

## Effect of Unilateral Eyestalk Ablation on the Biochemical Changes of Edible Portunidae Crab *Portunus sanguinolentus* (HERBST)

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**Abstract:** In the present study was attempted to know the effect of eyestalk ablation on the biochemical composition of the crab, *Portunus sanguinolentus*. After 3 days experimental period, proximate composition was estimated both control and eyestalk ablated crabs. The protein content of the unilateral eyestalk ablated ( $39.81 \pm 1.83\%$ ) crabs was higher than that of control crabs ( $36.15 \pm 1.22\%$ ). The carbohydrate content of eyestalk ablated crabs ( $2.89 \pm 0.85\%$ ) was relatively higher when compared to intact control crabs ( $2.48 \pm 0.23\%$ ). The lipid content of the present study was higher in eyestalk ablated crabs ( $1.81 \pm 0.03\%$ ) rather than intact control crabs ( $1.54 \pm 0.07\%$ ). The ash content of eyestalk ablated crabs ( $7.83 \pm 1.29\%$ ) was relatively higher when compared to intact control crabs ( $7.62 \pm 0.40\%$ ). The moisture content in eyestalk ablated crabs ( $79.15 \pm 4.58\%$ ) was higher when compared to intact control crabs ( $78.24 \pm 3.58\%$ ). The total essential amino acids with eyestalk ablated and control crabs were 47.541% and 46.535% respectively. However, the non essential amino acids were 49.126% and 48.65% in eyestalk ablated and control crabs respectively. The results of the present study clearly shows that eyestalk ablation influenced the biochemical composition, of *P. sanguinolentus*.

### Key words:

### INTRODUCTION

The crabs rank third after shrimps and lobsters for their esteemed seafood delicacy and also the value of fishery they support [1]. Shell fish is one of the most important sources of proteins provided from sea and blue crab is one of the most important among them [2]. The crab meats contains many nutrients like vitamins, carbohydrates, minerals and free amino acids many therapeutic properties are attributed to the crab meat and it is used to cure asthma and chronic fever [3]. Most of marine crabs occurring along Indian coast are belonging to the family portunidae [4]. The commercially important portunid crabs found along Parangipettai coast are *Scylla serrata*, *S.tranquebarica*, *Portunus pelagicus*, *P.sanguinolentus* and *Charybdis freiata*, *C.lucifera*, *C.natator*, *C.granulata* *C.truncata* and *Podopthalmus vigil* [5]. They have very good demand in both Indian and foreign market. In general eyestalk ablation is performed in hatcheries and research experiments to induce gonad development and moulting in commercial crustacean.

But nobody studied the impact of unilateral eyestalk ablation on the biochemical composition in edible crabs in general and *P. sanguinolentus* in particular. Since biochemical studies are more important in nutritional perspective. So in the present study an attempt has been made to know the effect of unilateral eyestalk ablation on the biochemical composition of (Protein, lipid, carbohydrates, ash, moisture and amino acids) the commercial crab *P. sanguinolentus*.

### MATERIALS AND METHODS

The experimental crabs were collected from Parangipettai (Lat.11 °29' N and Long. 79° 46' E) coastal water, (weight of 80-120g and carapace width of 65-84cm) and they were acclimatized to the laboratory conditions (Salinity 30-34 ppt; DO 5.0-6.0 ppm; Temperature 28-30°C, pH 7.5-8.5). The experimental animals were divided into two groups. One group was used for eyestalk ablation experiment and the other was kept as intact control. The unilateral eyestalk ablation was performed in the

