



Research Paper

Utilization of unconventional feeds, hotel waste, bakery waste, brewery by products and slaughter house by products and its composition in pigs diets

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ABSTRACT

Feed cost plays major role in the pig farming; In Nepal Higher feed cost due to all ingredients imported from India. Middle class farmer in Nepal claims that higher feed cost resulting less profit from pig rearing business, So they depends on dangerous by product like slaughter house waste products, intestine offal's, hotel and restaurant leftover, brewery by products uses in the pig feed. Pig entrepreneurs don't consider getting the advantages or harmful effects on pig health by these waste products. Unconventional feeds and their by product, Bakery product plays important role in the fattening of pig and minimize the feed cost. These feed and food waste play important role in the pig diet if proper way to mixing in to the feed. This review study could help that how these product and waste material are useful in the pig diet.

KEYWORDS: pig, feed, plant, offal

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I. INTRODUCTION

Improved pigs (*Sus domestica*) originated from crossing of wild pigs and domestic pigs, There are 1.16 million pigs in Nepal (MoAD, 2013). Pork production in Nepal is limited, representing only 7% of the country's animal protein sources. Production is concentrated mainly in the northeastern corner of the country and consists primarily of backyard and informal sector producers. . Feed costs accounts for most of the production costs in almost any animal production system but in the pig industry, this cost is as high as 65-75% (Boggess 2008). Corn and soybean have been the major components of conventional feed for monogastrics and satisfy the needs for energy and protein respectively.

The market for processed pork products is small, and the majority of this market is supplied through imports. Although there are some local companies manufacturing processed products such as sausages and bacon, quantities are limited and the Industry is small. Estimated processed pork product production in urban cities of Nepal is about 5.0 M. ton per day by 25 registered Meat processors .Pigs are omnivorous and superior feed convertors to meat among the animals. The swine have capacity to transform large amount of vegetable concentrated feed into valuable animal protein source for human diet as pork, bacon, hams etc. Swine have good feed efficiency capacity (3 feed: 1meat). They can consumed all vegetables, human food waste, roots and tubers, meat byproducts and crops byproducts as rice bran, wheat bran, mustard cake, soybean cakes, fish byproducts, brewery byproducts which are not fit for human consumption. There are three main categories of feed resources as outlined by Devendra (1989). The main categories are crop residues, agro industrial by products and NCFR. Pecu (2009) stated that alternative feedstuffs are crop residues and food industry by products that cannot be consumed by humans and can be fed to pigs.

Unconventional feeds

Unconventional feeds are those feed ingredients that are not commonly used in animal feeding. Unconventional feed ingredients are available in large quantities like crop byproducts, bakery byproducts (waste), slaughter house byproducts and waste human foods. Unconventional feed contain unbalanced nutrients composition for example brewery byproduct content source of protein but deficient in energy, minerals and vitamins. Roots and tubers (Osti and Mandal 2013) like sweet potato is good source of energy comparable with maize but lacking in protein and minerals. Balanced pig ration could be formulated by judicial use of many unconventional feed resources with the help of feed formulation packages. A study was carried out in Alaska

where nontraditional feed sources were used to rear pigs because pig production feed costs were up to 75% (Alaska Extension 2011). NCFR used in this part of the world ranged from silage crops, dairy products, candy, and raw vegetables to stale bakery products. Sugars were obtained from the candy, minerals and vitamins from the dairy products depending on the moisture content, energy from the vegetables and fiber from the silages.

Hotel waste

Around urban areas periphery many pig farms are manged with hotel waste collection. Hotel waste could be good source of protein, minerals and vitamins. There should be better utilization of these feeding resources by proper collection, handling and storage of food waste. Households should be aware to separate food waste and other non perishable kitchen waste should be kept in separate bucket and actual food waste should be kept in separate buckets and should give some nominal price which encourage household to do this jobs in every house in urban areas. Food waste must be heat treatment in 100^{0c} for 30 minutes.

