed containing YC (B, C and D), were: 17.19%; 17.19% and 21.75% significantly ($P<0.05$) higher than the control.

Supplementation of YC in piglet feed in the first phase, significantly ($P<0.05$) reduced the FCR value (feed consumption: weight gain; g/g). The average FCR values, during the 2nd phase period, in groups B, C and D were: 7.03%; 8.95% and 10.22% significantly ($P<0.05$) lower than in control pigs (group A). Supplementation of YC in feed has been shown to increase the performance of weaned piglets (Hansen *et al*., 2017; Kiros *et al*., 2018). However, in several studies YC supplementation did not affect the growth, feed consumption and feed efficiency in piglets (Taranu *et al*., 2022).

The increase in feed consumption is a logical consequence of supporting high weight gain in piglets compared to piglets fed without probiotics. An increase in feed consumption will be followed by an increase in protein consumption, which has an impact on increasing meat synthesis (Bidura *et al*., 2012). According to Kiros *et al*. (2018), yeast may contribute to the regulation of intestinal homeostasis and improved performance of piglets. Li *et al*.

Table 1: Ingredient and composition of nutrient in rations of piglet.

Feed ingredient	Composition of feed (%)		Composition of nutrient	Calculated nutrient analysis	
	35-70 days	70-112 days		35-70 days	70-112 days
Yellow corn	59.75	62.00	Metabolizable energy, Kcal/kg	3160	3190
Pollard	14.95	14.04	Crude protein, %	18	16
Soybean meal	9.80	9.00	Crude fibre, %	3.26	3.21
Fish meal (CP: 45%)	12.00	11.45	Ether extract, %	8.75	8.69
Coconut oil	3.00	3.06	Calcium, %	1.20	1.16
Premix[1]	0.50	0.45	Phosphorus, %	0.66	0.64
Total	100	100	Lysine, %	1.21	1.15
			Methionine+Cysteine, %	0.71	0.69
			Trypthophan, %	0.60	0.61

[1]Calcium: 4.9 kg, phosphorus: 1.4 kg, iron: 40000 mg, manganese 27500 mg; magnesium: 27.500 mg; zinc 25 mg; vitamin B12: 4.50 mg, vitamin D3: 500000 IU per 10 kg of premix.

Table 2: Growth performance of piglets in the starter-grower and 2nd phase period and the population of *Eschericia coli* and *Coliform* in the faecal of piglets fed rations with YC supplementation.

Variable	Level of YC in diet (%)				P-value
	0.0	0.2	0.4	0.6	
Starter grower (35-70 days)					
Initial body weight, kg	12.750	12.780	12.765	12.775	0.250
Daily feed consumption, g	937.71	966.60	945.63	959.94	0.258
Final body weight, kg	27.752c[3)]	30.339b	30.373b	31.105a	0.508
Avarage daily gain, g	428.57c	501.63b	504.39b	523.71a	0.595
Feed Conversion Ratio (FCR)	2.19a	1.93b	1.87b	1.83b	0.052
2nd phase period (70-112 days)					
Daily feed consumption, g	2403.55b	2561.71a	2564.86a	2627.21a	0.495
Final body weight, kg	60.915b	70.193a	73.802a	76.325a	0.258
Avarage daily gain, g	767.91b	880.31a	899.95a	934.95a	0.585
Feed:gain, g/g	3.13a	2.91b	2.85b	2.81b	0.019
Dry matter digestibility, %	72.03b	76.84a	76.59a	77.05a	0.041
Organic matter digestibility, %	73.19b	77.46a	77.27a	77.98a	0.072
Crude protein digestibility, %	74.25b	79.36a	79.19a	80.13a	0.048
E. coli (colony forming unit/g)	$3.93.10^5 \pm 0.14 \times 10^5$a	$7.53.10^4 \pm 0.21 \times 10^4$b	$8.05.10^4 \pm 0.19 \times 10^4$b	$6.84.10^4 \pm 0.25 \times 10^4$b	0.251
Coliform (colony forming unit/g)	$2.94x10^6 \pm 0.17 \times 10^6$a	$9.36x10^5 \pm 0.29 \times 10^5$b	$8.75 \times 10^5 \pm 0.14 \times 10^5$b	$7.97 \times 10^5 \pm 0.21 \times 10^5$b	0.352

[ab] Values with different letters in the same row are significantly different (P<0.05).