experimental crabs by cutting the right eye at its base with a fine and clean scissors and the wound was cauterized immediately with a hot blunt needle in order to prevent the loss of hemolymph and mortality [6]. Both eyestalk ablation and intact control crabs were introduced into synthetic tanks of rectangular shape, having dimensions of 0.5 × 0.35 × 0.35m of length, width and height, respectively. Water exchange was done regularly in the morning. Clam meat was given twice a day as a feed for both experimental and intact control crabs at 10% of their body weight. Excess feed and other debris were removed while water exchange. Optimum water quality parameters were maintained during the experimental period (Salinity 30-34ppt; DO 5.0-6.0 ppm; Temperature 28-30°C, pH 7.5-8.5). Triplicate was maintained for both control and experimental group. After 3 days of experimental period both control and eyestalk ablated crab were dried at 60°C in an oven and used for biochemical analysis. The protein, carbohydrate and lipid, were analyzed by adopting standard method of [7-9], respectively. To calculate the moisture content, 1 g of fresh tissue was oven dried at a constant temperature of 105 °C for 24 hours [10]. The loss of weight was taken as moisture content. Ash content was determined gravimetrically by incinerating 1 g dried sample in muffle furnace at about 550 °C for 6 hours [10] and the result are expressed in percentage. The experimental crab were dried at 60°C for 24hrs in an oven and the dried sample were finely ground for estimating the amino acids in the HPLC (Merck hitachedL-7400) following the method of [11].

### RESULT

Biochemical composition, protein, lipid and carbohydrate contents were found to be higher in eyestalk ablated crabs than in intact control crabs. The protein content was found to be higher in eyestalk ablated crabs (39.81±1.83%) than that of control crabs (36.15±1.22%). Carbohydrate content of eyestalk ablated crabs (2.89±0.85%) was relatively higher when compared to intact control crabs (2.48±0.23%). The lipid content of the present study was also higher in eyestalk ablated crabs (1.81±0.03%) rather than intact control crab (1.54±0.07%). The ash content of eyestalk ablated crab and intact control crab was found to be 7.83±1.29% and 7.62±0.40% respectively and moisture content did not show much variation between eyestalk ablated (79.15±4.58%) and intact control crabs (78.24±3.58%) (Fig. 1). The total values of essential amino acids in eyestalk ablated *P. sanguinolentus* were 47.541%.

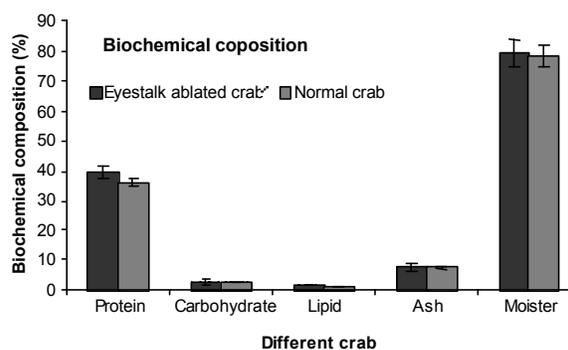


Fig. 1: Biochemical composition of eyestalk and control crabs of *Portunus sanguinolentus*

Table 1: Essential amino acids of control and eyestalk ablated crabs of *P. sanguinolentus*

S.No	Amino acids	Control (%)	Eyestalk ablated (%)
1	Threonine	4.512	4.836
2	Valine	5.635	5.965
3	Arginine	6.905	9.168
4	Methionine	1.024	1.845
5	Isoleucine	4.721	5.175
6	Leucine	8.402	10.334
7	Lysine	7.011	8.117
8	Phenylalanine	3.910	ND
9	Histidine	3.513	3.101
10	Tryptophan	0.897	ND
Total		46.535	47.541

ND-Not Detected

Table 2: Non essential amino acids of control and eyestalk ablated crabs of *P. sanguinolentus*

S.No	Amino acids	Control (%)	Eyestalk ablated (%)
1	Aspartic acid	1.145	N.D
2	Glutamic acid	9.983	9.595
3	Cystine	N.D	0.684
4	Tyrosine	2.013	2.154
5	Taurine	4.548	ND
6	Alanine	3.039	4.137
7	Aspargine	10.675	11.295
8	Glycine	3.221	5.589
9	Proline	4.827	5.781
10	Serine	9.199	9.891
Total		48.65	49.126

ND-Not Detected

Whereas in the intact control was 46.535% (Table, 1). The total values of non essential amino acids in eyestalk ablated *P. sanguinolentus* were 49.126%. Whereas in the intact control was 48.65% (Table, 2).