Bakery byproducts

Bakery byproducts are good source of energy and protein for pig production. Near to bakery factory pig farmers collecting bakery byproducts and mostly fed only bakery products, if mixed with rice bran, mustard cakes and mineral mixture that could be best for better growth performance fattening pigs.

Table 1: Nutrient content of unconventional pig feed ingredients available in Nepal.

SN	Local Name	Scientific Name	Description	DM	OM	T.Ash	CP	EE	CF	Ca	P
1	Kanika(Broken rice)		Mean	85.43	99.05	0.95	8.80			0.10	0.11
			Std	0.58	0.07	0.07	1.61				0.01
			Max	86.10	99.10	1.00	10.60				0.12
			Min	85.10	99.00	0.90	7.50				0.10
			N	3	2	2	3				3
2	Kerau ko geda (whole pea)		Mean	88.00	97.00	3.00	22.56		7.36	0.11	0.30
			Std	1.18	0.10	0.10	0.76		0.72	0.02	0.01
			Max	89.50	97.10	3.10	23.40		8.10	0.14	0.31
			Min	86.20	96.90	2.90	21.40		6.30	0.08	0.28
			N	5	5	5	5		5	5	5
3	Gahun ko geda (whole wheat)		Mean	87.25	97.22	2.78	13.05		6.07	0.11	0.41
			Std	1.77	1.86	1.86	2.81		5.40	0.03	0.30
			Max	88.50	98.34	5.56	15.44		12.30	0.15	0.84
			Min	86.00	94.44	1.66	9.35		2.80	0.08	0.21
			N	2	4	4	4		3	4	4
4	Gahun ko chokar (Wheat bran)		Mean	88.17	93.41	6.59	12.72	2.24	9.86	0.32	0.58
			Std	2.32	2.50	2.50	2.46	0.91	1.54	0.43	0.23
			Max	93.90	96.20	12.73	16.40	4.30	13.10	2.34	0.90
			Min	84.30	87.27	3.80	5.94	0.80	6.35	0.02	0.06
			N	25	41	41	41	23	25	35	30
5	Til ko pina (linseed cake)		Mean	90.30	92.24	7.76	30.52		11.30	0.61	0.69
			Std	1.33	1.89	1.89	1.86		1.19	0.18	0.24
			Max	92.40	95.30	11.20	34.10		12.90	0.96	0.91
			Min	87.60	88.80	4.70	28.26		10.30	0.27	0.24
			N	12	13	13	12		4	11	11
6	Tori ko pina (Mustard cake)		Mean	89.76	91.18	8.82	31.81	8.80	11.77	0.72	0.93
			Std	2.66	2.54	2.54	3.10		2.17	0.20	0.21
			Max	98.80	94.91	19.95	37.70		16.08	1.15	1.65

