



Effect of Fermented Liquid Feed (FLF) on Performance and Feed Efficiency of Large White Yorkshire (LWY) Pigs under Tropical Climate of North-East India

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ABSTRACT

Background: Feeding of fermented feed is not popular among the pig farmers inspite of manifold advantages as preparation is laborious, involves technical knowledge requiring considerable time. An attempt was made to standardise a preparation method of FLF and comparative assessment was made with dry and liquid feed in LWY pigs.

Methods: Twenty-four weaned LWY piglets (11.45±2.42 to 11.46±2.37 kg) were assigned - dry feed (T₁), Liquid feed (T₂), liquid feed fermented with *Lactobacillus acidophilus* (T₃) and liquid feed fermented with *Enterococcus faecium* (T₄) in a 180 days feeding trial. Liquid feed was prepared by mixing feed and water at 1:2 (w/w) and the FLFs were prepared by fermenting liquid feed with *Lactobacillus acidophilus* for T₃ and *Enterococcus faecium* for T₄. Pigs were fed individually *ad libitum* considering each piglet as replicate. Nutrient digestibility was estimated at 18th and 30th week of age conducting two feeding trials. Carcass traits and sensory quality of pork were evaluated by slaughtering 3 pigs from each treatment at the end of trial.

Result: No significant effect (P>0.05) of FLFs was observed in feed intake in the growing phase, but it was significantly high in T₃ and T₄ in the finishing phase. Significantly (P<0.05) high body weight gain with improvement of 17.76% in T₃ and 17.71% in T₄ were recorded. Apparent nutrient digestibility was better in T₃ and T₄ and crude protein digestibility was significantly (P<0.05) high in T₃ in finishing phase. Significantly improved feed efficiency was recorded for T₃ and T₄. The feeding cost/kg body weight gain was Rs. 128.36, 120.43, 112.87 and 115.51, respectively for T₁, T₂, T₃ and T₄. Significantly high dressing% and carcass length with positive effect on water holding capacity were observed for feeding FLFs, but without any significant effect on proximate composition and sensory attributes of pork.

Key words: Carcass traits, Fermented feed, Growth, Nutrient digestibility, Pigs.

INTRODUCTION

In India, pig farming is mostly concentrated in the Eastern parts of India. According to livestock census (2012), the North Eastern states namely, Assam, Arunachal Pradesh, Nagaland, Meghalaya, Mizoram, Tripura, Manipur and Sikkim shares 38.42% of the total pig population in India. Pig farming is integral to life and livelihood for majority people of North East India and the tribal communities throughout India.

The way feed is offered to pigs influences feed intake and nutrient digestibility (Choct *et al.*, 2004). Pig farmers in India generally offer feeds in dry and liquid forms under the intensive and semi-intensive production system. In the recent years, feeding of FLF is gaining popularity throughout the globe for manifold advantages associated with its feeding (Brooks 2008; Choi *et al.*, 2011). However, feeding of FLF is not popular among the pig farmers in India and majority of them still follow the traditional dry and liquid feed feeding practices. In the North Eastern parts of India, the hilly states of the North-East in particular, farmers offer liquid feeds to the pigs and also cooked liquid feeds (Kumaresan *et al.*, 2007; Buragohain 2012). The probable constraints associated with FLF are the laborious process involved in preparation, requirement of technical knowledge and also involvement of considerable time in preparation. Being poor

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(majority of pig farmers are landless, small or marginal), pig farmers need low-cost, affordable method of preparation of FLF which requires less time and labour. Considering the soaring prices of feed ingredients day-by-day, feed efficiency is the key to profitability and sustainability as being nearly 2/3rd of total investment is only for feeding in piggery. In our study, therefore, an attempt was made to standardise a preparation method of FLF at farm level and to make a

comparative assessment of performance of LWY pigs fed with dry feed, liquid feed and FLF under the tropical climatic condition in Mizoram, a North Eastern state of India.

