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# Feed Preference Study and Performance Effects of Ripe Papaya, Banana, Mango and Pineapple on Weaned Piglets

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**Abstract:** Objective to improve the feed performance of early weaned piglets via local left over ripe fruits as feed additive. 3 trials were done. Trial 1, each of 4 piglets were performing 16 feed preference tests on ground fresh ripe whole fruits; papaya, banana, mango and pineapple. The ranks of chosen were averaged (1= first choice or most preferred and 4 = last choice or not preferred). Result showed that piglets preferred banana to mango, papaya and pineapple, respectively (1.83, 2.28, 2.78 and 3.11). So, ripe banana and mango were chosen to continue in the 2nd trial.

Trial 2, each of 8 piglets were performing 16 feed preference tests on 4 treatments using creep feed mixed with the preferred fruits 0.5% by weight as feed additive (0% fruit, 0.5% banana, 0.5% mango or 0.25% banana + 0.25% mango). Results showed that piglets preferred feed added 0.5% banana to 0.5% mango or 0.25% banana+ 0.25% mango and 0% fruit respectively (1.84, 2.48, 2.65 and 3.05).

Trial 3, randomly grouping 36 early weaned piglets in 12 cages and ad libitum fed the same 4 feed rations as trial 2 (0% fruit, 0.5% banana, 0.5% mango or 0.25% banana+ 0.25% mango) for 14 days performance test. Results found that 7 piglets in 0.5% mango group had mild diarrhea for the first few days and recovered without medication. Average feed intake of piglets in all 5% fruits added rations were significantly higher than control (356b, 373a, 378a, 374a;  $p < 0.05$ ). But treatments had no significant effect on the piglet body weights. The other significant effects showed only on the first 7 days feeding. Average daily gain 0-7 days was highest in piglets fed 0.5% banana and lowest in piglets fed 0.5% mango ration (152.38ab, 190.48a, 138.10b, 163.49ab;  $p < 0.05$ ). Feed conversion rate 0-7 days was lowest in 0.5% banana and highest in 0.5% mango rations (1.79ab, 1.46b, 1.98a, 1.68ab;  $p < 0.05$ ). Comparing adg to control, adding 0.5% banana to feed could significantly increase piglet growth 7 days after weaning 38.10 g/d or 25% besides it might lowering feed conversion rate for 0.33 or 18.44 %, but not significantly. Hence, the left over ripe banana has high potential to be used not only as feed flavor

but also for growth performance of first week after weaning piglets.

**Keywords:** feed preference, growth performance, ripe fruit, papaya, banana, mango, pineapple, weaned piglets.

## 1. INTRODUCTION

Actually pigs have excellence smell and taste receptors. Eugeni. [1], [2] reported that pigs are feed choosy. They prefer sweet to bitter, prefer sucrose to fructose, lactose and glucose. Pigs prefer fish meal and yeast to meat meal [3]. They choose soybean meal over other bean meals. Pigs fond of sour taste from citric acid and formic acid added in feed as well. Besides they like several tastes and some tastes might far from human being knows [4], so, feedstuff preferences should be taken into account during diet formulation, particularly at critical stages such as immediately after weaning. [6]. Simple carbohydrates, like sugars, seem to stimulate sweet taste in pigs enhancing voluntary intake. The use of sweeteners in pig diets is a common practice particularly in young animals [1]. Anyhow, jacela et al. [7] reported that healthy pigs are choosy when only they have chance and frederick et al. [8] reported smell and taste are not essential to the whole pig performance but will be important only on the critical period such as first week after weaning or during highly stress situation.

First week after weaning, piglets had high stress, eating less, immunity reducing, diarrhea susceptible and highly economic lost. Therefore stimulating piglets to eat as much as possible after weaning is main concerned. A lot of costly feed ingredients and flavors such as milk powder, lactose or spray-dried porcine plasma are added but not for tropical fruits. Most fruits are sweet and tasty for wild pigs [9], but they were not well reported as feed additive yet.

Thailand is well known in fruits which available all over country and all year round. Refused fruits due to wrong size and shape or over ripe, either in farm or at market, are

extremely high waste. So, this research aimed to investigate the feed preference of weaned piglets on ripe fruits such as banana, pineapple, mango and papaya. Expecting that this wasted ripe fruits can increase feed intake and growth performance of weaned piglets.

