EFFECT OF EYESTALK ABLATION IN THE SPINY LOBSTER *PANULIRUS HOMARUS* (LINNAEUS): 2. ON FOOD INTAKE AND CONVERSION

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ABSTRACT

Eyestalk ablation induced hyperphagia and increased food consumption by 50 to 75% in *Panulirus homarus*. Feeding rate decreased with increase in size, in both ablated and control lobsters. In ablated lobsters the conversion efficiency was maximum at low feeding rate. The percent loss of converted food as exuvia was an average of 43.2% in ablated and 64.0% in control lobsters.

INTRODUCTION

Bilateral eyestalk ablation enhances moulting frequency and weight gain in the spiny lobster *Panulirus homarus* (Radhakrishnan and Vijayakumaran 1982, 1983, and Silas 1983). The accelerated moulting frequency is attributed to the removal of Moult Inhibiting Hormone (MIH) factors as a result of the eyestalk ablation. The influence of increased food intake and conversion leading to higher weight gain in ablated *P. homarus* has been studied. A report on the effect of eyestalk ablation on increased food consumption, conversion ratio and accelerated growth rate in the American lobster, *Homarus americanus* is available (Castell et al 1976), but no such study has been carried out so far on palinurid lobsters.

MATERIAL AND METHODS

P. homarus, ranging in carapace length from 24.3 mm and in weight 14 g (juveniles) to 71. 7 mm and 297 g (adults), were used in this study. In experiments I to V clam meat (of *Meretrix casta*) was fed *ad libitum* twice daily, in the morning (1100-1400 hrs) and in the evening (1700-0800 hrs). In experiment VI, equal quantity (equivalent to the *ad libitum* quantity fed to the control) was fed to the ablated and control lobsters in the evening. In experiment VII, lobsters were fed *ad libitum* food once a day (evening). (For further details refer Radhakrishnan and Vijayakumaran 1983.) The temperature in the culture system ranged from 26 to 33.8°C.

Feeding rate, conversion rate, gross conversion efficiency and conversion factor, in terms of wet/dry weight food to live weight animal, were calculated using the following equations Pandian and Vivekanandan 1976):

$$\text{Feeding rate} = \frac{\text{food consumed (wet/dry) (mg)}}{\text{gram live body weight x number of days}}$$

$$\text{Conversion rate} = \frac{\text{live weight gain (mg)}}{\text{gram live body weight x number of days}}$$

(Gram live body weight mentioned above is the mid point of initial and final weights.)

$$\text{Gross conversion efficiency (\%)} = \frac{\text{live weight gain x 100}}{\text{food consumed (wet/dry)}}$$

$$\text{Conversion factor} = \frac{\text{food consumed (wet/dry)}}{\text{live weight gain}}$$

RESULTS

Eyestalk ablation induced hyperphagia and increased food consumption by 50-96.5%. Feeding rate, conversion rate, conversion efficiency and conversion factor, calculated in terms of wet weight of food consumed to live weight gain and dry weight of food to live weight gain, are presented in Tables 1 and 2 respectively. Food consumption decreased with increase in size in both ablated and control lobsters, the decrease being only 33% in ablated and 46% in the controls. Gross food conversion efficiency (excluding weight of exuvia), in terms of dry weight of food, decreased in control lobsters from 38.4% in juveniles to 13.3% in mature ones. When exuvia weight was also included in the calculations, the same figures ranged from 78% in juveniles to 58% in mature adults. No such definite trend was noticed in ablated lobsters. Food offered remaining equal in control and ablated lobsters, as in experiment VI, the feeding rate of ablated individuals was much less (36.2 mg/g live body weight/day) compared to the controls (46.7 mg). This was due to the fact that average weight (mid point of initial and final weights) of ablated individuals was much higher (105.2 g) than the controls (75.7 g), resutling from the faster growth rate in ablated lobsters. Food conversion efficiency in this experiment, however, was more than double in ablated lobsters (112.5% without exuvia and 172.0% including exuvia) compared to that of the controls (29.8% without exuvia and 76.0% including exuvia). The lowest food conversion factor (0.9 and 0.6 without and with exuvia, respectively) also was rcorded in this experiment for ablated lobsters (Table 2). In experiment VII, where food was offered *ad libitum* once daily, food consumption of ablated lobsters was almost twice that of the controls and food conversion efficiency more than double (without exuvia weight). This conversion efficiency compares well with those obtained in experiments I-V where food was offered *ad libitum* twice daily.