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			Min	86.80	80.05	5.09	25.68		8.10	0.22	0.30	
			N	16	34	34	31		22	29	29	
7	Dhan ko dhuto (Rice Bran)		Mean	89.07	88.64	11.36	10.37	6.81	10.60	0.24	0.71	
			Std	3.03	3.16	3.16	3.26	2.36	4.62	0.25	0.35	
			Max	95.49	93.45	19.00	19.05	9.55	30.12	1.42	1.59	
			Min	82.50	81.00	6.55	4.19	2.80	7.20	0.02	0.13	
			N	46	83	83	83	30	24	75	54	
8	Bhatamas ko geda (Whole soyabean)		Mean	88.84	93.18	6.82	40.43	4.32		0.37	0.57	
			Std	2.48	2.47	2.47	4.94			0.09	0.05	
			Max	93.55	95.10	13.74	47.80			0.53	0.64	
			Min	84.80	86.26	4.90	29.80			0.24	0.47	
			N	12	16	16	17			12	12	
9	Bhatmas ko pina (Soyabean Meal)		Mean	90.12	92.43	7.57	39.43		6.83	1.30	0.65	
			Std	0.51	1.35	1.35	3.28		0.04	0.96	0.07	
			Max	90.48	93.98	9.93	44.00		6.85	2.66	0.79	
			Min	89.76	90.07	6.02	35.00		6.80	0.52	0.60	
			N	2	11	11	11		2	6	6	
10	Makai ko geda (Whole maize)		Mean	88.87	98.06	1.94	10.19	1.35	3.81	0.16	0.42	
			Std	2.67	0.89	0.89	1.18	3.76	1.22	0.19	0.13	
			Max	93.30	99.26	4.34	12.30	1.19	6.70	0.75	0.99	
			Min	83.30	95.66	0.74	8.30	1.52	2.23	0.02	0.31	
			N	16	31	31	31	6	16	25	25	
11	Makai ko geda (QPM) (Quality Protein Maize)					8.99						
12	Makai ko pitho (Maize powder)		Mean	87.32	97.77	2.23	9.46	3.21	2.73	0.13	0.42	
			Std	2.66	1.48	1.48	1.46	0.57	0.52	0.25	0.16	
			Max	92.39	98.95	6.31	13.02	4.11	3.70	1.18	0.97	
			Min	83.79	93.69	1.05	6.94	2.10	2.20	0.01	0.21	
			N	8	25	25	25	10	8	22	22	
13	Makai ko chokar (Maize bran)			84.5	96.3	3.7	6.1		16.9		0.25	
14	Makai ko dhuto (Maize bran)		Mean		93.84	6.16	10.29	4.29	4.90	0.09	0.44	
			Std		1.29	1.29	0.21			0.01	0.39	
			Max		94.75	7.07	10.43			0.09	0.71	
			Min		92.93	5.25	10.14			0.08	0.16	
			N		2	2	2			2	2	
15	Machha ko dhulo (Fish meal)		Mean	93.96	49.45	50.55	33.26	1.90	3.23	2.91	0.94	
			Std	0.08	12.98	12.98	9.97		0.38	0.70	0.16	
			Max	94.02	61.50	68.92	46.80		3.50	3.56	1.12	
			Min	93.90	31.08	38.50	21.41		2.96	2.21	0.75	
			N	2	4	4	10		2	4	4	
16	Mas ko geda Black gram		Mean	90.02	95.80	4.20	25.25		6.72	0.14	0.43	
			Std	1.37	1.88	1.88	1.08		0.86	0.08	0.02	
			Max	91.90	97.60	6.30	26.60		7.90	0.27	0.47	
			Min	88.60	93.70	2.40	24.00		5.60	0.04	0.40	

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			N	6	6	6	6		6	6	6	
17	Suryamukhi pina Sunflower cake		Mean	91.50	90.99	9.01	34.60		18.12	0.64	0.98	
			Std				3.81					
			Max				37.29					
			Min				31.90					
			N				2					
18	Haddi ko dhulo (Bone Meal)		Mean	93.77	38.71	61.29	26.32		0.19	22.25	1.55	
			Std		0.71	0.71	6.94			0.30	0.06	
			Max		39.23	62.10	34.16			22.46	1.59	
			Min		37.90	60.77	20.94			22.03	1.51	
			N		3	3	3			2	2	