Bananas (*musa* spp.) Contain mostly non-structural carbohydrates (85-93% dm) and is determined by their degree of ripeness. In the immature fruit, starch is the main carbohydrate (65-75% dm) and ripening transforms it into soluble sugars, particularly sucrose (about 2/3 of the sugars), glucose and fructose. Fully mature fruits can contain more than 70% sugars. Fresh bananas are rich in water (70-80%). Bananas have a low concentrations of crude protein (5-6% dm), ether extract (1-3% dm) and minerals (2-4% dm). Crude fiber content is also low (3-5% dm). The peels account for 18-23% of the dry matter and contain more crude fiber, so removing them decreases the crude fiber down to 0-3% dm. Acids [9]. Gohl [10] reported bananas should be allowed to ripen before they are fed to pigs; but fed in large amounts may cause diarrhea. [10]

Mangos (*mangifera indica*) are the most important tropical fruit crop after bananas. Mango processing yields about 40-50% of by-products, which can be used for animal feed. These by-products are also potential sources of pectin and phenolic compounds (antioxidants). Mangoes are relished by pigs. Fruit silage may be useful for off-season pig feeding. Dried mango peels included at 10% in finishing diets for pigs had no deleterious effects on feed conversion ratio or animal performance and were found to be cost effective feeds [9].

Papaya (*carica papaya*) fruits supplemented with concentrates have been fed to pigs with good results [10].

In 2011, research on the use of pineapple (*anas* comosus) wastes for pigs was limited to a series of 11 trials carried out in the 1930-1940s in hawaii. Dried pineapple bran was not very palatable to pigs, they only selected it at 5 - 9% of the ration when offered ad libitum. The high crude fiber content (20% dm) limited its use in pigs. In particular, pineapple bran was not recommended for pigs under 27 kg except in small quantities. However, it produced adequate results with older pigs weighing over 57 kg at inclusion rates as high as 50% of the diet. At higher levels the rate of weight gain decreased and feed conversion was depressed. Protein supplementation was required. Grinding did not improve daily gain or feed efficiency [9].

## 2. MATERIALS AND METHODS

Fresh ground local left over ripe banana, mango, papaya and pineapple were used as feed additive in 3 trials. Whole fruits without seed were blended and grinding by @sharp em-ice blender then keep frozen in plastic boxes and let thawing at 15 Celsius an evening before using in the morning. Trial 1, each of 4 piglets were performing 16 feed preference tests [11] on ground fresh ripe whole fruits; papaya, banana,

mango and pineapple. The rank of choosing were averaged (1= first choice or most preferred and 4 = last choice or not preferred). Two fruits of best scores were chosen to continue the 2nd trial.



**Fig. 1. Left over ripe banana, mango, papaya and pineapple: before and after whole fruit ground**

Trial 2, each of 8 piglets were performing 16 feed preference tests on 4 treatments, control feed mixed with the preferred fruits 0.5% by weight as feed additive (0% fruit, 0.5% banana, 0.5% mango or 0.25% banana+ 0.25% mango).

Trial 3, randomly grouping 36 early weaned piglets in 12 cages, 3 pigs each and ad libitum fed the same 4 feed rations as trial 2 (0% fruit, 0.5% banana, 0.5% mango or 0.25% banana+ 0.25% mango) 3 times a day for 14 days performance test. Health and diarrhea symptom were observed intensively and record as diarrhea scores every

day. Score 0 represent to no diarrhea, 1 for just start soft excretion, 2 for mild diarrhea and no medicated and 3 for diarrhea and medicated).

Preference test in trial 1 and 2 results were ranking scores 1 – 4 and presented as average with standard deviation. Translating preference scores as 1.0 - 1.75 = most prefer, 1.76 - 2.5 = prefer, 2.51 - 3.25 =slightly prefer and 3.26 - 4.0 dislike. Total diarrhea scores were total scores of every pig in 14 days in each treatment. Body weight, feed intake (fi), daily growth (adg), feed conversion rate (fcr) in trial 3 was calculated on pens. Using completely randomized design and one way anova tested at day 0, 7 and 14 (after weaning) by sas version 9.1.3 service pack 4 xp\_pro platform at p<0.05. The significant means were duncan's multiple range test at p=0.05.

### 3. RESULTS

Trial 1, average preference scores from 16 feed preference tests of 4 first-day weaned piglets on ripe banana, mango, papaya and pineapple was presented in table 1. Average preference scores were lowest in banana follow by mango papaya and pineapple (1.8281, 2.2813, 2.7813 and 3.1094 respectively). The meaning of the ranking score was piglets preferred all fruits in difference level. They preferred ripe banana and ripe mango but slightly prefer papaya and pineapple. This preference order is go along with the sugar content in the fruit, as several reports said pig like sweet feed [1], [2].

