

STUDY OF EYESTALK TRIGGER HORMONES AND BIOCHEMICAL CHANGES IN FRESHWATER CRAB *PARATELLPHUSA JACQUEMONTII*

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ABSTRACT

Using chemical similar to eyestalk trigger hormone like Methionine-enkephalin and Serotonin acted in the same way as eyestalk extract has acted in injecting the homogenate in eyestalk ablated crab, *Paratellphusa jacquemontii*. In this paper study is done on eyestalk trigger hormones to reset physiology and Biochemical changes in Freshwater Crab *Paratellphusa jacquemontii*. In this study trigger hormones were replaced by Methionine-enkephalin and Serotonin which acted as triggering for the release of hyperglycemic hormone from the sinus gland of the eyestalks.

KEYWORDS: Eyestalk, Methionine-enkephalin, Serotonine, *Paratellphusa jacquemontii*

INTRODUCTION

The eyestalks of crustaceans like *Paratellphusa jacquemontii* contain neurosecretory cells that involve in the regulation of molting. Molting in crustaceans was thought to be regulated by two hormones; (1) molt-inhibiting hormone - produced in the eyestalk and stored in the sinus gland and (2) molting hormone - produced in the Y-organ (Sartaj Ahmad Allayie *et.al.*, 2011). Because of eyestalk ablation, the molt inhibiting hormone is excluded which result the molting hormone to act. Thus the removal of eyestalks causes an increase in ecdysteroid secretion from the Y-organ, which induces precocious molting (Nakatsuji and Sonobe, 2004 and Venkitraman *et al.*, 2004). In (Reddy, 1999) have hypothesized those methionine-enkephalin acts as a neurotransmitter in causing hyperglycemia in fresh water crab, *Oziotelphusa senex senex*, apparently triggering release of the hyperglycemic hormone from the eyestalks. In this paper study is done on eyestalk trigger hormones to reset physiology and Biochemical changes in Freshwater Crab *Paratellphusa jacquemontii*. In this study trigger hormones were replaced by Methionine-enkephalin and Serotonin which acted as triggering for the release of hyperglycemic hormone from the sinus gland of the eyestalks.

Met-enkephalin is found mainly in the adrenal medulla and throughout the central nervous system (CNS). The enkephalins were originally described as the endogenous ligands for morphine receptors in the brain (en.wikipedia.org). Injection of methionine enkephalin caused a significant increase in the hemolymph glucose and total sugar level of intact crabs in a dose-dependent manner, apparently by triggering release of the hyperglycemic hormone (P. Sreenivasula Reddy *et al.*, 2001).

Serotonin acts as a neurotransmitter, a type of chemical that helps relay signals from one area of the brain to another. Although serotonin is manufactured in the brain, where it performs its primary functions, some 90% of our serotonin supply is found in the digestive tract and in blood platelets.(en.wikipedia.org). The eyestalks are the main source of hyperglycaemic hormone and methionine-enkephalin induces hyperglycemia through eyestalks.

MATERIALS AND METHODS

The freshwater crabs *P. jacquemontii* were collected from local fish market. All the animals used were of same size (6.5 x 5.3cm) and weight about (55.65 gm). They were acclimatized to laboratory conditions for 3-4 days. For the purpose experimental work to take acclimatized fresh water crab *P. jacquemontii*. The test crabs were divided into four groups having equal animals. Removals of Eyestalks were done by cutting off the organs at the base, without surgery but with cautery of the wound after operation.

RESULTS AND DISCUSSION

Methionine-enkephalin

Hepatopancreas glycogen and TCHO level in crab with injection of Methionine-enkephalin were significantly lower than those of Control Crab. Decrease in muscle glycogen and TCHO levels were also significant after injecting methionine-enkephalin. Decreased hepato-pancreas and muscle glycogen indicate/suggesting the possibility of its mobilization of glucose molecule into hemolymph. It is observed that bilateral eyestalk ablation significantly decreased the hemolymph sugar levels; whereas injection of eyestalk extract into ablated crabs significantly increased the hemolymph sugar levels. Total carbohydrate (TCHO) and glycogen levels were significantly increased in hepatopancreas and muscle of eyestalk-ablated crabs, with a decrease in phosphorylase activity. Injection of eyestalk extract into ablated crabs resulted in partial/complete reversal of these changes. Injection of Methionine-enkephalin into intact crabs significantly increased the hemolymph sugar level in a dose-dependent manner.

Table 1: Graphical interpolation and probit analysis LC50 values of Cypermethrin pesticide for normal intact (N), unilateral eyestalk ablated and eyestalk extract injected Cypermethrin, Methionine-enkephalin and Serotonin, in *Paratelphusa jacquemontii* (ml/lit).