(2016) reported that probiotics can increase broiler weight gain through beneficial modulation of the cecum microbiota. Giang *et al*. (2012) reported that feed supplemented with probiotic increased ADG and feed efficiency. According to Dong *et al*. (2013), one of the causes of the increased growth performance of piglets is the increased immune response in the early stages of the post-weaning period in piglets caused by probiotics in their feed.

Nutrient digestibility

The effects of supplementation of YC on digestibility of pigs are shown in Table 2. DM digestibility of feed in groups B, C and D, were increased significantly different (P<0.05): 6.68%; 6.33% and 6.97%, respectively than group A. The digestibility of OM in groups B, C and D increased significantly different (P<0.05): 5.83%; 5.57% and 6.54%, respectively higher than control. The digestibility of CP in group B, C and D pigs increased: 6.88%; 6.65% and 7.92% significantly (P<0.05) higher than control (A).

Cheng and Kim (2019); Jørgensen *et al*. (2016) reported that post-weaning piglets and growth piglets fed with *Bacillus licheniformis* supplementation significantly increased DM and CP digestibility, resulting in increased pig growth during the starter-finisher period. These results are in agreement with those reported by Lee *et al*. (2014) that probiotics significantly increased CP and fat digestibility. The same thing was reported by Giang *et al*. (2012) that feed supplemented with lactic acid bacteria had higher feed digestibility and had a lower incidence of diarrhea. Supplementation of 0.45% fermented feed products in pigs significantly increased villi and crypt height in the duodenum, jejunum and ileum compared to controls (Lee *et al*., 2014), so that nutrient absorption can be optimal. Feed supplementation with YC significantly increased DM and OM digestibility of feed (Bidura *et al*., 2012; 2019a; Grela *et al*., 2019) and increased mineral absorption (Bidura *et al*., 2019b). On the other hand, several researchers (Zurmiati *et al*., 2014) reported that probiotics in feed had no effect on ADG and feed efficiency.

Population of *Eschericia coli* and *Coliform* in the small intestine

The number of *E. coli* bacteria in pigs that received treatment B, C and D were: 80.84%; 79.50%; and 82.60% significantly (P<0.05) lower than the control (A). Likewise, the total population of *Coliform* bacteria decreased significantly (P<0.05) in treatments B, C and D, were: 68.16%; 70.24% and 72.89% significantly (P<0.05) lower than the control. Benyacoub *et al*. (2003) states that probiotics can compete with the colonization of harmful intestinal flora and maintain intestinal integrity. The same thing was reported by Arena *et al*. (2014) and Grela *et al*. (2019) that probiotics promote colonization of beneficial bacteria in gastro intestinal tract of host. The positive response of yeast given to piglets was due to to suppress the concentration of phatogenic bacteria in the intestinal tract of weaning piglets (White *et al*., 2002).

Yeast may contribute to the regulation of gut homeostasis and improved piglet performance (Kiros *et al*., 2018). The feed supplemented with 5% *S. cerevisiae* increased the level of IgA in the serum of piglets. Giang *et al*. (2012) reported that feed supplemented with probiotics can reduced the number of *E. coli*. The same thing was reported by Lee *et al*. (2014) that feed supplemented with *Bacillus subtilis*, significantly reduced the population of *Clostridium spp.* and *Coliform* in the cecum of pigs.

The research of Taranu *et al*. (2022) showed that the use of 10% of feed products fermented by YC in feed can reduce piglets experiencing diarrhea during the experimental period and can reduce intestinal inflammation in piglets. Lee *et al*. (2014) and Dumitru *et al*. (2021) reported that piglets fed rations with additional fermented feed by the probiotic *Bacillus subtilis* could increase nutrient digestibility and growth of piglets, as well as suppress the number of *Clostridium spp*. and *Coliform* in the cecum and has strong antibacterial activity against *E. coli* and *C. perfringens* (Hanczakowska *et al*., 2017). Conflicting results were reported by Cheng and Kim (2019) that there are no effect on fecal microflora in post-weaning and growth piglets fed with *B. licheniformis* supplementation.

CONCLUSION

Based on the results of this study, it can be concluded that the administration of YC at the level of 0.20-0.60% in the ration of weaned piglets until the finisher phase can increase average daily body weight, feed efficiency, CP and OM digestibility. On the other hand, it can suppress the number of *Eschericia coli* and *Coliform* bacteria in the digesta of piglets.

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Conflict of interest

All authors declare that they have no conflicts of interest.

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