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SUITABILITY OF LOCAL RAW MATERIALS FOR MUD CRAB FEED DEVELOPMENT

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ABSTRACT

The aims of study were to identify the potency and nutritional values of local raw materials available in Central Java, and to develop the mud crab feed using selected raw materials for its fattening culture.

The potency level of local raw materials was determined by using secondary data available in relevant technical institution eg. Agriculture Departement, Fisheries Bureau and followed by direct site survey in the production centres of agriculture and fisheries by catch in Central Java i.e. Pekalongan, Kendal, Semarang, Jepara, Pati and Rembang. Data obtained were analyzed descriptively to determine the resource of the potentials of local raw materials and followed by determining their nutritional values, profile and availability of essential amino acids (EAA) and essential fatty acids (EFA), using standard methods available. The result indicated that the local raw materials for protein sources are found in abundance in Central Java throughout the year with relatively cheap price i.e. : trash fish, mysid, squid, blood meals, worm-meals and shrimp head meals (animal protein) and saga, soy beans (plant protein). The protein level of selected raw materials were high (41,15 - 80,35 %) and the highest level was found in blood meal and followed by squid, trash fish and shirmp head meals.

The selected raw materials, generally, contains ten essential amino acids (Arginine, Lysin, Histidine, Phenylalanine, Leucine, Isoleucine, Methionine, Valine, Threonine and Tryptophan) and a long chain of EFA (n-3 HUFA) and (n-6 HUFA) which are required by mud crab (crustacean) for their growth. The selected local raw materials are therefore nutritionally suitable for mud crab feed development in Central Java.

Key words : local raw materials, nutritional values, mud crab feed development, fattening culture.

I. Introduction

Mud crab (*Scylla serrata*) is one of the important fisheries commodity which has recently been decided by Central Java Government that the production level has to be improved in the near future, since the demand either for domestic or export commodity tends to increase from year to year (DGF, 1993). Mud crab fisheries in Central Java Indonesia, has not been intensively developed, as it still depends on wild caught in mangrove area. Development of mud crab farming in brackish water ponds is an alternative effort for increasing the production levels. Theoretically, the potential for increasing mud crab production is vast. There are approximately 20,000 ha of existing brakish-water ponds (tambak) in Central Java available for mud crab culture which has previously been used for shrimp culture. In spite of the potential for mud crab culture development, it is still facing a number of problems and constraints. At present, the mud crab farmer practises the fattening culture system found virtually in Central Java e.g. Demak and Jepara (Central Java Fisheries Beaureau, 1996). It has been faced by shortage of mud crab feed available for fattening culture, due to the fact that farmers are still depending on trash fish as main food sources which is inefficient, less accurate and viable to water quality deterioration (Wartas and Hutabarat, 1992). Availability of mud crab feed in good quantity and quality throughout the year is important in order to support mud crab culture development. It can be achieved, since the raw materials are available in several agriculture and fisheries production centre in Central Java and so far have not been utilized for aquaculture feed production. This study, therefore, was initiated in an attempt to overcome existing problems and to optimise use of local raw materials in mud crab feed development in Central Java. The aims of the study (phase I 1996/1997) were to identify the suitability of local raw materials with respect to quality (level of nutritional values), quantity and its availability and to formulate experimental diets using selected local raw materials to produce cost effective diets for the purposes of mud crab feed development in Central Java. The results derived from this study (phase I) will be used for growout studies (phase II, 1997/1998).

II. Methodology

Phase I (1996/1997). To identify the potency of local raw materials available in several production centre (agriculture by product and fisheries by catch) of Central Java, followed by proximate analysis, EAA and EFA determination, in respects to their level of nutritional values.

The results will be used for formulating experimental diets by using selected materials. The data information on potency of local raw materials (agriculture by product/fisheries by catch) has been collected from several agriculture and fisheries production centres in Central Java (Pekalongan, Kendal, Semarang, Jepara, Pati and Rembang regencies) by using the statistical books available in related technical institutions and confirmed by direct site checking (groundtruth survey). Data obtained

from others institution has also been used to complementing the information required. The potential local raw materials were selected according to quantity (availability throughout the year at low price), quality (the level of nutritional value contained in the raw materials) and of less competition as a human food sources or industrials goods. Determination of nutritional values (proximate analysis, profile and availability of EAA and EFA) of the selected raw materials has been performed in Laboratory of Fish Nutrition - Tokyo University of Fisheries - Tokyo, Minatoku - Japan using standard procedure available (AOAC, 1990 and Takeuchi, T. 1988). Formulation of experimental diets was made by varying the level of dietary protein and varying ratio of animal and plant proteins contained in the diets. The diets were formulated by Least cost-method using different combination of protein sources i.e. trash fish, squid, mysid (animal protein) and soybean, saga, flour (plant protein). Experimental diets contain approximately 30 % and 35 % of dietary protein level.

