Studies on Salinity Stress on the Biochemical Composition of Tissues in Shrimp *Penaeus Monodon*

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Abstract: **The environment can have a significant impact on shrimp *Penaeus monodon* health, growth and production. While change in salinity that affects the shrimp health. In the present study, an attempt has been made to assess the salinity stress 15 ppt (control), 5, 25, 35 and 45 ppt (experimental), which induced changes in biochemical constituents of muscle, gill and hepatopancreas of *P. monodon* during 60 min. interval. The protein content of muscle and gill was gradually increased at 5 to 45 ppt, whereas hepatopancreas protein showed high at 25 ppt and low at 5, 35 and 45 ppt when compared to control. The carbohydrate content of muscle, gill and hepatopancreas showed more at 5 to 35 ppt and low at 45 ppt salinity. The trend noticed for the variation in lipid content of muscle and gill of *P. monodon* at 5 ppt to 45 ppt showed a steady increasing trend. The hepatopancreas lipid content showed fluctuation in all the experimental groups (5 to 45 ppt) and was more when compared with control (15 ppt).**

***Key words*: salinity stress, *Penaeus monodon*, muscle, gill, hepatopancreas**

I. INTRODUCTION

Fishes and aquaculture sector have played a key role in the production of nutritional and healthy food for the ever growing population in this world. A change in one environmental parameter such as temperature extreme, low dissolved oxygen, abrupt changes in pH and salinity etc., can affect the fish health (Malins and Ostrander, 1991; Bucke, 1993).

One of the most important environmental parameter which changes with time and distance is 'salinity'. It is considered 'a dominant ecological factor' in controlling the survival rate and growth in marine organisms (Kinne, 1971; Alderdice, 1972). The optimum salinity for the best growth and survival of *P.monodon* is between 15 to 25ppt (Raj and Raj, 1982). High salinity decreased the food intake, absorption, conversion efficiency, biochemical process that control digestion and nutrition absorption by the gut (Febry and Lutz, 1987). In *P.monodon* lower growth rate and production was observed when reared in lower salinity (Sivakami, 1988). Exposure of various salinity stress leads to short and long term changes in respiratory function, energy metabolism, fluid and ionic balance, acid-base balance and immunity (Iwama *et al*., 1997; Hall and Van Ham, 1998).

However extreme high and low salinity always cause more problems than the suitable salinities. Culture in high salinity over 30ppt may cause disease problems particularly white spot or yellow head virus and luminescent bacteria (Laxminarayana, 2001; Chanratchakool, 2003). The present work deals, tissues biochemical changes occur during the sudden changes in the environmental salinity on *P.monodon.*

II. MATERIALS AND METHODS

(i) Collection of animals

Post larvae (PL20) of tiger shrimp *P.monodon* were obtained from the St.John Bosco and Co Shrimp Hatchery, Kollam, Kerala state. The post larvae were transported in oxygenated bags and acclimatized to the laboratory (15ppt salinity; 8.0±0.20 pH) for a period of 10 days.

(ii) Experimental Setup

Well maintained and healthy shrimps weighing 6.5 to 7.5g were acclimatized at 15ppt salinity were suddenly stressed at 5, 25, 35 and 45ppt salinities for a period of 60 min.

(iii) Collection of tissues

After experimentation, shrimps were dissected out under aseptic condition and tissue samples such as muscle, gill and hepatopancreas were collected in a labeled sterile containers, temporarily stored in deep freezer (-20^{o}C) until further analysis.

(iii) Biochemical analysis

The tissue biochemical constituents (protein, carbohydrate and lipid) of control and stressed shrimps were estimated by standard methods.

III. RESULT

In the present study, the effect of abrupt change in rearing salinity on variation in tissue biochemical constituents of *P.monodon* was studied for shorter duration (60 min). In this experimentation, 5, 25, 35 and 45 ppt salinity stress were assessed in *P.monodon* acclimatized at 15 ppt salinity. In the tested tissues of *P.monodon* stressed at various salinities, the biochemical constituents also showed salinity dependent variation.

Variation in biochemical constituents in muscle tissue

In 5 ppt salinity stressed *P.monodon*, the muscle protein content recorded was low and 25, 35, and 45 ppt was high when compared to control (Fig 1). The muscle lipid content also established a similar trend. On the other hand, the muscle carbohydrate content showed an enhancing trend compared to control stress. In those shrimps stressed at 5, 25 and 35 ppt salinity, the muscle carbohydrate content increased and showed low carbohydrate at 45 ppt.

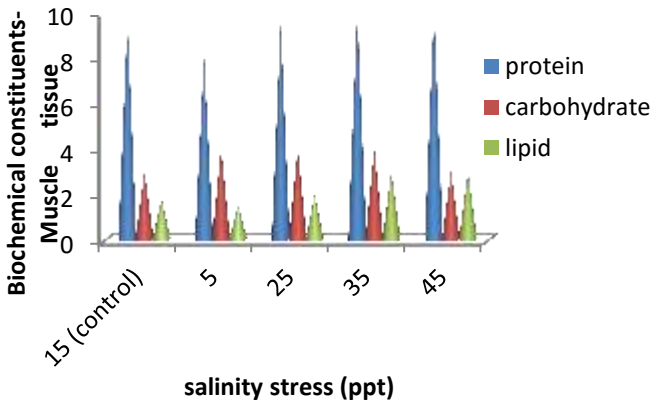

Fig 1. Biochemical constituents of muscle tissue of control (15 ppt) and experimental (5, 25, 35 and 45) salinity stressed *P.monodon* during 60 min interval

