

# Biochemical Changes in Hepatopancreas of White Shrimp (*Litopenaeus Vannamei*) On Exposure to Altered pH Media

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## Abstract

The present study was made by exposing the *Litopenaeus vannamei* to environmental acidic [pH 6.4] and alkaline [pH 9.0] media for 24 hrs and studied the tissue somatic index (TSI) and tissue proximate analysis of hepatopancreas was significantly lowered in both acidic and alkaline media similarly, the dry weight was also reduced in both media. In contrast, the water content was showed no significant change on exposure to altered pH media. The total carbohydrate content of hepatopancreas exhibited significant reduction in both acidic and alkaline medium on acute exposure. Total protein content showed differential pattern in hepatopancreas on exposure to altered pH media. The protein content was significantly decreased in acidic medium and elevated the same in alkaline medium. The total lipids showed decreased trend in both acidic and alkaline media on an acute exposure. It is observed that the environmental acidic and alkaline pH induced metabolic modulations in hepatopancreas, which lead to metabolic adjustment and provides increased survival value against the imposed pH stress.

**Key words:** *Litopenaeus vannamei*, Altered pH media, Total Lipids, Tissue Somatic Index, Acute Exposure.

## 1. Introduction

Dynamic equilibrium exists in aquatic ecosystems between biotic and abiotic factors. Chemical and physical demands of life in water imposed vigorous constraints on aquatic species. In aquatic habitats usually variation occurs in abiotic factors such as temperature, salinity, photoperiod, pH, turbidity and gaseous contents daily and seasonally. Each of these factors, single or together if altered can impose a considerable load of stress on the physiology of aquatic animals.

Of late, drastic alterations in hydrogen ion concentrations of the aquatic systems leading to environmental acidification posing a severe problem to aquatic life causing decline and disappearance of many inhabitants in different parts of the globe and drawing the attention of many investigations<sup>1-10</sup>. However, the literature available on the effect of the environmental acidity and alkaline pH in relation to prawn is very scanty. Hence, the present work is proposed to understand the impact of altered pH media on tissue proximate analysis of hepatopancreas in prawn on acute exposure.

## **MATERIALS AND METHODS**

The white leg prawn, *Litopenaeus vannamei* were obtained from sripa aqua marine hatchery at Nellore, A.P., India and they were maintained under laboratory conditions in normal brackish water at room temperature ( $27.5 \pm 0.5$ ), salinity (22 ppm), pH ( $7 \pm 0.1$ ) and exposed to 12 hrs dark and 12 hours photoperiod. The prawns were fed daily with a standard commercial diet. The prawns with the standard size and weight such as  $5.0 \pm 0.5$  gm were selected for the study. After acclimatization to the laboratory condition the prawns were 3 batches and each batch consists of 12 prawns. The first batch considered as control and maintained them in normal brackish water pH  $7.1 \pm 0.1$ . The second and third batch of prawns were exposed to acidic media at pH  $6.5 \pm 0.1$  and alkaline media at pH  $9.0 \pm 0.1$  for 24 hours respectively and treated them as acute exposure (experimental). A special device described by Bhaskar and Govindappa in 1986 was used to maintain the pH of the acidic and alkaline media. After 24 hours of acute exposure, both control and experimental prawns hepatopancreas was isolated and used for both TSI and tissue proximate analysis studies. The tissue somatic index, dry weight and water content levels were analyzed gravimetrically. The total carbohydrate levels were analyzed<sup>11</sup>. The protein content<sup>12</sup> and the total lipid content were estimated by the method<sup>13</sup>.

## **RESULTS**

The changes in the tissue somatic index, dry weight, water content, total carbohydrates, and total lipids of the hepatopancreas were analyzed in both acidic and alkaline media on acute exposure. The water content was increased in both acidic and alkaline media than control. But the total protein content was decreased in acidic medium with an increase in alkaline medium.

