

*Original Research***Effect of Jaggery Filter Cake Supplementation on Nutrient Digestibility in Grower and Finisher Large White Yorkshire Pigs****B. H. M. Patel<sup>1\*</sup>, Sanjay Kumar<sup>2</sup> and S. B. Prasanna<sup>3</sup>**<sup>1</sup>IVRI, Hebbal, Bangalore-24, Karnataka, INDIA<sup>2</sup>Department of LPM, G.B.P.U.A &T., Pantnagar, Uttarakhand, INDIA<sup>3</sup>Department of LFC, Veterinary College, Hebbal, Bangalore-24, Karnataka, INDIA\*Corresponding author: [mpatellpm@gmail.com](mailto:mpatellpm@gmail.com)

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**Abstract**

Jaggery filter cake (JFC) is scum obtained while making Jaggery. Considering the importance of JFC as un-conventional feed in economic pig feeding, the study was conducted on digestibility of JFC in grower and finisher stages of Large White Yorkshire pigs fed on different levels of JFC. The experiment was designed using 30 Large White Yorkshire piglets (3 ½ month old), randomly divided and maintained on 5 dietary treatment groups, viz. group I: concentrate only, group II: concentrate +250 g JFC, group III: concentrate +500 g JFC, group IV: concentrate +750 g JFC and group V: ad lib. JFC only. Jaggery filter cake supplementation was increased in the ratio of 50:100:150 g in group II, III, IV respectively, every fortnight during grower stage and every week during finisher stage. Digestive trial was conducted once during the grower and finisher period as per standard procedure. During growing stage the dry matter digestibility (%) was  $70.92 \pm 1.38$ ,  $69.66 \pm 1.06$ ,  $68.94 \pm 0.79$ ,  $70.60 \pm 1.34$  and  $73.10 \pm 1.26$  and during finishing stage it was  $74.00 \pm 1.15$ ,  $71.36 \pm 0.40$ ,  $75.49 \pm 1.38$ ,  $75.20 \pm 0.60$  and  $73.89 \pm 1.30$  in groups I, II, III, IV and V, respectively. During grower stage DM digestibility was higher in group V than other the groups, however, there was no significant difference in DM digestibility among the groups. Similar trend was also observed for OM, CP, EE and CF contents. However, highly significant ( $P < 0.01$ ) difference was found for NFE, and total carbohydrate digestibility among different treatment groups of pigs. During the finishing stage, there was an increase in digestibility % with respect to DM, EE, NFE and total carbohydrate in group V compared to rest of the groups. Contrarily, total ash digestibility during both grower and finishing stage was significantly low ( $P < 0.01$ ) in group V which might be due to less body requirement of minerals in pigs than the mineral contents present in JFC. When sole feeding of JFC was done (V group), digestibility of most of the nutrients was higher in comparison to JFC supplemented group with concentrate. The final weight of pigs in group I, II, III, IV & V was  $69.25 \pm 1.41$ ,  $73.04 \pm 0.99$ ,  $72.92 \pm 1.27$ ,  $74.79 \pm 2.10$  and  $45.50 \pm 1.01$  kg respectively. Thus, it can be concluded that fresh jaggery filter cake is fairly digestible and can be offered to pigs in both stages without any adverse effect.

**Key words:** Digestibility, Finisher, Grower, Jaggery Filter Cake, Pigs

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## Introduction

Feed is the major cost in the pork industry. Maize grain is the one of main energy source and most commonly used feed ingredient in pig ration. In the recent past, demand for maize warrants for an alternative to maize with other easily available and cheaper source of energy which may be suitable for pig feeding. Many researchers (Sikka, 2007 and Campos *et al.*, 2006) have tried to replace the maize with molasses also. Pigs being omnivorous, can consume un-conventional feeds which are un-fit for other species. Hence, alternative agro-industrial byproducts suitable for pig feeding are in constant search (Julpo *et al.*, 1985). Farmers often feed Jaggery filter cake (scum/maili) to pigs during winter season. JFC is nothing but scum obtained while making Jaggery (Patel *et al.*, 2009). Feeding of sugarcane filter cake/press mud in different livestock species have also been tried (Gupta and Ahuja, 1998; Suresh, 2007; Suma *et al.*, 2007 and Avijit *et al.*, 2018). While feeding such unconventional feeds, it is always advisable to know the digestibility of the feed stuff. Therefore, considering the importance of JFC as unconventional feed in economic pig feeding, the study was conducted on digestibility of JFC in grower and finisher stage of Large White Yorkshire pigs fed on different levels of Jaggery filter cake.

