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Economic Feeding of Pigs in Mizoram: A Field Study for Assessment of Nutritional Constraints and Identifying the Useful Local Feed Resources for Economic Feeding

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ABSTRACT

The study was conducted in the Department of Animal Nutrition, College of Veterinary Sciences and Animal Husbandry, Central Agricultural University (Imphal), Aizawl, Mizoram during 2018-19. The objective of the research was to assess the nutritional constraints of feeding pigs in Mizoram and to put forward some solutions by identifying and utilizing local feed resources for economic feeding. Numbers of unconventional feeds were used for feeding pigs in Mizoram and fourteen among them were identified to be commonly used in day-to-day preparation of home-made cooked feed, which was the composite feed given to all categories of pigs. Constraints of the existing feeding practice were identified as high cost of conventional feeds, low dry matter intake causing deficient energy consumption, poor digestibility of nutrients when home-made cooked feed was fed, high tannin content of unconventional feeds. Except crude protein, apparent digestibility of dry matter, ether extract, crude fibre, nitrogen free extract and organic matter were low under the existing feeding practice. Based on nutrient contents, unconventional local feeds were categorized as protein and energy rich for substitution of conventional ingredients in ration formulation. Few rations with unconventional feeds substituting conventional ones suggested for grower and finisher pigs. Complete feed block of conventional and unconventional feeds was found acceptable to pigs. The study indicated the possibility of economic feeding of pigs by utilizing the local feeds keeping in view their nutritive and anti-nutritive contents and taking into consideration the constraints associated with nutrient intakes under the existing feeding management.

KEYWORDS: Complete feed block, feeding constraint, pig, unconventional feed

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1. INTRODUCTION

Mizoram is one of the eight sister states of the North Eastern region of India. It is situated at 23.1645°N latitude and 92.9376°E longitude with the geographical area of 21,087 km^2 and population of nearly 13 lacs (Anonymous, 2021). Nearly 60% population of the state depends on agriculture and allied sectors and this sector contributed 25.93% of the total gross state domestic product during 2020–21 (Anonymous, 2020–21). For the undulating topography and constraints associated with it, agricultural operations are limited and therefore, majority of agrarian communities of the state depend on animal husbandry activities for their livelihood.

Piggery is one of the important farming practices for livelihood of the Mizo people and people of the entire North-Eastern states (Moanaro et al., 2011; Nath et al., 2013). It plays pivotal role in improving the socio-economic status of the resource-poor rural farmers throughout Mizoram (Patr et al., 2014; Vanlalmalsawma and Sharma, 2015 and Lalhmangaihsangi, 2018). Rearing pigs and eating pork are the part of the culture of the people of Mizoram and tribal communities of the North Eastern Hill region (Haldar et al., 2017). Total pig population in Mizoram is 0.29 million which is 81% of the total livestock population of the state (0.35 million) contributing enormously to the economic subsistence of agrarian communities throughout the state (Anonymous, 2019).

Feeding pigs economically has been the big challenge for the pig farmers in Mizoram. Nearly 80% of the total investment in piggery is for feeding only (Anonymous, 2012 and Liao and Nyachoti, 2017). Unavailability as well as involvement of very high prices for the conventional feed ingredients compel the pig farmers of Mizoram to use the locally available grains with many unconventional feeds for day-to-day feeding of pigs to reduce the feeding cost and to have remunerative profit (Buragohain, 2012) and thereby to improve the sustainability of the enterprise (Muthui et al., 2018). Unconventional feed resources contribute majority of the feedstuffs offered to pigs and feeding of homemade cooked feed including kitchen waste and locally available plants is the common feeding practice (Kumaresan et al., 2009 and Moanaro et al., 2011) in Mizoram.

The economics of pig feeding depends on locally available feed stuffs. Small pig producers across the world have been adopting low-cost feeding regime to curtail the cost of production and the left over from the kitchen, restaurants, slaughter houses and various agricultural by-products are used as the main feed resources for the pigs (Harikumar et al., 2016). Many researchers also reported that non-conventional feedstuffs were rich in many nutritional components and could be utilised as beneficial pig feeds under the tropical production systems (Kambashi et al., 2014; Engle, 2017 and Diarra et al., 2017).