## **DISCUSSION**

Sudden and acute exposure to the sub-lethal acidic and alkaline waters of prawn resulted drastic changes in the tissue organic constituents, exhibiting the impact of altered pH media in the mobilization of various tissue reserves into different metabolism. The hepatopancreas tissue showed consistent depletion was more in alkaline medium than in acidic medium. Since the TSI indicate the relation between the growth of both organ and the whole animal, the reduced TSI suggest the lowered weight of hepatopancreas on exposure to altered pH media in proportion to the whole body weight. This might be due to the mobilization of the organic constituents towards the energy release.

Though the whole animal weight was increased on exposure to alkaline pH, the TSI was reduced which suggest the lowered weight of the hepatopancreas. This was supported by the reduced weight of the dry matter observed in both acidic and alkaline media. The decreased dry matter envisages the active mobilization of tissue constituents towards blood and/or tissue metabolism.

Since the oxygen consumption of the prawn was depleted over the normal level<sup>14</sup>, mobilization of hepatic constituents into the haemolymph to a large extent can be envisaged. The hepatopancreas tissue seems to have the least impact on osmotic properties and ionic regulation, as there was no accumulation of water in the tissue on acute exposure to acidic and alkaline media. The total carbohydrates and total lipids of hepatic tissue showed maximum depletion with lesser protein depletion in acidic medium. In addition on exposure to alkaline medium the total carbohydrates and total lipids were also decreased. However, the total protein content was elevated in the hepatopancreas of prawn on exposure to alkaline

medium. Since, the carbohydrates forms an immediate source of energy, and the hepatopancreas is concerned with the main site for the detoxificatory mechanism<sup>15</sup> which is energy dependent processes, depletion was minimum when compared with other components suggesting the possibility of little proteolysis in the tissue in response to acute exposure to acidic medium. The depletion of total lipids envisages, since hepatopancreas forms a reserve source of lipid material in general <sup>15,16</sup> and as ph forms stress condition, the mobilization of lipids towards haemolymph constituents to meet the energy demands can be envisaged. Interestingly the protein content was elevated in alkaline medium can be explained on the basis of geared up synthetic activities with reduced proteolysis which was supported by elevation of whole animal weight in the present study on exposure to alkaline medium.

Table-1: changes in Bio-chemical constituents of hepatopancreas of control and experimental white leg prawn. Each mean value is an average of 6 individual observations. Mean,  $\pm$  S.D.,  $\pm$  or indicate the percentage increase or decrease over control.” P” denotes the level of statistical significance. “NS” is non-significant.

S.NO	Component	Control	Acidic ph 6.5	Alkaline Ph 9.0
1	Tissue Somatic index(%)	4.37	2.75	2.57
		$\pm$ 0.230	$\pm$ 0.174	$\pm$ 0.205
			-36.56	-40.65
			P<0.001	P<0.001
2	Dry Weight ( mg/gm wet weight)	150.00	138.64	140.02
		$\pm$ 12.44	$\pm$ 9.68	$\pm$ 11.13
			-7.57	-6.65
			P<0.01	P<0.01
3	Water content (mg/gm wet weight)	850.00	861.36	859.98
		$\pm$ 1.17	$\pm$ 63.09	$\pm$ 71.84
			+1.33	+1.17
			NS	NS
4	Total carbohydrates ( mg/gm wet weight)	23.64	18.52	19.81
		$\pm$ 1.17	$\pm$ 1.44	$\pm$ 1.06
			1.65	$\pm$ 16.20
			P<0.001	p<0.001
5	Total protein ( mg/gm wet weight)	87.09	80.06	99.81
		$\pm$ 8.11	$\pm$ 5.34	$\pm$ 19.73
			$\pm$ 8.07	+14.60

		P<0.001	P<0.001
6	Total lipids	28.8	25.13
	mg/gm wet weight)	+ <sub>2.53</sub>	+ <sub>2.01</sub>
		- <sub>12.98</sub>	- <sub>41.83</sub>
		P<0.001	P<0.001

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