Two fruits of the highest preference scores, ripe banana and ripe mango, were chosen to continue investigate in trial 2.

**TABLE 1: Average preference scores of 4 first-day-weaned piglets on ripe banana, mango, papaya and pineapple**

PIGLET NO.	RIPE BANANA	RIPE MANGO	RIPE PAPAYA	RIPE PINEAPPLE
1	1.8750	1.9375	2.9375	3.2500
2	2.0000	2.1875	2.7500	3.0625
3	1.5625	2.6875	2.5625	3.1875
4	1.8750	2.3125	2.8750	2.9375
MEAN± SD.	1.8281±0.95	2.2813±1.06	2.7813±0.98	3.1094±1.06

1.0 - 1.75 = MOST PREFER, 1.76 - 2.5 = PREFER, 2.51 - 3.25 =SLIGHTLY PREFER AND 3.26 - 4.0 DISLIKE.

Trial 2, average preference scores and standard deviation from 8 weaned piglets (16 feed preference tests each) on creep feed added 0.5% w/w of ripe banana, 0.5% w/w ripe mango or 0.25% ripe banana + 0.25% ripe mango was presented in table 2. Results showed that average preference scores lowest in added 0.5% banana followed by added 0.5% mango, 0.25%banana + 0.25% mango and highest in control (1.83, 2.46, 2.64 and 3.06 respectively). The meaning of the ranking scores were piglets preferred creep

feed added 0.5% banana and 0.5% mango but slightly preferred creep feed added 0.25% banana + 0.25% mango and control feed. So, piglets preferred creep feed added ripe banana most follow by added ripe mango feed. And the control feed without added fruit was the least preferred. This result supported the idea of taking feedstuff preferences into account during diet formulation particularly at critical stages such as immediately after weaning. [6] and ripe banana and mango have highly potential.

**TABLE 2: Average preference scores of 8 weaned piglets on creep feed (control), creep feed add 0.5% of ripe banana, 0.5% of ripe mango, and 0.25% banana + 0.25% mango.**

AVERAGE PREFERENCE SCORES OF PIGLETS NO.	CONTROL	CREEP FEED ADDED 0.5% OF RIPE FRUITS		
		BANANA	MANGO	BANANA + MANGO
1	3.2500	1.7500	2.6250	2.3750
2	2.6250	2.4375	2.3750	2.5625
3	3.1875	1.5625	2.6875	2.6250
4	3.2500	1.6875	2.3750	2.6875
5	3.0000	1.6875	2.5625	2.7500
6	3.3125	2.0625	1.6875	2.9375
7	2.6875	2.1250	2.4375	2.7500
8	3.1875	1.3750	2.9375	2.5000
MEAN ± SD.	3.06 ± 1.07	1.83 ± 1.01	2.46 ± 1.07	2.64 ± 0.96

1.0 - 1.75 = MOST PREFER, 1.76 - 2.5 = PREFER, 2.51 - 3.25 = SLIGHTLY PREFER AND 3.26 - 4.0 DISLIKE.

Trial 3 average performance test of weaned piglets on creep feed (control) add 0.5% of ripe banana, mango, and 0.25% banana + 0.25% mango showed in table 3. Piglet body weights were not significantly difference but average daily feed intake of 14 days test, average daily growth and feed conversion rate at 0-7 days were significantly difference ( $p < 0.05$ ). Piglets significantly ate creep feed without adding fruit less than the fruit added feeds, but not difference among 3 fruit added feeds (356<sup>b</sup>, 373<sup>a</sup>, 378<sup>a</sup> and 374<sup>a</sup>). This increasing feed intake was about 5% by weight of control feed weight. This is possibly due to fresh fruits are juicy, the nutritive value of them are lower than creep feed and it lowering the whole nutritional value of the rations. Therefore piglets need to consume more feed to reach their nutrient requirements. Besides, as Jacela et al. [7] reported healthy pigs are choosy when only they have chance. But

this performance test the piglets had no choice to choose. Therefore, they ate more feed but not receive higher nutrients.

