ENERGY CONVERSION IN THE PRAWN *METAPENAEUS DOBSONI* (MIERS) FED ON ARTIFICIAL FEED

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ABSTRACT

Measured quantities of feed containing 33.33% by weight of tapioca powder, 16.67% of rice bran, 41.67% of fishmeal and 8.33% of mineral supplements (Starmin PS), made into pellets, using agar-agar as binding agent, were fed to *Metapenaeus dobsoni*. Mean gross and net conversion (growth) efficiencies, K_1 and K_2 were 39.62% and 49.34%. Average assimilation efficiency was of the order 80.99%.

INTRODUCTION

Studies on the nutritional requirements, conversion efficiencies and growth rate of prawns using different compounded diets are essential for formultaing a nutritionally balanced and economical feed that would yield a higher growth rate. The present work is an attempt to study the energy conversion in the prawn *Metapenaeus dobsoni* fed on artificial diet.

MATERIAL AND METHODS

Juveniles of *M. dobsoni* collected from Cochin backwaters were acclimatized in the laboratory tanks for a day. Three healthy specimens of a same size group (total length: 40-45 mm) were weighed collectively for each set of experiments in a monopan electric balance after blotting out water with the help of filter paper. Care was taken not to press or squeeze out water from the gill chambers. They were kept in round troughs of size 25 cm diameter and 12 cm height, containing about 4 litres of fresh filtered sea water. Another set of prawns similar to the ones used for the feeding experiments were also weighed in the same way and kept for drying and for subsequent chemical analysis. Every morning a known quantity of compounded feed was given *ad libitum*. Before feeding on the next day, the faecal matter and the food left over were removed and stored separately in pre-weighed petridishes. To remove salt the following procedure was adopted. The faecal matter and feed were transferred separately on to a piece of No. 20 bolting silk kept over a petridish. Distilled water was poured

over this to wash the adhering salt and the water collected in the petridish below was removed. This procedure was continuously done until the water collected in the petridish was free of salt. Then, the bolting silk was kept over a filter paper to remove the excess water. Later, the mass was transferred to a pre-weighed petridish, dried in a hot-air oven at 55°C, and stored in a dessicator. The faecal matter and excess feed were thus retrieved without any loss. At the end of the experiment the faecal matter and left-over feed were weighed and the nitrogen contents were etimated, following the semi-microkjeldahl method, using digestion mixture of potassium sulphate and copper sulphate in the ratio 10 : 1 W|W with a pinch of selinium dioxide. The liberated ammonia was trapped in 10 ml of 2% methyl red and 2% methylene blue dissolved in rectified spirit in the ratio 2 : 1 V|V was found to be useful. An aqueous mixture of 50% sodium hydroxide and 5% sodium thiosulphate was used as alkali mixture. By this method, finely powdered entire prawn, faecal matter, feed and moult were treated for nitrogen estimation. The values were expressed in terms of nitrogen units as such, instead of in terms of protein.

Each experiment was conducted for a period of 10 days. The pelleted feed, of the size 3-5 mm long and 3 mm diameter used in the experiments, was a mixture of 33.33% tapioca powder, 16.67% rice bran, 41.67% fishmeal and 8.33% mineral supplement (Starmin PS) bound by agar-agar, as the growth-response studies conducted earlier had shown these ratios of the ingredients to yield the best growth rate (Thomas et al, MS).

Results and Discussion

The nitrogen content of the feed was estimated to be 4% by weight, equivalent to 25% protein. The dry weight of the prawns was 23.62% (range: 22.98-24.72%) of the wet weight after drying at 55°C. The nitrogen content of prawns was 10.56% of the dry weight. The nitrogen content of the faecal matter varied from 1.87% to 2.38% of the dry weight, with a mean of 2.19%. The energy spent in moulting was difficult to estimate because the prawns moulted generally at night and ate away some part of the exuviae. So, the number of moulting in each experimental trough was noted down and the remaining portion of the moult was collected, washed, dried and weighed.