III. Results

Data potency of the local raw materials available in Central Java (Jepara, Pati, Rembang, Semarang, Kendal, Pekalongan), the level of raw materials requirement (ton/year) and the competition level with human food/industry and their price (Rp/kg) are presented in Table 1.

From Table 1, it can be noted that the raw materials for protein sources are available throughout the year and animal protein, either from fisheries by catch or cold storage by product, seems to be abundance than plant protein sources (soybean, saga or ground nut). The selected raw materials, its availability and their nutritional levels are also presented in Table 1. From Table 1, it can also be seen that the protein levels of selected raw materials are varied from 41.99% to 80.53% and 41.15% to 45.82% (plant origin). The quality of protein, was determined by their amino acids profile and availability, these are presented in Table 2.

Meanwhile, the profile and availability of fatty acids in selected raw materials are presented in Table 3 (animals origin) and Table 4 (plants origin). The results of nutritional levels contained in selected raw materials are then used for formulating experimental diets. The compositions of experimental diets with protein levels of 30% and 35% are presented in Table 5.

IV. Discussion

The results indicated that the local raw materials for protein sources (animal and plant origin) of mud crab feed are available throughout the year with less competition to human food/ industrial good. The requirements of these materials for feed industry are still below their potential level and the price is relatively low (Table 1). The potency of local materials varying from area to area and animal protein sources either from fisheries by catch or agriculture by products, are more abundant than plant protein sources (soybean, saga, groundnut), therefore some raw materials have

been selected. These selected raw materials as indicated in Table 1 contained relatively high protein animals (45,54% - 80,55%) and plant protein (41% - 45%) which are suited to the nutritional requirements for aqua-culture feed as stated by Eldrin (1973) and Hutabarat (1984) that protein level of raw materials for aquatic feed should be high in order to produce a good quality, efficient and better conversion feed.

Profile and availability of amino acids in the materials (animals and plants origin) will also determine the quality of protein sources (Jauncey and Ross, 1982). Table 2 indicated that the local protein sources i.e. trash fish, mysid, squid, blood meal, worm meal, shrimp head meal, saga and soybean contained ten essential amino acids i.e. Methionine, Arginine, Threonine, Tryptophan, Histidine, Isoleucine, Leucine, Lysine, Valine and Phenylalanine, which are important for mud crab growth. These could not be synthesized by cultivan (mud crab) and must be available in the diets (Halver, 1972). Meanwhile, Kanazawa (1985) stated that beside the availability of EAA, the raw materials should also contain a long chain of fatty acids (n-3 HUFA) and (n-6 HUFA). Table 3 and 4 indicated that the long chain fatty acids (n-3 HUFA and n-6 HUFA) are available in the selected raw materials. They could not also be synthesized by mud crab (Castel, 1982), therefore they should be available in the diets in certain levels for further desaturated elongation process to be essensial fatty acids (EFA) eg. 20:5n-3 ; 22:5n-3 and 22:6n-3 (Kanazawa et al, 1985). Based on this findings, it could be stated that these selected local raw materials are nutritionally suitable for mud crab feed and therefore they have been used in formulating the experimental diets as exhibited in Table 5. The protein level of experimental diets is formulated to be 30% and 35% according to Djuwito *et al,* 1992 who had stated that protein requirements for "fattening" and mud crab culture were aranging from 30% to 35% and should contained ten essential amino acids, particularly lyisine, arginine, leucine, isoleucine and valine (Akiyama *et al,* 1991).

V. Conclussions

1. Local raw materials for protein souces (animal and plant origin) are found abundant in Central Java (Jepara, Pati, Rembang, Semarang, Kendal, Pekalongan) throughout the year with relatively cheap price.
2. The potential raw matrials selected during survey are : trash fish, mysid, squid, blood meal, worm meal and shrimp head meal (animals origin) and saga and soy bean (plants origin).
3. Nutritionals values, profile and availability of EAA, profile and EFA composition (n-3 HUFA and n-6 HUFA) of local raw materials are qualitatively suitable for mud crab feed ingredients, therefore it will be proof on feeding trial experiments conducting in growout studies (Phase II, 1997/1998 fiscal year).