The piglets got 0.5% banana added feed had the highest growth (190.48<sup>a</sup> g/d), not difference from the 0.25% banana added feeds (163.49<sup>ab</sup> g/d), but significantly higher than control feeds (152.38<sup>b</sup> g/d) and 0.5% mango added (138.10<sup>b</sup> g/d). Comparison to control feed, 0.5% banana added feed could significantly increase the 7 days weaned piglet growth for 38.10 g/d or 25%. This increase of piglet growth in the 0.5% ripe banana feed did not course by nutrient intake increasing but might be stress releasing. Piglet might be happier from having more tasty feed or it might due to some unknown factors in ripe banana which should be further study.

**TABLE 3: Average performance test of weaned piglets on creep feed (control), creep feed add 0.5% of ripe banana, 0.5% of ripe mango, and 0.25% banana + 0.25% mango.**

PERFORMANCE	CONTROL	CREEP FEED ADDED 0.5% OF RIPE FRUITS			P-VALUE
		BANANA	MANGO	BANANA + MANGO	
BODY WEIGHT D 0 (KG.)	7.39	7.53	7.47	7.47	0.8913
BODY WEIGHT D 7 (KG.)	8.46	8.87	8.43	8.61	0.2310
BODY WEIGHT D 14 (KG.)	10.97	11.82	11.32	11.50	0.3992
FEED INTAKE/DAY 0 – 7 (G.)	271	278	273	270	0.7624
FEED INTAKE/DAY 8 – 14 (G.)	441	463	483	478	0.0660
FEED INTAKE/DAY 0 – 14 (G.)	356 <sup>B</sup>	373 <sup>A</sup>	378 <sup>A</sup>	374 <sup>A</sup>	0.0126
ADG 0 – 7 (G.)	152.38 <sup>B</sup>	190.48 <sup>A</sup>	138.10 <sup>B</sup>	163.49 <sup>AB</sup>	0.0254
ADG 8 – 14 (G.)	358.73	422.22	412.70	412.70	0.6122
ADG 0 – 14 (G.)	255.56	306.35	275.40	288.10	0.4035
FCR 0 – 7	1.79 <sup>AB</sup>	1.46 <sup>B</sup>	1.98 <sup>A</sup>	1.68 <sup>AB</sup>	0.0475
FCR 8 – 14	1.23	1.10	1.20	1.21	0.8514
FCR 0 – 14	1.39	1.22	1.39	1.34	0.6436
TOTAL DIARRHEA SCORE	0	0	22	0	-

For feed conversion rate, the highest fcr was from piglets fed 0.5% mango added feed (1.98<sup>a</sup>) which showing not suitable for piglets. Piglets fed 0.5% banana added feed had the significant lowest fcr (1.46<sup>b</sup>) but not difference from 0.25% banana + 0.25% mango (1.68<sup>ab</sup>) and control feed treatment (1.79<sup>ab</sup>). If we do not consider to the significant level, the fcr of piglets fed 0.5% banana was lower than control group 0.33 or 18.44 % ( $p > 0.05$ ). This is quite an impressed effect.

The total diarrhea scores showed only in piglets fed 0.5% mango added feed (22 score) while the other feed treatment had 0 score, no diarrhea. This 22 score come from 7 piglets got mild diarrhea for 2-4 days and recovered without medicated. Ripe mango is sweet, contained high fiber and

high fructose/glucose. The excess fructose in large intestine can cause digestive symptoms such as irritable bowel, gas and diarrhea in some human [12] and [13]. So, this study confirmed that piglet has similar response to mango as reported in human. Piglets liked mango but need few days to get accustomed and can recovered in the second weeks, anyhow this diarrhea problem is unacceptable.

The significant effect of adding fruits found in average daily growth (adg) and feed conversion rate (fcr) were found only in 7 days feeding but not afterward. This is concredited to frederick et al. [8] which had reported that smell and taste are not essential to the whole pig performance but will be important only on the critical period such as first week after weaning or during highly stress situation.

#### 4. CONCLUSIONS

Piglets prefer fruits taste to creep feed. They prefer ripe banana to mango, pineapple and papaya respectively. Adding ground fresh ripe banana or mango or mix fruits 5% w/w can improve 14 days feed intake ( $p < 0.05$ ) but not get body weight benefit ( $p > 0.05$ ). Mango added feed could cause piglet mild diarrhea. Comparing to control feed, adding 0.5% banana to feed gave best result. It could significantly increase the 7 days weaned piglet growth for 38.10 g/d or 25% and might lowering feed conversion rate for 0.33 or 18.44 % ( $p > 0.05$ ). Therefore, the left over ripe banana had high potential to be used not only improve taste but also welfare and growth performance in first week after weaning piglets.

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