Table 2. Grasses and legumes that can be supplement in pig feed

1	Bethe (cheno)		Mean	16.67	77.95	22.05	24.54		32.65	29.82	20.46	2.81
			Std	8.78	9.67	9.67	2.15		6.18	6.90	7.07	0.68
			Max	33.00	91.21	30.73	26.53		44.92	43.70	26.95	3.57
			Min	10.00	69.27	8.79	21.11		28.48	25.62	9.32	1.66
			N	6	6	6	6		6	6	6	6
2	Sisnu(stinging nettle)			87.40	12.60	5.10		74.30	56.20	18.10		
3	Oat grass	<i>Avena sativa Linn.</i>	Mean	15.74	89.13	10.87	11.65	3.35	57.37	44.12	8.43	0.46
			Std	2.86	2.99	2.99	3.35	0.64	7.40	7.19	3.06	0.17
			Max	19.70	96.81	16.10	17.22	3.80	70.26	57.39	14.18	0.83
			Min	11.37	83.90	3.19	5.69	2.90	44.77	33.71	4.45	0.18
			N	10	24	24	24	2	19	19	19	20
4	Berseem		Mean	20.50	85.98	14.02	20.92	2.20	59.65	51.72	19.93	1.64
			Std		3.69	3.69	4.32		10.04	9.17	3.37	0.46
			Max		90.59	17.65	26.17		70.83	63.54	22.22	2.13
			Min		82.35	9.41	14.40		48.07	41.55	16.06	1.24
			N		5	5	5		4	4	3	4
5	Vetch grass	<i>Vicia sativa</i>	Mean	17.50	84.64	15.36	21.90	2.75	54.59	48.95	17.97	1.04
			Std	2.51	7.29	7.29	6.51	0.35	12.64	11.78	9.89	0.35
			Max	19.90	92.16	28.32	27.70	3.00	64.53	57.53	32.52	1.45
			Min	14.90	71.68	7.84	11.39	2.50	36.43	32.14	10.61	0.63
			N	3	6	6	5	2	4	4	4	4
6	White clover	<i>Trifolium repens L.</i>	Mean		87.61	12.39	22.72		41.68	35.63	11.20	1.76
			Std		2.72	2.72	3.11		4.09	2.20	1.92	0.36
			Max		90.48	16.91	25.00		46.04	38.53	13.92	2.05
			Min		83.09	9.52	17.82		36.58	32.41	9.18	1.36
			N		5	5	5		5	5	5	3

Brewery byproducts

Brewery byproducts as brewery grains and yeast contain 18 percent protein and 15 percent crude fiber. During the brewery byproducts processing, barley is first soaked and germinate. After germination sprouts are removed and sold as malt, the dried malt is then passed through a process known as mashing to promote enzymatic action on proteins and starch. The mixture is sprayed onto this mixture and temperature increase up to 65°C . After mashing process is complete the sugary liquid or wort is drained off leaving brewery grains as residues which is used for animal feeding.

Slaughter house byproducts

Slaughter house byproducts as meat meal, bone meal, blood meal are good protein source for farm animals including pigs. Meat meal contains over 55 percent crude protein, good source of vitamins, calcium (8%) phosphorous (4%), good source of lysine and methionine. Hide, hoofs, hair, stomach content should be properly dried and grinding so that there should not be harmful effect on animals. Meat meals or meal scrap can be use in pig feed about 15 percent of the diets, in some places only meat byproducts are using in pig feed that is not good practices, mixed with rice/wheat bran may give good results with low cost. Another slaughter house byproducts is bone meals, bone meal contains calcium (36%) and phosphorous (29%). There should be proper heat processing of bones to make bone meals, in local market raw bone meal is available which is not good for pig feed. The calcium and phosphorous contains in raw bone meal are not available to pig, there should be taken care when bone meal is use for pig feed. Large amount of blood meal is available during animal slaughtering in slaughter houses. Properly collected and process blood meal is good source of protein (80%) for farm animal's diets. Blood meal is poor source of calcium and phosphorous therefore not recommended for your piglets, up to 10 percent of blood meal could be incorporate in fattening pig's diets. It shall be contaminated from the disease include hog cholera, foot and mouth disease, swine fever, salmonella, trichinella if not proper heat treatment to the waste. This must be better way to follow cooking regulation for food waste containing meat waste. Chicken offal meal replaced 33 % of fish meal in pig diets without depressing performance or carcass characteristics (Fanimo et al., 1997). Blood meal is a high protein ingredient derived from animal blood but quality varies among species and processing techniques. Blood meal is usually approximately 20% DM and is fed in the powdered form. Recent studies have shown that blood is now used in the liquid form and sprayed onto fed and is good for starter pig diets (Papadopoulos 1985).



Fig: Slaughter house offal and vegetables waste

Animal nonconventional feed resources (NCFR) usually originated from sources of the large animal and poultry industry (Preston 1986). The more common products to be used were meat, bone and blood meals. Such products would have been given to the animals either as one single component or combined like meat and bone meal. To a lesser extent, feather meal and hatchery by products such as dead birds and eggs were also reported to be used as animal NCFR. One of the more favorable sources of animal derivatives was fishmeal usually obtained as by-catch from the fish industry. Fishmeal sources have been reported to be high in ash from the bones of the fish and high in oils if the entire fish was used.