## Material and Methods

The present investigation was conducted at Swine Production Unit, Department of Livestock Production & Management, College of Veterinary and Animal Sciences, G. B. Pant University of Agriculture & Technology, Pantnagar, Uttarakhand. The farm is located in the foothills of Himalayas at 29.5°N latitude, 79.3°E longitude and an altitude of 243.84 m above mean sea level. Thirty Large White Yorkshire growers aged 3-3½ months were selected for the study. They were housed individually in a well-ventilated shed under corrugated asbestos sheet roof on cement concrete floor with a floor space allowance of 2×3 m<sup>2</sup> per individual along with open space of similar size. The pigs were randomly divided into five dietary treatment groups with 6 pigs in each group, viz. group I: concentrate only, group II: concentrate +250 g JFC, group III: concentrate +500 g JFC, group IV: concentrate +750 g JFC and group V: *ad lib.* JFC only. Jaggery filter cake supplementation was increased in the ratio of 50:100:150 g in group II, III, IV respectively, every fortnight during grower stage and every week during finishing stage. The initial body weight of weaners in group I, II, III, IV & V was 12.00± 0.22, 12.75± 0.30, 11.00± 0.66, 12.17± 0.68 and 12.00± 0.66 kg respectively. The final body weight of pigs in the corresponding groups were 69.25± 1.41, 73.04± 0.99, 72.92± 1.27, 74.79± 2.10 and 45.50 ± 1.01 kg respectively.

Pens were cleaned and washed with water twice daily. All the piglets were cleaned everyday using clean water at 8.00 AM. Proper hygienic conditions including healthy surroundings were maintained in the shed throughout the experimental trial. All the piglets were de-wormed 15 days before the start of the experiment with Albendazole. All animals were vaccinated against swine fever (BP Division, IVRI).

### Experimental Design and Feeding

Ration was prepared at the experimental site. The percentage of maize, soybean meal, wheat bran, fish meal, mineral mixture, common salt and vitamin (A<sub>B</sub><sub>2</sub>D<sub>3</sub>) & vitamin B complex in grower ration was 52, 15, 24.5, 6, 2, 0.5% and 25 g/quintal respectively. The corresponding values for finisher ration were 60, 12.5, 20, 5, 2, 0.5% and 25 g respectively. The CP content of grower and finishing ration was 20.50 and 18.15% respectively. However, required portion of fresh JFC in calculated ration was added at feeding time. The grower ration continued for 9 weeks (upto approx. 35 kg mean body weight). Subsequently all were shifted to finisher ration for another two months (upto approx. 60 kg mean body weight). Daily voluntary feed intake of each animal was noted during experimental period. Weighed quantity of feed was offered in individual feeder daily twice (once in the morning at 10:00 AM and also in the evening 4:00 PM). The residues were collected and weighed at 2:00 PM same day and 9:30 AM on next day in all the groups.

**Table 1:** Experimental design based on JFC feeding

	Group I	Group II	Group III	Group IV	Group V
<b>Jaggery Filter Cake</b>	No jaggery filter cake	250g*	500*	750*	<i>Ad lib</i> <sup>#</sup>
<b>Standard Balanced Ration*</b>	<i>Ad lib</i>	<i>Ad lib</i>	<i>Ad lib</i>	<i>Ad lib</i>	<i>No feed</i>

\*The quantity of jaggery filter cake was increased in the ratio of 50:100:150 g in II, III, IV groups, respectively every fortnight during grower stage and every week during finishing stage. # Vitablend @ 0.25g/kg feed, salt 0.5%, Mineral mixture 2% were added daily to the feed on DM basis.

Digestive trial was conducted once at the end of grower and again at the end of finisher stage. Representative samples of the ration offered and residues left were collected daily to estimate the dry matter intake and a pooled sample was taken for estimation of proximate principles. At the time of digestibility trial faeces from the individual animal was collected manually as soon as the animal defecated. The total quantity of faeces voided during the preceding 24-hour period was pooled and weighed daily at 9:00 am. The faeces collected were thoroughly mixed in a clean plastic tub and representative sample amount of 250g was taken for dry matter and nitrogen estimation from each animal separately. Samples for dry matter estimation (1/20th) were taken on steel plate and it was kept in a pre-heated hot-air oven for overnight at 100°C. The faecal samples were weighed before and after moisture loss for DM estimation. The sample meant for nitrogen estimation was weighed as per the factor (1/100th to 1/40th) based on total faecal output

and stored in a plastic bottle and preserved with 5 ml of 1:4 H<sub>2</sub>SO<sub>4</sub> to fix the nitrogen and was preserved in pre-weighed air tight stoppered bottle at the end of collection period. A suitable aliquot (1/20th) was taken after thorough mixing of pooled samples for nitrogen estimation of each animal. Samples of feeds, residues and faeces were analysed for proximate principles as per the methods described by AOAC (1995).