MATERIALS AND METHODS

Approval of institutional animal ethics committee

The study was approved by the Institutional Animal Ethics Committee, College of Veterinary Sciences, Assam Agricultural University, Guwahati, Assam via approval letter no. 770/ac/CPCSEA/F.V.Sc./AAU/IAEC/17-18/481 dated 09.08.2017.

Location of the study

The study was conducted during 2017-18 at the experimental unit of the Department of Animal Nutrition, College of Veterinary Sciences and Animal Husbandry, Central Agricultural University (Imphal), Selesih, Aizawl, Mizoram as per MOU signed between Assam Agricultural University, Jorhat and Central Agricultural University, Imphal, Manipur.

Experimental animals and design of experiment

Twenty-four weaned LWY pigs (11.45±2.42 to 11.46±2.37 kg) were selected from the stock of the Piggery Unit, College of Veterinary Sciences and Animal Husbandry, Central Agricultural University (Imphal), Selesih, Aizawl, Mizoram. The piglets were allotted to four treatments in a complete randomised block design (RCBD) i.e., treatment 1 (T_1): Pigs provided with dry basal rations; treatment 2 (T_2): Pigs provided with liquid basal ration (feed: water 1:2, w/w); treatment 3 (T_3): Pigs provided with FLF with *Lactobacillus acidophilus* (10^9 cfu/g) and treatment 4 (T_4): Pigs provided with FLF with *Enterococcus faecium* (10^9 cfu/g).

Basal rations and liquid feed

The basal rations were formulated as per NRC (2012) (Table 1). Liquid feed was prepared by mixing feed and water at 1:2 (w/w).

Method standardised for preparation of FLF

Freeze-dried cultures of *Lactobacillus acidophilus* (ATCC 11975) and *Enterococcus faecium* (ATCC 19434) were procured from NCDC, Dairy Microbiology Division, ICAR-

National Dairy Research Institute, Karnal, India and were revived following standard procedure. From stock culture of *Lactobacillus acidophilus*, a loop full of culture was transferred aseptically to 100 ml of *Lactobacillus* De Man, Rogosa and Sharpe (MRS) broth and was incubated for 24 hours at 37°C in an automatic incubator shaker. Similarly, a loop full of stock culture of *Enterococcus faecium* was incubated in Brain Heart Infusion (BHI) broth for 24 hours at 37°C in the automatic incubator shaker. One kg of ground yellow maize was mixed with 1 litre of drinking water (previously boiled and cooled) and inoculated with 100ml of 24 hours old culture of *Lactobacillus acidophilus* and incubated at 37°C for 24 hours. The same procedure was followed for fermentation of ground yellow maize with *Enterococcus faecium* also.

The basal ration mixed with water (1:2) was further mixed with fermented yellow maize at 1:5 (w/w) in a plastic container. The plastic container was sealed and allowed for fermentation for 48 hours at room temperature. Then, 50% of fermented liquid feed was utilized for feeding to pigs and to the rest, equal quantity of basal ration mixed with water (1:2) was added and fermented again for 48 hours for the next day feeding. This back-slopping was repeated for 7 days after which the whole process was started from the beginning.

Feeding and management

The feeding trial was conducted for 180 days. The feed was offered *ad libitum* twice daily (7.00 to 8.00 AM and 2.00 to 3.00 PM). Individual feed intake was recorded daily and body weight gain was recorded at fortnightly interval. The pigs were reared in individual pens made of iron grills and concrete floor with separate feeding and watering troughs. No artificial lighting was provided during the night time.

Digestibility trials

Two digestion trials were conducted at 18th and 30th week of age. Three pigs from each treatment were selected and individual daily feed intake and faeces voided were recorded for 5 days. A suitable aliquot of faeces was stored in air-light labelled container for analysis of proximate principles. A separate aliquot of faeces was preserved in sulphuric acid (1:4) for nitrogen estimation.

Table 1: Ingredient composition (%) of the basal rations (NRC 2012).