Another series of experiments were conducted to determine the quantity of matter lost through exuviae for calculating the nitrogen budget. *M. dobsoni* of known weights (weight: 0.579 to 1.004 g; total length : 40-50 mm) were kept individually in glass troughs and every early in the morning the troughs were examined for exuviae. The ones which moulted were considered for calculation. It was found that the mean moult weight was 7.90% of the dry weight of the whole prawn. The nitrogen content of the moult was found to be 1.12%. Since the number of moultings in each experiment was thus known, the quantity of energy lost at moulting could be calculated (Table 1).

TABLE 1. *Estimates of energy used for moult in* M. dobsoni.

Experiment number	1	2	3	4	5	6
No. of prawns used	3	3	3	3	3	3
No. of moults collected	6	5	2	2	4	5
No. of moults per animal	2.00	1.67	0.66	0.66	1.33	1.67
Dry wt. of moult as percentage of mean dry wt. of prawn	15.80	13.19	5.21	5.21	10.51	13.19
Dry wt. of exuviae (mg)	25.95	21.73	10.77	11.80	25.53	48.36
Nitrogen in exuviae	0.315	0.264	0.136	0.143	0.307	0.587
			Mean			0.291

In the calculation the equations given by Easterson (1974) were used. The assimilation efficiency of the feed was considerably high. The consumption rate of the feed per day, in percentage of body weight, was much more than that reported by Deshimaru and Shigeno (1972) for *Penaeus japonicus*. So also, the rate of growth in *M. dobsoni* fed on the present feed was much better than that observed in *P. japonicus* with the 17 different types of feed by those authors. Although higher assimilation efficiency (93.32%) had been found in *Metapenaeus monoceros*, when fed on estuarine detrirus (Qasim and Easterson 1974), the growth (conversion) efficiency (K_1) and net growth (conversion) efficiency (K_2) had been much less (average K_1 = 21. 60% and average K_2 = 24.10%) when compared with *M. dobsoni* fed on the present artificial feed (mean K_1 = 39.62% and mean K_2 = 49.34%). Moreover, more detritus was assimilated by *M. monoceros* but it exhibited less growth. But with the artificial feed used in the present study, *M. dobsoni* gave higher growth rate, indicating the higher efficiency of the feed.

The assimilation efficiency of the feed ranged from 78.10% to 84.90% in the six experiments conducted during the present studies (Table 2) with an average of 80.99%, while the gross conversion efficiency varied from 35.95% to 44.50% (mean = 39.62%). The net conversion efficiency in the different experiments exhibited a range between 46.62% and 54.90% (mean = 49.34%). The trophic coefficient was estimated to be 2.3-2.8 (mean = 2.5). The consumption rate per day in percentage of body weight was showing slight variation (from 9.2 to 12.2 with mean of 12.2). The growth rate per day, in percentage of body weight, was from 4.9 in the sixth experiment to 11.4 in the first (mean = 8.5). Based on these values, the nitrogen budgent was:

assimilation = 80.18% (growth = 38.79%; moult = 0.60%; metabolism = 40.79%) and faeces = 19.82%.

TABLE 2. *Energy balance sheet of* M. dobsoni *after* 10 *days growth.*

Experiment number	1	2	3	4	5	6
Initial weight (mg)	307.3	329.1	536.9	597.1	673.1	1115.5
Final weight (mg)	1121.6	1092.1	1269.8	1370.1	1416.2	1846.7
Gain in weight (mg)	814.3	762.9	732.9	773.0	743.1	731.2
Gain in weight in terms of prawn weight (mg)	187.3	176.9	168.5	177.7	172.7	180.9
Weight of exuviae (mg)	25.95	21.73	10.77	11.80	25.53	48.36
Consumption of feed in terms of weight of prawn (mg)	1314.7	1158.3	1099.8	1062.4	1237.2	1369.4
Weight of faeces (mg)	405.3	426.1	355.3	406.6	452.8	553.4
Assimilation efficiency (%)	81.93	78.10	84.90	81.04	79.99	75.97
Gross conversion efficiency (%)	32.21	40.88	40.74	44.50	37.47	35.85
Net conversion efficiency (%)	46.64	52.35	47.99	54.90	46.85	47.32
Trophic coefficient	2.6	2.4	2.5	2.3	2.7	2.8
Consumption in percentage weight per day	18.40	9.27	12.18	10.02	11.84	9.25
Growth rate in weight per day in percentage body weight	11.40	10.74	8.11	8.75	7.11	4.94

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