Agro-byproducts

Agricultural byproducts are good source of pig feed (Table 1), rice and wheat bran, maize grits; rice grits (kanika) are good source of energy. Soybean cake, mustard cake, til cake, sunflower cake and other oilseed cakes are good source of protein. Organic pig farming was explored heavily by Edwards (2012). This author summarised that there were many plant sources that can be used to promote growth of pigs at different

physiological states. These non conventional feed resources included: barley, wheat, oats, rye, triticale, wheat bran, carrots, parsnips, fresh clover, grass meal, Lucerne silage, and whole crop silages. All non conventional feed resources had positive effects on pig production by as Prestion (1986) suggested, they all needed to be partially processed before feeding. These agro-byproducts should store in moisture free condition, some time mold growth and May occurs aflatoxin problems in pigs. , Okai and Boateng (ND) spoke about using NCFR from products that they have in their country. There are three main products that are obtained from the Oil palm industry, oil palm slurry, the palm kernel cake and the palm press fiber. An experiment was carried out using the palm kernel cake and results showed that the back fat thickness of pigs was higher than those not fed the cake. It was also noted that the palm press fiber had a positive impact of growing finishing pigs since oil extraction techniques were quite inefficient so ether extracts in the product were high.

Grasses and legumes

Few succulent grasses and legumes are good source of pig feed (Table 2), attention should be taken in how much should be fed, about 5-10 percent of fresh total diet could be supplied through green fodder because green fodder contain high amount of fiber which lead to diarrhea in young pigs. Green grass like oat (jai) and sisnu has been extensively used in pig feeding; likewise bethe, white clover, vetch, berseem etc are good source of protein supplements. A study on small holder pig production was carried out by Phengsavanh (2013) and some non conventional feed resources were found to be very useful. This author focused mainly on using forage legumes for feed substitution. He stated that protein was the most limiting nutrient for tropical pig production. He then suggested that using legumes in a leaf meal form in the diet would be helpful in the production dilemma. Results showed that using Leucaena leaf meal was nutritionally on par with soybean meal. Further experimentation showed that using the leaf meal had a slight negative effect in terms of voluntary feed intake supposedly because of the levels of the fiber in the forage.