Treatment Period (h)	Normal (N)		Cypermethrine							
			Unilateral Eyestalk ablated (EA)		Bilateral Eyestalk ablated (EA)		Eyestalk extract injected (EEI) Methionine- enkephaline		Eyestalk extract injected (EEI) Serotonin	
	Graphical interpolation	Probit Analysis	Graphical interpolation	Graphical interpolation	Graphical interpolation	Probit Analysis	Graphical interpolation	Probit Analysis	Graphical interpolation	Probit Analysis
24	9.28	5.28	10.28	10.28	12.28	12.28	10.08	10.10	9.88	9.88
48	8.84	5.84	9.84	9.84	11.98	11.85	9.90	10.06	9.45	9.45
72	6.75	4.75	9.76	9.76	11.85	11.45	7.21	7.67	8.00	7.20
96	6.16	4.16	8.75	8.75	9.35	9.87	7.88	7.97	7.29	7.50

It activates the phosphorylase system, which causes degradation of glycogen. It also resulted in accumulation of sugar molecules in the tissues; these molecules are ultimately mobilized to hemolymph, causing hyperglycemia. Methionine-enkephalin might have elevated the phosphorylase system in intact crabs in several different ways—for example, by triggering release of hyperglycemic hormone or by mimicking the action of this hormone. However, because Methionine-enkephalin was not able to produce these changes in eyestalk less crabs. It seems most likely that Methionine-enkephalin exerted its hyperglycemic effect by triggering release of hyperglycemic hormone from the sinus gland of eyestalks. The supporting results suggested that sinus glands in the eyestalks of crabs are the main release site for hyperglycemic hormone (S. Chengal Redd et al., 2015).

Serotonin

Injection of serotonin into intact crabs resulted in significant hyperglycemia in a dose-dependent manner when compared to the controls, whereas injection of physiological saline did not cause any significant effect on hemolymph glucose level. The hemolymph glucose level increased significantly (pb0.001) within 1-h after serotonin injection and reached a highest peak at 2-h. Hemolymph glucose level declined gradually after 2-h and reached control level 6-h

post-injection. In the next experiment we determined whether serotonin induced hyperglycemia was mediated by the eyestalk hormone, CHH. Eyestalk less crabs (24-h post ablation) were injected with different doses of serotonin. No elevation in hemolymph glucose concentration was observed 2-h after injection of serotonin in eyestalk ablated crabs. As expected, bilateral eyestalk ablation produced significant hypoglycemia. The fresh water crabs, *Paratelphusa jacquemontii* were injected with serotonin and hemolymph glucose and CHH levels were determined. Injection of serotonin into intact crabs caused significant hyperglycemia in a dose-dependent manner. In contrast, injection of serotonin did not cause any change in hemolymph glucose level in eyestalk ablated crabs. The results indicate that serotonin-induced hyperglycemia required as in the presence of the eyestalks in *Paratelphusa Jacquemontii*. An effort was also made to determine whether CHH has a role in serotonin-induced hyperglycemia. Injection of serotonin produced significant (pb0.001) increase in hemolymph CHH level.

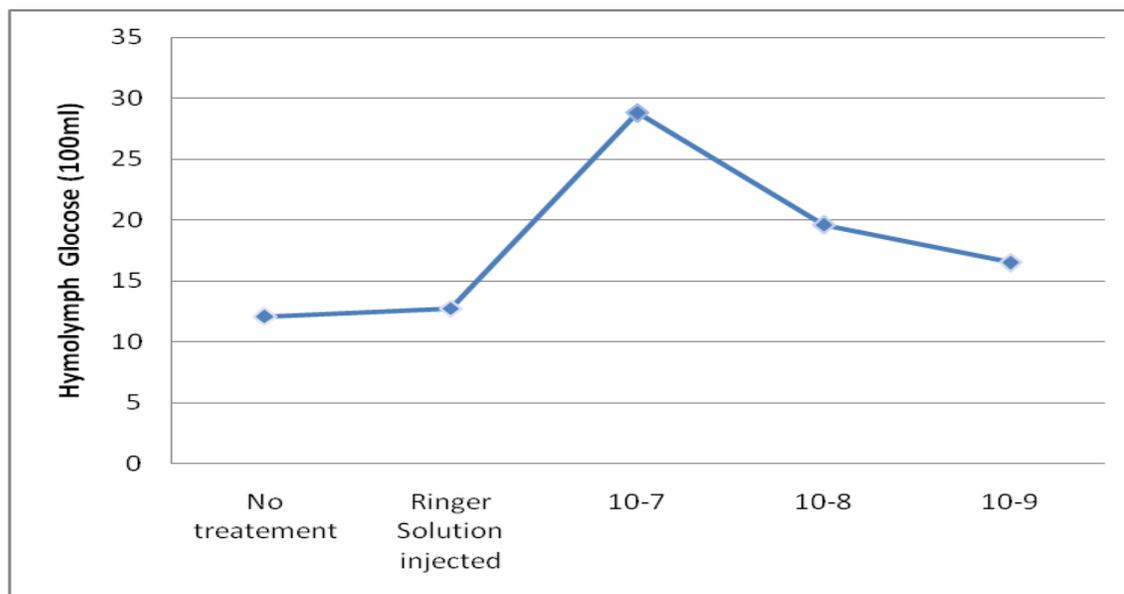


Fig 1: A point in time path for Methionine-enkephalin and serotonin induced hyperglycemia

