

## Use of Slaughter House Waste as a Feed for Shrimps & Prawns

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Feeding experiments with some shrimps and fishes (*Metapenaeus monoceros*, *M. dobsoni*, *Sarotherodon mossambicus* and *Eetroplus suratensis*) using slaughter house waste as food, showed that the shrimps and *Sarotherodon* were able to utilize the slaughter house waste more efficiently than *E. suratensis*.

In the cultivation of any animal the factor of major importance is the inexpensive and artificial feed which can ensure rapid growth and high survival rate. One such feed is the slaughter house waste, rich in protein and vitamins. The slaughter house waste is largely used as a feed for trout fry and salmonid culture in other countries. Earlier feeding experiments have been made on the shrimp, *Metapenaeus monoceros* and the fish, *Eetroplus suratensis* using natural, processed and compounded diets<sup>1-5</sup>. The purpose of this study is to evaluate the efficiency of utilization of the slaughter house waste by the test organisms *M. monoceros*, *M. dobsoni* (detritus-animal feeder), *E. suratensis* (phytoplankton-detritus feeder) and *Sarotherodon mossambicus* (scavenger feeder).

Slaughter house waste (mainly beef-liver, lungs and intestine discarded from human use), obtained from the local market, was dried at 70°C, powdered and made into dry pellets. The dried pellets remained bound for 8-10 hr in water. Biochemical analyses of the test diet, made using standard procedures<sup>6-8</sup>, showed per cent composition of carbohydrate, 4.2; protein, 60.9; lipid, 9.6; and ash, 25.3; caloric content (cal/g dry wt), 3640.

Juveniles of *M. monoceros* and *M. dobsoni* (0.5 g) were collected from the backwater areas of Mandovi Estuary (Goa). *E. suratensis* and *S. mossambicus* (4-6 g) were obtained from the Goa State Fish Farm. The shrimps and fishes were divided into 4 groups (10 animals in each) and maintained in glass aquaria (40 × 20 × 20 cm). Groups I-III containing *M. monoceros*, *M. dobsoni* and *E. suratensis* respectively were held in 10 litre sea water (15‰) at 30°C ± 2°C while, group IV having *S. mossambicus* was held in 10 litre freshwater (temp. 30°C ± 2°C). The experimental animals were acclimated to test diet for a week. Prior to the commencement of the experiment they were kept starved for 24 hr. Gain in weight/calorie was taken as an index of growth. The animals were fed *ad libitum* and the quantity of food consumed throughout the experiment was recorded. Faecal matter was collected daily and oven dried. Experiments were run for 15 days during which the shrimps moulted atleast twice.

Calculations of energy conversion were made using the equations given by Crisp<sup>9</sup>. Calorific determinations were made on the test animals, feed and faecal matter using bomb calorimeter. Other experimental procedures were same as reported elsewhere<sup>4</sup>.

The shrimps and fishes accepted the feed, ate and grew and there was 100% survival. In groups I and II, assimilation efficiency (A/C), conversion efficiency values (K<sub>1</sub> and K<sub>2</sub>) and faecal output as a percentage of consumed food were similar (Table 1). The shrimps from group I, although consumed a greater quantity of food per unit weight, their relative growth rate was lower than that of the shrimps belonging to group II. Among the fishes, in group IV, A/C, K<sub>1</sub>, K<sub>2</sub> and the relative growth rates were greater than those in group III. However, per unit weight, the group III fishes consumed a larger quantity of food but converted little into their body tissues. The energy loss through defaecation was high (15.31%) in group III, while, it was only 3.21% in group IV thus resulting in low assimilation efficiency.

Earlier studies have suggested a variety of protein optima for the shrimps. Thus, *Penaeus setiferus*<sup>10</sup>, *P. aztecus*<sup>11</sup>, *P. monodon*<sup>12</sup> and *P. japonicus*<sup>13</sup> have 28-32, 40, 40 and 60% protein optima respectively. Decreased growth at higher protein levels is reported in *P. setiferus*, *P. aztecus* and *P. monodon*<sup>10-12</sup> fed a diet of 42-52% protein. Present results confirm the earlier reports<sup>1-3</sup> that the optimum growth associated with an efficient utilization of feed requires a protein optimum of 60% in the diet. However, Goswami and Goswami<sup>14</sup> have obtained good growth in *M. monoceros*, *M. affinis* and *M. dobsoni* fed 30-40% protein food using the slaughter house waste as a major source of feed. The conversion efficiency values obtained in the present study agree very closely with those obtained by Goswami and Goswami<sup>14</sup>.

