

Table 5. List of feed ingredients that are used or have the potential to be used as protein and/or energy supplements in milkfish feed (nutrient content as % dry matter)

Feed ingredients		Primary use			Moisture DM (%)	Crude protein (%)	Gross energy (kJ/g)	Inclusion (% max)	Main nutritional interest	Main nutritional deficiencies	Processing restrictions
		Protein supplement	Energy supplement	Both							
Animal origin	Fishmeal (local)	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	10	64	19	25	Protein, essential amino acids, minerals	Fat soluble vitamins	Air drying reduces protein and fat content
	Fishmeal (Peruvian)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	8	68	20	25	Protein, essential amino acids, minerals	Fat soluble vitamins	Air drying reduces protein and fat content
	Fishmeal (tuna)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	9	65	20	25	Protein, essential amino acids, minerals	Fat soluble vitamins	Air drying reduces protein and fat content
	Shrimp meal (Acetes)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	8	69	19	10	Chemoattractants, lysine, methionine, HUFA	Poor mineral digestibility	Oven drying may damage fatty acids
	Meat meal (snail meat)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	4	52	16	5–10	Protein, essential amino acids and fatty acids, xanthophyll	Anti-nutritional factor in slime	Cooking is required
	Meat & bone meal	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	6	47	16	10–15	Protein, minerals	Isoleucine, methionine+cystine	Hygienic standard needed
	Mussel meal (green)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	6	65	21	5	Protein, unsaturated fatty acids, chemoattractant	Contains enzyme inhibitor thiaminase	Heating destroys thiaminase
	Poultry by-product meal	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	8	61	22	35	Essential amino acids, iron, zinc, choline	Low digestibility due to keratin and raw feathers	

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	cow pea (Vigna sp.)	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	8	25	18	15	Protein, energy, iron, nicotinic acid	Sulfur containing amino acids, presence of trypsin inhibitor	Heat treatment necessary
	feed pea (Pisum sativum)	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	12	25	18	26	Protein, lysine		
	soybean meal, as is	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	6	36	22	30	Protein, amino acid profile	Lysine, methionine; presence of trypsin inhibitor	
	soybean meal, defatted	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	8	44	18	20	Protein, amino acid profile	Fat, lysine, methionine; presence of trypsin inhibitor	
	<i>Root crop</i>										
	cassava tuber	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	56	2	16		Energy	Methionine	
	<i>Leaf meals</i>										
	ipil-ipil leaf meal, native	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	10	29	18	5–10	Protein, pigments (β -carotene, xanthophylls)	High mimosine	
	ipil-ipil leaf meal, giant	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	8	25	16	5–10	Protein, pigments (β -carotene, xanthophylls)	High mimosine	
	swamp cabbage	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	-	28	15		Protein		
	sweet potato	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	-	23	16		Protein		
	cassava leaves	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	6	22	17		Protein, lysine, carotene	Methionine	

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	<i>Azolla</i>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	8	27	14		Protein		
	molasses, black strap	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	19	25	16		Energy	Minerals	
	Single cell protein	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>							
	<i>Natural food</i>										
	<i>Acartia</i> (copepods)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	8	71	22		Lipids, n-3 fatty acids, amino acids, vitamin C, carotenoids		
	<i>Artemia</i>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	8	56	18		Protein, lipids, essential fatty acids		Lipid composition of diet affects fat composition of body
	<i>Brachionus</i>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	8	52	19		Protein, lipids, essential fatty acids		Lipid composition of diet affects fat composition of body
	<i>Moina</i>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	9	58	20		Protein, n-3 fatty acids		

Data source: Centralized Analytical Laboratory (SEAFDEC); Hertrampf and Pascual (2000); Støttrup and McEvoy (2003), Lumasag (1985) (for *Moina*)