The study, therefore, made an assessment of the nutritional adequacy of the existing feeding practice of pigs in Mizoram and identified the promising commonly used and available unconventional feeds by the pig farmers in Mizoram for utilising them as substitutes of the conventional feeds in ration formulation. Being a very convenient method of feeding with lots of advantages (Anonymous, 2012 and Konka et al., 2016), acceptability of complete feed block by the pigs was also assessed under this study.

2. MATERIALS AND METHODS

2.1. Location of the study

The study was carried out in the Department of Animal Nutrition, College of Veterinary Sciences and Animal Husbandry, Central Agricultural University (Imphal), Aizawl, Mizoram during 2018–19.

2.2. Methodology adopted

Surveys were conducted throughout the Aizawl district of Mizoram covering all the rural development blocks of the district, namely Tlangnuam, Phullen, Thingsulthliah, Aibawk and Darlawn. A total of Fifteen pig farmers of three randomly selected villages from each of the rural development block were surveyed. The farmers' made cooked feed of pigs was collected from all the locations and samples of unconventional feeds were collected. Information like quantity of feed offered to pigs and samples of faeces were also collected during the survey period.

2.3. Analytical methods

The collected samples of home-made cooked feeds of pig, unconventional feeds and faeces were analyzed for proximate principles following Anonymous (1995), calcium and phosphorous was analyzed by volumetric and spectrophotometric methods (Anonymous, 1975) and microminerals of unconventional feed by Atomic Absorption Spectrophotometer following standard methods. Based on the nutritional composition of home-made cooked feed and faeces samples collected from different locations, apparent digestibility coefficient of nutrients was calculated by marker method of indirect method of digestibility. Digestible energy (DE) content of feeds was calculated as per formula of Noblet and Perez (1993).

The findings were analyzed statistically by following methods of Snedecor and Cochran (1995).

3. RESULTS AND DISCUSSION

3.1. Nutritional constraints: Mizoram perspectives

The nutritional composition of home-made cooked feed of pigs collected from different parts of Aizawl district, Mizoram is presented in Table 1. Based on data of quantity

Table 1: Nutritional composition of home-made cooked feed of pig in Mizoram (on DM basis)

Feed type	CP (%)	DE (kcal/kg)	EE (%)	CF (%)	NFE (%)	Ca (%)	P (%)	Cu (ppm)	Fe (ppm)	Mn (ppm)
Home-made cooked feed	18.65± 0.84	2888.16± 86.89	2.94± 0.36	16.31± 0.72	56.21± 1.59	2.77± 0.22	0.82± 0.06	0.31± 0.02	2.87± 0.54	0.67± 0.10

* CP: Crude protein; DE: Digestible energy; CF-Crude fibre; NFE: Nitrogen free extract, Ca: Calcium; P: Total phosphorous; Cu: Copper, Fe: Iron; Mn: Manganese

of feed offered to adult pigs, the average intakes of dry matter (DM) and crude protein (CP) were calculated as 1042.74±45.04 g pig^{-1} day^{-1} and 193.72±11.58 g pig^{-1}day^{-1} respectively, indicating that DM intake was less than the requirement for an adult pig (e.g. 50 kg body weight) if consumed @ 2.5–3.0 kg 100 kg^{-1} body weight day^{-1}. The protein level was adequate in the cooked feed if considered the recommendation for protein in the adult pig ration i.e., 14-18% (Anonymous, 1985). The calculated energy level of the home-made cooked feed was less than the recommended level (Anonymous, 1985) which is 3000 kcal DE kg^{-1} in the ration for adult pigs. As the protein level of the unconventional feeds was high and they were utilised by farmers with home-grown grains and by-products for preparation of home-made cooked feed, it might be the reason for sufficient protein level in the cooked feed. However, as the DM% of home-made cooked feed was only 20.86±0.90%, it might contribute to the less DM intake and hence the energy intake in pigs under the existing feeding practice in Mizoram. In a similar study, Phengsavanh et al. (2010) also cited that by-products such as rice bran and distiller's waste, planted feeds, mainly maize and cassava, and various green plant materials were the common feeds fed to pigs by smallholder pig farmers of Northern Laos of PDR and reported that the feedstuffs were high in energy and but low in protein content. Contrary to our findings, Chittavong et al. (2013) reported lower protein allowance to pigs than their requirement under smallholder feeding management in Central Lao and it might be for differences in feed resources utilised for feeding pigs. Another constraint associated with the feeding of pigs in Mizoram is the unavailability of conventional feeds. Farmers has to purchase the conventional feeds from outside Mizoram which fetches very high prices making the feeding very expensive. It was observed in our study that to curtain feeding cost and to make pig rearing remunerative, farmers uses only the home grown grains and locally available cereal by-products like wheat bran along with numerous unconventional feeds for feeding of their pigs.