Ingredients	Ration I (11-25 kg)	Ration II (25-50 kg)	Ration III (50-75 kg)	Ration IV (75-100 kg)
Yellow maize	52.45	59.06	62	66
Wheat bran	0	0	6	8
Soya bean meal	27	21	15	11
De-oiled ground nut cake (SE)	8	8	7	5.6
Fish meal	5	5	4	3
L-Lysine	0.5	0.4	0.3	0.3
DL-Methionine	0.05	0.04	-	-
Vegetable oil	4	3.5	3.2	3.6
Common salt	0.5	0.5	0.5	0.5
Commercial mineral mixture	2.5	2.5	2.0	2.0

Studies on carcass traits

Three animals per treatment (the lightest, heaviest and the middle by weight) were slaughtered for carcass traits, physico-chemical properties of meat and to evaluate sensory qualities of meat. Thiobarbituric acid value (TBA) was estimated by the method described by Strange *et al.* (1977), the water holding capacity (WHC) by Wardlaw *et al.* (1973), extract release volume (ERV) by Pearson (1967) and tyrosine value by Strange *et al.* (1977). For evaluating sensory qualities of meat, twenty-four untrained scorers, 18 years of age or older and consuming pork on regular basis, were selected to evaluate the samples for colour, flavour, juiciness, tenderness, palatability and overall acceptability on an 8-point hedonic scale. Meat samples without salt were grilled for 15 minutes at 70°C in an electric oven, sliced into uniform sizes after cooling and were presented to the scorers after wrapping with aluminium foil. Each scorer was provided with water and pieces of bread to serve as neutralizers between samples. The moisture, fat, protein and ash content of dissected *Longissimus dorsi* muscle were also estimated following methods of AOAC (2012).

Economic parameters

The feed cost per kg gain in body weight, the total feed consumption, total body weight gain during the experiment and feed conversion ratio were estimated.

Analytical methods

The proximate principles of feed and faeces were analysed as per AOAC (2012), whereas fibre fractions as per Goring and Van Soest (1970). Calcium and phosphorous of the samples were estimated following methods of Talapatra *et al.* (1940) and AOAC (1975), respectively.

Statistical analysis

For interpretation of results, data were analysed using SPSS version 16.0 according to one-way ANOVA. The means were compared between the groups as per Duncan's multiple range test at 1% and/or 5% level of significance (Duncan, 1995).

RESULTS AND DISCUSSION

Nutritional composition of basal rations

The nutritional composition of the basal rations is presented in Table 2. The estimated CP (%) and calculated energy value (Kcal ME/kg) of the rations were as per standard and CF (%) was below 6% (on DM basis) in all the rations. The calculated lysine (%) and methionine (%) were also within the recommended levels of NRC (2012) for grower-finisher pigs.

The average DM% of Liquid feed, FLF was estimated at weekly interval as back-slopping was done for 7 days. The FLF DM (%) of T₃ varied from 24.02-28.93% (average-26.57%) and of T₄ varied from 24.27-28.08% (average-26.71%). The DM% of liquid feed varied from 26.48%-29.26% (average-27.92%).

Feed consumption

Feed intake has direct relationship with the efficiency of pork production. It is influenced by many factors and the way feed is delivered is one of the important factors which significantly influences feed consumption in pigs (Choct *et al.* 2004; NRC 1998). There was no significant effect of FLF on feed consumption during growing phase; however, an increasing trend was noticed for T₃ and T₄ (Fig 1). In finishing phase, feed consumption was significantly high in T₃ and T₄ (Fig 2). Total average feed consumption, however, was non-significant, but showed increasing trend (T₁ < T₂ < T₃ < T₄) (Table 3).

Table 2: Nutritional composition of the basal experimental rations (on dry matter basis).