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Table 1. Data potency of local raw materials (animal and plant origin) available in agriculture and fisheries production centre of Central Java (average per year in tons)

Raw Materials	Jepara	Pati	Rembang	Semarang	Kendal	Pekalongan	Total Potency
Tembang	632,30	7.871,50	4.216,30	87,40	489,90	8.093,50	21.341,23
Lerognat. sp	656,51	43,03	1.934,60	792,40	26,50	179,55	3.632,59
Trash fish	535,50	817,04	2.708,66	294,50	202,16	6.544,60	11.102,46
Mysid	1,78	132,30	-	-	-	-	134,09
Squid	14,43	11,52	58,45	30,50	18,10	16,17	149,18
Blood meal	-	-	-	360,32	-	139,68	500,00
Worm meal	-	-	19,14	40,86	-	-	50,00
Shrimp head meal	51,20	4.592,04	42,49	163.516,5	1.771,90	15,15	169.989,3
Saga	-	139,76	160,24	-	-	-	300,0
Ground nut	11.700,5	4.732,60	654,0	5.190,0	5.416,3	1.150,1	28.834,5
Soy bean	548,5	3.343,60	5.741,0	1.258,30	1.025,0	593,0	1.2509,4

Requirements of local raw maerials (ton/year), compotition level to human / industrial good and price (Rp/kg).

Raw Materials	Potency	Requirements	Compotition to human/industrial	Price per kg (Rp)
Tembang	21.341,23	1.067,10	++	345
Lerognathus sp	3.632,59	181,60	++	299
Trash fish	11.102,46	2.775,60	+	358
Mysid	134,09	13,40	+	137
Squid	149,18	7,50	++	1.200
Blood meal	500,00	50,0	+	500
Worm meal	50,00	10,0	-	300
Shrimp head meal	169.989,30	16.998,9	+	50
Saga	300,0	50,0	-	150
Ground nut	28.843,52	1.441,70	+++	2.500
Soy bean	12.509,40	3.127,40	+++	1.200

Nutritional levels (Proximate analysis) of selected local raw materials

Selected raw materials	Proximate Analysis (%)				
	Protein	Carbohydrate	Lipid	Ash	Moisture
Trash fish	57,46	1,14	7,04	20,80	13,20
Mysid	45,54	2,26	6,20	31,90	14,10
Squid	70,74	2,62	10,90	4,90	11,20
Blood meal	80,55	1,05	2,70	3,70	12,00
Worm meal	41,99	25,41	5,40	16,50	10,70
Shrimp head meal	48,06	8,64	4,80	25,40	13,10
Saga	41,15	30,55	11,80	3,50	13,00
Soy bean	45,82	20,28	19,40	4,20	10,30

Table 2. Profile and availability of Essensial Amino Acids (EAA) and Non EAA of selected local raw matrials from Central Java.

Raw materials	EAA (mg/gr. amn.acd)										
	Arg	Lys	His	Ph	Tyr	Leu	Iso	Met	Va	Thr	Tryp
Trash fish	75	87	24	42	35	75	45	34	51	42	7
Mysid	77	70	21	49	44	78	50	26	56	42	6
Squid	75	79	19	44	43	80	48	35	45	42	8
Blood meal	54	90	57	66	35	111	41	15	70	47	17
Worm meal	52	55	23	2	51	78	47	22	59	47	tr[1]
Shrimp head meal	58	58	24	55	47	73	46	27	62	46	10
Saga	78	56	16	49	47	75	40	12	50	30	10
Soy bean	87	59	25	50	39	76	47	13	49	38	tr

Raw materials	EAA (mg/gr. amn.acd)						
	Tau	Al	Gly	Glu	Se	Asp	Pro
Trash fish	6	67	73	155	41	99	43
Mysid	9	69	60	151	39	108	44
Squid	19	61	63	153	38	103	44
Blood meal	3	86	38	105	38	91	34
Worm meal	-[2]	61	74	125	44	93	36
Shirmp head meal	7	61	62	153	48	112	50
Saga	-	46	69	177	57	100	45
Soy bean	-	43	43	202	48	113	49

Note : Arg = Arginine; Lys = Lysine; His : Histidine; Ph = Phenylalanine
Tyr = Tyr; Leu = Leusine; Iso = Isoleusine; Met = Methionine
Va = Valine; Thr = Threonine; Tryp = Tryptopan; Tau = Taurine
Al = Alanin; Gly = Glysine; Glu = Glutamic Acid; Se = Serine
tr[1] = Trace
-[2] = No detected

Table 3. Profile and availability of fatty acids (area %) of selected raw materials (animal origin) available in Central Java.