3.2. Locally available unconventional feeds and nutritional composition

The survey helped to make a conclusion that there were 14 different unconventional feeds commonly utilized by the pig farmers in Mizoram for the preparation of home-made cooked feed for pigs. The analysis revealed that some of the unconventional feeds were good sources of protein and some were good sources of energy (Table 2). This indicated the possibility of utilization of these feeds as substitutes of conventional protein and energy feed ingredients. As reported by Mutua et al. (2012), ground maize or "ugali" (88%), kitchen leftovers (83%) and dried fish locally called "omena" (78%) were the very commonly used feedstuffs for feeding pigs in Western Kenya and observed that cassava and sweet potato roots could supplement maize as energy sources. It was observed that *Mikania micrantha* Kunth. was a very popular unconventional feed utilised as pig feed in Mizoram which was locally known as *Japan Hlo* and could be a valuable substitute of conventional protein feed ingredients as it contained 21.76% crude protein on DM basis (Table 2).

The main limitation of the unconventional feeds was found to be their high tannin content (Table 3). However, as established by recent investigations that all the naturally occurring plant compounds including tannins are not harmful unless their levels are very high or level of incorporation of unconventional feeds is high and harmfulness also depends on their chemical nature. Some of these naturally occurring plant secondary compounds at low concentration are, instead, known to improve productivity by improving the efficiency of nutrient utilization and maintaining gut health for their anti-oxidant, anti-bacterial and immune-modulating effects (Bhaskarachary et al., 2015; Hassan et al., 2020; Huang et al., 2018). Thus, it might be opined that as the pigs farmers in Mizoram never used single unconventional feed and always used many in the preparation of cooked feed, levels of plant secondary metabolites might be within the permissible limit and also cooking might destroy or inactivate some of the toxic compounds present in unconventional feeds.

Microminerals are important for optimum productivity of livestock. Requirements of microminerals are small, but essential for growth and performance in pigs (Anonymous, 2012). Information on mineral composition of available feeds helps to prevent deficiencies by supplementation of deficit minerals. The unconventional feeds were found to have good quantity of Cu, Zn, Fe and Mn (Table 4) indicating that they might be promising feeds for the pigs. Contrary to our findings, however, Garg et al. (2009)

Table 2: Unconventional feeds and nutritional composition (on DM basis)