Parameters	Ration I (11-25 kg)	Ration II (25-50 kg)	Ration III (50-75 kg)	Ration IV (75-100 kg)
Dry matter (g/kg)	899.80	892.30	895.50	893.40
Crude protein (g/kg)	225.20	194.90	172.60	152.20
Ether extract (g/kg)	48.40	32.80	32.50	46.70
Crude fibre (g/kg)	34.20	40.20	41.10	45.30
Total ash (g/kg)	91.50	88.10	94.90	83.70
Nitrogen free extract (g/kg)	600.70	644.00	658.90	672.10
Organic matter (g/kg)	908.50	911.90	905.10	916.30
Acid insoluble ash (g/kg)	9.80	8.50	13.60	12.20
Neutral detergent fibre (g/kg)	148.60	154.00	193.60	230.40
Acid detergent fibre (g/kg)	48.70	34.50	49.90	49.70
Hemi-cellulose (g/kg)	99.90	119.50	143.70	180.60
Calcium (g/kg)	33.40	31.20	29.60	29.70
Total phosphorous (g/kg)	8.70	7.50	6.00	7.90
Energy* (Kcal ME/kg)	3332.28	3315.93	3266.00	3272.88
Lysine* (%)	1.37	1.16	0.93	0.81
Methionine* (%)	0.48	0.45	0.37	0.34

*Calculated value.

Improvement of feed consumption in T_3 and T_4 might be for fermentation of feed as it causes physical and chemical changes of feed in favourable way (Brooks 2003; Choi *et al.*, 2011). It might also be for enhanced acceptability due to liquid nature of feed without dustiness. Fermentation of feed is also known to control pathogens in feed and pig's gut excluding enteropathogens like *E. coli* and *Salmonella* and improves foregut barrier function against pathogens (Engberg *et al.*, 2006). Inhibition or prevention of pathogens in the gut and enhancement of intestinal mucosal immunity (Pasca *et al.*, 2009; Rauch and Lynch 2010) might also be related with more feed consumption in T_3 and T_4 . Macasait *et al.* (2021) reported significantly higher cumulative feed intake in pigs fed wet and fermented feed with different levels of wood vinegar and Xin *et al.* (2021) also observed positive tendency in feed intakes in pigs fed fermented liquid feed.

Growth performance

Sustainable growth indicates optimal feed efficiency and is also one of the indications of sound gut health and immunity.

As feeding cost accounts nearly 2/3rd of total production, supply of quality feed and feeding method is important for efficient utilization of feed in pigs. The body weight gain was significantly ($P < 0.05$) high in T_3 in the growing phase. In the finishing phase, significantly ($P < 0.01$) higher gain was recorded in T_4 . The total average body weight gain was significantly high in T_3 and T_4 than T_1 and T_2 (Table 3). In growing phase, improvement in body weight gain was 22.34% and 13.64%, respectively in T_3 and T_4 than T_1 and was 15.58% and 6.85%, respectively than T_2 . Similar records for T_3 and T_4 in finishing phase were 14.59% and 20.49% than T_1 ; and 7.66% and 13.20% than T_2 , respectively. As a whole, improvement of 17.76% and 17.71%; and 10.86% and 9.76% were recorded for T_3 and T_4 , respectively than T_1 and T_2 . Xin *et al.* (2021) also reported significantly increased final body weight and average daily gain in pigs fed fermented liquid feed. Similar findings were also reported by Jiang *et al.* (2019), Xu *et al.* (2020) and Hao *et al.* (2020). Significant improvement in growth for FLF might be for