In *M. monoceros* the feeding experiments have been carried out atleast with 20 different feeds<sup>1-3</sup>. When one considers the information available for *M. monoceros*, *M. dobsoni* and *M. affinis*, there is wide

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Table 1—Energy Balance of Some Shrimps and Fishes Fed Slaughter House Waste

(Values are expressed as cal/animal)

	Group I <i>M. monoceros</i>	Group II <i>M. dobsoni</i>	Group III <i>E. suratensis</i>	Group IV <i>S. mossambicus</i>
Initial dry wt ( $w_1$ -g)	0.083	0.091	0.1334	0.3808
Final dry wt ( $w_2$ -g)	0.147	0.196	0.1685	0.5017
Weighted mean ( $\bar{w}$ -g)	0.115	0.1435	0.151	0.4413
Initial calories ( $I_1$ )	325	336	539	1510
Final calories ( $I_2$ )	774	769	753	2093
Production ( $P = I_2 - I_1$ )	449	433	214	583
Consumption (C)	3953	4012	8311	7361
Faecal output (F)	474	481	1272	236
Assimilation ( $A = C - F$ )	3479	3531	7039	7125
Metabolism ( $R = A - P$ )	3030	3098	6750	6542
Assimilation efficiency ( $A/C \times 100$ )	88.01	88.01	84.69	96.79
Gross growth efficiency ( $P/C \times 100$ or $K_1$ )	11.36	10.79	2.57	7.92
Net growth efficiency ( $P/A \times 100$ or $K_2$ )	12.91	12.26	3.04	8.18
Consumption/unit wt/d (g)	0.629	0.512	1.008	0.305
Relative growth rate [ $P/\bar{w}/d - g$ ]	0.037	0.049	0.015	0.018

variation in the  $K_1$  (0.3 to 30%) or  $K_2$  (0.4 to 38%) or  $A/C$  (64 to 93%) values. These variations may probably be attributed to species specificity<sup>14</sup> and also may indicate that these are largely dependent on the quality of food<sup>15</sup>.

In successful fish feeds the protein levels should range from 20 to 60% to accommodate differences in the physiological needs of different fishes<sup>16</sup>. Thus, Delong *et al.*<sup>17</sup>, reported 40 to 55% as the optimum protein requirement for the chinook salmon. The channel cat fish showed optimum growth on 38-40% protein diet<sup>18</sup>. For the common carp, the protein optimum is reported to be 38%<sup>19</sup>. The conversion rate in the 0 group plaice was high on a diet containing 50-70% protein<sup>20</sup>. Earlier reports on *Etroplus* have indicated a protein requirement of 60-80%<sup>4</sup>. The low conversion values obtained in *E. suratensis* in this study may probably be attributed to the source of protein. For *S. mossambicus*, 60% protein (animal source singularly) appears to be optimum. Bayne *et al.*<sup>21</sup>, have reported good growth in *Sarotherodon* when it was fed on supplemented feeds containing coffee pulp.

A review of the literature shows that  $K_2$  values range from 8% in the adult carps fed detritus and algae<sup>22</sup> to 44% in the young *Ophiocephalus striatus* fed young fishes and prawns<sup>23</sup>. The average conversion efficiency for flat fishes lies between 19.9 and 38%<sup>24</sup>. *S. mossambicus* fed different proportions of *Spirogyra* and liver<sup>25</sup> gave  $K_2$  values ranging from 15.8 to 26%. In *E. suratensis*  $K_2$  values have been reported to range from 3 to 11% when fed diets containing low protein and

high carbohydrates<sup>5</sup>. In the present study  $K_2$  values in *E. suratensis* and *S. mossambicus* were 3.04 and 8.18% respectively. This shows that *S. mossambicus* is able to utilize the animal protein more efficiently than *E. suratensis*.

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