Mizo name (Botanical name)	Protein (CP %)	Energy (Kcal DE/kg)	Fat (EE %)	Total CHO (%)
Japan hlo (*Mikania micrantha* Kunth.)	21.76±0.45	1707.94±93.01	1.63±0.15	43.44±1.51
An-ka-sa-kir-lo [*Acmella paniculate* (Wall. Ex DC) R.K.Jansen]	24.33±0.76	2047.43±33.86	1.64±0.11	43.66±0.96
Buar [*Cyanthilium cinereum* (L.) H. Rob.]	25.60±0.17	1753.09±37.54	2.21±0.11	40.11±0.53
Cassava (*Manihot esculenta* Crantz.)	11.51±0.35	3798.69±24.66	0.49±0.04	81.59±0.64
Dang-kha (*Garcinia cowa* Roxb. *Ex Choisy*)	29.74±1.27	1321.53±73.32	1.17±0.06	41.89±1.53
Vai-Bal-hla [*Musa acuminata* Colla. (AAA Group) cv. 'Dwarf Cavendish']	5.41±0.15	432.65±25.57	1.62±0.12	46.62±0.71
Dawl [*Colocasia esculenta* (L.) Schott.]	15.44±0.32	2190.49±98.56	1.54±0.11	58.78±0.88
Khup-nal (*Pilea symmeria* Wedd.)	15.17±0.83	1888.13±41.83	1.35±0.14	59.13±3.52
Thing-fang-hma (*Carica papaya* Linn.)	6.94±0.29	1887.98±52.06	0.61±0.04	66.34±0.59
Kawl-ba-hra [*Ipomoea batatas* (L.) Lam]	10.44±0.16	3163.65±104.63	1.55±0.14	74.51±1.24
Ta-ham [*Persicaria chinensis* (L.) H. Gross]	17.00±0.17	2493.25±27.35	1.44±0.05	56.70±0.32
Then-hang (*Lithocarpus xylocarpa*)	16.21±0.33	1633.13±78.51	1.36±0.04	45.03±1.12
Vawk-pui-thal (*Bidens pilosa* L.)	29.14±0.49	2340.68±64.88	1.32±0.06	41.46±0.68
Par-ar-si [*Tabernaemontana divaricate* (L.) R. Br. Ex Roem. & Schult.]	22.98±0.22	1557.32±95.04	1.69±0.09	41.50±0.97

Table 3: Total tannin content of unconventional feeds (on DM basis)

Feed-stuff	Total tannin (%)
Japan hlo (*Mikania micrantha* Kunth.)	6.09
Vawkpuithal (*Bidens Pilosa* L.)	5.95
Khup-nal (*Pilea symmeria* Wedd.)	6.00
Cassava (*Manihot esculenta* Crantz.) root	Traces
Buar [*Cyanthilium cinereum* (L.) H. Rob.]	6.01
An-ka-sa-kir-lo [*Acmella paniculate* (Wall. Ex DC) *R.K. Jansen*]	Traces
Dawl [*Colocasia esculenta* (L.) Schott.]	5.92
Par-ar-si [*Tabernaemontana divaricate* (L.) R. Br. Ex Roem. & Schult.]	6.07
Kawl-ba-hra [*Ipomoea batatas* (L.) Lam] root	Traces
Ta-ham [*Persicaria chinensis* (L.) H. Gross]	5.93
Kawl-ba-hra [*Ipomoea batatas* (L.) Lam] leaves	Traces
Cassava (*Manihot esculenta* Crantz.) leaves	Traces

reported that the level of zinc, copper, cobalt, calcium, phosphorus and sulphur was inadequate in the common feeds and fodders fed to buffaloes in the semi-arid zone of Rajasthan, which might be the reflection of regional variation depending on soil type and environment.

3.3. Nutrient digestibility of cooked feed

Inclusion of fibrous alternative feedstuffs replacing cereal grains can economise pork production (Wang et al., 2016). However, digestibility may be reduced as pigs has limited ability to digest high-fibre diets. In the present study, the digestibility of different nutrients was observed to be variable but statistically non-significant in different study areas of Aizawl district (Table 5). The average apparent digestibility of DM, CP, EE, CF, NFE and OM was 37.23$\pm$2.34, 84.10$\pm$2.09, 40.09$\pm$4.88, 28.98$\pm$2.72, 37.67$\pm$3.89 and 45.42$\pm$2.19% respectively. Low DM digestibility might be for high fibre content in home-made cooked feed for inclusion of unconventional feeds. Interestingly, CP digestibility was found to be very high as compared to other nutrients and it might be the effect of cooking the unconventional feeds with the available grains before feeding to the pigs.