Profile fatty acids	Shrimp head meal	Mysid	Squid	Trash fish	Worm meal	Blood meal
12:0	0,2	0,3	0,8	0,1	1,7	0,6
13:0	2,3	0,8	0,4	0,2	1,6	0,5
14:0	3,4	4,0	2,5	3,7	1,3	0,7
15:0	1,3	1,2	0,7	0,5	0,7	0,1
16:0	30,6	16,6	27,6	19,8	21,3	28,1
16:1n-7	2,6	13,7	1,0	6,1	0,5	1,4
17:0	1,3	1,8	1,3	0,3	1,0	0,2
16:3n-6	0,5	0,9	0,1	0,7	0,4	0,1
16:3n-3	0,4	1,0	1,7	0,4	0,1	0,3
16:4n-1	-[2]	0,1	0,1	0,4	tr[1]	0,3
18:0	10,2	8,1	8,3	5,7	5,0	10,1
18:1	20,0	10,3	4,7	23,2	15,9	32,3
18:2n-6	9,3	3,9	0,3	1,2	8,9	14,3
18:3n-6	0,4	0,9	0,2	0,1	0,2	0,2
18:3n-3	0,3	3,6	0,1	0,7	0,2	0,2
18:4n-3	0,1	0,7	0,1	1,4	0,4	-
18:4n-1	0,2	tr	tr	0,1	0,1	-
20:0	0,8	0,4	0,2	0,1	0,1	0,3
20:2n-6	0,5	0,3	0,3	0,1	0,1	0,2
20:3n-6	0,1	0,1	tr	tr	0,1	0,5
20:4n-6	0,7	3,7	5,7	1,0	0,1	4,4
20:3n-3	0,1	0,2	1,1	0,1	0,3	tr
20:4n-3	0,1	0,2	0,1	0,6	0,1	-
20:5n-3	1,3	6,8	7,6	9,9	0,1	0,1
22:0	1,1	0,4	0,1	0,1	tr	0,2
22:1	1,7	0,1	0,5	0,7	3,2	-
22:4n-9	0,3	0,2	0,3	0,4	0,9	-
22:4n-6	-	0,1	0,5	0,1	0,2	0,4
22:5n-6	-	0,4	1,9	0,2	-	0,4
22:5n-3	0,3	0,4	0,7	1,8	1,1	0,2
22:6n-3	1,0	1,9	25,9	12,4	2,1	1,5
Σsaturate	51,2	43,6	41,9	30,5	32,7	40,8
Σmonoene	27,4	24,6	8,2	32,0	25,4	34,1
Σn-6	11,5	9,8	?6,6	3,1	9,8	19,7
Σn-3	3,6	14,8	37,3	27,3	4,4	2,3
Σn-3 HUFA	2,8	9,5	35,4	24,8	3,7	1,8
Lipid (% d.b)[3]	4,8	6,2	10,9	7,4	5,4	2,7
Moisture	13,1	14,1	11,2	3,7	10,7	12,0

Note : tr[1] = Trace
-[2] = No detected
(%d.b) = Dry basis (%)

Table 4. Profile and availabity of fatty acids (area %) of selected raw matrials (plant origin) available in Central Java.

Profile Fatty Acids	Soy Bean	Saga
12:0	tr[1]	0,3
13:0	0,1	0,1
14:0	0,1	0,1
15:0	-[2]	tr
16:0	11,1	10,5
16:1n-7	0,1	0,2
17:0	0,1	0,1
16:3n-6	tr	tr
16:3n-3	-	-
16:4n-1	-	-
18:0	4,1	6,0
18:1	23,1	33,4
18:2n-6	52,9	41,0
18:3n-6	0,2	0,3
18:3n-3	6,6	3,4
18:4n-3	0,1	0,1
18:4n-1	-	-
20:0	0,4	0,8
20:1	0,2	0,4
20:2n-6	-	tr
20:3n-6	-	tr
20:4n-6	-	-
20:3n-3	-	-
20:4n-3	-	-
20:5n-3	-	-
22:0	0,5	1,7
22:1	-	0,1
22:4n-9	-	0,1
22:4n-6	-	-
22:5n-6	-	-
22:5n-3	-	-
22:6n-3	-	0,1
Σsaturate	16,4	19,6
Σmonoene	23,4	34,1
Σn-6	53,1	41,3
Σn-3	6,7	3,6
Σn-3 HUFA	0,0	0,1
Lipid (% d.b)[3]	19,4	11,8
Moisture	10,3	13,0

Note : tr[1] = Trace
-[2] = No detected
(%d.b) = Dry basis (%)

Table 5. Compotision of experimental diets with protein level of 30% and 35% (per 100 gr).

Ingredients	Protein level of 30%	
	80% animal protein + 20% plant protein	100% animal protein
Trash fish	12,53	15,56
Squid	10,18	12,72
Mysid	21,08	26,35
Soy beon	6,55	-
Saga	7,29	-
Flour	38,87	41,77
Lecithin	1	1
Top Mix	2	2
CMC	0,5	0,5

Ingredients	Protein level of 35%	
	80% animal protein + 20% plant protein	100% animal protein
Trash fish	14,62	18,27
Squid	11,87	14,48
Mysid	24,59	30,74
Soy beon	7,64	-
Saga	8,51	-
Flour	29,27	32,65
Lecithin	1	1
Top Mix	2	2
CMC	0,5	0,5