### Statistical Analysis

The data were analyzed using Analysis of Variance (ANOVA) and the Critical Difference (CD) was calculated to determine any significant difference among the treatment means (Snedecor and Cochran, 1994).

### Results and Discussion

The proximate composition of experimental diet offered during digestive trial in grower and finisher stage has been presented in Table 2. The digestibility % of various nutrients of experimental diet offered to pigs during grower period is presented in Table 3 and Fig.1. During grower stage DM digestibility was marginally higher in group V than other the groups, however, there was no significant difference in DM digestibility among the groups. Similarly digestibility of OM, CP and EE didn't differ among the groups. However, highly significant ( $P < 0.01$ ) difference was found for NFE, ash and total carbohydrate digestibility among different treatment groups of pigs.

**Table 2:** Proximate composition (% on DM basis) of experimental diet offered during digestive trial in grower and finisher stage

Constituents	Groups/treatments				
	I	II	III	IV	V
<b>Grower Stage</b>					
Dry matter	89.77	85.07	79.95	76.81	32.5
Organic matter	89.88	89.9	89.98	90.03	91.32
Total ash	10.12	10.1	10.02	9.98	8.44
Crude protein	20.5	19.76	19.05	18.6	12.33
Crude fibre	5.94	5.45	4.92	4.59	0
Ether extract	4.89	5.31	5.67	5.9	9.13
Nitrogen free extract	58.55	59.46	60.47	61.11	70.08
Total carbohydrate	64.49	64.89	65.39	65.69	70.08
<b>Finisher Stage</b>					
Dry matter	90.17	84.84	80.32	65.29	32.5
Organic matter	90.67	90.34	90.45	90.59	91.32
Total ash	9.33	9.66	9.55	9.41	8.44
Crude protein	18.15	17.89	17.41	16.76	12.33
Crude fibre	6.78	5.85	5.35	4.67	0
Ether extract	4.58	4.62	5.01	5.53	9.13
Nitrogen free extract	61.15	61.98	62.68	63.62	70.08
Total carbohydrate	67.93	67.84	68.03	68.29	70.08

During the finishing stage, there was an increase in digestibility % with respect to DM, EE, NFE and total carbohydrate in group V compared to rest of the groups. Low digestibility of crude protein both in grower and finishing stages in group V might be due to low availability of protein or due to nature of protein in JFC. Further total ash digestibility during both grower and finishing stage was also significantly ( $P < 0.01$ ) less which might be due to less body requirement of minerals in pigs than the mineral contents present in JFC.

**Table 3:** Digestibility (%) of various nutrients during grower and finisher stage in pigs fed ration containing jaggery filter cake

Nutrients Grower	Groups/Treatments					
	I	II	II	IV	V	
Dry matter	70.92± 1.38	69.66± 1.06	68.94± 0.79	70.60± 1.34	73.09± 1.26	NS
Organic matter	74.12± 1.34	74.54± 1.49	73.62± 0.92	73.66± 1.16	76.83± 1.12	NS
Crude protein	77.37± 0.94	74.72± 1.05	75.69± 0.80	74.04± 1.41	54.46± 1.88	NS
Ether extract	41.84± 3.57	45.03± 6.28	43.64± 4.25	42.09± 4.95	58.70± 2.00	NS
Ash	41.99 <sup>a</sup> ± 1.94	40.7 <sup>a</sup> ± 2.14	49.84 <sup>a</sup> ± 2.65	43.96 <sup>ab</sup> ± 3.26	33.02 <sup>c</sup> ± 2.57	**
Crude fibre	43.4± 2.75	48.22± 2.25	43.58± 4.01	42.54± 2.95	0.00± 0.00	NS
NFE	78.95 <sup>ab</sup> ± 1.27	76.63 <sup>a</sup> ± 0.89	80.07 <sup>bc</sup> ± 0.94	78.53 <sup>ab</sup> ± 1.15	83.11 <sup>c</sup> ± 0.98	**
Total CHO	75.66 <sup>a</sup> ± 1.39	74.67 <sup>a</sup> ± 0.81	77.30 <sup>a</sup> ± 1.14	75.70 <sup>a</sup> ± 0.10	83.11 <sup>b</sup> ± 0.98	**
<b>Finisher</b>						
Dry matter	74.00± 1.15	71.36± 0.40	75.49± 1.37	75.20± 0.60	73.89± 1.30	NS
Organic matter	76.90 <sup>a</sup> ± 1.22	73.88 <sup>b</sup> ± 0.348	77.76 <sup>a</sup> ± 1.42	77.97 <sup>a</sup> ± 0.63	78.39 <sup>a</sup> ± 0.85	**
Crude protein	77.87 <sup>a</sup> ± 0.77	75.62 <sup>a</sup> ± 0.70	74.95 <sup>a</sup> ± 1.18	74.85 <sup>a</sup> ± 1.04	57.24 <sup>b</sup> ± 1.56	**
Ether extract	25.42 <sup>a</sup> ± 2.56	23.33 <sup>a</sup> ± 0.89	27.64 <sup>a</sup> ± 5.63	41.22 <sup>b</sup> ± 4.72	62.22 <sup>c</sup> ± 1.55	**
Ash	47.23 <sup>a</sup> ± 1.34	47.78 <sup>a</sup> ± 1.16	53.93 <sup>b</sup> ± 1.03	48.46 <sup>a</sup> ± 1.16	35.66 <sup>c</sup> ± 2.26	**
Crude fibre	50.59± 1.33	50.44± 1.10	47.68 <sup>a</sup> ± 1.94	47.31 <sup>a</sup> ± 1.13	0.00± 0.00	NS
NFE	83.33 <sup>a</sup> ± 1.00	79.87 <sup>b</sup> ± 0.13	84.11 <sup>a</sup> ± 1.03	84.24 <sup>a</sup> ± 0.70	85.02 <sup>a</sup> ± 0.67	**
Total carbohydrate	80.21 <sup>a</sup> ± 1.03	77.34 <sup>b</sup> ± 0.20	81.24 <sup>a</sup> ± 1.10	81.72 <sup>a</sup> ± 0.71	85.02 <sup>c</sup> ± 0.67	**