3.4. Formulation of rations with unconventional feeds for pigs

Considering the protein (%) and energy (DE) values, the unconventional feeds were grouped into three as follows –

i). Protein rich unconventional feed stuffs (CP>18% on DM basis): Japan hlo (*Mikania micrantha* Kunth.), An-ka-sa-kir-lo [*Acmella paniculate* (Wall. Ex DC) R.K. Jansen], Buar [*Cyanthilium cinereum* (L.) H. Rob.], Cassava (*Manihot esculenta* Crantz.), Dang-kha (*Garcinia cowa Roxb. Ex Choisy*), Par-ar-si [*Tabernaemontana divaricate* (L.) R. Br.

Table 4: Micro-mineral content of unconventional feeds of different rural development blocks of Aizawl district

	Cu (ppm)	Zn (ppm)	Fe (ppm)	Mn (ppm)
Tlangnuam Rural Development Block				
Ta-ham [*Persicaria chinensis* (L.) H. Gross]	0.94+0.03	1.41+0.04	4.09+0.01	5.06+0.03
An-ka-sa-kir-lo [*Acmella paniculate* (Wall. Ex DC) R.K. Jansen]	0.87+0.01	1.53+0.02	6.17+0.03	3.90+0.05
Cassava (*Manihot esculenta* Crantz.) leaves	0.62+0.00	1.12+0.00	5.10+0.06	1.15+0.03
Buar [*Cyanthilium cinereum* (L.) H. Rob.]	1.30+0.03	1.59+0.04	9.43+0.27	0.26+0.03
Cassava (*Manihot esculenta* Crantz.) root	0.18+0.00	0.58+0.02	0.71+0.01	3.46+0.02
Dawl [*Colocasia esculenta* (L.) Schott.]	0.82+0.01	3.70+0.02	6.22+0.06	2.08+0.02
Par-ar-si [*Tabernaemontana divaricate* (L.) R. Br. Ex Roem. & Schult.]	1.18+0.03	1.88+0.05	0.31+0.04	1.20+0.05
Kawl-ba-hra [*Ipomoea batatas* (L.) Lam] root	0.54+0.01	0.68+0.01	2.16+0.03	0.91+0.00
Khup-nal (*Pilea symmeria* Wedd.)	0.26+0.01	0.32+0.00	2.66+0.04	2.82+0.02
Kawl-ba-hra [*Ipomoea batatas* (L.) Lam] leaves	0.55+0.01	0.98+0.01	3.09+0.08	2.84+0.24
Vawkpuithal (*Bidens pilosa* L.)	0.45+0.01	0.71+0.01	4.91+0.01	2.31+0.02
Phullen Rural Development Block				
Vai-Bal-hla [*Musa acuminata* Colla. (AAA Group) cv. 'Dwarf Cavendish'] leaves	0.22+0.00	0.22+0.00	4.15+0.00	1.10+0.01
Cassava (*Manihot esculenta* Crantz.) root	0.17+0.00	0.44+0.00	1.83+0.02	0.35+0.00
Dawl [*Colocasia esculenta* (L.) Schott.] leaves & stem	0.32+0.00	1.72+0.03	7.43+0.01	7.71+0.57
Kawl-ba-hra [*Ipomoea batatas* (L.) Lam] root	0.23+0.00	0.66+0.00	4.63+0.03	0.31+0.02
Cassava (*Manihot esculenta* Crantz.) leaves	0.07+0.00	0.73+0.01	3.22+0.00	2.21+0.07
Japan hlo (*Mikania micrantha* Kunth.)	0.39+0.05	0.95+0.01	3.74+0.03	4.82+0.02
Ta-ham [*Persicaria chinensis* (L.) H. Gross]	0.91+0.02	1.32+0.05	3.75+0.24	4.83+0.09
Thingsulthliah Rural Development Block				
Kawl-ba-hra [*Ipomoea batatas* (L.) Lam] leaves	0.26+0.01	0.13+0.01	3.91+0.00	0.14+0.00
Vai-Bal-hla [*Musa acuminata* Colla. (AAA Group) cv. 'Dwarf Cavendish'] pseudo-stem	0.35+0.01	0.15+0.01	2.10+0.06	0.28+0.03
Dawl [*Colocasia esculenta* (L.) Schott.] leaves & stem	0.38+0.01	0.16+0.01	3.15+0.03	0.18+0.05
Thing-fang-hma (*Carica papaya* Linn.) leaves	0.05+0.01	0.22+0.00	0.71+0.01	0.10+0.00
Japan hlo (*Mikania micrantha* Kunth.)	0.46+0.01	0.35+0.00	1.80+0.03	0.57+0.02
Vawkpuithal (*Bidens pilosa* L.)	0.31+0.00	0.18+0.00	2.18+0.03	0.16+0.00
Dang-kha (*Garcinia cowa* Roxb. Ex Choisy)	0.18+0.01	0.30+0.01	0.92+0.02	0.65+0.03
Cassava (*Manihot esculenta* Crantz.) leaves	0.07+0.01	0.26+0.02	1.09+0.02	5.07+0.09
Aibawk Rural Development Block				
Japan hlo (*Mikania micrantha* Kunth.)	0.39+0.00	0.60+0.00	5.31+0.17	1.23+0.01
Cassava (*Manihot esculenta* Crantz.) leaves	0.12+0.00	0.25+0.00	1.07+0.03	2.17+0.04
Dawl [*Colocasia esculenta* (L.) Schott.] leaves & Stem	0.30+0.03	1.22+0.05	3.06+0.04	0.17+0.01
Kawl-ba-hra [*Ipomoea batatas* (L.) Lam] leaves	0.21+0.01	0.11+0.01	2.93+0.03	0.11+0.00
Dawl [*Colocasia esculenta* (L.) Schott.] root	0.71+0.01	3.21+0.01	5.40+0.30	1.89+0.06
Vai-Bal-hla [*Musa acuminata* Colla. (AAA Group) cv. 'Dwarf Cavendish'] pseudo-stem	0.46+0.18	0.14+0.01	1.89+0.06	0.21+0.02