## DISCUSSION

Biochemical studies are very important from the nutritional point of view. The biochemical constituents in animals are known to vary with season, size of the animal, stage of maturity, temperature and availability of food etc. Protein is essential for the sustenance of life and accordingly exists in the largest quantity of all nutrients as a component of the human body [12]. An increasing demand for good quality animal protein for the expanding population has led to effective and increasing exploitation of the aquatic resources. The acceptability and easy digestibility of fish proteins make it very valuable in combating protein malnutrition, especially in children. The protein of fish has a high biological value with its growth promoting capacity. Fish occupy an important part in the world protein supply, accounting for about 10 % of the total protein supply. About 60% of the population in the developing countries derives 40% or more of their total animal protein supplies from fish. The average protein content of fish approximately ranges from 8 to 23g/100g wet edible protein.

In the present study protein content was higher in eyestalk ablated crabs ( $39.81 \pm 1.83\%$ ) than those in control crabs ( $36.15 \pm 1.22\%$ ). Values of protein in the present study are agreement with other studies [13, 14]. The protein content of soft shell was found to be 8.33% and hard shell crab was 14.93% in *S. oenicina*, [15]. [16] assessed the protein values in *C. smithii* was 59.8 to 71% in dry matter basis. The protein value in *P. vigil* was 15.75 to 20.16 %. [17] in *C. affinis* was 17.8% [18]. In *S. serrata*, the protein content of the body meat and claw meat was 20.11% and 18.54% respectively [19], 1989). Anon, [20] reported that the protein value in blue crab was 17.17%. [21] Observed the protein content in *S. serrata* with egg (19.16%), without egg (20.92%), body meat (16.8%) and claw meat (16.28%). [22] Noticed the protein values in cooked crab of *S. serrata* ranged from 14.43 to 18.96%. The protein content of *P. pelagicus* and *P. sanguinolentus* was 0.47 to 15.91% and 12.81 to 13.6% respectively [17]. Zafer *et al.*, [14] reported that the protein values in *S. serrata* male were 17.69% and 19.39% for females. Khan, [23] investigated 11.60% protein in body meat of male and 19.92% protein in females' body meat of *S. serrata*. [24] recorded the protein values in *S. tranquebarica* from different parts *viz.*, body meat (65.48 to 72.24%), claw meat (69.5 to 80.29%) and leg meat (69.47 to 74.7%).

Carbohydrates constitute only a minor percentage of total biochemical composition. Carbohydrates in fishery products contain no dietary fiber but only glucides, the

majority of which consist of glycogen. They also contain traces of glucose, fructose, sucrose and other mono and disaccharides [12]. In the present study, carbohydrate content was higher in control crabs ( $2.48 \pm 0.23\%$ ) and lower in eyestalk ablated crabs ( $2.89 \pm 0.85\%$ ). The previous studies were suggested that the carbohydrate in the muscle varied from 0.3 to 0.63% in *P. vigil*, [17], 2.4 to 3.4% in *C. smithii* [16], 0.17% in body meat, 0.24% in claw meat of *S. serrata* [19], 0.16 to 0.55% in *P. pelagicus* and 0.44 to 0.73% in *P. sanguinolentus*, [25]. In *S. tranquebarica*, the carbohydrate values of body meat, claw meat and the leg meat was 0.59 to 2.23%, 0.68 to 2.87% and 0.76 to 2.76% respectively [24]. Recently lipids are highly efficient as sources of energy and they contain more than twice the energy of carbohydrates and proteins [12].

In the present study, lipid content of the control crab ( $1.54 \pm 0.07\%$ ) was higher than eyestalk ablated crabs ( $1.81 \pm 0.03\%$ ). In *P. vigil* the lipid values assessed from 5.13 to 9.73% by [17]. Balasubramanian and Suseelan, [16] recorded that the lipid values from 6.2 to 7.6% in *C. smithii*. In *Chaceon affinis*, the lipid values were 0.7% [18] blue crab it was 1.5% [20]. Prasad and Neelakantan, [19] noticed that the lipid content in *S. serrata* from body meat was 1.65% and claw meat was 2.01%. [21] assessed the lipid values in *S. serrata* with egg (0.43%), without egg (0.7%), body meat (1.07%) and claw meat (1.0%). In *P. pelagicus* the lipid value was 3.3 to 5.6% and *P. sanguinolentus* it was 3.8 to 5.5% [25]. The lipid content of the body meat (0.9 to 1.6) claw meat (1.83 to 2.06%) and leg meat (1.58 to 2.08%) was estimated by Thirunavukkarasu, [24]. In crustaceans, lipids are not only the principal organic reserve and source of metabolic energy, but also indispensable in maintaining cellular integrity. Lipids as a general rule act as major food reserve along with protein and are subject to periodic fluctuations influenced by environmental variables like temperature [26].