TABLE 1. *Feeding rate, conversion rate, conversion efficiency and conversion factor, on the basis of wet weight of feed to live weight of the eyestalk-ablated (A) and control (C)* P. homarus.

Expt. No. & duration (days)	No. of animals	Treatment	Feeding schedule	Weight (g) Initial and Final	Feeding rates (mg)	Conversion rate (mg) excluding wt. of exuvia	Conversion rate (mg) including wt. of exuvia	Conversion efficiency (%) excluding wt. of exuvia	Conversion efficiency (%) including wt. of exuvia	Conversion factor excluding wt. of exuvia	Conversion factor including wt. of exuvia
I (108)	14	A	*a.l.*	204-131.0 (75.7)*	117.30	13.53	24.10	11.5	20.5	8.7	4.9
	14	C	t.d.	24.8-62.5 (43.7)	79.62	7.95	16.20	10.0	20.3	10.0	4.9
II (98)	18	A	*a.l.*	49.7-184.3 (117.0)	94.61	12.37	22.90	13.1	24.2	7.6	4.1
	12	C	t.d.	48.8-71.3 (59.1)	72.3	4.60	11.80	6.4	16.3	15.6	6.1
III**											
IV (36)	4	A	*a.l.*	169.0-255.0 (212.0)	73.85	11.27	21.80	15.3	29.5	6.5	3.4
	4	C	t.d.	169.3-181.0 (175.2)	41.92	1.86	6.80	4.4	16.2	22.7	6.2
V (61)	6	A	*a.l.*	256.0-408.0 (332.0)	71.54	7.43	13.90	10.4	19.4	9.6	5.2
	6	C	t.d.	250.3-272.5 (261.4)	40.38	1.39	6.10	3.4	15.1	29.4	6.6
VI (63)	5	A	e.	69.4-141.0 (105.2)	36.92	10.80	16.60	29.3	45.0	3.4	2.2
	5	C	o.d.	66.0-83.4 (74.7)	47.69	3.70	9.40	7.8	19.7	12.8	5.1
VII (42)	6	A	*a.l.*	72.6-123.8 (98.2)	87.69	12.41	20.70	14.2	23.6	7.0	4.2
	6	C	o.d.	72.2-80.8 (76.5)	44.62	2.77	7.20	6.2	16.1	16.1	6.2

* Values in parenthesis show the mid point of initial and final w ights

** Not included for feed conversion studies since different diets were given initially to the group

a.l. = *ad libitum;* t.d. = twice daily; o.d. = once daily; e = equal quantity.

TABLE 2. *Feeding rate, conversion rate, conversion efficiency and conversion factor, on the basis of dry weight of feed to live weight of the animal, in eyestalk ablated (A) and control (C)* P. homarus.