Variation in biochemical constituents in gill tissue

In the gill tissue of *P.monodon* stressed at 5 ppt salinities, the protein content showed less and more at 25, 35 and 45 ppt than control (Fig 2). The gill carbohydrate content of experimental shrimps was low at 5 and 25 ppt, and high at 35 and 45 ppt when compared with the values registered in control group. The gill lipid content of shrimp showed a linear increase in 5 ppt to 35 ppt salinities and low at 45 ppt salinity than control tissue

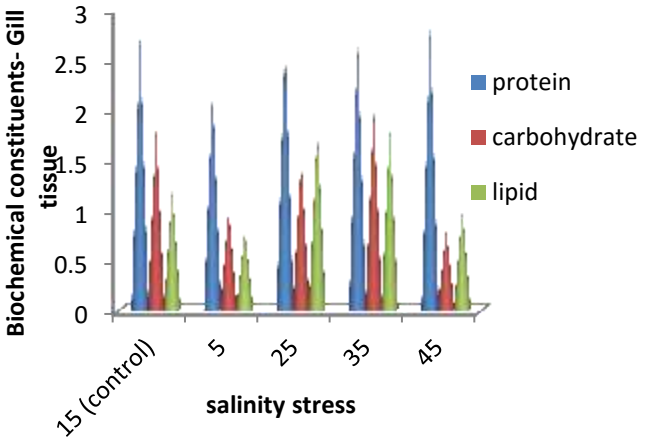

Fig 1. Biochemical constituents gill tissue of control (15 ppt) and experimental (5, 25, 35 and 45) salinity stressed *P.monodon* during 60 min interval

Variation in biochemical constituents in the hepatopancreas

The protein content of the hepatopancreas of *P.monodon* stressed at 5 ppt salinity showed low whereas, it was more in those shrimps stressed at 25, 35 and 45 ppt salinities as against the respective control. The carbohydrate content exposed to 25 and 35 ppt salinity showed an increase, when compared to the respective control; whereas in those shrimps stressed at 5 and 45 ppt showed fluctuation. The lipid content of the hepatopancreas stressed at the tested salinities established an increasing trend when compared to control.

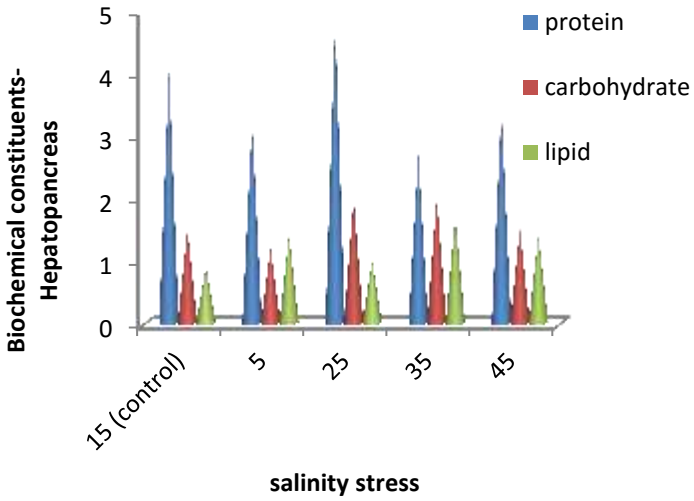

Fig 1. Biochemical constituents of hepatopancreas of control (15 ppt) and experimental (5, 25, 35 and 45) salinity stressed *P.monodon* during 60 min interval

IV. DISCUSSION

Environmental salinity plays an important role in electrolyte balance and might affect the body components and cause qualitative and quantitative changes and also affect the normal physiological and metabolic activities of aquatic animals. Acute salinity changes over a particular range weaken the immune system of shrimp and make them highly vulnerable to pathogens.

In the present study, the effect of abrupt change in rearing salinity on variation in tissue biochemical constituents of *P.monodon* was studied for shorter duration (60 min.). In this experimentation, both low (5 and 25 ppt) and high (35 and 45 ppt) salinity stress was assessed in *P.monodon* acclimatized at 15 ppt salinity. The results inferred that, the variation in biochemical constituents were found to be depending on rearing salinity and it was tissue specific.

Claybrook (1983) reported that in low salinity shrimp need to use protein as a source of amino acids to maintain osmotic pressure. According to George *et al*. (2001), there was a significant reduction in total protein concentration observed in the edible oyster *Crossostrea madrasensis* exposed to both high (36 ppt) and low (6 ppt) salinities.

Bindhu and Diwan (2002) reported that the shrimps acclimatized to high salinity were abruptly exposed to low saline media indicated a shift towards protein dominated metabolism (5, 10, 15 and 25 ppt). They further inferred that, when the shrimps exposed to high saline media indicating a shift towards lipid/ carbohydrate dominated metabolism (25, 30 and 35 ppt). The changes occurred in the protein content in the tested tissues of *P.monodon* stressed at low (5 and 25 ppt) and high (35 and 45 ppt) may be due to the immediate salinity changes prevailed in that environment.

It is well known that salinity affects food consumption, conversion efficiency and growth and survival of cultured penaeid shrimps (Staples and Heales, 1991).

V. CONCLUSION

The present work proved the effect of salinity stress on the tissue biochemical constituents of *P.monodon*. The results will be further used in stress recovery through immune stimulant and Antistress vitamin under controlled environmental conditions. Furthermore this work can be extended to various other fishes using different parameters.

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