The body ash content of the crab in the present study was not affected by eyestalk ablation. The range of both control and eyestalk ablated crab  $7.83 \pm 1.29\%$  to  $7.62 \pm 0.40\%$ . Similar result has been reported in juveniles of *P. monodon*, [27]. The body moisture content of the present study was  $79.15 \pm 4.58\%$  and  $78.24 \pm 3.58\%$ , eyestalk ablated and intact control crabs. The moisture content ranged from 73.5 to 81.8% in body meat, 73.5 to 80.16% in claw meat and 73.23 to 79.6% in leg meat of *S. tranquebarica* [24]. [17] Observed comparatively lower moisture values of 69.54 to 74.46% in *P. vigil*. Whereas in *C. affinis*, the moisture value was noticed as 80.16 by Vascellos and Braz, [18].

Biological value of protein is obviously reflected upon its essential amino acids concentration. In general, the shellfish have a balanced distribution of all essential amino acids required for an adult per day. There are 20 amino acids found in fish proteins. Some of these are listed as essential amino acids (EAA), *ie.* Arginine, histidine, isoleucine, leucine, lysine, methionine, phenylalanine, threonine, tryptophan and valine because these are not synthesized in the body. The essential amino acids are required for maintenance of life, growth, synthesis of vitamins and reproduction. The lowest level of any one of these essential amino acids in a protein source, which limits the utilization of that protein, makes it the first limiting amino acid [28].

In the present study, the eyestalk ablated crabs; Leucine (10.334%) was maximum followed by Arginine (9.168%) and lysine (8.117%). Valine (5.965%) was minimum when compared to other essential amino acids. In control crabs, leucine (8.402%) and arginine (7.905%) was maximum. Whereas tryptophan was minimum (0.897%). Tryptophan and Phenylalanine was not detected in eyestalk ablated crabs. As far as total essential amino acids concerned, eyestalk ablated crabs contributed maximum (48.609%) and minimum was in control crab (46.535%).

In general, the essential amino acids are essential for the animal because the animals not able to synthesize and it should be always through external source in the form of diets. The essential amino acid composition in *S.serrata* was reported by Prasad and Neelakandan, [19]. Histidine, leucine, threonine and cystine were possessed in higher proportion and the total contribution was 36.82 %. Anon, [20] reported arginine, lysine, leucine and isoleucine in blue crab. [24] recorded amino acids in the following order arginine, leucine, lysine, valine isoleucine, threonine, phenylalanine, methionine and histidine in *S. traquebarica*. The nutritive value of any animal is decided by the presence of essential amino acids. In this sense, individual and total essential amino acid contributions are much higher in eyestalk ablated crabs than control crabs of the present study. So eyestalks ablated crabs are declared superior over control crabs with reference to nutritive value.

In non essential amino acid are concerned, Asparagine was maximum (11.295%) followed by serine (9.891%) and glutamic acid (9.595%) in eyestalk ablated crab. Cystine (0.684%) was minimum and two amino acids are not detectable (Aspartic acid and Taurine). Among 10 non essential amino acids, 8 amino acids are reported in

eyestalk ablated crabs (Asparagine, Glutamic acid, Serine, Proline, Glycine, Alanine and Cystine) and 9 amino acids are recorded in control crabs (Asparagine, Glutamic acid, Serine, Proline, Taurine, Glycine, Alanine, Tyrosine and Aspartic acid) In control crabs, Asparagine was maximum (10.675%) followed by Glutamic acid (9.983%) and Serine (9.199%). Aspartic acid (1.145%) was minimum and Cystine was not detectable. Control crabs totally contributed 48.650% of amino acids and eyestalk ablated crabs are 49.126%. [24] Reported non essential amino acids in the following order: Glutamic acid, aspartic acid, alanine, glycine and serine in *S.tranquebarica*. In general, the presence of amino acids in the body of the animal is generally determined by the amount of protein. The protein content of the eyestalk ablated crabs are more so the total amino acid contribution is high and it is less because the protein content is less in control crabs of the present study.

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