Table 4: Continue...

	Cu (ppm)	Zn (ppm)	Fe (ppm)	Mn (ppm)
Darlawn Rural Development Block				
Dawl [*Colocasia esculenta* (L.) Schott.] leaves	0.11+0.01	0.41+0.01	0.85+0.03	6.89+0.06
Khup-nal (*Pilea symmeria* Wedd.)	0.35+0.08	0.24+0.04	1.81+0.03	0.90+0.01
Cassava (*Manihot esculenta* Crantz.) leaves	0.48+0.20	0.74+0.03	1.62+0.33	0.89+0.01
Par-ar-si [*Tabernaemontana divaricate* (L.) R. Br. Ex Roem. & Schult.]	0.14+0.01	0.25+0.01	2.88+0.04	0.27+0.01

Table 5: Nutrient digestibility (%) of cooked pig feed of Aizawl district of Mizoram

Nutrient	Rural Development Block (RDB)					Mean+SE
	Tlangnuam	Phullen	Aibawk	Thingsulthliah	Darlawn	
DM	32.35+3.03	38.15+3.86	40.79+7.89	36.61+4.17	38.23+8.24	37.23+2.34
CP	85.29+4.33	85.53+5.83	83.22+6.69	81.07+6.20	85.41+3.27	84.10+2.09
EE	34.47+8.95	41.68+12.83	46.72+13.26	38.57+11.24	39.02+15.66	40.09+4.88
CF	25.83+5.76	28.73+2.43	37.76+8.88	28.66+6.49	29.62+8.32	28.98+2.72
NFE	29.69+8.99	33.06+13.15	41.31+7.84	43.72+5.84	40.56+10.48	37.67+3.89
OM	40.75+3.19	45.25+4.58	47.32+7.11	46.76+3.61	47.00+7.63	45.42+2.19

Ex Roem. & Schult.] *and* Vawk-pui-thal (*Bidens pilosa L.*).

ii). Energy rich unconventional feed stuffs (DE>2.0 Mcal/kg): An-ka-sa-kir-lo [*Acmella paniculate* (Wall. Ex DC) R.K. Jansen], Cassava (*Manihot esculenta* Crantz.), Dawl [*Colocasia esculenta* (L.) Schott.], Kawl-ba-hra [*Ipomoea batatas* (L.) Lam], Ta-ham [Persicaria *chinensis* (L.) H. Gross] *and* Vawk-pui-thal (*Bidens pilosa L.*).