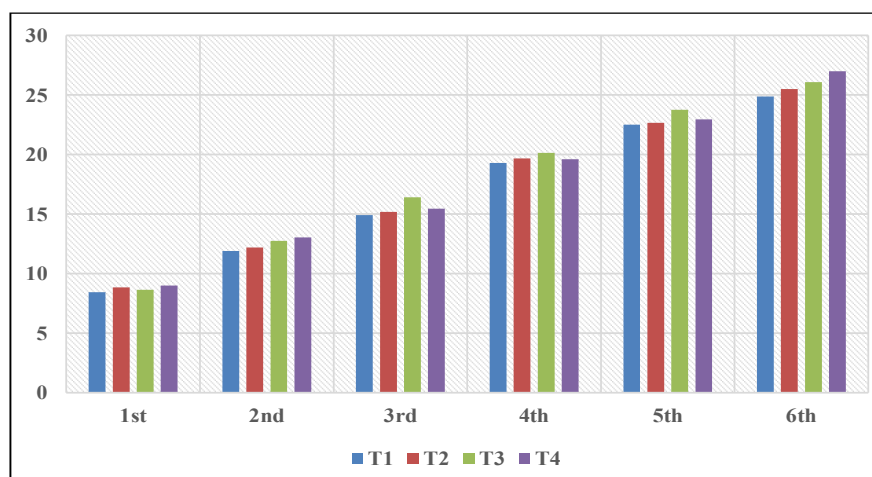


Fig 1: Fortnightly average total feed intake (kg/animal/fortnight) in the growing phase.

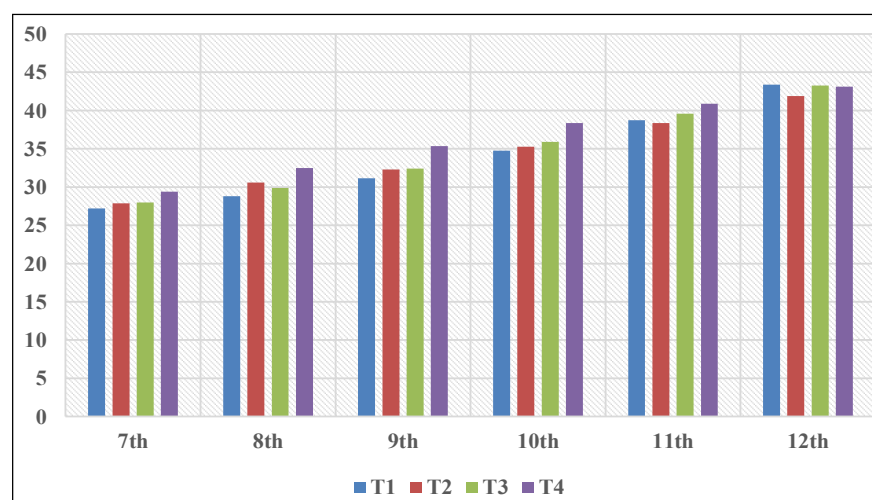


Fig 2: Fortnightly average total feed intake (kg/animal/fortnight) in the finishing phase.

improvement of feed consumption and nutrient digestibility for improved villus height enhancing nutrient digestibility and favourable effect on intestinal microbiota supporting gut health (Canibe and Jensen 2012).

Nutrient digestibility

No significant ($P>0.05$) difference observed for apparent nutrient digestibility in growing phase. However, positive effect was prominent as shown by higher digestibility of nutrients in T_3 and T_4 than T_1 and T_2 . In the finishing phase, CP digestibility was significant ($P<0.05$) high in T_3 . However,

nutrient digestibility in other groups were comparable without any significant differences (Fig 3 and 4). Insignificant but improvement of nutrient digestibility for feeding of fermented liquid feed in pigs were also reported by Lin *et al.* (2017) and Xin *et al.* (2021). Improvement of nutrient digestibility in T_3 and T_4 might be for enhancement of substrate availability for offering feed in liquid form, entero-pathogen removing effect of FLF and improvement in gut structures. Low pH of FLF might help in digestion of protein in starter pigs and maintain condition of cell wall inside small intestine which might lead to better absorption of nutrients

Table 3: Feed consumption and growth performance of LWY pigs.