Our results clearly demonstrate that Methionine-enkephalin is involved in the regulation of carbohydrate metabolism in the crab *Paratelphusa jacquemontii*. In the present study, we show that Methionine-enkephalin elicited a hyperglycemic response in a dose-dependent manner. Methionine-enkephalin hyperglycemia has been similarly demonstrated in the freshwater crab *Paratelphusa jacquemontii*.

One of the well-known crustacean hormones is the crustacean hyperglycemic hormone (CHH). However, the mechanisms involved in the release of this hormone into circulation are poorly studied. The fresh water crabs *Oziotelphusa senex senex* were injected with serotonin and hemolymph glucose and CHH levels were determined. Injection of serotonin into intact crabs caused significant hyperglycemia in a dose-dependent manner. Administration of serotonin also caused a significant increase in the circulatory levels of CHH. In contrast, injection of serotonin did not cause any change in hemolymph glucose level in eyestalk ablated crabs. The results confirm that serotonin induced hyperglycemia was apparently mediated by the eyestalk hormone CHH (Sreenivasula Reddy *et al.*, 2007).

In the present study, the role of eyestalks and involvement of methionine-enkephalin in the regulation of haemolymph sugar level was studied. Bilateral eyestalk ablation significantly decreased the haemolymph sugar levels, whereas injection of eyestalk extract into ablated crabs significantly increased the haemolymph sugar levels. Total carbohydrate (TCHO) and glycogen levels were significantly increased in hepatopancreas and muscle of eyestalk-ablated crabs, with a decrease in phosphorylase activity. Injection of eyestalk extract into ablated crabs resulted in partial/complete reversal of these changes. Injection of methionine-enkephalin into intact crabs significantly increased the haemolymph sugar level in a dose-dependent manner. Total tissue carbohydrate and glycogen levels were significantly decreased, with an increase in phosphorylase activity in hepatopancreas and muscle tissues of intact crabs after methionine-enkephalin injection. Methionine-enkephalin injection did not cause any changes in haemolymph sugar, tissue total carbohydrate and glycogen levels and activity levels of phosphorylase in eyestalk-ablated crabs. These results suggest that the eyestalks are the main source of hyperglycaemic hormone and methionine-enkephalin induces hyperglycaemia through eyestalks (Kishori *et al.*, 2005).

REFERENCES

- Chengal Reddy C., Reddy D.C. and Kalarani V (2015).** Role of combined effects of serotonin and dopamine on carbohydrate metabolism of commercial giant freshwater prawn, *Macrobrachium rosenbergii*, *Int. J. Pharmacy Life Sci.* 4578-4589, ISSN: 976-7126
- Kishori B. and Reddy P.S. (2005).** Role of Methionine-enkephalin on the regulation of carbohydrate metabolism in the rice field crab *Oziotelphusa senex senex*, *C R Biol.* 328(9):812-20.
- Nakatsuji T. and Sonobe H. (2004).** Regulation of ecdysteroid secretion from the Y-organ by molt inhibiting hormone in the American crayfish, *Procambarus clarkia*. *J. General Comparative Endocrinol.* 135: 358–364.
- Reddy P.S. (1999).** A neurotransmitter role for methionine-enkephalin in causing hyperglycemia in the fresh water crab, *Oziotelphusa senex senex*. *Curr. Sci.* 76: 1126–1128.
- Sartaj Ahmad Allayie, S. Ravichandran and Bilal Ahmad Bhat (2011).** Hormonal regulatory role of eyestalk factors on growth of heart in mud crab, *Scylla serrate*. *Saudi J. Biol. Sci.* 18(3): 283–286.
- Sreenivasula Reddy P. and Md. Riyaz Basha (2001).** On the Mode of Action of Methionine Enkephalin, FK 33-824 and Naloxone in Regulating the Hemolymph Glucose Level in the Fresh Water Field Crab *Oziotelphusa senex senex*, *Z Naturforsch C*, 56(7-8):629-32.
- Sreenivasula Reddy P., Pushpalatha T. (2007).** Effect of serotonin on hemolymph glucose regulation in the fresh water edible crab *Oziotelphusa senex senex*, *Aquaculture*. 266(1–4): 274–278.
<https://en.wikipedia.org/wiki/Serotonin> and <https://en.wikipedia.org/wiki/Met-enkephalin>