iii). Unconventional feed-stuffs rich in both protein and energy (CP >18% on DM basis and Energy>2.0 Mcal kg^{-1}): An-ka-sa-kir-lo [*Acmella paniculate* (Wall. Ex DC) R.K. Jansen], Cassava (*Manihot esculenta* Crantz.) *and* Vawk-pui-thal (*Bidens pilosa* L.).

Balanced feed formula (Anonymous, 1986) for grower and finisher pigs were formulated (Table 6) incorporating locally available unconventional feeds replacing the conventional protein and energy feed ingredients @ 10%, 20% and 30%

Table 6: Balanced concentrate feeds with local feeds (in meal form) for pigs in Mizoram

Ingredients (%)	Grower ration			Finisher ration		
Maize	50.80	41.77	40.10	55.33	55.05	37.71
Rice polish	12.70	10.44	10.03	13.83	13.76	9.43
Soyabean meal	16.60	17.77	12.44	12.70	6.15	14.53
Fish meal	7.11	7.62	5.33	5.44	2.64	6.23
Manihot esculenta root meal	7.18	-	-	-	-	-
Colocasia esculenta root meal	-	14.36	-	-	-	23.70
Ipomoea batatas root meal	-	-	-	7.90	-	-
Polygonum chinese meal	-	-	21.54	-	-	-
Bidens biternata meal	-	-	-	-	15.80	-
Spilanthes acmella meal	2.52	-	-	-	-	-
Manihot esculenta leaf meal	-	5.04	-	-	-	5.40
Garcinia anomala meal	-	-	-	1.80	-	-
Mikania micrantha meal	-	-	7.56	-	-	-
Vernonia cinerea meal	-	-	-	-	3.60	-
Ca-P supplement	1.40	1.40	1.40	1.40	1.40	1.40

Table 6: Continue...

Ingredients (%)	Grower ration			Finisher ration		
Trace mineral salt	1.00	1.00	1.00	1.00	1.00	1.00
Common salt	0.50	0.50	0.50	0.50	0.50	0.50
Vitamin mixture	0.10	0.10	0.10	0.10	0.10	0.10
Molasses	-	7.00	12.00	-	2.00	9.00

respectively. This might be the indication that if pig farmers utilise the available unconventional feeds following scientific recommendations, feeding would not only be economic, but also would sustain optimum growth and productivity of pigs.

3.5. Acceptability of complete feed block in pigs

Utilization of complete feed block in animal feeding is not new. However, its application is limited to ruminants only and feeding to pigs is rare, being very sensitive in regards to feed consumption. In the present study, *Mikania micrantha* (Japan hlo) and *Musa paradisiaca* (Banana) leaves '*in meal form*' were used for preparation of complete feed block. It was observed that pigs were adopted to complete feed block within one weeks (Figure 1) and consumed as that of normal feed. Patoo et al. (2014) found concentrate jaggery scum feed blocks acceptable for pigs. Trevisi et al. (2019) developed three formula (using wheat by-products, dried milk whey, calcium carbonate, oil, molasses) of feed block preparation for pigs and observed not significant difference in growth and carcass quality than normal feeding. They observed that formulation with wheat middlings, cane molasses, milk whey and coconut oil increased the mucosal surface area of the intestinal villi by 7.9% (p<0.05) and the length of time the pigs slept (p<0.01).

Figure 1: Preparation of complete feed block and feeding to pigs

4. CONCLUSION

Optimum dry matter (DM) and energy intake needed to be assured and energy deficiency might be balanced by supplementation of either molasses or extra grains. Local feeds with good nutritive values could be incorporated in pigs' rations as substitutes of conventional protein and energy feed ingredients for preparation of low-cost pig rations. Feeding of complete feed block utilizing locally available unconventional feed might be a valuable future feeding strategy for pigs in Mizoram.

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