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Influence of Size and Maturity on Food Conversion Efficiency in the Spiny Lobster *Panulirus homarus* (Linnaeus)

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Abstract

The effect of size and maturity on food conversion efficiency of the spiny lobster, *Panulirus homarus* was studied using clam meat as feed. Rates of feeding, assimilation, metabolism and conversion showed negative correlation with increase in size. Maximum feeding rate of 254.87 j g^{-1} day^{-1} was recorded in the smallest size group (13.17g). Net energy conversion efficiency, excluding exuvia, was highest - 15.4% - in the smallest size group and decreased to 6.6% in the biggest size group (256.66g). Considerable quantity of converted energy was lost as exuvia and the loss showed a positive correlation with increase in size. Total energy budget has been estimated for different size groups. Onset of maturity induces definite changes in feeding, conversion and metabolic rates in *P. homarus*.

Introduction

Juveniles of *Panulirus homarus* have been grown to market size in the laboratory (Vijayakumaran and Radhakrishnan, 1995) and few studies were made on their food conversion efficiency (Vijayakumaran and Radhakrishnan, 1984, Radhakrishnan, 1989) in relation to the quantity and quality of food and in bilaterally eyestalk ablated lobsters. The present study examines, the effect of size and maturity on food and protein conversion efficiency.

Materials and Methods

The spiny lobster, *P.homarus* collected from bottom-set gill net were reared in five groups. The experimental period ranged from 87 to 205 days. The meat of the clam, *Meretrix casta,* was fed *ad libitum* in the evening and uneaten food and faeces were collected the subsequent day morning. IBP scheme of energy balance (Petrusewicz and Mefadyen, 1970) was followed in the study. Ammonia, was estimated biweekly using phenol-hypochlorite method of Solorzano (1969) and was converted to its energy equivalent (Brafield, 1955).

Results and Discussion

Growth, expressed as weight increase per day (0.33 to 0.39g) did not vary with size but with the inclusion of exuvia weight, a positive correlation of weight increase with increase in size emerged. The intermoult period also showed a positive correlation with size increase.

The feeding rate was maximum (254.87±9.04 j g^{-1}day) in the smallest size group and proportionately reduced to 107.45 11.2 j $g^{-1}day^{-1}$ in the biggest lobsters in the study. Conversion rate also showed a negative correlation with increase in size. Net energy conversion efficiency, without exuvia, was maximum (15.40%) in the smallest size and minimum (6.60%) in the biggest group. Maximum net conversion efficiency with exuvia was 19.41% in the smallest size group. Food conversion ratio (FCR) was lowest (1.79) in the smallest size and increased with size to 5.12 showing a positive correlation. The food conversion efficiency reported here is significantly more than those reported earlier for the same species (3.4 - 10%), (Vijayakumaran and Radhakrishnan, 1984). Thus, increasing feeding rate beyond optimum level will not result in enhanced conversion in *P. homarus. P. homarus* loses enormous quantity of converted food as exuvia. The mean loses range from 47.05 to 82.76 as dry weight, 28.91 to 68.75% as protein and 17.76 to 44.68% as energy. The loss is 83.76%, 75.89% and 39.84% more in the big adult lobsters than early juveniles in terms of wet weight, dry weight and protein respectively. The difference in energy loss is as high as 151.57%. The highest (204.45 j g

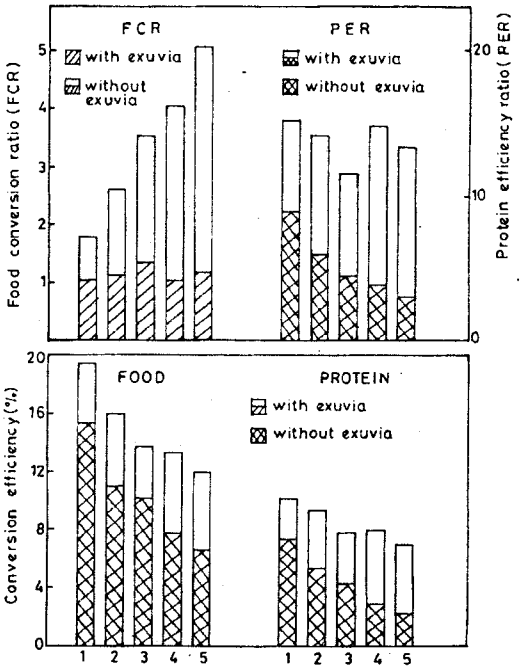

Fig. 1. Food conversion efficiency, protein conversion efficiency, food conversion ratio and protein efficiency ratio in different size groups of *P.homarus*.

Table 1. Energy budgets for different size groups of *P.homarus* fed with clam meat

Size Group	Energy parameter				
	C	F + U	E	P	R
I (13.17g)	100	3.45±0.02	4.00±0.62	15.40±3.59	77.15±10.27
II (48.00g)	100	2.94±0.01	5.07±0.75	11.01±3.21	80.98±9.17
III (100.83g)	100	4.51±0.03	4.51±0.73	9.22±2.89	81.76±5.65
IV (165.25g)	100	3.72±0.01	5.66±1.29	7.77±2.10	82.85±7.52
V (256.66g)	100	2.92±0.03	5.34±0.85	6.60±2.69	85.14±1.46

C = Consumption; E = Exuvia; F = Faeces; P = Growth (Production); U = Urine; R = Metaboslim

$^{1}day^{-1}$) and the lowest (97.87j $g^{-1}day^{-1}$) metabolic rates were calculated for highest and lowest feeding rates and showed a negative correlation with increase in size.

Apart from size, the physiological state of the animal has been shown to affect feeding rate and conversion resulting in animals of equal size showing variable feeding and conversion. The difference is attributed to the physiological ageing of the species. *P. homarus* attains first maturity at around 50 mm carapace length and 140-150 g weight (Vijayakumaran, 1990). The mid body weight of the third group of lobsters in this study is 137.1g, nearer to the size at which first maturity is observed. Significant reduction in feeding, conversion and metabolic rates were recorded in the fourth group of lobsters compared to the third group in this study, which can be attributed to attainment of maturity or physiological ageing.

Rates of feeding, conversion and absorption of protein, protein conversion efficiency (PCE) and protein efficiency ratio (PER) showed a negative correlation with increase in size (Fig.1). Protein conversion efficiency was significantly lower than net conversion efficiency in all size groups suggesting utilization of protein for metabolic purpose. PER did not show size dependent variation in *P. homarus* with the inclusion of exuvia and ranged from 1.16 to 1.53.

Ammonia excretion was maximum (12.24 g N g-1h) in small lobster (29.94 g) and minimum (4.6 gN g-1h) in the lobster with average body weight of 264.84 g. Ammonia excretion decreased with size and was negatively correlated with weight increase.

The total energy budgets calculated for various size groups (Table 1) reveals that 2.92 to 4.51% energy consumed was lost as faeces and urine and it is not size dependent. The loss is considerably low compared to that in the giant fairy shrimp, *Bronchionecta gigas* (Daborn, 1975). Energy converted as live weight gain (growth) showed a negative correlation (15.4 - 6.6%) with increase in size. Bulk of energy consumed was used for metabolism (77.15% in small to 88.14% in the biggest size group) and it was inversely related to growth.

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