Parameter	T_1	T_2	T_3	T_4	p/SEM value
Feed intake, growing (kg)	101.87 $\pm$ 1.55	104.01 $\pm$ 4.25	107.75 $\pm$ 3.01	106.65 $\pm$ 2.86	0.54/1.51
Feed intake, finishing (kg)	203.97 ^a $\pm$ 1.72	206.22 ^{ab} $\pm$ 7.18	209.03 ^{ab} $\pm$ 2.55	219.53 ^b $\pm$ 4.65	0.11/2.46
Total feed intake (kg)	305.83 $\pm$ 2.16	310.22 $\pm$ 11.33	316.78 $\pm$ 3.86	326.18 $\pm$ 7.41	0.23/3.69
Body weight gain, growing (kg)	32.63 ^a $\pm$ 1.31	34.54 ^{ab} $\pm$ 1.40	39.92 ^b $\pm$ 2.41	37.08 ^{ab} $\pm$ 1.12	0.028/0.954
Body weight gain, finishing (kg)	47.47 ^a $\pm$ 0.79	50.53 ^{ab} $\pm$ 0.81	54.40 ^{bc} $\pm$ 0.80	57.20 ^b $\pm$ 0.88	<0.001/0.862
Total gain (kg)	80.09 ^a $\pm$ 0.94	85.08 ^a $\pm$ 2.12	94.32 ^b $\pm$ 1.95	94.28 ^b $\pm$ 1.24	<0.001/1.486
Body weight at marketing (kg)	91.55 ^a $\pm$ 1.15	96.53 ^a $\pm$ 3.04	105.78 ^b $\pm$ 1.91	105.73 ^b $\pm$ 1.85	<0.001/1.609

Means in the same row without common superscript differ significantly at $P<0.05$.

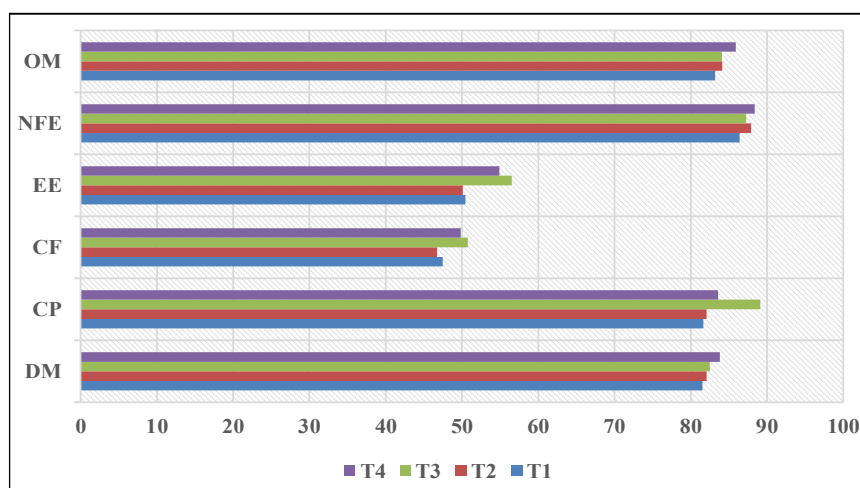


Fig 3: Apparent nutrient digestibility in growing phase.

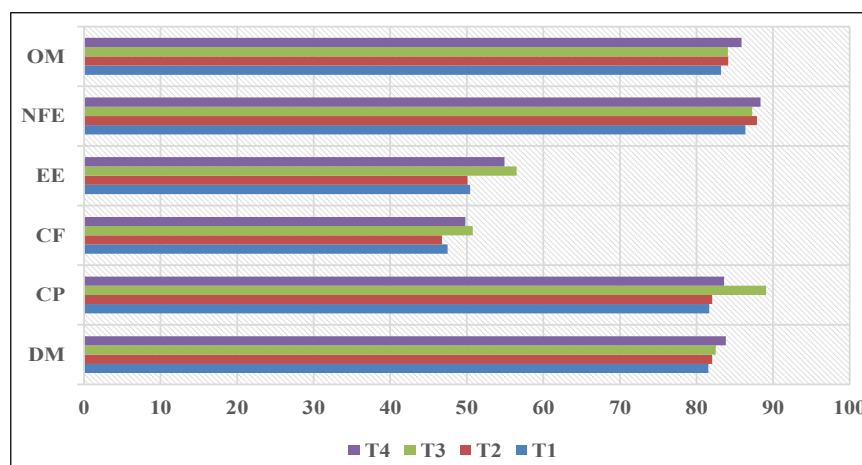


Fig 4: Apparent nutrient digestibility in finishing phase.