Expt. No. & duration (days)	No. of animals	Treatment	Feeding schedule	Weight (g) Initial and Final	Feeding rates (mg)	Conversion rate (mg) excluding wt. of exuvia	Conversion rate (mg) including wt. of exuvia	Conversion efficiency (%) excluding wt. of exuvia	Conversion efficiency (%) including wt. of exuvia	Conversion factor excluding wt. of exuvia	Conversion factor including wt. of exuvia
I (108)	14	A	*a.l.*	20.4-131.0 (75.7)*	30.5	13.53	24.10	44.4	79.0	2.3	1.3
	14	C	t.d.	24.8-62.5 (43.7)	20.7	7.95	16.20	38.4	78.0	2.6	1.3
II (93)	18	A	*a.l.*	49.7-184.3 (117.0)	24.6	12.37	22.90	50.3	93.0	2.0	1.1
	12	C	t.d.	48.8-71.3 (59.1)	18.8	4.60	11.80	24.5	63.0	4.1	1.6
III** IV (36)	4	A	*a.l.*	169.0-255.0 (212.0)	19.2	11.27	21.80	58.7	114.0	1.7	0.9
	4	C	t.d.	169.3-181.0 (175.2)	10.9	1.90	6.80	17.0	63.0	5.9	1.6
V (61)	6	A	*a.l.*	256.0-408.0 (332.5)	18.6	7.40	13.90	40.0	75.0	2.5	1.4
	6	C	t.d.	250.3-272.5 (261.4)	10.5	1.40	6.10	13.3	58.0	7.5	1.9
VI (53)	5	A	e.	69.4-141.0 (105.2)	9.6	10.80	16.60	112.5	172.0	0.9	0.6
	5	C	o.d.	66.0-83.4 (74.7)	12.4	3.70	9.40	29.8	76.0	3.4	1.3
VII (42)	6	A	*a.l.*	72.6-123.8 (98.2)	22.8	12.40	20.70	54.5	91.0	1.8	1.1
	6	C	o.d.	72.2-80.8 (76.5)	11.6	2.80	7.20	23.9	62.0	14.2	1.6

* Values in parenthesis show the mid point of initial and final weights

** Not included for feed conversion studies since different diets were given initially to the group

a.l. = *ad libitum*; t.d. = twice daily; o.d. = once daily; e = equal quantity.

3. The difference in percent loss of converted food as exuvia between ablated and control juveniles was only 7%, whereas it was about 30% in adults.

It is observed here that, at low feeding rate (1% dry food/g live body weight as in Experiment VI), the ablated *P. homarus* converted food to tissue more efficiently, although the growth rate was about 30% less compared to the

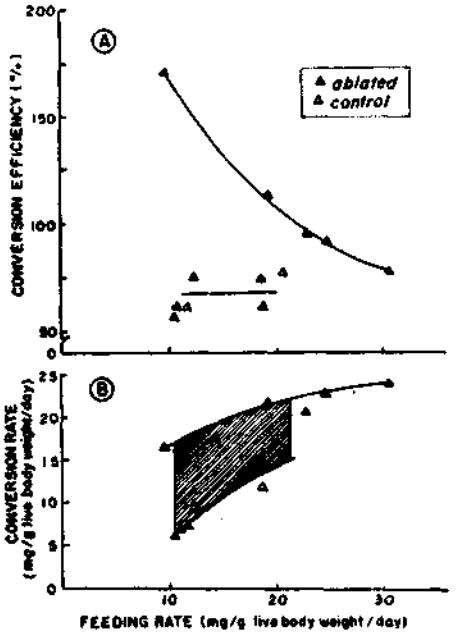

FIG. 1. Conversion efficiency (A) and conversion rate (B) in relation to feeding rate in eyestalk-ablated and control *P. homarus*. Shaded position indicates the quantum of difference in conversion rate induced by ablation.

groups fed once or twice *ad libitum* (2.3-2.5% dry food/g live body weight) of more or less similar size, as in Experiments II and III. Since all the controls in these experiments were fed *ad libitum* levels, no such relationship could be worked out for them. This observation is in agreement with the view of Paloheimo and Dickie (1966) that at low feeding levels poikilothermic organisms convert food to tissue more efficiently but with reduced growth rate and at higher feeding levels increased growth rates are obtained at the expense of lower conversion efficiency. The optimum feeding level necessary to obtain maximum conversion efficiency and growth rate is yet to be worked out for eyestalk-ablated *P. homarus*. Conversion efficiency of 44 to 112.5% (without exuvia) recorded in ablated *P. homarus* exceeds the approximate limit of 50% conversion efficiency suggested by Sedgewick (1979) for economically viable penaeid prawn culture. This study reveals the possibility that maximum weight gain can be obtained in ablated lobsters by optimising feed, which will also reduce the production costs

of the culture system. The high conversion, and the substantial weight increase of lobsters in shorter duration opens up scope for economically feasible lobster culture, using juveniles which do not fetch reasonable price in the market. Culture of mature lobsters may still be profitable since the absolute weight increase is higher in this group as shown in the present experiments.

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