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Effect of Food Quality on Food Utilisation of the Olive Ridley, *Lepidochelys olivacea*

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Abstract

The olive ridley *Lepidochelys olivacea* hatchlings were offered 4 different types of food *viz*, white prawn, tilapia, green mussel and jellyfish. The feeding rate of the hatchlings ranged from 174.7 J.g^{-1} day^{-1} in the group receiving jellyfish to 525.2 J.g^{-1} day^{-1} in the group receiving green mussel. The rate and efficiency of conversion were maximum in the group receiving combination of all the 4 types of food (K2 = 24.7%). The minimum maintenance, maintenance and optimum feeding rates of the hatchlings were 175, 225 and 450 J.g^{-1} day^{-1}, respectively. The optimum feeding rate (450 J.g^{-1} day^{-1}), was about 85% of the maximum feeding rate (525.2 J.g^{-1} day^{-1}).

Introduction

Although conspicuous advances in the study of olive ridley ecology and conservation have been made in the last two decades, the food preference of this animal is still poorly known. Available published information indicate that the feeding habit of the olive ridleys vary according to the habitat in which they are feeding and they feed on a wide variety of food ranging from floating organisms like jellyfishes to bottom living prawns and Mortimer (1982) concluded that more work needs to be done on the feeding ecology of all the sea turtles, especially on the carnivorous genera like *Lepidochelys*. He also pointed out that information available on the diet of the hatchlings is very much limited. Working on the food intake and growth of the hatchlings of the olive ridley, Vijayakumaran *et al.*, (1984) proved that *L. olivacea* hatchling is a predominant carnivore, and if there is no alternative, may feed on small quantities of sea grass without exhibiting growth. The headstarting programme on the conservation of *L. olivacea* in India and elsewhere includes sea ranching, in which the hatchlings are reared under controlled conditions. The knowledge gained on the effects of different food on the bioenergetic components will be useful in identifying suitable food for maximum growth rate of the hatchlings.

Materials and Methods

To identify the carnivorous food which may enhance the growth rate of *L.olivacea* hatchlings in the laboratory, the hatchlings which emerged from a single nest in the hatchery at Kovalam (near Chennai) were reared in seawater and acclimated to laboratory conditions. For the experiment, 25 healthy individuals (mean live body weight : 106.6 34.71 g; mean carapace length: 81.8 9.6 mm) were selected. The selected individuals were divided into 5 groups of 5 individuals each. For the experiment, dead but fresh white prawn Peneaus indicus, the tilapia *Oreochromis mossambicus*, the green mussel *Perna viridis* and the jellyfish *Crambionella stulhmanni* were chosen. Each test group was offered one of the 4 food and the 5th group was offered an equal proportion of all the 4 food. All the test individuals were fed *ad libitum* for 2 hours. day^{-1} in the morning.

The test individuals were reared separately in circular plastic aquaria of equal size (diameter: 32 cm) and capacity (10 l) for 40 days. The live weight of the test individuals was determined on every 10th day of the experiment. The calorimetric estimations on the turtle, food and faeces were made using a Parr semi-micro bomb calorimeter. The procedures followed for estimation and calculation of food utilisation parameters are described elsewhere (Rajagopalan, 1988).

Results and Discussion

The water content of the different food items ranged from 74.4% (prawn) to 96.6% (jellyfish). The energy contents of prawn, fish and mussel were almost equal (19.0 to 19.3 KJ.g-^{1}) and that of jellyfish (6.6 KJ.g-^{1}) was only about 30% of the energy content of the other food items. There was not much difference in the energy content of faeces produced by the 5 test groups; the average faecal energy content was 3.8 KJ.g dry weight-^{1}.

There was statistically significant difference among the feeding rates of different groups. For instance, the feeding rate of the hatchlings receiving green mussel was 525.2 J.g-^{1} day-^{1} and that of the group receiving fish was only 356.8 J.g-^{1} day-^{1} (Table 1) ($t = 5.16$; $p<<0.05$). The group receiving jellyfish exhibited the lowest feeding rate of 174.7 J.g-^{1} day-^{1}. Thus, *L. olivacea* has the capacity to ingest about 3 times more food (in terms of energy) depending on the type of food. Feeding rate in the group receiving the combination of prawn, fish, mussel and jellyfish was only 330.6 J.g^{-1} day^{-1}. The hatchlings receiving the mixed food consumed the entire quantity of green mussel and prawn and a small quantity of fish; the jellyfish was left uneaten on all the days of the experiment. Since all the 4 diets were offered in equal proportion, selective feeding on green mussel and prawn resulted in about 60% of the feeding rate of the groups receiving exclusively green mussel or prawn.

Table 1 : Effect of different food on food utilisation parameters in L. Olivacea. Rates are expressed as J.g. initial live turtle^{-1} day and efficiencies as %; the values are mean of 5 individuals; ± represents SD

Parameter	Prawn	Fish	Mussel	Jellyfish	Mixed food
Feeding rate	482.3±58.94	356.8±42.40	525.2±68.31	174.7±68.31	330.6±62.21
Assimilation rate	480.0±57.61	344.6±37.32	505.6±113.20	163.4±65.73	316.4±58.80
Conversion rate	60.6±7.80	56.6±5.71	72.8±4.60	-41.7±6.52	78.2±7.51
Metabolic rate	419.4±21.56	288.0±52.42	432.8±40.71	205.1±50.12	238.2±85.32
Assimilation efficiency	98.1±0.42	96.6±2.30	96.3±1.40	93.5±2.71	95.7±0.66
Conversion efficiency					
(K_1)	12.4±2.52	15.8±2.92	13.9±1.02	-	23.7±2.31
(K_2)	12.6±1.91	16.4±2.13	14.4±1.11	-	24.7±2.60

Among the test groups, assimilation rate varied almost in accordance with the feeding rate. The assimilation efficiency ranged from 93.5% (jellyfish-fed group) to 98.1% (prawn-fed group) with an average of 96.0%.