(Sayan *et al.* 2018). Improved nutrient digestibility might also be for production of antimicrobial substances, such as organic acids and bacteriocins, which functions as natural antimicrobial, decreases the intestinal pH, inhibits the growth of pathogenic bacteria, such as *Salmonella* spp. or *E. coli*, also reported by Cernauskiene *et al.* (2011) and Giang *et al.* (2010).

Effects of FLF on carcass traits and sensory qualities of pork

The carcass length was significantly more in T₃ and T₄ than T₁ and T₂. Dressing percentage was also significantly better in T₃ and T₄. However, no significant difference was observed for other wholesale cuts. There was no significant (P>0.05) difference in average pre-slaughter weights of the pigs. However, due to variability of body weight and hence the size, body length of the animals was not the same and this might contribute to the significantly (P<0.05) different carcass length. Significant (P<0.05) higher dressing

percentage in T₃ and T₄ might be for differences in live and visceral organ weights as negative correlation exists between live weight and weights of the visceral organs. Carcass weight and back-fat thickness have been reported to affect carcass grading and properties (Park *et al.*, 2009). A strong positive correlation exists between carcass weight and back-fat thickness and meat quality grade (Kim and Kim 2017). Comparatively higher body weights of the pigs might contribute to higher backfat thickness in pigs of T₃ and T₄. The leaf fat of pigs is positively correlated with body weight. Comparatively higher leaf fat weight in T₃ and T₄ might be related to higher final body weight than T₁ and T₂ (Table 4).

The quality indicators of raw meat that can predict the yield of the processed meat are especially the pH and water holding capacity. pH was found to be below 6.0 in all the groups indicating that feeding of FLF did not have any adverse effect on meat quality, particularly tenderness and

Table 4: Carcass traits of the experimental LWY pigs.

Parameter	T ₁	T ₂	T ₃	T ₄	p/SEM
Pre-slaughter weight (Kg)	94.03±7.02	103.50 ±4.65	106.37±3.79	106.00±2.93	0.307/2.56
Empty body weight (kg)	82.96±5.75	89.79±3.51	91.53±2.99	91.15±2.43	0.417/1.96
Hot carcass weight (kg)	72.51±5.08	80.78±3.33	84.41±3.63	83.83±2.40	0.171/2.14
Carcass length (cm)	99.48 ^a ±1.84	102.45 ^{ab} ±1.69	105.83 ^b ±0.85	104.99 ^b ±0.85	0.045/0.95
Back fat thickness (cm)	3.61±0.26	3.72±0.38	3.78±0.39	3.73±0.64	0.970/0.11
Leaf fat (kg)	1.53±0.06	1.61±0.15	1.63±0.03	1.62±0.18	0.933/0.05
Loin eye area (cm ²)	41.33±1.88	43.41±4.76	44.33±2.74	43.46±3.96	0.941/1.55
Dressing percentage	77.17 ^a ±0.44	78.08 ^{ab} ±0.30	79.31 ^b ±0.61	79.08 ^b ±0.14	0.021/0.31

Means bearing different superscripts (a,b) in a row differ significantly (*P<0.05, **P<0.01, NS-non-significant)

Table 5: Physico-chemical properties and sensory evaluation of meat.

Parameter	T ₁	T ₂	T ₃	T ₄	p/SEM
Physico-chemical properties					
Tyrosine value (µg/ml)	160.00±9.17	190.33±12.24	160.00±10.21	177.00±9.07	0.188/5.804
pH	5.26±0.05	5.34±0.06	5.24±0.28	5.35±0.18	0.951/0.075
WHC (ml/100g)	19.15 ^a ±0.85	21.93 ^a ±1.68	31.24 ^b ±3.83	24.54 ^{ab} ±3.34	0.064/1.778
ERV (ml)	21.33±2.18	22.00±3.51	23.67±1.20	24.67±0.88	0.705/1.018
TBA Value	0.013±0.00	0.014±0.00	0.012±0.00	0.014±0.00	0.964/0.002
Sensory evaluation of meat (n=45)					
Appearance	6.73±0.11	6.76±0.11	6.89±0.10	6.87±0.11	0.65/0.05
Flavour	6.36±0.09	6.49±0.09	6.62±0.10	6.58±0.09	0.17/0.05
Tenderness/texture	6.69±0.09	6.60±0.09	6.69±0.09	6.69±0.09	0.88/0.05
Juiciness	6.29±0.07	6.42±0.07	6.49±0.08	6.49±0.08	0.18/0.04
Overall acceptability	7.09±0.08	7.16±0.09	7.16±0.08	7.20±0.08	0.82/0.04