<sup>a,b&c</sup> Means bearing different superscripts in a row differ significantly from each other \*\* $P < 0.01$

When sole feeding of JFC was done, digestibility of most of the nutrients was higher in comparison to JFC supplemented group with concentrate. Suresh (2004) found that the digestibility of proximate principles was similar among sugarcane press residue supplemented treatment group and control. The digestibility (%) of CP in JFC is comparatively higher than that reported by Straub and Darne (1965) in cattle when scum was fed. In the present study digestibility of most of the parameters particularly total carbohydrate increased in finishing stage as compared to grower stage. This is in agreement with Longland and Low (1989) who found that xylose and glucose was poorly digested in 27 kg pigs than 50 kg pigs. Sahu *et al.* (2016) also found that digestibility of various nutrients remained statistically non-significant between different treatments. They reported marginal decrease in DM, OM, CP, NFE and Total carbohydrate from control to graded level of SPM supplemented groups were observed, but were comparable between the treatments. Ranjan *et al.* (2017) revealed that no significant ( $P > 0.05$ ) differences in intake and digestibility

of nutrients, nitrogen balance, nutritive value of diets, average daily gain, as well as feed conversion ratio was observed in Muzaffarnagari lamb fed with 10 and 20% sugar cane press mud ration.

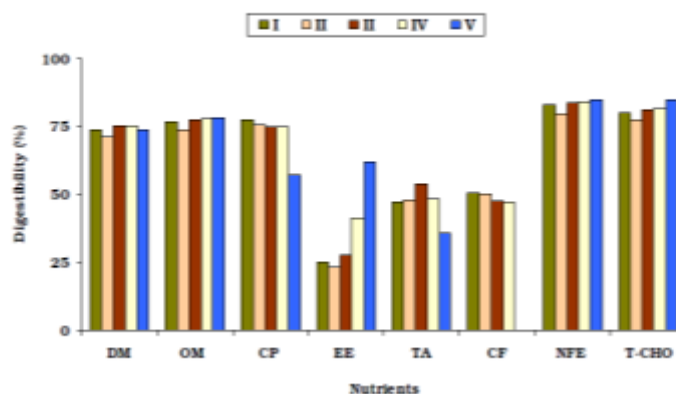


Fig. 1: Digestibility of various nutrients during finisher stage

## Conclusion

Supplementation of jaggery filter cake along with concentrate did not influence the digestibility in grower stage. However, digestibility of all nutrients in the finisher stage differed significantly except dry matter. The final weight of pigs in group I, II, III, IV & V was  $69.25 \pm 1.41$ ,  $73.04 \pm 0.99$ ,  $72.92 \pm 1.27$ ,  $74.79 \pm 2.10$  and  $45.50 \pm 1.01$  kg respectively. Thus, it can be concluded that fresh jaggery filter cake is fairly digestible which is on par with the concentrate ration and can be offered to pigs in both stages without any adverse effect.

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