During the 40 day experimental period, the live weight of the hatchlings receiving prawn (from 86 to 216 g) and mixed food (from 107 to 225 g) increased almost uniformly; the live weight of the group receiving mussel (from 115 to 264 g) increased faster than that of the group receiving fish (from 140 to 262 g). The group receiving jellyfish exhibited the slowest growth (from 108 to 152 g).

The group receiving mixed food exhibited the highest conversion rate followed by the group receiving green mussel, prawn and fish (Table 1); the conversion rate of the group receiving mixed food was significantly higher than that of the groups receiving fish ($t = 9.16$; $p<<0.05$) and prawn ($t = 6.5$; $p<<0.05$). The group receiving jellyfish lost 41.7 J.g^{-1} day^{-1}. The net conversion efficiency (K_2) was also the highest in the group receiving mixed food; the K_2 was 24.7% and was significantly higher than that of all the other groups (mean : 14.5%).

The group receiving jellyfish expended the least (205.1 J.g^{-1} day^{-1}) on metabolism, which is only about half of the energy spent on metabolism by the groups receiving prawn and green mussel (Table 1). The groups receiving mixed food (238.2 J.g^{-1} day^{-1}) and fish (288.0 J.g^{-1} day^{-1}) also expended less energy on metablism compared to the groups receiving prawn (419.4 J.g^{-1} day^{-1}) and green mussel (432.8 J.g^{-1} day^{-1}).

The group receiving green mussel exhibited the maximum feeding rate (525.2 J.g^{-1} day^{-1}), but the maximum conversion rate (78.2 J.g^{-1} day^{-1}) was recorded in the group receiving mixed food, eventhough only about 60% of the food was consumed by it. This was possible because the group receiving mixed food (i) ate the preferred food *viz.*, green mussel and prawn in required quantity, supplemented it with a small quantity of fish and discarded jellyfish which was poor in nutrient and energy contents; (ii) the group receiving mixed food allotted only 75.3% of the assimilated energy towards metabolism and diverted 24.7% for growth, whereas the groups receiving prawn, fish and green mussel expended on an average 85.5% towards metabolism; (iii) compared to all other groups, the group receiving mixed food exhibited the highest net conversion efficiency. It appears that *L. olivacea* hatchlings require a wide range of carnivorous food materials from which they can choose energy and nutrient rich food thereby resulting in maximum growth rate.

Figure 1 illustrates the rates of assimilation, conversion and metabolism as functions of the respective feeding rates of *L. olivacea* hatchlings receiving different food. It is evident from the figure that (i) *L. olivacea* hatchlings could just manage to survive if they are fed at a rate of 175 J.g^{-1} day^{-1}; (ii) the hatchlings could exhibit growth if they are fed at a rate more than 225 J.g^{-1} day^{-1} and feeding rate lower than this may result in negative growth; (iii) the conversion rate reaches an asymptote of about 75 J.g^{-1} day^{-1} at a feeding rate of about 450 J.g^{-1} day^{-1}. Hence, the minimum maintenance, maintenance and optimum feeding rates of the 3 to 4 month old *L. olivacea* hatchlings are 175, 225 and 450 J.g^{-1} day^{-1}, respectively.

The optimum feeding rate of 450 J.g^{-1} day^{-1} is about 85% of the maximum feeding rate (mussel-fed group : 525.2 J.g^{-1} day^{-1}). Earlier studies on optimum feeding rate of fishes have conclusively shown that a ration of 70-85% of the maximum feeding rate is the optimum feeding rate under different experimental conditions (Pandian, 1975; Vivekanandan, 1976).

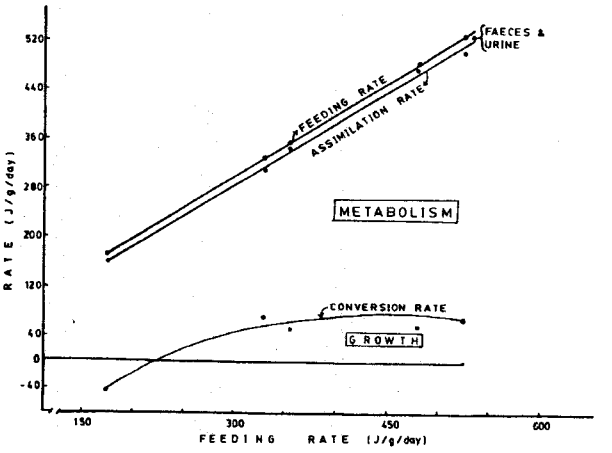

Fig.1 Rates of assimilation, conversion and metabolism as functions of respective feeding rate of *L.olivacea* receiving different food.

The experiment has provided the following clues for laboratory rearing of the hatchlings : (i) The hatchlings have the capacity to increase the feeding rate upto 3 times depending on the food quality. (ii) High feeding rate does not necessarily result in high conversion rate; in fact excess feeding may result in diversion of more energy for expenditure on metabolism. The optimum ration for achieving the maximum growth rate may be about 85% of the maximum feeding rate. (iii) As the hatchlings prefer to feed on a wide variety of food rich in energy and protein contents, they may be offered easily available, high energy food materials like green mussel, which may be augmented with prawn waste and chopped trash fish. Campbell and Busack (1979) also reported that hatchlings of most of the turtles require high protein diet rich in calcium and should be fed daily to stimulate proper growth.

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