Means bearing different superscripts (a,b) in a row differ significantly (*P<0.05, **P<0.01, NS-Non-significant).

Table 6: Economic parameters as affected by FLF.

Parameters	T ₁	T ₂	T ₃	T ₄	P/SEM
FCR (Growing phase)	3.16 ^a ±0.19	3.01 ^{ab} ±0.07	2.74 ^b ±0.14	2.88 ^{ab} ±0.08	0.10/0.06
FCR (Finishing phase)	4.30 ^a ±0.08	4.08 ^{ab} ±0.08	3.85 ^b ±0.05	3.84 ^b ±0.10	<0.01/0.06
Overall FCR	3.82 ^a ±0.07	3.64 ^b ±0.05	3.36 ^c ±0.04	3.46 ^c ±0.07	<0.01/0.05
Feed cost/kg live weight gain (Rs.)	128.36 ^a ±2.82	120.43 ^b ±1.67	112.87 ^c ±2.26	115.51 ^{bc} ±1.96	<0.001/1.60

Means in the same row without common superscript differ significantly at P<0.05.

juiciness. There was no significant ($P>0.05$) difference in tyrosine value among the pigs which is used to monitor the meat quality to indicate proteolysis and to measure the amino acids (tyrosine and tryptophan) present in non-polar extract of meat. Water holding capacity was comparatively higher in T_3 and T_4 than T_1 and T_2 and might be related to higher pH estimated in them. The thiobarbituric acid value was lesser than 0.02 in all the groups without any significant ($P>0.05$) difference. Higher extract release volume in T_2 , T_3 and T_4 might be associated with significantly higher water holding capacity as both are positively correlated (Table 5). Hao *et al.* (2020) also reported improved carcass performance and meat quality parameters in pigs fed fermented mixed feed.

No significant difference was observed between the groups for proximate principles of pork, which might be the indication that feeding of FLF might not have any effect on the proximate composition.

No significant difference ($P>0.05$) was recorded for different sensory attributes of pork between the treatment groups. Sensory evaluation of pork is important to judge meat quality because meat should be acceptable to the both consumers and the meat processors. Comparatively higher scores given by the panellists might be the indication of some favourable effect of liquid and FLF on pork flavour. Comparatively higher perception of juiciness by panellists for T_3 and T_4 might be for higher intramuscular fat as indicated by higher ether extract content of meat than T_1 and T_2 .

Effect on economic parameters

Amongst many factors, feed form is one of the external factors which can be manipulated for improvement of feed efficiency in pigs. The feed conversion ratio (FCR) was significantly better in T_3 and T_4 than T_1 and T_2 , both in the growing and finishing phase (Table 6). This improvement might be for better nutrient digestibility and growth rate for favourable effect of FLF. The feeding cost/kg gain in body weight were calculated as ₹ 128.36, ₹ 120.43, ₹ 112.87 and ₹ 115.51 in T_1 , T_2 , T_3 and T_4 , respectively based on the prices of feed ingredients at Aizawl, Mizoram, India during 2017-2018.

CONCLUSION

A method for fermentation of liquid feed either with *Lactobacillus acidophilus* or *Enterococcus faecium* at farm level was standardised. From the findings of the study, it was concluded that feeding of FLF either with *Lactobacillus acidophilus* or *Enterococcus faecium* could be recommended for LWY grower-finisher pigs than the dry and liquid feeding practices for better growth performance and economic returns to the pig farmers.

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