By-product	Metabolizable energy	Dry Matter	Crude Fiber	Protein	Lys	Trp	Ca	P
Milk by-products	kcal/lb.			%				
Liquid whole milk	290	12.8	0.0	3.4	0.25	0.05	0.12	0.09
Dried whole milk	2,200	97.0	0.1	26.0	2.09	0.37	0.91	0.75
Liquid skim milk	160	9.5	0.0	3.4	0.30	0.05	0.12	0.10
Dried skim milk	1,520	94.0	0.3	33.5	2.50	0.45	1.25	1.00
Liquid buttermilk	155	9.7	0.0	3.3	0.26	0.04	0.13	0.09
Condensed buttermilk	493	29.1	0.1	10.8	0.78	0.12	0.44	0.26
Dried buttermilk	1,380	93.0	0.4	32.0	2.20	0.47	1.32	0.93
Liquid sweet whey	103	7.1	0.0	0.9	0.07	0.01	0.05	0.05
Liquid acid whey	95	6.6	0.0	0.8	0.07	0.02	0.10	0.08
Dried whey	1,445	94.5	0.2	12.0	0.80	0.13	0.90	0.70
Dried whey product	1,240	92.0	0.2	16.0	1.40	0.22	1.69	1.13
Meat by-products								
Animal fat	3,550	95.0	0.0	0.0	0.00	0.00	0.00	0.00
Meat meal	1,200	92.0	0.4	55.0	3.00	0.35	8.20	4.10
Meat and bone meal	1,100	93.0	0.4	50.0	2.50	0.28	10.10	5.05
Flash dried blood meal	1,300	90.0	0.6	85.0	7.00	1.00	0.30	0.25
Hydrolyzed hog hair	1,000	95.0	1.0	94.0	3.50	0.50	0.20	0.80
Hydrolyzed feather meal	1,000	94.6	1.0	85.0	1.94	0.50	0.20	0.80
Poultry by-product meal	1,300	93.0	1.0	55.0	3.70	0.45	4.40	2.50
Egg by-products								
Bloodspot eggs	500	40.0	0.0	10.0	0.50	0.10	6.00	0.20
Hatchery by-product meal-broiler chick	800	90.0	0.0	22.2	1.16	0.22	24.60	0.33
Hatchery by-product meal-egg chick	1,000	90.0	0.0	32.3	1.83	0.30	17.20	0.60
Grain by-products								
Corn bran	1,200	89.0	8.5	8.0	0.20	0.10	0.03	0.20
Hominy feed	1,400	90.0	5.5	10.4	0.30	0.10	0.05	0.40
Corn gluten feed	1,100	90.0	10.0	22.0	0.60	0.12	0.30	0.70
Corn gluten meal	1,400	91.0	2.0	42.0	0.80	0.23	0.03	0.45
Wheat bran	890	90.0	11.0	15.0	0.56	0.18	0.10	1.15
Wheat middlings	1,300	88.0	7.0	16.0	0.64	0.18	0.10	0.90
Rice bran	1,350	91.0	12.0	13.0	0.60	0.10	0.10	1.30
Rice bran, fat extracted	1,200	91.0	11.4	16.0	0.60	0.18	0.13	1.32
Rice polishings	1,500	90.0	4.0	12.0	0.50	0.10	0.05	1.20
Brewers dried grains	1,000	92.0	13.0	25.0	0.90	0.30	0.25	0.50
Distillers dried grains	1,300	93.0	11.0	25.0	0.60	0.20	0.10	0.35
Distillers dried grains w/solubles, Old Generation	1,540	91.0	10.0	27.0	0.70	0.20	0.15	0.70
** New Generation	1,633	91.0	7.8	27.0	0.70	0.20	0.06	0.79
Stillage	150	10.0	1.0	3.0	0.08	0.02	0.02	0.10
Dried bakery by-product	1,650	92.0	1.0	10.0	0.30	0.10	0.06	0.47
Starch and sugar by-products								
Cane molasses	1,060	77.0	0.0	4.5	0.20	0.10	0.81	0.08
Dried cane bagasse	500	91.5	44.5	2.0	0.10	0.05	0.60	0.20
Beet molasses	1,060	77.5	0.0	6.6	0.15	0.05	0.12	0.03
Dried beet pulp	1,020	90.6	18.2	8.7	0.65	0.09	0.68	0.09
Corn molasses	1,200	73.0	0.0	0.4	0.00	0.00	0.04	0.04
Salvage candy	1,600	93.5	0.0	3.0	0.00	0.00	0.06	0.06
Vegetable and fruit by-products								
Cooked cull potatoes	370	22.0	0.7	2.2	0.06	0.02	0.02	0.06
Potato meal	1,100	90.0	2.0	9.0	0.25	0.10	0.10	0.30
Potato flakes	1,600	90.0	2.0	9.0	0.25	0.10	0.10	0.30
Potato slices	1,500	90.0	2.0	9.0	0.25	0.10	0.10	0.30
Potato pulp	1,000	90.0	6.0	7.7	0.20	0.10	0.10	0.30
Potato chips and fries	2,000	90.0	2.0	5.0	0.20	0.10	0.10	0.30
Cooked cull dry beans	1,400	90.0	4.0	23.0	1.50	0.20	0.20	0.40

Table 3: Nutrient Profiles of Common NCFR in Pig Diets (Bogges 2014)

II. CONCLUSIONS:

Feeding unconventional feeds, slaughter house waste, restaurant waste and bakery waste to pigs is common in throughout the Nepal near metropolitan area. This is the cheap source for to minimize the feed cost, if proper way to disinfections and treatment this waste it might be better feed ingredients in the pig diet. It could profitable for middle class farmers.

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